2016 Seed Product Information Guide

BallSeed



New Varieties for 2016

PanAmerican Seed

Anemone Mona Lisa Wine White Bicolor

F1 Angelonia Serenita Sky Blue Serenita Mixture Improved

F1 **Begonia** BabyWing Bicolor BabyWing Red BabyWing Mixture

F1 Calibrachoa (Mid 2015 introduction) Crave Sunset

Kabloom Deep Blue Kabloom Deep Pink Kabloom White Kabloom Yellow

Celosia

Ice Cream Cherry Improved Ice Cream Mixture Improved

Premium Shade Coleus Kong Scarlet Improved

Premium Sun Coleus Flip Side

F¹ **Interspecific Dianthus** Jolt Cherry Jolt Pink

F1 Single Dianthus

Sweet Magenta Bicolor Sweet Pink Sweet Pink Magic Sweet White Improved Sweet Mixture Improved

F¹ **Double Dianthus** Dynasty Red Improved

F1 Euphorbia Glamour

Fuseables Petunia Berry Bold

F1 Gazania

New Day[®] Red Stripe New Day Tiger Mixture New Day Mixture Improved

F1 New Guinea Impatiens Divine Pink Improved

Divine Pink Improved Divine Violet Improved Divine White

F1 African Marigold Marvel Series now supplied as

coated and de-tailed seed Taishan Orange Improved Taishan Yellow Improved Taishan Mixture Improved

Heat-Tolerant Extra-Dwarf Crested French Marigold

Hot Pak Fire Hot Pak Flame Hot Pak Gold Hot Pak Harmony Hot Pak Orange Hot Pak Spry Hot Pak Yellow Hot Pak Mixture

F1 Spreading Pansy Cool Wave Blue Skies Cool Wave Lemon Surprise

F1 Extra-Large-Flowered Pansy Matrix Beaconsfield Matrix Solar Flare

F1 Large-Flowered Pansy Promise Blue White Whiskers Promise Pure Lemon

Spring Matrix Lavender Shades Spring Matrix Primrose Spring Matrix Purple & White

F1 **Spreading Petunia** Easy Wave Pink Passion Easy Wave Silver Easy Wave Yellow

Shock Wave Yellow

Tidal Wave Red Velour

F1 Compact Growing Multiflora Petunia Lo Rider Violet

Pretty Flora Purple Improved Pretty Flora White Improved Pretty Flora Pink Pearl Pretty Flora Mix Improved

F1 Compact Growing Grandiflora Petunia Pretty Grand Violet

F1 Floribunda Petunia

Madness Pink Chiffon Clear Madness Mixture Improved Total Madness Mixture

Improved F1 **Multiflora Single Petunia** Mirage Pink Chiffon

Verbena Quartz XP Violet with Eye

F1 Vinca

Valiant Apricot Valiant Burgundy Valiant Lilac Valiant Orchid Valiant Punch Valiant Pure White Valiant Mixture

F1 Viola

Sorbet XP Coconut Swirl Sorbet XP Lavender Pink Sorbet XP Orange Jump Up Sorbet XP Purple Improved Sorbet XP YTT Sorbet XP Jump Up Mixture

Zinnia

Double Zahara Cherry Improved Double Zahara Salmon Rose Double Zahara Yellow

Zahara® Cherry Improved Zahara Red

Zahara XL Fire Zahara XL Pink Zahara XL White Zahara XL Yellow

VEGETABLES & HERBS

Basil Dolce Fresca

SimpleSalad® Kale Storm Mixture

Sweet Pepper Cute Stuff Gold II

Tomato

Chocolate Sprinkles Heirloom Marriage Cherokee Carbon Heirloom Marriage Marzinera Little Napoli Sugar Rush Tidy Treats

Kieft Seed

Campanula carpatica F¹ Rapido Blue Rapido White

F1 Gerbera

Mega Revolution Salmon Pink with Dark Eye Mega Revolution Salmon Rose with Light Eye

Revolution Bicolor Rose Shades Revolution Bicolor Yellow Orange Revolution Bright Rose with Light Eye Revolution Harvest Brights Revolution Red with Light Eye Revolution Spring Pastels Improved Revolution White with Light Eye Improved

Lavandula stoechas Bandera Purple

Lobelia x speciosa F¹ Starship Deep Rose

Verbena rigida Santos Purple

Premium Combos Featuring Kieft Brand First-Year-Flowering Perennials Jewels of Cleopatra: Heuchera Palace Purple, Dianthus

Dash Magician, NEW Lobelia Starship Deep Rose

Valley of the Kings: Heuchera Palace Purple, Lavender Ellagance Purple, NEW Lobelia Starship Deep Rose

Paris in Springtime: NEW Lobelia Starship Deep Rose, Echinacea Cheyenne Spirit

USDA Plant Hardiness Zone and Average Annual Minimum Temperature Range

Zone	Fahrenheit	Celsius	
1	Below -50 F	Below -46 C	
2	-45 to -40 F	-46 to -40 C	
3	-40 to -30 F	-40 to -35 C	
4	-30 to -20 F	-35 to -29 C	
5	-20 to -10 F	-29 to -23 C	
6	-10 to 0 F	-23 to -18 C	
7	0 to 10 F	-18 to -12 C	
8	10 to 20 F	-12 to -7 C	
9	20 to 30 F	-7 to -1 C	
10	30 to 40 F	-1 to 5 C	
11	above 40 F	above 5 C	

Container Conversion from cm to in.

Equivalent U.S. Container
3.5 in. Standard
4 in. Azalea
4 in. Standard
4.25 in. Standard
4.5 in. Geranium
5 in. Azalea
5 in. Standard
6 in. Trade
6 in. Azalea
6 in. Standard
6.5 in. Azalea
Trade Gallon
8 in. Standard

Substrate Moisture Level Table

	Level 1 Dry	Level 2 Medium Dry	Level 3 Medium	Level 4 Medium Wet	Level 5 Saturated
Substrate color	Very light brown or gray	Light brown	Brown to dark brown	Dark brown	Brown-black, glistening with water
Substrate feel when squeezed in hand	No moisture is detected in substrate	Substrate squeaks when squeezed	A small drop of water can be squeezed from the substrate	Water can be easily squeezed from the substrate	Water runs freely out of the substrate
Substrate structure	Substrate is dusty and freely scatters when blown	Substrate will barely stick together under pressure	Substrate will clump together but cracks apart under its own weight	Substrate easily clumps together and stays as one clump	Substrate has a semi-liquid consistency

Fertilizer Rate Table

Fertilizer Rate	PPM Nitrogen	EC (mS/cm)
One	Less than 100 ppm	Less than 0.7 EC
Two	100 to 175 ppm	0.7 to 1.2 EC
Three	175 to 225 ppm	1.2 to 1.5 EC
Four	225 to 300 ppm	1.5 to 2.0 EC
Five	More than 300 ppm	More than 2.0 EC

Key To Symbols:

COT – Coated seed DTL – De-tailed seed FCS – Filmcoated seed MSP – Multi-seed pellet PEL – Pelleted seed PMPL – Precision Multi-Pellet PRM – Primed seed SCR – Scarified seed SED – Raw seed TUN – Tuned Seeds from Kieft

Garden Location:



Full shade

Find culture and more at panamseed.com & kieftseed.com.

2 630 231-1400 panamseed.com

Annual Culture Chart

															(Spring unless sp	ecified)					
Grower Facts	Class	Series/Variety	Exposure	Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other	Key tips	Mature height	Plant spread	Heat Coo tolerant crop	Other recommendations
Unine*	AB UTLON A. x hybridum (Flowering Maple, Chinese Bell Flower)	Bella F1 Series		8,500 S/g)	SED	406-Cell or larger	Yes	/2-75°F (22-24°C)	3	3-5	4-4.5 in. (10-11 cm), 5 in. (13 cm), 6-6.5 in. (15-16 cm) 2-3 ppp, 8 in. (20 cm) basket 3-4 ppp, 10 in. (25 cm) 4-6 ppp	65-70°F (18-21°C)	60-65°F (16-18°C)	_	6-8 (Spring), 8-10 (Autumn)	7-10 (Spring), 9-12 (Autumn)	Space plants adequately to get the best branching and the showiest plants.	(35-45 cm)	(35-45 cm)	V	ideal for pot, basket and colour bowl programs year-round.
Online*	AGERATUM A. houstonianum	High Tide F1 Series	0	14,000 S/oz. (500 S/g)	PEL	406-cell or larger	No	72-75°F (22-24°C)	3	4	306 (9 cm), 4 in. (10 cm), 6 in. (15 cm)	70-80°F (21-27°C)	58-62°F (14-17°C)	-	7-9	7-9	Using multiple PGR applications of low concentrations are recommended for best leaf appearance.	14-16 in. (35-40 cm)	12 in. (30 cm)		Ideal for pot plant programs and for the landscape.
Online*	ALSTROEMERIA A. x hybrida	Jazze [®] F1 Series	٠	920 S/oz. (33 S/g)	SED	200-cell or larger	Yes	Week 1: 72-75°F (22-24°C) Weeks 2-4: 42-45°F (5-7°C)	21-28 (radicle emergence)	8-9	6 in. (15 cm) or larger	60-65°F (16-18°C)	52-58°F (11-14°C)	-	_	20-23 (Autumn), 12-17 (Spring)	Follow the Grower Facts germination recommendations closely.	10-16 in. (25-40 cm) (in pot)	8-12 in. (20-30 cm)		
Online*	ALTERNANTHERA A. dentata	Purple Knight	٠	17,400 S/oz. (614 S/g)	SED	288-cell or larger	Yes	72-76°F (22-24°C)	3-4	5-6	Pack, 306 (9 cm), 4 in. (10 cm), 6 in. (15 cm) 3 ppp	65-75°F (18-24°C)	62-65°F (17-18°C)	6-7	6-7	7-8	Growing under high light conditions will result in deeper purple foliage.	18-36 in. (45-90 cm)	24-36 in. (60-90 cm)	~	Well-suited to both containers and landscape plantings.
Online*	ALYSSUM Lobularia maritima	Clear Crystal® Series	0	70,875-87,885 S/oz. (2,500-3,100 S/g	SED	200 to 288-cell	No	70-72°F (21-22°C)	3-4	4	306 (9 cm), 4 in. (10 cm)	60-75°F (16-24°C)	55-60°F (13-16°C)	4-6	7	_	Cool-season crop can be grown with little or no heat. Grow outdoors or at very cool night temperatures for best color definition.	6-10 in. (15-25 cm)	12-14 in. (30-35 cm)	V	Fragrant, large-flowered varieties deliver stronger garden performance.
	ALYSSUM Lobularia maritima	Easter Bonnet Series	0	76,500-102,000 S/oz. (2,700-3,600 S/g	FCS	512-cell or larger	No	68-72°F (20-22°C)	2-3	4-5	Pack	55-70°F (13-21°C)	50-55°F (10-14°C)	5	-	-	Multi-sowing is recommended, 3 to 5 seeds per plug cell.	4-10 in. (10-25 cm)	10-12 in. (25-30 cm)	~	
Online*	ALYSSUM Lobularia maritima	Snow Crystals	0	70,875-87,885 S/oz. (2,500-3,100 S/g	SED	512-cell or larger	No	65-70°F (18-21°C)	2-3	4-5	Pack, 4 in. (10 cm)	55-70°F (13-21°C)	50-55°F (10-14°C)	6-7	6-7	-	Multi-sowing is recommended, 3 to 5 seeds per plug cell.	6-10 in. (15-25 cm)	12-14 in. (30-35 cm)	~	
	AMMI A. majus	Casablanca		47,500-56,000 S/oz. (1,700-2,000 S/g	5)	288-cell or larger	Cover lightly	68-72°F (20-22°C)	3-5	4-6	Field grown	54-86°F (12-30°C)				14-18	Uniform, low energy crop; can be grown indoors and outdoors	40-50 in. (1-1.25 m)	8-10 in. (20-25 cm)		Cut flower, field grown
	AMMI A. majus	Graceland		47,500-56,000 S/oz. (1,700-2,000 S/g	;)	288-cell or larger	Cover lightly	68-72°F (20-22°C)	3-5	4-6	Field grown	54-65°F (12-18°C)				12-16	Uniform, low energy crop; can be grown indoors and outdoors	40-55 in. (1-1.4 m)	8-10 in. (20-25 cm)		Cut flower, field grown
FOR SIR	OCCO ANEMANTHELE	See ColorGrass (pg 10	D)																		
Online*	ANEMONE A. coronaria	Mona Lisa® Series	٠	52,500 S/oz. (1,850 S/g)	SED	406-cell or larger	Yes	60-65°F (16-18°C)	10-14	8	4 in. (10 cm), 6 in. (15 cm)	60-65°F (15-18°C)	55°F (13°C)	-	12	12	See also Cut Flower section for more details (pg 68).	18 in. (45 cm) (stems)	6 in. (15 cm)	V	Ideally suited for young plant production from a March to June sowing in Northern Hemisphere for October through April season; a September to December sowing in Southern Hemisphere for April through October season.
Pg 78	ANGELONIA A. angustifolia	Serena® F1 Series	0	28,500 S/oz. (1,000 S/g)	PEL	288-cell or larger	No	72-76°F (22-25°C)	4-5	5-6	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm) 3 ppp, gallon (15-18 cm) 3 ppp	66-75°F (19-24°C)	64-66°F (18-19°C)	8-9	9-10	10-11	Light is required for germination. Grow on dry side but do not allow plants to wilt. It grows slowly when temperature is below 64°F (18°C).	16-20 in. (40-50 cm) (2 in./5 cm taller under FL conditions)	12-14 in. (30-35 cm)	~	Do not pinch. Pinching will only delay flowering and make plant habit unattractive.

78	ANGELONIA A. angustifolia	Serena® F1 Series		28,500 S/oz. (1,000 S/g)	PEL	288-cell or larger	No	72-76°F (22-25°C)	4-5	5-6	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm) 3 ppp, gallon (15-18 cm) 3 ppp	66-75°F (19-24°C)	64-66°F (18-19°C)	8-9	9-10	10-11
----	------------------------------	----------------------	--	-----------------------------	-----	-----------------------	----	----------------------	-----	-----	---	----------------------	----------------------	-----	------	-------

Weeks from plug to finish

Annual Culture Chart

															(Spring unless s	pecineu)					
Grower Facts		Series/Variety	Exposure	Seeds per oz.(g)	Seed form	Recommended plug size**	d Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other	Key tips	Mature height	Plant spread	Heat Co tolerant cro	ol Other pp recommendations
Pg 79	ANGELONIA A. angustifolia	Series	Q	28,500 S/oz. (1,000 S/g)	PEL	288-Cell Or larger	ΝΟ	/2-76°F (22-25°C)	4-5	5-6	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm) 3 ppp, gallon (15-18 cm) 3 ppp	66-75°F (19-24°C)	64-66 F (18-19°С)	8-9	9-10	10-11	Light is required for germination. Grow on dry side but do no allow plants to wilt. It grows slowly when temperature is below 64°F (18°C).	12-14 in. (30-35 cm) t (6 in./15 cm taller under FL conditions)	12-14 in. (30-35 cm)	V	Do not pinch. Pinching will only delay flowering and make plant habit unattractive. It is naturally more compact than Serena and requires less PGR.
FOR SO	NGBIRD & SWAN SERIE	ES AQUILEGIA See Pe	erennial C	ulture Chart (pg 4	8)																
FOR LO	TTI ARABIS See Perennia	al Culture Chart (pg 50))																		
	ASTER Callistephus chinensis	Meteor Series	Q	12,000 S/oz. (420 S/g)	SED	200-cell	Yes	70°F (21°C)	4-8	4-5	Cut flower	60-75°F (15-24°C)	50-60°F (10-15°C)	-	-	13-16	See also Cut Flower section for more details (pg 68).	2.5-3.5 ft. (0.8-1 m)	-		
	ASTER Callistephus chinensis	Pot 'N Patio Series	¢	12,000 S/oz. (420 S/g)	SED	288-cell or larger	Yes	70°F (21°C)	4-8	4-5	Pack, 4 in. (10 cm)	65-75°F (18-24°C)	55-65°F (13-18°C)	8	8	_	Flowers in just 90 days from sowing during the short days of Winter and early Spring.	6 in. (15 cm)	6 in. (15 cm)		Not recommended for landscape plantings.
Pg 80	BACOPA Sutera cordata	Blutopia® & Snowtopia®	0	12,675-19,845 MSP/oz. (500-700 MSP/g	MSP g)	288 or 128-co	ell No	68-73°F (20-23°C)	4	3-4	4.5 in. (10.5 cm), 10 in. (25 cm) baskets (5-6 ppp)	60-75°F (16-24°C)	55-60°F (13-16°C)	-	4-6	8-9	Use of PGRs or growing outdoors will give a much more controlled plant. Be sure to water multi-seed pellets thoroughly and give light for best germination.	6 in. (15 cm)	18-24 in. (45-60 cm)		Use primarily in baskets and container applications for best performance.
FOR BA	COPA, FUSEABLES See F	Fuseables Bacopa (pg	18)																		
FOR BA	SIL See Vegetable Culture	e Chart (pg 74)																			
Pg 80	BEGONIA B. x hybrida	BabyWing® F1 Series	•	28,550 S/oz. (1,000 S/g)	PEL	288-cell or larger	No	72-80°F (22-27°C)	7-10	7-8	4 in. (10 cm), 4.5 in. (12 cm), 6 in. (15 cm) 1-2 ppp, 6.5 in. (16 cm) 3 ppp, 10-12 in. (25-30 cm) baskets 4 ppp	65-70°F (18-21°C)	60-65°F (16-18°C)	-	5-7	5-7	Keep moisture high until the first true leaf develops. After transplant, if necessary, a very light spray of a tank mix of Cycocel 300 ppm and B-Nine 2,500 ppm can be used. BabyWing is very responsive to Bonzi and Sumagic. Avoid overspray from neighboring plants.	12-15 in. (30-38 cm)	10-12 in. (25-30 cm)	~	
Pg 81	BEGONIA B. x hybrida	Dragon Wing® F1 Series	•	28,550 S/oz. (1,000 S/g)	PEL	200-cell or larger	Cove lightly	r 72-75°F y (22-24°C)	7-10	7-8	4-4.5 in. (10-11 cm), 5.5-6 in. (14-15 cm) 1-2 ppp, 6.5-8 in. (16-20 cm) 2-3 ppp, gallon (15-18 cm) 2 ppp, 10-12 in. (25-30 cm) 4 ppp	65-70°F (18-21°C)	60-65°F (16-18°C)	-	7-9	7-11	Keep moisture high until first true leaf develops. After transplant, use Bonzi 3-5 ppm spray for height control.	12-15 in. (30-38 cm)	15-18 in. (38-45 cm)	4	
Pg 82	BEGONIA B. x hybrida	Gryphon	**	28,500 S/oz. (1,000 S/g)	PEL	288-cell or larger	No	72-78°F (22-26°C)	10-12	8-9	4.5 in. (11 cm), 6 in. (15 cm) 2 ppp, 8 in. (20 cm) 3ppp, 10-12 in. (25-30 cm) 3-4 ppp	65-75°F (18-25°C)	62-67°F (17-19°C)	-	5-6	7-11	A saturated media and high relative humidity is critical to germinate successfully.	14-16 in. (35-40 cm)	16-18 in. (40-45 cm)	•	
Online*	BELLIS <i>B. perennis</i> A Kieft Seed product	Bellissima Series	٠	21,428 S/oz. (750 S/g)	PEL	406-cell or larger	Yes	65-72°F (18-22°C)	3-5	5	Pack, 306 (9 cm), 5 in. (13 cm) 3 ppp	60-65°F (16-18°C)	40-45°F (5-7℃)	6-10 (U.S. Autumn/ Spring)	6-10 (U.S. Autumn/ Spring)	13-15 (Spring), 7-9 (Autumn North Europe	Use a medium covering of coarse- grade vermiculite to improve seedling) uniformity.	6-10 in. (15-25 cm)	5-8 in. (13-20 cm)	·	Grow as cool as possible but avoid freezing temperatures. For forcing the crop when grown at these temperatures, grow at 55-58°F (10-12°C) for 4 weeks before sale.

FOR CA	REX See ColorGrass [®] (p CARTHAMUS C. tinctorius	og 10) Grenade Series		700-800 S/oz. (25-30 S/g)	FCS	Direct sown preferred 180-cell or larger	Thick with soil	68-72°F (20-22°C)	2-3	11/2-21/2	Field grown	54-65°F (12-18°C)				DS to finish: 10-16
Pg 85	CAMPANULA C. medium	Campana Series	••	102,000-136,000 S/oz. (3,600-4,800 S/g) Raw; 105,000- 122,000 S/oz. (3,700-4,300 S/g) PEL) SED, PEL)	288-cell or larger	No	68-72°F (20-22°C)	4-5	7-8		60-70°F (15-21°C)	54-59°F (12-15℃)	-	-	10-14
Pg 84, 165	CALIBRACHOA C. x hybrida	Kabloom Series		25,000 S/oz. (860 S/g)	PEL	288-cell or larger	Op- tional	68-77°F (20-25°C), optimum 73°F (22.5°C) See Grower Facts or online culture spreadsheet for additional important details.	5-7	5-6 (288 cell) 7-8 for larger cell sizes	Quart, 4-6 in. (10-15 cm), 10 in. (25 cm) 3 ppp, 12 in. (30 cm) basket 5 ppp	55-64°F (13-18°C)	55-64°F (13-18°C)	-	7-8	9-11
Pg 83, 168	CALIBRACHOA <i>C. x hybrida</i>	Crave Series		25,000 S/oz. (860 S/g)	PEL	288-cell or larger	Op- tional	68-77°F (20-25°C), optimum 73°F (22.5°C) See Grower Facts or online culture spread- sheet for additional important details.	5-7	5-6 (288 cell) 7-8 for larger cell sizes	Quart, 4-6 in. (10-15 cm), 10 in. (25 cm) 3 ppp, 12 in. (30 cm) basket 5 ppp	55-64°F (13-18°C)	55-64°F (13-18°C)	-	7-8	9-11
	BROWALLIA B. speciosa major	Bells Series	٠	124,500 S/oz. (4,400 S/g)	SED	406-cell or larger	Yes	75-80°F (24-26°C)	7-15	5	3 ppp 4 in. (10 cm), 10 in. (25 cm) basket	60-65°F (16-18°C)	60-65°F (16-18°C)	-	9-11	11-13
Unime.	FIREWORKS Porphyrocoma pohliana	ividiaLas	*	(524 S/g)	JLU	200-001	103	(18-24°C)	+5	50	4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm) 3 ppp, gallon (15-18 cm)	(22-27°C)	(19-20°C)	7-0	7-0	-9

Plug crop Recommended weeks containers

4-5

Pack, 306 (9 cm), 5 in. (13 cm) 3 ppp

Seed Recommended Cover Germination Days to form plug size** seed temperature germinat

Yes

temperature germinate

3-5

65-72°F (18-22°C)

Annual Culture Chart

Class

BELLIS

B. perennis

A Kieft Seed product

Series/Variety

Medicis Series

Exposure Seeds per oz.(g)

۲

157,000 S/oz. (5,500 S/g)

SED

406-cell or

larger

Grower Facts

Other

-

4-in./ 10-cm

14

Growing on temperature

60-65°F (16-18°C)

day

Growing on

night

40-45°F (5-7°C)

Pack

14

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
Use a medium covering of coarse- grade vermiculite to improve seedling uniformity.	8 in. (20 cm)	5-8 in. (13-20 cm)		•	Under cooler temperatures, Medicis flowers are more fully double. Best grown as a biennial bedding or pot plant.
Heat-loving crop; crop time is very dependant on temperature.	6-8 in. (15-20 cm)	8-10 in. (20-25 cm)	~		
Requires long days to bloom.	10-12 in. (25-30 cm)	12-14 in. (30-35 cm)			
Min. daylength requirement: 11 hours. Recommended Daily Light Integral (DLI) of ≥10 moles• m ⁻² •d ⁻¹ Daminozide can cause slight chlorotic stippling (See Grower Facts or online culture spreadsheet for details)	10-14 in. (25-35 cm)	12-16 in. (30-40 cm)			Apical dominance results in poor branching. The causes include overgrown and spindly plants, low DLI (keep \geq of \geq 10 moles• m ⁻² •d ⁻¹), excessive plug crop time, inadequate plug height control. Pinching is a good solution to remedy the situation. Pinching can occur in plug trays (shear) or after transplant. Pinch at transplant: soft pinch, leaving 4 basal nodes. Pinch can delay flowering; the extent of the delay depends upon the timing and location of the pinch. Do not pinch if using Limited Inductive Photoperiod.
Min. daylength requirement: 10 hours for Yellow and White, 11 for Deep Blue, 12 for Deep Pink. Recommended Daily Light Integral (DLI) of \geq 10 moles• m ⁻² •d ⁻¹ Daminozide can cause slight chlorotic stippling (See Grower Facts or online culture spreadsheet for details)	8-12 in. (20-30 cm)	10-14 in. (25-35 cm)			Apical dominance results in poor branching. The causes include overgrown and spindly plants, low DLI (keep \ge of \ge 10 moles• m ⁻² •d ⁻¹), excessive plug crop time, inadequate plug height control. Pinching is a good solution to remedy the situation. Pinching can occur in plug trays (shear) or after transplant. Pinch at transplant: soft pinch, leaving 4 basal nodes. Pinch can delay flowering; the extent of the delay depends upon the timing and location of the pinch. Do not pinch if using Limited Inductive Photoperiod.
See also Cut Flower section for more details (pg 68).	30-34 in. (75-85 cm)	-			
Leaf fertilization prevents Mn deficiency	32-40 in. (80-100 cm)	8-10 in. (20-25 cm)	~		Direct sown advised due to tap root; sensitive to Mn deficiency

	iture tildi l														Weeks f
Grower Facts	Class CARTHAMUS C. tinctorius	Series/Variety Zanzibar	Exposure	 Seeds per oz.(g) 700-800 S/oz. (25-30 S/g) 	Seed form FCS	Recommended plug size** Direct sown preferred 180-cell or larger	Cover seed Thick with soil	Germination temperature 68-72°F (20-22°C)	Days to germinate 2-3	Plug crop weeks 1½-2½	Recommended containers Field grown	Growing on temperature day 54-65°F (12-18°C)	Growing on temperature night	Pack	4-in. 10-ci
	CELOSIA C. argentea var. plumosus	Glow Series	े	31,200 S/oz. (1,100 S/g)	SED	288-cell or larger	Yes	75°F (24°C)	2-4	4-5	Pack, 4 in. (10 cm)	65-70°F (18-21°C)	55-65°F (13-18°C)	6-7	6-7
Pg 88	CELOSIA C. cristata	Bombay Series	0	 21,300-28,350 S/oz. (750-1,000 S/g) Raw; 5,670-7,080 S/oz. (200-250 S/g) PEL; 20,000- 27,000 S/oz. (700-950 S/g) FCS 	SED, PEL, FCS	288-cell or larger	Cover lightly	• 68-72°F ((20-22°C)	3-4	2-3		Before flower development: 65-75°F (18-24°C) After flower development: 60-61°F (16°C)	Before flower development: 63-65°F (17-18°C) After flower development: 59°F (15°C)	-	-
g 88	CELOSIA C. plumosa	Arrabona Red	0	28,350-42,525 S/oz. (1,000- 1,500 S/g) Raw; 42,525-62,400 S, oz (1,500-2,200 S/g) FCS	FCS	288-cell or larger	Cover lightly	 70 to 72°F (21-22°C) 	2-4	3-4	Packs, 4 -5 in. (10-13 cm)	65 to 70°F (18 to 21°C)	59 to 61°F (15 to 16°C)	8-10	9-12
88	CELOSIA C. plumosa	First Flame Series	0	28,350-42,525 S/oz. (1,000- 1,500 S/g) Raw; 42,525-62,400 S, oz (1,500-2,200 S/g) FCS	FCS	288-cell or larger	Cover lightly	70 to 72°F (21-22°C)	2-4	3-4	Packs, 4 -5 in. (10-13 cm)	65 to 70°F (18 to 21°C)	59 to 61°F (15 to 16°C)	8-10	9-12
89	CELOSIA C. plumosa	Ice Cream Series	0	42,000-63,000 S/oz. (1,500- 2,400 S/g)	FCS	288-cell or larger	Cover lightly	[™] 70 to 72°F 7 (21-22°C)	2-4	3-4	Pack, 4-5 in. (10.5-13 cm)	65 to 70°F (18 to 21°C)	59 to 61°F (15 to 16°C)	8-10	9-12
Pg 90	CELOSIA C. plumosa	Sunday Series	0	42,525-68,040 S/oz. (1,500-	SED, COT	288-cell or larger	Cover lightly	68-72°F (20-22°C)	3-4	2-3		Before flower development:	Before flower development:	-	-

	C. plumosa			S/oz. (1,500- 2,400 S/g) Raw; 44,000-60,000 S/oz. (1,550-2,100 S/g) FCS	СОТ	larger	lightly	(20-22°C)				development: 65-75°F (18-24°C) After flower development: 60-61°F (16°C)	development: 63-65°F (17-18°C) After flower development: 59°F (15°C)			
Pg 90	CELOSIA C. spicata	Kosmo	0	42,000-63,000 S/oz. (1,500- 2,400 S/g)	FCS	288-cell or larger	No	70 to 72°F (21-22°C)	2-4	3-4	3.5-in (9 cm), 4 to 5-in. (10.5-13 cm), gallon (18 cm)	65-68°F (18-20°C)	62-65°F (17-18°C)	9-11	10-12	10-12
	CELOSIA C. spicata	Spiky Series	Q	39,000-47,000 S/oz. (1,400- 1,700 S/g)		406-cell or larger	Cover lightly	68 to 72°F (20-22°C)	3-5	3-4	4 in. (10 cm) 5 in. (13 cm)	65 to 68°F (18- 20°C)	61 to 63°F (16-17°C)		11-14	12-15
	COBAEA C. scandens		۲	375 S/oz. (13 S/g)	SED	72-cell or larger	Yes	70°F (21°C)	14-21	6	8 in. (20 cm)	68-75°F (20-24°C)		-	-	-

*Find online Grower Facts culture at panamseed.com.

Other DS to finish: 10-16

-

10-14

-

-

-

12-16

4-in./ 10-cm

8-10 9-12

8-10 9-12

9-12

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
Leaf fertilization prevents Mn deficiency	32-40 in. (80-100 cm)	8-10 in. (20-25 cm)	~		Direct sown advised due to tap root; sensitive to Mn deficiency
Create a unique pot crop by sowing 10-15 seeds into a 4-in. (10-cm) container. This produces an interesting mini-forest of celosia.	10-12 in. (25-30 cm)	8-10 in. (20-25 cm)	~		Plant growth regulator treatment may be needed once or twice under longer days for a more compact plant. Under Northwest European conditions, 1 or 2 light treatments with Alar (B-Nine) have shown to be effective.
See also Cut Flower	28-40 in.	-			

section for more	(70-100 cm)
details (pg 68).	

	10-14 in. (25-35 cm)	10-16 in. (25-40 cm)		Keep growing plugs under daylength of 14 hours or longer to prevent premature flowering. Also don't allow media to dry out.
	14-25 in. (35-50 cm)	10-16 in. (25-40 cm)		Keep growing plugs under daylength of 14 hours or longer to prevent premature flowering. Also don't allow media to dry out.
Keep medium moist constantly and do not allow the media dry out.	12 in. (30 cm)	10 in. (25 cm)	V	Keep growing plugs under daylength of 14 hours or longer to prevent premature flowering. Also don't allow media to dry out.
See also Cut Flower section for more details (pg 68).	28-40 in. (70-100 cm)	-		
Keep medium moist constantly and do not allow the media dry out.	8 in. (20 cm)	8-10 in. (20-25 cm)	~	
Reacts well on Alar; short day reaction	16 in. (40 cm)	8-12 in. (20-30 cm)	~	
In North America, plants started in April will bloom in August/ September.	Vine, to 25 ft. (7.5 m)	-		

Annual	Culture	Chart
/	carcarc	Circit

Weeks from plug to finish

Grower	Class	Sorios Mariatu	Exposure Soods per of (g)	Seed	Recommended	Cover	Germination	Days to	Plug crop	Recommended	Growing on temperature day	Growing on temperature	e Pack	4-in./	Othor	Kowting	Mature	Plant	Heat	Cool Other
1400	COLEUS Solenostemon scutellarioides	Black Dragon	100,000 S/oz. (3,500 S/g)	SED	288-cell or larger	Cover	r 72-75°F y (22-24°C)	4-5	5-6	Pack	65-75°F (18-24°C)	57-65°F (14-18°C)	5-6	-			12-14 in. (30-35 cm)	10-12 in. (25-30 cm)		
Pg 91	COLEUS Solenostemon scutellarioides	Kong® and Kong Jr. Series	(900 S/g)	PEL	288-cell or larger	Cover lightly	r 72-75°F y (22-24°C)	4-5	5-6	5 in. (13 cm), gallon (15 cm)	65-75°F (18-24°C)	57-65°F (14-18°C)	-	4-5	5-6	Do not pinch. It will result in smaller leaves and delay crop time. Note: Kong Salmon Pink might appear dark bronze under some very low light conditions. Later in the season, and in Summer landscape, color will appear Salmon Pink.	18-24 in. (45-60 cm)	15-35 in. (38-90 cm)	~	Shade is best. Leaf size is maximized in shade. Mosaic can scorch in sun. When using in combination planters, Kong performs best when planted near the outside of the container.
Pg 92	COLEUS Solenostemon scutellarioides	Premium Sun Collection	(970 S/oz. (970 S/g)	PEL	288-cell or larger	Cover lightly	r 72-75°F y (22-24°C)	4-5	5-6	306 Pack (9 cm), Chocolate Covered Cherry Only); 4 in. (10 cm), 5 in. (13 cm), 6 in. (15 cm) 3 ppp, gallon (15-18 cm) 3 ppp	65-75°F (18-24°C)	57-65°F (14-18°C)	6-8 (Chocolate Covered Cherry only)	6-8 2	6-8		20-30 in. (50-75 cm) Varies by variety.	10-24 in. (25-60 cm) Varies by variety.	V	Sun tolerant grown under high humidity. Sun tolerant under low humidity only in low light intensity areas such as northern Europe. Also suited to partial to full shade.
Online*	COLEUS Solenostemon scutellarioides	Wizard [®] Series	(3,500 S/oz.) (3,500 S/g)	SED	288-cell or larger	Cove lightly	r 72-75°F y (22-24°C)	4-5	5-6	Pack, 4 in. (10 cm), 5 in. (13 cm)	65-75°F (18-24°C)	57-65°F (14-18°C)	7-9	7-9	-		12-14 in. (30-35 cm)	10-12 in. (25-30 cm)	v	
FOR CO	LEUS, FUSEABLES See	Fuseables Coleus (pg	18) 4.876 MSP/oz.	MSP	288-cell or	No	65-76°F	5-6	5-6	306 (9 cm).	62-74°F	59-64°F	6-8	6-8	6-8 (3 ppp).	Color is better	12-14 in.	22-24 in.		Hardy to USDA Zones 7-10.
18,0	ANEMANTHELE A. lessoniana	5110220	(172 MSP/g)		larger	No	(18-24°C)			4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	(17-23°C)	(15-18°C)			8-10 (1 ppp)	under cool and high light conditions. If temperature permits, it is best to produce Sirocco in outdoor conditions.	(30-35 cm)	(55-60 cm)		Light for germination is optional.
Pg 87	COLORGRASS® CAREX C. buchananii	Red Rooster	3,750 msp/oz. (126 msp/g)	MSP	288-cell or larger	Yes	74-79°F (24-26°C)	7-10	6-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°C)	64-66°F (18-19°C)	8-9	8-9	9-10	Light for germination is optional.	20-30 in. (50-75 cm)	12 in. (30 cm)		✓ USDA Hardiness Zones 6 to 9.
Pg 85	COLORGRASS® CAREX C. comans (Leatherleaf Sedge)	Amazon Mist	5,184 MSP/oz. (183 MSP/g)	MSP	288-cell or larger	Yes	68-79°F (20-26°C)	7-10	6-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°C)	64-66°F (18-19°C)	9-10	9-10	10-11	Light for germination is optional.	6-12 in. (15-30 cm)	14 in. (35 cm)		✓ USDA Hardiness Zones 6 to 10.
Pg 86	COLORGRASS® CAREX C. comans (Leatherleaf Sedge)	Bronco	3,860 MSP/oz. (136 MSP/g)	MSP	288-cell or larger	Yes	74-79°F (24-26°C)	7-10	6-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°C)	64-66°F (18-19°C)	8-9	8-9	9-10	Light for germination is optional.	6-12 in. (15-30 cm)	14 in. (35 cm)		✔ USDA Hardiness Zones 6 to 10.
Pg 86	COLORGRASS® CAREX C. comans (Leatherleaf Sedge)	Phoenix Green	(77 S/g)	MSP	288-cell or larger	Yes	74-79°F (24-26°C)	7-10	5-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°C)	64-66°F (18-19°C)	6-7	6-7	7-8	Light for germination is optional.	20-24 in. (50-60 cm)	16-20 in. (40-50 cm)		✓ USDA Hardiness Zones 6 to 10.
Pg 93	COLORGRASS® CORYNEPHORUS C. canescens (Clubawn Grass)	Spiky Blue	9,916 MSP/oz. (350 MSP/g)	MSP	288-cell	Yes	68-79°F (20-26°C)	3-6	6-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°C)	64-66°F (18-19°C)	6-7	6-7	7-8	Light for germination is optional.	6-12 in. (15-30 cm)	8 in. (20 cm)		✓ USDA Hardiness Zones 5 to 9.
630	231-1400 panamseed	d.com					*Find onli	ine Grower Fa	acts culture a	t panamseed.com.	**Approxin	ate plug cell dia	meter: 128-cell	(3.25 cm), 288	-cell (2 cm), 406-c	ell (1.75 cm), 512-cell (1	25 cm)		63	0 231-1400 panamseed.com

uarci															(Spring unless sp	pecified)
Grower Facts	Class	Series/Variety	Exposure	Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other
	COLEUS Solenostemon scutellarioides	Black Dragon	•*	100,000 S/oz. (3,500 S/g)	SED	288-cell or larger	Cover lightly	72-75°F (22-24°C)	4-5	5-6	Pack	65-75°F (18-24°C)	57-65°F (14-18°C)	5-6	-	-
Pg 91	COLEUS Solenostemon scutellarioides	Kong [®] and Kong Jr. Series	••	25,650 S/oz. (900 S/g)	PEL	288-cell or larger	Cover lightly	72-75°F (22-24°C)	4-5	5-6	5 in. (13 cm), gallon (15 cm)	65-75°F (18-24°C)	57-65°F (14-18°C)	-	4-5	5-6

12 630 231-1400 panamseed.com

**Approximate plug cell diameter: 128-cell (3.25 cm), 288-cell (2 cm), 406-ce

Online*	COLORGRASS® ERAGROSTIS E. curvula (Love Grass)	Wind Dancer	0	5,670 MSP/oz. (200 MSP/g)	MSP	288-cell or larger	No	71-76°F (21-24°C)	2-3	3-4	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°	64-66°F C) (18-19°C)	5-6	6-7	7-8
Pg 97	COLORGRASS® FESTUCA F. cinerea (F. glauca)	Festina	0	Not available	MSP	288-cell or larger	Yes	64-72°F (18-22°C)	3-6	6-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°	64-66°F C) (18-19°C)	6-7	6-7	7-8
Online*	COLORGRASS® ISOLEPIS I. cernua (Fiber Optic Grass)	Live Wire	0	13,514 MSP/oz. (473 MSP/g)	MSP	288-cell or larger	No	64-68°F (18-20°C)	6	5	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°	64-66°F C) (18-19°C)	6-7	6-7	7-8
Online*	COLORGRASS® JUNCUS J. effusus spiralis	Twister	0	17,700 MSP/oz. (625 MSP/g)	MSP	288-cell or larger	No	70-78°F (21-25°C)	10-13	7-8	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°	59-64°F C) (15-18°C)	6-7	7-8	8-9
Pg 105	COLORGRASS® JUNCUS J. ensifolius	Starhead	0	32,296 MSP/oz. (1,140 MSP/g)	MSP	288-cell or larger	No	64-72°F (18-22°C)	7-10	6-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°	64-66°F C) (18-19°C)	7-8	7-8	8-9
Online*	COLORGRASS® JUNCUS J. inflexus	Blue Arrows	0	29,768 MSP/oz. (1,050 MSP/g)	MSP	288-cell or larger	No	71-76°F (22-24°C)	7-8	6-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°	64-66°F C) (18-19°C)	6-7	6-7	7-8
Online*	COLORGRASS® JUNCUS J. pallidus	Javelin	0	28,237 MSP/oz. (996 MSP/g)	MSP	288-cell or larger	No	71-76°F (22-24°C)	5-6	5-6	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	62-73°F (17-22°	59-64°F C) (15-18°C)	5-6	5-6	6-7
Online*	COLORGRASS® JUNCUS J. tenuis	Blue Dart	ं	: 19,901 MSP/oz. (702 MSP/g)	MSP	288-cell or larger	No	71-76°F (22-24°C)	7-8	6-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	62-73°F (17-22°	59-64°F C) (15-18°C)	7-8	7-8	8-9
Online*	COLORGRASS® KOELERIA K. glauca	Coolio	0	7,995 MSP/oz. (282 MSP/g)	MSP	288-cell or larger	No	65-74°F (18-23°C)	4-5	6-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°	64-66°F C) (18-19°C)	6-7	6-7	7-8
Pg 108	COLORGRASS® LUZULA L. nivea	Lucius	ं	4,335 MPS/oz. (153 MPS/g)	MSP	288-cell or larger	Yes	64-68°F (18-20°C)	10-12	4-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°	64-66°F C) (18-19°C)	8-9	8-9	9-10

Plug crop Recommended weeks containers

Seed Recommended Cover Germination Days to form plug size** seed temperature germinate

Exposure Seeds per oz.(g)

Series/Variety

Class

Grower Facts

Other

4-in./ 10-cm

Growing on temperature

night

Pack

Growing on

Kouting	Mature	Plant	Heat	Cool	Other
Grows well under outdoor nursery conditions if the temperature permits. If produced in a greenhouse, they should be grown on the dry side with low feed.	3-4 ft. (0.9-1.2 m)	3-4 ft. (0.9-1.2 m)		crop	Prefers being grown on the dry side with low feed. Growing too wet or with too much feed will tend to make plants less upright. Hardy to USDA Zone 6.
Light for germination is optional.	12-18 in. (30-45 cm)	10-15 in. (25-38 cm)		~	USDA Hardiness Zones 4 to 10.
Sow uncovered at 65°F (18°C) for fastest and most uniform germination; prefers moist soil.	6-8 in. (15-20 cm)	18-20 in. (45-50 cm)			Do not allow plants to dry out, as this will cause the foliage to become yellow. USDA Hardiness Zones 8 to 10.
	12-14 in. (30-35 cm)	12-14 in. (30-35 cm)	~		Great for mixed containers. USDA Hardiness Zones 5 to 9.
Light for germination is optional.	8-10 in. (20-25 cm)	8-10 in. (20-25 cm)		~	USDA Hardiness Zones 4 to 10.
Light for germination is optional.	36 in. (90 cm)	12 in. (30 cm)	~		Well-suited to both containers and landscape plantings. Good for moist and boggy spots or shallow water. USDA Hardiness Zones 5 to 9.
To prevent leaf bending, Bonzi 30 ppm spray can be used. Light for germination is optional.	48 in. (1.2 m)	18-20 in. (45-50 cm)	~		USDA Hardiness Zones 8 to 10.
Excellent substitute for Draecena Spike. Light for germination is optional.	14-16 in. (35-40 cm)	10-12 in. (25-30 cm)	~		Well-suited to both containers and landscape plantings. Good for moist and boggy spots or shallow water. USDA Hardiness Zones 4 to 10.
Requires light to germinate.	First season 6-8 in. (15-20 cm); later 20 in. (50 cm)	8 in. (20 cm)			USDA Hardiness Zones 6 to 8.
Requires light to germinate. Make sure plants don't get too wet.	6-12 in. (15-30 cm)	18 in. (45 cm)		~	USDA Hardiness Zones 4 to 9.

Annual	Culture	Chart	
		••••••	

Grower Facts	Class	Series/Variety	Exposure	e Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other
Pg 108	COLORGRASS [®] LUZULA L. sylvatica	Starmaker	0	Not available	MSP	288-cell	Yes	64-68°F (18-20°C)	10-12	4-7	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	66-74°F (19-23°C)	64-66°F (18-19°C)	9-10	9-10	10-11
Online*	COLORGRASS® STIPA S. tenuissima (Mexican Feather Grass)	Pony Tails	<u> </u>	4,026 MSP/oz. (142 MSP/g)	MSP	288-cell	No	64-75°F (18-24°C)	4-5	4-5	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	62-74°F (17-23°C)	59-64°F (15-18°C)	6-7	6-7	6-7 (3 ppp), 8-9 (1 ppp)
FOR EAI	RLY SUNRISE, RISING S	UN, SUNFIRE & SUN	N UP COR	EOPSIS See Peren	nial Cult	ure Chart (pg 50-!	52)									
	COSMOS C. bipinnatus	Antiquity		5,500-7,000 S/o; (200-250 S/g)	z. RAW	288-cell or larger	Thick	61-65°F (16-18°C)	3-5	4-5	3.5 in. (9 cm), 4 in. (10 cm), 5 in. (13 cm)	65-75°F (18-24°C)	61-65°F (16-18°C)	-	6-7	6-7
	COSMOS C. bipinnatus	Sonata Series	0	5,100 S/oz. (180 S/g)	SED	406-cell or larger	Yes	66-70°F (19-21°C)	3-4	4-5	4 in. (10 cm), gallon (15-18 cm) 3 ppp	70-80°F (21-26°C)	70-75°F (21-24°C)	-	6-7	7-8
	CRASPEDIA C. globosa	Billy Buttons		45,000-50,000 S/oz. (1,600- 1,800 S/g)		288-cell or larger	Cover lightly	65-68°F (18-20°C)	10-14	6-7	Field grown			-	-	17-18
Online*	CROSSANDRA C. infundibuliformis	Tropic Series	0	6,180 S/oz. (218 S/g)	SED	406-cell or larger	Yes	78-82°F (25-28°C)	7-10	6-7	4 in. (10 cm), 6 in. (15 cm) 3 ppp	75-80°F (24-26°C)	68-75°F (20-24°C)	-	10-11 in South	10-11 in South
FOR CU	CUMBER See Vegetable	Culture Chart (pg 74	.)													
	CUPHEA C. ignea (Cigar Plant)	Dynamite	ं	21,300 S/oz. (750 S/g)	SED	288-cell or larger	Cover lightly	70-75°F (21-24°C)	4-6	5-6	4 in. (10 cm)	70-75°F (21-24°C)	65-68°F (18-20°C)	-	6-7	-
	DAHLIA D. x hybrida	Figaro Series	٠	2,800 S/oz. (100 S/g)	SED	288-cell or larger	Yes	66-70°F (19-21°C)	3-7	4-5	Pack, 4 in. (10 cm)	52-60°F (11-16°C)	52-60°F (11-16°C)	5-6	5-6	-
FOR DA	SANTE BLUE, DIAMON	IDS BLUF & GUARD	IAN SERIE		See Perer	nial Culture Cha	rt (ng 52	2)								
10110/1	DESCHAMPSIA	Zephyr	····	4.876 MSP/oz.	MSP	288-cell or	No	-/ 65-71°F	4-5	4-5	306 (9 cm).	66-74°F	64-66°F	5-7	6-7	6-7
	D. elongata			(172 MSP/g)		larger		(18-22°C)			4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm), gallon (15-18 cm)	(19-23°C)	(18-19°C)			
Online*	DIANTHUS D. barbatus interspecific	Amazon F1 Series	0	12,190-13,890 pellets/oz. (430-490 pellets/g)	PEL	288-cell	Yes	64-68°F (18-20°C)	3-5	4-5	Cut flower. For Container production - 8 in. (20 cm) 3 ppp	60-72°F (16-22°C)	50-60°F (10-16°C)	-	-	11-22
Online*	DIANTHUS D. barbatus	Sweet F1 Series	0	7,300-9,600 pellets/oz. (260 - 340	PEL	288-cell or larger	Yes	64-68°F (18-20°C); light	3-5	4-5	Cut flower	60-72°F (15-22°C)	50-60°F (10-16°C)	-	-	Weeks from transplant to first flower: 11

pellets/g)

optional

Weeks from plug to finish (Spring unless specified)

PanAmerican Seed.

Key tips	Mature height	Plant	Heat tolerant	Cool	Other
Requires light to germinate. Make sure plants don't get too wet.	12-18 in. (30-45 cm)	10 in. (25 cm)		~	USDA Hardiness Zones 4 to 9.
Light for germination is optional.	16-24 in. (40-60 cm)	24 in. (60 cm)			USDA Hardiness Zones 7 to 10.
	20-30 in. (50-75 cm)	12-14 in. (30-35 cm)			Cosmos flower faster under short days. Daylength extension in the plug stage may be used to prevent premature flowering.
Can treat the plugs at early Stage 1 with Bonzi at 15 ppm applied as a spray to control the early stretch.	24 in. (60 cm)	12-14 in. (30-35 cm)			Cosmos flower faster under short days. Daylength extension in the plug stage may be used to prevent premature flowering.
Best grown as annual.	16-20 in. (40-50 cm)	10-12 in. (25-30 cm)	~		Support netting is advised.
Best in tropical and semi-tropical climates.	10 in. (25 cm)	8 in. (20 cm)	~		For cooler (Northern) growing areas, add 3 weeks to crop time or grow for Summer sales.
No pinching required.	8-10 in. (20-25 cm)	10-12 in. (25-30 cm)	•		
If germ chamber is used, move trays to greenhouse at first sign of germination.	14-18 in. (35-45 cm)	10-12 in. (25-30 cm)			Very responsive to B-Nine.
Will perform better if grown in containers.	6-8 in. (15-20 cm)	10-12 in. (25-30 cm)			Prefers being grown on the humid side. Will dry out very easily. Hardy to USDA Zone 7.
Responsive to PGRs; PGRs are needed to produce as a bedding plant. See Grower Facts for recommendations. See also Cut Flower section for more details (pg 68).	18-36 in. (45-90 cm)	10-12 in. (25-30 cm)		v	In low-light conditions (Northern areas), Amazon is best produced as the daylength increases for finishing as an early Summer crop.
See also Grower Facts for recommendations and Cut Flower section for more details (pg 70).	18-36 in. (45-90 cm)	10-12 in. (25-30 cm)		~	

(Spring) 12-16 (late Autumn/ . Winter)

16 630 231-1400 panamseed.com

**Approximate p	lug cell diameter: 128-cell (3.25 cm),	, 288-cell (2 cm), 406-cell (1	.75 cm), 512-cell (1.25 cm)

Grower Facts	Class	Series/Variety	Exposure	e Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other	Key tips	Mature height	Plant spread	Heat tolerant	Cool Other crop recommendations
Pg 93	DIANTHUS D. barbatus	Dash F1 Series	0	6,520-10,915 pellets/oz. (230-385 pellets/g)	PEL	288-cell or larger	Yes	64-68°F (18-20°C); light optional	3-5	4-5	Quart - 1 ppp, Gallon (15-18 cm) 1-3 ppp	Provide 65 to 75°F (18 to 24°C) day temperatures for the first 2 weeks of greenhouse production to establish the plants. Finish at 60 to 70°F (15 to 21°C) days.	Provide 60°F (15°C) night temperatures for the first 2 weeks of greenhouse production to establish the plants. Finish in the low 50°s (11 to 12°C).	-	-	Weeks from transplant to finish: 9 to 10 weeks (Late Spring/Early Summer), 11-12 (late Summer/ Winter)	Dash Dianthus has a naturally compact plant habit and has good basal branching when compared to other barbatus type dianthus, making it more suitable for container production.	15-20 in. (38-50 cm)	12-14 in. (30-35 cm)		Avoid using fungicides such as Heritage containing active ingredient Azoxystrobin as they can cause phytotoxic symptoms on Dash Dianthus.
Online*	DIANTHUS D. barbatus interspecific	Bouquet F1 Series	<u> </u>	8,900-12,360 pellets/oz. (314-436 pellets/g)	PEL	288-cell or larger	Yes	64-68°F (18-20°C); light required	3-5	4-5	6 in. (15 cm); Gallon (15-18 cm), 1-3 ppp	60-72°F (16-22°C)	50-60°F (10-16°C)			8-9 weeks from transplant	Responsive to PGRs; PGRs are needed to produce as a bedding plant; see Grower Facts for recommendations and Cut Flower section for more details (pg 68).	18-24 in. (45-60 cm)	10-12 in. (25-30 cm)		
Online*	DIANTHUS, DOUBLE <i>D. barbatus</i> <i>interspecific</i>	Dynasty F1 Series		7,370-10,490 pellets/oz. (260-370 pellets/g)	PEL	288-cell or larger	Yes	64-68°F (18-20°C); light required	3-5	4-5	4 in. (10 cm); 6 in. (15 cm)	60-72°F (16-22°C)	50-60°F (10-16°C)			8-9 weeks from transplant		16-20 in. (40-50 cm)	10 in. (25 cm)		
Online*	DIANTHUS D. chinensis x barbatus	Floral Lace F1 Series	Q	31,190 S/oz. (1,100 S/g)	SED, PEL	288-cell or larger	Yes	64-68°F (18-20°C)	3-5	4-5	Pack	60-72°F (16-22°C)	50-60°F (10-16°C)	4-5	-	-		8-10 in. (20-25 cm)	8 in. (20 cm)		V
Online*	DIANTHUS D. chinensis x barbatus	Ideal Select F1 Series	\bigcirc	31,190 S/oz. (1.100 S/g)	SED, PEL	288-cell or larger	Yes	64-68°F (18-20°C)	3-5	4-5	Pack	60-72°F (16-22°C)	50-60°F (10-16°C)	4-5	-	-		8-10 in. (20-25 cm)	8 in. (20 cm)		v
Pg 94	DIANTHUS D. barbatus interspecific	Jolt	0	12,190-13,890 pellets/oz. (430-490 pellets/g)	PEL	288-cell or larger	Yes	64-68°F (18-20°C)	3-5	4-5	Quart 1 ppp, Gallon (15-18 cm) 1-3 ppp	65-67°F (18-24°C) for first 2 weeks, then 60-70°F (15-21°C)	60°F (15°C) for first 2 weeks then low 50°F (11-12°C)	-	-	12-14 weeks for later Spring through Autumn 14-18 weeks for early Spring	Temperature and light intensity have greater impact on Jolt flowering, especially during Winter and early Spring season.	16-20 in. (40-50 cm)	12-14 in. (30-35 cm)	•	V
Online*	DIASCIA D. barberae	Diamonte Series	00	: 721,068-33,575 S/oz. (4,590-5,880 S/į	SED	288-cell or larger (4 seed per cell)	Cove s lightly	r 65-70°F y (18-21°C)	4-6	4	306 Pack (9 cm), 4 in. (10 cm), 6 in. (15 cm) 3 ppp	60-66°F (16-19°C)	50-60°F (10-16°C)	6-8	7-9	8-10	Plants can be grown on with much cooler temperatures, but crop time will be longer. Do not use growth regulator before radicle emergence as this can delay or stop germination. See Grower Facts for growth regulator details.	10-12 in. (25-30 cm)	12-14 in. (30-35 cm)		✓ Sow 4 seeds per cell.
Pg 95	DICHONDRA D. argentea	Silver Falls	*	: 5,950 S/oz. (210 S/g)	SED	288-cell or larger	Cove	r 72-76°F y (22-24°C)	4-5	5	306 (9 cm), 4 in. (10 cm), 10 in. (25 cm) basket 3 ppp	65-75°F (18-24°C)	62-65°F (17-18°C)	-	6-7	7-8	Grows best in warm and dry conditions. Use light feed. Rinse foliage after feeding to avoid salt burn.	2-3 in. (5-7 cm)	3-4 ft. (0.9-1.2 m)	~	Excellent as a groundcover, but requires well-drained soils due to the ground- hugging habit.
Online*	DICHONDRA D. repens	Emerald Falls	•	1,840 MSP/oz. (65 MSP/g)	MSP	288-cell or larger	Cove	r 72-76°F y (22-24°C)	4-5	5-6	306 (9 cm), 4 in. (10 cm), 10 in. (25 cm) basket 3 ppp	65-75°F (18-24°C)	62-65°F (17-18°C)	-	7-8	8-9	Grows best in warm and dry conditions. Use light feed. Rinse foliage after feeding to avoid salt burn.	2-4 in. (5-10 cm)	3 ft. (90 cm)	~	Excellent as a groundcover, but requires well-drained soils due to the ground- hugging habit.
FOR DIL	L See Vegetable Culture	Chart (pg 74)	ريەس	00.000.04-	650	200	¥	77 75%5	4.Γ	4 5	Dock			7.0	9.0			10:-	10 i r		
	Cineraria maritima/ Senecio cineraria	Silverdust	Q	90,000 S/oz. (3,175 S/g)	SED	288-cell or larger	Yes	72-75°F (22-24°C)	4-5	4-5	часк, 4 in. (10 cm)	60-65°F (16-18°C)	55-58°F (13-14°C)	7-8	8-9	-		10 m. (25 cm)	10 in. (25 cm)		
FOR PO	WWOW SERIES AND 'O	CHEYENNE SPIRIT' E	CHINACE	A See Perennial C	ulture Cl	nart (pg 54)						 									
Online*	ERYSIMUM <i>E. species</i> A Kieft Seed product	Citrona [®] Series	Ō	14,000 S/oz. (500 S/g)	SED	406-cell or larger	Yes	68-72°F (20-22°C)	2-4	4	306 (9 cm), 4 in. (10 cm), gallon (15 cm) 3 ppp	65-70°F (18-21°C)	55-60°F (13-16°C)	-	7-9	8-10	Erysimum performs well when grown under cooler temperatures.	10-12 in. (25-30 cm)	10-12 in. (25-30 cm)		 Grow like Cheiranthus or Matthiola (Stock).

18 630 231-1400 panamseed.com

FOR 'SPARKLE WHITE' GAURA See Perennial Culture Chart (pg 54)

**Approximate plug cell diameter: 128-cell (3.25 cm), 288-cell (2 cm), 406-cell (1.75 cm), 512-cell (1.25 cm)

Grower Facts	Class	Series/Variety	Exposure	Seeds per oz.(g)	Seed form	Recommended	Cover seed	Germination	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature dav	Growing on temperature night	Pack	4-in./ 10-cm	Other
Pg 95	EUPHORBIA E. graminea	Glamour	Ò	18,425-20,553 S./oz (650-725 S./g)	SED	288-cell or larger	Cover lightly	64-72°F (18-22°C)	3-6	3-4	1801 pack, 4-5 in. (10-13 cm) pots, quart, 6 in. (15 cm), gallon (15-18 cm)	65-77°F (18-25℃)	65-68°F (18-20°C)	3-5	4-6	5-7
Pg 96	EUPHORBIA E. graminea	Glitz	0	18,425-21,000 S/oz (650-750 S/g)	SED	288-cell or larger	Op- tional	65-72°F (18-22°C)	3-6	4-5	4-5 in. (10-13 cm) pots, quart, 6 in. (15 cm), Gallon (15-18 cm), 10 in. (25 cm) HB	65-77°F (18-25°C)	65-68°F (18-20°C)	-	5-8	6-8
	EUPHORBIA E. marginata	Kilimanjaro	Ç	1,400-1,700 S/oz (50-60 S/g)	. RAW	288-cell or larger	Nor- mal cover	68-72°F (20-22°C)	3-7	4-5	Field grown, 6 in. (15 cm), gallon	61-72°F (16-22°C)	54-61°F (12-16°C)			8-12
Pg 97	FUSEABLES® BACOPA Sutera cordata	Utopia	0	Precision Multi-Pellet	PMPL	288 or 128-cell	No	68-73°F (20-23°C)	4	4-5	6 to 8-in. (15 to 20 cm) pots, 10-12 in. (25-30 cm) baskets 4 ppp	59-76°F (15-24°C)	55-60°F (13-16°C)	-	-	6-7 from 288 cells, 5-6 from 105/128 cells, 4-5 from 72 cells
Pg 98	FUSEABLES® COLEUS Solenostemon scutellariodes	Chocolate Symphony, Under the Sun	*	Precision Multi-Pellet	PMPL	288 or 128-cell	Cover lightly	· 72-75°F (22-24°C)	4-5	5-6	6-8 in. (15-20 cm) pots, 10 in. (25 cm) 1-3 ppp, 12 in. (30 cm) 4-5 ppp	65-76°F (18-24°C)	59-64°F (15-18°C)	-	-	5-7
Pg 99	FUSEABLES® JUNCUS Juncus inflexus (Blue Arrows) and Juncus effusus spiralis (curly juncus)	Twisted Arrows	0	22,600-25,515 MSP/oz. (800-900 MSP/g)	MSP	288-cell or larger	No	71-76°F (22-24°C)	7-8	7-9	306 (9 cm), 2.5 in. (6 cm), 4 in. (10 cm), 6 in. (15 cm) 1-3 ppp, gallon (15-18 cm) 1-3 ppp	62-73°F (17-22°C)	59-64°F (15-18°C)	6-7	7-8	7-8
Pg 99	FUSEABLES® JUNCUS Juncus tenuis (Blue Dart) and Juncus effusus spiralis (curly juncus)	Twisted Dart	*	11,300-14,000 MSP/oz. (400-500 MSP/g)	MSP	288-cell or larger	No	71-76°F (22-24°C)	7-8	7-9	306 (9 cm), 2.5 in. (6 cm), 4 in. (10 cm), 6 in. (15 cm) 1-3 ppp, gallon (15-18 cm) 1-3 ppp	62-73°F (17-22℃)	59-64°F (15-18°C)	6-7	7-8	7-8
Pg 100	FUSEABLES® MULTI-SPECIES, MULTI-PELLET Petunia x hybrida and Sutera cordata (Bacopa)	Blue Dawn, Cloud N' Sky, Silk N' Satin, Healing Waters	O	Precision Multi-Pellet	PMPL	288, 128-cell or larger	No	72-76°F (22-24°C)	4	4-5	6-8 in. (15-20 cm) pots, 10 in. (25 cm) 1-3 ppp, 12 in. (30 cm) 4-5 ppp	61-75°F (16-24°C)	57-65°F (14-18°C)	-	-	6-7 from 288 cells, 5-6 from 105/128 cells, 4-5 from 72 cells
	FUSEABLES® MULTI-SPECIES, MULTI-PELLET Viola cornuta and Lobularia maritima	Wine Cooler	Ç	Precision Multi-Pellet	PMPL	288, 128-cell or larger	No	65-70°F (18-21°C)	2-4	3-4	6-8 in. (15-20 cm) pots, 10-12 in. (25-30 cm) baskets 4 ppp	60-68°F (16-20°C)	50-60°F (10-16°C)	-	-	5-7 from 288 cell, 4-6 from 128 cell
Pg 100	FUSEABLES® PETUNIA P: x hybrida	Blueberry Lime Jam, Burgundy Starlight, Lime Coral, Ooh La La, Pleasantly Blue, Strawberry Wine	0	Precision Multi-Pellet	PMPL	288, 128-cell or larger	No	72-76°F (22-24°C)	4	5-6	6-8 in. (15-20 cm) pots, 10 in. (25 cm) 1-3 ppp, 12 in. (30 cm) 4-5 ppp	61-75°F (16-24°C)	57-65°F (14-18°C)	_	-	6-7 from 288 cells, 5-6 from 105/128 cells, 4-5 from 72 cells
FOR MI	ESA SERIES GAILLARDIA	A See Perennial Cultur	re Chart (p	g 54)												

Annual Culture Chart

Koy tine	Mature	Plant	Heat	Cool	Other
Avoid temperatures below 62°F (16°C) as cooler temperatures cause foliage yellowing.	15-24 in. (38-60 cm)	15-20 in. (38-50 cm)			Works well in the landscape, as a mix with vigorous growers or solo in large cityscape planters
Do not grow plant at temperature below 62°F (16°C). Can apply daminozide (B-Nine) 2,500 to 5,000 ppm spray for height control.	10-14 in. (25-35 cm)	12-18 in. (30-45 cm)	~		
Needs LD conditions to reach stemlength of 90-cm. – prechill period of a week could improve germination.	36 in. (90 cm) under LD conditions	8-10 in. (20-25 cm)	~		Avoid contact with pollen and milky sap to prevent possible allergic reactions.
	6 in. (15 cm)	18-24 in. (45-60 cm)			Use primarily in baskets and container applications for best performance.
	Varies depending on the mix.	_	~		
	18-36 in. (45-90 cm)	12-18 in. (30-45 cm)	~	~	Great for mixed containers. USDA Hardiness Zones 5 to 9.
	14-16 in. (35-40 cm)	10-18 in. (25-45 cm)			USDA Hardiness Zones 5 to 9.
Do not use B-Nine/ Alar or Topflor for height control as they will stunt Bacopa.	Varies depending on the mix.	Varies depending on the mix.			
	6-10 in. (15-25 cm)	6-14 in. (15-35 cm)			
PGR can use the same regime as that for standard or spreading petunia. Note that Pleasantly Blue responds better to a B-Nine spray than it does to a Bonzi spray or drench. So for this specific Fuseables the use of B-Nine is preferred.	Varies depending on the mix	Varies depending on the mix			

Grower Facts	Class	Series/Variety	Exposure	e Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other
Online*	GAZANIA G. rigens	New Day [®] Series	Ç	4,400-8,500 S/oz (150-300 S/g)	. COT	406-cell or larger	Yes	70-72°F (21-22°C)	3-4	4-5	306 (9 cm), 4 in. (10 cm), 6 in. (15 cm) 3 ppp	65-70°F (18-21°C)	55-60°F (13-16°C)	8-9	8-9	8-9
	GAZANIA, Tetraploid G. rigens	Sunshine Mixture	Ô	14,500 S/oz. (500 S/g)	SED	packet seed item	Yes	70°F (21°C)	2-3	4-5	Packet seed item	65-68°F (18-20°C)	55-60°F (13-16°C)	-	-	-
	GERANIUM, IVY Pelargonium x peltatum	Summer Showers F1 Series	٠	3,700 S/oz. (130 S/g)	SED	288-cell or larger	Yes	70-75°F (21-24°C)	3-5	4-5	4 in. (10 cm), 10 in. (25 cm) basket	60-65°F (16-18°C)	60-65°F (16-18°C)	-	11-12	13-14
Pg 143	GERBERA, F1 <i>Gerbera jamesonii</i> A Kieft Seed product	Revolution Series	0	8,550-11,400 S/oz. (300-400 S/g)	PEL	144 to 128-cell	Cover lightly	68-70°F (20-21°C)	4-7	6-7	Micro: 3 in. (8 cm) Mini: 3.5-4 in. (9-10 cm) Midi: 3.5-4 in. (9-11 cm) Standard: 4.5-5.5 in. (11-14 cm) Mega: 6 in. and larger (15 cm and larger)	66-68°F (19-20°C)	62-66°F (17-19°C)	8-10	8-10	8-10
Pg 101	GOMPHRENA G. sp.	Fireworks	O	14,175 S/oz. (500 S/g)	СОТ	406-cell or larger	Yes	68-75°F (20-24°C)	2-3	5-6	5 in. (13 cm), gallon (15-18 cm) 2-3 ppp	65-75°F (18-24°C)	63-66°F (18-25°C)	-	-	8-9
Online*	HELENIUM H. amarum	Dakota Gold	0	5,000 MSP/oz. (200 MSP/g)	MSP	288-cell or larger	Yes	65-75°F (18-22°C)	3-5	3-4	306 (9 cm), 4 in. (10 cm), 6 in. (15 cm)	65-70°F (18-21°C)	64-66°F (18-19°C)	-	5-7	6-8
Online*	HELIANTHUS H. annuus (Sunflower)	Ballad F1	0	2,693 S/oz. (95 S/g)	SED	200-cell or direct sown	Yes	68-72°F (20-22°C)	3-5	2-3	5 in. (13 cm), gallon (15-18 cm) 1-3 ppp	64-72°F (18-22°C)	61-64°F (16-18°C)	-	8-9	7-8 (Summer/ Autumn)
Online*	HELIANTHUS H. annuus (Sunflower)	Jua F1 Series	Q	482-567 S/oz. (17-20 S/g)	SED	Direct sow recommended; 200-cell	Yes	68-75°F (20-24°C)	2-3 if plug; 3-5 if direct sown	2-2.5	Cut flower	65-85°F (18-29°C)	50-65°F (10-18°C)	-	-	8.5-10.5 (from sowing)
Online*	HELIANTHUS H. annuus (Sunflower)	Miss Sunshine F1	0	2,693 S/oz. (95 S/g)	SED	200-cell or direct sown	Yes	68-72°F (20-22°C)	3-5	2-3	5 in. (13 cm), gallon (15-18 cm) 1-3 ppp	64-72°F (18-22°C)	61-64°F (16-18°C)	-	7-8	6-7 (Summer/ Autumn)
	HELIANTHUS H. annuus (Sunflower)	Prado Series	O	1,135 S/oz. (40 S/g)	SED	Direct sow recommended; 200-cell	Yes	68-75°F (20-24°C)	3-5	2-3	Cut flower	65-85°F (18-29°C)	50-65°F (10-18°C)	-	-	10-12 (from sowing)
Online*	HELICHRYSUM H. microphyllum (Plectostachys serphyllifolia)	Silver Mist	0	22,679 MSP/oz. (800 MSP/g)	MSP	288-cell or larger	No	72-76°F (22-24°C)	6-8	6-7	306 (9 cm), 4 in. (10 cm), 6 in. (15 cm) 3 ppp	65-75°F (18-24°C)	62-65°F (17-18°C)	-	8-9	9-10
FOR LU	NA SERIES HIBISCUS Se	e Perennial Culture Ch	hart (pg 5	6)												
Pg 102	HIBISCUS H. acetosella	Mahogany Splendor	Ç	2,350 S/oz. (83 S/g)	SED	200-cell or larger	Yes	71-76°F (21-24°C)	2-3	2-3	4.5 in. (11 cm), 6 in. (15 cm), gallon (15-18 cm), 8 in. (20 cm)	65-70°F (18-21°C)	62-67°F (17-19°C)	-	5-6	6-8
	HYPOESTES H. phyllostachya	Splash Select Series	٠	25,000 S/oz. (880 S/g)	SED	406-cell or larger	Yes	70-75°F (21-24°C)	2-3	4-5	Pack, 4 in. (10 cm), 6 in. (15 cm) 3 ppp	65-75°F (18-24°C)	62-65°F (17-18°C)	6-7	7-8	8-9

Annual Culture Chart

Weeks from plug to finish (Spring unless specified)

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
	8-10 in. (20-25 cm)	6-8 in. (15-20 cm)			
	12 in. (30 cm)	6-8 in. (15-20 cm)	~		
	12-15 in. (30-38 cm)	12-15 in. (30-38 cm)			Branches don't interlock on the bench, allowing for tighter spacing.
When transplanting, do not pot too deep as this may result in crown rot. Space plants when the leaves of the plants are touching each other, generally 5 to 6 weeks after transplanting.	Micro/Mini: 8-10 in. (20-25 cm) Midi: 10-12 in. (25-30 cm) Standard/ Mega: 12-16 in. (30-40 cm)				Crop Schedule is dependent on sowing date, available light and required pot/plant ratio. Total crop time is approx. 14-15 weeks from sowing to 50% flowering. 100% color will appear 10-14 days later.
See also Cut Flower section for more details (pg 70).	4 ft. (1.2 m)	4 ft. (1.2 m)	~		
Daylength affects plant growing habit and crop time. See Grower Facts for details.	12-14 in. (30-35 cm)	24-28 in. (60-70 cm)	~		Plants grow slowly under daylengths shorter than 12 hours and become very flat or even rosette when grown under 10 hours. Growing plants under long days (12 hours or more) is recommended.
Plants grow shorter under short days. Under longer days, plants grow taller without growth regulators. Plants can flower year-round.	24-30 in. (60-75 cm)	6-8 in. (15-20 cm)	V		PGR treatments will delay flowering about 1 week.
See also Cut Flower section for more details (pg 70).	3-5 ft. (0.9-1.5 m) depending on culture	-			
	10-16 in. (25-40 cm)	6-8 in. (15-20 cm)	~		PGR treatments will delay flowering about 1 week.
See also Cut Flower section for more details (pg 70).	4-5.5 ft. (1.2-1.7 m)	-			
Do not overwater and avoid watering plants late in the day, as constant wet foliage may make the plants susceptible to <i>Botrytis</i> . Does not require pinching.	6-8 in. (15-20 cm)	18-24 in. (45-60 cm)	V		
Light for some institution	258	24.20 :			
Light for germination is optional.	3-5 ft. (0.9-1.5 m)	24-30 in. (60-75 cm)	~		
Too much light will cause leaves to curl. Grow under low light conditions (400-500 f.c./4,000-5,000 Lux).	10-18 in. (25-45 cm)	12-14 in. (30-35 cm)			Application of a Cycocel spray will intensify the foliage colour. Crop time can be reduced by planting multiple-sown plugs or direct sowing up to 15 scode in each pat

Annu	ual Culture Chart			
	Grower			

Weeks from plug to finish (Spring unless specified)

Grower Facts		Series/Variety	Exposure	Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other
Online*	IMPATIENS, SINGLE F1 I. walleriana	Dazzler Series	**	35,700-61,500 S/oz. (1,250-2,150 S/g)	SED	512-cell or larger	No	72-76°F (22-24°C)	4-5	4-5	Packs, 4 in. (10 cm) pots, 10 in. (25 cm) basket 5 ppp	65-75°F (18-24°C)	62-65°F (17-18°C)	3-4	4-5	6-7
Pg 103	IMPATIENS, SINGLE F1 I. walleriana	Impreza Series	*	35,714-61,428 S/oz. (1,250-2,150 S/g)	SED	512-cell or larger	No	72-76°F (22-24°C)	3-5	4-5	Packs, 4 in. (10 cm) pots, 10 in. (25 cm) basket 5 ppp	65-75°F (18-24°C)	62-65°F (17-18°C)	3-4	5-6	6-7
Online*	IMPATIENS, SINGLE F1 I. walleriana	Super Elfin® Series (XP & standard varieties)	*	35,700-61,500 S/oz. (1,250-2,150 S/g)	SED	512-cell or larger	No	72-76°F (22-24°C)	4-5	4-5	Packs, 4 in. (10 cm) pots, 10 in. (25 cm) basket 5 ppp	65-75°F (18-24°C)	62-65°F (17-18°C)	3-4	4-5	6-7
Pg 104	IMPATIENS, NEW GUINEA I. hawkeri	Divine F1 Series	*	15,800 S/oz. (558 S/g)	SED	288 to 128-cell	No	74-77°F (23-25°C)	5-8 Watch for 80% radicle emergence before removal from stage 1	5-6	306 Pack (9 cm), 1801 flats, 4-6 in. (10-15 cm) pots, baskets	68-76°F (20-24°C), see Key tips section	65-68°F (18-20°C)	6-7	7-8	8-9
Pg 156	INCARVILLEA I. sinensis A Kieft Seed product	Cheron Series	0	38,275-52,445 S/oz. (1,350-1,850 S/g)	SED	288-cell or larger (2-3 seeds per cell)	Yes, lightly	65-68°F (18-20°C)	4-6	4-6	4-5 in. (10-13 cm) pots	67-70°F (19-21°C)	63-65°F (17-18°C)	-	7-8	8-9
Online*	IRESINE I. herbstii	Purple Lady	٠	44,800 S/oz. (1,580 S/g)	SED	288-cell or larger	Yes	72-76°F (22-24°C)	3-4	4-5	306 (9 cm), 4 in. (10 cm), 10 in. (25 cm) basket	65-75°F (18-24°C)	62-65°F (17-18°C)	-	5-6	6-7
Pg 105	ISOTOMA <i>I. hybrida</i> (laurentia)	Gemini Series	0	280,000-340,000 S/oz. (10,000- 12,000 S/g)) PEL	288-cell or larger (2-4 seeds per cell)	No	68-72°F (20-22°C)	5-8	4-5	4-5 in. (10-13 cm), gallon (15-18 cm) with 3 ppp	60-66°F (16-18°C)	54-57°F (12-14°C)	9-10	9-12	14-16
	ISOTOMA <i>I. hybrida</i> (laurentia)	Tristar Series	0	252,000-308,000 S/oz. (9,000- 11,000 S/g)) PEL	288-cell or larger	No	68-72°F (20-22°C)	4-7	4-5	4 in. (10 cm), 5 in. (13 cm)	61-65°F (16-18°C)	57-61°F (14-16°C)		9-10	
	LAVATERA <i>I. trimestris</i>	Twins Series	O	3,500-4,200 S/oz. (125-150 S/g)	. RAW	288-cell or larger	Nor- mal cover	68-72°F (20-22°C)	3-7	3-5	Field grown, gallon	65-68°F (18-20°C)	61-65°F (16-18°C)			8-10
FOR LAV	ENDER See Perennial Cu	ulture Chart (pg 56-58	3)													
Pg 106	LEYCESTERIA L. formosa	Jealousy	0	Not available	MSP	288-cell or larger	Cover lightly	65-70°F (18-21°C)	9-12	7-8	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm) 3 ppp, gallon (15-18 cm) 3 ppp	68-75°F (20-24°C)	65-67°F (18-19°C)	6-7	6-7	7-8
Online*	LINARIA L. hybrida	Enchantment F1	0	18,857 S./oz. (660 S/g)	MSP	406-cell or larger	Yes	65-68°F (18-20°C)	2-3	4-5	306 (9 cm), 4 in. (10 cm)	60-70°F (16-21°C)	52-60°F (11-15°C)	_	6-7	-
Online* Flare, pg 107	LISIANTHUS, CUT FLOWER Eustoma grandiflorum	ABC F1, Flare, Laguna F1 Series	Ō	28,500 S/oz. (1,000 S/g)	PEL	406-cell	No	68-72°F (20-22°C)	8-12	8-10	Cut flower	68-75°F (20-24°C)	60-65°F (16-18°C)	-	-	10-18

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
Do not cover seed. Impatiens require more than 10 f.c. (100 Lux) of light for optimum germination.	9-11 in. (23-28 cm)	13-15 in. (33-38 cm)			
Do not cover seed. Impatiens require more than 10 f.c. (100 Lux) of light for optimum germination.	6-8 in. (15-20 cm)	12-14 in. (30-35 cm)			
Do not cover seed. Impatiens require more than 10 f.c. (100 Lux) of light for optimum germination.	8-10 in. (20-25 cm)	12-14 in. (30-35 cm)			
Feed plants moderately. Overfeeding leads to lush, leafy plants at the expense of flowers. See Grower Facts for complete information.	10-14 in. (25-35 cm)	12-14 in. (30-35 cm)			
Plant final height does not respond to growth regulators very well. Avoid using B-Nine/Alar in later application as it could significantly delay flowering.	10-20 in. (25-50 cm)	6-8 in. (15-20 cm)	~		Pink takes approximate 7 to 10 days longer crop time compared to White.
Reddish foliage indicates plants need more feed. High light, especially with low humidity, results in puckered foliage.	6-8 in. (15-20 cm)	3-4 ft. (0.9-1.2 m)	~		Ideally suited to partial sun/partial shade conditions, it can withstand more sun in humid areas like Florida.
Prefers to grow in cooler conditions. Warmer temperature above 70°F (21°C) could delay or inhibit flowering.	8 in. (20 cm)	10-14 in. (25-35 cm)		~	
	8-10 in. (20-25 cm)	10-12 in. (25-30 cm)			
Reacts well to Cycocel; plant stays more compact in containers.	12-20 in. (30-50 cm)	12-20 in. (30-50 cm)			
Requires light to germinate.	36-60 in. (90 cm- 1.5 m)	18-20 in. (45-50 cm)	~		Sensitive to spider mites.
Stage 1 PGR is very important for avoiding leggy seedlings.	14-16 in. (35-40 cm)	12-14 in. (30-35 cm)		~	
See also Cut Flower section for more details (pg 70).	29-45 in. (75-115 cm)	-	~		Cover the plug trays with a medium layer of vermiculite after germination phase.

Weeks from plug to finish (Spring unless specified) Growing on Growing on Grower Facts 4-in./ 10-cm Cover Plug crop Recommended Seed Recommended Germination Days to Class Exposure Seeds per oz.(g) Other Series/Variety form plug size* seed temperature containers Pack gern nigh 28,500 S/oz. 14-16 Online* LISIANTHUS, POT & Florida F1 Series \bigcirc PEL 406-cell or No 72-80°F 8-12 8-10 4 in. (10 cm), 68-75°F 60-65°F 14-16 _ BEDDING F1 (1,000 S/g) (22-26°C) 6 in. (15 cm) (20-24°C) (16-18°C) larger Eustoma grandiflorum Online* LISIANTHUS, POT & Forever F1 Series 28,500 S/oz. PEL 406-cell or No 68-72°F 8-12 8-10 4 in. (10 cm) 68-75°F 60-65°F 13-14 _ _ BEDDING F1 (1,000 S/g) larger (20-22°C) (20-24°C) (16-18°C) Eustoma grandiflorum Online* LISIANTHUS, POT & Sapphire F1 28,500 S/oz. PEL 406-cell or No 68-72°F 8-12 8-10 4 in. (10 cm) 68-75°F 55-60°F 12-14 \bigcirc _ _ BEDDING F1 (1,000 S/g) (20-22°C) (20-24°C) (13-16°C) larger Series Eustoma grandiflorum LOBELIA, COMPACT 820,000-SED, 288-cell or No 70-76°F 4-6 Pack 66-72°F 55-60°F Cambridge Blue, 4-5 8-9 - (* k _ _ 1,300,000 S/oz. MSP larger L. erinus Cobalt Blue, (21-24°C) (19-22°C) (13-16°C) Crystal Palace, (29,000-45,000 S/g) Mrs. Clibran, Rosamund, String of Pearls, White Lady Online* LOBELIA, COMPACT Riviera Series SED, 288-cell or 4-6 Pack 66-72°F 55-60°F 5-6 820,000-No 70-76°F 4-5 1 _ _ L. erinus 1,300,000 S/oz. MSP larger (21-24°C) (19-22°C) (13-16°C) (29,000-45,000 S/g) LOBELIA, TRAILING Fountain Series 820,000-SED, 288-cell or No 70-76°F 4-6 4-5 10 in. (25 cm) 66-72°F 55-60°F 10-12 _ _ 1,300,000 S/oz. MSP larger (21-24°C) basket (19-22°C) (13-16°C) L. erinus (29,000-45,000 S/g) Online* LOBELIA, TRAILING Regatta Series 820,000-SED, 288-cell or No 70-76°F 4-6 4-5 10 in. (25 cm) 66-72°F 55-60°F _ _ 8-10 1,300,000 S/oz. MSP larger (19-22°C) L. erinus (21-24°C) basket (13-16°C) (29,000-45,000 S/g)

Annual Culture Chart

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
Maintain pH above 6.5. Do not allow plugs to become rootbound. Lisianthus are tender seedlings and are recommended as a plug-purchased item.	8-10 in. (20-25 cm)	6-8 in. (15-20 cm)	V		Resists rosetting when sown in temperatures as high as 88°F (31°C).
Maintain pH above 6.5. Do not allow plugs to become rootbound. Lisianthus are tender seedlings and are recommended as a plug-purchased item.	8-10 in. (20-25 cm)	6-8 in. (15-20 cm)	~		
Maintain pH above 6.5. Do not allow plugs to become rootbound. Lisianthus are tender seedlings and are recommended as a plug-purchased item.	5-6 in. (12-15 cm)	4-6 in. (10-15 cm)	~		Well-suited for use as a Lifestyle Plant.
Lighting plants when days are shorter than 12 hours speeds flowering. Light shading helps to produce a better crop when plants are growing under hot weather and long days in late Spring.	5 in. (13 cm)	6-8 in. (15-20 cm)		~	
Lighting plants when days are shorter than 12 hours speeds flowering. Light shading helps to produce a better crop when plants are growing under hot weather and long days in late Spring.	5 in. (13 cm)	8 in. (20 cm)		V	
Lighting plants when days are shorter than 12 hours speeds flowering. Light shading helps to produce a better crop when plants are growing under hot weather and long days in late Spring.	6-8 in. (15-20 cm)	10-12 in. (25-30 cm)		~	
Lighting plants when days are shorter than 12 hours speeds flowering. Light shading helps to produce a better crop when plants are growing under hot weather and long days in late Spring.	6-8 in. (15-20 cm)	10-12 in. (25-30 cm)		V	

		Weeks from plug to finish (Spring unless specified)
Growing on temperature	Growing on temperature	4-in./

Grower Facts	Class	Series/Variety	Exposure	e Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other	Key tips	Mature height	Plant spread	Heat tolerant	Cool Other crop recommendations
	LOBELIA, TRAILING L. erinus	Sapphire Pendula	٠	820,000- 1,300,000 S/oz. (29,000-45,000 S/g)	SED, MSP	288-cell or larger	No	70-76°F (21-24°C)	4-6	4-5	10 in. (25 cm) basket	66-72°F (19-22°C)	60-62°F (16-17°C)	-	-	10-12	Lighting plants when days are shorter than 12 hours speeds flowering. Light shading helps to produce a better crop when plants are growing under hot weather and long days in late Spring.	6-8 in. (15-20 cm)	10-12 in. (25-30 cm)		v
	MARIGOLD, AFRICAN Tagetes erecta	Garland Orange F1	0	7,000-7,600 S/oz. (250-270 S/g)	EZ- Flow Seed	128 to 394-ce	ell Yes	70-72°F (21-22°C)	3-4		4.5 in. (11 cm)	65-68°F (18-20°C)	60-62°F (16-17°C)	-	7-8	-	Higher temperatures inhibit germination, shorten crop time and cause stretching.	Short day 28-34 in. d (70-85 cm) Long day 48-60 in. (1.2-1.5 m)	N/A		
	MARIGOLD, AFRICAN Tagetes erecta	Lady F1 Series	0	9,000-10,000 S/oz. (317-352 S/g)	DTL	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	4.5 in. (11 cm)	65-68°F (18-20°C)	60-62°F (16-17°C)	-	8-9	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	20 in. (50 cm)	10 in. (25 cm)		
	MARIGOLD, AFRICAN Tagetes erecta	Marvel F1 Series	0	9,000-10,000 S/oz. (317-352 S/g)	DTL	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	4.5 in. (11 cm)	65-68°F (18-20°C)	60-62°F (16-17°C)	-	7-8	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	18 in. (45 cm)	10 in. (25 cm)		
Online*	MARIGOLD, AFRICAN Tagetes erecta	Vanilla F1	0	9,000-10,000 S/oz. (317-352 S/g)	DTL, COT	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	4.5 in. (11 cm)	65-68°F (18-20°C)	60-62°F (16-17°C)	-	7-8	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	16 in. (40 cm)	10 in. (25 cm)		
Online*	MARIGOLD, DWARF AFRICAN Tagetes erecta	Taishan® F1 Series	0	9,200-10,600 S/oz. (325-375 S/g)	DTL, COT	288-cell or larger	Yes	70-72°F (21-22°C)	2-3	3	306 (9 cm), 4 in. (10 cm), 4.5 in. (11 cm)	65-68°F (18-20°C)	60-62°F (16-17°C)	-	4-6 (Spring), 7-8 (Summe	- -)	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	10-12 in. (25-30 cm)	8-10 in. (20-25 cm)	~	
Pg 108	MARIGOLD, FRENCH DWARF Anemone Tagetes patula	Durango [®] Series	O	9,500-10,500 S/oz. (335-370 S/g)	DTL, COT	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	Pack, 4 in. (10 cm)	65-68°F (18-20°C)	60-62°F (16-17°C)	4-5	5-6	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	10-12 in. (25-30 cm)	6-8 in. (15-20 cm)		
Pg 108	MARIGOLD, FRENCH DWARF CRESTED Tagetes patula	Bonanza Series	¢	9,500-10,500 S/oz. (335-370 S/g)	dtl, Cot	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	Pack	65-68°F (18-20°C)	60-62°F (16-17°C)	3-4	-	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	10-12 in. (25-30 cm)	6-8 in. (15-20 cm)		
	MARIGOLD, FRENCH DWARF CRESTED Tagetes patula	Boy Series	O	9,500-10,500 S/oz. (335-370 S/g)	SED, DTL, COT	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	Pack	65-68°F (18-20°C)	60-62°F (16-17°C)	5-6	-	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	8-10 in. (20-25 cm)	6-8 in. (15-20 cm)		
	MARIGOLD, FRENCH DWARF CRESTED Tagetes patula	Honeycomb	Ċ	9,500-10,500 S/oz. (335-370 S/g)	SED, DTL	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	Pack	65-68°F (18-20°C)	60-62°F (16-17°C)	5-6	-	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	10-12 in. (25-30 cm)	6-8 in. (15-20 cm)		
	MARIGOLD, FRENCH DWARF CRESTED Tagetes patula	Jacket Series	O	9,500-10,500 S/oz. (335-370 S/g)	SED	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	Pack	65-68°F (18-20°C)	60-62°F (16-17°C)	5-6	-	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	10-12 in. (25-30 cm)	6-8 in. (15-20 cm)		
Pg 108	MARIGOLD, FRENCH DWARF CRESTED Tagetes patula	Janie Series	O	6,800-9,200 S/oz. (240-325 S/g)	DTL, COT	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	Pack	65-68°F (18-20°C)	60-62°F (16-17°C)	3-4	-	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	8-10 in. (20-25 cm)	6-8 in. (15-20 cm)		
	MARIGOLD, FRENCH DWARF SINGLE Tagetes patula	Red Marietta	O	9,500-10,500 S/oz. (335-370 S/g)	SED, DTL	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	Pack	65-68°F (18-20°C)	60-62°F (16-17°C)	4-5	-	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	10 in. (25 cm)	6-8 in. (15-20 cm)		
	MARIGOLD, FRENCH FULLY DOUBLE Tagetes patula	Gate Series	Ò	9,500-10,500 S/oz. (335-370 S/g)	SED, DTL	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	4 in. (10 cm)	65-68°F (18-20°C)	60-62°F (16-17°C)	-	4-5	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	10-12 in. (25-30 cm)	6-8 in. (15-20 cm)		
Pg 108	MARIGOLD, FRENCH Tagetes patula	Hot Pak Series	0	9,500-10,500 S/oz. (335-370 S/g)	DTL	288-cell or larger	Yes	70-72°F (21-22°C)	3-4	3	Pack, 4 in. (10 cm)	65-68°F (18-20°C)	60-62°F (16-17°C)	3-4	5-6	-	Maintain soil pH of 6.2-6.5 to avoid iron toxicity.	6-7 in. (15-18 cm)	6-8 in. (15-20 cm)	~	Stay compact and continue to flower reliably even in locations with high temperature and high humidity nights.
Online*	MATRICARIA Tanacetum parthenium A Kieft Seed product	Vegmo Series	0	18,650 S/oz. (650 S/g)	PEL	200-cell	No	70-72°F (21-22°C)	4-6	4-5	Cut flower	Winter: 55-58°F (13-14°C); Summer: 72-74°F (22-24°C)	Winter: 55-58°F (13-14°C); Summer: 60-65°F (16-18°C)	-	-	7-16	See also Cut Flower section for more details (pg 70).	28-36 in. (70-90 cm)	-		 Recommendation is to have longer days (14 to 16 hours) during plug time.

28 630 231-1400 panamseed.com

Online* NEMESIA

N. foetans

4

306 (9 cm),

4 in. (10 cm), 6 in. (15 cm)

3 ppp

65-70°F

(19-21°C)

Yes

4-5

	BEDDING M. incana										3 ррр				
Online*	MATTHIOLA (STOCK), BEDDING M. incana	Vintage Series	0	15,600-20,000 S/oz. (550-700 S/g)	SED	406-cell or larger	Yes	62-68°F (17-20°C)	3-5	4	Pack, 4 in. (10 cm)	60-70°F (16-21°C)	50-55°F (10-13°C)	7-8	8-9
	MATTHIOLA (STOCK), FIELD CUT M. incana	Column Stocks	O	15,600-20,000 S/oz. (550-700 S/g)	SED	Direct sown in field	Yes	65-70°F (18-21°C)	14-21	N/A	Cut flower	55-65°F (13-18°C)	55-60°F (13-16°C)	-	-
	MATTHIOLA (STOCK), GREENHOUSE- GROWN SELECTABLE M. incana	Aida, Carmen, Figaro, Opera (Vegmo) Series	0	15,600-20,000 S/oz. (550-700 S/g)	SED	200-cell	Yes	59°F (15℃)	5	5-6	Cut flower	50-62°F (10-17°C)	50-62°F (10-17°C)	-	_
Online*	MATTHIOLA (STOCK), GREENHOUSE- GROWN SELECTABLE M. incana	Katz Series	¢	15,300-18,100 S/oz. (540-640 S/g)	SED	406-cell	Yes	68-72°F (20-22°C)	3-4	4	Cut flower	60-75°F (15-24°C)	45-55°F (7-13°C)	-	-
Pg 110	MILLET, ORNAMENTAL Pennisetum glaucum	Jade Princess F1	0	3,400-4,500 S/oz. (120-160 S/g)	SED	128-cell or larger	Yes	72-78°F (22-25°C)	2-3	2-3	4 in. (10 cm), 4.5 in. (11 cm), gallon (15-18 cm) 1-2 ppp	68-85°F (20-30°C)	64-66°F (18-19°C)	-	4-5
Pg 111	MILLET, ORNAMENTAL Pennisetum glaucum	Jester F1	00	3,400-4,500 S/oz. (120-160 S/g)	SED	128-cell or larger	Yes	72-78°F (22-25°C)	2-3	2-3	4 in. (10 cm), gallon (15-18 cm)	68-85°F (20-30°C)	64-66°F (18-19°C)	-	4-5 (green)
Pg 111	MILLET, ORNAMENTAL Pennisetum glaucum	Purple Baron F1	•	3,400-4,500 S/oz. (120-160 S/g)	SED	128-cell or larger	Yes	72-78°F (22-25°C)	2-3	2-3	4 in. (10 cm), gallon (15-18 cm)	68-85°F (20-30°C)	64-66°F (18-19°C)	-	4-5 (green)
Pg 111	MILLET, ORNAMENTAL Pennisetum glaucum	Purple Majesty F1	•	3,400-4,500 S/oz (120-160 S/g)	z. SED	128-cell or larger	Yes	72-78°F (22-25°C)	2-3	2-3	4 in. (10 cm), gallon (15-18 cm)	68-85°F (20-30°C)	64-66°F (18-19°C)	-	4-5 (green)
FOR MU	LTI-SPECIES, MULTI-PE	LLET SIMPLYSALAD	See Vege	table Culture Charl	t (pg 74)										
Online*	MYOSOTIS (Forget-Me-Not) <i>M. sylvatica</i> A Kieft Seed product	Mon Amie Blue	٠	48,195-59,535 S/oz. (1,700-2,100 S/g	SED	288-cell or larger	No	68-74°F (20-23°C)	3-5	4	306 (9 cm), 4 in. (10 cm), 6 in. (15 cm) 3 ppp	60-70°F (16-21°C)	50-55°F (10-13°C)	5-9	5-9

Plug crop Recommended weeks containers

4

4 in. (10 cm),

6 in. (15 cm)

Seed Recommended Cover Germination Days to form plug size** seed temperature germina

Yes

temperature germinate

3-5

62-68°F

(17-20°C)

Annual Culture Chart

Class

MATTHIOLA

(STOCK),

Series/Variety

Hot Cakes Series

Exposure Seeds per oz.(g)

17,000 S/oz.

44,086-71,650 SED

(6,700-8,530 S/g)

288-cell or

per cell)

larger (4 seeds

Poetry F1 Series

 \bigcirc

S/oz.

(600 S/g)

SED

406-cell or

larger

Grower Facts

Pg 109

Other

5-8

_

20-22

4-12

8-13

5-6

5-6, 11-13

(with spike)

5-6, 11-13

(with spike)

5-6, 11-13

(with spike)

5-9

8-9

(from sowing)

4-in./ 10-cm

4-7

Growing on temperature

60-70°F

62-68°F

(17-20°C)

55-62°F

(13-17°C)

5-7

7-8

(16-21°C)

day

Growing on

ature

Pack

tempe

50-55°F

(10-13°C)

night

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
Maintain 90-100% relative humidity at sowing. Do not overwater. Reduce relative humidity to 50-60% during growing on.	10-16 in. (25-40 cm)	6-8 in. (15-20 cm)		~	See Grower Facts for detailed information on how to select Hot Cakes plugs for a reliable fully double product.
Maintain 90-100% relative humidity at sowing. Do not overwater. Reduce relative humidity to 50-60% during growing on.	15-20 in. (38-50 cm)	12-14 in. (30-35 cm)		~	
See also Cut Flower section for more details (pg 70).	24-30 in. (60-75 cm)	-			
See also Cut Flower section for more details (pg 70).	32 in. (80 cm)	-			
See also Cut Flower section for more details (pg 70).	32 in. (80 cm)	-			Best performance when grown in tunnels.
12-14 weeks in a gallon to flower.	24-30 in. (60-75 cm)	18-24 in. (45-60 cm)	<i>✓</i>		Well-suited to both container and landscape plantings.
Plants that are rootbound or stressed due to drought or nutrient deficiency will not perform well. See Grower Facts for specific details.	36-48 in. (90-120 cm)	10-14 in. (25-35 cm)	v		Well-suited to both containers and landscape plantings.
Plants that are rootbound or stressed due to drought or nutrient deficiency will not perform well. See Grower Facts for specific details.	30-42 in. (75-110 cm)	10-14 in. (25-35 cm)	v		Well-suited to both containers and landscape plantings.
Plants that are rootbound or stressed due to drought or nutrient deficiency will not perform well. See Grower Facts for specific details.	4-5 ft. (1.2-1.5 m)	8-12 in. (20-30 cm)	~		Ideal for landscapes and large container plantings.
Maintain low pH. Myosotis suffer from chlorosis at high pH. Grow like <i>Primula</i> <i>acaulis</i> .	8-10 in. (20-25 cm)	6-8 in. (15-20 cm)		•	See Grower Facts for details on how to mitigate chlorosis caused by high pH.
Seedlings may be more stretchy if germinating under dark conditions. Do not use a growth regulator before radicle emergence as this can delay or stop germination.	12-14 in. (30-35 cm)	10-12 in. (25-30 cm)		v	

Annual Culture Chart

Weeks from plug to finish

															-1						
Grower Facts	Class	Series/Variety	Exposure	e Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other	Key tips	Mature height	Plant spread	Heat C tolerant c	Cool Other rop recommendations
	NEMESIA N. strumosa	Sundrops Mixture	O	170,000 S/oz. (6,000 S/g)	SED	406-cell or larger	No	68-70°F (20-21°C)	3-5	4	Pack, 4-6 in. (10-15 cm)	60-65°F (16-18°C)	55-60°F (13-16°C)	8	8-10	-	Grow cool; optimum temperature 55°F (13°C).	10 in. (25 cm)	8-10 in. (20-25 cm)		V
	NICOTIANA	Nicki F1 Series	٠	326,000 S/oz.	SED	406-cell or	No	70-75°F	3-5	4-5	306 (9 cm), 4 in (10 cm)	65-70°F	60-65°F	-	4-5	-	(20 0).	16-18 in.	10-12 in.		
	NIEREMBERGIA N. coerulea	Robe Series		(11,500 5/g) 190,000-210,00 S/oz. (6,800- 7,500 S/g)	0 RAW	288-cell or larger	No	68-72°F (20-22°C)	3-5	4	Packs, 3.5 in. (9 cm), 4 in. (10 cm)	61-68°F (16-20°C)	59-61°F (15-16°C)	3-4 (green)	8-10	-	Reacts well to Alar, B9	8 in. (20 cm)	8-10 in. (20-25 cm)	~	
Pg 112	OSTEOSPERMUM O. ecklonis	Akila [®] Series	0	1,980-2,830 S/o (70-100 S/g)	z. SED	288-cell or larger	Yes	65-68°F (18-20°C)	5-6	4-5	306 (9 cm), 4 in. (10 cm)	60-70°F (16-21°C)	50-55°F (10-13°C)	10-12 (Spring), 7-9 (Autumn)	10-12 (Spring), 7-9 (Autumn)	-		16-20 in. (40-50 cm)	16-20 in. (40-50 cm)		
Pg 116	PANSY, LARGE-FLOWERED F1 Viola x wittrockiana	Spring Matrix Series	0	t 18,575-24,280 S/oz. (650-850 S/g)	SED, PRM	288-cell	Yes	65-70°F (18-21°C)	3-4	5	Pack, 4 in. (10 cm)	60-70°F (16-21°C)	50-55°F (10-13°C)	6-7 (Spring), 4-5 (Autumn)	6-7 (Spring, annual culture), 16-20 (Spring, overwinter culture), 4-5 (Autumn)	-		8 in. (20 cm)	8-10 in. (20-25 cm)		Bred for uniformity of plant architecture across the series. All colours will flower together in Spring production covering the soil with superior branching across all environments. Schedule as an all-purpose pansy for Spring finish or short day growing conditions.
Pg 116	PANSY, LARGE-FLOWERED F1 Viola x wittrockiana	Matrix [®] Series	•	18,575-24,280 S/oz. (650-850 S/g)	SED, PRM	288-cell	Yes	65-70°F (18-21°C)	3-4	5	Pack, 4 in. (10 cm)	60-70°F (16-21°C)	50-55°F (10-13°C)	6-8 (Spring), 4-6 (Autumn)	6-8 (Spring), 4-6 (Autumn)	-	Matrix resists stretching better than other pansies under stressful conditions and warm temperatures of Autumn production, so don't be cautious with fertility.	8 in. (20 cm)	8-10 in. (20-25 cm)		✔ Bred for uniformity of plant architecture across the series. All colours will flower together in Autumn production, covering the soil with superior branching across all environments. Schedule as an all-purpose pansy for Autumn finish or long day growing conditions.
	PANSY, LARGE-FLOWERED Viola x wittrockiana	Promise Series		18,575-24,280 S/oz. (650-850 S/g)	SED, PRM	288-cell	Yes	65-70°F (18-21℃)	3-4	5	Pack, 4 in. (10 cm)	60-70°F (16-21°C)	50-55°F (10-13°C)	6 (Spring), 4 (Autumn)	6-7 (Spring, annual culture), 16-20 (Spring, overwinter culture), 4-5 (Autumn)	,		8-12 in. (20-30 cm)	8-12 in. (20-30 cm)		Bred for a compact plant, early Spring production in Northern Europe perfect for high density production.
Pg 116	PANSY, MULTIFLORA F1 Viola x wittrockiana	Panola® Series (XP & standard varieties)	•	: 18,425-31,200 S/oz. (650-1,100 S/g)	SED, PRM	288-cell	Yes	65-70°F (18-21°C)	3-4	5	Pack, 4 in. (10 cm)	60-70°F (16-21°C)	50-55°F (10-13°C)	4-5 (Spring), 3-4 (Autumn)	4-5 (Spring), 3-4 (Autumn)	-		6-8 in. (15-20 cm)	8-10 in. (20-25 cm)		Bred for superior landscape performance and overwintering capabilities. Use in landscapes and retail programs where maximum color and holding capacity in packs is needed.
Pg 116	PANSY, RUFFLED F1 Viola x wittrockiana	Fizzy & Frizzle Sizzle Series	0	20,000-31,500 S/oz. (700-1,100 S/g)	SED, PRM	288-cell	Yes	65-70°F (18-21°C)	3-4	5	Pack, 4 in. (10 cm)	60-70°F (16-21°C)	50-55°F (10-13°C)	Fizzy 8-9 Frizzle Sizzle 6-8 (Spring), 4-6 (Autumn)	Fizzy 8-9 Frizzle Sizzle 6-8 (Spring), 4-6 (Autumn)	-	For maximum ruffled edge, schedule for late Fall, Winter and Spring programs. Heat reduces the ruffled edge and color contrast.	6-8 in. (15-20 cm)	8-10 in. (20-25 cm)		V
	PANSY, SPECIALTY MEDIUM- FLOWERED F1 Viola x wittrockiana	Halloween II	0	18,425-31,200 S/oz. (650-1,100 S/g)	SED, PRM	288-cell	Yes	65-70°F (18-21°C)	3-5	5	Pack	60°F (16°C)	50-55°F (10-13°C)	2-3 (Autumn)	3-4 (Autumn)	_		6-8 in. (15-20 cm)	8-10 in. (20-25 cm)		 Schedule for Halloween programs.
Pg 113	PANSY, TRAILING F1 Viola x wittrockiana	Cool Wave® Series	0	28,000-40,000 S/oz. (1,000-1,400 S/§	PRM g)	288 or 128-ce	II Yes	65-70°F (18-21°C)	2-3	4-5	4 1/2 in. (10.5-cm), Quart, 10-12 in. (25-30 cm) baskets 3-4 ppp	62-70°F (17-21°C)	50-65°F (10-18°C)	6-7 (Spring), 4-5 (Autumn)	6-7 (Spring), 4-5 (Autumn)	8-10 (Spring), 6-8 (Autumn)	Total crop time to finish can be 10-14 days longer when grown from a smaller size plug such as a 288-cell size.	6-8 in. (15-20 cm)	24-30 in. (60-75 cm)		 Regular scouting for powdery mildew and preventative measures are recommended.
FOR PA		ON See Perennial Cult	ture Chart	t (pg 62)											-	_					

nual Cu	lture Chart														Weeks from plug (Spring unless sp	to finish Jecified)
Grower Facts Pg 116	Class PENTAS, F1 Pentas lanceolata	Series/Variety Butterfly F1 Series	Exposure	 Seeds per oz.(g) 31,900 S/oz. (1,125 S/g) 	Seed form PEL	Recommended plug size** 288-cell or larger	Cover seed No	Germination temperature 75°F (24°C)	Days to germinate 6-9	Plug crop weeks 8-10	Recommended containers 4 in. (10 cm), 6 in. (15 cm) , gallon (15-18 cm)	Growing on temperature day 72-80°F (22-27°C)	Growing on temperature night 62-65°F (17-18°C)	Pack —	4-in./ 10-cm 8-10 (South), 10-12 (North)	Other 8-10 (South), 10-12 (North)
FOR PE	PPER, HOT See Vegetab	ble Culture Chart (pg 74	1)													
Pg 118	PEPPER, ORNAMENTAL Capsicum annuum	Black Pearl	0	6,850 S/oz. (240 S/g)	SED	288-cell or larger	Cover lightly	72-76°F (22-24°C)	5-7	4-5	Pack, 4 in. (10 cm), 4.5 in. (11 cm), 6 in. (15 cm), gallon (15-18 cm)	68-80°F (20-26°C)	65-70°F (18-21°C)	9-10 (no fruit), 16-20 (mature fruit)	9-10 (no fruit), 16-20 (mature fruit)	9-10 (no fruit), 16-20 (mature fruit)
Pg 118	PEPPER, ORNAMENTAL Capsicum annuum	Calico F1	0	6,850 S/oz. (240 S/g)	SED	288-cell or larger	Cover lightly	72-76°F (22-24°C)	5-7	4-5	Pack, 4 in. (10 cm), 4.5 in. (11 cm), 6 in. (15 cm), gallon (15-18 cm)	68-72°F (20-22°C)	65-70°F (18-21°C)	9-10 (no fruit), 16-20 (mature fruit)	9-10 (no fruit), 16-20 (mature fruit)	9-10 (no fruit), 16-20 (mature fruit)
	PEPPER, ORNAMENTAL Capsicum annuum	Cappa Series	0	6,850 S/oz. (240 S/g)	SED	288-cell or larger	Cover lightly	72-76°F (22-24°C)	5-7	4-5	Pack, 4 in. (10 cm), 4.5 in. (11 cm), 6 in. (15 cm), gallon (15-18 cm)	68-72°F (20-22°C)	65-70°F (18-21°C)	8-12 (no fruit), 12-18 (mature fruit)	8-12 (no fruit), 12-18 (mature fruit)	8-12 (no fruit), 12-18 (mature fruit)
Pg 119	PEPPER, ORNAMENTAL Capsicum annuum	Chilly Chili F1	0	8,000 S/oz. (285 S/g)	SED	288-cell or larger	Cover lightly	72-76°F (22-24°C)	5-7	4-5	Pack, 4 in. (10 cm), 4.5 in. (11 cm), 6 in. (15 cm), gallon (15-18 cm)	65-75°F (18-24°C)	60-65°F (16-18°C)	8-12 (no fruit), 12-18 (mature fruit)	8-12 (no fruit), 12-18 (mature fruit)	8-12 (no fruit), 12-18 (mature fruit)
	PEPPER, ORNAMENTAL Capsicum annuum	Masquerade F1	0	8,000 S/oz. (285 S/g)	SED	288-cell or larger	Cover lightly	72-76°F (22-26°C)	5-7	4-5	4 in. (10 cm)	68-72°F (20-22°C)	65-70°F (18-21°C)	-	12-14 (mature fruit)	-

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
Maintain pH at 6.5- 6.8 for growing on. At pH levels below 6.5, iron toxicity and calcium/magnesium deficiency may develop.	12-22 in. (30-55 cm)	10-18 in. (25-45 cm)	•		Under high light, long days and warm temperatures (Summer production), Butterfly can be produced in 12-13 weeks from seed.
Dorforms bost under	14.19 in	12.16 in			
high light and warm temperatures. Total crop times can be reduced by 4-5 weeks during Summer production. If necessary, uniconazole (Sumagic) at rate of 2.5 ppm can be applied at 2 weeks after sowing for height control.	(35-45 cm)	(30-40 cm)	<i>v</i>		
Performs best under high light and warm temperatures. Total crop times can be reduced by 4-5 weeks during Summer production. If necessary, uniconazole (Sumagic) at rate of 2.5 ppm can be applied 2 weeks after sowing for height control.	10-12 in. (25-30 cm)	14-16 in. (35-40 cm)	V		
Performs best under high light and warm temperatures. Total crop times can be reduced by 4-5 weeks during Summer production. If necessary, uniconazole (Sumagic) at rate of 2.5 ppm can be applied 2 weeks after sowing for height control.	32-40 in. (80 cm-1 m)	12-16 in. (30-40 cm)	V		
Performs best under high light and warm temperatures. Total crop times can be reduced by 4-5 weeks during Summer production. If necessary, uniconazole (Sumagic) at rate of 2.5 ppm can be applied 2 weeks after sowing for height control.	9-10 in. (23-25 cm)	13-14 in. (33-35 cm)	V		
Performs best under high light and warm temperatures. Total crop times can be reduced by 4-5 weeks during Summer production. If necessary, uniconazole (Sumagic) at rate of 2.5 ppm can be applied 2 weeks after sowing for height control.	10-12 in. (25-30 cm)	8-10 in. (20-25 cm)	~		

Annual	Culture	Chart
Annuar	Culture	Chart

Weeks f	rom	plug	to	fini	sh
(Spring	unle	ss sn	eci	ified	4)

uai cu														Neeks from plug (Spring unless sr	contraction to finish secified)
Grower Facts	Class	Series/Variety	Exposure	e Seeds per oz.(g)	Seed form	Recommended plug size**	Cover Germinatior seed temperature	n Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other
Pg 119	PEPPER, ORNAMENTAL Capsicum annuum	Medusa	0	8,000 S/oz. (285 S/g)	SED	288-cell or larger	Cover 72-76°F lightly (22-24°C)	5-7	4-5	Pack, 4 in. (10 cm), 4.5 in. (11 cm)	65-75°F (18-24°C)	60-65°F (16-18°C)	8-12 (no fruit), 12-18 (mature fruit)	8-12 (no fruit), 12-18 (mature fruit)	-
Pg 118	PEPPER, ORNAMENTAL Capsicum annuum	Purple Flash	0	6,850 S/oz. (240 S/g)	SED	288-cell or larger	Cover 72-76°F lightly (22-24°C)	5-7	4-5	Pack, 4 in. (10 cm), 4.5 in. (11 cm), 6 in. (15 cm), gallon (15-18 cm)	68-72°F (20-22°C)	65-70°F (18-21°C)	9-10 (no fruit), 16-20 (mature fruit)	9-10 (no fruit), 16-20 (mature fruit)	9-10 (no fruit), 16-20 (mature fruit)
	PEPPER, ORNAMENTAL Capsicum annuum	Red Missile	0	8,000 S/oz. (285 S/g)	SED	288-cell or larger	Cover 72-76°F lightly (22-26°C)	5-7	4-5	4 in. (10 cm)	68-72°F (20-22°C)	65-70°F (18-21°C)	-	12-14 (mature fruit)	-
Pg 119	PEPPER, ORNAMENTAL Capsicum annuum	Sangria F1	0	8,000 S/oz. (285 S/g)	SED	288-cell or larger	Cover 72-76°F lightly (22-24°C)	5-7	4-5	Pack, 4 in. (10 cm), 4.5 in. (11 cm), 6 in. (15 cm), gallon (15-18 cm)	65-75°F (18-24°C)	60-65°F (16-18°C)	8-12 (no fruit), 12-18 (mature fruit)	8-12 (no fruit), 12-18 (mature fruit)	8-12 (no fruit), 12-18 (mature fruit)

FOR PE	PPER, SWEET See Veget	able Culture Chart (pg	g 76)													
Pg 127	PETUNIA, SMALL-FLOWERED SPREADING F1 P. x hybrida	Shock Wave® F1 Series	0	33,000 S/oz. (1,200 S/g)	PEL	288-cell or larger	No	72-76°F (22-24°C)	4	4-6	306 (9 cm), 4 in. (10 cm), 4.5 in. (11 cm), 6 in. (15 cm) 2-3 ppp, 10 in. (25 cm) basket 3-4 pop	61-75°F (16-24°C)	57-65°F (14-18°C)	5 (Spring), 4 (Summer)	5 (Spring), 4 (Summer)	6-7 (Spring), 4-5 (Summer)

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
Performs best under high light and warm temperatures. Total crop times can be reduced by 4-5 weeks during Summer production.	6-8 in. (15-20 cm)	4-6 in. (10-15 cm)	~		
Performs best under high light and warm temperatures. Total crop times can be reduced by 4-5 weeks during Summer production. If necessary, uniconazole (Sumagic) at rate of 2.5 ppm can be applied 2 weeks after sowing for height control.	13-15 in. (33-38 cm)	19-21 in. (48-52 cm)	~		
Performs best under high light and warm temperatures. Total crop times can be reduced by 4-5 weeks during Summer production. if necessary, uniconazole (Sumagic) at rate of 2.5 ppm can be applied 2 weeks after sowing for height control.	8-10 in. (20-25 cm)	6-8 in. (15-20 cm)	V		
Performs best under high light and warm temperatures. Total crop times can be reduced by 4-5 weeks during Summer production. If necessary, uniconazole (Sumagic) at rate of 2.5 ppm can be applied 2 weeks after sowing for height control.	10-12 in. (25-30 cm)	16-18 in. (40-45 cm)	~		
Lighting is optional during Stage 1. See Grower Facts for rest of lighting recommendation and for plant growth regulator recommendations. Easy Wave and Shock Wave petunias can be grown as low as 50°F (10°C). Crop timing (time to flower) is related to average temperature when grown under proper daylength. Plants will take longer to flower when grown in cooler conditions.	7-10 in. (17-25 cm)	2.5-3 ft. (75-90 cm)			Shock Wave petunias are less sensitive to daylength than Wave petunias. All Shock Wave varieties will flower successfully at 10 hours. See Supplemental Lighting Chart on page 123.

36 630 231-1400 panamseed.com

1-3 ppp, 10 in. (25 cm)

basket 3-4 ppp

**Approximate plug cell diameter: 128-cell (3.25 cm), 288-	cell (2 cm), 406-cell

(Summer) (Summer)

Grower Facts	Class	Series/Variety	Exposure	Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommende containers
Pg 126	PETUNIA, SPREADING F1 P. x hybrida	Easy Wave® F1 Series	0	33,000 S/oz. (1,200 S/g)	PEL	288-cell or larger	No	72-76°F (22-24°C)	4	4-6	306 (9 cm), 4 in. (10 cm) 6 in. (15 cm) 1-3 ppp, 10 in. (25 cm basket 3-4 ppp

Pg 131	PETUNIA, SPREADING F1 P. x hybrida	Tidal Wave® F1 Series	0	33,000 S/oz. (1,200 S/g)	PEL	288-cell or larger	No	72-76°F (22-24°C)	4-7	5-6	8 in. (20 cm)	61-75°F (16-24°C)	57-65°F (14-18°C)	-	-	11-13 (Spring), 9-11 (Summer)
Pg 128	PETUNIA, SPREADING F1 P: x hybrida	Wave® F1 Series	0	33,000 S/oz. (1,200 S/g)		288-cell or larger	No	72-76°F (22-24°C)	4-7	5-6	4 in. (10 cm), 6 in. (15 cm), 10 in. (25 cm) basket	61-75°F (16-24°C)	57-65°F (14-18°C)	7-9	7-9 (Spring), 4-7 (Summer)	8-10 (Spring), 5-7 (Summer)
	PETUNIA, SINGLE FLORIBUNDA F1 P. x hybrida	Madness Series	Ò	285,000 S/oz. (10,000 S/g)	SED, PEL	512-cell or larger	No	72-76°F (22-24°C)	3-5	5-6	Pack, 4 in. (10 cm)	62-65°F (17-18°C)	55-65°F (13-18°C)	5-6	6-7	-
Pg 122	PETUNIA, SINGLE FLORIBUNDA F1 P. x hybrida	Pretty Flora Series	0	33,000 S/oz. (1,200 S/g)	PEL	288-cell or larger	No	72-76°F (22-24°C)	4	5-6	804 pack, 10 in. (25 cm) basket 3-4 ppp	61-75°F (16-24°C)	57-65°F (14-18°C)	5-6	-	6-7
	PETUNIA, SINGLE GRANDIFLORA F1 P. x hybrida	Daddy [®] Series	Ò	285,000 S/oz. (10,000 S/g)	SED, PEL	512-cell or larger	No	72-76°F (22-24°C)	3-5	4-5	Pack, 4 in. (10 cm)	62-65°F (17-18°C)	55-65°F (13-18°C)	5-6	7-8	-
	PETUNIA, SINGLE GRANDIFLORA F1 P. x hybrida	Dreams Series	Ô	285,000 S/oz. (10,000 S/g)	SED, PEL	512-cell or larger	No	72-76°F (22-24°C)	3-5	5-6	Pack, 4 in. (10 cm)	62-65°F (17-18°C)	55-65°F (13-18°C)	5-6	6-7	-
Pg 121	PETUNIA, SINGLE F1 GRANDIFLORA <i>P. x hybrida</i>	Ez Rider [®] Series	0	33,000 S/oz. (1,200 S/g)	PEL	288-cell or larger	No	72-76°F (22-24°C)	4	5-6	804 pack, 10 in. (25 cm) basket 3-4 ppp	 61-75°F (16-24°C)	57-65°F (14-18°C)	5-6	-	6-7
Pg 124	PETUNIA, SINGLE F1 GRANDIFLORA P. x hybrida	Pretty Grand Series	0	33,000 S/oz. (1,200 S/g)	PEL	288-cell or larger	No	72-76°F (22-24°C)	4	5-6	804 pack, 10 in. (25 cm) Basket 3-4 ppp	 61-75°F (16-24°C)	57-65°F (14-18°C)	5-6	-	6-7
Pg 125	PETUNIA, SINGLE GRANDIFLORA F1 P. x hybrida	Sophistica [®] Collection	Ō	33,000 S/oz. (1,200 S/g)	PEL	288-cell	No	72-76°F (22-24°C)	4	4-6	4 in. (10 cm), 5 in. (13 cm), 6 in. (18 cm)	61-75°F (16-24°C)	57-65°F (14-18°C)	_	5-7 (Spring), 3-5	5-8 (Spring), 3-6

Growing on temperature

(16-24°C)

day 61-75°F Growing on temperature night

57-65°F

(14-18°C)

Pack

6

4

Other

6-7

4-5

(Spring),

(Summer)

4-in./ 10-cm

6

4

(Summer) (Summer)

(Spring), (Spring),

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
Lighting is optional during Stage 1. See Grower Facts for rest of lighting recommendation and for plant growth regulator recommendations. Easy Wave and Shock Wave petunias can be grown as low as 50°F (10°C). Crop timing (time to flower) is related to average temperature when grown under proper daylength. Plants will take longer to flower when grown in cooler conditions.	6-12 in. (15-30 cm)	2.5-3.25 ft. (75-100 cm)			Easy Wave Petunias are less sensitive to daylength than Wave Petunias. See the Supplemental Lighting Chart on page 123.
Lighting is required for Tidal Wave during Stage 1. See Grower Facts for rest of lighting recommendations and for plant growth regulator recommendations.	16-22 in. (40-55 cm)	2.5-5 ft. (75-152 cm)			Crop times are based on production during long days (greater than 13 hours) and minimum night temp. of 65°F (18°C). When producing under short days, day extension or night interruption will reduce crop times. See Supplemental Lighting Chart on page 123.
Lighting is optional for Wave Misty Lilac ('PAS3190') and Wave Rose ('PAS3191'), but required for other Wave and Tidal Wave colors during Stage 1. See Grower Facts for rest of lighting recommendations and for plant growth regulator recommendations.	5-7 in. (12-18 cm)	3-4 ft. (90 cm-1.2 m)			Crop times are based on production during long days (greater than 13 hours) and minimum night temp. of 65°F (18°C). When producing under short days, day extension or night interruption will reduce crop times. See Supplemental Lighting Chart on page 123.
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
Genetically compact and needs less to no PGR after transplant	7-10 in. (17-25 cm)	8-12 in. (20-30 cm)			
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
Genetically compact and needs less to no PGR after transplant	6-10 in. (15-25 cm)	8-12 in. (20-30 cm)			
Genetically compact and needs less to no PGR after transplant	6-10 in. (15-25 cm)	8-12 in. (20-30 cm)			
Avoid using B-Nine on Lime Bicolor and Blackberry as this may impact flower color. Options include Bonzi or Topflor.	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			

38 630 231-1400 panamseed.com

**Approximate plug cell diameter: 128-cell (3.25 cm), 288-cell (2 cm), 406-cell (1.75 cm), 512-cell (1.25 cm)

	PETUNIA, SINGLE GRANDIFLORA F1 P. x hybrida	Supercascade Series	O	285,000 S/oz. (10,000 S/g)	SED, PEL	512-cell or larger	No	72-76°F (22-24°C)	3-5	5-6	Pack, 4 in. (10 cm)	62-65°F (17-18°C)	55-65°F (13-18°C)	5-6	7-8	-
	PETUNIA, SINGLE MULTIFLORA F1 P. x hybrida	Carpet Series	0	285,000 S/oz. (10,000 S/g)	SED, PEL	512-cell or larger	No	72-76°F (22-24°C)	3-5	5-6	Pack, 4 in. (10 cm)	62-65°F (17-18°C)	55-65°F (13-18°C)	4-5	6-7	-
Pg 120	PETUNIA, SINGLE MULTIFLORA F1 P. x hybrida	Debonair Collection	0	33,000 S/oz. (1,200 S/g)	PEL	288-cell	No	72-76°F (22-24°C)	4	4-6	4 in. (10 cm), 5 in. (13 cm), 6 in. (15 cm) 1-3 ppp, 10 in. (25 cm) basket 3-4 ppp	61-75°F (16-24°C)	57-65°F (14-18°C)	-	5-7 (Spring), 3-5 (Summer)	5-8 (Spring), 3-5 (Summer)
Pg 122	PETUNIA, SINGLE MULTIFLORA F1 <i>P. x hybrida</i>	Lo Rider [®] Series	Q	33,000 S/oz. (1,200 S/g)	PEL	288-cell or larger	No	72-76°F (22-24°C)	4	5-6	804 pack, 10 in. (25 cm) basket 3-4 ppp	61-75°F (16-24°C)	57-65°F (14-18°C)	5-6	-	6-7
	PETUNIA, SINGLE MULTIFLORA F1 P. x hybrida	Mirage Series	O	285,000 S/oz. (10,000 S/g)	SED, PEL	512-cell or larger	No	72-76°F (22-24°C)	3-5	5-6	Pack, 4 in. (10 cm)	62-65°F (17-18°C)	55-65°F (13-18°C)	4-5	6-7	-
	PETUNIA, DOUBLE FLORIBUNDA F1 P. x hybrida	Double Madness Series	Q	265,000 S/oz. (9,300 S/g)	SED, PEL	288-cell or larger	No	72-76°F (22-24°C)	3-5	4-5	5 in. (13 cm), 10 in. (25 cm) basket	62-65°F (17-18°C)	55-65°F (13-18°C)	-	5-6	7-8
	PETUNIA, DOUBLE GRANDIFLORA F1 P. x hybrida	Double Cascade Series	O	270,000 S/oz. (9,500 S/g)	SED, PEL	288-cell or larger	No	72-76°F (22-24°C)	4-6	4-5	5 in. (13 cm), 10 in. (25 cm) basket	62-65°F (17-18°C)	55-65°F (13-18°C)	-	6-7	8-9
	PETUNIA, DOUBLE GRANDIFLORA F1 P. x hybrida	Valentine, Glorious Mixture	0	270,000 S/oz. (9,500 S/g)	SED, PEL	288-cell or larger	No	72-76°F (22-24°C)	4-6	4-5	5 in. (13 cm), 10 in. (25 cm) basket	62-65°F (17-18°C)	55-65°F (13-18°C)	-	6-7	8-9
	PETUNIA, DOUBLE GRANDIFLORA F1 P. x hybrida	Pirouette Series	0	270,000 S/oz. (9,500 S/g)	SED, PEL	288-cell or larger	No	72-76°F (22-24°C)	4-6	4-5	5 in. (13 cm), 10 in. (25 cm) basket	62-65°F (17-18°C)	55-65°F (13-18°C)	-	6-7	8-9
	PETUNIA, DOUBLE MULTIFLORA F1 P. x hybrida	Duo Series	<u> </u>	265,000 S/oz. (9,300 S/g)	SED, PEL	288-cell or larger	No	72-76°F (22-24°C)	3-5	4-5	5 in. (13 cm), 10 in. (25 cm) basket	62-65°F (17-18°C)	55-65°F (13-18°C)	-	5-6	7-8
	PETUNIA, DOUBLE MULTIFLORA F1 P. x hybrida	Bonanza Mixture	0	265,000 S/oz. (9,300 S/g)	SED, PEL	288-cell or larger	No	72-76°F (22-24°C)	3-5	4-5	5 in. (13 cm), 10 in. (25 cm) basket	62-65°F (17-18°C)	55-65°F (13-18°C)	-	5-6	7-8
Online*	PHLOX F1 P. drummondii	21st Century Series	¢	14,000-24,000 S/oz. (500-850 S/g)	PRM	406-cell or larger	Yes	65-70°F (18-21°C)	3-5	4-5	306 (9 cm), 4 in. (10 cm), gallon (15-18 cm) 3 ppp	55-60°F (13-16°C)	50-55°F (10-13°C)	_	6	7-8
	PHLOX F1 P. drummondii	Ethnie Series		16,800-18,200 S/oz. (600-650 S/g)	RAW	406-cell or larger	Nor- mal	65-68°F (18-20°C)	3-5	4-5	Pack, 3.5 in. (9 cm), 4 in. (10 cm)	61-68°F (16-20°C)	57-61°F (14-16°C)	5-6	6-7	-
	PHLOX F1 P. drummondii	Grammy Pink & White	0	14,000- 24,000 S/oz. (500-850 S/g)	PRM	406-cell or larger	Yes	65-70°F (18-21°C)	3-5	4-5	306 (9 cm), 4 in. (10 cm), gallon (15-18 cm) 3 ppp	55-60°F (13-16°C)	50-55°F (10-13°C)	-	6	7-8
	PHLOX F1 P. drummondii	Promise Series		19,600-22,400 S/oz. (700-800 S/g)	RAW	406-cell or larger	Nor- mal	65-68°F (18-20°C)	3-5	4-5	Pack, 4 in. (10 cm)	61-68°F (16-20°C)	57-61°F (14-16°C)	6-7	7-8	
Pg 133	PLECTRANTHUS <i>P. argentatus</i>	Silver Crest	•	85,000 S/oz. (3,000 S/g)	SED	288-cell or larger	No	64-72°F (20-22°C)	4-5	5-6	306 (9 cm), 4 in. (10 cm), 4.5 in. (11 cm), 10 in. (25 cm) basket 3 ppp	64-80°F (18-27°C)	61-68°F (16-20°C)	-	4-6	6-7
Pg 133	PLECTRANTHUS <i>P. argentatus</i>	Silver Shield	0	21,200 S/oz. (1,100 S/g)	PEL	288-cell or larger	No	64-72°F (20-22°C)	5-7	5-6	306 (9 cm), 4 in. (10 cm), gallon (15-18 cm) 2 ppp	70-75°F (21-24°C)	64-68°F (18-20°C)	-	8-9	9-10
FOR CH	AMPAGNE BUBBLES SE	RIES ICELAND POPP	Y See Per	rennial Culture Cha	rt (pg 62	2)										

Plug crop Recommended weeks containers

Seed Recommended Cover Germination Days to form plug size** seed temperature germinate

Exposure Seeds per oz.(g)

Series/Variety

Annual Culture Chart

Class

Grower Facts

Other

4-in./ 10-cm

Pack

Growing on

Growing on

tem

night

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
	10-12 in. (25-30cm)	10-15 in. (25-38 cm)			
Avoid using B-Nine on Black Cherry as this may impact flower color. Options include Bonzi or Topflor.	10-15 in. (20-38 cm)	10-12 in. (25-30 cm)			
Genetically compact and needs less to no PGR after transplant	7-10 in. (17-25 cm)	8-12 in. (20-30 cm)			
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
	10-15 in. (25-38 cm)	10-12 in. (25-30 cm)			
Cover thoroughly with coarse vermiculite. Darkness is required for germination.	10 in. (25 cm)	10 in. (25 cm)		~	Ideal for Spring and southern Autumn sales.
No PGRs needed.	8 in. (20 cm)	8 in. (20 cm)	•		
Cover thoroughly with coarse vermiculite. Darkness is required for germination.	8-10 in. (20-25 cm)	10 in. (25 cm)		~	Ideal for Spring and southern Autumn sales.
Strong outdoor performance.	8 in. (20 cm)	8 in. (20 cm)	•		
Due to directional stem arching, it is advisable to position Silver Crest plugs with the growing shoot facing outward, toward the outside of the container.	8-10 in. (20-25 cm)	18-24 in. (46-61 cm)	~		Ideal as a cascading plant in mixed containers or hanging baskets as well as the edge of rockwalls.
Requires light to germinate. Does not need pinching.	24-30 in. (60-75 cm)	24-30 in. (60-75 cm)	~		Stress tolerant and very vigorous. Ideal for containers or garden beds.

Annual Culture Chart

Weeks from plug to finish

																Spring unless spe	cineu)					
Grower Facts	Class	Series/Variety	Exposure	e Seeds per oz.(g)	Seed form	Recommended plug size**	d Cover seed	r Germination temperature	n Days to e germinate	Plug crop weeks	Recommended containers		Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other	Key tips	Mature height	Plant spread	Heat Coc tolerant cro	I Other recommendations
Pg 134	PORTULACA F1 P. grandiflora	Happy Hour F1 Series	0	257,000 S/oz. (9,000 S/g)	SED, MSP	288-cell	No	71-79°F (22-26°C)	2-3	4-5	Pack, 4 in. (10 cm)		68-76°F (20-25°C)	65-67°F (18-19℃)	5	5-6	-	See Grower Facts for important photoperiod information.	8-10 in. (20-25 cm)	10-12 in. (25-30 cm)	v	May be sown at 10 hour 30 minute daylength without rosetting. Daylength must be maintained from sowing to finish.
Pg 134	PORTULACA F1 P. grandiflora	Happy Trails F1 Series	0	257,000 S/oz. (9,000 S/g)	SED, MSP	288-cell	No	71-79°F (22-26°C)	2-3	4-5	Pack, 4 in. (10 cm)		68-76°F (20-25°C)	65-67°F (18-19°C)	6	7	-	See Grower Facts for important photoperiod information.	6-9 in. (15-23 cm)	14-18 in. (35-45 cm)	v	May be sown at 10-hour daylength without rosetting. Daylength must be maintained from sowing to finish.
Pg 135	PRIMULA P. acaulis	Primlet [®] Series	0	28,000 S/oz. (1,300 S/g)	SED	512-cell or larger	Cove lightl	er 64°F y (17°C)	7-10	512/406 5-6 288: 6-7	4 in. (10 cm)	:	See Grower Facts	See Grower Facts	-	15-17	-		5-6 in. (13-15 cm)	5-7 in. (13-18 cm)	V	,
Pg 136	PURSLANE P. oleracea	Toucan Series	े	88,000-107,000 S/oz. (3,100-3,780 S/g)	SED	288-cell (4 seeds per cell)	No	68-74°F (20-24°C)	3-4	4-5	306 (9 cm), 4 in. (10 cm), 6 in. (15 cm), 10 in. (25 cm) basket		68-75°F (20-24°C)	65-68°F (18-20°C)	6-7	6-7 (3 ppp)	8-9 (4 ppp)		3-4 in. (7-10 cm)	14-16 in. (35-40 cm)	~	Sow 4 seeds per cell.
Pg 136	RUELLIA R. brittoniana (R. tweediana)	Southern Star Series	O	13,850 S/oz. (488 S/g)	SED	288 cell	Yes	72-76°F (22-25°C)	5-6	5-6	Pack, 4 in. (10 cm), 4.5 in. (11 cm), 6 in. (15 cm), gallon (15-18 cm)		68-75°F (20-24°C)	65-68°F (18-20°C)	10 (Spring), 8 (Summer)	10 (Spring), 8 (Summer)	10 (Spring), 3 ppp; 8 (Summer) 3 ppp		10-12 in. (25-30 cm)	16-18 in. (40-45 cm)	V	Perfect choice for the warm South.
FOR SA	GE See Vegetable Culture	Chart (pg 76)																				
	SALVIA S. splendens	Flare	0	7,500 S/oz. (256 S/g)	SED	406-cell or larger	Yes	70-75°F (21-24°C)	4-6	4-5	Pack, 4 in. (10 cm)		68-74°F (20-23°C)	64-68°F (18-20°C)	4-5	4-5	-	Salvia is very sensitive to high salt during the early plug stages.	14 in. (35 cm)	8 in. (20 cm)	~	
	SALVIA S. splendens	Lighthouse Series	0	7,500 S/oz. (256 S/g)	SED	406-cell or larger	Yes	70-75°F (21-24°C)	4-6	4-5	1801 Pack, 4 in. (10 cm)		68-74°F (20-23°C)	64-68°F (18-20°C)	4-5	4-5	-	Salvia is very sensitive to high salt during the early plug stages.	24-30 in. (60-75 cm)	10-12 in. (25-30 cm)	~	Versatile for landscapes and large mixed containers
	SALVIA S. splendens	Scarlet King	0	7,500 S/oz. (256 S/g)	SED	406-cell or larger	Yes	70-75°F (21-24°C)	4-6	4-5	Pack		68-74°F (20-23°C)	64-68°F (18-20°C)	4-5	-	-	Salvia is very sensitive to high salt during the early plug stages.	11 in. (28 cm)	8 in. (20 cm)	~	
	SALVIA S. splendens	Scarlet Queen	0	7,500 S/oz. (256 S/g)	SED	406-cell or larger	Yes	70-75°F (21-24°C)	4-6	4-6	Pack		68-74°F (20-23°C)	64-68°F (18-20°C)	4-5	-	-	Salvia is very sensitive to high salt during the early plug stages.	9 in. (23 cm)	8 in. (20 cm)	~	
	SALVIA S. splendens	Vista Series	O	7,500 S/oz. (256 S/g)	SED	406-cell or larger	Yes	70-75°F (21-24°C)	4-6	4-5	Pack, 4 in. (10 cm)		68-74°F (20-23°C)	64-68°F (18-20°C)	4-5	4-5	-	Salvia is very sensitive to high salt during the early plug stages.	10-12 in. (25-30 cm)	8 in. (20 cm)	~	
Online*	SCUTELLARIA S. javanica	Veranda	*	39,057 S/oz. (1,367 S/g)	SED	288-cell	No	70-75°F (21-24°C)	6-10	406: 6 288: 7	306 (9 cm), 6 in. (15-18 cm), gallon (15-18 cm), hanging basket		72-78°F (22-26°C)	66-68°F (19-20°C)	7-10	8-11	9-12	Heat-loving crop; crop time is very dependent on temperature.	10 in. (25 cm)	10-12 in. (25-30 cm)	•	
FOR SIN	IPLYSALAD See Vegetab	ole Culture Chart (pg 74	1)																			
Online*	SNAPDRAGON, DWARF GARDEN F1 Antirrhinum majus	Snapshot F1 Series	0	171,000 S/oz. (6,000 S/g)	SED	288-cell	Cove lightl	er 64-68°F y (18-20°C)	4-6	5-6	Pack, 4 in. (10 cm)		55-70°F (13-21°C)	45-55°F (7-13°C)	6	6	-		6-10 in. (15-25 cm)	10-12 in. (25-30 cm)	V	,
	SNAPDRAGON, FORCING F1 Antirrhinum majus	Trumpet Series	0	180,000 S/oz. (6,350 S/g)	SED	512-cell or larger	Cove lightl	er 64-68°F y (18-20°C)	4-6	4-5			60-75°F (16-24°C)	45-55°F (7-13°C)			8-19	See also Cut Flower section for more details (pg 72).	39-60 in. (1-1.5 m)			
	SNAPDRAGON, GARDEN F1 Antirrhinum majus	Rocket F1 Series	ं	180,000 S/oz. (6,350 S/g)	SED	288-cell	Cove lightl	er 65-68°F y (18-20°C)	4-8	5-6	Gallon (15-18 cm) 3 ppp		65-80°F (18-26°C)	55-60°F (13-16°C)	-	-	13-16	See also Cut Flower section for more details (pg 72).	2.5-3 ft. (75-90 cm)	16-18 in. (40-45 cm)	V	 Rocket makes an excellent Spring and Summer- flowering landscape snapdragon.
Online*	SNAPDRAGON, GARDEN F1 Antirrhinum majus	Solstice F1 Series	0	180,000 S/oz. (6,350 S/g)	SED	288-cell	Cove lightl	r 64-68°F y (18-20°C)	4-8	5-6	306 (9 cm), 4 in. (10 cm), gallon (15-18 cm) 3 ppp		55-70°F (13-21°C)	45-55°F (7-13°C)	-	9-10 (Oct-early Jan sow), 4-6 (Sept & mid Jan sow)	9-10 (Oct-early Jan sow), 4-6 (Sept & mid Jan sow)	Performs best under cool temperatures (lower than 55°F/13°C), producing optimum stem strength.	16-20 in. (40-50 cm)	10-14 in. (25-35 cm)	v	Group 1 winter-flowering snapdragon. Necessary to have cool temperatures and short days for crop production. Northern hemisphere: recommend sowing September to January. Southern hemisphere: sow March to July.

ai Cu	iture chart														Weeks from plug (Spring unless s	g to finish pecified)
Grower Facts	Class	Series/Variety	Exposure	Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other
	SNAPDRAGON, CUT FLOWER F1 Antirrhinum majus	Apollo, Cool, Maryland, Monaco, Early Potomac, Potomac Series, Purple Twist, Red Delilah	0	180,000 S/oz. (6,350 S/g)	SED	512-cell or larger	Cover lightly	64-68°F (18-20°C)	4-5	4-5	Cut flower	See Cut Flower section, pg 46-48.	See Cut Flower section, pg 46-48.	-	-	8-18
Online*	SPILANTHES Acmella oleracea	Peek-A-Boo	0	116,200 S/oz. (4,100 S/g)	COT	288-cell or larger	Cover lightly	72-76°F (22-24°C)	4	4-5	306 (9 cm), 4 in. (10 cm), 6 in. (15 cm) 3 ppp	65-75°F (18-24℃)	62-65°F (17-18°C)	-	7-8	7-8
FOR SQ	UASH See Vegetable Cul	ture Chart (pg 76)														
	STATICE (LIMONIUM), ANNUAL Limonium sinuatum	QIS Series	O	10,000 S/oz. (350 S/g)	SED	200-cell or larger	Yes	70°F (21°C)	3-8	4-5		55-60°F (13-16°C)	50-55°F (10-13°C)	-		18-24 (12-15 with vernalization
	A Kieft Seed product	la Cultura Chart (ng 7	<i>IC</i>)													
Online*	TALINUM T. paniculatum	Limón	0	56,698 S/oz. (2,000 S/g)	SED	288-cell or larger	Yes	68-74°F (20-23°C)	4-5	5	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm) 3 ppp	66-74°F (19-23°C)	62-66°F (17-19°C)	4-5 (foliage); add 2 weeks for flower	4-5 (foliage); add 2 weeks for flower	4-5 (foliage); add 2 weeks for flower
Online*	TALINUM T. paniculatum	Verde	Ç	56,698 S/oz. (2,000 S/g)	SED	288-cell or larger	Yes	68-74°F (20-23°C)	6	5	306 (9 cm), 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm) 3 ppp	66-74°F (19-23°C)	62-66°F (17-19°C)	4-5 (foliage); add 2 weeks for flower	4-5 (foliage); add 2 weeks for flower	4-5 (foliage); add 2 weeks for flower
	THUNBERGIA T. alata	Susie Series	O	1,100 S/oz. (40 S/g)	SED	200-cell or larger	Cover lightly	70-75°F (21-24°C)	6-12	4-5	4 in. (10 cm), gallon (15-18 cm)	62-68°F (17-20°C)	60-62°F (16-17°C)	-	4-5	8-10
FOR TH	YME See Vegetable Cultu	ure Chart (pg 76)														
FOR TO	MATO See Vegetable Cu	lture Chart (pg 76)														
Pg 138	TORENIA T. fournieri	Kauai Series F1	•*	28,400-32,600 S/oz. (1,000-1,150 S/g	PEL	288-cell or larger	No	71-76°F (22-24°C)	4-6	5-6	Pack, 4 in. (10 cm)	65-70°F (18-21°C)	62-64°F (17-18°C)	5-6	6-7	-
	TRACHELIUM, CUT FLOWER TYPE T. caeruleum	Lake Forest, Lake Michigan, Lake Louise Series	0	21,500 S/oz. (750 S/g)	PEL	200-cell	No	72°F (21°C)	7-10	7-9	Cut flower	62-68°F (17-20°C)	60°F (16°C)	-	-	10-18

FOR SOUTHERN CHARM VERBASCUM See Perennial Culture Chart (pg 66) (11,900 S/oz. Pg 138 VERBENA 72-75°F 65-70°F 60°F 6-8 6-8 **Quartz Series** SED, 406-cell or Yes 4-6 Pack, 4 _ V. x hybrida (XP varieties) (420 S/g) PRM larger (22-24°C) 4 in. (10 cm) (18-21°C) (16°C) (Spring), (Spring), 5-7 5-7 (Summer) (Summer) 11,900 S/oz. (420 S/g) SED, 406-cell or PRM larger Pg 138 VERBENA Quartz Blue & Waterfall \bigcirc Yes 72-75°F 4-6 Pack, 4 in. (10 cm) 65-70°F 60°F 7-9 7-9 5 (Spring), 6-7 (22-24°C) (16°C) (Spring), 6-7 V. x hybrida (18-21°C) Mixture (Summer) (Summer)

FOR BLUE BOUQUET VERONICA See Perennial Culture Chart (pg 66)

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
See also Cut Flower section for more details (pg 46-48).	39-60 in. (1-1.5 m)	-			
Requires light to germinate.	12-15 in. (30-38 cm)	24-30 in. (60-76 cm)	~		Plants have a tendency to grow to one side at first, especially if well-spaced. Plants can be grown pot tight to produce more upright growth. Pinching encourages earlier branching and better- shaped plants.
See also Cut Flower section for more details (pg 70).	24-35 in. (60-90 cm)	12 in. (30 cm)			Popular series for both fresh and preserved cut flower production. Stiff stems do not require netting.
	28-32 in. (70-80 cm)	16-18 in. (40-45 cm)	v		Well-suited to both containers and landscape plantings.
	32 in. (80 cm)	24 in. (60 cm)	~		Well-suited to both containers and landscape plantings.
Pre-soak seed overnight for faster germination.	Vine: 6-8 ft. (2 m)	-			
Light is required for germination.	8 in. (20cm)	8 in. (20 cm)	~		
See also Cut Flower section for more details (pg 72).	2.5-3.5 ft. (75-105 cm)	-			
Avoid excessive moisture in plug media during germination Stage 1.	8-10 in. (20-25 cm)	10-12 in. (25-30 cm)			
Avoid excessive moisture in plug media during germination Stage 1.	10-12 in. (25-30 cm)	12-14 in. (30-35 cm)			

Annual Culture Chart Weeks from plug to finish (Spring unless specified) Growing on Growing on Seed Recommended form plug size** 4-in./ 10-cm Cover Germination Days to Plug crop Recommended Grower Facts Class Series/Variety Exposure Seeds per oz.(g) containers Other seed temperature weeks Pack gern VINCA 12,200-24,100 SED 288-cell 65-68°F 6-7 Online* Jams 'N Jellies \bigcirc Yes 75-78°F 3-5 5 Pack, 75°F 5-6 -S/oz. (430-850 S/g) (24-25°C) 4 in. (10 cm) (24°C) (18-20°C) Catharanthus roseus Series or above () 12,200-24,100 SED 288-cell Online* VINCA Yes 75-78°F 3-5 65-68°F 5-6 6-7 Pacifica XP 5 Pack, 75°F -Catharanthus roseus Series S/oz. (24-25°C) 4 in. (10 cm) (24°C) or (18-20°C) (430-850 S/g) above Pg 139 VINCA 18,500 S/oz. SED 288-cell 75-78°F 3-5 Pack, 306 75°F 65-68°F 3-4 4-5 Titan[®] F1 Series Ô Yes 5 _ (9 cm), 4 in. (10 cm) (24°C) or Catharanthus roseus (650 S/g) (24-25°C) (18-20°C) above Pg 139 VINCA 18,500 S/oz. SED 288-cell Yes 75-78°F 3-5 Pack, 306 65-68°F Valiant F1 Series Ö 5 75°F 3-4 4-5 _ Catharanthus roseus (650 S/g) (24-25°C) (9 cm), (24°C) or (18-20°C) 4 in. (10 cm) above

Online	* VINCA, TRAILING Catharanthus roseus	Mediterranean Series (XP & standard varieties)	0	12,200-24,100 S/oz. (430-850 S/g)	SED	288-cell	Yes	75-78°F (24-25°C)	3-5	5	4.5 in. (11 cm), 10 in. (25 cm) basket 7 ppp, 12 in. (30 cm) basket 9 ppp	75 (24 ab	5°F 4°C) or bove	65-68°F (18-20°C)	-	8-9 (Spring), 5-6 (Summer)	12-14 (Spring), 8-10 (Summer)
Pg 140	VIOLA F1 V. cornuta	Sorbet [®] Series (XP & Standard Varieties), Pierrot	٠	37,000-40,000 S/oz. (1,300-1,400 S/g)	SED, PRM	288-cell or larger	Yes	68°F (20°C)	3-4	4	Pack, 4 in. (10 cm)	60 (10)°F 6°C)	50-55°F (10-13°C)	3-5	4-6	_
	ZINNIA Z. angustifolia	Star Series	\bigcirc	65,710 S/oz. (2,300 S/g)	SED	288-cell or larger	Yes	70-73°F (21-22°C)	2-5	4-5	Pack, 4 in. (10 cm)	65 (18	5-70°F 8-21°C)	65-70°F (18-21°C)	5-6	6-7	_
	ZINNIA Z. marylandica	UpTown Series	O	10,000-17,000 S/oz. (350-600 S/g)	COT	288-cell or larger	Cover lightly	68-73°F (20-22°C)	2-3	3	4 in. (10 cm), gallon (15-18 cm) 3ppp	65 (18	5-70°F 8-21°C)	60-65°F (16-18°C)	8-9 (Spring), 5-6 (Summer)	8-9 (Spring), 5-6 (Summer)	-

Key tips	Mature height	Plant spread	Heat tolerant	Cool crop	Other recommendations
Plant growth regulators may not be necessary for this series. Negative DIF can be used to control height. Note: Phytotoxicity has been reported on <i>Catharanthus roseus</i> with Bonzi, Sumagic and Topflor. B-Nine and A-Rest can be used for height control if needed.	14-16 in. (35-40 cm)	10-12 in. (25-30 cm)	V		
Plant growth regulators may not be necessary for this series. Negative DIF can be used to control height. Note: Phytotoxicity has been reported on <i>Catharanthus roseus</i> with Bonzi, Sumagic and Topflor. B-Nine and A-Rest can be used for height control if needed.	10-14 in. (25-35 cm)	6-8 in. (15-20 cm)	V		
Plant growth regulators may not be necessary for this series. Negative DIF can be used to control height. Note: Phytotoxicity has been reported on <i>Catharanthus roseus</i> with Bonzi, Sumagic and Topflor. B-Nine and A-Rest can be used for height control if needed.	14-16 in. (35-40 cm)	10-12 in. (25-30 cm)	V		
Plant growth regulators may not be necessary for this series. Negative DIF can be used to control height. Note: Phytotoxicity has been reported on <i>Catharanthus roseus</i> with Bonzi, Sumagic and Topflor. B-Nine and A-Rest can be used for height control if needed.	14-20 in. (35-50 cm)	10-12 in. (25-30 cm)	V		Valiant has intermediate resistance to <i>Phytophthora</i> as determined by the International Seed Federation guidelines
Bottom heat during production can increase Yield Potential and decrease crop time.	4-6 in. (10-15 cm)	20-30 in. (50-75 cm)	~		Trailing habit begins 12-15 weeks after sowing.
Delaying shipment of violas until 3 or more flowers are open provides more color at retail.	6-8 in. (15-20 cm)	6-8 in. (15-20 cm)		~	
	14 in. (35 cm)	8 in. (20 cm)	~		
Avoid excessive moisture on plants and flowers. Monitor for <i>Botrytis</i> .	18-24 in. (45 -60 cm)	18-24 in. (45 -60 cm)	~		More vigor than traditional type.

Annual Culture Chart

Weeks from plug to finish

															(opining unless op	culledy						
Grower Facts	Class	Series/Variety	Exposure	e Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other	Key tips	Mature height	Plant spread	Heat tolerant	Cool Oth crop reco	ner ommendations
Pg 140	ZINNIA Z. marylandica	Zahara [®] Series	O	11,3000-17,000 S/oz. (400-600 S/g)	COT	288-cell or larger	Cove lightl	r 68-73°F y (20-22°C)	2-3	3	Pack, 4 in. (10 cm) , gallon (15-18 cm) 3ppp	65-70°F (18-21°C)	60-65°F (16-18°C)	8-9 (Spring), 5-6 (Summer)	8-9 (Spring), 5-6 (Summer)	-	Avoid excessive moisture on plants and flowers. Monitor for <i>Botrytis</i> .	12-18 in. (30-45 cm)	12-18 in. (30-45 cm)	~		
Pg 141	ZINNIA Z. marylandica	Zahara XL Series	0	10,000-17,000 S/ oz. (350-600 S/g)	/ COT)	288-cell or larger	Cove light	r 68-73°F y (20-22°C)	2-3	3	4 in. (10 cm) , gallon (15-18 cm) 3ppp	65-70°F (18-21°C)	60-65°F (16-18°C)	8-9 (Spring), 5-6 (Summer)	8-9 (Spring), 5-6 (Summer)	-	Avoid excessive moisture on plants and flowers. Monitor for <i>Botrytis</i> .	18-24 in. (45-60 cm)	18-24 in. (45-60 cm)	~		
Pg 142	ZINNIA, DOUBLE Z. marylandica	Double Zahara Series	¢	10,000-17,000 S/oz. (350-600 S/g)	COT	288-cell or larger	Yes	68-73°F (20-22°C)	2-3	3	Pack, 4 in. (10 cm), gallon (15-18 cm) 3 ppp	65-70°F (18-21°C)	59-64°F (15-17℃)	-	8-9 (Spring), 5-6 (Summer)	8-9 (Spring), 5-6 (Summer)		16-20 in. (40-50 cm)	16-20 in. (40-50 cm)	~		
	ZINNIA Z. violaceae (syn. Z. elegans)	State Fair Mixture F1	0	2,000 S/oz. (67 S/g)	SED	200-cell or larger	Yes	70-73°F (21-22°C)	2-5	4-5	4 in. (10 cm), 6 in. (15 cm)	65-70°F (18-21°C)	65-70°F (18-21°C)	-	6-7	7-8		3-4 ft. (90-120 cm)	12-14 in. (30-35 cm)	4		

Perennial Culture Chart

Growe Facts	er Class ACANTHUS	Series/ Variety	Hard- First iness year zone flowe 6-10	r Exposure	Seed info 140-180	Recomm- ended plug Seeds size** cell 180-cell 1	/ Cover seed Yes	Germin- ation conditions Pre-soak	Days to germin- ation 14-21	Stage 2-3 Plug temp. PGRs 60-65°F	Plug crop wks. 8-10	Plug tips	Vernalization Yes	Recommended containers (ppp : plugs/pot 4-5 in.	d Growing of t) temps. 65-68°F	n Media pH/EC 5.8-6.2 /	PGR ppm	Photoperiod response	Annual crop weeks to flower from transplant with recommendations	Overwinter crop weeks to flower from transplant with recommendations 36-40	Tips, diseases & recommendations Solid green; landscape	Mature height & spread 40 in.	Heat Cool tolerant crop
	A. mollis			م ادر پندر	S/oz. (5 S/g) SED			H ₂ 0 for 24 hrs., 65-68°F		(16-18°C)				(10-13 cm), 1 ppp; 1 Gallon, 1-3 ppp	(18-20°C) Day; 60-65°F (16-18°C) Night	1.0-1.2					market	(100 cm) height; 32-36 in. (80-90 cm) spread	
	AGASTACHE A. astromontana	Pink Pop	7-10 🖌	0	100,000- 115,000 S/oz. (3,500- 4,000 S/g) SED	- 288-cell 4	No	65-68°F (18-20°C); light not required	5-7	60-65°F B-Nin (16-18°C) 500 ppm	e 6-7		No	4-5 in. (10-13 cm), 1 ppp; 1 Gallon, 1-3 ppp	65-68°F (18-20°C) Day; 60-65°F (16-18°C) Night	5.8-6.2/ 1.2-1.4	B-Nine 2,000	Long day beneficial	7-10; Sow: March-May; Finish: May-August	-	Growing at day temp below 65°F (18°C) will significantly delay crop time; <i>Botrytis</i> , powdery mildew and Sclerotinia	10-12 in. (25-30 cm) height; 8-10 in. (20-25 cm) spread	~
	ALCHEMILLA A. erythropda	Alma	3-8	٠	46,000- 51,000 S/oz. (1,600- 1,800 S/g) TUN	288-cell 4	Optional	65-68°F (18-20°C); light not required	8-10	60-65°F None (16-18°C)	8-10) Spray damp-off fungicide	Yes; duration of 10 weeks; max 40°F (4°C)	4-5 in. (10-13 cm), 1 ppp; 1 Gallon, 1-3 ppp	61-64°F (15-18°C) Day; 50-55°F (10-13°C) Night	5.8-6.5 / 1.0-1.2	None		-	32-38; Sow: June July; Finish: April-June	No fertilizer in winter; restart after visible growth; prevent Mg and Fe deficiency; aphids	6-8 in. (15-20 cm) height; 12-14 in. (30-35 cm) spread	V
	ALCHEMILLA A. mollis	Irish Silk	3-8	٠	84,000- 94,000 S/oz. (3,000- 3,400 S/g) SED	288-cell 4	Optional	Prechill 7 days at 41°F (5°C) then 61-64°F (16-18°C); light	10-15	61-64°F None (16-18°C)	8-10) Spray damp-off fungicide	Yes	4-5 in. (10-13 cm), 1 ppp; 1 Gallon, 1-3 ppp	61-64°F (15 -18°C) Day; 50-55°F (10-13°C) Night	5.8-6.5/ 1.0-1.2	None	Long day beneficial		32-38; Sow: June-July; Finish: April-June	No fertilizer in winter; restart after visible growth; prevent Mg and Fe deficiency; aphids	12-14 in. (30-35 cm) height; 14-16 in. (35-40 cm) spread	~
	AQUILEGIA A. vulgaris	Clementine	2 3-8	٠	17,000- 23,000 S/oz. (600-800 S/g) SED	288-cell 2-3	Cover lightly	68-72°F (20-22°C); light optional	7-12	65-68°F None (18-20°C)	7-8		Yes; duration of 10-12 weeks; juvenility min. 10 true leaves	Gallon (17 cm), 1 ppp	65°F (18°C) Day; 50-54°F (10-12°C) Night	5.8-6.4 / 1.0-2.0	B-Nine/ Alar 1,250- 2,500	Day neutral	-	36-40; Sow: June-July; Finish: April - May	Keep RH opt 65%; powdery mildew, Sclerotinia, aphids, leaf miner, sciara and spidermites; outside crops can be forced indoors at 54-59°F (12-15°C)	7 14-16 in. (35-40 cm) height; 12-14 in. (30-35 cm) spread	v
Pg 14	4 AQUILEGIA A. vulgaris	Winky Single, Winky Double Series	3-8	٠	17,000- 23,000 S/oz. (600-800 S/g) SED	288-cell 2-3	Cover lightly	68-72°F (20-22°C); light optional	7-12	65-68°F None (18-20°C)	7-8		Yes; duration of 8-10 weeks; juvenility min. 10-12 true leaves	5 in. (13 cm), 1 ppp; 1 Gallon, 1-3 ppp; 1.5 Gallon, 3 ppp	60-72°F (16-22°C) Day; 50-59°F (10-15°C) Night	5.8-6.4 / 1.0-2.0	Optional; B-Nine 2,500- 5,000 ppm	Day neutral	-	36-40; Sow: June-July; Finish: April - May	Keep RH opt 65%; powdery mildew, Sclerotinia, aphids, leafminer, sciara and spidermites; outside crops can be forced indoors at 54-59°F (12-15°C)	 12-14 in. (30-35 cm) height; 12-14 in. (30-35 cm) spread 	v
Online	* AQUILEGIA A. x caerulea (Rocky Mountain Columbine)	Songbird F Series	1 3-9 🖌	0	26,900 S/oz. (950 S/g) SED	288-cell 1 or larger	Yes	70-75°F (21-24°C); light required	10-14	65-68°F Tank (18-20°C) mix of B-Nin 2,500 ppm and A-Res 10 pp spray	6-8 f e t m		Yes, but vernalization temperature can go as high as 55°F (13°C) at night and 60°F (15°C) at day; duration of 4 weeks at 41°F (5°C) or 6 weeks at 55°F (13°C); start cool treatment after 12-15 leaf stage	6 in. (15 cm)	60-68°F (16-20°C) Day; 55-64°F (13-18°C) Night	5.8-6.4/ 1.0-2.0	Tank mix of B-Nine 2,500 ppm and A-Rest 10 ppm spray	Long day without vernalization; day neutral after vernalization	22-28; Sow: mid September- late October; Finish: late April- mid May	32-38; Sow: July-August; Finish: late April- mid May	Requires night temperatures below 55°F (13°C) to initiate flower buds	11-18 in. (28-45 cm) height; 10-14 in. (25-35 cm) spread	
Online	* AQUILEGIA A. x caerulea (Rocky Mountain Columbine)	Swan F1 Series	3-9 🖌	0	26,900 S/oz. (950 S/g) SED	288-cell 1 or larger	Yes	70-75°F (21-24°C); light required	10-14	65-68°F Tank (18-20°C) mix of B-Nin 2,500 ppm and A-Res 10 pp spray	6-9 f e t m		Yes, but vernalization temperature can go as high as 55°F (13°C) at night and 60°F (15°C) at day; duration of 4 weeks at 41°F (5°C) or 6 weeks at 55°F (13°C); start cool treatment after 12-15 leaf stage	6 in. (15 cm)	60-68°F (16-20°C) Day; 55-64°F (13-18°C) Night	5.8-6.4/ 1.0-2.0	Tank mix of B-Nine 2,500 ppm and A-Rest 10 ppm spray	Long day without vernalization; day neutral after vernalization	22-28; Sow: mid September- late October; Finish: late April- mid May	32-38; Sow: July-August; Finish: late April- mid May	Requires night temperatures below 55°F (13°C) to initiate flower buds	20-24 in. (50-60 cm) height; 12-14 in. (30-35 cm) spread	V

Grower Facts	Class ARABIS A. blepharophylla	Series/ Variety Spring Charm	Hard- First iness year zone flowe 4-7	r Exposure	Seed info 51,000- 63,000 S/oz. (1,800- 2,200 S/g) SED	Recomm- ended plug Seed size** cell 288-cell 4	is/ Cover seed No	Germin- ation ger conditions atio 68-72°F 3-5 (20-22°C); light optional	s to nin-Stage 2-3 Pl n temp. Po 65-68°F N (18-20°C)	Plu Jg cro iRs wk one 6-8	g p s. Plug tips 3	Vernalization Yes; duration of 8-10 weeks	Recommended containers (ppp : plugs/pot 3.5-5 in. (9-13 cm)	d Growing on M temps. pH 60-65°F 5. (16-18°C) 1. Day; 50-54°F (10-12°C) Night	edia I/EC 5-6.5 / 0-1.2	PGR ppm None	Photoperiod response	Annual crop weeks to flower from transplant with recommendations	Overwinter crop weeks to flower from transplant with recommendations' 30-36; Sow: July-August; Finish: March-April	Tips, diseases & recommendations Well-drained soil; dislikes winter wet; moderate fertilization; <i>Botrytis,</i> <i>Pythium</i> , downy mildew, <i>Rhizoctonia</i> and aphids	Mature height & spread 6-8 in. (15-20 cm) height; 8 in. (20 cm) spread	Heat Cool tolerant crop
Pg 145	ARABIS A. caucasica	Lotti Series	4-7	0	White: 79,000- 85,000 S/oz. (2,800- 3,300 S/g) Deep Rose: 102,000 113,000 113,000 S/oz (3,600- 4,000 S/g) FILMCOATEL	288-cell 3-4	No	65-68°F 4-7 (18-20°C); light not required	65-68°F N (18-20°C)	one 5-6	5	Yes; approximately 8-10 weeks with temperature at 35-40°F (2-5°C)	3.5-5 in. (9-13 cm), 1 ppp; 1 Gallon, 1-3 ppp	50-65°F 5. (10-18°C) 1. Day; 46-50°F (8-10°C) Night	8-6.5 / D-1.5	B-Nine- 3,500 ppm	Day neutral	-	25-28; Sow: late July to early September; finish: mid-Feb to late March	Low to moderate feed; grow in low RH and as cool as possible. <i>Botrytis</i> ; <i>Pythium; Rhizoctonia</i> and aphids	4-6 in. (10-15 cm) height; 6-8 in. (15-20 cm) spread	V
	ARENARIA A. montana	Avalanche	4-8	0	21,000- 26,000 S/oz (750-900 S/g) SED	288-cell 4	Yes, lightly vermiculite	Pre-chill 8-1 2 wks at 50°F (10°C) then 60-65°F (16-18°C)	0 60-65°F (16-18℃)	8-1	LO Grows dry not wet; spray damp-off fungicide	Yes; duration of 8-10 weeks	5 in. (13 cm), 1 ppp; 1 Gallon, 1-3 ppp	60-65°F 5. (16-18°C) 1. Day; 50-54°F (10-12°C) Night	8-6.5 / 0-1.2		Long day beneficial	-	40-44; Sow: June-July; Finish: May-June	Low to moderate feeder; prevent Mg and Fe deficiency; aphids; if pinch, no later than September	6-8 in. (15-20 cm) height; 10-12 in. (25-30 cm) spread	V
Pg 145	ARMERIA A. pseudarmeria	Ballerina Series	7-9 🖌	0	 28,350- 31,200 S/oz. (900- 1,100 S/g) SED 	288-cell 2-4	No	60-65°F 3-6 (16-18°C); light optional	60-65°F N (16-18℃)	one 5-é	5	No	4-5 in. (10-13 cm), 1 ppp; 1 Gallon, 1-3 ppp	60-65°F 5. (16-18°C) 1. Day; 50-58°F (10-14°C) Night	8-6.2 / 2-1.4	None. If necessary, Bonzi 5 ppm spray	Day neutral	12-15; Sow: February-May; Finish: May-September	28-36; Sow: August- September; Finish: late March-May	Prevent Mg and Fe deficiency; red spider mites and aphids; good centerpiece in combos	8-10 in. (20-25 cm) height; 8-10 in. (20-25 cm) spread	~ ~
Online*	^e BELLIS B. perennis	Bellissima Series	4-7	٠	21,428 S/oz. (750 S/g)	406-cell 1-2/ or larger 288; 2/18	Yes 30	65-72°F 3-5 (18-22°C)	65-70°F (18-21°C) Stage 2; 60-65°F (16-18°C) Stage 3	5		No	Pack, 306 (9 cm), 5 in. (13 cm) 3 ppp	60-65°F 5. (16-18°C) 0. Day; 40-45°F (5-7°C) Night	8-6.2 / 5-0.75	None		6-10 (U.S. Autumn/ Spring)	13-15 Spring/ 7-9 Autumn North Europe	Use a medium covering of coarse-grade vermiculite to improve seedling uniformity. Grow as cool as possible but avoid freezing temperatures. For forcing the crop when grown at these temperatures, grow at 55-58°F (10-12°C) for 4 weeks before sale.	6-10 in. (15-25 cm) height; 5-8 in. (13-20 cm) spread	V
Pg 146	CAMPANULA C. carpatica	Rapido F1 Series	3.9 🖌	0	 39,200- 47,600 S/oz. (1,400- 1,700 S/ gr) PEL 	288-cell 4 or larger	No	65-72°F 7-9 (18-22°C) light required	60-65°F N (16-18℃)	one 7-1	10 Grow at less than 13 hours. to keep vegetative; spray damp- off fungicide	Νο	4-5 in. (10-13 cm), 1 ppp; 1 Gallon (17 cm) 2-3 ppp (3-4 ppp when grown under daylength longer than 16 hrs)	60-65°F 5. (16-18°C) 1. Day; 50-57°F (10-14°C) Night	8-6.2/ D-1.2	Not needed normally; if necessary, Cycocel 750 ppm can be used; B-Nine/ Alar at 2,000 ppm is also effective but may delay flowering about 5-7 days	Long day required (14 hours. or 4-hr NI); until buds visible	9-12 (LD); Sow: February-June; Finish: May-August	-	Moist, well-drained medium; too-cool growing delays both plug and finished plant	5-7 in. (12-18 cm) height; 5-8 in. (12-20 cm) spread	
Pg 147	COREOPSIS C. grandiflora	Early Sunrise	4-9 🖌	0	10,700 S/oz. (375 S/g) SED	288-cell 1/28 or larger 2-4/8	8; Cover 84 lightly	65-68°F 5-6 (18-20°C); light optional	70-75°F N (21-24°C) days; 60-65°F (16-18°C) nights	one 5		No	4 in. (10 cm), 1 ppp; Gallon (17 cm), 1-3 ppp	60-70°F 5. (16-21°C) 1. Day; 55-60°F (13-16°C) Night	8-6.2 / 5-2.0	If needed, B-Nine 2,000 one application when bud is visible	Obligate long day min. 14 hours	9-12	_	White flies, thrips, aphids and powdery mildew	24 in. (60 cm) height; 22-24 in. (55-60 cm) spread	V

*Find online Grower Facts culture at panamseed.com **Approximate plug cell diameter: 128-cell (3.25 cm), 288-cell (2 cm), 406-cell (1.75 cm)

50 630 231-1400 kieftseed.com

Grower Facts	Class	Series/ Variety	Hard- Fir iness ye zone flo	rst ear ower Exp	Seed osure info	Recom ended plug size**	ım- Seeds/ Co cell se	over ed	Germin- [ation g conditions a	Days to germin- ation	Stage 2-3 temp.	Plug PGRs	Plug crop wks. Plu	ug tips	Vernalization	Recommended containers (ppp : plugs/pot	Growing on) temps.	Media pH/EC	PGR ppm	Photoperiod response	Annual crop weeks to flower from transplant with recommendations ¹	Overwinter crop weeks to flower from transplant with recommendations ¹	Tips, diseases & recommendations	Mature height & spread	Heat Cool tolerant crop
Pg 147	COREOPSIS C. grandiflora	Rising Sun	4-9	 C 	10,7 S/oz (375 SED	00 288-ce . or larg S/g)	ell 1/288; Cc ger 2-4/84 lig	over shtly	65-68°F 5 (18-20°C); light optional	5-6	70-75°F (21-24°C) days; 60-65°F (16-18°C) nights	None	5		No	4 in. (10 cm), 1 ppp; Gallon (17 cm), 1-3 ppp	60-70°F (16-21°C) Day; 55-60°F (13-16°C) Night	5.8-6.2 / 1.5-2.0	If needed, B-Nine 2,000 one application when bud is visible	Long day required min. 13 hours	8-10	-	White flies, thrips and aphids	18-30 in. (45-75 cm) height; 24-26 in. (60-65 cm) spread	V
Pg 147	COREOPSIS C. grandiflora	Sun Up	4-9	 C 	11,2 12,6 S/oz (400 S/g)	00/ 288-ce 00 or larg -450 SED	ell 1/288; Co ger 2-4/84 lig	over shtly	65-68°F 5 (18-20°C); light optional	5-6	70-75°F (21-24°C) days; 60-65°F (16-18°C) nights	None	5		No	4 in. (10 cm), 1 ppp; Gallon (17 cm), 1-3 ppp	60-70°F (16-21°C) Day; 55-60°F (13-16°C) Night	5.8-6.2/ 1.5-2.0	If needed, B-Nine 2,000 one application when bud is visible	Long day required min. 12.5 hours	8-12	-	White flies, thrips and aphids	10-12 in. (25-30 cm) height; 12-14 in. (30-35 cm) spread	~
Pg 147	COREOPSIS C. grandiflora	Sunfire	4-9	 C 	10,7 S/oz (375 SED	00 288-ce . or larg S/g)	ell 1/288; Cc ger 2-4/84 lig	over shtly	65-68°F 5 (18-20°C); light optional	5-6	70-75°F (21-24°C) days; 60-65°F (16-18°C) nights	None	5		No	4 in. (10 cm), 1 ppp; Gallon (17 cm), 1-3 ppp	60-70°F (16-21°C) Day; 55-60°F (13-16°C) Night	5.8-6.2 / 1.5-2.0	If needed, B-Nine 2,000 one application when bud is visible	Long day required min. 13 hours	8-10	-	White flies, thrips and aphids	24 in. (60 cm) height; 22-24 in. (55-60 cm) spread	V
	DELPHINIUM D. belladonna	Blue Donna	a 5-9	v	10,0 11,0 S/oz (3,50 4,00 S/g)	00- 288-ce 00 180-ce 00- 0 Raw	ell/ 1/288; M ell 4/180 co	ledium over	68-72°F 7 (20-22°C)	7-10	65-68°F (18-20°C)	None	5-6 Spr aga dar	oray gainst amping off	Not needed but beneficial	1 gallon, 1 ppp; 2 gallon, 3 ppp	65-70°F (18-21°C) Day; 57-60°F (14-16°C) Night	5.8-6.2/ 1.5-2.0	Bonzi 5-6 ppm spray Tilt 0.3ml/l	Day neutral	12-16		Powdery mildew	32-40 in. (80-1 m) height; 8-10 in. (20-25 cm) spread	
Online	* DELPHINIUM D. elatum	Guardian F1 Series	4-7	 C 	9,28 oz. (: S/g) SED	5 S/ 288-ce 325 or larg	ell 1 Ye ger	25	65-70°F (20-21°C); light optional	7-8	65-68°F (18-20℃)	None	6-7		No	6 in. (15 cm) and larger, 1-3 ppp; Gallon (15-18 cm)	65-70°F (18-21°C) Day; 60°F (16°C) Night	5.8-6.2 / 1.5	Bonzi 20 ppm sp	Day neutral	16; Finish: May-July	-	See also Cut Flower section for more details (pg 44)	a 30-39 in. (75-100 cm) height; 10-12 in. (25-30 cm) spread	V
Pg 147	DELPHINIUM D. elatum, x belladonna, x bellamosum	Dasante Blue F1	4-7	 C 	14,0 21,2 S/oz (500 S/g)	00- 288-ce 50 or larg - -750 SED	ell 1 Ye ger	25	65-70°F 7 (20-21°C); light optional	7-8	65-68°F (18-20℃)	None	6-7		No	Gallon (15-18 cm), 1-2 ppp; 2 Gallon (20 cm), 3 ppp	65-70°F (18-21°C) Day; 55-63°F (13-17°C) Night	5.8-6.0/ 1.5-2.0	Bonzi 20 ppm sp	Day neutral	11-13; Finish: May-July	-	Ship this crop when bottom one-third of the florets on the first flower spike are open to reduce risk of flower shattering during shipping	28-34 in. (70-85 cm) height; 10-12 in. (25-30 cm) spread	V
Online	* DELPHINIUM D. grandiflorum	Diamonds Blue F1	4-9	•	(600 (600 (5/g)	00- 288-ce 00 or larg -850 SED	ell 1 Ye ger	25	65-70°F (20-21°C); light optional	7-8	65-68°F (18-20℃)	None	6-7		No	Gallon (15-18 cm), 1-3 ppp; 2 Gallon (20 cm), 3 ppp	65-70°F (18-21°C) Day; 55-63°F (13-17°C) Night	5.8-6.0/ 1.5-2.0	Bonzi 20 ppm sp	Day neutral	10-12; Finish: May-July	-	Avoid planting plugs too deep; maintain good fertilisation, especially at flower initiaiton. Aphids; <i>Botrytis</i> ; powdery milldew	16-24 in. (40-60 cm) height; 10-12 in. (25-30 cm) spread	V
	DELPHINIUM D. nudicaule	Red Cap	6-9	 C 	20,0 23,0 S/oz (700 S/g) SED	00- 288-ce 00 -800	ell 3-4 Ye	25	68-72°F (20-22°C); light optional	7-10	65-68°F (18-20°C)		6-8 Spr dar fun	oray amp-off ngicide	No	4-5 in. (10-13 cm), 1 ppp; Gallon, 1-3 ppp	60-65°F (16-18°C) Day; 54-60°F (12-16°C) Night	5.5-6.5/ 1.2-1.4	B-Nine 3,000	Day neutral	12-14; Sow: February-May; Finish: May-July	-	Needs moderate fertilization; well-drained medium; let pot soil dry in between waterings; NO WET; prevent Mg and Fe deficiency; powdery mildew, leafspot, slugs, snails and leaf miners	8-12 in. (20-30 cm) height; 8-10 in. (20-25 cm) spread	v
Online	 DIANTHUS D. barbatus interspecific A PanAmerican Seed Product 	Bouquet F1 Series	. 4-9	•	8,57 oz. (i S/g) PEL	5 S/ 288-ce 300 or larg	ell 1 Ye ger ve	es, lightly ermiculite	64-68°F 3 (18-20°C); light required	3-5	60-65°F (16-18℃)	Bonzi 6 ppm spray	4-5		No	6 in. (15 cm); Gallon (15-18 cm), 1-3 ppp	60-72°F (16-22°C) Day; 50-60°F (10-16°C) Night	5.8-6.2 / 1.5-2.0	1-2x Bonzi 20 ppm sp	Day neutral	8-9	-	Responsive to PGRs; PGRs are needed to produce as a bedding plant; see Grower Facts for recommendation: and Cut Flower section for more details (pg 44)	18-30 in. (45-75 cm) height; 10-12 in. (25-30 cm) spread	V
Online	* DIANTHUS, DOUBLE D. barbatus interspecific A PanAmerican Seed Product	Dynasty F1 Series	6-9	V Ç	7,08 8,50 S/oz (250 S/g)	5- 406-ce 0 or larg -300 PEL	ell 1 Ye ger ve	es, lightly ermiculite	64-68°F 3 (18-20°C); light required	3-5	60-65°F (16-18℃)	Bonzi 6 ppm spray	4-5		No	4 in. (10 cm); 6 in. (15 cm)	60-72°F (16-22°C) Day; 50-60°F (10-16°C) Night	5.8-6.2/ 1.5-2.0	2-3x Bonzi 20 ppm sp	Long day beneficial	8-9	-		16-20 in. (40-50 cm) height; 10 in. (25 cm) spread	V
	DIANTHUS D. deltoides	Arctic Fire	4-7	 C 	100, 129, S/oz (3,50 4,50 S/g) SED	000- 288-ce 000 00- 0	ell 4 Ye ve	es, lightly ermiculite	65-68°F 5 (18-20°C); light required	5-7	60-65°F (16-18℃)		6-8 Spr dar fun	nay Imp-off ngicide	No	4-5 in. (10-13 cm), 1 ppp; Gallon, 1-3 ppp	60-65°F (16-18°C) Day; 50-54°F (10-12°C) Night	5.8-6.5 / 1.0-1.2	CCC 2,000 ppm	Day neutral	10-14; Sow: February-May; Finish: May-July	36-44; Sow: July; Finish: late April-May	Low fertilization; prevent Mg and Fe deficiency; rust, Fusarium wilt, aphids and slugs	6-8 in. (15-20 cm) height; 8-10 in. (20-25 cm) spread	~ ~

Grower Facts	Class	Series/ Variety	Hard- First iness year zone flow	er Exposure	Seed info	Recomm- ended plug Seeds, size** cell	/ Cover seed	Germin- Days ation gern conditions ation	s to nin- Stage 2-3 Plug n temp. PGRs	Plug crop wks	Plug tips	Vernalization	Recommendec containers (ppp : plugs/pot	d Growing c t) temps.	n Media pH/EC	PGR ppm	Photoperiod response	Annual crop weeks to flower from transplant with recommendations	Overwinter crop weeks to flower from transplant with recommendations ¹	Tips, diseases & recommendations	Mature height & spread	Heat Cool tolerant crop
Pg 148	DIGITALIS D. purpurea	Dalmatian Series	5-9 🖌	′ ००	23,000- 29,000 S/oz. (800- 1,000 S/g) PEL	288-cell 1/288 for 5-in 4/84 (13-cm); 84-cell for Gallon	3 No	65-68°F 5-6 (18-20°C); light required	65-68°F B-Nir (18-20°C) 2,000 Bonz 5 ppr spray Suma 3 ppr spray	ne 288); 5-6; i 84: m 6-7 /; ggic m	: Spray damp-off fungicide	No	6 in. 1 ppp; 1 Gallon 1 ppp; 2 Gallon 3-4 ppp from 288 or 1 ppp from 84	60-68°F (16-20°C Day; 50-65°F (10-18°C Night	5.8-6.2/ start 1.0-1.2 to 1.3-1.5	Sumagic 5 ppm; B-Nine 2,500; Bonzi 5-10 ppm; Tilt 0.03% (0.3 ml/ liter)	Long day beneficial	10-14; Sow: February- March; Finish: late May-July	_	Digitalis can be grown under high light, provided enough moisture	16-20 in. (40-50 cm) height; 12-14 in. (30-35 cm) spread	V
Pg 149	ECHINACEA E. purpurea (Coneflower)	'Cheyenne Spirit', PowWow [®] Series	4-10 V	´	7,400- 7,600 S/oz. (260-270 S/g) SED	288-cell 1 or larger	Yes	71-76°F 4-1((22-24°C); light optional	0 71-73°F None (22-23°C) Stage 2; 68-70°F (20-21°C) Stage 3	288 5-6; 128 6-7; 72: 6-7	 Patch plugs as late as possible 	No, but beneficial; duration of 10 weeks; flowering will occur 2-3 weeks earlier after vernalization	Quart or 5 in. (13 cm); 1 ppp; Gallon (17 cm) 1 ppp	60-75°F (16-24°C Day; 50-60°F (10-16°C Night	6.0-6.5/ 1.5-2.0	Tank mix of B-Nine 2,500 ppm and CCC 750-1,000 ppm	Short day- long day (see Grower Facts for forcing echinacea via manipulating daylengths)	13-17; Sow: early January; Finish: mid-late May	30-40; Sow: July-early September; Finish: late May-early June	Keep soil media dry during overwinter period; bark media is recommended; aphids, fungus gnats and powdery mildew; plants from overwinter production will flower slightly early, have better branching and shorter flower stems	16-20 in. (40-50 cm) first year height; 22-24 in. (56-60 cm) second year height; 12-16 in. (30-40 cm) spread	V
	ERIGERON E. karvinskianus	Stallone	6-9 🖌	´	286,000- 343,000 S/oz. (10,000 - 12,000 S/g) SED	288-cell 4	No	68-72°F 7-1((20-22°C); light not required	0 64-68°F (18-20°C)	7-9	Spray damp-off fungicide	No	4-5 in. (10-13 cm), 1 ppp; Gallon, 1-3 ppp	60-65°F (16-18°C Day; 54-60°F (12-16°C Night	5.8-6.5/ 1.1-1.3	Cycocel 2,000	Long day required min 13 hours	10-14 (LD); . Finish: May-July	36-40; Finish: May-July	Grow relatively dry; needs low RH and high light for compact growth; prevent MG and Fe deficiency; powdery mildew and slugs nice perennial combo edging	6-8 in. (15-20 cm) height; 12-14 in. ; (30-35 cm) spread	VV
Pg 151	GAILLARDIA G. x grandiflora	Mesa Series	5-10 🖌	´	7,080- 9,900 S/oz. (250-350 S/g) CLEAN	288-cell 1 or larger	Yes	68-73°F 4-5 (20-23°C); light optional	Stage 2; None 68-73°F (20-23°C) Stage 3: 65-67°F (8-19°C)	e 288 5-6; 128 6-7; 72: 6-7	:		Quart or 5 in. (13 cm), 1 ppp; Gallon (17 cm), 1 ppp; 10 in. (25 cm), 3 ppp	59-70°F (16-21°C Day; 50-61°F (10-16°C Night	6.0-6.5 / 1.5-2.0	B-Nine 2,500- 5,000 ppm	Long day beneficial	11-13; Sow: early February-July; Finish: late May-September	30-38; Sow: July-early September; Finish: April-early May	Fungus gnat larva, thrips/ INSV, white smut and powdery mildew	14-16 in. (35-40 cm) height; 20-22 in. (50-55 cm) spread	V
	GAULTHERIA G. procumbens	Very Berry	6-9 🖌	,	100-110 S/oz (35-40 S/g)	288-cell 8/288	3 No	65-68°F 7-10 (18-20°C)	0 65-68°F None (18-20°C)	2 8-12	2 Low EC 0.4-0.5 ; keep uniform moist, not wet; spray damp off fungicide; avoid drying out.	Not needed but beneficial	4-5 in. (10-13 cm), 1 ppp	65-68°F (18-20°C) Day; 59-60°F (15-16°C) Night	4.3-5.0/ 0.7-max 0.8			36-42	42-46 weeks for salable fruited plants		5-6 in. (12-15 cm) height; 6-8 in. (15-20 cm) spread	
Pg 152	GAURA G. x lindheimeri	'Sparkle White'	5b-9 🖌	0	1,820- 2,380 S/oz. (65-85 S/g)	288-cell 1	Yes	65-68°F 5-6 (18-20°C); light not required	66-70°F None (19-21°C)	e 288 5	:	No. May result in earlier flowering following a minimum of six weeks cold treatment.	4.5-6-in. (11-15-cm) or Quart; Gallon (17 cm)	59-70°F r (15-21°C) n Day; 50-64°F (10-18°C) Night	5.8-6.2/ 1.5-2.0	Tank mix of B-Nine 2,500 ppm and CCC 750-1,000 ppm	Quantitative long day plant with critical day length of 13 hours	7-8 weeks under warm production; or 11-14 weeks under cold production; Sow: January; finish: early May to early June	Sow: July-early September; Finish: mid-late May	Well-drained soil; dislikes winter wet; watch for aphids	12-24 in. (30-60 cm) height; 12-20 in. (30-50 cm) spread	V
Pg 153	GYPSOPHILA G. cerastioides	Pixie Splas	h 4-7	0	60,000- 69,000 S/oz. (2,100- 2,400 S/g) TUN	288-cell 4	No	60-65°F 3-4 (16-18°C); light required	60-65°F (16-18℃)	5-6	Spray damp-off fungicide	Yes; duration of 8 weeks; max 40°F (4°C)	3-5 in. (8-13 cm), 1 ppp	60-65°F (16-18°C Day; 50-58°F (10-14°C Night	5.8-6.5/ 1.0-1.2	None	Day neutral	-	26-40; Sow: July-August; Finish: late April-May	Well-drained soil; dislikes winter wet; Moderate fertilization; <i>Botrytis</i> , aphids, spider mites and whitefly; nice perennial combo edging; foliage turns purple with cold, partly reversible	3-5 in. (8-13 cm) height; 4-7 in. (10-18 cm) spread	V
Pg 153	HEUCHERA H. hybrida	Melting Fire, Malachite	5-8	٠	26,000- 31,000 S./oz. (900- 1,100 S/g) PEL	288-cell 6-8	No vermiculite cover with fleece/ white plastic	68-72°F Meł , (20-22°C); Fire: light 10-1 required Mal chit 8-10	ting 65-68°F : (18-20°C) [4 a- e:])	8-10) Spray damp-off fungicide	No	4-5 in. (10-13 cm), 1 ppp; Gallon, 1-3 ppp	60-68°F (16-20°C Day; 58-60°F (14-16°C Night	5.8-6.2/ 1.2-1.4	None	N/A	12-16; Sow: January-May; Finish: May-July	32-36; Sow: June-July; Finish: March-May	Avoid wet and overly dry; needs well-drained medium; <i>Pythium,</i> <i>Botrytis,</i> powdery mildew, aphids, leaf nematodes and leaf eelworms	8-in. (20 cm) foliage height; 18 in. (45 cm) flower height; 12-14 in. (30-35 cm) spread	V

Grower Facts Class HEUCHERA H. micrantha	Series/ Variety Palace Purple	Hard- First iness year zone flower 4-7	Exposure	Seed info 26,000- 31,000 S./oz. (900- 1,100 S/g) SED or PEL	Recommended ended plug Seed size** cell 288-cell 4	s/ Cover seed No vermiculite cover with fleece/ white plastic	Germin- ation conditionsDays t germi ation68-72°F7-10(20-22°C); light required7-10	to F n- Stage 2-3 Plug of temp. PGRs of 65-68°F ((18-20°C)	Plug rop vks. Plug tips 5-8 Spray damp-off fungicide	Vernalization No	Recommended containers (ppp : plugs/por 4-5 in. (10-13 cm), 1 ppp; Gallon, 1-3 ppp	d growing on temps. Media pH/EC 65-68°F 5.8-6.2/ (18-20°C) 1.2-1.4 Day; 60-65°F (16-18°C) Night	PGR ppm None	Photoperiod response N/A	Annual crop weeks to flower from transplant with recommendations 10-12; Sow: January-May; Finish: May-July	Overwinter crop weeks to flower from transplant with recommendations' 30-34; Sow: June-July; Finish: March-May	Tips, diseases & recommendations Grow relatively dry; needs well-drained medium; <i>Pythium, Botrytis,</i> powdery mildew, aphids, leaf nematodes and leaf eelworms	Mature height & spread 10 in. (25 cm) foliage height; 20 in. (50 cm) flower hoidbt;	Heat Cool tolerant crop
Pg 154 HIBISCUS H. moscheutos	Luna F1 Series	5-9 🖌	0	2,835 S/ oz. (100 S/g) SED	200-cell 1 or larger	Yes, cover with medium	68-75°F 3-5 (20-24°C); light optional	68-70°F Cycocel 3 (20-21°C) 300ppm spray at true leaf initiate stage. In warmer con- ditions, tank mix of Cycocel 300ppm and B-Nine 2,500	3-4 Cover seed with plug media; grow plants under daily average temperature above 68°F (20°C) and keep media moist to wet	No; plugs die when cooled at 41°F (5°C)	Quart (13 cm), 1 ppp; Gallon (15-18 cm), 1 ppp	70-85°F 6.0-6.5 / (21-30°C) 1.5-2.0 Day; 65-70°F (18-21°C) Night	Tank mix of B-Nine 2,500 ppm and CCC 750-1,000 ppm. In Southern, very warm conditions, Bonzi 0.5 ppm drench	Long day min. 12 hours; optimum 14 hours or longer	10-13; Sow: March-May; Finish: June-August	-	Does not need pinching; maintain media in high moisture; growing plant too dry will result in flower bud abortion; thrips, aphids and spider mites; growth stops and lower leaves turn yellow when grown below 68°F (20°C)	height; 14-16 in. (35-40 cm) spread 24-36 in. (60-90 cm) height; 24 in. (60 cm) spread	4
Pg 155 IBERIS <i>I. sempervirens</i> A Pan-American Seed product	Whiteout	3-8	0	9,500- 12,600 S/oz. (340- 450 S/g)	288-cell 3-4	Yes	60-65°F 4-7 (16-18°C); light not required	60-65°F None 7 (16-18°C)	7-8 No pinching needed	Yes; minimur 8 to 10 week Plants should be bulked for about 8 to 10 weeks before being receptive to cold treatment.	4 in. quart (10 cm): 1 ppp; Gallon 1-2 ppp	60-72°F 5.5-6.2 / (16-22°C) 1.2-1.4 Day; 41-50°F (5-10°C) Night	Genetically compact; no PGR necessary.	Day neutral	-	26-36; Sow: May-mid August; Finish: March-May	No pinch needed; allow enough bulk time; grow in active climate; downy and powdery mildew	6-8 in. (15-20 cm) height; 8-12 in. (20-30 cm) spread	V
Pg 157 LAVENDER Lavandula angustifolia	Ellagance Series	5-8 🖌	0	20,000- 34,000 S/oz. (700- 1,200 S/g) TUN	288-cell 4	Yes	65-68°F 4-5 (18-20°C); light not required but beneficial	65-68°F B-Nine 5 (18-20°C) 2,000 Stage 2; ppm 59-63°F (2g/ (15-17°C) liter) Stage 3	5-6 Spray damp- off fungicide. Provide good ventilation and active respiration in plug production; grow on the dry side, with watering in early morning, to allow the plugs to dry up during the day. If too low respiration, Lavandula will show "black spots" on cotyledons that could disappear with improved ventilation/ respiration.	No	4-5 in. quart (10-13cm), 1 ppp; Gallon, 1-3 ppp	60-72°F 5.8-6.5/ (16-22°C) start Day; 1.1-1.2 to 54-60°F 1.4-1.5 (12-16°C) Night	B-Nine 2,000- 3,000; Sumagic 10-15 ppm	Long day beneficial for Purple; long day required for all others	Purple 9-12; Sky 10-13; Ice & Snow 12 -15; Sow: January-May; Finish: Iate May-July	32-36; Sow: July-August; Finish: April-May	Grow low RH and high light; let top soil dry in between waterings but do not allow medium to dry as high EC could cause root damage; <i>Botrytis</i> , root rot, leafspot, aphids and mites; for shipping, keep soil moist and plant dry	12-14 in. (30-35 cm) height; 10-12 in. t (25-30 cm) spread	V

*Find online Grower Facts culture at panamseed.com **Approximate plug cell diameter: 128-cell (3.25 cm), 288-cell (2 cm), 406-cell (1.75 cm)

58 630 231-1400 kieftseed.com

Perennial	Culture	Chart
-----------	---------	-------

Grower Facts Pg 157	Class LAVENDER Lavandula angustifolia	Series/ Variety Lavance and Mini Blue	Hard- First iness year zone flower Exp 5-8 🖌 🤇	Seed plu info 229,000- 37,000 S/oz. (1,000- 1,300 S/g) TUN	comm- uded ⁴ g Seeds/ Cover e** cell seed 88-cell 4 Yes	Germin- ation conditions Days to germin ation 65-68°F (18-20°C); 4-5 (18-20°C); light not required but beneficial	Stage 2-3 temp. Plug PGRs 65-68°F B-Nine (18-20°C) 2,000 Stage 2; ppm 59-63°F (2g/ (15-17°C) liter) Stage 3 Stage 3	Plug crop wks. Plug tips 5-6 Spray damp- off fungicide. Provide good ventilation and active respiration in plug production; grow on the dry side, with watering in early morning, to allow the plugs to dry up during the day. If too low respiration, Lavandula will show "black spots" on cotyledons that could disappear with improved ventilation/ respiration.	Vernalization No	Recommended containers (ppp : plugs/pot 4-5 in. quart (10-13cm), 1 ppp; Gallon, 1-3 ppp	Growing on temps. Media pH/EC 60-72°F 5.8-6.5 (16-22°C) start Day; 1.1-1.2 60-65°F 1.4-1.5 (16-18°C) Night	PGR ppm 5 / B-Nine 2,000- 2:to 3,000; 5 Sumagic 10-15 ppn	Photoperiod response Long day required	Annual crop weeks to flower from transplant with recommendations' 10-12 (needs potting late Spring); Sow: March-June; Finish: late May-July	Overwinter crop weeks to flower from transplant with recommendations' 32-36; Sow: July-August; Finish: late April-May	Tips, diseases & recommendations Grow low RH and high light; let top soil dry in between waterings but do not allow medium to dry as high EC could cause root damage; <i>Botrytis</i> , root rot, leafspot, aphids and mites; for shipping, keep soil moist and plant dry	Mature height & spread 10-20 in. (25-50 cm) height; Lavance: 10-12 in. (25-30 cm) spread Mini Blue: 12-14 in. (30-35 cm) spread	Heat Cool tolerant crop
	LAVENDER Lavandula angustifolia	Hidcote Blue Strain	5-8 🗸 🤇	27,000 28 S/oz. or (950 S/g) TUN	88-cell 4 Yes 'larger	65-68°F 4-5 (18-20°C); light not required but beneficial	65-68°F B-Nine (18-20°C) 2,500 Stage 2; ppm 59-63°F spray (15-17°C) Stage 3	6-7 Spray damp- off fungicide. Provide good ventilation and active respiration in plug production; grow on the dry side, with watering in early morning, to allow the plugs to dry up during the day. If too low respiration, Lavandula will show "black spots" on cotyledons that could disappear with improved ventilation/ respiration.	No	4-5 in. quart (10-13 cm), 1 ppp; Gallon, 1-3 ppp	60-72°F 5.8-6.5 (16-22°C) / start Day; 1.1-1.7 54-60°F 1.4-1.5 (12-16°C) Night	 B-Nine 2,000- 2to 3,000; Sumagic 10-15 ppn 	Long day required	_	32-36; Sow: July-August; Finish: late April-May		12-20 in. (30-50 cm) height; 12-14 in. (30-35 cm) spread	
	LAVENDER Lavandula multifada	Spanish Eyes	7-10 🖌	28	88- cell 1/288 Light cover	68-72°F 4-5 (20-22°C)	66-68°F Reacts (19-20°C) well to Alar/ B-9	5-6	No	5-6 in. (13-15 cm), 1 ppp; Gallon (15-18 cm), 3 ppp	65-70°F (18-21°C) Day; 57-59°F (14-15°C) Night	Alar/B- Nine if necessary	Long day	10-12 weeks			16-25 in. (40-65 cm) height; 20-30 in. (50-75 cm) spread	V

Grower Facts	Class	Series/ Variety	Hard- Fir iness ye zone <u>flo</u>	rst ar owe <u>r Exp</u>	oos <u>ure</u>	Seed info	Recomm- ended plug Se size* <u>* ce</u>	eds/ Cover seed	Germin- Days t ation germin conditions ation	o n- Stage 2-3 Plug temp. PGRs	Plug crop wks.	Plug tips	Vernalization	Recommended containers (ppp <u>:plugs/pot</u>)	Growing on) temps.	Media pH/EC	PGR ppm	Photoperiod response	Annual crop weeks to flower from transplant with recommendations ⁺	Overwinter crop weeks to flower from transplant with recommendations [†]	Tips, diseases & recommendations	Mature height & spread	Heat Cool tolerant <u>crop</u>
Pg 156	LAVENDER Lavandula stoechas	Bandera Purple	7-10	•	•	25,200- 28,000 S/oz. (900 - 1,000 S/g SED	288-180 1 cell	Yes	65-68°F 3-5 (18-20°C); Light optional but beneficial; at 10-15% emergence move to Stage 2	60-65°F B-Nin (15-18°C) 2,500 Stage 2 to ppm 50-58°F stage (10-14°C) Stage 3 and 4	e 5-6 3	Keep active growing environment; Spray damp- off fungicide	No	4 -6 in. (10-15 cm) 1 ppp; Gallon 1-2 ppp	Annual production: 65-68°F (18-20°C) Day; 55-64°F (12-16°C) Night	5.8-6.5 / 1.0-1.2; gradually increase Potassium (N:K) ratio 1:1 to 1:2	Genetically compact; if needed B-Nine 2,500 ppm	Quantitative long day plant	11-14	28 -35 only in high light ; low humidity area; needs frost protection	Don't plant too deep since Bandera has low and deep branching and Botrytis could more easily affects plants.	7-9 in. (17-23 cm) height; 10-12 in. (25-30 cm) spread	V
Pg 158	LOBELIA L. x speciosa	Starship Series F1	6-10	 C 		30,800- 42,000 S/oz. (1,100- 1,500 S/g) PEL	288-84 1/ cell 4/	288; Only 34 needed when grown under dry condition:	65-72°F 6-10 (18-22°C); light improves germination	65-68°F None, (18-20°C) if growr in sho day	, 7-10 1 rt	Avoid drying out; grow at less than 12 hours for at least the first 6 weeks from sowing to keep vegetative	No	5 in. (13 cm) 1 ppp; 1 Gallon (17 cm) 1-2 ppp; 2 Gallon (23 cm) 3-4 ppp	65-70°F (18-21°C) Day; 60-65°F (15-18°C) Night; Frost- sensitive: grow at min. 40°F (3°C)	5.8-6.6/ 1.1-1.3	Bonzi 30 ppm sp; Sumagic 5 ppm sp	Long day plants. Scarlet flowers faster at 13 hours or longer. Deep Rose requires 13 hours or longer for flowering.	13-17 (at LD min. 13 hours)		Avoid drought stress; grow evenly moist but not wet. Snails, slugs, root and crown rots, <i>Pythium,</i> <i>Phytophthora</i> (if too wet). Control thrips as Lobelia is very susceptible to INSV damage.	20-24 in. (50-60 cm) height; 6-8 in. (15-20 cm) spread	V
Pg 159	LOBELIA L. x speciosa	Vulcan Red	6-10	~ ()		30,800- 44,800 S/oz (1,100- 1,600 S/g) PEL	288-84 1/ cell 4/	288; Only 34 needed when grown under dry condition	65-72°F 8-10 (18-22°C); light improves germination	65-68°F None, (18-20°C) if growr in sho day	, 7-10 n ırt	Avoid drying out; grow at less than 12 hours for at least the first 6 weeks from sowing to keep vegetative	No	1 Gallon (17 cm) 1-2 ppp; 2 Gallon (23 cm) 3-4 ppp	65-70°F (18-21°C) Day, 60-65°F (15-18°C) Night; Frost- sensitive: grow at min. 40°F (3°C)	5.8-6.6/ 1.1-1.3	Bonzi 30 ppm sp; Sumagic 5 ppm sp	Long day required (min. 14 hours)	14-19 (at LD min. 14 hours)		Avoid drought stress; grow evenly moist but not wet. Snails, slugs, root and crown rots, <i>Pythium</i> , <i>Phytophthora</i> (if too wet). Control thrips as Lobelia is very susceptible to INSV damage.	24-32 in. (60-80 cm) height; 10-14 in. (25-35 cm) spread	v
	LOBELIA L. valida	Delft Blue	7-9	•		30,800- 36,400 S/oz. (1,100- 1,300 S/g) PEL	288-cell 4	No	65-68°F 7-10 (18-20°C); light optional	65-68°F (18-20°C)	8-10		No	5 in., 1 ppp; Gallon, 1-3 ppp; 2 Gallon, 3 ppp	66-70°F (19-21°C) Day; 62-66°F (17-19°C) Night	5.8-6.5/ 1.0-1.2		Long day beneficial	10-12; Sow: March-May; Finish: June-August		Grow relatively dry. Well-drained soil; dislikes winter wet; moderate fertilization.	10-12 in. (25-30 cm) height; 12-16 in. (30-40 cm) spread	V
	MONARDA M. hybrida	Bergamo	6-8	•	0	58,800- 67,200 S/oz. (2,100- 2,400 S/g) SED	288-cell 4	Yes, lightly	65-68°F 7-10 (18-20°C); light	60-65°F B-Nin (16-18°C) 2,000	e 6-7		No	5 in., 1 ppp; Gallon, 1-3 ppp; 2 Gallon, 3 ppp	60-65°F (16-18°C) Day; 54-60°F (12-16°C) Night	5.8-6.5 / 1.2-1.4	B-Nine 2,500	Long day beneficial	10-12; Sow: March-May; Finish: June-August		Well drained soil; grow relatively dry; aphids; <i>Botrytis</i> ; powdery mildew	20-24 in. (50-60 cm) height; 16-20 in. (40-50 cm) spread	V
	MYOSOTIS M. sylvatica	Mon Amie Blue	6-8	v ;		48,195- 59,535 S/oz. (1,700- 2,100 S/g) SED	288-cell 1 or larger	No	68-74°F 3-5 (20-23°C)	65-68°F None (18-20°C) Stage 2; 60-64°F (16-18°C) Stage 3	4		No	306 (9 cm), 4 in. (10 cm), 6 in. (15 cm) 3 ppp	60-70°F (16-21°C) Day; 50-55°F (10-13°C) Night	5.6-5.8; avoid 6.0 and up/1.5- 2.0	None; if need tank mix B-Nine 3,500/CCC 375	Day neutral	Pack: 5-9; 4-in. (10-cm): 5-9	-	Maintain low pH. Mysotis suffer from chlorosis at high pH. Grow like <i>Primula</i> <i>acaulis</i> . See Grower Facts for details on how to mitigate chlorosis caused by high pH.	8-10 in. (20-25 cm) height; 6-8 in. (15-20 cm) spread	V
	NEPETA N. nervosa	Blue Moon & Pink Cat	4-7	•	0	57,000- 69,000 S/oz. (2,000- 2,400 S/g) SED	288-cell 4	Yes	65-68°F 4-5 (18-20°C); light not required but beneficial	60-65°F B-Nin (16-18°C) 2,000	e 5-6	Spray damp-off fungicide	No	5 in., 1 ppp; Gallon, 1-3 ppp	60-65°F (16-18°C) Day; 54-60°F (12-16°C) Night	5.8-6.5/ 1.2-1.4	B-Nine 2,500	Long day beneficial	8-10; Sow: March-May; Finish: May-July	-	Grow relatively dry; prevent Mg and Fe deficiencies; <i>Botrytis</i> , downy mildew and aphids	10-12 in. (25-30 cm) height; 10-12 in. (25-30 cm) spread	~
Pg 161	PENSTEMON P. hartwegii	Tubular Bells Series	7-10			71,000- 94,000 S/oz. (2,500- 3,300 S/g) SED	288 to 4/ 180-cell 6/	288 No 180	65-68°F 3-6 (18-20°C); light not required but beneficial	65-68°F If (18-20°C) neede Stage 2; B-Nin 60-64°F 2,000 (16-18°C) ppm Stage 3	6-8 ed	Spray damp-off fungicide	No	Gallon, (1-3 ppp); 2 Gallon, 3-5 ppp	60-72°F (16-22°C) Day; 50-59°F (10-15°C) Night	5.5-6.5 / start 1.1-1.2 to 1.4-1.5	B-Nine 2,500 ppm	Long day beneficial	13-16; Sow: January-May; Finish: May-July	_	Needs high light; low RH; grow relatively dry; prevent Mg and Fe deficiency; leafspot, powdery mildew, slugs, snails and leaf eelworm	14-16 in. (35-40 cm) height; 10-14 in. (25-35 cm) spread	v

Grower Facts	Class PENSTEMON P. heterophyllus	Series/ Variety Electric Blue	Hard- iness zone 6-8	First year flower	Exposure	Seed info 48,000 S/oz. (1,700 S/g) SED	Recomm- ended plug size** cell 288-cell 1 or larger	s/ Cover seed No	Germin- ation conditionsDays to germin ation65-74°F8-10 (18-23°C); light not required but beneficial	Stage 2-3 temp. Plug PGRs 65-68°F None (18-20°C) Stage 2; 60-64°F (16-18°C) Stage 3 Stage 3	Plug crop wks. 4-5	Plug tips	Verna No, b bene coole flowu unific faste non- plant dura	alization but eficial; led plants ver more formly and er than -ccoled its; ation of 10	Recommended containers (ppp : plugs/pot) 4 in. (10 cm)	Growing on temps. 66-70°F (19-21°C) Day; 62-66°F (17-19°C) Night	Media pH/EC 5.8-6.5 / 1.0-1.5	PGR ppm None	Photoperiod response Day neutral but needs high light intensity for complete, rapid and uniform flowering	Annual crop weeks to flower from transplant with recommendations * 12-13	Overwinter crop weeks to flower from transplant with recommendations *	Tips, diseases & recommendations Bulking prior to vernalization ensures pot- fill and improves flowering uniformity; white flies	Mature height & spread 18 in. (45 cm) height; 24 in. (60 cm) spread	Heat Cool tolerant crop
Pg 160	PENSTEMON P. x mexicali	Carillo Series	5-7	~	<u> </u>	51,000- 69,000 S/oz. (1,800 -2,400 S/g) SED	288-cell 3-4 or larger	No	65-68°F 3-6 (18-20°C); light not required but beneficial	65-68°F If (18-20°C) neede Stage 2; B-Nin 60-64°F 2,000 (16-18°C) ppm Stage 3	6-8 ed	Spray damp-off fungicide	weel (5°C) No	sks at 41ºF ()	4-5 in. (10-13 cm); Quart (10-13 cm); 1 gallon, 1 ppp; 2 gallons, 3 ppp	65-72°F (18-22°C) Day; 55-59°F (13-15°C) Night	5.8-6.5 / start 1.1-1.2 to 1.4-1.5	B-Nine 2,500 ppm	Long day beneficial	Red and Purple 12-14; Rose 13-15; Sow: February-May; Finish: May-July	-	Needs high light; low RH; grow relatively dry; prevent Mg and Fe deficiency; leafspot, powdery mildew, slugs, snails and leaf eelworm; also suited for 1 plug and 3 plug gallons	8-10 in. t (20-25 cm) height; 10-12 in. (25-30 cm) spread	<i>v</i>
	PEROVSKIA P. atriplicifolia	Taiga	4-7	~	0	28,000- 33,600 S/oz. (1,000- 1,200 S/g); TUN	288-cell 3-4 or larger	No	68-72°F 7-10 (20-22°C)	65-68°F (18-20°C)	7-9	Spray damp-off fungicide	No			5 in., 1 ppp; Gallon, 1-3 ppp; 2 Gallon, 3 ppp	6.0-6.5 / 1.2-1.4	B-Nine 2,500 ppm	Long day required	14-16; Sow: February-April; Finish: July-September	38-42; Sow: July-August; Finish: May-June	Grow relatively dry; well drained; prevent Mg and Fe deficiencies; aphids; mites; whitefly	40-48 in. (100-120 cm) height; 12-16 in. (30-40 cm) spread	V
	POPPY Papaver miyabeanum	Moondance	e 4-7	~	0	200,000- 229,000 S/oz. (7,000- 8,000 S/g) SED	288-cell 2-3	No	60-65°F 4-6 (16-18°C); light optional	60-65°F (16-18°C)	6-8	Spray damp-off fungicide	No		5 in. (13 cm), 1 ppp; 1 Gallon, 1-3 ppp; 2 Gallon, 3 ppp	65-72°F (18-22°C) Day; 55-59°F (13-15°C) Night	5.8-6.8/ 1.1-1.3	None	Long day beneficial	10-12; Sow: February-April; Finish: May-July	_	Well-drained soil; moderate fertilization; high light and airy; <i>Botrytis</i> , downy mildew and aphids	6-8 in. (15-20 cm) height; 5-7 in. (13-18 cm) spread	v
	POPPY, ICELAND Papaver nudicaule	Champagne Bubbles F1 Series	e 4-8	~	••	142,000 S/oz. (5,000 S/g) PRM, SED	288-cell 1 or larger	Cover lightly	64-68°F 7-12 (18-20°C); light not required but beneficial	60-65°F (16-18°C)	4-5	Spray damp-off fungicide	No		4 in. (10 cm), 6 in. (15 cm) 1-3 ppp	50-55°F (10-13°C) Day; 40-45°F (4-7°C) Night	5.5-6.0/ 1.2-1.4		Day neutral	4 in. (10 cm): 5-6; 6 in. (15 cm): 6-7; Sow: February-April; Finish: June-August	-	Suffers from Chlorosis at high pH (above 6.1), due to iron deficiency. Moderate fertilization, well-drained soil.	15 in. (38 cm) height; 6 in. (15 cm) spread	V
FOR PR	REMIUM PERENNIAL C	COMBOS See	KieftSeed	l.com for	culture i	nformation	n.	No	CO CEPE 9 10		0 10		No		4 F in		FF60 /	Nana	Long day	10.12.		Lice well drained medium	9.10 in	
	P. capitata ssp. mooreana	Deep Blue	4-7	U III		S/oz. (30,000 S/g) SED	200-0011 4	NU	(16-18°C); light not required	(16-18°C)	8-10	,	NU		(10-13 cm)	(18-20°C) Day; 60-65°F (16-18°C) Night	1.1-1.3	NOTE	beneficial	Sow: March-May; Finish: June-August	-	prevent Mg and Fe deficiency; <i>Botrytis,</i> <i>Pythium, Rhizoctonia</i> and aphids	(20-25 cm) height; 6-8 in. (15-20 cm) spread	V
	RUDBECKIA R. fulgida var. sullivanti	Goldsturm	3-9	V	Q	29,000- 34,000 S/oz. (1,000- 1,200 S/g) TUN	288-cell 2 or larger	Yes, vermiculite normal layer (not thick!)	68-72°F 5-7 (20-22°C); light required	65-68°F (18-20°C)	6-8		No		Gallon, 1 ppp; 2 Gallon, 1-3 ppp	65-68°F (18-20°C) Day; 60-65°F (16-18°C) Night	5.8-6.5 / 1.3-1.6	Sumagic 5-10 ppm spray; Bonzi 20-30 ppm spray	Long day required	20-24; Sow: January-May; Finish: July-September	-	High feeder; use long day or night interruption to finish early pottings; prevent Mg and Fe deficiency; <i>Botrytis</i> and downy mildew; high light and good ventilation	16-24 in. (40-60 cm) height; 14-18 in. (35-45 cm) spread	~
	RUDBECKIA R. hirta	Irish Eyes	7-9	~		5,000- 5,500 S/oz. (1,800- 2,000 S/g)	288-cell/ 2-3 180-cell	Cover lightly	68-72°F 4-7 (20-22°C)	66-68°F React: (19-20°C) well tr Alar/ B-Nin	s 6-7 o	Requires light for germination	No		5-6-in. (13-15 cm), 1 ppp; Gallon (15-18 cm), 3 ppp	65-68°F (18-20°C) Day; 59-60°F (15-16°C) Night	5.8-6.5/ 1.2-1.5	Alar/ B-Nine 2,500- 4,000 ppm if necessary		12-14		Powdery mildew	24-36 in. (60-90 cm) height; 14-18 in. (35-45 cm) spread	
	RUDBECKIA R. hirta	Moreno	7-9	~		300-400 S/oz. (100-125 S/g)	288-cell/ 2-3 180-cell	Cover lightly	68-72°F 4-7 (20-22°C)	66-68°F React: (19-20°C) well tr Alar/ B-Nin	s 6-7 o	Requires light for germination	No		5-6-in. (13-15 cm), 1 ppp; Gallon (15-18 cm), 3 ppp	65-68°F (18-20°C) Day; 59-60°F (15-16°C) Night	5.8-6.5 / 1.2-1.5	Alar/ B-Nine 2,500- 4,000 ppm if necessary		10-12		Powdery mildew	12-20 in. (30-50 cm) height; 10-12 in. (25-30 cm) spread	

Grower Facts	Class SALVIA S. lyrata	Series/ Variety Purple Volcano	Hard- F iness y zone f 6-8	First Jear Nower E	xposure	Seed info 14,000- 17,000 S/oz. (500-600 S/g) SED	Recomm- ended plug size** 288-cell	Seeds/ cell 3-4	Cover seed Cover lightly	Germin- ation g conditions a 68-72°F 5 (20-22°C); light required	Days to germin- ition	Stage 2-3 Plug temp. PGRs 65-68°F None (18-20°C)	Plug crop wks. 6-8	Plug tips Spray damp-off fungicide; grow relatively dry after Stage 1	Vernalization No	Recommended containers (ppp : plugs/pot 5 in. (13 cm), 1 ppp; 1 Gallon, 1-3 ppp	d Growing or temps. 60-65°F (16-18°C) Day; 54-60°F (12-16°C) Night	Media pH/EC 5.8-6.2 / 1.2-1.4	PGR ppm None	Photoperiod response Day neutral	Annual crop weeks to flower from transplant with recommendations 8-10; Sow: March-June; Finish: late April-July	Overwinter crop weeks to flower from transplant with recommendations' 32-38; Sow: August- September; Finish: March-May	Tips, diseases & recommendations Use well-drained medium, prevent Mg and Fe; <i>Botrytis</i> , downy mildew, aphids and spider mites	Mature height & spread 8-10 in. (20-25 cm) height; 6-8 in. (15-20 cm) spread	Heat Cool tolerant Crop
Pg 162	2 SALVIA S. nemorosa	New Dimension Series	4-8	V	<u> </u>	Blue: 29,000- 31,000 S/oz. (1,000- 1,100 S/g); Rose 17,000- 21,000 S/oz. (600-750 S/g) COT	288-cell	4	Cover lightly	68-72°F 3 (20-22°C); light optional	}-4	65-68°F None (18-20℃)	5-6	Spray damp-off fungicide	No	4-5 in./quart (10-13cm), 1 ppp; Gallon, 1-3 ppp	60-72°F (16-22°C) Day; 50-59°F (10-15°C) Night	5.5-6.2/ start 0.8-1.0 to 1.2-1.3	Indoor prod. B-Nine 2,500	Long day required	Rose 8-10; Blue 9-11; Sow: March-May; Finish: May-July	32-38; Sow: August- September; Finish: April-May	Avoid leaf yellow with high pH (Fe) and/or low N when generative; spray weekly Bittersalt MGSO4 1g/liter; spider mites, <i>Rhizoctonia</i> , leafspot and root rot; wet after transplant with preventive spray	8-10 in. (20-25 cm) height; 6-8 in. (15-20 cm) spread	~ ~
	SALVIA S. Patens	Patio Series	8-10	v	0	2,660- 3,500 S/oz. (95-125 S/g)	288-cell	1	No	65-68°F 4 (18-20°C); light required	1-7	65-68°F B-Nine (18-20°C) 1,500 ppm (1.5g/ liter)	5-6		No	5 in., 1 ppp; Gallon, 1-3 ppp	60-65°F (16-18°C) Day; 57-60°F (14-16°C) Night	5.8-6.5 / 1.0-1.2	B-Nine 2,000	Long day beneficial	7-11; Sow: April-May; Finish: May-July		Grow relatively dry. Use well-drained medium, prevent Mg and Fe deficiency; <i>Botrytis</i> , downy mildew, aphids and spider mites; high light and good ventilation	12-14 in. (30-35 cm) height; 8-12 in. (20-30 cm) spread	V
	SALVIA S. roemeriana	Hot Trumpets	7-10	~	0	11,000- 14,000 S/oz. (400-500 g/oz.) SED	288-cell	3-4	Cover lightly	65-68°F 5 (18-20°C); light required	5-7	65-68°F B-Nine (18-20°C) 2,000	6-8	Spray damp-off fungicide; grow relatively dry after Stage 1	No	5 in., 1 ppp; Gallon, 1-3 ppp	65-68°F (18-20°C) Day; 54-60°F (12-16°C) Night	5.8-6.2/ 1.2-1.4	B-Nine 2,000	Day neutral	8-12; Sow: April-May; Finish: June-August	_	Use well-drained medium, prevent Mg and Fe deficiency; <i>Botrytis</i> , downy mildew, aphids and spider mites; high light and good ventilation	8-10 in. (20-25 cm) height; 6-8 in. (15-20 cm) spread	V
	SAXIFRAGA S. x arendsii	Purple Robe	4-7	v		545,000- 600,000 S/oz. (19,000- 21,000 S/g)	288-cell	4-6	Cover lightly	65-68°F 8 (18-20°C)	3-10	65-68°F None (18-20°C)	8-10	Spray against damping off	Yes; 12 weeks at 41°F (5°C)	3.5-5 in. (9-13 cm), 1 ppp	50-54°F (10-12°C) Day; 45-50°F (7-10°C) Night	5.8-6.5 / 1.0-1.2		Day neutral	-	40-44; Sow: June-July; Finish: late April-June	Very well-drained medium; prevent Mg and Fe deficiency, <i>Botrytis</i> and spider mites	3-5 in. (8-13 cm) height; 4-6 in. (10-15 cm) spread	~
Pg 163	3 SAXIFRAGA S. x arendsii	Rocco Red	4-7		0	392,000- 492,000 S/oz. (1,400- 1,600 S/g) PEL	288-cell	2	Cover lightly	65-68°F 7 (18-20°C); light not required	7-11	65-68°F None (18-20°C)	9-10	Spray damp-off fungicide	Yes; duration of 12 weeks at 41°F (5°C)	3.5-5 in. (10-13 cm), 1 ppp	60-65° ^F (15-18°C) Day; 40-50°F (4-10°C) Night	5.8-6.2/ 1.0-1.2	None	Day neutral	-	28-36; Sow: June-mid August; Finish: April-May	Very well-drained medium; prevent Mg and Fe deficiency; grown best as slightly dry to average moisture; water thoroughly and allow to dry moderately; <i>Botrytis</i> and spider mites	3-4.5 in. (7-11 cm) height; 3.5-5 in. (9-13 cm) spread	V
	SCABIOSA S. col.	Blue Note, Pink Diamonds	5-9	• :	••	11,000- 20,000 S/oz. (400-700 S/g) SED	288-cell	2-3	Yes	65-68°F 8 (18-20°C); light not required	3-10	65-68°F None (18-20°C)	6-8	Spray damp-off fungicide	No	4-5 in. (10-13 cm), 1 ppp; Gallon, 1-3 ppp	65-68°F (18-20°C) Day; 60-65°F (16-18°C) Night	5.8-6.2 / start 0.8-1.0 to 1.2-1.3	None	Day neutral	12-14; Sow: January-April; Finish: May-July	30-36; Sow: July-September; Finish: April-May	Needs high light; low RH; grow relatively dry; prevent Mg and Fe deficiency; <i>Botrytis</i> , downy mildew, root rot, aphids and mites; early spring forcing 6 wks 62-65, no long days	8-10 in. (20-25 cm) height; 8-10 in. (20-25 cm) spread	V
	SILENE S. alpestris	Starry Dreams	5-8	v <u>i</u>		171,00- 200,000 S/oz. (6,000- 7,000 S/g) SED	288-cell	3-4	No	68-72°F 5 (20-22°C); light not required	5-7	65-68°F B-Nine (18-20°C) 2,000 ppm (2g/ liter)	5-6		No	4-5 in. (10-13 cm)	65-68°F (18-20°C) Day; 60-65°F (16-18°C) Night	5.8-6.5 / 1.0-1.2	B-Nine 2,500	Long day required	10-12; Sow: February-April; Finish: May-July	_	Low-moderate fertilization, grow uniformly moist; prevent Mg and Fe deficiency; aphids, spidermites, slugs and snails	6-8 in. (15-20 cm) height; 8-10 in. (20-25 cm) spread	~
	STACHYS S. byzantina		5-7	¥ {		14,250- 15,675 S/oz. (500-550 S/g)	288-cell or larger	3-4	Yes	68-72°F 3 (20-22°C); light not required	3-6	65-68°F (18-20°C)	6-7	A cooling period of 2 weeks at 5° could influence germination positively	No	4-5 in. (10-13 cm), 1 ppp; 6 in. (15 cm), 2-3 ppp	60-65°F (16-18°C) Day; 54-60°F (12-16°C) Night	5.8-6.5 / 1.0-1.2			Sow: December- March; Finish: March-June		Pinching to keep more compact is possible; <i>S. byzantina</i> is not really suitable for forcing.	Ground- cover; height up to 16 in. (40 cm)	

	Grower Facts Class	Series/ Variety	Hard- F iness y zone fl	irst ear ower Expos	Seed ire info	Recomm- ended plug Seeds/ Cover size** cell seed	Germin- Days to ation germir conditions ation	o 1- Stage 2-3 Plug temp. PGRs	Plug crop wks.	Plug tips	Vernalization	Recommended containers (ppp : plugs/pot	Growing on Media) temps. pH/EC	PGR ppm	Photoperiod response	Annual crop weeks to flower from transplant with recommendations [†]	Overwinter crop weeks to flower from transplant with recommendations [†]	Tips, diseases & recommendations	Mature height & spread	Heat Cool tolerant crop
	VERBASCUM V. x hybrida	Southern Charm F1	5-8	 C 	28,350 S/oz. (1,000 S/g) SED	200-cell 1 Yes or larger	65-68°F 3-7 (18-20°C); light not required	65-68°F (18-20℃)	4-5		No	Gallon (15-18 cm), 1 ppp	64-67°F 5.8-6.5 / (18-19°C) 1.1-1.3 Day; 62-65°F (17-18°C) Night		Day neutral	12-13; Sow: February-April; Finish: May-July	-	Flowering more uniform under high light conditions	24-30 in. (60-75 cm) height; 12-18 in. (30-45 cm) spread	
	VERBENA V. bonariensis	Buenos Aires	7-9	 C 	98,000 - 126,000 S/oz (3,500- 4,500 S/g) TUN	- 288-cell 4 Yes	68-72°F 7-10 (20-22°C); light not required	65-68°F (18-20°C)	6-7	Spray damp-off fungicide; grow relatively dry after Stage 1	No	5 in. (13 cm), sold green	65-68°F 5.5-6.2 / (18-20°C) 1.3-1.5 Day; 60-65°F (16-18°C) Night		Long day beneficial	16-18; Sow: February-April; Finish: May-August	-	Grow dry and light; relatively high fertilization; avoid high N; prevent Mg and Fe deficiency; powdery mildew, aphids and thrips	40-50 in. (1-1.5 m) height; 12-16 in. (30-40 cm) spread	V
-	VERBENA V. rigida	Santos	7a- 11	V	34,000 S/oz. (1,200 S/g)	288-cell 4/288	68-72°F 7-10 (20-22°C)	65-68°F (18-20°C)	6-7	Spray against damping off	No	5 in. (13 cm), 1 ppp; 1 Gallon, 1-2 ppp; 2 Gallon, 2-3 ppp	65-68°F 5.5-6.2 / (18-20°C) 1.3-1.5 Day; 60-65°F (16-18°C) Night	Alar/B- Nine 2,000- 2,500 ppm or a tank mix Alar/B- Nine with Cycocel if necessary	Long day beneficial	11-13		Grow dry and light; relatively high fertilization, avoid high N; prevent Mg and Fe deficiency; powdery mildew, aphids, thrips	12 in. (30 cm) height; up to 48 in. (120 cm) spread	V
	VERONICA V. x hybrida	Blue Bouquet F1	5-8		25,500 S/oz. (900 S/g PEL	288-cell 1 Yes or larger)	65-75°F 6-9 (18-24°C); light not required	65-68°F (18-20℃)	5-6		No	Gallon, 1 ppp	65°F 5.5-6.2/ (18°C) 1.3-1.5 Day; 55-65°F (13-18°C) Night			14-16; Sow: February-April; Finish: May-August	-		12 in. (30 cm) height; 12 in. (30 cm) spread	
Cut	Flower	Culture	Chart																	
-----	--------	---------	-------																	
ιuu	FIOWER	Culture	liari																	

Grower Facts	Class	Series/ <u>Variety</u>	Exp <u>osure</u>	Seed <u>s per oz.(g)</u>	Seed Recommende	d Cover <u>seed</u>	Germination temperature	Days to germinate	Plug crop	Planting density	Growing on temperature day	Growing on temperature night	Weeks from plug <u>to finish</u>	Key tips	Stem length	Other recommendations
	AGERATUM A. houstonianum	Everest Blue	0	14,175-17,000 S/oz. (500-600 S/g)	PEL 406-cell or larger	No	68-72°F (20-21°C)	3-4	4-5	3 plants/ft. ² (32 plants/m ²) in Summer & 2 plants/ ft. ² (24 plants/m ²) in Autumn for Pinched crop. For Non-Pinched crop can use 6 plants/ft. ² (64 plants/m ²)	65-75°F (18-24°C)	55-60°F (13-16°C)	12-15	Greenhouse cut flower. Low temperatures (46-54°F/ 8-12°C) promote optimum stem length.	26 in. (65 cm)	After harvest, the cut stems should remain in water for at least 1 night in water before transport or sale. The flowers will open better if handled this way.
Online*	ANEMONE A. coronaria	Mona Lisa® Series	0	52,500 S/oz. (1,850 S/g)	SED 406-cell or larger	Yes	60-65°F (16-18°C)	10-14	8	2-4 plants/ft. ² (22 to 44 plants/m ²)	60-65°F (16-18°C)	55°F (13°C)	12	Greenhouse cut flower. Low temperatures (46-54°F/8-12°C) promote optimum stem length.	18 in. (45 cm)	Ideally suited for young plant production from a March to June sowing in Northern Hemisphere for October through April season; a September to December sowing in Southern Hemisphere for April through October season.
	ASTER Callistephus chinensis	Meteor Series	0	12,000 S/oz. (420 S/g)	SED 200-cell	Yes	70°F (21°C)	4-8	4-5	7 plants/ft. ² (78 plants/m ²)	60-75°F (16-24°C)	50-60°F (10-16°C)	13-16	Greenhouse, shade house or field. Soils must be free of pathogens. Provide 1 layer of netting. Fertilize with alternate applications of calcium nitrate and potassium nitrate to supply 125 to 150 ppm N. Decrease nitrogen and increase potassium-containing fertilizers when flower buds appear.	30-40 in. (80-100 cm)	Crop timing is affected by the ratio of long days (LD) to short days (SD). Under SD conditions, increasing LD treatments will increase stem length and shorten time to harvest. LD consists of 16 hours of light. Cyclic lighting of 7.5 min. per half-hour.
Pg 95	CAMPANULA C. medium	Campana Series	٠	102,000- 136,000 S/oz. (3,600-4,800 S/g) Raw; 105,000- 122,000 S/oz. (3,700-4,300 S/g) PEL	SED, 288-cell or PEL larger	No	68-72°F (20-22°C)	4-5	7-8	6-8 plants/ft. ² (64-80 plants/m ²)	60-70°F (16-21°C)	54-59°F (12-15°C)	10-14	This greenhouse cut-flower campanula is a qualitative long day plant. To ensure sufficient vegetative growth and stem length, it is recommended to provide 6 weeks of short day conditions (11 hours) from approximately 2 weeks after sowing. When producing for Winter flowering, providing long days at 6 weeks after transplanting is required. "Mum lighting" from 10 PM to 2 AM can be used.	30-34 in. (75-85 cm)	Maintain a medium moisture level. In order to reach sufficient stem length, Campanula medium needs adequate moisture and fertilization. Dry growing conditions will cause early flowering and reduced stem length. However, do not over water as this will cause weaker stems and weaker root systems which will lead to plants falling over.
Pg 88	CELOSIA C. cristata	Bombay Series	٠	21,300-28,350 S/oz. (750- 1,000 S/g) Raw; 5,670-7,080 S/oz. (200-250 S/g) PEL; 20,000-27,000 S/oz. (700-950 S/g) FCS	SED, 288-cell or PEL, larger FCS	Cover lightly	68-72°F (20-22°C)	3-4	2-3	6-8 plants/ft. ² (64-80 plants/m ²)	Before flower development: 65-75°F (18-24°C) After flower development: 60-61°F (16°C)	Before flower development: 63-65°F (17-18°C) After flower development: 59°F (15°C)	10-14	This greenhouse cut-flower celosia is a quantitative short day plant. Flowers will initiate under short days. The optimum daylength for Bombay to reach the appropriate stem length lies between 12 to 13 hours.	28-40 in. (70-100 cm)	Celosia makes a taproot and is sensitive for root damage, which will result in early bud formation, deformed flowers and less uniformity. Therefore, planting should be done before the plugs get rootbound. It is important to maintain a constantly moist media, especially for the first 2 weeks after transplanting to prevent premature flowering.
	CELOSIA <i>C. cristata</i> A Kieft Seed product	Celway Series	٠	2,547-3,538 S/oz. (90- 125 S/g) PEL; 24,055-35,375 S/oz. (850- 1,250 S/g) FCS	PEL, 288-cell or FCS larger	Cover lightly	68-72°F (20-22°C)	3-4	2-3	6-8 plants/ft.² (64-80 plants/m²)	Before flower development: 65-75°F (18-24°C) After flower development: 60-61°F (16°C)	Before flower development: 63-65°F (17-18°C) After flower development: 59°F (15°C)	10-14	This greenhouse cut-flower celosia is a quantitative short day plant. Flowers will initiate under short days. The optimum daylength for Celway to reach the appropriate stem length lies between 12 to 13 hours.	40-48 in. (100-120 cm)	Celosia makes a taproot and is sensitive for root damage, which will result in early bud formation, deformed flowers and less uniformity. Therefore, planting should be done before the plugs get rootbound. It is important to maintain a constantly moist media, especially for the first 2 weeks after transplanting to prevent premature flowering.
Pg 90	CELOSIA C. plumosa	Sunday Series	٠	42,525-68,040 S/oz. (1,500- 2,400 S/g) Raw; 44,000- 60,000 S/oz. (1,550-2,100 S/g) FCS	SED, 288-cell or FCS larger	Cover lightly	68-72°F (20-22°C)	3-4	2-3	6-8 plants/ft. ² (64-80 plants/m ²)	Before flower development: 65-75°F (18-24°C) After flower development: 60-61°F (16°C)	Before flower development: 63-65°F (17-18°C) After flower development: 59°F (15°C)	12-16	This greenhouse cut-flower celosia is a quantitative short day plant. Flowers will initiate under short days. The optimum daylength for Sunday to reach the appropriate stem length lies between 12 to 13 hours.	28-40 in. (70-100 cm)	Celosia makes a taproot and is sensitive for root damage, which will result in early bud formation, deformed flowers and less uniformity. Therefore, planting should be done before the plugs get rootbound. It is important to maintain a constantly moist media, especially for the first 2 weeks after transplanting to prevent premature flowering.
Online*	DELPHINIUM <i>D. elatum</i> A Kieft Seed product	Guardian F1 Series	ं	9,285 S/oz. (325 S/g)	SED 200-cell	Yes	65-70°F (18-21°C)	5-6	5-6	2-4 plants/ft. ² (22-44 plants/m ²)	60-70°F (16-21°C)	50-60°F (10-16°C)	11-16 (see Key tips)	Autumn: greenhouse 13 weeks, field 16 weeks. Spring: greenhouse 11 weeks, field 13 weeks. Treat cut stems with an ethylene- inhibiting agent.	30-39 in. (75-100 cm)	In temperate areas, such as coastal California, plugs are generally transplanted into the field August through October, and February to early May. Autumn transplants will flower the following Spring (February onward); Spring transplants flower late Spring.
Online*	DIANTHUS D. barbatus interspecific	Amazon F1 Series	0	12,760-14,175 S/oz. (450-500 S/g)	PEL 406-cell	Yes	64-68°F (18-20°C)	3-5	4-5	3-4 plants/ft. ² (30-40 plants/m ²); 1.5 plants/ft. ² (15 plants/m ²) if pinched	60-72°F (16-22°C)	50-60°F (10-16°C)	11-23 (see Key tips)	Late Spring/Summer greenhouse/field: 11-14 weeks. Late Summer/Winter greenhouse: 12- 18 weeks. Field: 18-23 weeks	18-36 in. (45-90 cm)	A small percentage of early off-types can be observed at 4-5 weeks from sowing. They should be removed. Can tolerate night temperatures as low as 45°F (7°C). Plants are frost-tolerant although frost will damage the flowers.
Online*	DIANTHUS D. barbatus interspecific	Bouquet F1 Series	\bigcirc	8,575 S/oz. (300 S/g)	PEL 406-cell	Yes	64-68°F (18-20°C)	3-5	4-5	3-4 plants/ft. ² (30-40 plants/m ²)	60-72°F (16-22°C)	50-60°F (10-16°C)	11-23 (see Key tips)	Late Spring/Summer greenhouse/field: 11-14 weeks. Late Summer/Winter greenhouse: 12-18 weeks. Field: 18-23 weeks	18-24 in. (45-60 cm)	Hardy perennial.

Cut Flower Culture Chart

Grower Facts	Class	Series/Variety	Exposure	Seeds per oz.(g)	Seed R for <u>m p</u>	Recommended blug size**	Cover seed	Germination temperature	Days to germinate	Plug cro weeks	p Planting density	Growing on temperature day	Growing on temperature night	Weeks from plug to finish	Key tips	Stem length	Other
Online*	DIANTHUS D. barbatus	Sweet F1 Series	0	7,300-9,600 pellets/oz. (260-340 pellets/g)	PEL 4	106-cell	Yes	64-68°F (18-20°C)	3-5	4-5	4-6 plants/ft. ² (42-64 plants/m ²)	60-72°F (16-22℃)	50-60°F (10-16°C)	10 (Summer/ Autumn), 11-15 (Winter/Spring)	Late Spring/Summer greenhouse/field: 8-9 weeks. Later Summer/Winter greenhouse: 9-13 weeks. Field: 15-18 weeks. Greenhouse or full sun. No vernalization required for flower induction.	18-36 in. (45-90 cm)	Taller growth achievable from early Autumn- transplanted, greenhouse-grown plants.
Pg 101	GOMPHRENA G. sp.	Fireworks	Q	14,175 S/oz. (500 S/g)	COT 4	106-cell or arger	Yes	68-75°F (20-24°C)	2-3	5-6	.75 plants/ft. ² (8 plants/m ²)	65-75°F (18-24°C)	63-66°F (18-25°C)	8-9		18 in. (45 cm)	
	GOMPHRENA <i>G. haageana</i> A Kieft Seed product	QIS Series	0	5,700-8,500 S/oz. (200-300 S/g)	SED 4 la	106-cell or arger	Yes	68-75°F (20-24°C)	2-3	5-6	1.5 plants/ft. ² (16 plants/m ²)	65-75°F (18-24°C)	63-66°F (18-25°C)	10-12		24-26 in. (60-70 cm)	To increase productivity, the first blooms of the plants should be removed.
	HELIANTHUS H. annuus (Sunflower)	Jua Series	0	483-567 S/oz.	SED E ri 2	Direct sow ecommended; 200-cell	Yes ;	68-75°F (20-24°C)	2-3 days if sown in plugs and 3-5 days when direct sown in field	2-2.5	6-9 days after seedlings emerge, thin to 4-5 plants/ft ² (42-52 plants/m ²)	65-85°F (18-29°C)	50-65°F (10-18°C)	8.5-10.5 depending on culture conditions	Suitable for short and long day conditions, bred for best quality flowers under long day conditions.	36-60 in. (90-150 cm) depending on culture conditions	
	HELIANTHUS H. annuus (Sunflower)	Prado Series	O	1,135 S/oz. (40 S/g)	SED D ri 2	Direct sow ecommended; 200-cell	Yes ;	68-75°F (20-24°C)	3-5	2-3	.75 plants/ft.² (8 plants/m²)	65-85°F (18-29°C)	50-65°F (10-18°C)	10-12 (from sowing)	At high elevations (5,000 ft+/1,500 m+) and high light levels, Prado Red may produce almost-black ray petals. Very low humidity or very high light levels can reduce stem length.	48-66 in. (1.2-1.7 m)	Approximately 7-10 flower stems per plant may be harvested when the main stem is pinched at the fifth set of true leaves. Harvest approximately 10-12 weeks from sow.
	LIMONIUM (STATICE), ANNUAL Limonium sinuatum A Kieft Seed product	QIS Series	0	9,900-14,175 S/oz. (350-500 S/g)	SED 2	200-cell or arger	Yes	70°F (21°C)	3-8	4-5	1-2 plants/ft. ² (10-20 plants/m ²)	55-60°F (13-16°C)	50-55°F (10-13°C)	18-22 (12-13 with vernalization)	Plants flower more rapidly and uniformly if subjected to a cold treatment of 50-55°F (10-13°C) for 3-5 weeks following germination.	30-35 in. (75-90 cm)	Popular series for both fresh and preserved cut flower production. Stiff stems do not require netting.
Online ^a Flare, pg 107	LISIANTHUS, CUT FLOWER Eustoma grandiflorun	Flare F1 Series (Spray ⁷ Type Double Flowering), ABC F1 Series (Double Flowering), Laguna F1 Series (Single Flowering)	0	28,000 S/oz. (1,000 S/g)	SED 3 c	392, 406 or similar cell size plug	No	68-72°F (20-22°C)	8-12	8-10	Summer: 8 plants/ft. ² (84 plants/m ²) Winter: 6 plants/ft. ² (64 plants/m ²)	68-75°F (20-24°C)	60-65°F (16-18°C)	14-18 Winter, 12-14 Spring/ Autumn, 10-12 Summer	Full-sun plantings of cut flower Lisianthus produce shorter stems than greenhouse- grown Lisianthus.	29-45 in. (75-115 cm)	Flare is a series of F1 spray-type double flowering Lisianthus. They have a top-flowering habit producing more flowers on top of each stem within a short flowering window giving a bouquet effect. Flare series is Speed Group 2 (Mid/medium speed) for flowering speed.
Online*	MATRICARIA Tanacetum parthenium	Vegmo Series	0	18,650 S/oz. (650 S/g)	PEL 2	200-cell	No	70-72°F (21-22°C)	4-6	4-5	Summer: 8 plants/ft. ² (80 plants/m ²) Winter: 7 plants/ft. ² (70 plants/m ²)	Winter: 55-58°F (13-14°C) Summer: 72-74°F (22-24°C)	Winter: 55-58°F (13-14°C) Summer: 60-65°F (16-18°C)	14-16 Winter, 10-14 Spring/ Autumn, 7-10 Summer	16 hours of lighting is required for flowering; supplemental lighting may be solid or cyclic. Matricaria are not sensitive to ethylene.	28-36 in. (70-90 cm)	
Online*	MATTHIOLA (STOCK), EXTRA EARLY FLOWERING M. incana	Katz Series	Ç	15,300-18,100 S/oz. (540-640 S/g)	SED 4	106-cell	Yes	68-72°F (20-22°C)	3-4	4	12 plants/ft. ² (126 plants/m ²)	60-75°F (16-24°C)	45-55°F (7-13°C)	8-13	Crop time is dependent on daylength and light intensity. As a general guide with daylength of 13 hours or more, the crop time will be 8 weeks from planting. Shorter days will slow the crop time, depending on the temperature, up to 13 weeks from planting.	32 in. (80 cm)	Best performance when grown in tunnels.
	MATTHIOLA (STOCK), FIELD CUT M. incana	Column Stocks	Ô	15,600-20,000 S/oz. (550-700 S/g)	SED D	Direct sow to Tield	Yes	65-70°F (18-21°C)	14-21	N/A	2.2 lbs./acre (1kg/4,000m ²)	55-65°F (13-18°C)	55-60°F (13-16°C)	20-22 (from sowing)	Column stocks are non-selectable for doubleness. Supply one layer of support netting. Direct sow seed.	24-30 in. (60-75 cm)	Optimum stem length will be achieved during cool growing periods. High heat can stunt plants or prevent flower spikes from developing.
	MATTHIOLA (STOCK), GREENHOUSE- GROWN SELECTABLE M. incana	Aida, Carmen, Figaro, Opera (Vegmo) Series	<u></u>	15,600-20,000 S/oz. (550-700 S/g)	SED 2	200-cell	Yes	59°F (15°C)	5	5-6	6 plants/ft.² (64 plants/m²)	50-62°F (10-16°C)	50-62°F (10-16°C)	11-12 Winter, 8-9 Spring, 3-5 Summer, 4-7 Autumn	Double-flowering Matthiola may be selected from single-flowering types by exposing seedlings with fully expanded cotyledons to 41°F (5°C) for approximately 3-5 days. At this point, seedlings of double-flowering plants will appear a pale green, while singles remain dark green.	32 in. (80 cm)	After removal from cold treatment, double-flowering seedlings will appear yellow and chlorotic within 1-2 days, while single-flowering seedlings remain robust and green. This cold treatment may only be done once to selectable Matthiola plugs.
	SNAPDRAGON, FORCING F1 Antirrhinum majus	Apollo Series	0	180,000 S/oz.	SED 5	512-cell or arger	Cover lightly	65-68°F (18-20°C)	4-5	4-5	6-10 plants/ft. ² (64-106 plants/m ²); high-density planting under high-light or field situation.	60-75°F (16-24°C)	52-57°F (11-14°C)	8-18		39-60 in. (1-1.5 m)	Group 2,3: Open-faced series ideal for Autumn and Spring harvests. Refer to the Snapdragon Culture Guide for detailed information.
	SNAPDRAGON, FORCING F1 Antirrhinum majus	Cool Series	0	180,000 S/oz. (6,350 S/g)	SED 5 la	512-cell or arger	Cover lightly	65-68°F (18-20°C)	4-5	4-5	6-10 plants/ft. ² (64-106 plants/m ²); high-density planting under high-light or field situation	55-70°F (13-21°C)	45-55°F (7-13°C)	8-18		39-60 in. (1-1.5 m)	Group 1 to early Group 2: Highly uniform series for germination, plug growth, spike architecture and flowering date.

Cut Flower Culture Chart

Grower Facts	Class	Series/Variety	Exposure	Seeds per oz.(g)	Seed Recommended form plug size**	l Cover seed	Germination temperature	Days to germinat	Plug croj e weeks	o Planting density	Growing on temperature day	Growing on temperature night	Weeks from plug to finish	Key tips	Stem length	Other recommendations
	SNAPDRAGON, FORCING F1 Antirrhinum majus	Maryland Series	0	180,000 S/oz. (6,350 S/g)	SED 512-cell or larger	Cover lightly	65-68°F (18-20°C)	4-5	4-5	6-10 plants/ft. ² (64-106 plants/m ²); high-density planting under high-light or field situation.	55-70°F (13-21°C)	45-55°F (7-13°C)	8-18	Dark Orange germinates best with light.	39-60 in. (1-1.5 m)	Group 1,2
	SNAPDRAGON, FORCING F1 Antirrhinum majus	Monaco Series, Paxia Series	0	180,000 S/oz. (6,350 S/g)	SED 512-cell or larger	Cover lightly	65-68°F (18-20°C)	4-5	4-5	6-10 plants/ft. ² (64-106 plants/m ²); high-density planting under high-light or field situation.	60-75°F (16-24°C)	52-57°F (11-14°C)	8-18		39-60 in. (1-1.5 m)	Group 2,3: Well suited to difficult transition periods, such as Group 3,4 (Summer) to Group 1,2 (Autumn/ Winter). Tolerates warm Autumn conditions, perfect for Winter production in warmer climates, performs well all year in moderate temperatures.
	SNAPDRAGON, FORCING F1 Antirrhinum majus	Early Potomac, Potomac Series, Axiom Series	0	180,000 S/oz. (6,350 S/g)	SED 512-cell or larger	Cover lightly	65-68°F (18-20°C)	4-5	4-5	6-10 plants/ft. ² (64-106 plants/m ²); high-density planting under high-light or field situation.	70-85°F (21-30°C)	Potomac: 60°F (16°C), Early Potomac: 55-60°F (13-16°C)	8-18	Appleblossom and Dark Orange germinate best with light.	39-60 in. (1-1.5 m)	Group 3,4: Ideal for production during periods of high light, long days and warm temperatures. Can be grown year-round with supplemental high-intensity lighting.
	SNAPDRAGON, FORCING F1 Antirrhinum majus	Purple Twist	0	180,000 S/oz. (6,350 S/g)	SED 512-cell or larger	Cover lightly	65-68°F (18-20°C)	4-5	4-5	6-10 plants/ft. ² (64-106 plants/m ²); high-density planting under high-light or field situation.	55-70°F (13-21°C)	50-55°F (10-13°C)	8-18	The flowers have a unique purple and white striped color pattern. The striped pattern varies depending on the growing environment - when grown in warmer greenhouse conditions, the white stripes are more dense and prominent, but when grown under cool outside/tunnel conditions, the purple is more dense and prominent.	39-60 in. (1-1.5 m)	This is a unique novelty stand-alone Group 2 variety. Purple Twist can be produced under short days, moderate light conditions with night temperatures of 50 to 55°F (10 to 13°C) during production. It can be scheduled and grown along with the Maryland series.
	SNAPDRAGON, FORCING F1 Antirrhinum majus	Red Delilah	Ċ	180,000 S/oz. (6,350 S/g)	SED 512-cell or larger	Cover lightly	65-68°F (18-20°C)	4-5	4-5	6-10 plants/ft. ² (64-106 plants/m ²); high-density planting under high-light or field situation.	55-70°F (13-21°C)	50-55°F (10-13°C)	8-18	Red Delilah has a unique flower spike with red and white tube flowers.	39-60 in. (1-1.5 m)	This is a unique novelty stand-alone Group 2 variety. Red Delilah can be produced under short days, moderate light conditions with night temperatures of 50-55°F (10-13°C) during production. It can be scheduled and grown along with the Maryland series.
	SNAPDRAGON, FORCING F1 Antirrhinum majus	Trumpet Tangerine & Trumpet Pink	0	180,000 S/oz. (6,350 S/g)	SED 512-cell or larger	Cover lightly	65-68°F (18-20°C)	4-6	4-5	6-10 plants/ft. ² (64-106 plants/m ²); high-density planting under high-light or field situation.	60-75°F (16-24°C)	45-55°F (7-13°C)	8-18		39-60 in. (1-1.5 m)	
	SNAPDRAGON, GARDEN F1 Antirrhinum majus	Rocket Series	0	180,000 S/oz. (6,350 S/g)	SED 406-cell	Cover lightly	65-68°F (18-20°C)	4-8	5-6	3-4 plants/ft. ² (30-40 plants/m ²)	65-80°F (18-26°C)	55-60°F (13-16°C)	13-16	Bronze, Golden, Pink, Red and Rose Shades will germinate best with light.	30-36 in. (75-90 cm)	Versatile snapdragon can be used as both landscape series and as field-grown cut flower. Rocket makes an excellent quality Group 3,4 Spring and Summer- flowering landscape snapdragon.
	TRACHELIUM, CUT FLOWER TYPE T. caeruleum	Lake Forest, Lake Michigan, Lake Louise Series	0	21,500 S/oz. (750 S/g)	PEL 200-cell	No	72°F (21°C)	7-10	7-9	6-8 plants/ft.² (64-84 plants/m²)	62-68°F (16-20°C)	60°F (16°C)	10-18	Trachelium needs 16-hour daylengths for faster flowering.	[•] 30-42 in. (75-105 cm)	Should be transplanted Autumn to early Winter for flowering in mid-Winter to early Spring.

Grower Facts	Class	Series/Variety	Exposure	e Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germinatior temperature	Days to	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other	Key tips	Mature height	Plant spread	Heat Cool Other tolerant crop recommendations
	BASIL Ocimum basilicum	Multi-Seed Pellet SimplyHerbs	¢	737 S/oz. (26 S/g)	MSP	288-cell or larger	Yes	68-74°F (20-23°C)	2-4	3-4	4 in. (10 cm)	62-75°F (17-24°C)	50-60°F (10-16°C)	3-4	3-4	4-5	Can be directly sown into final container.	24-30 in. (60-75 cm)	12-16 in. (30-40 cm)	
	BASIL Ocimum basilicum	Multi-Seed Pellet 'Try Basil'	O	737 S/oz. (26 S/g)	MSP	288-cell or larger	Yes	68-74°F (20-23°C)	2-4	3-4	4 in. (10 cm)	62-75°F (17-24°C)	50-60°F (10-16°C)	3-4	3-4	4-5	Can be directly sown into final container.	24-30 in. (60-75 cm)	12-16 in. (30-40 cm)	
	BASIL Ocimum basilicum	Purple Ruffles, Sweet Dani Lemon	0	14,275 S/oz. (500 S/g)	SED	406-cell or larger	Yes	68-74°F (20-23°C)	2-4	4-5	Pack, 3.5 in. (9 cm)	62-75°F (17-24°C)	50-60°F (10-16°C)	2-3 (green)	2-3 (green)	-	Seed can be directly sown into finish containers up to 3.5 in. (9 cm).	18-24 in. (45-60 cm)	18-24 in. (45-60 cm)	The use of plant growth regulators on food crops is prohibited by law.
	BASIL Ocimum basilicum	Dolce Fresca		15,500-17,000 S/oz. (550-600 S/g)	SED	406-cell or larger	Yes	68-74°F (20-23°C)	2-4	4-5	Pack, 3.5 in. (9 cm)	62-75°F (17-24°C)	50-60°F (10-16°C)	2-3 (green)	2-3 (green)	-	Seed can be directly sown into finish containers up to 3.5 in. (9 cm).	12-14 in. (30-35 cm)	10-12 in. (25-30 cm)	
	CUCUMBER Cucumis sativus	Patio Snacker	Ô	935 S/oz. (33 S/g)	SED	Direct sow inf	o Yes r	72-75°F (21-24°C)	2-4 [†]		Packs, 4-6 in. (10-15 cm)	65-70°F (18-21°C)	62-65°F (16-18°C)	2-4 ⁺	2-4 ⁺	6-8 tubs ⁺	⁺ Can be directly sown into final container		36-60 in. (0.9-1.5m)	Excellent in tubs with trellis.
	DILL Anethum graveolens	Fernleaf	O	13,850 S/oz. (485 S/g)	SED	288-cell or larger	Yes	60°F (16°C)	5-8	4	4 in. (10 cm)	60-65°F (16-18°C)	55-58°F (13-14°C)	-	4-5	-	The use of plant growth regulators on food crops is prohibited by law.	12-15 in. (30-38 cm)	10-12 in. (25-30 cm)	Plants will flower later, allowing for an extended ornamental period.
	DILL Anethum graveolens	Fernleaf® Multi-Seed Pellet SimplyHerbs	0	765 S/oz. (27 S/g)	MSP	288-cell or larger	Yes	60°F (16°C)	5-8	3-4	4 in. (10 cm)	60-65°F (16-18°C)	55-60°F (13-16°C)	3-4	3-4	-	Can be directly sown into final container.	12-24 in. (30-60 cm)	10-16 in. (25-40 cm)	
	EGGPLANT Solanum melongena	Patio Baby	Q	4,560-7,381 S/oz (160-259 S/g)	z. SED	288-cell or larger	Cover lightly	[•] 75-90°F 7 (24-32°C)	5-8	4-5	Pack, 4-4.5 in./10-11cm, 6 in./15cm, gallon, 12 in./ 30 cm	70-85°F (21-29°C)	65-70°F (18-21°C)	4-5	4-5	5-7		16-20 in. (40-50 cm)	18-22 in. (45-55 cm)	
Pg 137	MULTI-SPECIES, MULTI-PELLET SIMPLYSALAD Mixes may include: Lactuca sativa, Brassica spp., Eruca sativa, Cichorium spp. and Chrysanthemum coronarium	Global Gourmet Mixture Improved, Alfresco Mixture, City Garden Mixture, Kale Storm Mixture, Summer Picnic Mixture (formerly Endless Summer), Wonder Wok Mixture	•	855-1,995 MSP/oz. (30-70 MSP/g)	MSP	128, 105-cell or larger	Cover lightly	- 65-70°F 7 (18-21°C)	2-3	2-3	306 (9 cm), 4-in. (10 cm), 6-in. (15 cm), colour bowl	55-70°F (13-21°C)	50-61°F (10-16°C)	_	2-4	2-6	Can be directly sown into final container.	12 in. (30 cm)	12 in. (30 cm)	
	MULTI-SPECIES, MULTI-PELLET SIMPLYSALAD Mixes may include: Brassica spp.	Kale Storm Mixture		140-280 PMPL/ oz. (5-10 PMPL/g)	PMPL	L 105-cell or larger	Cover lightly	· 65-70°F / (18-21°C)	2-3	2-3	306 (9 cm), 4-in. (10-cm), 6-in. (15-cm), colour bowl	55-70°F (13-21°C)	50-61°F (10-16°C)	-	2-4	2-6	Can be directly sown into final container. SimplySalad Kale Storm will develop darker colours in cool temperatures.	12-24 in. (30-60 cm)	12-24 in. (30-60 cm)	✓ Can be grown in-ground after transplant stage.
	OREGANO Origanum vulgare	Multi-Seed Pellet SimplyHerbs	Ç	7,894 S/oz. (277 S/g)	MSP	288-cell or larger	Yes	68-70°F (20-21°C)	5-8	4-5	4 in. (10 cm)	68-75°F (20-24°C)	62-65°F (16-18°C)	3-4	4-5	_	Can be directly sown into final container.	12-30 in. (30-75 cm)	12-24 in. (30-60 cm)	
	PARSLEY Petroselinum crispum	Curled, Flat Leaf Multi- Seed Pellet SimplyHerbs	O	850 S/oz. (30 S/g)	MSP	288-cell or larger	Yes	68-70°F (20-21°C)	5-8	4-5	4 in. (10 cm)	65-70°F (18-21°C)	60-65°F (16-18°C)	4-5	4-5		The use of plant growth regulators on food crops is prohibited by law.	15-18 in. (38-45 cm)	12-18 in. (30-45 cm)	
	PEPPER, HOT Capsicum annuum	Jalapeno 'La Bomba'	0	4,820 S/oz. (170 S/g)	SED	288-cell or larger	Cover lightly	75-78°F (24-26°C)	5-7	5-6	Packs, 4-6 in. (10-15 cm)	65-70°F (18-21°C)	62-65°F (17-18°C)	4-5 (no fruit)	4-7 (no fruit)		Pepper is very sensitive to high salts, particularly high ammonium, during germination. Keep ammonium levels to less than 10 ppm.	18-22 in. (45-55 cm)	12-18 in. (30-50 cm)	
Pg 118	PEPPER, HOT Capsicum annuum	Sweet Heat	Ò	4,400 S/oz. (155 S/g)	SED	288-cell or larger	Cover lightly	72-76°F (22-24°C)	5-7	5-6	4 in. (10 cm)	68-80°F (20-26°C)	65-70°F (18-21°C)	-	4-7 (no fruits), 9-12 (green fruits)	Pepper is very sensitive to high salts, particularly high ammonium, during germination. Keep ammonium levels to less than 10 ppm.	10 in. (25 cm)	14 in. (35 cm)	Plant in full sun after all danger of frost has passed.

Grower Facts	Class	Series/Variety	Exposure	Seeds per oz.(g)	Seed form	Recommended plug size**	Cover seed	Germination temperature	Days to germinate	Plug crop weeks	Recommended containers	Growing on temperature day	Growing on temperature night	Pack	4-in./ 10-cm	Other	Key tips	Mature height	Plant spread	Heat Cool tolerant crop	Other recommendations
Pg 108	PEPPER, HOT Capsicum annuum	Cajun Belle	Ô	4,400 S/oz. (155 S/g)	SED	288-cell or larger	Cover lightly	72-76°F (22-24°C)	5-7	5-6	4 in. (10 cm)	68-80°F (20-26°C)	65-70°F (18-21°C)	-	4-7 (no fruits), 9-12 (green fruits)	-	Pepper is very sensitive to high salts, particularly high ammonium, during germination. Keep ammonium levels to less than 10 ppm.	24 in. (60 cm)	24 in. (60 cm)	V	Plant in full sun after all danger of frost has passed.
Pg 108	PEPPER, SWEET MINI BELL Capsicum annuum	Cute Stuff Gold II, Cute Stuff Red		4,400 S/oz. (155 S/g)	SED	288-cell or larger	Cover lightly	72-76°F (22-24°C)	5-7	5-6	4 in. (10 cm)	68-80°F (20-26°C)	65-70°F (18-21°C)	-	4-7 (no fruits), 9-12 (green fruits)	-	Pepper is very sensitive to high salts, particularly high ammonium, during germination. Keep ammonium levels to less than 10 ppm.	18-24 in. (45-60 cm)	12-20 in. (30-50 cm)		Plant in full sun after all danger of frost has passed.
	ROSEMARY Rosmarinus officinalis	Multi-Seed Pellet SimplyHerbs	Ô	712 S/oz. (25 S/g)	MSP	288-cell or larger	Yes	68-70°F (20-21°C)	5-8	4-5	4 in. (10 cm)	68-75°F (20-24°C)	62-65°F (16-18°C)	3-4	4-5	-	Can be directly sown into final container.	12-24 in. (30-60 cm)	12-24 in. (30-60 cm)		
	SAGE Salvia officinalis	Multi-Seed Pellet SimplyHerbs	O	425 S/oz. (15 S/g)	MSP	288-cell or larger	Yes	68-70°F (20-21°C)	5-8	3-4	4 in. (10 cm)	68-75°F (20-24°C)	62-65°F (16-18°C)		3-4		Can be directly sown into final container.	18-24 in. (45-60 cm)	14-24 in. (35-60 cm)	v	
FOR SIN	IPLYSALAD See Multi-Sp SQUASH, SUMMER, ZUCCHINI Cucurbita pepo	eccies, Multi-Pellet (pg EasyPick Green, EasyPick Gold	(74) Ç	200 S/oz. (7 S/g)	SED	84-cell or larger. Can also be sown into finish container	Yes	70-95°F (21-35°C)	3-6	2-3	Packs, 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm)	65-75°F (18-21℃)	55-65°F (13-16°C)	2-3	2-3	6-8 tubs ⁺	Can be directly sown into final container.	36-52 in. (90 cm-1.3 m)	36-52 in. (90 cm-1.3 m)		
	SQUASH, WINTER, BUTTERNUT Cucurbita moschata	'Honeynut'	Ò	342-427 S/oz. (12-15 S/g)	SED	84-cell or larger. Can also be sown into finish container	Yes	70-95°F (21-35°C)	3-6	2-3	Packs, 4-4.5 in. (10-11 cm), 6-6.5 in. (15-16 cm)	65-75°F (18-21℃)	55-65°F (13-16°C)	2-3	2-3	3-4	Can be directly sown into final container.	8-12 in. (20-30 cm)	7-10 ft. (2-3 m)		Vining plants can be trained up a trellis to save garden space.
	STRAWBERRY Fragaria x ananassa	Fresca	Q	60,000 S/oz. (2,100 S/g)	SED	288-cell	Cover lightly	65°F (18°C)	7-14	4-5	4 in. (10 cm), 10 in. (25 cm) basket	60-64°F (16-18°C)	60-64°F (16-18°C)	-	12-13	13-15	Strawberry is sensitive to high salts, especially during germination. Strawberry is also susceptible to mildew	3-4 in. (7-10 cm)	10-12 in. (25-30 cm)		
	THYME Thymus vulgaris	Multi-Seed Pellet SimplyHerbs	Ç	3,700-3,900 S/oz (130-140 S/g)	z. MSP	288-cell or larger	Yes	68-70°F (20-21°C)	5-8	4-5	4 in. (10 cm)	60-65°F (16-18°C)	55-60°F (13-16°C)		4-5		The use of plant growth regulators on food crops is prohibited by law.	12-18 in. (30-45 cm)	12-18 in. (30-45 cm)		
	TOMATO, DETERMINATE Solanum lycospersicum	Homeslice	O	7,000-10,000 S/oz. (250-350 S/g)	SED	288-cell or larger	Cover lightly	60-85°F (16-29°C)	5-8	3-4	Packs, 4-6 in. (10-15 cm), Gallon (15-18 cm)	70-75°F (21-24°C)	62-65°F (16-18°C)	4-8	4-8	5-8 tub		18-24 in. (45-60 cm)	24-36 in. (60-90 cm)		Excellent container variety. Determinate varieties.
	TOMATO, COMPACT INDETERMINATE Solanum lycospersicum	Tidy Treats	0	7,125-12,540 S/oz. (250-400 S/g)	SED	288-cell or larger	Cover lightly	60-85°F (16-29°C)	5-8	3-4	Packs, 4-6 in. (10-15 cm), Gallon (15-18 cm)	70-75°F (21-24°C)	62-65°F (16-18°C)	4-8	4-8	5-8 tub		3-5 ft. (0.9- 1.5 m)	2-3 ft. (60-90 cm)	~	Excellent container or in-ground variety. Compact indeterminate.
	TOMATO, CONTAINER Solanum lycospersicum	Micro-Tom, Topsy Tom, Tumbler, Little Napoli	0	7,000-15,000 S/oz. (250-550 S/g)	SED	288-cell or larger	Cover lightly	60-85°F (16-29°C)	5-8	3-4	Packs, 4-6 in. (10-15 cm), gallon (15-18 cm)	70-75°F (21-24°C)	62-65°F (17-18°C)	4-8	4-8	5-8 tub		12-18 in. (30-45 cm) Unstaked	Micro-Tom: 12-18 in. (30-45 cm), Topsy Tom & Tumbler: 3-6 ft. (90- 180 cm), Little Napoli: 24-36 in. (60-90 cm)	V	Little Napoli and Micro-Tom are excellent container varieties. Topsy Tom & Tumbler are superior varieties for hanging baskets and containers. Perform well upside-down.
	TOMATO, HEIRLOOM MARRIAGE™ Solanum lycospersicum	Big Brandy, Cherokee Carbon, Genuwine, Marzinera, Perfect Flame	Ç	6,000-13,000 S/oz. (200-450 S/g)	SED	288-cell or larger	Cover lightly	60-85°F (16-29°C)	5-8	3-4	Packs, 4-6 in. (10-15 cm), gallon (15-18 cm)	70-75°F (21-24°C)	62-65°F (16-18°C)	4-8	4-8	5-8 tub		5-7 ft. (1.5-2 m)	3-4 ft. (90 cm-1.2 m)	~	All varieties are indeterminate and will perform best when grown in the ground with support.
	TOMATO, INDETERMINATE Solanum lycospersicum	'Chocolate Sprinkles', 'Orange Zinger', Sugar Rush	Q	7,000-14,000 S/oz. (250-500 S/g)	SED	288-cell or larger	Cover lightly	60-85°F (16-29°C)	5-8	3-4	Packs, 4-6 in. (10-15 cm), gallon (15-18 cm)	70-75°F (21-24°C)	62-65°F (16-18°C)	4-8	4-8	5-8 tub		5-7 ft. (1.5-2 m)	3-4 ft. (90 cm-1.2 m)	v	All varieties are indeterminate and will perform best when grown in the ground with support.

Vegetable Culture Chart

Weeks from plug to finish (Spring unless specified)

PanAmerican Seed Grower Facts

NOTE: Growers should use the information presented here as a starting point. Crop times will vary depending on the climate, location, time of year and greenhouse environmental conditions. Chemical and PGR recommendations are only guidelines. It is the responsibility of the applicator to read and follow all the current label directions for the specific chemical being used in accordance with all regulations.

Sirocco Anemanthele

Plug Production

Media

Use a well-drained, disease-free soilless media with a pH of 5.8-6.2 and an EC of 0.75 mmhos/cm (2:1 extraction).

Sowing

Plug tray size: Can be produced in a 288, 128, 72 liner (European size: 264) or a similar size plug tray. Do not cover pellets.

Stage 1 – Germination takes approximately 5 to 6 days.

Germination temperature: 65 to 76°F (18 to 24°C)

Light: Light is optional.

Media moisture: Keep the media medium wet (level 4) during germination. Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 65 to 70°F (18 to 21°C) Light: Can be up to 2,500 f.c. (26,900 Lux) during Stages.

Media moisture: Reduce soil moisture slightly (level 3) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 65 to 70°F (18 to 21°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 65 to 67°F (18 to 19°C) Light: Can be up to 5,000 f.c. (54,000 Lux) Media moisture: Maintain wet/dry cycle. Do not allow the seedlings to wilt. **Fertilizer:** Keep the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

78 630 231-1400 panamseed.com

Growth regulators: Not needed.

Growing On to Finish Media

Use a well-drained, disease-free soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 64 to 66°F (18 to 19°C) **Days:** 66 to 74°F (19 to 23°C) Plants can be grown under temperatures as low as 50°F (10°C) but the crop time will increase significantly.

Coloration is better under cool conditions with high light. Foliage color can be changed to more intensive even with one week exposure to cool conditions.

Light

As high as possible while maintaining a moderate temperature.

Irrigation

Grow plant on dry side but avoid plant drying to wilting.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus. Avoid using excessive ammonia nitrogen-form fertilizers and overfeeding, as these will result in less upright plants. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.5 to 6.2.

Growth Regulators

Not needed. Pinching

Not needed.

Container Size

306 premium pack: 1 plug per cell **2.5-in. (6-cm) pot:** 1 plug per pot 4-in. (10-cm) pot: 1 plug per pot

6-in. (15-cm) pot: 1 to 3 plugs per pot 1-gallon (18-cm) pot: 1 to 3 plugs per pot

Crop Scheduling

Sow to transplant (288/264-cell plug tray): 5 to 6 weeks

Add one more week when using 128 or 72 cell plug tray but reduce post-transplant crop times by one week.

Transplant to saleable size (from 288 cell):

Container Size	Plants per Pot/ Basket	Weeks From Transplant	Total Weeks
306 premium pack	1	6-8	11-14
2.5 in. (6 cm) pot	1	5-6	10-12
4-4.5 in. (10-11 cm) pot	3	6-8	11-14
6-6.5 in. (15-16 cm) pot	3	6-8	11-14
Gallon	3	6-8	11-14

Note: Add 2 more weeks to the crop time when planting 1 plug per 6-in. (16-cm) and gallon (18-cm) container.

Common Problems Insect: No serious problems Disease: No serious problems

Serena[®] Series Angelonia

Plug Production

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.0 and a medium initial nutrient charge (EC 0.75 mmhos/cm with a 1:2 extraction).

Sowing

Plug tray size from 288 to 128. Do not cover or bury the seed.

Stage 1 – Germination takes 4 to 5 days. Soil temperature: 71 to 76°F (22 to 24°C) Light: 10 f.c. (100 Lux) or higher. Light is required for germination. Seeds will not

germinate in the dark. Moisture: Keep soil moist but not saturated (level 4) during Stage 1 for optimal germination.

Humidity: Maintain 95% relative humidity (RH) until radicle emergence.

Stage 2

Soil temperature: 68 to 73°F (20 to 23°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 3) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less

than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) **Moisture:** Allow the media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture level at wet-dry cycle (moisture level 4 to 2). Do not allow the seedlings to wilt as they do not recover very well.

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). **Growth regulators:** Growth regulators

are generally not needed in plug stage. If necessary, B-Nine/Alar (daminozide) 5,000 ppm (6.0 g/l, 85% formulation or 7.8 g/l, 64% formulation) spray can be used. In Northern Europe: 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) sprays have been tested and shown to be effective if needed.

Stage 4

Soil temperature: 65 to 67°F (18 to 19°C) **Light:** Up to 5,000 f.c. (53,800 Lux) if optimal temperature can be maintained. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.4 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 65 to 67°F (18 to 19°C) **Days:** 65 to 76°F (18 to 24°C) Daily average temperatures below 65°F (18°C) will slow down the crop growth rate dramatically.

Light

Keep light as high as possible while maintaining recommended temperatures.

Irrigation

Avoid both excessive watering and drought.

Fertilizer

Feed plants weekly at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrate-form fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2.

Growth Regulators

A tank mix of B-Nine/Alar (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) mixed with Cycocel (chlormequat) 750 to 1,000 ppm (6.4 to 8.5 ml/l 11.8% formulation or 1.0 to 1.5 g/lof 75% formulation) is the most effective growth regulator for angelonia. Cycocel rates can be adjusted depending on environmental conditions. Use lower rates under cooler and shorter daylength conditions, and higher rates under warmer and longer daylength conditions. Growth regulators can be started 2 weeks after transplanting. Repeat as needed.

For growers in warmer climates, a Bonzi (paclobutrazol) drench at 5-10 ppm (1.3 to 2.5 ml/l, 0.4% formulation) can be used 2 weeks after transplant instead of the B-Nine/ Cycocel tank mix.

In Northern Europe: 1 to 2 applications of B-nine/Alar (daminozide) 3,150 ppm (3.7 g/l 85% formulation or 5.0 g/l of)64% formulation) mixed with Cycocel (chlormequat) 350 ppm (3.0 ml/l 11.8% formulation or 0.5 g/l of 75% formulation) has been tested and shown to be effective.

Pinching

Do not pinch the plants! Seed angelonia has excellent natural basal-branching. Pinching will only delay flowering and make the plant habit unattractive.

Crop Scheduling Sow to transplant (288 to 128-cell plug tray): 5 to 6 weeks

(10-11 cm) pot 6-6.5 in. (15-16 cm) pot Gallon

Container Size

306 pack

4-4.5 in.

Note: When transplanted from a 128-tray, finish crop time for Serena can be reduced by 1 to 2 weeks.

Common Problems Insect: No serious problems **Disease:** No serious problems

Serenita[®] Series Angelonia **Plug Production**

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.0 and a medium initial nutrient charge (EC 0.75 mmhos/cm with a 1:2 extraction).

Sowing

or bury the seed. germinate in the dark. germination.

Stage 2

phosphorous.

Stage 3

PanAmerican Seed.

Transplant from 288-tray to saleable finished container:

Plants Per Pot	Weeks From Transplant	Total Weeks
1	8-9	13-15
1	9-10	13-15
3	9-10	14-16
3	9-10	14-16

Plug tray size from 288 to 128. Do not cover

Stage 1 – Germination takes 4 to 5 days. **Soil temperature:** 71 to 76°F (22 to 24°C) Light: 10 f.c. (100 Lux) or higher. Light is required for germination. Seeds will not

Moisture: Keep soil moist but not saturated (level 4) during Stage 1 for optimal

Humidity: Maintain 95% relative humidity (RH) until radicle emergence.

Soil temperature: 68 to 73°F (20 to 23°C) Light: Up to 2,500 f.c. (26,900 Lux). Moisture: Start to slightly reduce soil moisture (level 3) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low

Soil temperature: 65 to 70°F (18 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux) **Moisture:** Allow the media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture level at wet-dry cycle (moisture level 4 to 2). Do not allow the seedlings to wilt as they do not recover very well.

Fertilizer: Increase the fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC).

Growth regulators: Growth regulators are generally not needed in plug stage.

Stage 4

Soil temperature: 65 to 67°F (18 to 19°C) Light: Up to 5,000 f.c. (53,800 Lux) if optimal temperature can be maintained. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.4 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 65 to 67°F (18 to 19°C) **Davs:** 65 to 76°F (18 to 24°C) Daily average temperatures below 65°F (18°C) will slow down the crop growth rate dramatically.

Light

Keep light as high as possible while maintaining recommended temperatures.

Irrigation

Avoid both excessive watering and drought.

Fertilizer

Feed plants weekly at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrate-form fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2.

Growth Regulators

Serenita requires less plant growth regulators than Serena varieties as it is more compact and naturally shorter than Serena. It may not need any growth regulators, especially under cooler conditions. However, if necessary, a tank mix of B-Nine/Alar (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) mixed with Cycocel (chlormequat) 500 to 750 ppm (4.2 to 6.4 ml/l 11.8% formulation or 0.7 to 1.0 g/l of 75% formulation) is good for Serenita. Cycocel rates can be adjusted depending on environmental conditions. Use lower rates under cooler and shorter daylength conditions, and higher rates under warmer and longer daylength conditions. Growth regulators can be started 2 weeks after transplanting. Repeat as needed.

For growers in warmer climates, a Bonzi (paclobutrazol) drench at 3 to 5 ppm (1.3 to 2.5 ml/l, 0.4% formulation) can be used 2 weeks after transplant instead of the B-Nine/ Cycocel tank mix.

Pinching

Do not pinch the plants! Seed angelonia has excellent natural basal-branching. Pinching will only delay flowering and make the plant habit unattractive.

Serenita[®] Series Angelonia continued

Crop Scheduling

Sow to transplant (288 to 128-cell plug tray): 5 to 6 weeks Transplant from 288-tray to saleable

finished container:

Container Size	Plants per Pot	Weeks From Transplant	Total Weeks
306 pack	1	8-9	13-15
4-4.5 in. (10-11 cm) pot	1	9-10	13-15
6-6.5 in. (15-16 cm) pot	3	9-10	14-16
Gallon	3	9-10	14-16

Note: When transplanted from a 128-tray, finish crop time for Serenita can be reduced by 1 to 2 weeks.

Common Problems

Insect: No serious problems Disease: No serious problems

Blutopia[®] & Snowtopia[®] Bacopa

Plug Production

Media

Use a well-drained, disease-free plug media with a pH range of 5.5 to 6.0, and EC less than 0.75mS/cm (2:1 extraction).

Plug Tray Size

Can be produced in 288, 128 or similar cell size plug trays.

Sowing

Do not cover the multi-seed pellets with vermiculite at sowing, and make sure to pass the plug trays through the misting/watering tunnel after sowing, as this will help in faster dissolution/breakdown of the pellet.

Stage 1 - Germination takes approximately 4 days. (White may take a couple of days longer to germ.)

Germination temperature: 68 to 74°F (20 to 23°C).

Light: Required during germination (10 f.c./100 Lux or more).

Media moisture: Keep the media medium wet (level 4) during germination. Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 65 to 75°F (18 to 24°C) days; 60 to 65°F (15 to 18°C) nights. Light: Up to 2,500 f.c. (26,900 Lux) during Stage 2 & 3.

Media moisture: Keep the media medium (level 3) to medium wet (level 4) during Stages 2 and 3.

630 231-1400 panamseed.com

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 65 to 75°F (18 to 24°C) days; 60 to 65°F (15 to 18°C) nights. **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 60 to 70°F (15 to 21°C) days; 55 to 60°F (13 to 15°C) nights. Light: Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained.

Media moisture: Keep the media medium (level 3) wet. Do not let the seedlings wilt, as they will not recover favorably. Fertilizer: Same as Stage 3. Growth regulators: Generally PGRs are not

required during plug production if plants are shipped/transplanted on time. Under Northern European conditions, foliar sprays of B-Nine/Alar (daminozide) at 640 to 950 ppm (1 to 1.5g/l of 64% formulation or

0.75 to 1.15g/l 85% formulation) worked well in toning the plugs.

Growing On to Finish

Container Size

Can be produced in 4.5-in. (10.5-cm) or similar size containers with one multi-seeded plug per pot, or 5-6 plugs approximately for a 10-in. (25-cm) basket. Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.2, and a medium initial nutrient charge.

Temperature

Nights: 55 to 60°F (13 to 15°C) **Days:** 60 to 75°F (15 to 24°C) Bacopa can be grown as low as 50°F (10°C), but the crop time will be longer.

Light

Keep light levels as high as possible while maintaining appropriate temperatures.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrateform fertilizer with low phosphorus. If needed, a balanced ammonium and nitrate form fertilizer may be used as needed to encourage growth and balance the media pH.

Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.8 to 6.2.

Irrigation

Avoid both excessive watering and drought. Do not let the plants wilt as this will result in flower/bud drop.

Plant Growth Regulators

In North American conditions: Responds well to foliar sprays of B-Nine/Alar (daminozide) at 2,500 ppm (2.9 g/l 85% formulation or 3.9 g/l 64% formulation) applied once after transplant. In Northern European conditions: Can use foliar sprays of B-Nine/Alar (daminozide) at 2,500 ppm (2.9 g/l 85% formulation or 3.9 g/l 64% formulation), and if necessary can follow-up with Cycocel (chlormequat) at 375 ppm (0.5ml/l 75% or 3.1ml/l 11.8% formulation).

Crop Scheduling

Sow to transplant: 3 to 4 weeks (Typically it takes 3.5 weeks in a 288-cell tray and a few days more in a 128-cell size liner.) Transplant to flower: 4 to 6 weeks Total crop time (sow to flower): 8 to 9 weeks in a 4.5-in. (10.5-cm) size pot. When finishing in larger containers such as 10in. (25-cm) hanging baskets, the crop time can be 12 to 13 weeks. Crop time is also temperature-dependent - plants will flower slightly earlier under warmer temperatures and slightly later under cooler temperatures.

Common Problems Insect: White Flies

BabyWing® Series Begonia

Germination

Germination takes 7 to 10 days.

Sowing

Do not cover seed. Water thoroughly at sowing to completely dissolve the pellet. Recommended plug sizes are 288 to 200-cell.

Temperature

72 to 80°F (22 to 27°C). Keep temperature as constant as possible.

Humidity

Maintain relative humidity at 95%.

Sowing

Do not cover seed. Germinating in a chamber is recommended.

Light

Light is beneficial, but not required.

Plug Production

Media

Use a very well-drained, disease-free soilless medium with a medium pH of 5.8 to 6.2 and an EC of about 0.5 mmhos/cm (1:2 extraction).

Temperature

Maintain soil temperature at 70 to 75°F (21 to 24°C) after true leaves develop. Plugs can be held at 62 to 65°F (17 to 18°C) from maturity until transplant.

Light

After germination, maintain light levels between 1,000 and 2,500 f.c. (10,000 to 30,000 Lux). As seedlings mature, light levels can be increased up to 5,000 f.c. (54,000 Lux).

Moisture

BabyWing is very sensitive to drying out during early stages of germination. Keep soil moisture high until the first true leaf develops, then reduce moisture levels.

Fertilizer

The high soluble salts in fertilizers tend to affect BabyWing; however, it will also grow slowly if not fertilized. Frequent light fertilization is best. Use 20-10-20 about 50 ppm at Day 8 and 100 ppm at Day 11. Then use every other day until Stage 3. After true leaves emerge, alternate with 15-0-15 until transplant. Always rinse foliage after feeding.

Plant Growth Regulators

None are required during the plug stage.

Growing On To Finish

Container Size 4 to 4.5-in. (10 to 12-cm) pot: 1 plant per pot 6-in. (15-cm) pot: 1 to 2 plants per pot 6.5-in. (16-cm) and larger pots: 3 plants per pot

10 to 12-in. (25 to 30-cm) hanging baskets: 4 plants per pot

Media

Use a well-drained, disease-free soilless medium with a medium initial nutrient charge and a pH of 6.0 to 6.5.

Temperature

Nights: 60 to 65°F (15 to 18°C) Days: 65 to 70°F (18 to 21°C)

Light

Grow in a high light environment: 3,000 to 7,000 f.c. (30,000 to 70,000 lux). High light levels will result in earlier flowering and stronger stems.

Irrigation

Allow the media to dry slightly, then water liberally. Water early in the day to avoid leaf burn when temperatures are high.

Fertilization

Fertilize every other irrigation with 15-0-15, alternating with 20-10-20 at 150 ppm N. Maintain the medium EC around 1.0 mmos/ cm (1:2 extraction).

Plant Growth Regulators

A very light spray of tank mix containing B-Nine 2,500 and Cycocel 300 ppm can be used at 2 to 3 weeks after transplant. A light phytotoxicity may appear on the foliage after the PGR spray, but the plant will recover later.

Note: BabyWing is very responsive to Bonzi and Sumagic. Avoid overspray from neighboring plants.

Pinching No pinching is required.

Crop Scheduling 7 to 8 weeks

Common Problems Insect: Fungus Gnats, Shore Flies **Disease:** No major problems when using good cultural and IPM practices.

Dragon Wing[®] Series Begonia

Germination

Plug Tray Size Dragon Wing plants are best produced in 200-cell plug trays. This permits the plant enough growth at the plug stage so that the direction of the arching stem is clear for correct orientation at planting time. This orientation can be seen in smaller plugs, but is less readily apparent.

Media

bench.

Moisture

Humidity

germination.

Moisture

Light

Light

PanAmerican Seed.

Sow to transplant (288-cell plug tray):

Transplant to finish: 5 to 7 weeks **Note:** Space the plants when the foliage starts touching each other.

Germination takes 7 to 10 days.

Use a well-drained, disease-free sowing medium with a pH of 5.8 to 6.0 and electrical conductivity (EC) of 0.5 mmhos/cm. A very light covering of vermiculite may be needed when germinating pelleted seed on the

Keep media saturated through germination.

Temperature

72 to 75°F (22 to 24°C). Keep temperature as constant as possible.

Maintain relative humidity at approximately 95% or higher.

Light is beneficial but not required for

Plug Production

Temperature

After radicle emergence, maintain a constant 70°F (21°C) soil temperature for two weeks. In Week 3, the temperature can be decreased to 65°F (18°C).

Slightly reduce media moisture levels after radicle emergence. Maintain uniform media moisture until the true leaves appear; then allow media to dry out slightly between waterings. Do not stress plugs until Stage 4.

Light will help to ensure a higher-quality seedling. After radicle emergence, keep light levels at 400 to 2,000 f.c. (4,000 to 20,000 Lux) for two weeks.

Fertilizer

Begin fertilization at 5 days out of the germination chamber, or 10 days after germination on the bench. Dragon Wing plugs require more feed than other fibrous begonias. Recommended application is 50 ppm N, 2 to 3 times per week. In Week 3, increase feed to 150 to 200 ppm N, 2 to 3 times per week.

Plant Growth Regulators

Growth regulators are not required to produce Dragon Wing begonia plugs.

Growing On to Finish

Temperature

Nights: 60 to 65°F (15 to 18°C) Days: 65 to 70°F (18 to 21°C)

Container Size

Dragon Wing begonias can be transplanted into a wide range of container sizes. Follow these guidelines for the number of plants per pot or basket:

Container Size	Bench Spacing	Plants Per Pot/Basket
4-4.5 in. (10-11 cm) pot	Pot Tight	1
5.5-6 in. (14-15 cm) pot	8 in. (20 cm)	1-2
6.5-8 in. (16-20 cm) pots	8 to 10 in. (20-25 cm)	2-3
1 gal. container	10 in. (25 cm)	2
10-12 in. (25-30 cm) baskets	_	4

Transplanting

Due to directional stem arching, it is very important to position Dragon Wing plugs properly when placing more than one plug into baskets and containers for finishing. Plugs must be placed with the growing shoot facing outward, toward the outside of the container (see drawing). This is the side of the plant the flower is on. The directional growth remains consistent as the plant matures, ensuring flowers on the outside of the finish container.

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.4 to 6.0 and electrical conductivity (EC) of 1.0 mmhos/cm.

Light

Grow on in a high-light environment – 3,000 to 7,000 f.c. (30,000 to 70,000 Lux). Daylength and light quality can have a dramatic effect on plant habit; daylength can also affect flowering time. Dragon Wing begonias will flower under natural daylength year-round, making them a good choice for year-round production in warmer climates. They flower 1 to 3 weeks faster under short days. Short days (8 to 10 hours) cause plants to grow nearly horizontal. Natural or HID long days give intermediate, arching growth.

Dragon Wing[®] Series Begonia continued

Long days provided by incandescent lighting cause more upright growth, which is beneficial for plant shipment (tighter spacing on shelves with less breakage).

Watering

Produce Dragon Wing begonias on the drier side to help prevent any fungal or water mold-type diseases. However, allowing plants to wilt even slightly between waterings will delay flowering, reduce branch number and result in pale foliage.

Fertilizer

A feed program of 200 ppm N once a week can begin as soon as the plugs have begun to root out.

Note: Severe fertility and/or water stress will delay flowering 1 to 2 weeks.

Plant Growth Regulators

4-in. (10-cm) pots: A spray of 3 ppm (0.75ml/l) Bonzi can be applied weekly for 3 applications to keep plants compact. Start the first application 2 weeks after transplanting.

6-in. (15-cm) pots: A spray of 5 ppm (1.25 ml/l) Bonzi 2 weeks after transplant has been found to be effective in trials in Elburn,

IL. An additional 1 or 2 sprays of 5 ppm (1.25 ml/l) Bonzi every other week after the first application results in earlier flowering, shorter internodes,

darker foliage and more uniform branches.

For larger containers, these additional applications may not be needed. In trials in Elburn, IL, Dragon Wing begonias grown in an 8-in. (20-cm) pot with 3 plants per pot evidenced more branches and more flowers than those grown in a 6-in. (15-cm) pot without using any plant growth regulators. **Note:** In-house trials are recommended to determine the best rates for your location. Always follow current manufacturer label instructions.

Crop Scheduling

Sow to transplant: 7 to 8 weeks

Transplant to finish:

4-in. (10-cm) pots with 1 plant per pot: 7 to 9 weeks

6-in. (15-cm) pots with 2 to 3 plants per pot: 7 to 9 weeks

8-in. (20-cm) pots with 3 plants per pot: 8 to 10 weeks

10-12-in. (25-30-cm) pots with 4 plants per pot: 9 to 11 weeks

Common Problems

Dragon Wing begonias are quite disease and pest-free. No major problems will occur if using good cultural and IPM practices. A wide range of insecticides has been tested on Dragon Wing plants with little or no phytotoxicity.

Gryphon Begonia

Plug Production

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.5 mmhos/cm with a 1:2 extraction).

Sowing

Plug tray size: Sow one pelleted seed per cell in 288 or larger plug tray. In Europe, 264cell trays can be used. Water thoroughly at sowing to completely dissolve the pellet. Do not cover the pellet at sowing.

Stage 1 – Germination takes approximately 10 to 12 days.

Germination temperature: 72 to 78°F (22 to 26°C). Prefers warmer temperature but can also germinate well at 72°F (22°C). Light: Light is required.

Media moisture: Keep the media moist (level 5) during germination. Gryphon is very sensitive to drying out during early stages of germination.

Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge. A saturated media and high relative humidity is critical to germinate successfully.

Stage 2

Temperature: Optimum 71 to 76°F (21 to 24°C)

Light: Up to 2500 f.c. (26,900 Lux) Media moisture: Keep the media very wet (level 5) to medium wet (level 4) during stage 2. Keep soil moisture high and maintain uniform media moisture. Do not stress plugs. Fertilizer: Begin fertilization at 5 days out of the germination chamber. Start with 50-75 ppm N from ammonia-form fertilizer, 2 to 3 times per week; increase slowly to 100 ppm. Maintain a media pH of 5.8 to 6.2.

Stage 3

Temperature: 68 to 73°F (20 to 22°C) **Light:** Up to 5,000 f.c. (54,000 Lux). Media moisture: Keep media medium wet to medium (level 4 to 3). Do not allow the seedlings to wilt. Maintain uniform media moisture until the true leaves appear; then allow media to dry out slightly between waterings. Do not stress plugs.

Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC), 2 to 3 times per week. Alternate fertilizers from ammonia-form to nitrate-form. Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: Can be decreased to 65 to 67°F (18 to 19°C)

Light: Up to 5,000 f.c. (54,000 Lux) Media moisture: Moisture level can be reduced to medium dry (level 3). Avoid excess humidity later in the plug production, as this will create conditions favorable for disease incidence. Fertilizer: Same as stage 3. Growth Regulators: Not needed.

Growing On To Finish Media

Use a well-drained, disease-free, soilless medium with a pH of 5.4 to 6.0 and electrical conductivity (EC) of 1.0 mmhos/cm.

Temperature

Nights: 62 to 67°F (16 to 19°C) **Days:** 65 to 75°F (18 to 24°C)

Light

Light level from 3,000 to 7,000 f.c. (32,400 to 75,600 lux).

Photoperiod

Gryphon is a foliage plant, but plant could flower when grown under a daylength of 11 hours or shorter. Under daylength longer than 11 hours, flowering will be significantly delayed or plants will never flower.

Irrigation

Avoid both excessive watering and drought. Fertilizer

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week as soon as the plugs have begun to root out. A balanced ammonium and nitrate-form fertilizer may be applied as needed to encourage growth and balance the media pH.

Growth Regulators

Generally, PGRs are not needed. But if necessary, a tank mix of B-Nine/Alar (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) and Cycocel (chlormequat) 300 ppm (2.5 ml/l 11.8% formulation or 0.4 g/l of 75% formulation) or B-Nine/Alar alone (for cooler area) can be used at 2 weeks after transplanting. Avoid using CCC alone as it can cause phytotoxicity. Also use caution with Bonzi, Topflor, and Sumagic as they can stunt plants.

In Northern European area: No PGRs needed, but if necessary we've had the best results with a mix of B-Nine/Alar 3200 ppm (3.7 g/l 85% formulation or 5.0 g/l of 64% formulation) and CCC 375 ppm (3.1 ml/l 11.8% formulation or 0.5 g/l of 75% formulation).

Note: In-house trials are recommended to determine the best rates for your location. Always follow current manufacturer label instructions.

Pinching

No pinching is required.

Crop Scheduling Sow to transplant (288 cell plug tray): 8 to 9 weeks

Container Size	Plants Per Pot/Basket	Weeks From Transplant
4-5 in. (10-12 cm) pot	1	5-6
6 in. (15 cm) pot	2-3	5-6
8 in. (20 cm) pots	3	7-8
10-12 in.(25-30 cm) pot	3-4	9-11

Common Problems

Gryphon begonias are quite disease and pestfree. No major problems will occur if using good cultural and IPM practices. A wide range of insecticides has been tested on Gryphon plants with little or no phytotoxicity.

Crave Calibrachoa

Plug Production

Use a well-drained, disease-free media with a pH of 5.5 to 5.8 and an EC of 0.75 mS/cm (1:2

Sowing

288, 128, 105 and 72 are all suitable sizes. Seed covering is not required.

Stage 1 – Germination to radicle

25°C) with optimum media temperature of 73°F (22.5°C)

Media moisture: Level 5, saturated Relative humidity: Maintain 100% relative

humidity (RH) until radicles emerge. **Stage 2 -** Radicle emergence to cotyledon

expansion

Average Daily Temperature: 68°F (20°C) Light: Daily Light Integral (DLI) of ≥10 moles $m^{-2} \cdot d^{-1}$ is optimum; if not possible, provide as much light as possible.

Media moisture: Reduce moisture level to 4. Do not allow wilting.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Growth Regulator: Spray application after completion of stage 1, approximately day 7 to 10 depending on the variety and thereafter as needed.

Effective PGRs: Flurprimidol (Topflor): 2 to 3 ppm (0.53 to

0.79 ml/l, 0.38% formulation) Paclobutrazol (Bonzi): 3 ppm (0.75 ml/l, 0.4% formulation)

Limited Inductive Photoperiod (LIP) Results from experiments conducted at Michigan State University indicate that Crave juvenility ends at 6 leaves (6 weeks

82 630 231-1400 panamseed.com

NK (Kin

Media

extraction).

emergence: 5 to 7 days Germination temperature: 68 to 77°F (20 to

Light: Light or dark

PanAmerican Seed.

Daminozide (B-Nine): 2,500 ppm (3.0 g/l, 85% formulation or 3.9 g/l, 64% formulation)

Special Note: Daminozide is more effective than paclobutrazol at tested rates for height control and promoting branching. However, daminozide can cause minor chlorotic stippling on Crave Sunset. No stippling with paclobutrazol or flurprimidol.

Stage 3 - Cotyledon expansion to true

leaves

 $m^{-2} \cdot d^{-1}$

extraction).

Stage 4

 $m^{-2} \cdot d^{-1}$

plug per pot

production.

Light

hours.

Media

Average Daily Temperature: 64°F (18°C) Light: Daily Light Integral (DLI) of ≥10 moles.

Media moisture: Cycle between levels 2 and 4. Do not allow wilting.

Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain a media pH of 5.5 to 6.0 and EC between 1.0 and 1.5 mS/cm (1:2

Growth regulators: Using same rates and application method as noted in Stage 2, every 10 to 14 days, as needed.

Temperature Range: 55 to 64°F (13 to 18°C). No lower than 55°F (13°C). Light: Daily Light Integral (DLI) of ≥10 moles

Media moisture: Cycle between levels 2 and 4. Do not allow wilting. Fertilizer: Same as Stage 3.

Growth regulators: Using same rates and

application method as noted in Stage 2, every 10 to 14 days, as needed.

Growing On to Finish

Container Sizes 4 to 6-in. (10 to 15-cm) pots and quart: 1

10-in. (25-cm) basket: 3 plugs per pot 12-in. (30-cm) basket: 5 plugs per pot

Use a well-drained, disease-free soilless medium with a pH of 5.5 to 5.8 and a medium initial nutrient charge.

Average Daily Temperature

55 to 64°F (13 to 18°C).

Can be cool-grown, similar to vegetative calibrachoa. Cool growing will delay flowering compared to warm temperature

Daily Light Integral (DLI) of ≥10 moles·m⁻²·d⁻¹

Photoperiod Response

Crave Sunset is a facultative long day variety. The minimum day length requirement is 11

from sowing). After the end of juvenility, growing under long-day photoperiod (≥14 hours or night interruption) for 4 weeks in plug travs or finish containers induces plants to flower. After induction, flowers continue to develop if grown under short-day photoperiod. Please conduct your own trials to test LIP under your conditions before borad use.

Fertilizer

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and to balance media pH. Maintain media pH 5.5 to 5.8.

For constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Paclobutrazol 1 to 3 ppm (0.25 to 0.75 ml/l, 0.4% formulation) drench 7 to 10 days from transplant; reapply as needed.

Uniconazol (Sumagic) can be applied in rates similar to those used for mid-vigor vegetative calibrachoa.

Special Note: Pinching

Apical dominance results in poor branching. The causes include:

- Overgrown and spindly plants
- Low DLI (keep \geq of \geq 10 moles·m⁻²·d⁻¹)
- Excessive plug crop time
- Inadequate plug height control

Pinching is a good solution to remedy the situation. Pinching can occur in plug trays (shear) or after transplant.

Pinch at transplant: Soft pinch, leaving 4 basal nodes. Pinch can delay flowering; the extent of the delay depends upon the timing and location of the pinch. Do not pinch if using LIP.

Crop Scheduling

Sow to pullable (288/128-cell plug): 5 to 6 weeks

(105/72-cell plug): 7 to 8 weeks

Finish Crop Time from Non-Pinched Plugs

Container Size	Crop time from 288 plug to 100% Flowering	Total Crop Time from Sowing to 100% Flowering
4-6 in. (10-15 cm) pots, Quarts/1 ppp	7-8	12-13
10 in. (25 cm) Basket/3 ppp	9-11	14-15
12 in. (30 cm) Basket/5 ppp	9-11	14-15

Common Insect and Disease Problems

Manage similar to vegetative calibrachoa. See page 168 for additional growing information.

Kabloom[™] Calibrachoa

Plug Production

Media

Use a well-drained, disease-free media with a pH of 5.5 to 5.8 and an EC of 0.75 mS/cm (1:2 extraction).

Sowing

288, 128, 105 and 72 are all suitable sizes. Seed covering is not required.

Stage 1 – Germination to radicle emergence: 5 to 7 days continuing through day 14. Germination temperature: 68 to 77°F (20 to 25°C) with optimum media temperature of 73°F (22.5°C)

Special Note: Due to the variability of germination speed, reference the following: **Fast Germinating Varieties:**

Kabloom White, Kabloom Deep Pink, Kabloom Yellow

Stage 1 at 77°F (25°C) for 5 days

Stage 1 at 68°F (20°C) for 5 to 7 days

Slow Germinating Varieties:

Kabloom Deep Blue

Stage 1 at 77°F (25°C) for 7 to 10 days Stage 1 at 68°F (20°C) for 10+ days Light: Light or dark.

Media moisture: Level 5, saturated. Relative humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2 - Radicle emergence to cotyledon expansion

Average Daily Temperature: 68°F (20°C) Light: Daily Light Integral (DLI) of ≥10 moles $m^{-2} \cdot d^{-1}$ is optimum; if not possible, provide as much light as possible.

Media moisture: Reduce moisture level to 4. Do not allow wilting.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Growth Regulator: Spray application after completion of stage 1, approximately day 7 to 10 depending on the variety and thereafter as needed. **Effective PGRs:**

Flurprimidol (Topflor): 2 to 3 ppm (0.53 to 0.79 ml/l, 0.38% formulation)

Paclobutrazol (Bonzi): 3 ppm (0.75 ml/l, 0.4% formulation)

Daminozide* (B-Nine): 2,500 ppm (3.0 g/l, 85% formulation or 3.9 g/l, 64% formulation)

Special Note: Daminozide is more effective than Paclobutrazol at tested rates for height control and promoting branching. However, Daminozide can cause slight chlorotic stippling. No stippling with Paclobutrazol or Flurprimidol.

Stage 3 - Cotyledon expansion to true leaves Average Daily Temperature: 64°F (18°C) Light: Daily Light Integral (DLI) of ≥10 moles $m^{-2} \cdot d^{-1}$

Media moisture: Cycle between levels 2 and Fertilizer

4. Do not allow wilting. **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain a media pH of 5.5 to 6.0 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Using same rates and application method as noted in Stage 2, every 10 to 14 days, as needed.

Stage 4

Temperature Range: 55 to 64°F (13 to 18°C). No lower than 55°F (13°C).

Light: Daily Light Integral (DLI) of ≥10 moles. $m^{-2} \cdot d^{-1}$

Media moisture: Cycle between levels 2 and 4. Do not allow wilting. Fertilizer: Same as Stage 3.

Growth Regulators: Using same rates and application method as noted in Stage 2, every 10 to 14 days, as needed.

Growing On to Finish

Container Sizes 4 to 6 in. (10 to 15 cm) pots and quart: 1 plug per pot

10 in. (25 cm) basket: 3 plugs per pot 12 in. (30 cm) basket: 5 plugs per pot

Media

Use a well-drained, disease-free soilless medium with a pH of 5.5 to 5.8 and a medium initial nutrient charge.

Average Daily Temperature 55-64°F (13-18°C).

Can be cool-grown, similar to vegetative calibrachoa. Cool growing will delay flowering compared to warm temperature production.

Light

Daily Light Integral (DLI) of ≥10 moles m⁻²·d⁻¹

Photoperiod Response

All Kablooms are facultative long day with exception of Deep Pink, which is obligate long day. Reference the following table for minimum daylength requirement for each variety.

10 hours: Kabloom Yellow, Kabloom White 11 hours: Kabloom Deep Blue 12 hours: Kabloom Deep Pink

Limited Inductive Photoperiod (LIP)

Results from experiments conducted at Michigan State University indicate that Kabloom juvenility ends at 6 leaves (6 weeks from sowing). After the end of juvenility, growing under long-day photoperiod (≥14 hours or night interruption) for 4 weeks in plug trays or finish containers induces plants to flower. After induction, flowers continue to develop if grown under short-day photoperiod. Please conduct your own trials to test LIP under your conditions before broad use.

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and to balance media pH. Maintain media pH 5.5 to 5.8.

For constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Paclobutrazol 1 to 3 ppm (0.25 to 0.75 ml/l, 0.4% formulation) drench 7 to 10 days from transplant, reapply as needed. Uniconazol (Sumagic) applied in rates similar to those used for mid-vigor vegetative calibrachoa.

Special Note: In finished production,

Kabloom White is more receptive and sensitive to paclobutrazol. Too heavy or too frequent applications may result in excessively compacted or stunted plants.

To determine the best rate for your conditions, we recommend that you run an in-house trial.

Special Note: Pinching

Apical dominance results in poor branching. The causes include:

- Overgrown and spindly plants
- Low DLI (keep \geq of \geq 10 moles·m⁻²·d⁻¹)
- Excessive plug crop time
- Inadequate plug height control

Pinching is a good solution to remedy the situation. Pinching can occur in plug trays (shear) or after transplant.

Pinch at transplant: Soft pinch, leaving 4 basal nodes. Pinch can delay flowering; the extent of the delay depends upon the timing and location of the pinch. Do not pinch if using LIP.

Crop Scheduling

Plug Crop Time Sow to pullable (288-cell plug): 5 to 6 weeks

(128/105/72-cell plug): 7 to 8 weeks

Finish Crop Time from Non-Pinched Plugs

Container Size	Crop time from 288 plug to 100% Flowering	Total Crop Time from Sowing to 100% Flowering
4-6 in. (10-15 cm) pots, Quarts/1 ppp	7-8	12-13
10 in. (25 cm) Basket/3 ppp	9-11	14-15
12 in. (30 cm) Basket/5 ppp	9-11	14-15

Common Insect and Disease Problems

Manage similar to vegetative calibrachoa. See page 165 for additional growing information.

Campana Series Campanula

Plug Production

Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.5 and an EC of 0.8 mmhos/cm.

Sowing

Sow 1 seed or pellet per cell in a 288 or larger plug tray. Larger plug size can increase plug time by a week. Do not cover the seed. Use a fungicide after sowing to prevent damping-off.

Photoperiod

Campanula is a qualitative long-day plant. To ensure sufficient vegetative growth and stem length, it is recommended to provide 6 weeks of a short-day conditions (11 hours) from approximately 2 weeks after sowing.

Stage 1 – Germination takes 4 to 5 days. Soil temperature: 68 to 72°F (20 to 22°C) **Light:** Campana is a light germinator. Moisture: Keep soil moist (level 4) in Stage 1. Humidity: Maintain approximately 98% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 72°F (20 to 22°C) Light: 370 f.c (4,000 Lux) to 2,500 f.c. (26,900 Lux)

Moisture: Keep soil moisture at level 3 to 4 to allow the roots to penetrate into the media. Don't let the media dry out. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC).

Stage 3

Soil temperature: 60 to 65°F (16 to 18°C) Light: 370 f.c (4,000 Lux) to 2,500 f.c. (26,900 Lux)

Moisture: Keep soil moisture at level 3 to 4. Fertilizer: Apply fertilizer to rate 2 (100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC). Growth Regulators: Do not use growth regulators at this stage so that sufficient stem length is reached.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) **Light:** 370 f.c (4,000 Lux) to 5,000 f.c. (54,000 Lux) Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Planting Density $64-80 \text{ plants/m}^2$). Use netting for support (5x5 in./12.5x12.5 cm).

Media

Plant in beds with a well-drained, diseasefree media with a pH of 5.5 to 6.0 and an EC of 0.75 mmhos/cm.

Temperature Nights: 54 to 59°F (12 to 15°C) Days: 60 to 70°F (16 to 21°C)

temperature and day lengths. **Common Problems Insect:** Aphids, Thrips, Leaf Miners Rust, Downy Mildew

Light

Photoperiod

Campanula is a qualitative long-day plant. To ensure sufficient vegetative growth and stem length, it is recommended to provide 6 weeks of short-day conditions (11 hours) from approximately 2 weeks after sowing. When producing for Winter flowering, providing long days starting at 6 weeks after transplanting is required. "Mum lighting" from 10:00 p.m. to 2:00 a.m. can be used. Maintain a medium moisture level. In order

Irrigation

length.

Fertilizer

to 175 ppm).

Pinching

range

range

Maintain light levels as high as possible while keeping the temperature moderate. To assure enough stem length and good plant quality, a minimum of 370 f.c. (4,000 Lux) light is required in the plug stage.

to reach sufficient stem length, Campanula medium needs adequate moisture and fertilization. Dry growing conditions will cause early flowering and reduced stem

Do not overwater as this will cause weaker stems and weaker root systems, which will lead to plants falling over.

Campana needs adequate nutrition to reach the desired length. Apply standard mix with micro-elements included fertilizer at level 3 (175 to 225 ppm, EC 1.2 to 1.5 mmhos/cm) constantly with irrigation water at the first 4 weeks after transplant. Then, reduce EC in irrigation water to 1.0 to 1.2 mmhos/cm (145

Growth Regulators

Do not use growth regulators.

Pinching is not required. Pinching will lead to a delay in flowering of about 2 weeks. It will result in multiple stems of shorter length and lesser stem quality.

Crop Scheduling

Sow to transplant (288 cell plug): 7 to 8 weeks with minimum 5 to 6 weeks short days (11 hours) on plugs under cooler conditions $(60 \text{ to } 65^{\circ}\text{F}/16 \text{ to } 18^{\circ}\text{C})$

Transplant to flower: 10 to 14 weeks Under proper day length and temperature

Total crop time: 17 to 22 weeks Under proper day length and temperature

Production: Campana can be produced yearround under the appropriate light levels,

Disease: Fusarium, Rhizoctonia, Ramularia,

Amazon Mist Carex

Plug Production

Media

Use a well-drained, disease-free soilless media with a pH of 5.8-6.2 and an EC of 0.75 mmhos/cm (2:1 extraction).

Sowing

Plug tray size: Can be produced in a 288, 128, 72 liner but prefer 288 cell tray (European size: 264) or a similar size plug tray. Cover the seed with vermiculite.

Stage 1 – Germination takes approximately 7 to 10 days.

Germination temperature: 68 to 79°F (20 to 26°C); warmer temperature is preferred but will not make significant difference. Light: Light is optional.

Media moisture: Keep the media medium wet (level 4) during germination. Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Reduce soil moisture slightly (level 3) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 65 to 67°F (18 to 19°C) Light: Can be up to 5,000 f.c. (54,000 Lux) Media moisture: Maintain wet/dry cycle. Do not allow the seedlings to wilt. Fertilizer: Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: Not needed.

Growing On to Finish

Media

Use a well-drained, disease-free soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 64 to 66°F (18 to 19°C) Days: 66 to 74°F (19 to 23°C)

Amazon Mist Carex continued

Plants can be grown under temperatures as low as 50°F (10°C) but the crop time will increase significantly.

Foliage color is more reddish under cooler conditions with high light.

Light

As high as possible.

Irrigation

Grow plant on dry side. Do not keep media too wet.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus. Growth Regulators: Not needed.

Pinching

Pinching is not needed.

Container Size

306 premium pack: 1 plug per cell **2.5-in. (6-cm) pot:** 1 plug per pot 4-in. (10-cm) pot: 1 plug per pot 6-in. (15-cm) pot: 3 plugs per pot 1-gallon (18-cm) pot: 3 plugs per pot

Crop Scheduling

Sow to transplant (288/264-cell plug tray): 6 to 7 weeks

Add 2 to 3 more weeks when using 128 or 72 cell plug tray but reduce post-transplant crop time by 2 to 3 weeks.

Transplant to saleable size (from 288 cell):

Container Size	Plants per Pot/ Basket	Weeks From Transplant	Total Weeks
306 premium pack	1	9-10	15-17
2.5 in. (6 cm) pot	1	8-9	14-16
4-4.5 in. (10-11 cm) pot	1	9-10	15-17
6-6.5 in. (15-16 cm) pot	3	10-11	16-18
Gallon	3	10-11	16-18

Common Problems

Insect: No serious problems.

Disease: Root Rot when grown too wet.

Bronco Carex

Plug Production

Media

Use a well-drained, disease-free soilless media with a pH of 5.8-6.2 and an EC of 0.75 mmhos/cm (2:1 extraction).

Sowing

Plug tray size: Can be produced in a 288, 128, 72 liner but prefer 288 cell size (European size: 264) or a similar size plug tray. Do not cover the seed.

Stage 1 – Germination takes approximately 7 to 10 days.

Pinching

Not needed.

Container Size

306 premium pack: 1 plug per cell 2.5-in. (6-cm) pot: 1 plug per pot 4-in. (10-cm) pot: 1 plug per pot 6-in. (15-cm) pot: 3 plugs per pot 1-gallon (18-cm) pot: 3 plugs per pot

Crop Scheduling

Sow to transplant (288/264-cell plug tray): 6 to 7 weeks

Add 2 to 3 more weeks when using 128 or 72 cell plug tray but reduce post-transplant crop time by 2 to 3 weeks.

Transplant to saleable size (from 288 cell):

Container Size	Plants per Pot/ Basket	Weeks From Transplant	Total Weeks
306 premium pack	1	8-9	14-16
2.5 in. (6 cm) pot	1	7-8	13-15
4-4.5 in. (10-11 cm) pot	1	8-9	14-16
6-6.5 in. (15-16 cm) pot	3	9-10	15-17
Gallon	3	9-10	15-17

Common Problems

Insect: No serious problems Disease: Root Rot when grown too wet

Phoenix Green Carex

Plug Production

Media

Use a well-drained, disease-free soilless media with a pH of 5.8-6.2 and an EC of 0.75 mmhos/cm (2:1 extraction).

Sowing

Plug tray size: Can be produced in a 288, 128, 72 liner but prefer 288 cell size (European size: 264) or a similar size plug tray. Do not cover the seed.

Stage 1 – Germination takes approximately 7 to 10 days.

Germination temperature: 74 to 79°F (24 to 26°C)

Light: Light is optional. Media moisture: Keep the media medium wet (level 4) during germination. Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Reduce soil moisture slightly (level 3) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 65 to 67°F (18 to 19°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Media moisture: Maintain wet/dry cycle. Do not allow the seedlings to wilt. **Fertilizer:** Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: Not needed.

Growing On to Finish

Media Use a well-drained, disease-free soilless media with a pH of 5.5 to 6.2 and an EC of

0.75 mmhos/cm. Temperature

Nights: 64 to 66°F (18 to 19°C) **Days:** 66 to 74°F (19 to 23°C) Plants can be grown under temperatures as low as 50°F (10°C) but the crop time will increase significantly.

Light

As high as possible. Irrigation

Grow plants on the dry side. Do not keep media too wet.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus.

Growth Regulators

Not needed. Pinching Not needed.

Container Size

306 premium pack: 1 plug per cell 2.5-in. (6-cm) pot: 1 plug per pot **4-in. (10-cm) pot:** 1 plug per pot 6-in. (15-cm) pot: 3 plugs per pot 1-gallon (18-cm) pot: 3 plugs per pot

Crop Scheduling

Sow to transplant (288/264-cell plug tray): 5 to 7 weeks Add 2 to 3 more weeks when using 128 or 72 cell plug tray but reduce post-transplant crop time by 2 to 3 weeks.

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux) Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Stage 4

Transplant to saleable size (from 288 cell):

Container Size 306 premium pa 2.5 in.

(6 cm) pot

4-4.5 in. (10 -11 cm) pot 6-6.5 in. (15-16 cm) pot Gallon

Common Problems Insect: No serious problems **Disease:** No serious problems

Red Rooster Carex Plug Production

Media

Sowing

Plug tray size: Can be produced in a 288, 128, 72 liner but prefer 288 cell size (European size: 264) or a similar size plug tray. Do not cover the seed.

Stage 1 – Germination takes approximately 7 to 10 days. Germination temperature: 74 to 79°F (24 to 26°C) Light: Light is optional. Media moisture: Keep the media medium wet (level 4) during germination. Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

slightly (level 3) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Growth Regulators: Not needed. Growing On to Finish

Use a well-drained, disease-free soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Germination temperature: 74 to 79°F

Media moisture: Keep the media medium

relative humidity until cotyledons emerge.

Relative humidity: Maintain 95 to 97%

Temperature: 68 to 72°F (20 to 22°C)

Light: Can be up to 2,500 f.c. (26,900 Lux).

Media moisture: Reduce soil moisture

Fertilizer: Apply fertilizer at rate 1 (less

than 100 ppm N/less than 0.7 mS/cm EC)

with a nitrate-form fertilizer with low

phosphorous. Maintain a media pH of

5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm

Temperature: 68 to 72°F (20 to 22°C)

Light: Can be up to 2,500 f.c. (26,900 Lux).

reduced to medium to medium dry (level 3

Media moisture: Moisture level can be

to 2). Do not allow the seedlings to wilt.

Fertilizer: Increase the fertilizer rate to 2

(100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC).

0.7 to 1.0 mS/cm (1:2 extraction).

Temperature: 65 to 67°F (18 to 19°C)

Do not allow the seedlings to wilt.

0.7 to 1.0 mS/cm (1:2 extraction).

Light: Can be up to 5,000 f.c. (54,000 Lux)

Fertilizer: Keep the fertilizer rate to 2

(100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC).

Maintain a media pH of 5.8 to 6.2 and EC at

Media moisture: Maintain wet/dry cycle.

Maintain a media pH of 5.8 to 6.2 and EC at

slightly (level 3) to allow the roots to

penetrate into the media.

(1:2 extraction).

Stage 3

Stage 4

wet (level 4) during germination.

(24 to 26°C)

Stage 2

Light: Light is optional.

Temperature

Media

Nights: 64 to 66°F (18 to 19°C) **Days:** 66 to 74°F (19 to 23°C) Plants can be grown under temperatures as low as 50°F (10°C) but the crop time will increase significantly.

Light

Irrigation Grow plant on dry side. Do not keep media too wet.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus.

Growth Regulators

Not needed.

As high as possible.

PanAmerican Seed

	Plants per Pot/ Basket	Weeks From Transplant	Total Weeks
ck	1	6-7	11-13
	1	5-6	10-11
	1	6-7	11-13
	3	7-8	12-14
	3	7-8	12-14

Use a well-drained, disease-free soilless media with a pH of 5.8-6.2 and an EC of 0.75 mmhos/cm (2:1 extraction).

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Reduce soil moisture

Temperature: 65 to 67°F (18 to 19°C)

Light: Can be up to 5,000 f.c. (54,000 Lux) Media moisture: Maintain wet/dry cycle. Do not allow the seedlings to wilt. **Fertilizer:** Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: Not needed.

Growing On to Finish

Media

Use a well-drained, disease-free soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 64 to 66°F (18 to 19°C) **Days:** 66 to 74°F (19 to 23°C) Plants can be grown under temperatures as low as 50°F (10°C) but the crop time will increase significantly.

Light

As high as possible.

Irrigation

Grow plants on the dry side. Do not keep media too wet.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus.

Growth Regulators Not needed.

Pinching

Not needed.

Container Size

306 premium pack: 1 plug per cell 2.5-in. (6-cm) pot: 1 plug per pot 4-in. (10-cm) pot: 1 plug per pot 6-in. (15-cm) pot: 3 plugs per pot 1-gallon (18-cm) pot: 3 plugs per pot

Crop Scheduling

Sow to transplant (288/264-cell plug tray): 6 to 7 weeks

Add 3 to 5 more weeks when using 128 or 72 cell plug tray but reduce post-transplant crop time by 3 to 5 weeks.

Transplant to saleable size (from 288 cell):

Container Size	Plants per Pot/ Basket	Weeks From Transplant	Total Weeks
306 premium pack	1	8-9	14-16
2.5 in. (6 cm) pot	1	7-8	13-15
4-4.5 in. (10-11 cm) pot	1	8-9	14-16
6-6.5 in. (15-16 cm) pot	3	9-10	15-17
Gallon	3	9-10	15-17

Common Problems

Insect: No serious problems Disease: Root Rot when grown too wet

Arrabona Red & First Flame Series Celosia

Plug Production

Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.7 to 1.2 mmhos/cm).

Sowing

Sow 1 seed per cell in a 288 or smaller plug tray. Cover seed lightly with vermiculite. Use a preventative treatment against soil-borne diseases.

Stage 1 - Germination takes 2 to 4 days. Soil temperature: 70 to 72°F (21 to 22°C) Light: Light is required. Moisture: Keep soil moist (level 4) in Stage 1. Humidity: Maintain 95 to 98% relative

humidity (RH) until cotyledons emerge.

Stage 2

Soil temperature: 68 to 72°F (20 to 22°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Maintain soil moisture at the same level (level 4); don't allow the media to drv out.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC).

Stage 3

Soil temperature: 68 to 72°F (20 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Maintain the moisture level constantly medium moist to medium wet (level 3 to 4). Don't allow the media to dry out as water stress could cause premature flowering.

Fertilizer: Apply fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Growth Regulators: None

Stage 4

Soil temperature: 68 to 72°F (20 to 22°C) **Light:** Up to 5,000 f.c. (53,800 Lux) Moisture: Keep plug tray uniform moisture. Fertilizer: Same as Stage 3.

General Remark for Plug Stage:

Tips to prevent premature flowering: keep growing plugs under daylength of 14 hour or longer due to short day flowering response. Also don't allow media to dry out. Celosia makes a taproot and is sensitive to root damage. Transplant on time and do not allow seedlings to get root bound.

Growing On to Finish Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and an EC of 0.75 mmhos/cm in a well-balanced fertilizer.

Temperature

Nights: 59 to 61°F (15 to 16°C) **Days:** 65 to 70°F (18 to 21°C)

Light Maintain light levels as high as possible.

Photoperiod

Celosia Arrabona Red and First Flame are quantitative short day plants and will flower slightly faster under day length of 13 hours or shorter.

Irrigation

Maintain media constantly moist to prevent from premature flowering.

Fertilizer

Arrabona Red and First Flame are moderate feeders. Apply fertilizer at lower range of rate 3 (about 175 ppm N/1.2 mS/cm). Celosia is susceptible to high salt levels.

Growth Regulators

Generally, Arrabona Red and First Flame varieties do not need PGRs. But if necessary, they are responsive to B-Nine/Alar (daminozide) spray at 2,000 to 3,000 ppm (2.4 to 3.5 g/l, 85% formulation or 3.1 to 4.7 g/l 64% formulation) depending on weather. If necessary, repeat the treatment.

Pinching

Pinching is not needed.

Crop Scheduling

Sow to transplant (288 cell plug): 3 to 4 weeks

Transplant to flower:

Container Size	Plants per Pot	Weeks From Transplant	Total Weeks
Pack	1	8-10	11-14
4-5 in. (10-13 cm)	1	9-12	12-16

Production: Celosia Arrabona Red and First Flame can be produced year-round under the appropriate climate conditions.

Common Problems

Insect: Aphids, Thrips, Spider Mites, Leafminers

Disease: Powdery Mildew, Botrytis

Bombay Series Celosia

Plug Production

Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.2 and an EC of 0.75 mmhos/cm.

Sowing

Sow 1 seed (or 1 pellet) per cell in a 288 or larger plug tray. Cover seed lightly with vermiculite. It is also possible to sow directly into the beds in the greenhouse. Press seeds lightly into the soil. Keep soil evenly moist. Treat preventively against fungi.

Stage 1 - Germination takes 3 to 4 days. Soil temperature: 68 to 72°F (20 to 22°C) Light: Required for germination. Moisture: Keep soil moist (level 4) in Stage 1. Humidity: Maintain 97 to 98% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Maintain soil media moist (level 4). Don't let the media dry out. **Fertilizer:** Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC).

Stage 3

Soil temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Soil moisture can be reduced slightly (level 3 to 4), but do not allow media to dry out as it will result in premature flowering.

Fertilizer: Apply fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Growth Regulators: None needed. Do not use PGRs in this stage as cutflower Celosia will not reach sufficient length otherwise. Stage 4

Soil temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

General Remark for Plug Stage:

Celosia makes a taproot and is sensitive for root damage, which will result in early bud formation, deformed flowers and less uniformity. Therefore, planting should be done before the plugs get rootbound. Depending on season and plug size, this will generally take between 10 to 18 days after sowing. In this stage, mostly the first pair of true leaves unfolds.

Growing On to Finish

Planting Density

6 to 8 plants/sq. ft. (64 to 80 plants/sq. m). Use netting for support.

Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.5 and an EC of 0.75 mmhos/cm.

Temperature

From planting until start of flower development (6 to 8 weeks): Nights: 63 to 65°F (17 to 18°C) **Days:** 65 to 75°F (18 to 24°C)

From start of flower development onwards:

Nights: 59°F (15°C)

Days: 60 to 61°F (16°C)

Light

Maintain light levels as high as possible. Shading is only required when light intensity is very high. Low light intensity, short days and low temperatures may cause growth disturbances (for example, flat stems and combs shattering). Therefore, it is recommended not to sow later than the end of June in Northwest Europe.

Photoperiod

Celosia is a quantitative short-day plant. Flowers will initiate under short days. The optimum daylength for Celosia Bombay to reach the appropriate stem length lies between 12 to 13 hours. Under short-day conditions, provide daylength extension up to 13 hours to allow plants to elongate and to prevent early flowering. When daylength is over 13 hours, short-day treatments can be applied. Provide a dark period for a minimum of 12 hours for 5 to 6 weeks. Do not start short days until 1 week after planting. Prevent high relative humidity when using short-day treatments.

Irrigation

From transplanting to flower initiation, it is important to maintain constantly moist media, especially for the first 2 weeks. We recommend irrigating the first 10 to 14 days after transplanting each morning for approximately half an hour, as this is an important step in establishment and growing-on of the crop. If Celosia suffers from water stress during this stage, root development gets blocked and plants start flowering without reaching sufficient length. Overhead irrigation can be used, preferably in the morning.

After flower initiation, refrain from overhead irrigation in order to prevent disease incidence and to keep the soil drier; only irrigate when extremely sunny or when foliage wilts. Over-irrigating may cause flowers to become top-heavy and fall over.

Fertilizer

Celosia Bombay is a moderate feeder (level 2). Maintain 100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC with completely balanced fertilizer. Celosia is susceptible to salt and high EC.

Growth Regulators

PGRs are generally not recommended as this is for cut flower production. If needed to control the excessive stem length, PGRs can be used. Celosia is responsive to B-Nine/ Alar (daminozide) 2,000 ppm (2.5 g/l 85% formulation or 3.0 g/l of 64% formulation) when excessive stem length is expected, starting at 12 to 20-in. (30 to 50-cm) height; depending on the weather, a weekly spray is advised. At final desired length, a spray with B-Nine/Alar (daminozide) 3,250 ppm (3.8 g/l 85% formulation or 5.0 g/l of 64% formulation) could be given to stop the plant growing further.

Pinching Do not pinch.

Crop Scheduling Sow to transplant (288 cell plug): 2 to 3 weeks

with "Fi".

Miners

Disease: Powdery Mildew, *Botrytis* It is recommended to treat preventively against Botrytis 1 week after transplanting.

Ice Cream Series Celosia **Plua Production**

Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.7-1.2 mmhos/cm).

Sowing

diseases. Light: Light is required.

Stage 2

Soil temperature: 68 to 72°F (20 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Maintain soil moisture at the same level (level 4); don't allow the media drv out. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC).

Stage 3 flowering.

Stage 4 **Soil temperature:** 68 to 72°F (20 to 22°C) Light: Up to 5,000 f.c. (53,800 Lux) Moisture: Keep plug tray uniform moisture. Fertilizer: Same as Stage 3.

PanAmerican Seed.

Transplant to flower: 10 to 14 weeks (under proper daylength and temperature range) Total crop time: 12 to 16 weeks (under proper daylength and temperature range) The classic Bombay series varieties flower approximately 1 week earlier than Bombay Fire types, which are all varieties starting

Production: Bombay can be produced yearround under the appropriate light levels, temperature and daylengths.

Common Problems

Insect: Aphids, Thrips, Spider Mites, Leaf

Sow 1 seed per cell in a 288 or smaller plug tray. Cover seed lightly with vermiculite. Use a preventative treatment against soil-borne

Stage 1 - Germination takes 2 to 4 days. Soil temperature: 70 to 72°F (21 to 22°C)

Moisture: Keep soil moist (level 4) in Stage 1. Humidity: Maintain 95 to 98% relative humidity (RH) until cotyledons emerge.

Soil temperature: 68 to 72°F (20 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Maintain the moisture level constantly medium moist to medium wet (level 3-4). Don't allow the media dry out as water stress could cause premature

Fertilizer: Apply fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Growth Regulators: None.

General remark for plug stage:

Tips to prevent premature flowering: keep growing plugs under daylength 14 hours or longer due to short day flowering response. Don't allow medium to dry out.

Growing On to Finish

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and an EC of 0.75 mmhos/cm in a well-balanced fertilizer.

Temperature

Nights: 59 to 61°F (15 to 16°C) **Days:** 65 to 70°F (18 to 21°C)

Light

Maintain light levels as high as possible.

Photoperiod

Celosia Ice Cream is a quantitative short day plant and will flower uniformly under daylength 13 hours or shorter. When producing under natural daylength longer than 13 hours, daylength control can be applied. Start daylength control no earlier than one week after transplanting.

Irrigation

Maintain media constantly moist to prevent from premature flowering.

Fertilizer

Celosia Ice Cream is a moderate feeder. Apply fertilizer at lower range of rate 3 (about 175 ppm N/1.2 mS/cm). Celosia is susceptible to high salt levels.

Growth Regulators

Generally, Celosia Ice Cream does not need PGRs. But if necessary, Celosia Ice Cream is responsive to B-Nine/Alar (daminozide) spray at 2,000-3,000 ppm (2.4-3.5 g/l, 85% formulation or 3.1-4.7 g/l 64% formulation) depending on weather. If necessary, repeat the treatment.

Pinching

Not needed.

Crop Scheduling

Sow to transplant (288 cell plug): 3 to 4 weeks

Transplant to flower:

Container Size	Plants per Pot	Weeks From Transplant	Total Weeks
Pack	1	8-10	11-14
4-5 in. (10.5-13 cm) pot	1	9-12	12-16

Production: Celosia Ice Cream can be produced year-round under the appropriate climate conditions.

Common Problems

Insect: Aphids, Thrips, Spider Mites, Leafminers **Disease:** Powdery Mildew, *Botrytis*

Kosmo Series Celosia

Plug Production

Media

Use a well-drained, disease-free, media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Sowing

Sow 1 seed per cell in 288 or smaller plug tray. Cover seed lightly with vermiculite. Use a preventative treatment against soil-borne diseases.

Stage 1 - Germination begins at day 2-4 continuing through day 12-20. Soil temperature: 70 to 72°F (21 to 22°C) Light: Light is required. Moisture: Keep soil moist (level 4) in Stage 1.

Humidity: Maintain 95 to 98% relative humidity (RH) until cotyledons emerge.

Stage 2

Soil temperature: 68 to 72°F (20 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux). Moisture: Maintain soil moisture at the same level (level 4); don't allow the media to dry out.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC).

Stage 3

Soil temperature: 68 to 72°F (20 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux). Moisture: Maintain the moisture level constantly medium moist to medium wet (level 3-4). Don't allow the media to dry out as water stress could cause premature flowering.

Fertilizer: Apply fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Growth Regulators: None.

Stage 4

Soil temperature: 68 to 72°F (20 to 22°C) Light: Up to 5,000 f.c. (53,800 Lux). Moisture: Keep plug tray uniform moisture. Fertilizer: Same as Stage 3.

General remark for plug stage: Celosia makes a taproot and is sensitive to root damage.

Growing On to Finish

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm).

Temperature

Nights: 62 to 65°F (17 to 18°C) **Days:** 65 to 68°F (18 to 20°C)

Light

Maintain light levels as high as possible; a minimum of 4500 lux (450 FC) is recommended.

Photoperiod

Celosia Kosmo is a quantitative short day plant and will flower uniformly under daylength of 13 hours or shorter.

Irrigation

Maintain media constantly moist to prevent from premature flowering.

Fertilizer

Celosia Kosmo is a moderate feeder. Apply fertilizer at lower range of rate 3 (about 175 ppm N/1.2 mS/cm). Celosia is susceptible to high salt levels.

Growth Regulators

Celosia Kosmo generally does not need PGR. But if necessary, Alar/B-Nine 2,000-2,500 ppm (2.4-3.0 g/l 85% formulation or 3.1-4.0 g/l 64% formulation) 2 to 3 applications can be used. Do not treat when flower buds become visible.

Pinching

Not needed.

Crop Scheduling Sow to transplant (288 cell plug): 3 to 4 weeks, after second true leaf pair. Transplant to flower:

Container Size	Plants per Pot	Weeks From Transplant	Total Weeks
3.5 in. (9 cm)	1	9-11	12-15
4-4.5 in. (10.5-13 cm)	1	10-12	13-16
Gallon	3	10-12	13-16

Common Problems

Insect: Aphids, Thrips, Spider Mites, Disease: Powdery Mildew, Botrytis

Sunday Series Celosia

Plug Production

Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.5 and an EC of 0.75 mmhos/cm.

Sowing

Sow 1 seed (or 1 pellet) per cell in a 288 or larger plug tray. Cover seed lightly with vermiculite. Treat preventively against fungi.

Stage 1 – Germination takes 3 to 4 days. Soil temperature: 68 to 72°F (20 to 22°C) Light: Required for germination. Moisture: Keep soil moist (level 4) in Stage 1. Humidity: Maintain 97 to 98% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 72°F (20 to 22°C)

Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Maintain soil media moist (level 4). Don't let the media dry out. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N less than 0.7 mmhos/cm EC).

Stage 3

Soil temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Soil moisture can be reduced slightly (level 3 to 4), but do not allow media to dry out as it will result in premature flowering.

Fertilizer: Apply fertilizer at rate 2 (100 to 175 ppm N 0.7 to 1.2 mmhos/cm EC). Growth Regulators: None needed. Do not use PGRs in this stage as cutflower Celosia will not reach sufficient length otherwise.

Stage 4

Soil temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

General Remark for Plug Stage:

Celosia makes a taproot and is sensitive for root damage, which will result in early bud formation, deformed flowers and less uniformity. Therefore, planting should be done before the plugs get rootbound. Depending on season and plug size, this will generally take between 12 to 20 days after sowing. In this stage, mostly the first pair of true leaves unfolds.

Growing On to Finish

Planting Density

6 to 8 plants/sq. ft. (64 to 80 plants/sq. m). Use netting for support.

Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.5 and an EC of 0.75 mmhos/cm.

Temperature

From planting until start of flower development (6 to 8 weeks): Nights: 63 to 65°F (17 to 18°C) Days: 65 to 75°F (18 to 24°C) From start of flower development onwards: Nights: 59°F (15°C)

Days: 60 to 61°F (16°C)

Light

Maintain light levels as high as possible. Shading is only required when light intensity is very high. Low light intensity, short days and low temperatures may cause growth disturbances (for example, flat stems and plumes shattering). Therefore, it is recommended not to sow later than end of June in Northwest Europe.

Photoperiod

Celosia is a quantitative short-day plant. Flowers will initiate under short days. The optimum daylength for Celosia Sunday to reach the appropriate stem length lies between 12 to 13 hours. Under short-day conditions, provide daylength extension up to 13 hours to allow plants to elongate and to prevent early flowering. When daylength is over 13 hours, short-day treatments can be applied. Provide a dark period for a minimum of 12 hours for 5 to 6 weeks. Do not start short days until one week after planting. Prevent high relative humidity when using short-day treatments.

Irrigation

From transplanting to flower initiation, it is important to maintain constantly moist media, especially for the first 2 weeks. We recommend irrigating the first 10 to 14 days after transplanting each morning approximately half an hour, as this is an important step in establishment and growing-on of the crop. If Celosia suffers from water stress during this stage, root development gets blocked and plants start flowering without reaching sufficient length. Overhead irrigation can be used, preferably in the morning.

After flower initiation, refrain from overhead irrigation in order to prevent disease incidence and to keep soil drier; only irrigate when extremely sunny or when foliage wilts. Over-irrigating may cause flowers to become top-heavy and fall over.

Fertilizer

Celosia Sunday is a moderate feeder (level 2). Maintain 100 to 175 ppm N;0.7 to 1.2 mmhos/ cm EC with completely balanced fertilizer. Celosia is susceptible to salt and high EC.

Growth Regulators

PGRs are generally not recommended as this is for cut flower production. If needed to control the excessive stem length, PGRs can be used. Celosia is responsive to B-Nine/ Alar (daminozide) 2,000 ppm (2.5 g/l 85% formulation or 3.0 g/l of 64% formulation) when excessive stem length is expected, starting at 12 to 20-cm (30 to 50-cm) height; depending on the weather, a weekly spray is advised. At final desired length, a spray with B-Nine/Alar (daminozide) 3,250 ppm (3.8g/l 85% formulation or 5.0 g/l of 64% formulation) could be given to stop the plant growing further.

Pinching

Do not pinch. **Crop Scheduling** weeks

Transplant to flower: 12 to 16 weeks (under proper daylength and temperature range) Total crop time: 14 to 18 weeks (under proper daylength and temperature range) The Sunday series flowers approximately 2 weeks later than the Bombay types. Production: Sunday can be produced yearround under the appropriate light levels, temperature and daylengths. **Common Problems** Insect: Aphids, Thrips, Spider Mites, Leaf Miners

Disease: Powdery Mildew, *Botrytis* It is recommended to treat preventively against Botrytis 1 week after transplanting.

Chocolate Covered Cherry, Chocolate Mint, **Chocolate Splash & Dark Chocolate Coleus**

See Premium Sun Collection Coleus, pg 89

Coleus

Plua Production Media

Sowing

Stage 1 - Germination takes 4 to 5 days. **Soil temperature:** 72 to 75°F (22 to 24°C) Light: Light is not necessary. Moisture: Keep media evenly moist (level 4), but not saturated. Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge. Note: Coleus is very sensitive to high salts - particularly high ammonium - during germination. Keep ammonium levels less than 10 ppm.

Stage 2 **Soil temperature:** 72 to 75°F (21 to 24°C) Light: Up to 2,500 f.c. (26,900 Lux)

Leafminers

PanAmerican Seed.

Sow to transplant (288 cell plug): 2 to 3

Kong[®] and Kong Jr.

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 5.8 and a medium initial nutrient charge (EC 0.75 mS/cm).

Sow seed in 288 or larger plug trays. Cover lightly with vermiculite.

Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous. Alternate feed with clear water. Feed between 2 to 3 clear irrigations. Irrigate early in the day so foliage is dry by nightfall to prevent diseases. Keep soil pH at 5.5 to 6.2 and EC less than 1.0 mS/cm.

Stage 3

Soil temperature: 68 to 70°F (20 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering but avoid excessive wilting to promote root growth and control shoot growth. Keep the moisture to wet-dry cycle (moisture level 4 to 2).

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain soil pH at 5.5 to 5.8 and EC less than 1.0 mS/ cm (1:2 extraction).

Growth Regulators: Generally not needed. If necessary, A-Rest, B-Nine or Bonzi are effective on coleus. Always follow label recommendations.

Use temperature differential (DIF) whenever possible, especially the first 2 hours after sunrise, to control plant height.

Stage 4

Soil temperature: 60 to 62°F (16 to 17°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Fertilize with 14-0-14 or calcium/ potassium nitrate feed at 100 to 150 ppm N as needed.

Growing On to Finish

Container Size

4 to 6-in. (10 to 15-cm) pots: 1 plant per pot Gallon pots: 1 plant per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.0 and a medium initial nutrient charge (EC 0.75 mS/cm).

Temperature

Nights: 62 to 65°F (17 to 18°C) Days: 70 to 75°F (21 to 24°C)

Light

Provide shade if over 5,000 f.c. (53,800 Lux).

Irrigation

Avoid both excessive watering and drought.

Kong[®] and Kong Jr. Coleus continued

Fertilizer

Coleus are low to moderate feeders. Excessive feed can lead to dull coloration and decreased vigor. Apply fertilizer at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm) using predominantly nitrate-form fertilizer with low phosphorus and high potassium. Maintain medium electrical conductivity around 1.0 mS/cm (using 1:2 extraction).

Growth Regulators

Kong and Kong Jr. are well branched and have short internodes, but because of the large leaves, the plants tend to get too wide and need more space before they get too tall. Growth regulators are generally not needed. But if necessary, B-Nine/Alar (daminozide) 2,500 to 5,000 ppm (3.0 to 6.0 g/l 85% formulation or 4.0 to 8.0 g/l of 64% formulation) can be applied at 2 to 3 weeks after transplanting. Repeat if necessary.

Pinching

Pinching is not recommended. It will result in smaller leaves and delay crop time.

Spacing

Space plants when foliage is touching.

Crop Scheduling

Sow to transplant (288 cell plug):

5 to 6 weeks

Transplant to finish:

4-in. (10-cm) pots: 4 to 5 weeks

5 to 6-in. (13 to 15-cm) pots: 5 to 6 weeks Gallon pots: 6 to 7 weeks

Common Problems

Insect: Aphids, Mealy Bugs, White Flies Diseases: Alternaria, Botrytis, Verticillium Other: Excessive internode elongation under low light

Premium Sun Collection Coleus

Plua Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 5.8 and a medium initial nutrient charge (EC 0.75 mS/cm).

Sowing

Sow seed in 288 or larger plug trays. In Europe, 264-cell trays can be used. Cover lightly with vermiculite.

Stage 1 - Germination takes 4 to 5 days. Soil temperature: 72 to 75°F (22 to 24°C)

Media **Moisture:** Keep media evenly moist (level 4),

Light: Light is not necessary.

(RH) until radicles emerge.

Humidity: Maintain 95%+ relative humidity

Note: Coleus is very sensitive to high salts -

particularly high ammonium – during

germination. Keep ammonium levels less

Soil temperature: 72 to 75°F (21 to 24°C)

Moisture: Reduce soil moisture slightly

Fertilizer: Apply fertilizer at rate 1 (less

than 100 ppm N/less than 0.7 mS/cm EC)

from nitrate-form fertilizers with low

5.5 to 6.2 and EC less than 1.0 mS/cm.

Light: Up to 2,500 f.c. (26,900 Lux)

(moisture level 4 to 2).

cm (1:2 extraction).

recommendations.

Stage 4

Soil temperature: 68 to 70°F (20 to 21°C)

Moisture: Allow media to dry further until

before watering, but avoid excessive wilting

to promote root growth and control shoot

growth. Keep the moisture to wet-dry cycle

Fertilizer: Increase fertilizer to rate 2 (100

to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain

soil pH at 5.5 to 5.8 and EC less than 1.0 mS/

Growth Regulators: Generally not needed.

If necessary, A-Rest, B-Nine and Bonzi are

Use temperature differential (DIF) whenever

possible, especially the first 2 hours after

Soil temperature: 60 to 62°F (16 to 17°C)

Light: Up to 5,000 f.c. (53,800 Lux) if

306 pack: 1 plant per cell (Chocolate

4 to 5-in. (10 to 13-cm) pots: 1 plant per pot

6-in. (15-cm) or gallon pots: 3 plants per pot

temperature can be controlled.

Moisture: Same as Stage 3.

Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

Covered Cherry only)

sunrise, to control plant height.

effective on coleus. Always follow label

the surface becomes light brown (level 2)

phosphorous. Alternate feed with clear

water. Feed between 2 to 3 clear irrigations.

nightfall to prevent diseases. Keep soil pH at

Irrigate early in the day so foliage is dry by

(level 3 to 4) to allow the roots to penetrate

Light: Up to 2,500 f.c. (26,900 Lux)

but not saturated.

than 10 ppm.

into the media.

Stage 3

Stage 2

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.0 and a medium initial nutrient charge (EC 0.75 mS/cm).

Temperature

Nights: 57 to 65°F (14 to 18°C) **Days:** 65 to 75°F (18 to 24°C)

Light

Provide shade if over 5,000 f.c. (53,800 Lux). Irrigation

Avoid both excessive watering and drought.

Fertilizer

Coleus are low to moderate feeders. Excessive feed can lead to dull coloration and decreased vigor. Apply fertilizer at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm) using predominately nitrate-form fertilizer with low phosphorus and high potassium. Maintain medium electrical conductivity around 1.0 mS/cm (using 1:2 extraction).

Growth Regulators

Control plant growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid stem elongation. Coleus are responsive to day/night DIF and are shorter with a negative DIF.

Florel (ethephon) can be applied for promoting increased branching and height control if necessary. A rate of 300 ppm (7.69 ml/13.9% formulation) at 2 to 3 weeks after transplanting is effective. Florel also delays flowering.

Optional PGR: B-Nine/Alar (daminozide) 2,500 to 5,000 ppm (3.0 to 6.0 g/l 85% formulation or 4.0 to 8.0 g/l of 64% formulation) can be applied for height control at 2 to 3 weeks after transplanting. Repeat if necessary.

Note: Use caution when using Augeo and Topflor as they can alter foliage color.

Pinching

Not necessary.

Spacing

Space plants when foliage is touching.

Crop Scheduling Sow to transplant (288 cell plug):

5 to 6 weeks

Transplant to finish: 6 to 8 weeks

Common Problems

Insect: Aphids, Mealy Bugs, White Flies Disease: Alternaria, Botrytis, Verticillium, Downy Mildew Other: Excessive internode elongation under low light or crowding.

Spiky Blue Corynephorus

Plug Production

Media

media with a pH of 5.5-6.2 and an EC of 0.75 mmhos/cm (2:1 extraction).

Plug tray size: Can be produced in a 288

Stage 1 – Germination takes approximately 3 to 6 days.

Germination temperature: 68 to 79°F

Light: Light is optional. Media moisture: Keep the media medium wet (level 4) during germination. **Relative humidity:** Maintain 85 to 90% relative humidity until cotyledons emerge.

Stage 2

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Reduce soil moisture slightly (level 3) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm

Stage 3

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 65 to 67°F (18 to 19°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Media moisture: Maintain wet/dry cycle. Do not allow the seedlings to wilt. **Fertilizer:** Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: Not needed.

Gallon **Common Problems**

Use a well-drained, disease-free soilless

Sowing

cell tray (European size: 264) or a similar size plug tray. Cover the seed lightly with vermiculite.

Irrigation

(20 to 26°C)

(1:2 extraction).

(6 cm) pot 4-4.5 in. (10-11 cm) pot 6-6.5 in.

Growing On to Finish

Media

Light

Fertilizer

Not needed.

Pinching

Not needed.

per pot

Container Size

Use a well-drained, disease-free soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 64 to 66°F (18 to 19°C)

- **Davs:** 66 to 74°F (19 to 23°C)
- Plants can be grown under temperatures
- as low as 50°F (10°C) but the crop time will increase significantly.

As high as possible.

Grow plants on the dry side. Do not keep media too wet as it may cause root rot or lean and lanky stems.

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus.

Growth Regulators

Container Size

306 premium pack: 1 plug per cell

- 2.5-in. (6-cm) pot: 1 plug per pot
- 4-in. (10-cm) pot: 1 plug per pot
- 6-in. (15-cm) pot: 3 plugs (space out) per pot 1-gallon (18-cm) pot: 3 plugs (space out)

Crop Scheduling

Sow to transplant (288/264-cell plug tray): 6 to 7 weeks

Transplant to saleable size (from 288 cell):

Container Size	Plants per Pot/ Basket	Weeks From Transplant	Total Weeks
306 premium pack	1	6-7	12-14
2.5 in. (6 cm) pot	1	5-6	11-13
4-4.5 in. (10-11 cm) pot	1	6-7	12-14
6-6.5 in. (15-16 cm) pot	3	7-8	13-15
Gallon	3	7-8	13-15

Insect: Sciara in plug stage or young plant stage when pots are kept too wet

Diseases: Root Rot when grown too wet

Dash F1 Dianthus

Plug Production

Media

Use a well-drained, disease-free soilless media with a pH of 5.8 to 6.2 and an EC of 0.5 to 0.75 mmhos/cm (2:1 extraction).

Sowing

Plug tray size: Can be produced in a 288 or similar size plug tray. Cover the seed with a medium layer of coarse grade vermiculite at sowing.

Stage 1 – Germination takes approximately 3 to 5 days.

Germination temperature: 64 to 68°F (18 to 20°C)

Light: Not required, but can be beneficial. Media moisture: Keep the media medium wet (level 4) during germination.

Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 65 to 70°F (18 to 21°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Reduce the media moisture slightly (level 3) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 60 to 65°F (15 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 55 to 60°F (13 to 15°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Media moisture: Maintain wet/dry cycle. Do not allow the seedlings to wilt. Fertilizer: Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: Generally not needed, but if the plugs need to be toned, then a foliar spray of Bonzi (paclobutrazol) at 6 ppm (1.5 ml/l, 0.4% formulation) applied during early stage 3 will be helpful.

Dash F1 Dianthus continued

Growing On to Finish

Media

Use a well-drained, disease-free soilless media with a pH of 5.8 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Provide 65 to 75°F (18 to 24°C) day temperatures and 60°F (15°C) night temperatures for the first 2 weeks of greenhouse production to establish the plants. Finish at 60 to 70°F (15 to 21°C) days, and nights in the low 50s (11 to 12°C). Lower temperatures can be tolerated in the mature plant stage.

Light

Keep as high as possible while maintaining the optimal production temperatures.

Irrigation

Maintain optimal media moisture, i.e. not too wet or too dry.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus.

Growth Regulators

Dash dianthus has a naturally compact plant habit and good basal branching compared to other barbatus type dianthus, making it more suitable for container production. When producing Dash in containers, foliar spray of Bonzi (paclobutrazol) at 20 ppm (5.0 ml/l, 0.4% formulation) applied once at 2-3 weeks after transplant will help in toning the crop, if needed.

Pinching

Not needed.

Container Size Quart: 1 plug per cell

1-gallon (18-cm) pot: 1 to 3 plugs per pot

Crop Scheduling

Sow to transplant (288/264-cell plug tray): 4 to 5 weeks

Transplant to finish: Spring through Early Summer: 9 to 10 weeks Winter: 11 to 12 weeks

Common Problems Insect: Thrips, Aphids, Mites

Disease: Powdery Mildew

Cultural Tip: Avoid using fungicides such as Heritage containing active ingredient Azoxystrobin as they can cause phytotoxic symptoms on Dash dianthus.

Jolt F1 Interspecific **Dianthus**

Plug Production

Media Use a well-drained, disease-free soilless media with a pH of 5.8 to 6.2 and an EC of 0.5 to 0.75 mmhos/cm (2:1 extraction).

Sowing

Plug Tray Size:

Can be produced in a 288 or similar size plug tray. Cover the seed with a medium layer of coarse grade vermiculite at sowing.

Stage 1 – Germination takes approximately 3 to 5 days

Germination temperature: 64 to 68°F (18 to 20°C)

Light: Light is not required, but can be beneficial.

Media moisture: Keep the media mediumwet (level 4) during germination. **Relative humidity:** Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 65 to 70°F (18 to 21°C) Light: Can be up to 2,500 f.c. (26,900 Lux). DLI 5 to 8 moles.m-2.d-1

Media moisture: Reduce the media moisture slightly (level 4 to 3) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 60 to 65°F (15 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). DLI 8-10 moles.m⁻².d⁻¹ Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 55 to 60°F (13 to 15°C) Light: Can be up to 5,000 f.c. (54,000 Lux). DLI >10 moles.m⁻².d⁻¹ Media moisture: Maintain wet/dry cycle. Do not allow the seedlings to wilt. **Fertilizer:** Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Growth Regulators: One to two applications of paclobutrazol (Bonzi, Piccolo) at 4 to 6 ppm (1.0 to 1.5 ml/l, 0.4% formulation) is effective for Jolt plug height control. When grown under low light conditions (DLI <5 moles.m-2.d-1) a paclobutrazol (Bonzi, Piccolo) 5 ppm (1.25 ml/l, 0.4% formulation) spray at radicle emergence stage will help in controlling hypocotyl stretch.

Northern Europe: Start with 2 ppm (0.5 ml/l, 0.4% formulation) paclobutrazol (Bonzi, Piccolo) spray at 2 weeks after sowing and then, if necessary, build up concentration to 4 ppm and 6 ppm at 3 and 4 weeks after sowing, respectively.

Growing On to Finish Media

Use a well-drained, disease-free soilless media with a pH of 5.8 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Provide 65 to 75°F (18 to 24°C) day temperatures and 60°F (15°C) night temperatures for the first 2 weeks of greenhouse production to establish the plants. Finish at 60 to 70°F (15 to 21°C) days, and nights in the low 50s (11 to 12°C). Lower temperatures can be tolerated in the mature plant stage, but it will lengthen the crop time. Jolt will flower earlier under warmer temperatures.

Light

Jolt will benefit from being grown under high light levels. Grow them under light levels as high as possible while maintaining the optimal production temperatures. Growing under low light conditions (<5 moles.m-2.d-1) could significantly delay flowering.

Irrigation

Maintain optimal media moisture, i.e. not too wet or too dry.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from a nitrate-form fertilizer with low phosphorus.

Photoperiod

Jolt is a facultative/quantitative long day plant and can flower all year around, but it will take slightly longer to flower under short days than long days.

Growth Regulators

Jolt has a naturally compact plant habit with excellent basal branching, making it perfectly suitable for premium container programs. When producing Jolt in premium containers such as quarts & 1 gallons, foliar sprays of paclobutrazol (Bonzi, Piccolo) at 20 ppm (5.0 ml/l, 0.4% formulation) applied at 2 to 3 weeks after transplant will be effective in controlling height. If necessary, repeat the treatment 2 to 3 weeks later.

Northwestern Europe: Apply paclobutrazol (Bonzi) as foliar spray at 2 to 3 weeks after transplant. Start with 8 ppm (2.0 ml/l 0.4% active ingredient). Repeat weekly with 4 ppm higher dose built up each week as needed up to 16 to 20 ppm (4.0 to 5.0 ml/l 0.4% active ingredient) until visible bud stage.

Pinching

Pinching is not needed.

Container Size Quart: 1 plug per cell

1-gallon (18-cm) pot: 1 to 3 plugs per pot Crop Scheduling

Sow to transplant (288/264-cell plug

tray): 5 to 6 weeks

Transplant to finish: Late Spring through Autumn finishing: 12 to 13 weeks

Winter to Early Spring finishing: 14 to 18 weeks

Note: Jolt flowering is influenced by light

However, light intensity and temperature

intensity, temperature, and daylength.

have greater impact on Jolt flowering,

Silver Falls Dichondra

Use a well-drained, disease-free, soilless

Cover the seed lightly with coarse

Germination: 72 to 76°F (22 to 24°C)

medium with a pH of 5.5 to 6.3 and a medium

initial nutrient charge (EC 0.75 mmhos/cm

production stage.

Common Problems

Insect: Thrips, Mites

Plug Production

with a 1:2 extraction).

Media

Sowing

vermiculite.

Temperature

Temperature Light

especially during Winter and early Spring season. A small percentage (less than 1%) of early off-types may be observed in Jolt Pink Irrigation at 4 to 5 weeks after sowing. These off-type

seedlings can be roughed out as early as plug in between irrigations.

Fertilizer fertilizer.

Growth Regulators week after transplant can be used to

Pinching Pinching is not needed. Crop Scheduling Sow to transplant (288-cell plug tray): 6-7 weeks

Light Stage one: Not required.

> Seedling maturity: Up to 5,000 f.c. (54,000 Lux) if temperature can be controlled. Humidity Maintain 95% relative humidity until cotyledons emerge.

Soil Moisture Keep soil moisture high until radicle emergence, then reduce moisture levels after the radicle penetrates the medium. Plug development is faster with drier plug culture. Do not allow the seedlings to wilt.

Fertilizer

At radicle emergence, apply 50 to 75 ppm N from 15-0-15. As cotyledons expand, increase to 100 to 150 ppm N. Growth Regulators

Spray B-Nine at 2,500 ppm one week before transplant to promote branches.

Growing On to Finish

Media

PanAmerican Seed.

Cotyledon stage: 65 to 72°F (18 to 22°C) **True leaves:** 65 to 70°F (18 to 21°C) Hold plugs: 62 to 65°F (16 to 18°C)

After germination: 1,000 to 2,500 f.c. (10,000 to 30,000 Lux).

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.5 and a medium initial nutrient charge.

Nights: 62 to 65°F (16° to 18°C) **Days:** 65 to 75°F (18° to 24°C)

Higher light levels result in foliage that is more silver in color and shorter internodes.

Silver Falls dichondra benefits from warm, dry growing conditions. Let crop dry out well

Feed weekly with 200 ppm N in complete

For pot production, a tank mix of 5,000 ppm B-Nine and 1,000 ppm Cycocel one increase branching, control stem length and prevent plants from becoming tangled. This treatment also makes the foliage more silver. Transplant to saleable 4-in. (10-cm) pot: 7 to 8 weeks

Container Size	Plants Per Pot/Basket	Weeks From Transplant
4-4.5 in. (10-11 cm) pot	1	6-7
6 in. (15 cm) or gallon pot	3	7-8
12 in. (30 cm)	3	8-9
hanging basket	4	7-8
	5	6-7

If producing liners (72-tray), allow 7 to 8 weeks from sow to transplant, and reduce post-transplant crop time by two weeks.

Common Problems

Insect: No serious problems Disease: No serious problems

For PowWow[®] Series Echinacea, see pg 149

Glamour Euphorbia

Plug Production

Media

Use a well-drained, disease-free seedling medium with a pH of 5.8 to 6.2. Maintain EC of about 0.75 to 0.80 mS/cm (1:2 extraction).

Sowing

Can be produced in a 288 cell tray at 1 seed per cell, or larger cell travs at 2 seeds per cell. Covering the seed is optional. A light cover can help maintain high relative humidity around the seed and improve germination.

Stage 1

Germination in approximately 3 to 6 days. Move plug tray out of germination chamber as soon as radicles emerge to avoid hypocotyl stretch.

Soil temperature: 65 to 72°F (18 to 22°C) Note: Germinates readily at temperatures of 62 to 77°F (16 to 25°C). Warmer temperatures result in faster germination.

Light: Light is optional.

Moisture: Keep soil wet (level 4) during stage 1.

Humidity: Maintain 95% or greater relative humidity (RH) until radicle emergence.

Stage 2

Soil temperatures: 65 to 72°F (18 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Maintain high moisture (level 4). Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorus.

Glamour Euphorbia continued

Stage 3

Soil temperatures: 65 to 72°F (18 to 22°C) **Light:** Up to 2,500 f.c.(26,900 Lux) Moisture: Soil moisture can be reduced to level 3. Keep wet-dry moisture cycle between levels 3 and 4. Avoid seedling wilting. Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain medium pH 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Stage 4

Soil temperatures: 65 to 72°F (18 to 22°C) Light: Up to 5,000 f.c. (54,000 Lux). Moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Same as stage 3

Growth Regulators: Daminozide is effective for Glamour plug height control. Two applications of daminozide 2,500 to 5,000 ppm spray (3 to 6 g/l, 85% formulation or 4 to 8 g/l, 64% formulation) starting at true leaf initial stage (early stage 3), followed by a second application 7 days later, works well for plug height control. Adding sticker to the solution may cause leaf damage.

Alternatively, a paclobutrazol sprench at 2.5 ppm (0.6 ml/l, 0.4% formulation) or a drench at 0.25 to 0.5 ppm (0.06 to 0.12 ml/l, 0.4% formulation) at radicle emergence stage has been shown effective to control hypocotyl stretch. This treatment should be followed 7 to 10 days later with a daminozide 2,500 to 5,000 ppm (3 to 6 g/l, 85% formulation or 4 to 8 g/l, 64% formulation) spray. Pinching: Not recommended.

Note: Do not grow plugs at temperatures below 62°F (16°C) as it could cause leaves to yellow and drop.

Growing On to Finish

Transplanting: Euphorbia Glamour plugs can be transplanted deeply to the level of the first node for stretched plugs.

Container Size

1801 pack, 4 to 5-in (10 to 13-cm), quart pot (12-cm) and 6-in (15-cm) pot: 1 plug per pot

Gallon (18-cm): 2 plugs per pot

Media

Use a well-drained, disease-free growing medium with a pH of 5.8 to 6.2.

Temperature

Nights: 65 to 68°F (18 to 20°C) **Days:** 65 to 77°F (18 to 25°C) Avoid temperatures below 62°F (16°C) as cooler temperatures cause foliage yellowing. Light

Keep light as high as possible while maintaining recommended temperature.

Media Moisture

The medium should be allowed to dry between waterings. Do not allow the plants to wilt.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2.

Pinching

Pinching is not necessary.

Plant Growth Regulators

Applications of daminozide 2,500 to 5,000 ppm (3 to 6 g/l, 85% formulation or 4 to 8 g/l, 64% formulation) spray have been shown to be effective. Start the first application one week after transplant. Repeat weekly.

Alternatively: paclobutrazol drench at 1.5 to 3 ppm (0.38 to 0.75 ml/l, 0.4% formulation) at one week after transplant has also been effective at controlling vigor. One treatment may be sufficient. This works well with larger plug size transplants.

Note: It is the responsibility of the applicator to read and follow all current label directions for the specific chemical being used and to use the PGR in accordance with all laws and regulations.

Crop Scheduling Germination: 3 to 6 days

Sow to transplant (288 cell): 3 to 4 weeks Transplant to finish:

Container Size	288- cell plugs per Pot	Weeks From Transplant	Total Weeks
1801 pack	1	3-5	6-9
4-5 in. (10-13 cm), quart pot (12 cm), and 6 in. (15 cm) pot	1	4-6	7-10
1 Gallon (18 cm)	2	5-7	8-11

Common Problems

Disease: No serious problems

Glitz Euphorbia

Plug Production

Media

medium with a pH of 5.8 to 6.2. Maintain EC of about 0.75 to 0.80 mS/cm (1:2 extraction).

seed per cell, or larger cell trays at two seeds per cell. Covering the seed is optional. A light cover can help maintain high relative humidity around the seed and improve germination.

Stage 1

Germination in approximately 3 to 6 days. Move plug trays out of germination chamber as soon as radicles emerge to avoid hypocotyl stretch.

Soil temperature: 65 to 72°F (18 to 22°C)

Note: Germinates readily at temperatures of 62 to 77°F (16 to 25°C). Warmer temperatures result in faster germination.

Light: Light is optional.

Moisture: Keep soil wet (level 4) during stage 1.

Humidity: Maintain 95% or greater relative humidity (RH) until radicle emergence.

Stage 2

Soil temperatures: 65 to 72°F (18 to 22°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Maintain high moisture (level 4). Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorus.

Stage 3

Soil temperatures: 65 to 72°F (18 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Soil moisture can be reduced to level 3. Keep wet-dry moisture cycle between levels 3 and 4. Avoid seedling wilting. Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain medium pH 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

initial stage (early stage 3), followed by a

solution may cause leaf damage.

Alternatively, a Paclobutrazol (Bonzi,

sprench or 0.25 to 0.5 ppm (0.06 to 0.12

should be followed 7 to 14 days later

Pinching: Not recommended.

ml/l, 0.4% formulation) drench at radicle

with a Daminozide 2,500 ppm (3 g/l, 85%)

formulation or 4 to 8 g/l, 64% formulation)

Note: Do not grow plugs at temperatures

below 62°F (16°C) as it could cause leaves to

emergence stage has been shown effective

to control hypocotyl stretch. This treatment

second application 7 days later, works well

for plug height control. Adding sticker to the

Piccolo) 2.5 ppm (0.6ml/l, 0.4% formulation)

Stage 4

spray.

yellow and drop.

Soil temperatures: 65 to 72°F (18 to 22°C) Light: Up to 5,000 f.c. (54,000 Lux). Moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not

	Pot	manspiant	WEEKS	allow the seedlings to wilt.
	1	3-5	6-9	Fertilizer: Same as stage 3.
n), n),)	1	4-6	7-10	Growth Regulators: Daminozide (B-Nine, Alar) is effective for Glitz plug height control. Two applications of Daminozide 2,500 ppm (3 g/l, 85% formulation or 4 g/l,
1	2	57	9 11	64% formulation) spray starting at true leaf

Insect: Thrips, Aphids, Spider Mites

Use a well-drained, disease-free seedling

Sowing

Can be produced in a 288-cell tray at one

Growing On to Finish

Media

Light

Temperature

Media Moisture

Fertilizer

Transplanting: Euphorbia Glitz plugs can be transplanted deeply to the level of the first node for stretched plugs.

Container Size

4 to 5-in. (10 to 13-cm), quart pot (12-cm): 1 plug per pot

6-in. (15-cm) pot: 2 plugs per pot

10-in. (25-cm) HB: 3 plugs per pot

medium with a pH of 5.8 to 6.2.

Nights: 65 to 68°F (18 to 20°C)

Days: 65 to 77°F (18 to 25°C)

Use a well-drained, disease-free growing

Avoid temperatures below 62°F (16°C) as

maintaining recommended temperature.

The medium should be allowed to dry between

waterings. Do not allow the plants to wilt.

Keep light as high as possible while

cooler temperatures cause foliage yellowing.

Sowing

Plug tray size: Can be produced in a 288 cell tray (European size: 264) or a similar size plug tray. Cover the seed with vermiculite. **Stage 1** – Germination takes approximately

4 to 6 days. to 22°C) Light: Light is optional. wet (level 4) during germination.

Stage 2

penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

to read and follow all current label directions for the specific chemical being used and to use the PGR in accordance with all laws and regulations.

Crop Scheduling

Germination: 3 to 6 days Sow to transplant (288 cell): 4 to 5 weeks Transplant to finish:

Container Size	288-cell plugs per pot	Weeks From Transplant	Total Weeks*
4-5 in. (10-13 cm) quart pot	1	5-8	9-13
6 in. (15 cm) pot to 1 gallon	2	5-8	9-13
10 in. (25 cm) basket	3	6-8	10-13

Common Problems

Insect: Thrips, Aphids, Spider Mites **Disease:** No serious problems

Plug Production Media

Growing On to Finish

Use a well-drained, disease-free soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus. Maintain

the media EC at 1.5 to 2.0 mS/cm at pH at 5.8 to 6.2. Pinching

Pinching is not necessary.

Plant Growth Regulators

Applications of Daminozide (B-Nine/Alar) 2,500-5,000 ppm (3 to 6 g/l, 85% formulation or 4 to 8 g/l, 64% formulation) spray have been shown to be effective. Start the first application one week after transplant. Repeat as needed.

Note: It is the responsibility of the applicator

Stage 4 **Temperature:** 65 to 67°F (18 to 19°C) **Light:** Can be up to 5,000 f.c. (54,000 Lux) Media moisture: Maintain wet/dry cycle. Do not allow the seedlings to wilt. **Fertilizer:** Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: Not needed.

Media

PanAmerican Seed

Festina Festuca

Use a well-drained, disease-free soilless media with a pH of 5.5-6.2 and an EC of 0.75 mmhos/cm (2:1 extraction).

Germination temperature: 64 to 72°F (18

Media moisture: Keep the media medium Relative humidity: Maintain 85 to 90% relative humidity until cotyledons emerge.

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Reduce soil moisture slightly (level 3) to allow the roots to

Temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Nights: 64 to 66°F (18 to 19°C)

Days: 66 to 74°F (19 to 23°C)

Plants can be grown under temperatures as low as 50°F (10°C) but the crop time will increase significantly.

Light

As high as possible.

Irrigation

Grow plant on the dry side. Do not keep media too wet as it may cause root rot or lean and lanky stems.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus.

Growth Regulators

Not needed.

Pinching

Not needed.

Container Size

306 premium pack: 1 plug per cell 2.5-in. (6-cm) pot: 1 plug per pot 4-in. (10-cm) pot: 1 plug per pot 6-in. (15-cm) pot: 3 plugs (space out) per pot 1-gallon (18-cm) pot: 3 plugs (space out)

per pot

Crop Scheduling

Sow to transplant (288/264-cell plug tray): 6 to 7 weeks

Transplant to saleable size (from 288 cell):

Container Size	Plants per Pot/ Basket	Weeks From Transplant	Total Weeks
306 premium pack	1	6-7	12-14
2.5 in. (6 cm) pot	1	5-6	11-13
4-4.5 in. (10-11 cm) pot	1	6-7	12-14
6-6.5 in. (15-16 cm) pot	3	7-8	13-15
Gallon	3	7-8	13-15

Common Problems

Insect: No serious problems Disease: Root Rot when grown too wet

Fuseables® Bacopa

Plug Production Media

Use a well-drained, disease-free plug media with a pH range of 5.5 to 6.0, and EC less than 0.75 mS/cm (2:1 extraction).

Plug Trav Size

Can be produced in a 288, 105/128, 72 liner

Sowing

Do not cover the multi-seed pellets with vermiculite at sowing, and make sure to pass the plug trays through the misting/watering tunnel after sowing, as this will help in faster dissolution/breakdown of the pellet.

Fuseables[®] Bacopa continued

Stage 1 - Germination takes approximately 4 days. Germination temperature: 68 to 73°F (20 to 23°C)

Light: Required during germination (10 f.c./100 Lux or more)

Media moisture: Keep the media medium wet (level 4) during germination. Relative humidity: Maintain 95 to 97%

relative humidity until cotyledons emerge.

Stage 2

Soil temperature: 68 to 70°F (20 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux) during Stage 2 & 3.

Media moisture: Keep the media medium (level 3) to medium wet (level 4) during Stages 2 and 3.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Growth Regulators: Generally PGRs are not required during plug production if plants are shipped/transplanted on time.

Under Northern European conditions, foliar sprays of B-Nine/Alar (daminozide) at 640 to 950 ppm (1 to 1.5g/l of 64% formulation or 0.75 to 1.15 g/l 85% formulation) worked well in toning the plugs.

Stage 4

Soil temperature: 59 to 65°F (15 to 18°C) **Light:** Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained.

Media moisture: Keep the media medium (level 3) wet. Do not let the seedlings wilt, as they will not recover favorably. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

6-in. (15 cm) pots: 1 plug per pot 10-in. (25-cm) to 12-in. (30-cm) color bowl or baskets: 3-4 plugs per color bowl or basket Media

98

Use a well-drained, disease-free media with a pH of 5.8 to 6.2, and a medium initial nutrient charge.

Temperature

Nights: 55 to 60°F (13 to 16°C) **Days:** 59 to 76°F (15 to 24°C) Utopia can be grown as low as 50°F (10°C), but the crop time will be longer.

Light

Keep light levels as high as possible while maintaining appropriate temperatures.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrateform fertilizer with low phosphorus. If needed, a balanced ammonium and nitrate form fertilizer may be used as needed to encourage growth and balance the media pH. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.8 to 6.2.

Irrigation

Do not let the plants wilt as this will result in flower/bud drop.

Plant Growth Regulators

In North American conditions: It is not necessary when grown under cool temperatures with high light conditions. In warmer conditions, if needed, one application of B-Nine/Alar (daminozide) at 1,000 -1,500 ppm (1.2-1.8 g/l 85% formulation or 1.5-2.3 g/l 64% formulation) spray at 2 weeks after transplant works well.

In Northern European conditions: Can use foliar sprays of B-Nine/Alar (daminozide) at 2,500 ppm (2.9 g/l 85% formulation or 3.9 g/l 64% formulation), and if necessary can follow-up with Cycocel (chlormequat) at 375 ppm (0.5ml/l 75% or 3.1ml/l 11.8% formulation).

Crop Scheduling Sow to transplant: 288 cells: 4 week 105/128 cells: 5 weeks 72 cells: 5 to 6 weeks

Transplant to flower: 6-7 weeks from **288 cells**

5-6 weeks from **105/128 cells** 4-5 weeks from 72 cells

Container Size	Number of Plants	Total Crop Time (Weeks)
6 in. (15 cm) pots	1-3	9-11
10 in. (25 cm) color bowl or basket	3-4	10-12
12 in. (30 cm) color bowl or basket	4-5	10-12

Insect: White Flies

Fuseables[®] Coleus

Plug Production Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 5.8 and a medium initial nutrient charge (EC 0.75 mS/cm).

Sowing

Sow seed in 288, 105/128 or larger plug trays (recommend 105/128 or larger). Dipple plug tray first. Sow seed to the center. Cover lightly with vermiculite. Water adequately after sowing to completely dissolve the pellet.

Stage 1 – Germination takes 4 to 5 days. Soil temperature: 71 to 76°F (22 to 24°C) Light: Light is not necessary.

Moisture: Keep media evenly moist (level 4), but not saturated.

Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge.

Note: Fuseables Coleus is very sensitive to high salts - particularly high ammonium during germination. Keep ammonium levels less than 10 ppm.

Stage 2

Soil temperature: 71 to 73°F (22 to 23°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous. Alternate feed with clear water. Feed between 2 to 3 clear irrigations. Irrigate early in the day so foliage is dry by nightfall to prevent diseases. Keep soil pH at 5.5 to 6.2 and EC less than 1.0 mS/cm.

Stage 3

Soil temperature: 68 to 70°F (20 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering but avoid excessive wilting to promote root growth and control shoot growth. Keep the moisture to wet-dry cycle (moisture level 4 to 2).

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain soil pH at 5.5 to 5.8 and EC less than 1.0 mS/ cm (1:2 extraction).

Growth Regulators: Generally not needed. The competition among the multiple seedlings in each plug cell will provide natural growth control. If necessary, A-Rest, B-Nine and Bonzi are effective on coleus. Always follow label recommendations. Use temperature differential (DIF) whenever possible, especially the first 2 hours after sunrise, to control plant height.

Stage 4

Soil temperature: 59 to 64°F (15 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

6 to 8-in. (15 to 20-cm) pots: 1 plug per pot 10-in. (25-cm) to 12-in. (30-cm) color bowl or baskets: 3 to 5 plugs per color bowl or basket

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.0 and a medium initial nutrient charge (EC 0.75 mS/cm).

Temperature

Nights: 59 to 64°F (15 to 18°C) **Days:** 65 to 76°F (18 to 24°C)

Light Provide shade if over 5,000 f.c. (53,800 Lux).

Irrigation

Avoid both excessive watering and drought.

Fertilizer

Fuseables Coleus is a low to moderate feeder. Excessive feed can lead to dull coloration and lush growth. Apply fertilizer at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm) using predominantly nitrate-form fertilizer with low phosphorus and high potassium. Maintain medium electrical conductivity around 1.0 mS/cm (using 1:2 extraction).

Growth Regulators

Control plant growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid stem elongation. Fuseables Coleus is responsive to day/night DIF and is shorter with a negative DIF.

B-Nine/Alar (daminozide) 2,500 to 5,000 ppm (3.0 to 6.0 g/l 85% formulation or 4.0 to 8.0 g/l of 64% formulation) can be applied at 2 to 3 weeks after transplanting. Repeat if necessary.

Pinching

Not necessary. Spacing

Space plants when foliage is touching.

Crop Scheduling Sow to transplant: 288 cell plug: 4 weeks **105/128 cell plug:** 5 to 6 weeks Transplant to finish: 5 to 7 weeks

Total Crop Time:

Container Size	Plants Per Pot / Basket	Spring (Weeks)	Summer (Weeks)
6-8 in. (15-20 cm) pot	1	10-12	9-10
10 in. (25 cm) color bowl or basket	1-3	11-13	10-12
12 in. (30 cm) color bowl or basket	4-5	11-13	10-12

Insect: Aphids, Mealy Bugs, White Flies Disease: Alternaria, Botrytis, Verticillium

Plug Production

Media

Sowing

7 to 8 days. (22 to 24°C) Light: Light is optional. wet (level 4) during germination.

Stage 2

during Stages. penetrate into the media. (1:2 extraction). Stage 3

Temperature: 68 to 70°F (20 to 21°C). Light: Can be up to 2,500 f.c. (26,900 Lux) Media moisture: Moisture level can be reduced from medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4 Temperature: 65 to 67°F (18 to 19°C). **Light:** Can be up to 5,000 f.c. (54,000 Lux) Media moisture: Maintain wet/dry cycle. Do not allow the seedlings to wilt. **Fertilizer:** Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: Not needed.

Common Problems

Disease: None

Common Problems

Fuseables[®] Juncus

Use a well-drained, disease-free soiless media with a pH of 5.8-6.2 and an EC of 0.75 mmhos/cm (2:1 extraction).

Plug tray size: Can be produced in a 288, 128, 72 liner (European size: 264) or a similar size plug tray. Do not cover pellets.

Stage 1 – Germination takes approximately

Germination temperature: 71 to 76°F

Media moisture: Keep the media medium

Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Temperature: 68 to 70°F (20 to 21°C). Light: Can be up to 2,500 f.c. (26,900 Lux)

Media moisture: Reduce soil moisture slightly (level 3) to allow the roots to

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm

Growing On to Finish

Media

Use a well-drained, disease-free soiless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 59 to 64°F (15 to 17°C). **Davs:** 62 to 73°F (16 to 22°C). Plants can be grown under temperatures as low as 50°F (10°C) but the crop time will increase significantly.

Light

As high as possible while maintaining moderate temperature.

Irrigation

Keep media moist. Avoid growing dry as this will cause yellowing of Juncus effusus spiralis. Can be grown under saturated conditions.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week from nitrate-form fertilizer with low phosphorus. Avoid using excessive ammonia nitrogen-form fertilizers and overfeeding, as these will result in less upright plants. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.5 to 6.2.

Growth Regulators

PGRs are not needed.

Pinching

Pinching is not needed.

Container Size

306 premium pack: 1 plug per cell 2.5-in. (6-cm) pot: 1 plug per pot 4-in. (10-cm) pot: 1 plug per pot 6-in. (15-cm) pot: 1 to 3 plugs per pot 1-gallon (18-cm) pot: 1 to 3 plugs per pot

Crop Scheduling

Sow to transplant: **288/264-cell plug tray:** 7 to 8 weeks 128/105, 72-cell plug tray: 8 to 9 weeks

Transplant to saleable size (from 288 cell):

Container Size	Plants Per Pot / Basket	Weeks From Transplant	Total Weeks
306 premium pack	1	6-7	13-15
2.5 in. (6 cm) pot	1	5-6	12-13
4-4.5 in. (10-11 cm) pot	1	7-8	14-16
6-6.5 in. (15-16 cm) pot	3	7-8	14-16
Gallon	3	7-8	14-16

Note: Add 2 more weeks to the crop time when planting 1 plug per 6-in. (16-cm) and gallon (18-cm) container.

Common Problems

Insect: No serious problems Disease: No serious problems

Fuseables[®] **Multi-Species** (Petunia x Bacopa)

Plug Production

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and an EC of 0.75 mS/cm (1:2 extraction).

Sowing

Can be produced in a 288, 105/128, 72 liner, but recommend 105/128 cells or larger. Do not cover the seed. Water adequately after sowing to completely dissolve the pellet.

Stage 1 – Germination takes approximately 4 days.

Germination temperature: 71 to 76°F (22 to 24°C).

Light: Lighting is beneficial.

Media moisture: Keep soil very wet (level 5) during Stage 1 for optimal germination. Relative humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2

Temperature: 68 to 76°F (20 to 24°C). Light: Up to 2,500 f.c. (26,900 Lux). Media moisture: Start to slightly reduce soil moisture (level 4) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Temperature: 65 to 70°F (18 to 21°C). **Light:** Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture to wet-dry cycle (moisture level 4 to 2). Fertilizer: Increase the fertilizer level to rate 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/ cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain a media pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: If possible, try to grow Multi-Species Fuseables Petunia x Bacopa plugs without any PGRs. The competition amongst the multiple seedlings in each plug cell will provide natural growth control and also cooler temperatures during stage 4 will provide natural toning of the plugs.

If PGRs are needed, use Bonzi (paclobutrazol) 2 to 5 ppm (0.5 to 1.3 ml/l, 0.4% formulation) foliar sprays. Avoid using B-Nine at rates higher than 1000 ppm for growth control during the plug stage as it could stunt bacopa and result in spreading petunia dominating the plug cell.

Stage 4

Temperature: 59 to 64°F (15 to 18°C). Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Media moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

6 to 8-in. (15 to 20-cm) pots: 1 plug per pot 10 to 12-in. (25 to 30-cm) color bowls or **baskets:** 3 plugs per color bowl or basket

Media

Use a well-drained, disease-free soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 56 to 64°F (13 to 18°C).

Days: 62 to 76°F (17 to 24°C). Fuseables Multi-Species Petunia x Bacopa can be grown at temperatures as low as 35°F (2°C). Crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Plants will take longer to flower when grown under cooler conditions.

Light

Keep light levels as high as possible while maintaining moderate temperatures.

Fertilizer

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N (1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and to balance media pH. Maintain media pH 5.8 to 6.2.

For constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7-1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Bonzi (paclobutrazol) drench about 2-4 ppm (0.5 to 1.0 ml/l, 0.4% formulation) works well for Fuseables Multi-Species Petunia x Bacopa plant size control. Drench can be done when foliage is close to reaching the edge of the container.

Do not use B-Nine/Alar (daminozide) at rates higher than 1000 ppm or Topflor (flurprimidol) as they will stunt bacopa. To determine the best rate for your conditions, we recommend that you run an in-house trial.

Photoperiod

Bacopa is not sensitive to daylength, but Easy Wave[®] petunias are slightly sensitive to daylength. All varieties of Easy Wave can flower successfully at 10 hours daylength with crop time delay of a couple of days depending on the Easy Wave petunia varieties compared to the long day conditions.

Crop Scheduling Sow to transplant: 288-cell plug tray: 4 weeks 105/128-cell plug tray: 5 weeks 72-cell plug tray: 5 to 6 weeks Transplant to flower: 6-7 weeks from 288 cells 5-6 weeks from 105/128 cells 4-5 weeks from 72 cells

Total Crop Time:

Container Size	Plugs Per Pot / Basket	Spring (weeks)	Summer (weeks)
6-8 in. (15-20 cm) pot	1	8-11	7-9
10 in. (25 cm) color bowl or basket	1-3	10-12	8-10
12 in. (30 cm) color bowl	4	10-12	8-10

Common Problems

No major problems will occur if good cultural and IPM practices are used.

Fuseables[®] Petunia

Plug Production

Media

or basket

Use a well-drained, disease-free media with a pH of 5.5 to 6.0 and an EC of 0.75 mS/cm (1:2 extraction).

Sowing

Can be produced in a 288, 105/128, 72 liner size plug tray, but recommend 105/128 cells or larger. Do not cover the seed. Water adequately after sowing to completely dissolve the pellet.

Stage 1 – Germination takes approximately 4 days.

Germination temperature: 72 to 76°F (22 to 24°C).

Light: Lighting is beneficial.

Media moisture: Keep soil very wet (level 5) during Stage 1 for optimal germination. Relative humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2

Temperature: 68 to 75°F (20 to 24°C). Light: Up to 2,500 f.c. (26,900 Lux). Media moisture: Start to slightly reduce soil moisture (level 4) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Temperature: 65 to 70°F (18 to 21°C). Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture to wet-dry cycle (moisture level 4 to 2). **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain a media pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: If possible, try to grow Petunia Fuseables plugs without any PGRs. The competition amongst the multiple seedlings in each plug cell will provide natural growth control and cooler temperatures during stage 4 will provide natural toning of the plugs.

In North American conditions: If PGRs are needed, apply B-Nine/Alar (daminozide) 1 to 2 applications at 5,000 ppm (6.0 g/l, 85% formulation or 7.8 g/l, 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants.

In Northern European conditions: 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) spray has been tested and shown effective if needed.

Stage 4

Temperature: 60 to 65°F (16 to 18°C). Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Media moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 6 to 8-in. (15 to 20-cm) pots: 1 plug per pot 10 to 12-in. (25 to 30-cm) color bowls or **baskets:** 3 plugs per color bowl or basket Media

Use a well-drained, disease-free soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 57 to 65°F (14 to 18°C). **Days:** 61 to 75°F (16 to 24°C). Fuseables Petunia can be grown at temperatures as low as 50°F (10°C). Crop timing (time to flower) is related to average temperature when grown under proper daylength. Plants will take longer to flower when grown under cooler conditions.

Light

Keep light levels as high as possible while maintaining moderate temperatures.

color bowl or basket **Common Problems**

100 630 231-1400 panamseed.com

Fertilizer

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and to balance media pH. Maintain media pH 5.8 to 6.2. For constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7-1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Use B-Nine/Alar (daminozide) at 5,000 ppm (5.9 g/l, 85% formulation or 7.8 g/l, 64% formulation) at 7 days after transplant followed by a Bonzi (paclobutrazol) 2-4 ppm (0.5 to 1.0 ml/l, 0.4% formulation) drench a week later or just use the same PGR regime as that for standard grandiflora petunias or spreading petunias.

Note: Pleasantly Blue responds better to a B-Nine spray than it does to a Bonzi spray or drench, so for this particular Fuseables, the use of B-Nine is preferred.

To determine the best rate for your conditions, we recommend that you run an in-house trial.

Photoperiod

Fuseables Petunias are slightly sensitive to daylength. All varieties can flower successfully at 10 hours daylength with crop time delay of about 3 to 6 days compared to that under long day conditions.

Crop Scheduling Sow to transplant: 288-cell plug tray: 4 weeks 105/128-cell plug tray: 5 weeks 72-cell trav: 5 to 6 weeks Transplant to flower: 6-7 weeks from 288 cells 5-6 weeks from 105/128 cells 4-5 weeks from 72 cells

Total Crop Time: Container Size

6-8 in.

(15-20 cm) pot

10 in. (25 cm)

12 in. (30 cm)

color bowl

or basket

Plugs Per Pot / Basket	Spring (weeks)	Summer (weeks)
1	9-11	7-9
1-3	10-12	8-10
4	10-12	8-10

No major problems will occur if good cultural and IPM practices are used.

For Mesa Series Gaillardia, see pg 151

Fireworks Gomphrena

Plug Production

Media

Use a well-drained, disease-free media with a pH range of 5.8 to 6.2, and EC less than 0.75mS/cm (2:1 extraction).

Sowing

Can be produced in a 406, 288 (European size; 264) or a similar size plug tray with 1 seed per cell. Cover the seed with vermiculite.

Stage 1 – Germination takes approximately 2 to 3 days.

Germination temperature: 68 to 75°F (20 to 24°C).

Light: Light is required for germination. Media moisture: Keep the media medium wet (level 4) during germination.

Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge. Avoid excess humidity later on in the plug production, as this will create conditions favorable for disease incidence.

Stage 2

Temperature: 72°F (22°C) days; 68°F (20°C) nights.

Light: Can be up to 2,500 f.c. (26,900 Lux) during Stages 2 and 3.

Media Moisture: Keep the media medium (level 3) to medium wet (level 4) during Stage 2.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 72°F (22°C) days; 68°F (20°C) nights.

Light: Can be up to 5,000 f.c. (54,000 Lux) while maintaining temperatures.

Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 68°F (20°C) days; 64°F (18°C) nights.

Light: Can be up to 5,000 f.c. (54,000 Lux) while maintaining temperatures.

Fireworks Gomphrena continued

Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Keep the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Growth Regulators: Generally not required in young plant stage. If needed, young plants react well to B-Nine/Alar.

Growing On to Finish

Media

Use a well-drained, disease-free soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 63° to 66°F (17° to 19°C) **Days:** 65 to 75°F (18 to 25°C) Gomphrena can be grown under moderate to cooler temperature conditions (50°F/10°C minimum); however, crop time increases.

Light

Light level should be as high as possible while maintaining proper temperature.

Irrigation

Avoid both excessive watering and drought.

Fertilization

Apply fertilizer at rate 4 (225 to 300 ppm N/1.5 to 2 mS/cm EC) once a week from a nitrate-form fertilizer with low phosphorus. A balanced ammonium and nitrate-form fertilizer may be applied as needed. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2.

For constant fertilizer program, can apply fertilizer at rate 3 (175 to 225 ppm N or 1.2 to 1.5 mS/cm) while maintaining the above recommended EC and pH ranges.

Plant Growth Regulators

High light levels, spacing on time and cooler temperatures will keep plants from stretching. However, gomphrena does stretch quite easily after transplant, therefore PGRs are necessary to maintain acceptable plant height.

North American conditions: Apply Bonzi 4 to 10 ppm (1 to 2.5 ml/l) drench about 2 to 3 weeks after transplant. The exact rate depends on circumstances. In the PanAmerican Seed Santa Paula, California facility, a 4 to 6 ppm (1 to 1.5 ml/l) Bonzi drench was sufficient.

Northwestern European conditions: In the PanAmerican Seed Rijsenhout, Holland facility, a 4 to 6 ppm (1 to 1.5 ml/l) Bonzi drench was sufficient.

A Bonzi spray is less efficient and needs to be repeated several times.

Under all conditions Bonzi sprays can be used after the drench to maintain plant structure.

Fireworks gomphrena plant response to PGRs is variable with container size and different environmental conditions. We recommend that you run an in-house trial to determine the best rate or method for your conditions.

Pinching

Pinching is not required.

Container Size

Gomphrena can be produced in 5-in. (13-cm) pots with 1 plant per pot or in 1-gallon (18 to 19-cm) containers with 2 to 3 plants per pot.

Crop Scheduling

Sow to transplant (400 or 288/264-cell plug tray): 5 to 6 weeks.

Transplant to finish: 8 to 9 weeks at recommended temperatures/conditions. If grown under moderate conditions, crop time can be up to 10 to 12 weeks.

Common Problems

No major problems when using good culture and IPM practices.

Mahogany Splendor Hibiscus

Plug Production

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm with a 1:2 extraction).

Sowing

Plug tray size: Sow one seed per cell in 200 or larger. EU: 128-84 cell plug tray. Cover heavily with plug media or vermiculite to prevent seedlings from tipping over.

Stage 1 – Germination takes 2 to 3 days. Germination temperature: 71 to 76°F (21 to 24°C). Germination can also be done under cooler temperature like 65°F (18°C) with one day longer in germination chamber. Light: Light is not required for germination. Media moisture: Keep the media medium wet (level 4) during germination. Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Soil temperature: 68 to 73°F (20 to 23°C) **Light:** Up to 2500 f.c. (26,900 Lux) Media moisture: Keep the media medium wet (level 4) to medium (level 3) during stage 2.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate form fertilizer with low phosphorous.

Stage 3

Soil temperature: 68 to 73°F (20 to 22°C) Light: Up to 5000 f.c. (54,000 Lux). Media moisture: Keep media medium wet to medium (level 4 to 3). Do not allow the seedlings to wilt.

Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Growth Regulators: Treat plugs with tank mix of B-Nine/Alar 2500 ppm (3.9 g/l 64% formulation or 2.9 g/l 85% formulation) and CCC 300 ppm (0.4 ml/l 75% formulation or 0.7 ml/l 46% formulation) foliar spray. Northwestern Europe: Treat plugs with tank mix of Alar/B-Nine 1250 ppm (2.0 g/l 64% formulation or 1.7 g/l 85% formulation) and Cycocel 300 ppm (0.4 ml/l 75% formulation or 0.7 ml/l 46% formulation) foliar spray.

Stage 4

Soil temperature: 65 to 70°F (18 to 21°C) Light: 5,000 f.c. (54,000 Lux) Media moisture: Moisture level can be reduced to medium dry (level 3). Fertilizer: Same as stage 3.

Growing On To Finish Media

Use a well-drained, disease-free, soilless medium with a pH of 5.8 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 62 to 67°F (17 to 19°C) **Days:** 65 to 70°F (18 to 21°C)

Light

Keep light levels as high as possible.

Photoperiod

It is a foliage plant. But plant could flower when grown under 12 hours day length or shorter. When day length is longer than 12 hours, flower initiation will be significantly delayed or will never occur.

Irrigation

Keep media uniform moisture. Plants can tolerate saturated moisture.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrateform fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.8 to 6.2.

Growth Regulators

PGR plus pinch (see below) will make a bushy, compact plant with dark purple foliage.

A tank mix of B-Nine/Alar 2500 ppm (3.9 g/l 64% formulation, 2.9 g/l 85% formulation) and Cycocel 750-1000 (1.0-1.3 ml/l 75% formulation, 6.4-8.5 ml/l 11.8% formulation) dependent on temperature can be applied every other week starting at 2 weeks after transplant.

In Northwest Europe, the Cycocel rate should start with 350 ppm (0.5 ml/l 75% formulation, 3.0 ml/l 11.8% formulation), and increase as plant mature but do not go higher than 750 ppm (1.0 ml/l 75% formulation, 6.4 ml/l 11.8% formulation). Bonzi spray can be used as a substitute for the tank mix B-Nine / Cycocel. Start with 5-10 ppm (1.3-2.5 ml/l 0.4% formulation) dependent on temperature. Repeat as needed and the rate can go up to 10-15 ppm (2.5-3.8 ml/l 0.4% formulation).

For growers in warmer climates, a Bonzi drench at 1ppm (0.25 ml/l 0.4% formulation) also works very well.

Pinching

A soft pinch will promote development of branches. The pinch can be done when plants have developed 6-7 leaf stage to leave 5-6 leaves, which is about 2 weeks after transplant. Do not pinch too hard as it may result in open center habit.

Crop Scheduling

Sow to transplant (200 cell plug tray): 2 to 3 weeks

Container Size	Plants Per Pot / Basket	Weeks From Transplant	Total Weeks
4.5 in. quart (10-12 cm) pot	1	5-6	9-10
6 in. (15) pot	1	6-7	9-11
Gallon or 8 in. (19 cm) pot	1	6-8	10-11

Common Problems Watch for Thrips.

Impreza[®] Series Impatiens

Plug Production

Stage 1 – Time of radicle emergence

- (3 to 5 days) • Keep media very moist and near saturation.
- Do not cover or bury the seed.
- Germination temperature: 72 to 76°F
- (22 to 24°C).

• Light levels at 100 to 400 f.c. (1,000 to 4,000 Lux) will enhance germination.

• Fertilize with 14-0-14 or calcium/potassium nitrate feed at 100 to 150 ppm N as needed. **Note:** Impatiens require low to moderate feed levels. Excessive amounts will result in lush, vegetative stretched plugs.

102

- than 10 ppm. germination. (10 days)
- germination and rooting. to 24°C).
- time.

irrigation.

be used.

Container Size	Plants Per Pot / Basket	Weeks From Transplant	Total Weeks
I.5 in. quart 10-12 cm) pot	1	5-6	9-10
5 in. (15) pot	1	6-7	9-11
Gallon or 8 in. 19 cm) pot	1	6-8	10-11

• Keep soil pH at 6.0 to 6.2 and soluble salts (EC) less than 0.75 mmhos/cm (2:1 extraction). Keep ammonium levels less

• Impatiens are sensitive to high salts during

Stage 2 - Stem and cotyledon emergence

• Reduce moisture levels once radicle emergence occurs. Allow the soil to dry out slightly before watering for best

• Soil temperature should be 72 to 75°F (22

• Light at 450 to 700 f.c. (4,500 to 7,000 Lux) using supplemental HID lights for two weeks after cotyledons have expanded (12 to 18 hours/day) to decrease plug crop

• Maintain ammonium levels at less than 10 ppm and soil pH at 6.0 to 6.2 with an EC of less than 1.0 mmhos/cm.

• Begin fertilizing with 50 to 75 ppm N from 14-0-14 or a calcium/potassium nitrate feed once cotyledons are fully expanded. • Alternate feed with 2 to 3 clear water

Stage 3 – Growth and development of true leaves (14 to 21 days)

• Allow the soil to dry out thoroughly

between irrigations, but avoid severe wilting to promote root growth and control shoot growth.

• Soil temperature should be between 68 to 72°F (20 to 22°C).

• Maintain soil pH 6.0 to 6.2 and EC less than 1.0 mmhos/cm.

• Increase feed to 100 to 150 ppm N from 20-0-20 alternating with 14-0-14 or other calcium/potassium nitrate fertilizer.

• Fertilize every 2 to 3 irrigations.

• Use DIF (temperature differential)

whenever possible to control plant height - especially the first 2 hours after sunrise. A-Rest, B-Nine, Bonzi or Sumagic can also

• In plugs, Impreza impatiens should respond to PGRs like other Impatiens walleriana.

Stage 4 – Plants ready for transplanting or shipping (7 days)

• Soil should still be allowed to dry thoroughly. • Temperature should be maintained at 62 to 65°F (17 to 18°C).

• Keep soil pH at 6.0 to 6.2 and EC less than 0.75 mmhos/cm.

Growing On to Finish

Temperature

Nights: 62 to 65 °F (17 to 18°C) **Days:** 65 to 75°F (18 to 24°C)

Light

Maintain light levels as high as possible while maintaining moderate temperatures.

Media

Use a well-drained, disease-free soilless medium with a medium initial nutrient charge and a pH of 6.2 to 6.8.

Fertilization

Fertilize every other irrigation with 15-0-15, alternating with 20-0-20 at 150 ppm nitrogen.

Maintain medium electrical conductivity around 1.0 mmhos/cm (using 1:2 extraction).

Controlling Height

Once plants are rooted to the sides of the containers, they can be allowed to wilt prior to irrigation to provide some height control. Height can also be controlled by withholding fertilizer, especially phosphorus and ammonium-form nitrogen. Impatiens are responsive to day/night DIF and are shorter with a negative DIF. B-Nine, Bonzi and Sumagic are effective for height control, but not labeled for use in all locations. Always follow label instructions. B-Nine and Bonzi can delay flowering. Impreza's differentiated plant structure

may enable growing with reduced PGR rates or frequency compared to other Impatiens walleriana. Perform trials to determine the most effective rate and frequency for your conditions and growing style.

Light

Impatiens are shade plants and should not be exposed to excessive amounts of sun. If properly hardened, impatiens can handle up to 4 hours of morning sun.

Impatiens Crop Schedule & Uses (Crop Schedule in Weeks)

· 1	,	
Sow to Transplant (406 plugs)	4 to 5 weeks	
Transplant to Flower (4-in./10-cm pot or 36 tray)	5 to 6 weeks	

Common Problems

Insect: Aphids, Thrips

Disease: Pythium, Rhizoctonia, Botrytis, TSWV/INSV (Impatiens Necrotic Spot Virus) Other: Boron deficiency, high media pH The most important disease and insect problem associated with impatiens is Impatiens Necrotic Spot Virus (INSV), which is transmitted by thrips. Control of thrips is necessary to avoid INSV.

Divine[™] Series New Guinea Impatiens

Plug Production

Media

Use a well-drained, disease-free seedling medium with a pH of 5.8 to 6.2. A pH below 5.8 may cause iron and manganese toxicity. Maintain EC of about 0.75 mS/cm (1:2 extraction).

Sowing

The recommended plug sizes are 288 to 128-cell. Water adequately after sowing. Maintain high relative humidity around the seed.

Stage 1 - Germination takes approximately 5 to 8 days, at 77 and 74°F (23 and 25°C), respectively. Keep plug tray in germination chamber until 80% radicle emergence. Soil temperature: 74 to 77°F (23 to 25°C) with 77°F (25°C) being best for emergence and uniformity. Cooler temperatures will negatively impact seed emergence and uniformity. Avoid temperatures in excess of 86°F (30°C).

Light: Light may be beneficial.

Moisture: Keep soil saturated with moisture (level 5) during Stage 1.

Humidity: Maintain 100% relative humidity (RH) during stage 1.

Stage 2

Air temperatures: 70 to 74°F (21 to 23°C) **Soil temperature:** 72°F (22°C) Light: Up to 2,500 f.c. (26,900 Lux) (DLI of 5

to 8 moles·m-2·d-1) Moisture: Maintain high moisture (cycle

between levels 3 to 4). Avoid excess moisture or wilt.

Humidity: Lower relative humidity, but maintain at a minimum of 75%, especially at night.

Fertilizer: Apply fertilizer at 50 to 75 ppm N/0.4-0.6 mS/cm EC) from nitrate-form fertilizers with low phosphorous, such as 13-2-13 or 17-5-17. Provide P at 8 to 10 ppm constantly.

Stage 3 to 4

Air temperature: 70 to 74°F (21 to 23°C) Soil temperature: 72°F (22°C)

Light: Up to 5,000 f.c. (54,000 Lux). High daily light integral (≥10 moles·m⁻²·d⁻¹) improves plug quality and reduces total crop time. Moisture: Keep wet-dry moisture cycle between levels 3 and 4. Avoid seedling wilt or excessive moisture. New Guinea impatiens cannot tolerate wilt.

Humidity: Lower relative humidity, but maintain at a minimum of 75%, especially at night.

Media Moisture

New Guinea impatiens are sensitive to over-watering. Do not use drought stress to regulate plant height as severe wilt may cause flower drop and flower bud abortion. Cycle between moisture levels 3 and 4.

Fertilizer

Fertilizer: Increase fertilizer to 50-75 ppm

N/0.5 to 0.6 mS/cm EC. Provide P at 8 to 10

ppm constantly. Maintain medium pH 5.8 to

6.2 and EC between 1.0 and 1.5 mS/cm (1:2

Growth Regulator: Negative DIF and DROP

work very well for New Guinea impatiens

height control. If necessary, Daminozide

(B-Nine, Alar) can be applied as a spray at

1,250 ppm at first true leaf, followed by rates

as high as 3,750 ppm if conditions warrant.

Paclobutrazol (Bonzi, Piccolo) spray at a low

rate (0.5 to 1 ppm) is also effective at first

Flowering may be delayed from crowded

conditions in a plug tray. Do not allow plugs

Divine New Guinea impatiens are best suited

to 306 premium packs, 1801 flats, 4-in. (10-cm)

to 6-in. (15-cm) pots and hanging baskets.

Use a well-drained, disease-free growing

medium with a pH of 5.8 to 6.2. A pH below

5.8 may cause micronutrient toxicity from

Maintain air temperature at 68 to 76°F (20

daily temperature (ADT) of 73°F (23°C).

Warmer temperatures hasten flowering,

cooler temperatures will delay flowering,

while flowers will be larger. At 85°F (29°C)

ADT, heat delay can occur in New Guinea

Divine can be grown at temperatures as low

as 57°F (14°C). However, plants will develop

increase to about 15 weeks from transplant.

very slowly and finished crop time will

Keep light as high as possible while

maintaining appropriate temperature.

Divine New Guinea impatiens are day

Keep the relative humidity above 75%,

especially at night, so that plants may

fully benefit from target greenhouse

temperatures. Relative humidity below

75% can drive plant temperature below

greenhouse air temperature.

can delay flowering.

Humidity

neutral for flowering. A high DLI of 10 to

15 moles·m-2·d-1 increases the number of

flowers and branches per plant. A lower DLI

but reduce the flower size. Likewise,

to 24°C) day and 65 to 68°F (18 to 20°C) night

from transplant to sale. Maintain an average

extraction).

true leaf stage.

Transplanting

to get root bound.

Container Size

iron and manganese.

Temperature

impatiens.

Light

Media

Growing On to Finish

New Guinea impatiens are moderate feeders. Excessive fertilizer causes leafy, lush growth and diminished flowering. Provide P at 12-15 ppm constantly. Maintain medium EC below 1.0 mS/cm. Avoid high ammonium and high phosphorus fertilizer. Selection of constant liquid feed program is dependent on local environment and can vary widely from 50 to 150 ppm N. Use a lower rate when ADT is low. Plants may benefit from occasional leaching with clear water to prevent salt accumulation. Excessive salt accumulation can cause bronzing, leaf cupping (down) and tip burn. Fertilizer rates maintaining medium EC (below 1.0 mmhos/cm) when combined with PGR applications will result in more flowers on top of the canopy.

Pinching

Due to natural branching, pinching is not required and will increase the crop time.

Plant Growth Regulators

Plant growth regulator use may be needed depending on light, temperatures, variety and container size.

In North American conditions:

1 or 2 applications of paclobutrazol (Bonzi, Piccolo) spray at 2 to 5 ppm (0.5 to 1.25 ml/l 0.4% formulation) can control height without reducing flower size. Paclobutazol drench at 0.125 to 0.25 ppm (0.03 to 0.06 ml/l, 0.4% formulation) is also effective, but may stunt less vigorous varieties (See Table 1 for vigor ratings). Start with low rates and adjust as necessary, especially for drenches. Negative DIF and DROP work well for New Guinea impatiens height control. Florel is not needed to promote branching. In North European conditions: 1 or 2

spray applications of paclobutrazol at 2 to 4 ppm (0.5 to 1.0 ml/l, 0.4% formulation) are effective. Negative DIF and DROP work well for NGI height control.

For larger containers or hanging baskets, PGRs may only be needed for vigorous varieties (see Table 1). Conduct your own trials to determine the best rate for your conditions.

Table 1. Divine series vigor rating		
Most vigor	Blue Pearl, Orange Bronze Leaf, Scarlet Bronze Leaf	
Mid vigor	Cherry Red, Lavender, Orange, Scarlet Red, White	
Least vigor	Violet Improved, Pink Improved	

Note: It is the responsibility of the applicator to read and follow all current label directions for the specific chemical being used and to use the PGR in accordance with all laws and regulations.

Crop Scheduling

Germination: 5 to 8 days; stage 1 is complete at 80% radicle emergence. Finish time for 288 or 128 plugs: 5 to 6

weeks, respectively. Weeks from transplant to flower

veeks from	transpiant	10 110	ver:
Container Size	288-cell	Spring	Autum

	Plug Per Pot		(Southeast)*
306/1801 flat	1	6-7	8-10
4-5 in. (10-12.5 cm), quart pot	1	7-8	8-10
6 in. (15 cm) pot	1-3	8-9	9-11
10 in. (25 cm) basket	3-4	8-9	9-11
12 in. (25-30 cm) basket	4-5	8-9	9-11

* Heat delay possible when ADT exceeds 86°F (30°C).

Common Problems

Insect: Thrips, Aphids, Fungus Gnats, Mites Diseases: Pythium, Rhizoctonia, Phytopththora, Botrytis, Tomato Spotted Wilt Virus, Impatiens Necrotic Spot Virus, Powdery Mildew, Myrothecium

Note: Divine New Guinea impatiens has high/standard resistance (HR) to Impatiens Downy Mildew in accordance with terminology set by the International Seed Federation.

Gemini Series Isotoma

Plug Production

Media

Use a well-drained, disease-free, media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Sowing

Sow 2 to 4 pellets per cell in 288 or larger plug tray; no cover needed. Spray preventively against damping off.

Stage 1 – Germination takes approximately 5 to 8 days.

Soil temperature: 68 to 72°F (20 to 22°C) Light: Not necessary, but beneficial. Moisture: Keep soil moist (level 4) in Stage 1 Humidity: Maintain 95 to 97% relative humidity (RH) until cotyledons emerge.

Stage 2

Soil temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Maintain soil moisture moist (level 4), to allow the roots to penetrate into the media. Don't let the media dry out.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm Nitrate/0.2 - 0.5 mmhos/cm EC) from nitrate-form fertilizers.

Soil temperature: 65 to 68°F (18 to 20°C) Light: Can be up to 2,500 f.c. (26,900 Lux). In low light area, supplemental light of 150 f.c. (1620 lux) is beneficial for reducing seedling stretching and cutting plug crop time. Moisture: Maintain the moisture level constantly medium moist to medium wet (level 3-4) Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm Nitrate/less than 0.7 mmhos/ cm EC) from nitrate-form fertilizers. Growth Regulators: Generally not needed, but if necessary B-Nine/Alar (daminozide) 1,000-1,500 ppm (1.2-1.8 g/l 85% formulation or 1.6-2.3 g/l of 64% formulation) can be used.

Stage 3

Stage 4 Soil temperature: 65 to 68°F (18 to 20°C) Light: can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm).

Temperature

Nights: 54 to 57°F (12 to 14°C) Days: 60 to 65°F (16 to 18°C) Gemini prefers to grow in cooler conditions. Warmer temperature above 70°F (21°C) could delay or inhibit flowering.

Light

Photoperiod Gemini is a facultative long-day plant with long-day enhanced flowering.

Irrigation

Fertilizer

Gemini Isotoma is a moderate feeder. Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) weekly or as needed with predominantly nitrate-form fertilizer with low phosphorus and high potassium, such as 15-5-15.

Growth Regulators Isotoma is responsive to B-Nine/Alar (daminozide) 2,500-3,250 ppm (3.0-3.9 g/l of 85% formulation or 4.0-5.0 g/l 64% formulation) at 2 weeks after transplant. If necessary, repeat the treatment a week later.

Growing On to Finish

Maintain light levels as high as possible while maintaining moderate temperature.

Maintain media constantly moist (level 2-3). Avoid letting plants dry to wilt.

Pinching Do not pinch.

Crop Scheduling

Sow to transplant (288 cell plug):

4 to 5 weeks

Transplant to flower:

Container Size	Plants Per Pot	Weeks From Transplant	Total Weeks
4 in. (10.5 cm)	1	9-11	13-16
5 in. (13 cm)	1	10-12	14-17
Gallon (19 cm)	3	10-11	14-16

Under proper temperature ranges

Common Problems

Insect: Aphids, Thrips, Spider Mites, Sciara (in young plant stage)

Disease: Pythium, Botrytis

Starhead Juncus

Plug Production

Media

Use a well-drained, disease-free media with a pH range of 5.8 to 6.2, and EC of 0.75mS/cm (2:1 extraction).

Sowing

Plug tray size: Use 288-cell plug tray or larger cell. Do not cover the seeds.

Stage 1 – Germination takes approximately 7 to 10 days.

Germination temperature: 64 to 72°F (18 to 22°C).

Light: Optional.

Media moisture: Keep soil moist (level 4) for optimal germination.

Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 64 to 79°F (18 to 26°C). Light: Up to 2,500 f.c. (26,900 Lux). Moisture: Once the plug trays come out of the germination chamber, reduce soil moisture slightly from level 4 to 3 to allow the roots to penetrate into the soil. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 64 to 72°F (18 to 22°C) Light: Can go up 2,500 f.c. (26,900 Lux). Moisture: Keep the media moisture medium and medium dry (level 3 to 2). Allow the media to dry until the surface becomes light brown (level 2) before watering but do not allow the seedlings to wilt.

Starhead Juncus continued

Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 61 to 64°F (16 to 18°C) Light: Can be up to 5,000 f.c. (54,000 Lux) if temperatures can be maintained. Moisture: Maintain moisture condition level

3 to 2.

Fertilizer: Maintain the fertilizer rate to 2. Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Check for powdery mildew from this stage onwards. Growth Regulators: Not required.

Growing On to Finish

Media

Use a well-drained, disease-free soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 64 to 66°F (18 to 19°C) **Days:** 66 to 74°F (19 to 23°C) Can also be grown in cooler temperatures; however, plants will grow more slowly.

Light

Keep light levels as high as possible while maintaining moderate temperatures. Starhead juncus can tolerate light shade.

Irrigation

Keep media moisture medium wet to medium (level 4-3). Avoid growing in dry media as this will cause yellowing on the tip of shoots. Can be grown under saturated conditions.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week with nitrate-form fertilizer with low phosphorus. Avoid using excessive ammonia nitrogen-form fertilizers and overfeeding, as these will result in less upright plants. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.5 to 6.2.

Growth Regulators

Not needed.

Crop Scheduling

Sow to transplant 288-cell plug tray or larger: 6 to 7 weeks

Transplant to saleable size (from 288 cell):

Container Size	Plants Per Pot / Basket	Weeks From Transplant	Total Weeks
306-cell pack	1 plant per cell	7-8	13-15
4-4.5 in. (10-11 cm)	1 plant per pot	7-8	13-15
6-6.5 in. (15-16 cm) Gallon (18 cm)	3 plants per pot	8-9	14-16

Common Problems Insect: No serious problems **Disease:** No serious problems

Jealousy Leycesteria

Plug Production

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm with a 1:2 extraction).

Sowing

Plug tray size 288 or larger. Cover lightly with vermiculite.

Stage 1 - Germination takes 9 to 12 days. **Soil temperature:** 65 to 70°F (18 to 21°C) Light: 10 f.c. (100 Lux) or higher. Light is required for germination. Moisture: Keep soil moist but not saturated (level 4) during Stage 1 for optimal germination.

Humidity: Maintain 95% relative humidity (RH) until radicle emergence.

Stage 2

Soil temperature: 68 to 73°F (20 to 23°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 4) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC)

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) **Moisture:** Allow the media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture level at wet-dry cycle (moisture level 4 to 2). Do not allow the seedlings to wilt, as they do not recover very well.

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Growth Regulators: None

Stage 4

Soil temperature: 65 to 67°F (18 to 19°C) Light: Up to 5,000 f.c. (53,800 Lux) if optimal temperature can be maintained. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish Media

Use a well-drained, disease-free, soilless medium with a pH of 5.6 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 65 to 67°F (18 to 19°C)

Days: 68 to 76°F (20 to 24°C) Jealousy leycesteria can tolerate cool temperatures. However, foliage will turn purplish brown color when night temperatures are below 53°F (12°C).

Light

Keep light levels as high as possible while maintaining recommended temperatures.

Irrigation

Maintain uniform media moisture. Plants can tolerate saturated media moisture.

Fertilizer

Feed plants weekly at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) by alternating ammonium and nitrate-form fertilizers. Excessive nitrate-form fertilizer may cause the top foliage to turn bronze color.

Growth Regulators

Plant growth regulators are not recommended for height control as PGR applications will make the foliage more dark greenish or will make the crop less uniform.

Pinching

The best way to control plant growth with good uniform habit is to pinch or trim the plants down to 3 to 4 leaves in main stem. The pinch or trimming can be done at two weeks after transplanting or before transplanting but it ends up slightly more uniform when pinch is done at two weeks after transplanting. When pinching manually, make sure to pinch all the main stems of each plant growing out of the multi-seeded pellets, so that the crop will be uniform at finish.

Crop Scheduling

Sow to transplant (288 plug tray): 7 to 8 weeks

Add one more week for larger plug/liner tray. Transplant from 288-tray to saleable finished container:

Container Size	Plants Per Pot	Weeks From Transplant	Total Weeks
306 pack	1	6-7	13-15
4-4.5 in. (10-11 cm) pot	1	6-7	13-15
6-6.5 in. (15-16-cm) pot	3	7-8	14-16
Gallon	3	7-8	14-16

Note: When transplanted from a 128-tray or 72-liner, finish crop time can be reduced by 1 week.

Common Problems

Insect: Watch for Spider Mites. **Disease:** No serious problems

Flare F1 Series Cut **Flower Lisianthus**

Plug Production

Plug Tray Size Lisianthus can be produced in a 392, 406, or similar cell size plug tray.

Media

Use a well-drained, disease-free plug media with a pH of 6.2 to 6.5 and EC about 0.75 mS/ cm (1:2 extraction). Note: Lisianthus are very sensitive to high

salts.

Stage 1

Germination takes approximately 10 to 12 days. Do not cover the seed.

Soil temperature: 68 to 72°F (20 to 22°C). Light: Light levels of 10 f.c. (100 Lux) or more is required/beneficial for germination. **Moisture:** Keep the media moisture saturated (level 5) during stage 1 for optimal germination.

Humidity: Maintain 100% relative humidity (RH) until radicle emergence.

Stage 2

Soil temperature: 68 to 72°F (20 to 22°C). **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce media moisture to medium wet (level 4) to allow roots to penetrate into the media. Some growers apply a thin layer of coarse grade vermiculite to the surface of the plug flat after they come out of the germination chamber for controlling algae growth, Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 68°F (18 to 20°C). Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Keep the media at medium (level 3) moisture level. Allow media to dry between irrigations. Avoid extreme wilting, as it can induce rosetting.

Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 6.2 to 6.5 and EC about 1.0 mS/cm (1:2 extraction). **Note:** Do not apply plant growth regulators to cut flower lisianthus plugs.

Stage 4

Soil temperature: 62 to 65°F (17 to 18°C). Light: Up to 5,000 f.c. (53,800 Lux) if optimal temperatures can be maintained. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3 Note: Do not hold lisianthus plugs until rootbound as this induces rosetting.

Growing On to Finish

structures.

Media

prefers a high pH media.

Planting Density per net sq. m)

net sq. m)

Netting

Temperature

Day: 68 to 75°F/20 to 24°C Cooler growing temperature will add to stem strength and caliper, but will increase production time. In regions that require supplemental heating, both space and soilsurface heating is recommended. Higher temperatures (above 82°F/28°C) during the first 4 weeks after transplant can induce rosetting in susceptible varieties.

Light and Shading

to increase stem length. crop time.

Irrigation

Begin production with overhead irrigation, then switch to drip irrigation 2 to 3 weeks following transplant. Keep the media moist but not wet; allow drying slightly between waterings. Lisianthus grow slowly at the beginning, and therefore require little water. Do not allow the soil to dry out when plants are in flower.

PanAmerican Seed.

Production Location

Optimal-quality lisianthus are produced in temperate climates in greenhouses for Autumn through Spring. Successful Summer production can be achieved in shadehouse

Lisianthus should be produced in diseasefree soils with a medium initial nutrient charge and a pH of 6.5 to 7.2. Lisianthus

Summer: 8 plants per net sq. ft. (84 plants

Winter: 6 plants per net sq. ft. (64 plants per

One to two layers of support netting (4×6) in./15 x 20 cm) are recommended.

Night: 60 to 65°F/16 to 18°C

Optimal light levels are 4,000 to 6,000 f.c. (40,000 to 60,000 Lux) if appropriate temperatures can be maintained. Higher light promotes high bud count and good flower development. However, excessive light (over 7,000 f.c./70,000 Lux) could reduce stem length. Shading may be needed

During Winter when daylength is shorter than 12 hours, supplemental light (incandescent or HID) can be used. Long day (greater than 14 hours) or night interruption from 10 p.m. to 2 a.m. will accelerate flowering. HID light is preferred as it increases flower quality and decreases

Fertilization

Fertilize every other irrigation with calcium nitrate-based fertilizer with low phosphorus at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/ cm EC).

Crop Scheduling

Sow to transplant: 8 to 10 weeks approximately. Weeks for plug to finish:

Winter: 14 to18

Spring/Autumn: 12 to 14 **Summer:** 10 to12

Flare series is speed group 2 (mid/medium speed) for flowering.

Note: Crop time is dependant on time of year, temperature, day length and light intensity and also on supplemental lighting and greenhouse conditions.

In far northern latitudes where daylength has great variation across the year, the use of HID lighting is common. These regions may experience an even greater degree of variation in crop times.

Post-harvest handling

Harvest lisianthus stems when one or more flowers are open. Harvest in the mornings when flower and plant tissues are cool. Remove field heat from the stems by transferring harvested bunches to coolers to optimize post-harvest life. Always use clean buckets with fresh cool water for harvested lisianthus. Do not ship flowers that have not had field heat removed. Pulsing with 3% sucrose for 24 hours after harvest increases vase life.

In Japan and Holland, cut flower lisianthus are brought to market in 10-stem bunches. In the United States, the market accepts "grower" bunches that are bunched according to stem caliper; 4 to 14 stems may comprise a bunch. Some wholesalers are encouraging growers to market a standard 10-stem bunch in the U.S.

Common Problems

Insect: Aphids, Leafminers, Thrips, White Flies

Diseases: Botrytis, Fusarium, Pythium, *Rhizoctonia*, Tospo Viruses Other: Algae over plug tray surfaces, rosetting

Lucius & Starmaker Luzula

Plug Production

Media

Use a well-drained, disease-free media with a pH range of 5.8 to 6.2, and EC of 0.75mS/cm (2:1 extraction).

Sowing

Plug tray size: Use 288-cell plug tray or larger cell. Cover seeds with a medium of coarse-grade vermiculite.

Stage 1 - Germination takes approximately 10 to 12 days.

Germination temperature: 64 to 68°F (18 to 20°C).

Light: Required for germination. Media moisture: Keep soil moist (level 4) for optimal germination.

Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 64 to 68°F (18 to 20°C). Light: Up to 2,500 f.c. (26,900 Lux). Moisture: Once the plug trays come out of the germination chamber, reduce soil moisture slightly from level 4 to 3 to allow the roots to penetrate into the soil. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 64 to 68°F (18 to 20°C) Light: Can go up to 5,000 f.c. (54,000 Lux). Moisture: Keep the media moisture between medium and medium dry (level 3 to 2). Allow the media to dry until the surface becomes light brown (level 2) before watering. Make sure they don't get too wet. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 61 to 64°F (16 to 18°C) Light: Can be up to 5,000 f.c. (54,000 Lux) if temperatures can be maintained. Moisture: Maintain moisture condition level 3 to 2.

Fertilizer: Maintain the fertilizer rate at 2. Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: Not needed.

Growing On to Finish Media

Use a well-drained, disease-free soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 64 to 66°F (18 to 19°C) **Davs:** 66 to 74°F (19 to 23°C) Can also be grown in cooler temperatures; however, plants will grow more slowly.

Light

Keep light levels as high as possible while maintaining moderate temperatures. Lucius luzula can tolerate light shade.

Irrigation

Keep media moist. Avoid growing in dry media as this will cause yellowing on the tip of shoots.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) with nitrate-form fertilizer with low phosphorus once a week. Avoid using excessive ammonia nitrogen-form fertilizers and overfeeding, as these will result in less upright plants. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.5 to 6.2.

Growth Regulators

Not needed.

Crop Scheduling Sow to transplant 288-cell plug tray or larger: 4 to 7 weeks

Transplant to saleable size (from 288 cell):

Container Size	Plants Per Pot / Basket	Weeks From Transplant	Total Weeks
306-cell pack	1 plant per cell	8-9	13-15
4-4.5 in. (10-11 cm)	1 plant per pot	8-9	13-15
6-6.5 in. (15-16 cm) Gallon (18 cm)	3 plants per pot	9-10	14-16

Note: Add one more week for Luzula Starmaker.

Common Problems

Insect: Mites, Thrips Disease: Powdery Mildew

Bonanza, Durango, Janie, Hot Pak French **Dwarf Marigold**

Plug Production

Media

Use a well-drained, disease-free soilless medium with a pH of 6.2 to 6.5, and a medium initial nutrient charge (EC less than 0.75 mmhos/cm with a 2:1 extraction).

Sowing

Plug Tray Size: Can be produced in 288 or larger cell-size plug trays. Cover the seed with a medium layer of vermiculite at sowing.

Stage 1 – Germination takes approximately 3 to 4 days.

Germination temperature: 70 to 72°F (21 to 22°C)

Light: Light is not required for germination. Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95 to 97% relative humidity (RH) until radicle emergence.

Stage 2

Temperature: 65 to 72°F (18 to 22°C) **Light:** Can be up to 2,500 f.c. (26,900 Lux) during Stage 2.

Moisture: Keep the media medium (level 3) to medium wet (level 4).

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous.

Stage 3

Temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) **Moisture:** Keep the media medium wet (level 3) during Stage 3. Fertilizer: Increase the fertilizer rate to

level 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 65 to 68°F (18 to 20°C) Light: Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3. Growth Regulators: Generally not required

during plug production.

Do not hold the plugs too long - transplant them on time.

Growing On to Finish

Transplant: French Marigold plugs can be transplanted deeply to the level of the first node for stretched plugs.

Container Size

Cell-packs, 4-in./quarts: 1 plant per cell 6-in. (15-cm) pots: 3 plants per pot

Media

Use a well-drained, disease-free media with a pH of 6.2 to 6.5 and a medium initial nutrient charge.

Temperature

Night: 60 to 62°F (15 to 17°C) **Day:** 63 to 70°F (17 to 21°C) Can be grown at moderate temperatures, minimum temperature 54°F (12°C).

Light

Keep light levels as high as possible while maintaining appropriate temperatures.

Irrigation

Maintain optimal media moisture (not too wet or not too dry).

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm) using predominantly nitrateform fertilizer with low phosphorus. Maintain the media EC at 1.0 to 1.5 mS/cm and pH at 6.2 to 6.5. For constant fertilizer program, can apply fertilizer at rate 1 (75 to 100 ppm N/0.5 to 0.7 mS/cm) while maintaining the above recommended EC and pH ranges.

Plant Growth Regulators

PGRs are generally not required, especially for compact series, Janie and Hot Pak. For Bonanza and Durango, to tone the plants for best appearance, we recommend applying daminozide at 2,500 ppm (3.0 g/l 85% formulation or 3.9 g/l of 64% formulation), 1 week after transplant for cell packs or 2 weeks after transplant for 6-in. (15-cm) pots.

Photoperiod

French Marigold can flower year-round but flower slightly quicker under short day than long day conditions.

Crop Scheduling

Sow to transplant (288 cells): Approximately 3 weeks. Transplant to flower: 3 to 4 weeks in

pack and 5 to 6 weeks in 6-in. (15-cm) pot with 3 ppp.

Common Problems

Insect: Aphids, Mites and White Flies **Disease:** Damping off in the seedling stage

Hot Cakes Series **Bedding Matthiola**

Plug Production

Media

Use a well-drained, disease-free media with a pH range of 5.5 to 6.0 and EC less than 0.75mS/cm (2:1 extraction).

Sowing

Plug tray size: Can be produced in a 392, 288 or a similar size plug tray with 1 seed per cell. Any other tray used for cut flower Matthiola can also be used (e.g. 600-cell tray in Europe with dimensions 40 by 60 cm).

Stage 1 – Germination takes approximately 3 to 4 days.

production cotyledons.

germination.

(20 to 22°C).

Media moisture: Keep the media medium wet (level 4) during germination. **Relative humidity:** Maintain 95 to 97% relative humidity until cotyledons emerge. Avoid excess humidity later in the plug production, as this will create conditions favorable for disease incidence.

Stage 2

Stages 2 and 3. Stages 2 and 3. (1:2 extraction).

Stage 3

cotyledon leaf color.

Stage 4

Temperature: 60 to 70°F (15 to 21°C) days; 50 to 55°F (10 to 13°C) nights. Light: Up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained. Media moisture: Keep the media medium (level 3) wet. Do not let the seedlings wilt as they will not recover favorably. Fertilizer: Same as Stage 3. Growth Regulators: Not required. Under North European conditions: foliar sprays of B-Nine/Alar (daminozide) at 600 to 1,200 ppm (0.7 to 1.4g/l 85% formulation or 0.9 to 1.8g/l 64% formulation) worked well in toning the plugs.

Germination temperature: 68 to 72°F

Light: Not required but beneficial during

Temperature: 60 to 70°F (15 to 21°C) days; 55 to 60°F (13 to 15°C) nights.

Light: Up to 2,500 f.c. (26,900 Lux) during

Media moisture: Keep the media medium (level 3) to medium wet (level 4) during

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm

Beginning at late Stage 2 and Stage 3, they can be held/grown at the recommended cool temperatures for differentiating the seedlings of singles and doubles based on

Note: Refer to the Seedling Selection Guidelines for the recommended temperatures during this stage. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Guidelines for selecting seedlings of double flowering plants during plug

Seedlings of double-flowering plants can be selected during plug production based on their cotyledon leaf color (lighter green/ yellowish green) when grown under appropriate cool temperatures, compared to those of singles which have dark green

PanAmerican Seed.

Option 1: Once the cotyledons have fully expanded (approximately 11 to 12 days from sowing), the seedlings can be moved into a cold chamber/storage set at 40 to 45°F (4 to 7°C) for a period of approximately 3 to 4 days. Make sure to moisten the trays well, before they go into the cool chambers. Lights are not required in chamber during this period. Monitor the plug trays for any color differentiation beginning at day 2 in the chamber, and bring them out accordingly. Hold them in the chamber for a maximum of 4 days, after which they can be grown at cool temperatures (50 to 60°F/10 to 15°C) in a greenhouse until selection. It is possible to differentiate the seedlings once they come out of the cold chamber. Avoid direct sun/ high light levels during sorting, as this can make the cotyledon color differences less obvious. Typically early mornings are best for this procedure.

In European trials where the sorting is automated, the camera eve of the machine was also able to see/sort the cotyledon color differences for the singles and doubles. In these trials, the plugs were held for 5 days in the cold chamber set at 41° F (5°C), and the selection was done by the machine 3 days after they came out of the cold chamber and moved into the greenhouse.

Option 2: If cold chamber space/facility is not available to cool the plugs, then the seedling selection can also be done by growing the plugs at cool temperatures (50 to 60°F/10 to 15°C) under greenhouse/ outside conditions, provided the conditions are cool enough. The timing and ease of the selection process will depend on the cool temperatures provided.

Growing On to Finish

Container Size

Can be produced in 4-in. (10-cm) or similar size containers.

Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.2, and a medium initial nutrient charge.

Temperature

Hot Cakes matthiola can best be produced under cooler temperatures for uniformity/ quality of flowering and plant habit. The optimal recommended production temperatures are:

Nights: 50 to 55°F (10 to 13°C)

Days: 60 to 70°F (15 to 21°C)

Note: Plants can also be produced under less optimal conditions, but the quality may not be the best.

Light

Keep light levels as high as possible while maintaining appropriate temperatures.

Hot Cakes Series Bedding Matthiola continued

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrate-form fertilizer with low phosphorus. If needed, a balanced ammonium and nitrate-form fertilizer may be used as needed to encourage growth and balance the media pH.

Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.8 to 6.2. Excessive fertilizer levels will result in large and lush leaves, while fertilizer stress will cause very small leaves, and yellow lower leaves.

Plant Growth Regulators

PGRs are generally not required. Under Northern European conditions, 1 to 3 foliar applications of B-Nine/Alar (daminozide) at 3,200 ppm (3.8 g/l 85% formulation or 5g/l of 64% formulation), or Cycocel (chlormeguat) at 375 ppm (0.5 ml/l 75% formulation or 3.1ml/l 11.8% formulation) gave optimal growth control.

Crop Scheduling

Sow to transplant (392, 288 size tray): 4 weeks

Transplant to flower: 4 to 7 weeks Total crop time (sow to flower): 8 to 11 weeks. Crop time is temperature dependent and can finish as early as 8 weeks from sowing if grown during periods of high temperatures/Summer.

Jade Princess F1 **Ornamental Millet**

Plug Production

Note: Plugs allowed to become rootbound or stressed by drought or nutrient deficiency will not perform well after transplant.

Media

Use a well-drained, disease-free media with a pH range of 5.5 to 6.3, and EC less than 0.75mS/cm (2:1 extraction).

Sowing

Recommended tray size is 128 or larger cell. Larger cells result in shorter overall crop times. Multiple sowing 2 to 3 seeds per plug is recommended.

Direct Sowing

Total crop time can be reduced by 2 weeks by direct sowing into the final container. Sowing 3 or more seeds in the center of the container is recommended. Using either method above, cover the seed with approximately 0.5 in. (1 cm) of media to prevent seedlings from tipping over.

Temperature

2 to 3 days. Germination temperature: 72 to 78°F (22 to 25°C). Temperatures below 68°F (20°C) will significantly delay germination.

Light: Light is not required for germination. Media moisture: Keep the media medium wet to wet (level 4-5) during germination. **Relative humidity:** As long as the soil is kept evenly moist, high air humidity is not required for germination. Therefore, seed can be germinated directly on the bench.

Stage 1 – Germination takes approximately

Stage 2

Temperature: 72°F (22°C) days; 68°F (20°C) nights.

Light: Can be up to 2,500 f.c. (26,900 Lux) during Stages 2 and 3. Media Moisture: Keep the media medium

(level 3) to medium wet (level 4) during Stage 2.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

Temperature: 72°F (22°C) days; 68°F (20°C) nights.

Light: Can be up to 5,000 f.c. (54,000 Lux) while maintaining temperatures. Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 72°F (22°C) days; 68°F (20°C) nights. Jade Princess prefers warm temperatures.

Light: Can be up to 5,000 f.c. (54,000 Lux) while maintaining temperatures.

Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Keep the fertilizer rate at 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Growth Regulators: Not required at plug stage. If needed, foliar sprays of B-Nine/ Alar (daminozide) at 600 to 1,200 ppm (0.7 to 1.4g/l 85% formulation or 0.9 to 1.8g/l 64% formulation) work well in toning the plugs.

Growing On to Finish Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.5 and a medium initial nutrient charge.

Nights: 64 to 66°F (18 to 19°C) Days: 68 to 85°F (20 to 30°C) This is a warm-season crop. Higher temperatures result in faster growth and taller plants. Average daily temperature below 64°F (18°C) will significantly delay crop time.

Do not grow Jade Princess with temperatures below 60°F (16°C), especially at times with low light intensity. It performs better at the upper end of the temperature range. Low temperatures can also cause Jade Princess foliage color to become more chlorotic or even cause necrosis and flower spike bending.

Light

Keep light levels as high as possible. Higher light results in stronger, thicker stems and better basal branching.

Irrigation

Maintain even moisture at level 2 to 3. Do not allow the substrate to dry up and the plants to wilt.

Fertilizer

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cmEC) once a week from a nitrate-form fertilizer with low phosphorus. A balanced ammonium and nitrate-form fertilizer may be applied as needed. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2. For constant fertilizer program, can apply fertilizer at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm) while maintaining the above recommended EC and pH ranges.

Growth Regulators - Plants Grown For Landscape Use

Jade Princess is naturally shorter and branches better than other ornamental millet varieties. It can do without any or with less PGRs. For example, no PGR to 1 application of Bonzi 3 to 5 ppm (0.75 to 1.25 ml/l) drench at about 1 week after transplanting or 4 weeks after sowing for directly sown.

Northwestern European conditions: Use

the lower concentrations listed above. This treatment results in a final height of 24 to 30 in. (60 to 75 cm) for Jade Princess. Note: Based on the PanAmerican Seed research trial at Elburn, Illinois, transplanted plugs require less PGRs and make bushier plants after PGR applications, but crop timing is 1 to 2 weeks longer than direct-sown plants.

Millet plant response to PGRs is variable with container size and different environmental conditions. We recommend that you run an in-house trial to determine the best rate or method for your conditions.

Pinching

Do not pinch.

Note: Do not allow the plants to be stunted from water stress or inadequate fertilizer, or allow the plants to become rootbound. Plants which are stunted in a young stage may produce only a single, short stem and not reach their full potential.

Crop Scheduling

Sow to transplant (288-cell plug tray): 2 to 3 weeks

Container Size	Plants Per Pot/Basket	Weeks From Transplant
1801s, 4-4.5 in. (10-11 cm) pots	1*	4-5 (green)
Gallon container	1-2*	4-5 (green) 12-14** (flowering)

This crop time is based on a 68°F (20°C) daily average temperature. When plants are grown in warm temperatures, crop time can be 2 or more weeks shorter.

*For multiple-sown plugs, only 1 plug is needed per pot. For single-sown plugs, plant the plugs close together in the center of the pot. Jade Princess does branch very well and therefore needs fewer seeds per cell/pot.

**Gallon container crop time is for plants with flower spikes emerging. See Growth Regulator recommendations for producing shorter plants with flower spikes.

When selling plants "green," the crop time is for plants with roots established enough to hold the substrate together and with a height of 12 to 16 in. (30 to 40 cm). Allowing plants to become excessively rootbound or to flower prior to planting in the landscape results in shorter plants.

Direct Sowing

Crop time can be reduced by 2 weeks if seed is direct sown into the final container. If directly sown, the seed can be easily germinated in the finished area. See Plug Production for sowing, temperature and soil moisture recommendations. Note: Jade Princess does not perform well in cooler temperatures.

Common Problems Insect: Aphids **Disease:** No serious problems

Jester, Purple Majesty & Purple Baron F1 **Ornamental Millet**

Plug Production

Note: Plugs allowed to become rootbound or stressed by drought or nutrient deficiency will not perform well after transplant.

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.3 and a medium initial nutrient charge (EC 0.75 mmhos/cm with a 1:2 extraction).

Sowing

Recommended tray size is 128 or larger cell. Larger cells result in shorter overall crop times. Multiple sowing 2 to 3 seeds per plug results in fuller, more attractive plants at retail.

Direct Sowing

Total crop time can be reduced by 2 weeks by direct sowing into the final container. Sowing 3 or more seeds in the center of the container is recommended. Using either method, cover the seed with approximately 0.5 in. (1 cm) of media to prevent seedlings from tipping over.

Temperature Germination: 72 to 78°F (22 to 25°C) Stage 2 to 3: 68 to 72°F (20 to 22°C) Hold plugs: 62 to 65°F (16 to 18°C) Seed germinates in 2 to 3 days at the recommended temperatures. Temperatures below 68°F (20°C) will significantly delay germination.

Light

Humidity

on the bench.

Soil Moisture Keep soil moisture high until radicle emergence, then reduce moisture levels after the radicle penetrates the medium. Do not allow the seedlings to wilt.

Fertilizer

as leaves develop. **Growth Regulators** See Growing On to Finish - Growth Regulators.

Growing On to Finish

Media Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.5 and a medium initial nutrient charge.

Temperature

Nights: 64 to 66°F (18 to 19°C) **Days:** 68 to 85°F (20 to 30°C) This is a warm-season crop. Higher temperatures result in faster growth and taller plants. Average temperature below 64°F (18°C) will significantly delay crop time; below 60°F (16°C) will stop plant growth.

PanAmerican Seed.

Light is not required for germination.

As long as the soil is kept evenly moist, high air humidity is not required for germination. Therefore, seed can be germinated directly

At radicle emergence, apply 50 to 75 ppm N from 15-0-15. Increase to 100 to 150 ppm N

Light

Keep light levels as high as possible. Higher light results in stronger and thicker stems and better basal branching. Young plants are green. The stem and mid-rib of the foliage first turn purple after about eight leaves have developed. The foliage coloration occurs when the plants are moved from the greenhouse outside to full sun. Note: Because the plants will be mostly green when sold, a color picture label is recommended to help consumers understand what the plant looks like after it is planted in the garden.

Irrigation

Maintain even moisture. Do not allow plants to wilt.

Fertilizer

Feed plants weekly with 150 to 200 ppm N in a complete fertilizer.

Growth Regulators

Plants Grown For Landscape Use

Applying Bonzi at an early stage results in bushier plants with more side shoots without significantly affecting the final plant height.

If seeds are sown directly into final containers, apply a 6 to 8 ppm Bonzi drench 4 weeks after sowing.

If using plugs, a 3 to 5 ppm Bonzi drench can be applied one week after transplanting. **Optional PGR Treatment**

Apply 2 applications of Florel 500 ppm spray. First application can be done 1 week after transplant or 4 weeks after sowing. Second application can be done 10 to 14 days later. Florel treatment can also result in bushier plants with more side shoots. However, Florel is not as strong as Bonzi in height control.

Plants Grown For Mixed Container Use

If seeds are sown directly into final containers, 2 applications of a 6 to 9 ppm Bonzi drench can be used to control plant height. First application can be done 4 weeks after sowing. Repeat 10 days later. If seeds are sown into plug trays, apply a 6 to 8 ppm Bonzi drench 1 week after transplanting into final container. Only one application is needed.

These treatments result in plants with the first flower spike approximately 2 to 2.5 ft. (60 to 75 cm) above the top of the container for Purple Majesty and 1.8 to 2 ft. (55 to 65 cm) for Purple Baron and Jester.

Note: Based on the PanAmerican Seed research trial at Elburn, Illinois, transplanted plugs require less PGRs and make bushier plants after PGR applications, but crop timing is 1 to 2 weeks longer than direct-sown plants. Jester, Purple Majesty & Purple Baron F1 Ornamental Millet continued

Millet plant response to PGRs is variable with container size and different environmental conditions. We recommend that you run an in-house trial to determine the best rate or method for your conditions.

Pinching

Do not pinch.

Note: Do not allow the plants to be stunted from water stress, inadequate fertilizer or allow the plants to become rootbound. Plants which are stunted in a young stage may produce only a single, short stem and not reach their full potential.

Crop Scheduling

Sow to transplant (288-cell plug tray): 2 to 3 weeks

Container Size	Plants Per Pot/Basket	Weeks From Transplant
1801s, 4-4.5 in. (10-11-cm) pots	1-2*	4-5 (green)
Gallon container (8 in./20 cm standard pot)	3*	5-6 (green)
Gallon container (8 in./20 cm standard pot)	3*	11-13** (flowering)

This crop time is based on a 68°F (20°C) daily average temperature. When plants are grown in warm temperatures, crop time can be 2 or more weeks shorter.

*For multiple-sown plugs, only one plug is needed per pot. For single-sown plugs, plant the plugs close together in the center of the pot.

**Gallon container crop time is for plants with flower spikes emerging. See Growth Regulator recommendations for producing shorter plants with flower spikes.

When selling plants "green," the crop time is for plants with roots established enough to hold the soil ball together and with a height of 12 to 16 in. (30 to 40 cm). Allowing plants to become excessively rootbound or to flower prior to planting in the landscape results in shorter plants.

Direct Sowing

Crop time can be reduced by two weeks if seed is direct sown into the final container. If directly sown, the seed can be easily germinated in the finished area. See Plug Production for sowing, temperature and soil moisture recommendations. Note: Jester does not perform as well in cooler temperatures.

Common Problems

Insect: Aphids Disease: No serious problems

Akila[®] Series Osteospermum

Plug Production

Media

Use a well-drained, disease-free soilless plug media with a pH of 5.8 to 6.2, and an EC of 0.75 mmhos/cm (1:2 extraction).

Sowing

Plug tray size: Can be produced in a 105-cell size liner with one seed per cell. (A bigger cell size liner such as 105 will help in promoting branching early on and also will reduce the total crop time slightly when compared production from a smaller cell size plug.) Akila plugs can also be produced using a 288-cell size tray.

A medium covering of coarse-grade vermiculite is recommended at sowing to help maintain humidity around the germinating seed for better germination performance.

Stage 1 – Germination takes approximately 5 to 6 days.

Germination temperature: 65 to 68°F (18 to 20°C) **Light:** Light is not required for germination.

Moisture: Keep the media moisture at medium wet (level 4) during Stage 1. **Relative humidity:** Maintain 95 to 97% relative humidity until cotyledons emerge. Stage 2

Soil temperature: 68 to 72°F (20 to 22°C) days; 60 to 62°F (16 to 17°C) nights Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Keep the media moisture at medium (level 3) to medium wet (level 4). **Fertilizer:** Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous.

Stage 3

Soil temperature: 68 to 70°F (20 to 21°C) days; 60 to 62°F (16 to 17°C) nights Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Keep the media moisture medium dry (level 2) to medium (level 3) during Stages 3 and 4.

Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: Generally not required for plug production, but if necessary can apply a foliar spray of B-nine/Alar (daminozide) at 2,500 to 3,500 ppm (3.0 to 4.2 g/l of 85% formulation or 4.0 to 5.6 g/l of 64% formulation) once at about 3 weeks after sowing to tone the plugs.

Stage 4

Soil temperature: 65 to 68°F (18 to 20°C) davs: 60°F (16°C) nights **Light:** Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained. Media moisture: Same as Stage 3 Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 306-packs, 4-in. (10-cm) pots.

Media

Use a well-drained, disease-free soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 50 to 55°F (10 to 13°C) **Days:** 60 to 70°F (16 to 21°C) Osteospermums in general perform best at cool temperatures.

Light

Keep light levels as high as possible while maintaining the optimal temperatures.

Fertilizer

Starting a week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominately nitrateform fertilizer with low phosphorus. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.8 to 6.2.

Irrigation

Maintain optimal media moisture, i.e. not too wet or not too dry.

Plant Growth Regulators

PGRs are generally not required, especially when grown under cool temperatures, as temperature can be the best natural growthcontrolling factor. If needed when producing the crop under warmer temperatures, apply a tank mix foliar application of B-Nine/Alar (daminozide) at 2,500 ppm (3.0 g/l of 85% formulation or 4.0 g/l of 64% formulation) and Cycocel (chlormequat) at 500 ppm (4.3 ml/l of 11.8% formulation or 0.7 ml/l of 75% formulation) to control plant growth. One application at 2 weeks after transplant will be sufficient.

Akila also responds well to foliar application of Topflor (flurprimidol) at 10 to 15 ppm (2.6 to 4.0 ml/l of 0.38% formulation) applied once after transplant.

Pinching

Pinching is not required, as Akila is naturally well branched.

Crop Scheduling

Sow to transplant: It takes approximately 5 weeks to finish a 105-cell size liner and approximately 4 weeks for a 288-cell size plug.

Transplant to finish in 306-packs and

4-in (10-cm) pots: Crop time is dependent on season and production temperatures; it takes about 10-12 weeks in spring/cool temperatures and 7-9 weeks in Autumn/ warm temperatures.

Total crop time to finish can be a week longer when grown from a smaller size plug such as a 288-cell size.

Common Problems

Insect: Check and monitor for Thrips and Aphids.

Note: Avoid using insecticides containing active ingredient "Methiocarb", as it affects the flower color.

Cool Wave® F1 **Spreading Pansy: Fall Production**

Plug Production

Media

Use a well-drained, disease-free media. A pH range of 5.4 to 5.8 and EC less than 0.75 mmhos/cm (2:1 extraction) is recommended. Keep the phosphorus level as low as possible to avoid initial stretch.

Sowing

Plug tray size: Can be produced in a 288cell or 128-cell size tray (105, 128, 144 or equivalent) with 1 seed per cell. The larger size of 128-cell will promote stronger lateral growth and quicker finish, with more flowers. Smaller plug sizes restrict the plant growth and increase the crop time; we do not recommend plug sizes smaller than 288. A medium covering of coarse-grade vermiculite is recommended at sowing to help maintain humidity around the germinating seed for better germination performance.

Stage 1 – Germination takes approximately 2 to 3 days.

Germination temperature: 65 to 70°F (18 to 21°C)

Light: Light is not required for germination. Moisture: Keep the soil wet (level 4) during Stage 1

Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 65 to 72°F (18 to 22°C) days; 60°F (16°C) nights

Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Keep the media medium (level 3) to medium wet (level 4).

> Temperature Night: 55 to 60°F (12 to 15°C) Day: 62 to 70°F (16 to 21°C)

Media

charge.

PanAmerican Seed.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous.

Temperature: 65 to 70°F (18 to 21°C) days; 60°F (16°C) nights

Stage 3

deficiency.

maintained.

or stunted.

Stage 4

Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Keep the media medium wet (level 3) during Stages 3 and 4. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.4 to 5.8 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). A higher pH (greater than 6.2) can induce Boron

Temperature: 62 to 67°F (16 to 19°C) days; 55°F (12°C) nights

Light: Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be

Fertilizer: Same as Stage 3.

Growth Regulators: When compared to standard pansies, Cool Wave pansies require fewer PGRs, or under ideal conditions they require no PGRs, in the plug stage. This is to ensure that the spreading habit isn't delayed

If needed, treat with a foliage spray of Daminozide (B-Nine) 2500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) and Chlormequat (Cycocel) 500 ppm (4.2 ml/l 11.8% formulation or 0.7 ml/l 75% formulation), applied once when the first set of true leaves is fully open.

Note: Some varieties are more sensitive than others to ancymidol (A-Rest); you may notice less uniformity between varieties if using ancymidol (A-Rest) in plug production.

Northwestern Europe: If needed, treat with a foliar spray of daminozide (B-Nine/Alar) at 1,280 ppm (1.5 g/l of 85% formulation or 2 g/l of 64% formulation) applied once when the first set of true leaves is fully open.

Transplant the plugs "on time" to avoid flower bud initiation in the plug stage.

Growing On to Finish

Container Size

306 packs, 4.5-in. (10.5-cm) pots, quarts, 6-in. (15-cm), and 10 to 12-in. (25 to 30-cm) or similar size hanging baskets.

Use a well-drained, disease-free media with a pH of 5.4 to 5.8 and a medium initial nutrient

Light

Keep light levels as high as possible while maintaining appropriate temperatures.

Fertilizer

Starting a week after transplant, apply nitrate-form with low phosphorus fertilizer once a week at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm EC).

For constant feed programs, apply fertilizer at 125 ppm N/1.0 mS/cm EC using predominantly nitrate-form fertilizer with low phosphorus. If needed, alternate with a balanced ammonium and nitrate-form fertilizer to encourage growth and balance the media pH. Maintain the media EC at 1.25 to 1.5 mS/ cm and pH at 5.4 to 5.8. If the media pH is greater than 6.2, take corrective measures. Because Cool Wave pansies are vigorous and spreading, they require more fertilizer to maintain good flowering in the landscape and for consumers. It is recommended to use slow release fertilizer such as Osmocote 15-9-12 at low to medium rate as a top dressing before shipping.

Irrigation

Maintain optimal media moisture, i.e. not too wet or not too dry.

Plant Growth Regulators

Plant growth regulator use may depend on light, temperature, variety and container size. Refer to Pansy Cool Wave PGR recommendation based on ADT (average dailty temperature) by variety chart.

Northwestern Europe: Temperature control is the best natural growth-controlling factor.

If needed, apply a tank mix foliar spray of daminozide (B-Nine/Alar) and chlormequat (Cycocel) once after transplant. Apply daminozide (B-Nine/Alar) at 1,280 ppm (1.5 g/l of 85% formulation or 2 g/l of 64% formulation) and chlormequat (Cycocel) at 750 ppm (6.4 ml/l of 11.8% formulation or 1 ml/l of 75% formulation) as a tank mix.

Photoperiod

Cool Wave Frost, White, Golden Yellow and Red Wing are almost day neutral. Purple, Blue Skies, Lemon Surprise, Violet Wing and Blueberry Swirl flower slightly later under short day conditions.

Pinching

Pinching is not recommended.

Crop Scheduling Sow to transplant:

Summer/Autumn: It takes approximately 4.5-5 weeks to finish a 128-cell or similar size plug. It takes approximately 3.5 weeks to finish a 288- cell plug.

Cool Wave® F1 Spreading Pansy: Fall Production continued

At 3.5 weeks, you may not get fully rooted plugs but this younger plug will finish substantially faster for the finished grower. At 5 or more weeks, Cool Wave may become rootbound and check the growth in a 288 plug. Transplant to finish:

_		
Crop Scheduling From a Larger Cell Plug 105, 128, 144, etc.		Weeks from Transplant to Finish
Container	Plugs Per Pot/Cell	Autumn
4.5 in. (10.5 cm), quart	1	4-5
6 in. (15 cm), gallon	1	5-6
10 in. (25 cm) basket	3	6-7
12 in. (30 cm) basket	4	6-8

Crop Scheduling From 288 Pl or Similar Size.	Weeks from Transplant to Finish	
Container	Plugs Per Pot/Cell	Autumn
306 pack (or equivalent)	1	4-5
4.5 in. (10.5 cm), quart	1	5-6
6 in. (15 cm), gallon	1	6-7
6 in. (15 cm), gallon	3	5-6
10 in. (25 cm) basket	4	7-8
12 in. (30 cm) basket	5	7-9

Note: Overcrowding plugs can result in a more mounded basket that will not trail over the sides as much.

Northwestern Europe: Total crop time to finish in 4.5-in. (10.5-cm) pots for Autumn production can be approximately 14 weeks from sowing. With Autumn sowings for Spring production when growing frost free, plan 21-22 weeks from sow for Spring production. If producing in bigger containers such as hanging baskets, then it may take approximately 3 weeks additional crop time to finish.

Common Problems

Insect: Check/monitor for Fungus Gnats and Shore Flies during plug production and for Aphids after transplant. Disease: Damping-off & Black Root Rot.

Regular scouting for powdery mildew and preventative measures are recommended.

Other Key Tips

When temperatures are too high in late summer/early fall, Cool Wave pansies will have smaller flowers and diminished shelf life at retail. For this reason we recommend mid to late season fall programs; retail weeks prior to week 38 are usually not recommended.

Pansy Cool Wave PGR recommendation for finish stage based on ADT by variety				
	Below 55°F/13°C	55-60°F/ 13-16°C	60-70°F/16-21°C	
Variety	PGR	Tank mix of B-Nine 5,000 ppm/ CCC 500 ppm ² -sp	Weekly ^w tank mix of B-Nine 5,000 ppm/ CCC 500 ppm ² -sp	Start with tank mix of B-Nine 5,000 ppm/cCC 500 ppm ² -sp, then Bonzi 3-5 ppm ^y sp when soil is 90% covered and repeat as needed.
Blue Skies	No PGR necessary	Adequate control	Insufficient control	Adequate control
Golden Yellow	No PGR necessary	Adequate control	Insufficient control	Adequate control
White	No PGR necessary	Adequate control	Insufficient control	Adequate control
Purple	No PGR necessary	Adequate control	Insufficient control	Adequate control
Violet Wing	No PGR necessary	Adequate control	Insufficient control	Adequate control

^zB-Nine 5,000 ppm = 5.9 g/l of 85%formulation or 7.8 g/l of 64% formulation and CCC (Cycocel) 500 ppm = 4.3 ml/l of 11.8% formulation or 0.7 ml/l of 75% formulation

^YBonzi 3 ppm = 0.75ml/l of 0.4% formulation, Bonzi 5 ppm = 1.25ml/l of 0.4% formulation ^xBonzi 0.125 ppm = 0.03 ml/l of 0.4% formulation

"You will likely be able to skip a few applications in larger containers. ^vDrench volume depending on container size: use 1.3 ounces for 306 packs, 2.5 ounces for 4.5-inch and Quart, 4 ounces for 6-in. pots, 10 ounces for gallons, and 12 ounces for 10-in. baskets.

Cool Wave® F1 **Spreading Pansy: Spring Production**

Plua Production

lia

well-drained, disease-free media. A ange of 5.4 to 5.8 and EC less than 0.75 nos/cm (2:1 extraction) is recommended. the phosphorus level as low as possible oid initial stretch.

ing

tray size: Can be produced in a 288cell or 128-cell size tray (105, 128, 144 or equivalent) with 1 seed per cell. The larger size of 128-cell will promote stronger lateral growth and quicker finish, with more flowers. Smaller plug sizes restrict the plant growth and increase the crop time; we do not recommend plug sizes smaller than 288

A medium covering of coarse-grade vermiculite is recommended at sowing to help maintain humidity around the germinating seed for better germination performance.

Stage 1 – Germination takes approximately 2 to 3 days.

Germination temperature: 65 to 70°F (18 to 21°C)

Light: Light is not required for germination. Moisture: Keep soil wet (level 4) during Stage 1. Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 65 to 72°F (18 to 22°C) days; 60°F (16°C) nights

Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Keep the media medium (level 3) to medium wet (level 4). Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous.

Stage 3

Temperature: 65 to 70°F (18 to 21°C) days; 60°F (16°C) nights

Light: Can be up to 2,500 f.c. (26,900 Lux). Media moisture: Keep the media medium wet (level 3) during Stages 3 and 4. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.4 to 5.8 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). A higher pH (greater than 6.2) can induce Boron deficiency.

Stage 4

Temperature: 62 to 67°F (16 to 19°C) days; 55°F (12°C) nights Light: Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained.

Fertilizer: Same as Stage 3.

Growth Regulators: When compared to standard pansies, Cool Wave pansies require fewer PGRs, or under ideal conditions they require no PGRs, in the plug stage. This is to ensure that the spreading habit isn't delayed or stunted.

If needed, treat with a foliage spray of Daminozide (B-Nine/Alar) 2500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) and Chlormequat (Cycocel) 300 to 500 ppm (2.5 to 4.2 ml/l 11.8% formulation or 0.4 to 0.7 ml/l 75% formulation), applied once when the first set of true leaves is fully open.

Note: Some varieties are more sensitive than others to ancymidol (A-Rest); you may notice less uniformity between varieties if using ancymidol (A-Rest) in plug production.

Northwestern Europe: If needed, treat with a foliar spray of daminozide (B-Nine/Alar) at 1,280 ppm (1.5 g/l of 85% formulation or 2 g/l of 64% formulation) applied once when the first set of true leaves is fully open.

Transplant the plugs "on time" to avoid flower bud initiation in the plug stage.

Growing On to Finish

Container Size

306 packs, 4.5-in. (10.5-cm) pots, quarts, 6-in. (15-cm), and 10 to 12-in. (25 to 30-cm) or similar size hanging baskets.

Media

Use a well-drained, disease-free media with a pH of 5.4 to 5.8 and a medium initial nutrient charge.

Temperature

Night: 45 to 55°F (7 to 12°C) Dav: 62 to 70°F (16 to 21°C) For a faster finish and to increase spread which is particularly important for Spring production, grow in a warmer zone for two weeks after transplant at 55 (12 °C) night temperature. This will encourage quicker spread.

Light

Fertilizer

For constant feed programs, apply fertilizer at 125 ppm N/1.0 mS/cm using predominantly nitrate-form fertilizer with low phosphorus. If needed, alternate with a balanced ammonium and nitrate-form fertilizer to encourage growth and balance the media pH. Maintain the media EC at 1.25 to 1.5 mS/cm and pH at 5.4 to 5.8. If the media pH is greater than 6.2, take corrective measures.

Because Cool Wave pansies are vigorous and spreading, they require more fertilizer to maintain good flowering in the landscape and for consumers. It is recommended to use slow release fertilizer such as Osmocote 15-9-12 at low to medium rate as a top dressing before shipping.

Irrigation

regulators are needed.

If needed, you can use tank mix foliar sprays of daminozide (B-Nine/Alar) at 5,000 ppm (5.9 g/l of 85% formulation or 7.8 g/l of 64% formulation) and chlormequat (Cycocel) at 500 ppm (4.3 ml/l of 11.8% formulation or 0.7 ml/l of 75% formulation) to control plant growth.

Northwestern Europe: Temperature control is the best natural growth-controlling factor. Minimal to no plant growth regulators are needed when the crop is being produced at cooler temperatures especially during Spring production.

If needed, apply a tank mix foliar spray of daminozide (B-Nine/Alar) and chlormequat (Cycocel) once after transplant. Apply B-Nine/Alar at 1,280 ppm (1.5 g/l of 85% formulation or 2 g/l of 64% formulation) and Cycocel at 750 ppm (6.4 ml/l of 11.8% formulation or 1 ml/l of 75% formulation) as a tank mix.

Photoperiod

Cool Wave Frost, White, Golden Yellow and Red Wing are almost day neutral. Purple, Blue Skies, Lemon Surprise, Violet Wing and Blueberry Swirl flower slightly later under short day conditions.

ekly ^w k mix 3-Nine 00 ppm/ 2 500 n ^z -sp	Start with tank mix of B-Nine 5,000 ppm/CCC 500 ppm ^z -sp, then Bonzi 5 ppm sp when soil is 90% covered and repeat as needed.	Start with tank mix of B-Nine 5,000 ppm/CCC 500 ppm'-sp, then Bonzi 0.125 ppm' dr' when soil is 90% covered.	5 1 1 1
ufficient	Adequate	Adequate control	1

Blue Skies	Insufficient control	Adequate control	Adequate control
Golden Yellow	Insufficient control	Adequate control	Adequate control
White	Insufficient control	Adequate control	Adequate control
Purple	Insufficient control	Adequate control	Adequate control
Violet Wing	Insufficient control	Adequate control	Adequate control
Lemon Surprise	Insufficient control	Adequate control	Adequate control
Frost	Adequate control	Adequate control	Adequate control
Red Wing	Adequate control	Adequate control	Variety reacts strongly to Paclobutrazol. Reduced rates/ frequency recommended.
Blue- berry Swirl	Adequate control	Variety reacts strongly to Paclobutrazol. Reduced rates/ frequency recommended.	Variety reacts strongly to Paclobutrazol. Reduced rates/ frequency recommended.

based o	n ADT by varie	ty	Ŭ
		Above 70°F/	21°C
Variety	Weekly ^w tank mix of B-Nine 5,000 ppm/ CCC 500 ppm ² -sp	Start with tank mix of B-Nine 5,000 ppm/CCC 500 ppm ² -sp, then Bonzi 5 ppm sp when soil is 90% covered	Start with tank mix of B-Nine 5,000 ppm/CCC 500 ppm ⁻ sp, the Bonzi 0.125 ppm ⁻ dr" when soil is 9 covered.

Lemon No PGR Adequate Insufficient Adequate

necessary control control

No PGR Adequate Adequate Adequate

Surprise necessary control control

Frost

Red

Wing

Blue

berry Swirl

Reduced ra frequency recommer										
insy Co	ool Wave PGR	recommendatio	n for finish stage							
ised oi	n ADT by varie	ty								
		Above 70°F/	'21°C							
riety	Weekly ^w	Start with	Start with tank							
	tank mix	tank mix of	mix of B-Nine							
	of B-Nine	B-Nine 5,000	5,000 ppm/CCC							
	5,000 ppm/	ppm/CCC 500	500 ppm ² -sp, then							
	CCC 500	ppm ^z -sp. then	Bonzi 0.125 ppm ^x							

No PGR necessary	Adequate control	Adequate control	Variety reacts strongly to Paclobutrazol. Reduced rates/ frequency recommended.										
Cool Wave PGR recommendation for finish stage on ADT by variety													
	Abov	e 70°F/21°C											

No PGR necessary	Adequate control	Adequate control	Adequate control
No PGR necessary	Adequate control	Adequate control	Variety reacts strongly to Paclobutrazol. Reduced rates/ frequency recommended.
ool Wave PG ADT by var	iR recomme iety	ndation for	finish stage

control

control

Keep light levels as high as possible while maintaining appropriate temperatures.

Starting a week after transplant, apply nitrate-form with low phosphorus fertilizer once a week at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm EC).

Maintain optimal media moisture, i.e. not too wet or not too dry.

Plant Growth Regulators

Since this is a spreading type pansy and mostly grown in larger containers such as hanging baskets, minimal to no plant growth

Pinching

Pinching is not recommended.

Crop Scheduling Sow to transplant:

Winter/Spring: It takes approximately 5.5 weeks to finish a 128 cell plug. It takes approximately 4 weeks to finish a 288 cell plug.

At 4 weeks, you may not get fully rooted plugs but this younger plug will finish substantially faster for the finished grower. At 5 or more weeks, Cool Wave may become rootbound and check the growth in a 288 plug.

Transplant to finish:

-		
Crop Scheduling From a Large 105, 128, 144, etc.	r Cell Plug	Weeks from Transplant to Finish
Container	Plugs Per Pot	Spring**
4.5 in. (10.5 cm), quart	1	6-7
6 in. (15 cm), gallon	1	7-8
10 in. (25 cm) basket	3	8-9
12 in. (30 cm) basket	4	8-10

**Note: Spring crop time varies depending on temperatures used. If growing frost-free, plan longer crop times.

Crop Scheduling From 288 Plu or Similar Size.	Ig	Weeks from Transplant to Finish
Container	Plugs Per Pot/Cell	Spring**
306 pack (or equivalent)	1	6-7
4.5 in. (10.5 cm), quart	1	6-7
6 in. (15 cm), gallon	1	8-9
6 in. (15 cm), gallon	3	6-7
10 in. (25 cm) basket	4	9-10
12 in. (30 cm) basket	5	9-11

**Note: Spring crop time varies depending on temperatures used. If growing frost-free, plan longer crop times.

Note: Overcrowding plugs can result in a more mounded basket that will not trail over the sides as much.

Northwestern Europe: Total crop time to finish in 4.5-in. (10.5-cm) pots for Autumn production can be approximately 14 weeks from sowing. With Autumn sowings for Spring production when growing frost free, plan 21-22 weeks from sow for Spring production. If producing in bigger containers such as hanging baskets, then it may take approximately 3 weeks additional crop time to finish.

Common Problems

Insect: Check/monitor for Fungus Gnats and Shore Flies during plug production and for Aphids after transplant.

Disease: Damping-off & Black Root Rot.

Regular scouting for powdery mildew and preventative measures are recommended.

Matrix[®], Spring Matrix, Panola[®] XP, Fizzy & Frizzle Sizzle F1 Series **Pansies**

Plug Production

Media

Use a well-drained, disease-free media with a pH range of 5.5 to 5.8, and EC less than 0.75 mmhos/cm (2:1 extraction). Keep phosphorus level as low as possible to avoid initial stretch.

Sowing

Plug tray size: Can be produced in a 288 or similar cell size plug tray. A medium covering of coarse-grade vermiculite is recommended at sowing to help maintain humidity around the germinating seed for better germination performance.

Stage 1 – Germination takes approximately 3 to 4 days.

Germination temperature: 65 to 70°F (18 to 21°C)

Light: Light is not required for germination. Moisture: Keep soil wet (level 4) during Stage 1.

Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge.

Stage 2

Temperature: 65 to 73°F (18 to 23°C) days; 60°F (16°C) nights

Light: Can be up to 2,500 f.c. (26,900 Lux) during Stages 2 and 3.

Media moisture: Keep the media medium (level 3) to medium wet (level 4). Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous.

Stage 3

Temperature: 65 to 70°F (18 to 21°C) days; 60°F (16°C) nights

Light: Can be up to 2,500 f.c. (26,900 Lux.) Media moisture: Keep the media medium wet (level 3) during Stages 3 and 4. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.5 to 5.8 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). A higher pH (greater than 6.2) can induce Boron deficiency and also encourages fungal black root rot caused by Thielaviopsis sp.

Stage 4

Temperature: 62 to 67°F (16 to 19°C) days; 55 to 60°F (13 to 18°C) nights Light: Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained.

Fertilizer: Same as Stage 3. Growth Regulators: Can treat with a foliar spray of A-Rest (ancymidol) at 10 ppm (38 ml/l of 0.0264% formulation) once during the plug stage at about 3 weeks after sowing, when the first set of true leaves are fully open.

Northwestern Europe: Can use 1 to 2 applications of B-Nine/Alar (daminozide) at 1,280 ppm (1.5 g/l of 85% formulation or 2 g/l of 64% formulation). Transplant the plugs "on time" to avoid initiation in the plug stage. Plugs that are initiated will not fill out the finish container well at the time of flowering.

Growing On to Finish

Container Size

606 jumbo cell packs, 1801 trays and 4-in. (10-cm) pots

Media

Use a well-drained, disease-free media with a pH of 5.6 to 5.8 and a medium initial nutrient charge.

Temperature

Nights: 50 to 55°F (10 to 13°C) **Days:** 62 to 70°F (16 to 21°C)

Light

Keep light levels as high as possible while maintaining appropriate temperatures.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrate-form fertilizer with low phosphorus. If needed, alternate with a balanced ammonium and nitrate-form fertilizer to encourage growth and balance the media pH. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.6 to 5.8. If the media pH is greater than 6.2, then take corrective measures.

Irrigation

Maintain optimal media moisture, not too wet or not too dry.

Plant Growth Regulators

The use of plant growth regulators on pansies is largely dependent on day/night temperatures, location and time of year. Can use tank mix foliar sprays of B-Nine/ Alar (daminozide) at 5,000 ppm (5.9 g/l 85% formulation or 7.8 g/l of 64% formulation) and Cycocel (chlormequat) at 500 to 1,000 ppm (4.3 to 8.5 ml/l of 11.8% formulation or 0.7 to 1.3 ml/l of 75% formulation). A tank mix foliar spray of B-Nine at 5,000 ppm (5.9 g/l 85% formulation or 7.8 g/l of 64% formulation) and A-Rest (ancymidol) at 5 to 10 ppm (19 to 38 ml/l of 0.0264% formulation) applied 2 to 3 times beginning 1 week after transplant with 7 to 10 days interval will also work. The rate and frequency is dependent on the production temperatures and time of the year.

Northwestern Europe: Temperature is the best natural growth-controlling factor. Minimal to no plant growth regulators are needed when the crop is produced at cooler temperatures during the Spring.

Can use a tank mix of B-Nine/Alar and Cycocel. Apply B-Nine/Alar (daminozide) at 1,280 ppm (1.5 g/l of 85% formulation or 2 g/l of 64% formulation) and Cvcocel (chlormequat) at 750 ppm (6.4 ml/l of 11.8% formulation or 1 ml/l of 75% formulation) as a tank mix. Frequency is dependent on the production temperatures and time of the year.

Crop Scheduling

For finishing in 606, 1801 (9-cm), & 4-in. (10-cm) container sizes seasonally. Crop times are dependent on container size, season and local growing conditions.

	Matrix	Spring Matrix	Panola XP	Fizzy & Frizzle Sizzle
Sow to Transplant	5 weeks	5 weeks	5 weeks	5 weeks
Transplant to Finish (Autumn)	4-6 weeks	4-5 weeks	3-4 weeks	4-6 weeks
Transplant to Finish (Spring)	6-8 weeks	6-7 weeks	4-5 weeks	6-8 weeks
Transplant to Finish (Spring in frost-free Northern Europe)	18-20 weeks	-	16-18 weeks	18-20 weeks

Common Problems

Insect: Check/monitor for Fungus Gnats and Shore Flies during plug production and for Aphids during early stages after transplant.

Disease: Damping-off, Black Root Rot, Foliar Leaf Spots and *Botrytis* blight are common

Butterfly F1 Series Pentas

Plug Production

Media

Use a well-drained disease-free seeding medium with a pH of 6.5 to 6.8 and EC of about 0.75 mmhos/cm (1:2 extraction). Below pH 6.5, plants will stop growing and exhibit iron toxicity as foliar necrosis and calcium/magnesium deficiency as foliar puckering.

Sowing

Recommended plug tray is 288-cell or larger. Do not cover the seed. Light improves germination and uniformity. Non-acidified water is recommended to maintain high media pH.

Stage 1 – Germination takes about 6 to 9 days.

Soil temperature: 75°F (24°C)

Light: Light during germination (10 f.c./110 Lux) will improve germination uniformity and seedling quality.

Moisture: Maintain moisture level at 4 to 5 during stage 1. Non-acidified water is beneficial throughout plug production. Humidity: Maintain 100%.

Stage 2 (About day 9)

Temperature: At full cotyledon emergence, maintain 75°F (24°C).

Light: Pentas have high light requirements. Seedlings must receive higher light levels immediately after germination to avoid elongation and promote rapid growth. After germination, maintain light levels between 1,500 and 2,000 f.c. (4 to 6 moles/m2/day or 16,150 to 21,530 Lux).

Moisture: Level 3 to 4, avoid extreme shifts in moisture. Non-acidified water recommended.

Humidity: Reduce to 70%. Fertilizer: 14-4-14 or 13-2-13 at 50 ppm

N once radicles fully emerge and adjust upward to 75 ppm through end of Stage 2. Maintain EC <1.0 mmhos/cm.

Stage 3

Temperature: Gradually reduce to 65 to 68°F (18 to 20°C)

Light: Up to 2,500 f.c. (6 to 8 moles/m2/day or 26,900 Lux)

Moisture: Level 2 to 4, avoid extreme shifts in moisture. Non-acidified water recommended.

Fertilizer: Increase fertilizer to 75-100 ppm with 14-4-14 or 13-2-13. Use 20-10-20 if needed to promote leaf expansion. Growth Regulators: Control plug growth first by environment, nutrition and irrigation management (keep plants on the dry side). Minimize phosphorus fertilizer to avoid elongation of seedlings. Temperature differential (DIF) can also be used to minimize height. If necessary, Cycocel (chlormequat) spray can be applied at 500 ppm (4.2 ml/l 11.8% formulation or 0.7 ml/l 75% formulation) or B-Nine/Alar (daminozide) spray at 2,500 to 3,500 ppm (3.0 to 4.1 g/l 85% formulation or 4.0 to 5.5 g/l of 64% formulation).

Stage 4

Temperature: Can be reduced to 60 to 65°F (15 to 18°C) from maturity until transplant Light: Up to 3,500 f.c. (10 moles/m2/day or 37,800 Lux) Moisture: Same as stage 3

Fertilizer: Same as stage 3

Container Size

Butterfly Pentas are well suited to 4-in. (10-cm) pots up to 1 to 2-gallon containers. Containers smaller than 4 in. (10 cm) will necessitate heavy PGR applications. 4-in. (10-cm) pot: 1 plug per pot 6-in. (15-cm) pot: 1 to 2 plugs per pot 1 to 2 gallon pot: 2 to 3 plugs per pot Media Use a well-drained, disease-free soilless medium with a medium initial nutrient

Water Pentas benefit from non-acidified water during production, which can decrease crop times by as much as two weeks versus using acidified water. Avoid both excess watering and drought, which will stress the plants and cause severe yellowing and necrosis.

Fertilization

Constant liquid fertilizer at 75 to 125 ppm N, depending on frequency, with 14-4-14 or 17-5-17. Use 20-10-20 if needed to promote leaf expansion. Maintain medium EC around 1.2 to 1.5 mmhos/cm (using 1:2 extraction).

Growth Regulators

Effective height control of Butterfly Pentas can be accomplished with environmental manipulation. Height can be controlled by withholding fertilizer, especially phosphorous and ammonium-form nitrogen. Pentas are responsive to day/ night temperature differential (DIF), and are shorter with a negative DIF. A tank mix of B-Nine (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) and Cycocel (chlormequat) 1,000 to 1,500 ppm (8.5 to 12.7 ml/l 11.8% formulation or 1.3 to 2.0 ml/l 75% formulation) dependent on temperature at visible bud can be used.

Growing On to Finish

charge and a pH of 6.5 to 6.8. When pH below 6.5, growth will be slowed and plants will exhibit iron toxicity as foliar necrosis and calcium/magnesium deficiency as foliar

Temperature

puckering.

crop time.

Humidity

Light

Butterfly Pentas benefit from warm temperatures and high light conditions. Maintain minimum day temperatures of 72 to 80°F (22 to 27°C) and minimum night temperatures of 62 to 65°F (17 to 18°C). Low temperatures will prevent uniform flower development, delay flowering and extend

Provide 12 to 15 moles/m2/day. Keep light levels as high as possible to promote compact growth. Extend daylength if grown under short days to achieve 12 to 15 moles/m2/day.

Maintain low relative humidity during production to reduce foliar diseases.

PanAmerican Seed.

Higher rates of Cycocel (chlormequat) may cause phytotoxicity. Cycocel (chlormequat) alone at 1,000 to 1,500 ppm (8.5 to 12.7 ml/l 11.8% formulation or 1.3 to 2.0 ml/l 75% formulation) spray or Bonzi (paclobutrazol) 5 ppm (1.3 ml/l 0.4% formulation) drench at visible bud stage are also effective (refer to photo). Always follow current manufacturer label instructions. In-house trials are recommended to determine the best rate for your location.



Crop Scheduling Sow to transplant: 6 to 9 weeks in a 288-cell plug tray.

Transplant to finish (flower first umbel): 10 to 12 weeks in the North. 8 to 10 weeks in the South.

Under high light, long days and warm temperatures (Summer production), Butterfly Pentas can be produced in as little as 12 to 13 weeks from seed.

Common Problems

Insect: Aphids, Thrips, White Flies Disease:

Pythium Root Rot: Soft, brown, mushy roots. Drench with Subdue, Banrot, Truban or similar compound.

Rhizoctonia: Tan, brown or black lesions on the stem at the soil line in conjunction with good root development. Drench the soil with Chipco 26019, Cleary's 3336, Banrot or Terraclor.

Botrytis Blight: Will appear at wound sites on the plant, especially where the air is stagnant. If undetected, this blight will form a canker that will girdle the stem, thus wilting and killing that part of the plant. Treatments include increased air circulation and Daconil fungicide spray applications. Refer to the Daconil label for the specifics.

Nutritional Problems:

Iron Toxicity: Excessive iron levels or pH below 6.2 for extended time will cause marginal burn on leaves in upper foliage. Raise pH by adding limestone.

Iron/Manganese Toxicity: Extremely low pH can induce iron and manganese toxicity, indicated by brown or tan lesions on the foliage. Switch to a base-forming fertilizer, such as 15-0-15. If symptoms do not improve or if the pH is below 6.0, irrigate the crop with a hydrated lime solution. Be sure to rinse foliage after application to avoid phytotoxicity.

Butterfly F1 Series Pentas continued

Calcium and Magnesium Deficiency: If pH falls below recommended target values, lower leaf interveinal chlorosis and foliar puckering can develop, especially during flowering when pH can fall as much one unit in 24 hours due to plant roots actively acidifying the media. Use fertilizers that contain magnesium during early crop development. Supplement with calcium nitrate as directed above to adjust pH. Avoid wide fluctuations in media moisture levels.

Note: To increase soil pH, apply 12 oz. hydrated lime per 100 gal. water (90 g. per 100 l) as a soil drench. Follow up with 1 tablespoon of limestone (dolomite or calcium carbonate) per pot. Do not apply hydrated lime if the medium ammonium level is above 10 ppm (1:2 extraction).

Note: Chemical recommendations are only guidelines. Follow national and state regulations.

'Cajun Belle', 'Cute Stuff Gold II', 'Cute Stuff Red' & 'Sweet Heat' Peppers

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Sowing

Can be produced in 512 or larger plug tray. Cover the seed lightly with coarse vermiculite.

Stage 1 - Germination takes 5 to 7 days. Soil temperature: 71 to 78°F (22 to 24°C) Light: Optional

Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge.

Note: Peppers are very sensitive to high salts, particularly high ammonium, during germination.

Keep ammonium levels to less than 10 ppm.

Stage 2

Soil temperature: 68 to 73°F (20 to 23°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the soil to dry out slightly before watering for best germination and rooting.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering to promote root growth and control shoot growth. Keep the moisture level to wet-dry cycle (moisture level 4 to 2). Avoid permanent wilting.

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC) from 14-0-14 or other calcium/potassium nitrate fertilizer. Fertilize every 2 to 3 irrigations. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction). Growth Regulators: If necessary, one application of Sumagic (uniconazole) at rate of 2.5 ppm (4.6 ml/l of 0.055% formulation) can be applied at 2 weeks after sowing for Cajun Belle and Cute Stuff Red. Sweet Heat is a naturally compact variety and does not need Sumagic.

Stage 4

Soil temperature: 62 to 67°F (17 to 19°C) **Light:** Up to 5,000 f.c. (53,800 Lux)

Moisture: Same as Stage 3. Fertilizer: Fertilize with 14-0-14, 15-5-15 or calcium/potassium nitrate feed at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC) as needed.

Growing On to Finish

Container Size

4-in. (10-cm) square/quart pots: 1 plug per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 65 to 70°F (18 to 21°C) **Days:** 68 to 79°F (20 to 26°C) Peppers prefer warm temperatures. Peppers can be damaged by temperatures below 45°F (7°C).

Light

Maintain light levels as high as possible. High light levels and spacing will keep plants from stretching.

Irrigation

Grow plants on the dry side. To provide some height control, plants can be allowed to wilt slightly prior to irrigation once plants are rooted to the edge of the container.

Fertilizer

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) every third irrigation with predominately a nitrate-form fertilizer with low phosphorus and high potassium. Maintain media pH at 5.8 to 6.2. For a constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm).

Pinching

Pinching is not needed.

Crop Scheduling Sow to transplant (512 cell plug): 5 to 6 weeks

Transplant to sale: 4 to 7 weeks For Growers who want to ship vegetables with developing fruit, Sweet Heat is an excellent choice. The crop time from transplant to ship with fruit is about 8-10

weeks. **Common Problems**

Insect: Watch for Aphids. Disease: No severe diseases.

Black Pearl, Calico & Purple Flash **Ornamental Peppers**

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Sowing

Can be produced in 288 or larger plug tray. Cover the seed lightly with coarse vermiculite.

Stage 1 - Germination takes 5 to 7 days. Soil temperature: 72 to 76°F (22 to 24°C)

Light: Optional Moisture: Keep soil evenly moist but not saturated (level 4).

Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge.

Note: Peppers are very sensitive to high salts, particularly high ammonium, during germination.

Keep ammonium levels to less than 10 ppm.

Stage 2

Soil temperature: 68 to 73°F (20 to 23°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the soil to dry out slightly before watering for best germination and rooting.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 68 to 70°F (20 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering to promote root growth and control shoot growth. Keep the moisture level to wet-dry cycle (moisture level 4 to 2). Avoid wilt.

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC) from 14-0-14 or other calcium/potassium nitrate fertilizer. Fertilize every 2 to 3 irrigations. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction). Growth Regulators: If necessary, one application of uniconazole (Sumagic) at rate of 2.5 ppm (4.6 ml/l of 0.055% formulation) can be applied at two weeks after sowing. Repeat two weeks later if needed.

Stage 4

Soil temperature: 68 to 70°F (20 to 21°C) **Light:** Up to 5,000 f.c. (53,800 Lux) Moisture: Same as Stage 3. Fertilizer: Fertilize with 14-0-14, 15-5-15 or calcium/potassium nitrate feed at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC) as needed.

Growing On to Finish

Container Size

1801 pack: 1 plug per cell 4 to 4.5-in (10 to 11-cm) pot: 1 plug per pot 6-in. (15-cm) pot: 1 to 3 plugs per pot 1 gallon (18-cm) pot: 1 to 3 plugs per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 65 to 70°F (18 to 21°C) **Days:** 68 to 80°F (20 to 26°C) Peppers prefer warm temperatures. Peppers can be damaged by temperatures below 45°F (7°C).

Light

Maintain light levels as high as possible. High light levels and spacing will keep plants from stretching.

Irrigation

Grow plants on the dry side. To provide some height control, plants can be allowed to wilt slightly prior to irrigation once plants are rooted to the edge of the container.

Fertilizer

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) every third irrigation with a predominantly nitrate-form fertilizer with low phosphorus and high potassium. Maintain media pH at 5.8 to 6.2.

For a constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm).

Controlling Height

High light levels and spacing will keep plants from stretching. Chemical plant growth regulators are not recommended on ornamental peppers after transplanting.

Pinching Pinching is not needed. **Crop Scheduling** weeks 10 weeks

Common Problems Insect: Watch for aphids. Disease: No severe diseases.

Chilly Chili, Medusa & Sangria Ornamental Peppers

Plug Production Media

Sowing

vermiculite. Light: Optional saturated (level 4). germination.

Stage 2

Soil temperature: 68 to 73°F (20 to 23°C) **Light:** Up to 2,500 f.c. (26,900 Lux) **Moisture:** Reduce soil moisture slightly (level 3 to 4) to allow the soil to dry out slightly before watering for best germination and rooting. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 68 to 70°F (20 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering to promote root growth and control shoot growth. Keep the moisture level to wet-dry cycle (moisture level 4 to 2). Avoid wilt.

Sow to transplant (288 cell plug): 4 to 5

Transplant to foliage only, no fruit: 9 to

Transplant to mature fruit: 16 to 20 weeks Note: Crop time for mature fruit will be 4 to 5 weeks shorter during Summer production.

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Can be produced in 288 or larger plug tray. Cover the seed lightly with coarse

Stage 1 - Germination takes 5 to 7 days. **Soil temperature:** 72 to 76°F (22 to 24°C)

Moisture: Keep soil evenly moist but not

Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge.

Note: Peppers are very sensitive to high salts, particularly high ammonium, during

Keep ammonium levels to less than 10 ppm.

PanAmerican Seed.

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC) from 14-0-14 or other calcium/potassium nitrate fertilizer. Fertilize every 2 to 3 irrigations. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction). Growth Regulators: If necessary, one application of uniconazole (Sumagic) at rate of 2.5 ppm (4.6 ml/l of 0.055% formulation) can be applied at two weeks after sowing. Repeat two weeks later if needed. Medusa is a naturally compact variety and does not need chemical control.

Stage 4

Soil temperature: 68 to 70°F (20 to 21°C) Light: Up to 5,000 f.c. (53,800 Lux) Moisture: Same as Stage 3 Fertilizer: Fertilize with 14-0-14, 15-5-15 or calcium/potassium nitrate feed at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC) as needed.

Growing On to Finish

Container Size

1801 pack: 1 plug per cell 4 to 4.5-in (10 to 11-cm) pot: 1 plug per pot 6-in. (15-cm) pot: 1 to 3 plugs per pot 1 gallon (18-cm) pot: 1 to 3 plugs per pot Note: Medusa is not recommended for production in 6-in. (15-cm) and larger containers.

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 65 to 70°F (18 to 21°C) **Days:** 68 to 80°F (20 to 26°C) Peppers prefer warm temperatures. Peppers can be damaged by temperatures below 45°F (7°C).

Light

Maintain light levels as high as possible. High light levels and spacing will keep plants from stretching.

Irrigation

Grow plants on the dry side. To provide some height control, plants can be allowed to wilt slightly prior to irrigation once plants are rooted to the edge of the container.

Fertilizer

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) every third irrigation with a predominantly nitrate-form fertilizer with low phosphorus and high potassium. Maintain media pH at 5.8 to 6.2.

For a constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm).

Chilly Chili, Medusa & Sangria Ornamental Peppers continued

Controlling Height

Sangria, Medusa and Chilly Chili ornamental peppers produce naturally dwarf, compact plants. High light levels and spacing will keep plants from stretching. Chemical plant growth regulators are not recommended on ornamental peppers after transplanting.

Pinching

Pinching is not needed.

Crop Scheduling

Sow to transplant (288 cell plug): 4 to 5 weeks

Transplant to sale: 8 to 12 weeks Flower to fruit: 4 to 6 weeks Total crop time: 16 to 22 weeks Note: Crop time for mature fruit will be 4 to 5 weeks shorter during Summer production.

Common Problems

Insect: Watch for aphids. **Disease:** No severe diseases.

Post-Production Care

Once the peppers have formed, night temperatures of 60 to 65°F (15 to 18°C) and day temperatures of 65 to 75°F (18 to 24°C) are optimal.

Avoid shipping Sangria, Medusa and Chilly Chili plants in closed boxes. Due to the high fruit count, ethylene can build up in the boxes, causing the foliage to drop. If boxing is necessary, do not close boxes until just before loading onto trucks. Recommend that your customer unbox the plants immediately upon arrival.

Ornamental peppers prefer full sun; however, partial shade may be beneficial during retail display.

Debonair Collection F1 Multiflora Petunia

Plug Production

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Covering seed is not recommended. Water adequately after sowing to completely dissolve the pellet.

Stage 1 – Germination takes approximately 4 days.

Soil temperature: 72 to 76°F (22 to 24°C) Light: Lighting is optional.

Moisture: Keep soil very wet (level 5) during Stage 1 for optimal germination.

Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2 **Soil temperature:**68 to 75°F (20 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil

moisture (level 4) to allow roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less

than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdrv cvcle (moisture level 4 to 2). Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Control plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant regulators first.

In North American conditions: Apply B-Nine/Alar (daminozide) 1 to 2 applications at 5,000 ppm (6.0 g/l, 85% formulation or 7.8 g/l, 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants.

In Northern European conditions:

1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) spray has been tested and shown effective if needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

4 to 5-in. (10 to 13-cm) pots: 1 plant per pot 6-in. (15-cm) pots: 1 to 3 plants per pot

10-in. (25-cm) baskets: 3 to 4 plants per basket

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 57 to 65°F (14 to 18°C) **Days:** 61 to 75°F (16 to 24°C) Debonair can be grown as low as 50° F (10° C). Crop timing (time to flower) is related to average temperature when grown under proper daylength. Debonair plants will take longer to flower when grown in cooler conditions.

Note: Black Cherry may get some yellow color breaks under cold temperature at about 35°F (2°C).

Light

Keep light levels as high as possible while maintaining moderate temperatures.

Fertilizer

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N (1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and balance medium pH. Maintain medium pH 5.8 to 6.2. For a constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Use B-Nine/Alar (daminozide) at 5,000 ppm (5.9 g/l, 85% formulation or 7.8 g/l, 64% formulation) for weekly application starting at 7 days after transplant, or just use the same PGR as that for multiflora petunias, such as Carpet or Mirage.

Caution: Avoid using B-Nine, as B-Nine could cause Black Cherry some yellow color breaks or wash out black color a little bit to become more cherry tone. Instead of B-Nine, Bonzi 2 to 3 ppm drench or Topflor 1 to 2 ppm at 10 days after transplant can be used. To determine the best rate for your conditions, we recommend that you run an in-house trial.

Photoperiod

All Debonair varieties can flower successfully at 10-hour daylengths. Debonair Dusty Rose will be slightly earlier than Debonair Lime Green in short-day conditions.

Crop Scheduling

Sow to transplant (400 to 288-cell plug): 4 to 6 weeks

Transplant to flower: 5 to 7 weeks

Total Crop Time:

Container	Plants/Pot	Spring	Summer
4 in. (10 cm) pot	1 plant per pot	10-12 weeks	8-10 weeks
6 in. (15 cm) pot	1-3 plants per pot	10-12 weeks	8-10 weeks
10 in. (25 cm) basket	3-4 plants per basket	10-13 weeks	8-11 weeks

Common Problems

No major problems will occur if good cultural and IPM practices are used.

Ez Rider[®] Grandiflora **Series Petunia**

Plug Production

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Covering seed is not recommended. Water adequately after sowing to completely dissolve the pellet.

Stage 1 - Germination takes approximately 4 days.

Soil temperature: 72 to 76°F (22 to 24°C) Light: Lighting is optional. Moisture: Keep soil saturated (moisture level 5) during Stage 1 for optimal germination.

Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 75°F (20 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) **Moisture:** Start to slightly reduce soil moisture (level 4) to allow roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux)

Media Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature **Nights:** 57 to 65°F (14 to 18°C) Days: 61 to 75°F (16 to 24°C)

regulators first. petunias.

Stage 4

basket

B-Nine/Alar (daminozide) 1 to 2 applications at 2500-5,000 ppm (3.0-6.0 g/l, 85% formulation or 3.9-7.8 g/l, 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants.

PanAmerican Seed.

Moisture: Allow media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2).

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Control plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant

Ez Rider plugs can be treated with the same growth regulators as other standard

In North American conditions: Apply

In Northern European conditions: 1 to 3 applications of B-Nine/Alar (daminozide) at

1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) spray have been tested and shown effective if needed.

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 804 pack: 1 plant per cell 10-in. (25-cm) baskets: 3 to 4 plants per

Ez Rider series petunias can tolerate temperatures as low as 35°F (2°C); however, keep in mind that crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Ez Rider plants will take longer to flower when grown in cooler conditions.

Light

Keep light levels as high as possible while maintaining moderate temperatures.

Fertilizer

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N (1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and balance medium pH. Maintain medium pH 5.8 to 6.2.

For a constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Ez Rider petunia is genetically compact and needs less to no PGR after transplanting. Based upon numerous trials, use B-Nine/ Alar (daminozide) at 2,500 ppm (2.9 g/l, 85% formulation or 3.9 g/l, 64% formulation) 1 to 3 applications starting at 7 days after transplant, or just use the half PGR rate as that for standard petunias, such as Dreams. Under some growing regimes, production with no plant growth regulators may be possible.

To determine the best rate for your conditions, we recommend that you conduct an in-house trial.

Photoperiod

Similar to Dreams petunia, all Ez Rider varieties can flower successfully at 10-hour daylengths with slightly delayed flower time compared with long day conditions.

Crop Scheduling

Sow to transplant (288-cell plug): 5 to 6 weeks

Transplant to flower: 5 to 7 weeks

Total Crop Time:

-			
Container Size	Number of Plants	Spring	Summer
804 pack	1 plant	9-11	8-10
	per cell	weeks	weeks
10 in. (25 cm)	3-4 plants	10-13	8-11
basket	per basket	weeks	weeks

Common Problems

No major problems will occur if good cultural and IPM practices are used.

Lo Rider[®] Multiflora Series Petunia

Plug Production

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Covering seed is not recommended. Water adequately after sowing to completely dissolve the pellet.

Stage 1 - Germination takes approximately 4 days.

Soil temperature: 72 to 76°F (22 to 24°C) Light: Lighting is optional. Moisture: Keep soil saturated (moisture

level 5) during Stage 1 for optimal germination.

Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 75°F (20 to 24°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 4) to allow roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2). Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Control plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant regulators first.

Lo Rider plugs can be treated with the same growth regulators as other standard petunia.

In North American conditions: Apply B-Nine/Alar (daminozide) 1 to 2 applications at 2500-5,000 ppm (3.0-6.0 g/l, 85% formulation or 3.9-7.8 g/l, 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants.

In Northern European conditions: 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) spray have been tested and shown effective if needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

804 pack: 1 plant per cell 10-in. (25-cm) baskets: 3 to 4 plants per basket

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 57 to 65°F (14 to 18°C) **Days:** 61 to 75°F (16 to 24°C)

Lo Rider petunias can tolerate temperatures as low as 35°F (2°C); however, keep in mind that crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Lo Rider plants will take longer to flower when grown in cooler conditions.

Light

Keep light levels as high as possible while maintaining moderate temperatures.

Fertilizer

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N (1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and balance medium pH. Maintain medium pH 5.8 to 6.2. For a constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Lo Rider petunia is genetically compact and needs less to no PGR after transplanting. Based upon numerous trials, use B-Nine/ Alar (daminozide) at 2,500 ppm (2.9 g/l, 85% formulation or 3.9 g/l, 64% formulation) 1 to 3 applications starting at 7 days after transplant, or just use the half PGR rate as that for standard petunias, such as Dreams. Under some growing regimes, production with no plant growth regulators may be possible.

To determine the best rate for your conditions, we recommend that you conduct an in-house trial.

Photoperiod

Similar to Dreams petunia, all Lo Rider varieties can flower successfully at 10-hour daylengths with slightly delayed flower time compared with long day conditions.

Crop Scheduling

Sow to transplant (288-cell plug): 5 to 6 weeks

Transplant to flower: 5 to 7 weeks

Total Crop Time:

Container Size	Number of Plants	Spring	Summer
804 pack	1 plant	9-11	8-10
	per cell	weeks	weeks
10 in. (25 cm)	3-4 plants	10-13	8-11
basket	per basket	weeks	weeks

Common Problems

No major problems will occur if good cultural and IPM practices are used.

Pretty Flora Floribunda Series Petunia

Plug Production

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Covering seed is not recommended. Water adequately after sowing to completely dissolve the pellet.

Stage 1 – Germination takes approximately 4 days.

Soil temperature: 72 to 76°F (22 to 24°C) Light: Lighting is optional. Moisture: Keep soil saturated (moisture level 5) during Stage 1 for optimal germination.

Supplemental Lighting Chart

These tables will help you to decide when you need to light the different Wave Petunia family varieties and choose the right variety for you. For example, if you want to produce Wave petunia during week 6 to week 20 in Kalamazoo, MI (N42.5°), you need to light group 3 varieties for 3 weeks, group 4 varieties for 6 weeks, but you don't need to use supplemental light for group 1 and group 2 varieties.

Daylength Requirements for Flowering Wave[™] Petunia Varieties

Group	Minimum Daylength Requirement*	Variety
1	10 hours	Easy Wave® Berry Ve Silver, Violet, White,
2	10.5 hours	Easy Wave® Blue, Bur
3	11 hours	Easy Wave Pink, Plur
4	12 hours	Wave Lavender, Mist

*Speed of flowering increases at longer daylengths.

Production Weeks When Lighting is Required for Different Wave Petunias Based on Latitude (N: Natural Daylength, L: Supplemental Lighting-daylength extension to 14 hours or night interruption from 10PM to 2AM by using HID or incandescent lights)

Latitude N25°. for cities such as: Miami, FL

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Group 1	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν
Group 2	L	L	L	L	L	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	Ν	Ν	Ν	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L
Group 3	L	L	L	Γ	L	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	Γ	L
Group 4	L	L	L	Γ	L	L	L	Γ	L	L	Γ	Γ	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	Ν	N	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L	L	L	L	Γ	L

Latitude N30°. for cities such as: Jacksonville. FL: New Orleans. LA: San Antonio and Houston. TX

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Group 1	L	L	L	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L
Group 2	L	L	L	N	Ν	N	Ν	Ν	Ν	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L
Group 3	L	L	L	L	L	L	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L
Group 4	L	L	L	L	L	L	L	L	L	L	L	L	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L	L	L	L	L	L

Latitude N35°, for cities such as: Atlanta, GA; Charlotte, NC; Little Rock, AR; Los Angeles, CA; Oklahoma City, OK

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Group 1	L	L	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L
Group 2	L	L	L	L	L	N	Ν	Ν	N	Ν	Ν	Ν	Ν	N	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L
Group 3	L	L	L	L	L	L	L	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	Γ	L	L	L
Group 4	L	L	L	L	L	L	L	L	L	L	L	L	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L	L	L	L	L	L

Latitude N40°, for cities such as: Baltimore, MD; Cincinnati, OH; Columbus, OH; Denver, CO; Indianapolis, IN; Philadelphia, PA; Salt Lake City, UT

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	3 14	1	5 16	5 17	18	3 19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Group 1	L	L	L	L	Ν	Ν	Ν	Ν	N	Ν	Ν	N	N	Ν	N	I N	N	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L
Group 2	L	L	L	L	Γ	L	Ν	Ν	N	N	Ν	N	N	Ν	N	I N	N	N	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	Γ	L	L	L	L	L
Group 3	L	L	L	L	L	L	L	L	N	Ν	Ν	N	N	Ν	N	I N	N	N	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L	L	L
Group 4	L	L	L	L	L	L	L	L	L	L	L	L	N	N	N	I N	N	N	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L	L	L	L	L	L

Latitude N42.5°, for cities such as: Boston, MA; Buffalo, NY; Chicago, IL; Cleveland, OH; Kalamazoo, MI; Grand Rapids, MI; Toledo, OH

																						-																	•														
Week	1	2	2 3	4	1 5	6	7	' 8	3 9	9 1	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27 2	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Group 1	L	L	. L	L	. L	. N	I N	IN	1 1	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L
Group 2	L	L	. L	. L	. L	. L	. N	IN	1 1	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	Γ	L	L	L	L	L
Group 3	L	L	. L	. L	. L	. L	. L	. L	LI	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	Γ	L	L	L	L	L
Group 4	L	L	. L	. L	. l	. L	. L	. L	-	L	L	L	L	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L	L	L	L	L	L

Latitude N45°, for cities such as: Minneapolis, MN; Montreal, ON; Ottawa, ON; Portland, OR; Traverse City, MI; Toronto, ON

Week	1	2	2 3	3 4	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Group 1	L	L			L	L	L	Ν	Ν	Ν	Ν	Ν	N	Ν	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L
Group 2	2 L	l	LI		L	L	L	L	Ν	Ν	Ν	Ν	N	Ν	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	Ν	L	L	L	L	L	L	L	L	L
Group 3	s L	L	LI	LI	L	L	L	L	L	L	Ν	Ν	N	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	N	L	L	L	L	L	L	L	L	L	L
Group 4	i L	L	LI	LI	L	L	L	L	L	L	L	L	L	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L	L	L	L	L	L

Latitude N50°, for cities such as: Seattle, WA; Vancouver, BC; Winnipeg, MB

Week 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21

elour, Pink Passion, Burgundy Star, Coral Reef, Neon Rose, Red, Rosy Dawn, and Yellow; Shock Wave® Coral Crush, Denim, Pink Shade, Red, Yellow

rgundy Velour; Shock Wave® Coconut, Pink Vein, Purple, and Rose

m Vein, and Red Velour; Wave Blue

ty Lilac, Pink, Purple Classic, Purple** and Rose; all Tidal Wave[®] colors

**Wave Purple improved requires 11.5 hours daylength or one week less of supplemental lighting compared to Purple Classic.

•	<u> </u>																													_
22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	Γ	L	L	L	L	Γ	L	L
Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	Γ	Γ	L	Γ	L	L	Γ	L	L
Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	Γ	L	Γ	L	L	Γ	L	L
Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	Ν	L	L	L	L	L	L	L	L	L	L	L	L	L

Pretty Flora Floribunda Series Petunia continued

Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 75°F (20 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 4) to allow roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2). Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH 5.8

to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Control plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant regulators first.

Pretty Flora plugs can be treated with the same growth regulators as other standard petunias.

In North American conditions: Apply

B-Nine/Alar (daminozide) 1 to 2 applications at 2500-5,000 ppm (3.0-6.0 g/l, 85% formulation or 3.9-7.8 g/l, 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants.

In Northern European conditions:

1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) spray have been tested and shown effective if needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 804 pack: 1 plant per cell 10-in. (25-cm) baskets: 3 to 4 plants per basket

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 57 to 65°F (14 to 18°C) **Days:** 61 to 75°F (16 to 24°C)

The Pretty Flora Floribunda series can tolerate temperatures as low as 35°F (2°C); however, keep in mind that crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Pretty Flora Floribunda plants will take longer to flower when grown in cooler conditions.

Light

Keep light levels as high as possible while maintaining moderate temperatures.

Fertilizer

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N (1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and balance medium pH. Maintain medium pH 5.8 to 6.2.

For a constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Pretty Flora petunia is genetically compact and needs less to no PGR after transplanting. Based upon numerous trials, use B-Nine/ Alar (daminozide) at 2,500 ppm (2.9 g/l, 85% formulation or 3.9 g/l, 64% formulation) 1 to 3 applications starting at 7 days after transplant, or just use the half PGR rate as that for standard petunias, such as Madness. Under some growing regimes, production with no plant growth regulators may be possible.

To determine the best rate for your conditions, we recommend that you conduct an in-house trial.

Photoperiod

Similar to Dreams petunia, all Pretty Flora varieties can flower successfully at 10-hour daylengths with slightly delayed flower time compared with long day conditions.

Crop Scheduling

Sow to transplant (288-cell plug): 5 to 6 weeks

Transplant to flower: 5 to 7 weeks

Total Crop Time:

Container Size	Number of Plants	Spring	Summer
804 pack	1 plant	9-11	8-10
	per cell	weeks	weeks
10 in. (25 cm)	3-4 plants	10-13	8-11
basket	per basket	weeks	weeks

Common Problems

No major problems will occur if good cultural and IPM practices are used.

Pretty Grand Grandiflora Series Petunia

Plug Production

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Covering seed is not recommended. Water adequately after sowing to completely dissolve the pellet.

Stage 1 – Germination takes approximately 4 days.

Soil temperature: 72 to 76°F (22 to 24°C)

Light: Lighting is optional.

Moisture: Keep soil saturated (moisture level 5) during Stage 1 for optimal germination.

Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 75°F (20 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 4) to allow roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

extraction).

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2). Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2

Growth Regulators: Control plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant regulators first.

Pretty Grand plugs can be treated with the same growth regulators as other standard petunia.

In North American conditions: Apply B-Nine/Alar (daminozide) 1 to 2 applications at 2500-5,000 ppm (3.0-6.0 g/l, 85% formulation or 3.9-7.8 g/l, 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants.

In Northern European conditions: 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) spray have been tested and shown effective if needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 804 pack: 1 plant per cell

10-in. (25-cm) baskets: 3 to 4 plants per basket

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 57 to 65°F (14 to 18°C) **Days:** 61 to 75°F (16 to 24°C)

basket

conditions.

Light Fertilizer

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and balance medium pH. Maintain medium pH 5.8 to 6.2.

For a constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

possible.

To determine the best rate for your conditions, we recommend that you conduct an in-house trial.

Photoperiod

Similar to Dreams petunia, all Pretty Grand varieties can flower successfully at 10-hour daylengths with slightly delayed flower time compared with long day conditions.

Crop Scheduling Sow to transplant (288-cell plug): 5 to 6 weeks

Transplant to flower: 5 to 7 weeks Total Crop Time:

Container Size

804 pack

10 in. (25 cm)

Common Problems

Pretty Grand petunias can tolerate temperatures as low as 35°F (2°C); however, keep in mind that crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Pretty Grand plants will take longer to flower when grown in cooler

Keep light levels as high as possible while maintaining moderate temperatures.

Pretty Grand petunia is genetically compact and needs less to no PGR after transplanting. Based upon numerous trials, use B-Nine/ Alar (daminozide) at 2,500 ppm (2.9 g/l, 85% formulation or 3.9 g/l, 64% formulation) 1 to 3 applications starting at 7 days after transplant, or just use the half PGR rate as that for standard petunias, such as Dreams. Under some growing regimes, production with no plant growth regulators may be

Number of Plants	Spring	Summer
1 plant per cell	9-11 weeks	8-10 weeks
3-4 plants per basket	10-13 weeks	8-11 weeks

No major problems will occur if good cultural and IPM practices are used.

Sophistica[®] Collection F1 Grandiflora Petunia

Plug Production

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Covering seed is not recommended. Water adequately after sowing to completely dissolve the pellet.

Stage 1 – Germination takes approximately 4 days.

Soil temperature: 72 to 76°F (22 to 24°C) Light: Lighting is optional for all varieties. Sophistica Lime Bicolor will benefit from light at Stage 1.

Moisture: Keep soil very wet (level 5) during Stage 1 for optimal germination.

Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 75°F (20 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 4) to allow roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2). Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Control plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant regulators first.

Sophistica[®] Collection F¹ Grandiflora Petunia continued

In North American conditions: Apply B-Nine/Alar (daminozide) 1 to 2 applications at 5,000 ppm (6.0 g/l, 85% formulation or 7.8 g/l, 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants.

In Northern European conditions: 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) spray has been tested and shown effective if needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

4 to 5-in. (10 to 13-cm) pots: 1 plant per pot 6-in. (15-cm) pots:1 to 3 plants per pot 10-in. (25-cm) baskets: 3 to 4 plants per basket

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 57 to 65°F (14 to 18°C) **Days:** 61 to 75°F (16 to 24°C) Sophistica petunias can tolerate temperatures as low as 35°F (2°C); however, keep in mind that crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Sophistica plants will take longer to flower when grown in cooler conditions.

Note: Blackberry may get some yellow color breaks under cold temperatures at about 35°F (2°C).

Light

Keep light levels as high as possible while maintaining moderate temperatures.

Fertilizer

Apply nitrate-form with low phosphorus fertilizer at rate 3 (175 to 225 ppm N (1.2 to 1.5 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and balance medium pH. Maintain medium pH 5.8 to 6.2. For a constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Use B-Nine/Alar (daminozide) at 5,000 ppm (5.9 g/l, 85% formulation or 7.8 g/l, 64% formulation) for weekly application starting at 7 days after transplant, or just use the same PGR as that for grandiflora petunias such as Dreams or Supercascade.

Caution: Avoid using B-Nine for Lime Green and Blackberry as B-Nine could bleach out color for Lime Green and wash out black color a little bit to become more cherry tone as well as get some yellow color breaks for Blackberry. Instead of B-Nine, Bonzi 2 to 3 ppm drench or Topflor 1 to 2 ppm drench at 10 days after transplant can be used.

To determine the best rate for your conditions, we recommend that you run an in-house trial.

Photoperiod

Sophistica petunias can flower successfully at 10-hour daylengths. Crop time is 3 to 6 days faster under longer day conditions. **Crop Scheduling**

Sow to transplant (288-cell plug): 5 to 6 weeks

Transplant to flower: 5 to 7 weeks Total Crop Time:

Container	Plants/Pot	Spring	Summer
4 in. (10 cm) pot	1 plant	10-12	8-10
	per pot	weeks	weeks
6 in. (15 cm) pot	1-3 plants	10-12	8-10
	per pot	weeks	weeks
10 in. (25 cm)	3-4 plants	10-13	8-11
basket	per basket	weeks	weeks

Common Problems

No major problems will occur if good cultural and IPM practices are used.

Easy Wave[®] Series Petunia

Plua Production

Note: Because their spreading habit begins after transplanting, Easy Wave plugs can be produced like other petunia plugs.

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Covering Easy Wave seed is not recommended. Water adequately after sowing to completely dissolve the pellet.

Stage 1 – Germination takes approximately 4 days.

Soil temperature: 72 to 76°F (22 to 24°C) Light: Lighting is optional. Burgundy Star, Pink and Plum Vein benefit from light during germination.

Moisture: Keep soil very wet (level 5) during Stage 1 for optimal germination.

Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 75°F (20 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 4) to allow root to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2). Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Control plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant regulators first.

In North American conditions: Apply B-Nine/Alar (daminozide) 1 to 2 applications

at 5,000 ppm (6.0 g/l, 85% formulation or 7.8 g/l, 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants. In Northern European conditions: 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) spray has been tested and shown effective if needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

1801 flats & Wave-Pink Packs: 1 plant per cell

4-in. (10-cm) pots: 1 plant per pot 6-in. (15-cm) pots: 1 to 3 plants per pot 10-in. (25-cm) baskets: 3 to 4 plants per basket

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 57 to 65°F (14 to 18°C) **Days:** 61 to 75°F (16 to 24°C) Easy Wave petunias can tolerate temperatures as low as 35°F (2°C); however, keep in mind that crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Easy Wave plants will take longer to flower when grown in cooler conditions. Light

Keep light levels as high as possible while maintaining moderate temperatures.

Fertilizer

Easy Wave petunias require more fertilizer than is usually recommended for petunias. For best results, apply nitrate-form with low phosphorus fertilizer at rate 4 (225 to 300 ppm N (1.5 to 2.0 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and balance medium pH. Maintain medium pH 5.8 to 6.2. For constant fertilizer program, can apply fertilizer at rate 3 (175 to 225 ppm N or 1.2 to 1.5 mS/cm EC) while maintaining the above recommended EC and pH ranges.

Growth Regulators

In North American conditions: Use B-Nine/Alar (daminozide) at 5,000 ppm (5.9 g/l, 85% formulation or 7.8 g/l, 64% formulation) at 7 days after transplant. Follow these with a Bonzi drench at 3 to 5 ppm (0.8 to 1.3 ml/l, 0.4% formulation) depending on environmental conditions. If additional PGR is needed, a Bonzi (paclobutrazol) spray at 30 ppm (7.5 ml/l, 0.4% formulation) will help hold the finished crop.

In Northern European conditions: Use

B-Nine/Alar at 5,000 ppm (5.9 g/l, 85% formulation or 7.8 g/l, 64% formulation) at 7 days after transplant. Follow these with a Bonzi drench 6 to 8 ppm (1.5 to 2.0 ml/l, 0.4% formulation) depending on environmental conditions. If additional PGR is needed, a Bonzi spray at 30 ppm (7.5 ml/l, 0.4% formulation) will help hold the finished crop.

In all conditions:

Burgundy Velour, Plum Vein and Red Velour are more vigorous within the Easy Wave series. They can take higher rates of 1 to 2 ppm more Paclobutrazol drench than others. For hanging basket production, Burgundy Velour and Plum Vein will benefit from one additional Bonzi 30 ppm spray. **Note:** Topflor can be used in place of Bonzi at 2/3 the rate of Bonzi.

Soil temperature: 71 to 76°F (22 to 24°C) Light: Lighting is optional. Denim and Red will benefit from lights in Stage 1. Moisture: Keep soil very wet (level 5) during Stage 1 for optimal germination. Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

weeks **Total Crop Time:**

Container

1801 flats, Wave-Pink Pack 4 in. (10 cm) pot

6 in. (15 cm) pot

10 in. (25 cm) basket

Common Problems

Shock Wave[®] **Series Petunia**

Plug Production

Note: Because their spreading habit begins after transplanting, Shock Wave plugs can be produced like other petunia plugs. Media

4 days.

Sowing Covering Shock Wave seed is not recommended. Water adequately after sowing to completely dissolve the pellet.

To determine the best rate for your

conditions, we recommend that you conduct an in-house trial.

Photoperiod

Wave petunia lighting requirements vary by location, variety and production week. Refer to the Supplemental Lighting Chart on page 123. Easy Wave petunias are less sensitive to daylength than Wave petunias. Most Easy Wave varieties will flower successfully at 10 hours. Easy Wave Pink, Plum Vein and Red Velour flower best with 11-hour daylength. The crop time for Easy Wave varieties will be shorter with longer days, such as 12 hours. When producing Easy Wave petunias early in the year when days are short, decrease crop times by using supplemental lighting after transplanting. Day extension or night break lighting is acceptable.

Crop Scheduling Sow to transplant (288-cell plug): 5 to 6

Transplant to flower: 5 to 7 weeks

Plants/Pot	Spring	Summer
1 plant	10-12	8-10
per cell	weeks	weeks
1 plant	10-12	8-10
per pot	weeks	weeks
2-3 plants	10-12	8-10
per pot	weeks	weeks
3-4 plants	10-13	8-11
per basket	weeks	weeks

No major problems will occur if good cultural and IPM practices are used.

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Stage 1 – Germination takes approximately

Stage 2

Soil temperature: 68 to 76°F (20 to 24°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 4) to allow root to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry until the surface becomes light brown (level 2) before watering. Keep the moisture to wet-dry cycle (moisture level 4 to 2).

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrateform fertilizer with every other fertilization. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction). Plant growth regulators: Control Shock Wave plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant regulators first.

In North American conditions: Apply B-Nine/Alar (daminozide) 1 to 2 applications at 5,000 ppm (6.0 g/l 85% formulation or 7.8 g/l 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants. In Northern European conditions: 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l 85% formulation or 2.0 g/l 64% formulation) spray has been tested and shown effective if needed.

Stage 4

Soil temperature: 59 to 64°F (15 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 1801 flats & Wave-Pink 9-Packs: 1 plant per cell 4 to 4.5-in. (10 to 11-cm) pots: 1 plant per pot 6-in. (15-cm) pots: 1 to 3 plants per pot 10-in. (25-cm) baskets: 3 to 4 plants per basket

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Shock Wave[®] Series Petunia continued

Temperature

Nights: 56 to 64°F (13 to 18°C) **Days:** 62 to 73°F (17 to 23°C) Shock Wave can tolerate temperatures as low as 35°F (2°C); however, keep in mind that crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Shock Wave plants will take longer to flower when grown in cooler conditions.

Note: Shock Wave Deep Purple may get some leaf burn under cold temperature at about 35°F (2°C), but do not significantly suffer in plant development and will grow out of this when temperatures rise.

Light

Keep light levels as high as possible while maintaining temperature.

Fertilizer

Shock Wave petunias require more fertilizer than is usually recommended for petunias. For best results, apply nitrate-form with low phosphorus fertilizer at rate 4 (225 to 300 ppm N/1.5 to 2.0 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and maintain a balanced medium pH of 5.8 to 6.2. For constant fertilizer program, can apply fertilizer at rate 3 (175 to 225 ppm N or 1.2 to 1.5 mS/cm EC) while maintaining the above recommended EC and pH ranges. Prior to shipping the finished product particularly baskets and large containers it is recommended to add a slow-release fertilizer. Due to the dense canopy and the tremendous branching that result in a high amount of foliage and flowers and the overall strong plant growth, Shock Wave plants are heavy feeders. For best consumer success, we encourage incorporation of NutriCoat or Osmocote into the fertilizer program. Please check the label for application quantities based upon the container size.

Plant Growth Regulators

In North American conditions: Use B-Nine/Alar (daminozide) at 5,000 ppm (5.9 g/l, 85% formulation or 7.8 g/l, 64% formulation) 7 days after transplant. Follow with a Bonzi drench about 3 ppm (0.8 ml/l, 0.4% formulation) in Illinois environment, similar to that recommended for Easy Wave varieties. Since Shock Wave Ivory and Pink Vein are genetically more vigorous than other varieties in the Shock Wave series, it is recommended to apply a heavier Bonzi drench rate similar to that recommended for Wave petunias about 5 ppm (1.3 ml/l, 0.4% formulation) in Illinois environment.

For 9-packs, it is recommended to follow the PGR regimes above and to ship product on time.

If additional PGRs are needed, a Bonzi (paclobutrazol) spray at 30 ppm (7.5 ml/l, 0.4% formulation) will help hold the finished crop.

In Northern European conditions: Use the same PGR regime but slightly heavier in Bonzi drench, i.e.; 3 to 4 ppm for Shock Wave Coconut, Coral Crush, Deep Purple, Denim, Pink Shades, Red and Rose, 6 to 8 ppm for Shock Wave Ivory and Pink Vein.

Note: Topflor can be used in place of Bonzi at 2/3 the rate of Bonzi.

To determine the best rate for your conditions, we recommend that you run an in-house trial.

Photoperiod

Shock Wave petunia lighting requirements vary by location, variety and production week. Refer to the Supplemental Lighting Chart on page 123. Shock Wave petunias are less sensitive to daylength than Wave petunias. Shock Wave varieties will flower successfully at 10 hours. The crop time at 10 hours will be about 10 to 14 days longer than at 12-hour daylength. When producing Shock Wave petunias early in the year when days are short, decrease crop times by using supplemental lighting after transplanting. Day extension or night break lighting is acceptable.

Crop Scheduling Sow to transplant (288-cell plug):

5 to 6 weeks Transplant to flower: 5 to 7 weeks

Total Crop Time:

room or op r			
Container	Plants/Pot	Spring	Summer
1801 flat, Wave-Pink 9 Pack	1 plant per cell	9-11 weeks	8-10 weeks
4-4.5-in. (10 -11 cm) pot	1 plant per pot	9-11 weeks	8-10 weeks
6 in. (15 cm) pot	2-3 plants per pot	10-12 weeks	8-10 weeks
10 in. (25 cm) basket	3-4 plants per basket	10-13 weeks	8-11 weeks
Note: While Sh	ock Wave o	can succe	essfully
flower under sl	nort-day co	onditions	, it
takes about 10	to 14 days l	longer to	flower
compared to lo	ng-day cor	nditions a	at the
same temperat	ure. In add	ition to c	lavlength,
temperature al	so affects c	rop time	
Therefore, whe	en producir	19 Shock	Wave
outdoors durin	g early Spr	ing, it sh	ould be
considered that	t both davl	ength an	d cool
townorative	11 1 1 C		

Wave[®] Series **Spreading Petunias: Plug & Liner Production**

Plug Production

Note: Because their spreading habit begins after transplanting, Wave plugs can be produced like other petunia plugs.

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Water thoroughly after sowing to make sure the pellet cracks before the tray is moved to chamber or bench. Do not cover with vermiculite due to physical barriers caused by vermiculite.

Stage 1 – Germination takes approximately 4 days.

Soil temperature: 72 to 76°F (22 to 24°C) Light: Lighting is beneficial. See below for detail.

Moisture: Keep soil very wet (level 5) during Stage 1 for optimal germination.

Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Note: Saturated moisture (level 5) and constant environmental conditions are the key issues for Wave germination. The best germination conditions are in a lighted chamber where the light level is about 10 f.c. (100 Lux) or higher, with 72 to 76°F (22 to 24°C).

If a light chamber is not available, either of the following conditions can be substituted for successful germination:

1) Dark chamber for the first 24 to 48 hours at 72 to 76°F (22 to 24°C). Once the trays are moved out of chamber, maintain saturated moisture (level 5) for the rest of Stage 1 at the same temperature.

2) If germinating on the bench, provide high media temperature from 72 to 76°F (22 to 24°C) and saturated moisture (level 5) by covering with Remay or plastic (Vermiculite is not recommended) until radicles emerge. If not covered, pay close attention to media moisture and maintain saturated condition (level 5) until the end of Stage 1.

Stage 2

Soil temperature: 68 to 75°F (20 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 4) to allow root to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to further dry until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2). Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other

fertilization. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Control Wave plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant regulators first.

In North American conditions: Apply

B-Nine/Alar (daminozide) 1 to 2 applications at 5,000 ppm (6.0 g/l 85% formulation or 7.8 g/l 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later. This treatment can improve basal branching of mature plants. In Northern European conditions: 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l 85% formulation or 2.0 g/l 64% formulation) spray has been tested and shown effective if needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Large Liner Production

For finished plant growers who do not have supplemental lighting and wish to finish Wave spreading petunias with the same PGRs as regular petunias, the best choice is to use larger, pre-lit liners. The following program produces Wave liners which have flower buds induced and all the heavy PGR applications already taken care of.

Liner Size

72-cell or larger. Wave Purple Classic and Wave Pink require 50-cell for uniform flowering.

Sowing

Direct sow into liner or transplant from 512 or 406-plug into liner. Note: If direct sowing, follow all germination requirements.

crop timing. Wave[®] Series Container Size or larger.

4.5 to 6-in. (11 to 15-cm) pots: 1 plant per pot. 10-in. (25-cm) baskets: 3 plants of Wave Purple, Wave Pink or Wave Misty Lilac, or 4 plants of Wave Blue, Wave Rose or Wave Lavender per basket.

abortion occurring. **Growth Regulators** following schedule:

formulation)

PanAmerican Seed.

Photoperiod

Start long-day conditions (daylength extension to 14 hours or 4-hour night interruption) at 5-leaf count or earlier. Continue long-days until plant leaf number reaches 12 (about 6 to 7 weeks from sowing depending on soil temperature, or up to 9 weeks if transplanted from small plugs). Be aware that if plant material is moved from a 14-hour environment to less than 12 hours of light, there is a possibility of bud

To achieve May flowering with a liner production time of 6 weeks, use the

Week 3: B-Nine/Alar (daminozide) at 5,000 ppm (6.0 g/l 85% formulation or 7.8 g/l 64%

Week 4: Repeat B-Nine/Alar spray Week 5: Bonzi (paclobutrazol) spray at 15 ppm (3.8 ml/l, 0.4% formulation) to 60 ppm (15.0 ml/l, 0.4% formulation) spray Week 6: Repeat Bonzi spray, if necessary. If liner production is taking place during periods of cool temperatures and low light, the liner production period is about 1 week longer (about 7 weeks). Therefore, all PGR applications can be postponed 1 week (postpone 2 weeks if transplanted). All other environmental conditions follow normal plug production regimes. Note: Do not overgrow Wave plugs. If plugs become rootbound, the plant slows/ stops growing. Rootbound plugs are more susceptible to disease. It takes about 1 to 2 weeks for plants to recover after transplanting from rootbound plugs. Make sure roots have optimum room for fastest

Growing On to Finish

Refer to the separate Wave Spreading Petunias: Growing On to Finish Grower Facts for complete details.

Spreading Petunias: Growing On to Finish

Growing On to Finish from Plugs

Containers should be 4.5-SVD (11-cm)

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.3 and a medium initial nutrient charge.

Temperature

Nights: 57 to 65°F (14 to 16°C) **Days:** 61 to 75°F (16 to 18°C)

Wave petunias can tolerate temperatures as low as 35°F (2°C); however, keep in mind that crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Wave plants will take longer to flower when grown in cooler conditions.

Photoperiod/Light

Wave petunia lighting requirements vary by location, variety and production week. Refer to the Supplemental Lighting Chart on page 123.

Start long-day or night-interruption conditions at 5-leaf count or earlier. Continue long-days until plants have a minimum of 12 leaves or until proper natural daylength is reached. When producing Wave petunias early in the year when days are short, decrease crop times by continuing to use supplemental lighting. Day extension or night break (providing a 4-hour night interruption from 10:00 p.m. to 2:00 a.m.) are acceptable.

Both HID and incandescent lights are equally effective for flower induction. For initiation, light levels of 10 f.c. (100 Lux) at 10 ft. (3 m) above plant canopy are recommended. However plants grown under incandescent lights will stretch more and need more PGRs to control plant size. Incandescent lights will also affect plant habit by causing shoots to be more upright than under short days, particularly for Wave Rose and Wave Misty Lilac. Plants will resume their normal spreading habit under natural light conditions in the garden. Keep light levels as high as possible while maintaining moderate temperatures. High light levels or PGR applications may cause white "splashes" or star patterns to appear on the blooms of Wave Misty Lilac.

Fertilizer

Wave petunias require more fertilizer than is usually recommended for petunias. For best results, apply a balanced fertilizer with every second or third irrigation of 300 ppm for all genetics. For light feeders, skip first application. To assure consumer satisfaction, an optional top dressing with slow-release fertilizer can be applied 10 days before shipping.

Wave[®] Series Spreading Petunias: Growing On to Finish continued

Growth Regulators

The following growth regulator schedule is used for growing on Wave petunias at the PanAmerican Seed Co. Elburn, Illinois (Midwest) research facility. This "recipe" results in 6-in. (15-cm) pots of heavily branched Wave plants with a spread of approximately 10 to 12 in. (25 to 30 cm) when flowering begins - the perfect look for point of sale. For Wave Rose and Wave Misty Lilac, the pots will be covered with blooms. For Wave Blue, Wave Pink, Wave Purple and Wave Lavender, the first flowers will appear closer to the center of the pot.

6-in. (15-cm) Pots

Apply a B-Nine spray at 2,500 to 5,000 ppm 7 to 10 days after transplanting. Repeat 7 days later. Use a Bonzi drench one time (8-10 ppm for Wave Purple Improved, 5 ppm for Wave Purple Classic, Wave Misty Lilac and Wave Pink; 2 ppm for Wave Lavender, Wave Rose and Wave Blue), 3 to 4 weeks after transplanting or when shoots have reached the edge of the pot. Follow with a Bonzi spray one time at 15 to 30 ppm one week later for additional control.

Somewhat dry conditions during the finishing stage will also keep Wave petunias more compact; allow plants to wilt slightly between waterings. If plants are grown pottight, PGR applications must be done more often or at higher rates than plants that are spaced over time. High temperatures or a moist growing regime may also necessitate greater PGR application rates to produce the best product.

Hanging Baskets

Option 1: Apply a B-Nine spray at 3,000 to 5,000 ppm 7 and 10 days after transplanting. Repeat 7 days later. Use a Bonzi spray one time at 30 ppm, 3 to 4 weeks after transplanting. If necessary, a second Bonzi spray can be done.

Option 2: Apply a B-Nine spray at 3,000 to 5,000 ppm 7 to 10 days after transplanting. Repeat 7 days later. Follow with a Bonzi drench at 3 to 5 ppm at week 3. Repeat Bonzi drench if holding plants longer than desired. B-Nine improves branching, but may delay flowering about 1 week. Bonzi does not appear to affect flower timing. Plants grow out of either plant growth regulator almost immediately after transplant to the landscape. Note: Be sure to check local regulations regarding the use of plant growth regulators.

Note: Topflor can be used in place of Bonzi at 2/3 the rate of Bonzi.

Crop Scheduling Sow to transplant (392-cell plug): 5 to 6 weeks

Transplant to flower: **Spring:** 7 to 10 weeks under long days Summer: 4 to 7 weeks under long days with high light and minimum night temp. of 65°

F (18°C). Total Crop Time:

Spring: 12 to 16 W	eeks	
Container	Plants/Pot	Total Crop Time
4.5-SVD (11 cm) pot	1 plant per pot	12-14 weeks
6 in. (15 cm) pot	1 plant per pot	12-14 weeks
10 in. (25 cm) basket	3-4 plants per basket	13-16 weeks
Summer: 9 to 13 v	weeks	
Container	Plants/Pot	Total Crop Time
4 in. (10 cm) pot	1 plant per pot	9-11 weeks
6 in. (15 cm) pot	1 plant per pot	9-11 weeks

Wave Lavender, Wave Blue, Wave Misty Lilac, Wave Rose and Wave Purple Improved flower up to one week earlier than Wave Purple Classic and Wave Pink.

per basket

10-13 weeks

Common Problems

10 in. (25 cm) basket 3-4 plants

No major problems will occur if using good cultural and IPM practices.

Growing On to Finish from Large Liners

Photoperiod

Natural day during Spring when daylength is longer than 11 hours.

Growth Regulators

One or more (if grown pot to pot) Bonzi 30 to 60 ppm sprays based on temperature, weather conditions and cultural practice. All other environmental conditions follow the normal production.

Crop Scheduling

Sowing to transplant: 6 to 7 weeks for direct sowing; 7 to 9 weeks for transplant from small plug.

Transplant to flower: 5 to 6 weeks from 50cell liner (add 1 more week for Wave Purple Classic and Wave Pink Improved); 5 to 7 weeks from 72-cell liner (add 1 more week for Wave Purple Classic and Wave Pink).

Hanging Basket Tips

At the end of production, maintain fertilization and utilize PGRs. Do not eliminate fertilization to control growth just prior to shipping. Apply fertilizer at half rate and, to hold plant habit, utilize PGRs. Provide good air circulation at the plant level. This reduces potential for disease and die-off. Do not allow plants to wilt. Maintain moderate moisture levels. This will provide better plant performance and color in the center of the basket.

Wave[®] and Tidal Wave[®] **Series Spreading Petunia** Landscape Tips

Important Notes for Growing & Using Wave and Tidal Wave Petunias in the Landscape • Pick the right Wave petunia for your needs. Wave and Tidal Wave have distinct habits. Wave offers a thick, ground-hugging ocean of color. Tidal Wave grows outward, then up for a big, shrublike shape. Tidal Wave looks great growing alongside a fence

- plants will grow up and over the fence! • Start with "fresh" plugs. Avoid starting from rootbound plugs. Plants grown from rootbound plugs may not be able to generate enough roots to adequately sustain themselves when planted outside. Wave and Tidal Wave plugs that have been scheduled and transplanted promptly will root out better in the container and perform better when planted in the landscape. Allowing the containers to dry out slightly between watering encourages better root development. Do not let plants wilt. • Plant well-rooted plants. Avoid planting

poorly rooted plants into the landscape. Poorly rooted plants may wilt quickly if the temperatures become very warm soon after planting.

· Acclimate plants before planting. As a general rule, greenhouse or nurserygrown plants will adapt better in the landscape if they are hardened off prior to planting. Exposing plants to the outside temperatures and light allows the soil to dry between watering and helps reduce transplant shock.

- Follow good soil preparation practices. Wave and Tidal Wave petunias tolerate a wide range of soil conditions. However, tilling the soil for good aeration, adding amendments, raising the beds to provide good drainage, maintaining the proper pH (6.5 to 7.0 is optimum), and using a broad spectrum fungicidal drench all contribute to successful landscape plantings. Plants will take off more quickly if a liquid feed is used before planting. See "Provide Adequate Nutrition" for more details.
- Petunias prefer sun. Wave and Tidal Wave petunias thrive in bright, sunny locations with at least 6 hours of direct sunlight. Sun is a MUST to keep these plants covered with blooms and looking terrific all season long.
- Space adequately. For fast fill, space Wave petunias 12 to 18 in. (30 to 45 cm) apart in the landscape. Wave petunias spread 3 to 4 ft. (90 cm to 1.2 m), so they can be spaced as far as 24 in. (60 cm) apart. Spacing plants closer than 12 in. (30 cm) can lead to overcrowding and contribute to disease.

Space Tidal Wave a minimum of 12 to 15 in. (30 to 38 cm) apart. At this spacing they will form dense mounds of 18 to 24 in. (45 to 60 cm) in height. When spaced at 18 to 24 in. (45 to 60 cm), Tidal Wave will spread more like a ground cover from 2.5 to 4 ft. (75 cm to 1.2 m).

• Irrigation. Wave and Tidal Wave petunias are excellent landscape performers. However, like any other plant, they need adequate water after planting in order to get established in the landscape. During the season, do not overwater. Night watering is not recommended. Morning watering is preferred.

- Water management. Do not let Wave or Tidal Wave petunias dry out to a wilt between waterings as too severe of wilt may lead to increased susceptibility and may limit nutrient uptake. Do not overwater or allow the plants to continually have wet roots. This can lead to disease. Mulching plants can help through conserving moisture.
- Provide adequate nutrition. Wave and Tidal Wave petunias are vigorous growers and benefit from heavier feeding than standard petunias, therefore give plenty of feed throughout the life of the planting. Before Planting: A good way to get the plants off to a fast start is to water the plants with a liquid fertilizer, such as Daniels, prior to planting.

At Planting: A slow-release fertilizer (such as NutriCoat or Osmocote), which is released by temperature, is recommended. For best season-long growth we suggest the following: incorporate slow release at half rate at installation. Too much fertilizer too soon will cause plants to put on leaves, but not flowers. At approximately the halfway point in the life of the landscape, apply another half rate of the slow release formula. In regions where temperatures are elevated, utilize the 8 to 9 month release formulation as this will provide fertilizer longer into the season. During the Growing Season: Because Wave and Tidal Wave are vigorous growers, using a liquid feed throughout the season, in addition to slow-release fertilizer, will give best plant performance. Fertilize with a liquid feed such as Daniels 10-4-3 (1 tablespoon per gallon, approximately 300 ppm) for approximately 6 waterings and water with plain water on the 7th watering. Later in the season, if the plants start to turn yellow, one or two liquid feeds with a higher nitrate level such as 20-10-20, (15-2-20 or 10-10-10 at 250 ppm N High nitrate, low ammonium) can be applied. Always follow the rates recommended on the label.

irrigation cycles.

• Rotate plantings. While it is tempting to use Wave and Tidal Wave petunias every year due to their exceptional garden performance, it is not recommended that any petunias be planted in the same beds every year so that the build-up of harmful disease pathogens specific to all petunias may be avoided. This can occur whenever the same types of plants are used in the same bed year after year. Here are some other high-impact, low-care plants to try in your sunny gardens in the alternating years when you aren't using Wave[™] family varieties. Try tall and stately Purple Majesty Ornamental Millet as a backdrop for bright Dakota Gold Helenium or Bonanza Marigolds. Plant lush, ground-hugging Silver Falls Dichondra along with vibrant Vista Salvias. Other great varieties to try include Serena[™] Angelonia, DragonWing[™] Begonia, Pentas Butterfly, and Ornamental Pepper Black Pearl, which is particularly nice mixed with Tidal Wave Silver.

Additional Tips for Using Wave and **Tidal Wave Petunias in Containers**

petunias. BallLandscape.com.

Tidal Wave® Series Hedge Petunia

Plug Production Because their spreading habit begins after transplanting, you can produce Tidal Wave plugs like other petunia plugs.

PanAmerican Seed.

• Mulching. Use at least 2 in. (5 cm) of mulch. Mulch helps by keeping soil temperatures down through insulation and reflection of light, keeping weeds in check and conserving moisture for possible fewer

• Wave and Tidal Wave petunias are multipurpose! In addition to making a wonderful color impact in gardens, they're spectacular in large containers, street planters and large window boxes. For fantastic showings in hanging baskets, choose Easy Wave™

• Containers dry out more quickly than ground plantings. Since containers need to be watered more frequently, nutrients are likely to be leached from the containers more quickly. As a result they may also require more frequent feeding. • Keep your Wave and Tidal Wave petunias well-fed and don't let them dry out between waterings. Apply a liquid fertilizer once a week or use a combination of liquid and slow-release fertilizers, following the rates recommended on the labels. For more information on all Wave Family spreading petunias, visit Wave-Rave.com or

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mmhos/cm (1:2 extraction).

Sowing

Covering Tidal Wave seed is not recommended. Water adequately to completely dissolve the pellet.

Temperature

Germination: 72 to 76°F (22 to 24°C) **Cotyledon stage:** 68 to 75°F (20 to 24°C) True leaves: 65 to 70°F (18 to 21°C) Hold plugs: 60 to 65°F (16 to 18°C)

Light

Tidal Wave plugs require light during Stage 1. Stage 1: 10 f.c. (100 Lux) or more After germination: 1,000 to 2,500 f.c. (10,000 to 30,000 Lux)

Seedling maturity: Up to 5,000 f.c. (54,000 Lux) if temperature can be controlled.

Humidity

Maintain 100% relative humidity (RH) until cotyledons emerge. RH can be reduced gradually to approximately 50% as plugs mature.

Soil Moisture

Apply above-average amounts of soil moisture during Stage 1 for optimal germination.

Fertilizing

At radicle emergence: 50 ppm N from low phosphorus-nitrate form fertilizer. As cotyledons expand: Increase to 100 to 150 ppm N. Maintain medium EC between 1.0 and 1.5 mmhos/cm (1:2 extraction).

Growth Regulators

Control Tidal Wave plug growth first by environment, nutrition and irrigation management, then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant regulators first.

B-Nine: 1 to 2 applications at 5,000 ppm as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later.

Bonzi: 1 application at 6 ppm as a spray during late Stage 3.

Growing On to Finish

Container Size

Containers should be 4-in. (10-cm) or larger. 4-in. (10-cm) pots: 1 plant per pot. 6 to 8-in. (15 to 20-cm) pots: 2 to 3 plants per pot.

10-in. (25-cm) baskets: 3 to 4 plants per basket.

Tidal Wave[®] Series Hedge Petunia continued

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.3 and a medium initial nutrient charge.

Temperature

Nights: 57 to 65°F (14 to 16°C) **Days:** 61 to 75°F (16 to 18°C) Tidal Wave petunias can tolerate temperatures as low as 35°F (2°C); however, keep in mind that crop timing (time to flower) is related to daily average temperature when grown under proper daylength. Tidal Wave plants will take longer to flower when grown in cooler conditions.

Light

Keep light levels as high as possible while maintaining moderate temperatures.

Fertilizer

Tidal Wave petunias require more fertilizer than is usually recommended for petunias. For best results, apply a balanced fertilizer with 200 to 300 ppm N with every other irrigation. At finish, feed to avoid lower yellow leaves. To assure consumer satisfaction, an optional top dressing with slow-release fertilizer can be applied 10 days before shipping.

Growth Regulators

The following growth regulator schedule is used for growing on Tidal Wave petunias at the PanAmerican Seed Co. Elburn, Illinois (Midwestern United States) research facility. This "recipe" results in 6 to 8-in. (15 to 20cm) pots of heavily branched Tidal Wave plants with a spread of approximately 8 to 10 in. (20 to 25 cm) when flowering begins – the plants will be covered with blooms and have the perfect look for point of sale.

6 to 8-in. (15 to 20-cm) Pots: Apply a

B-Nine spray at 3,000 to 5,000 ppm 7 to 10 days after transplanting. Repeat 7 days later. Use a Bonzi drench one time at 5 ppm, 3 weeks after transplanting or when shoots have reached the edge of the pot. Follow with a Bonzi spray one time at 30 ppm after visible bud for additional control if needed.

Hanging Baskets: Apply a B-Nine spray at 3,000 to 5,000 ppm 7 to 10 days after transplanting. Repeat 7 days later. Use a Bonzi spray one time at 30 ppm, 3 weeks after transplanting. If needed, a second Bonzi spray can be done.

B-Nine improves branching, but may delay flowering about 1 week. Bonzi does not appear to affect flower timing. Plants grow out of either plant growth regulator almost immediately after transplant to the landscape. Note: Be sure to check local regulations regarding the use of plant growth regulators. Always follow current manufacturer label instructions.

Photoperiod

Tidal Wave petunia lighting requirements vary by location, variety and production week. Refer to the Supplemental Lighting Chart on page 123. Flowering is fastest with daylengths greater than 13 hours. Tidal Wave petunias are responsive to daylength. When producing Tidal Wave petunias early in the year when days are short, decrease crop times by using supplemental lighting after transplanting. Day extension or night break lighting is acceptable.

Crop Scheduling

Sow to transplant (392-cell plug): 5 to 6 weeks

Transplant to flower:

Spring: 6 to 9 weeks under long days Summer: 4 to 7 weeks under long days with high light and minimum night temperature of 65° F (18°C)

Total Crop Time: Spring: 11 to 15 weeks

1 8		
Container	Plants/Pot	Total Crop Time
4 in. (10 cm) pot	1 plant per pot	11-13 weeks
6-8 in. (15-20 cm) pot	2-3 plants per pot	11-13 weeks
10 in. (25 cm) basket	3-4 plants per basket	13-15 weeks
Summer: 9 to 13	3 weeks	
Container	Plants/Pot	Total Crop Time
4 in. (10 cm) pot	1 plant per pot	9-11 weeks

2-3 plants 9-11 weeks 6-8 in. (15-20 cm) pot per pot 10 in. (25 cm) 10-13 weeks 3-4 plants basket per basket

Common Problems

No major problems will occur if using good cultural and IPM practices.

Wave Medleys[®] Petunias

Plug Production

Note: Because their spreading habit begins after transplanting, Easy Wave and Shock Wave plugs can be produced like other petunia plugs.

Media

Use a well-drained, disease-free seedling medium with a pH of 5.5 to 6.0 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Covering Easy Wave seed is not recommended. Water adequately after sowing to completely dissolve the pellet.

Stage 1 – Germination takes approximately 4 days.

Soil temperature: 72 to 76°F (22 to 24°C) Light: Lighting is optional. Burgundy Star, Pink and Plum Vein benefit from light during germination.

Moisture: Keep soil very wet (level 5) during Stage 1 for optimal germination. Humidity: Maintain 100% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 68 to 75°F (20 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Slightly reduce soil moisture (level 4) to allow root to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 70°F (18 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to further dry until the surface becomes light brown (level 2) before watering. Maintain wet-dry moisture cycles (moisture level 4 to 2).

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Control plug growth first by environment, nutrition and irrigation management; then with chemical plant growth regulators if needed. Minimize ammonium-form nitrogen fertilizer to avoid seedling elongation. Temperature differential (DIF) can also be used to minimize height. Test all chemical plant growth regulators first.

In North American conditions: Apply B-Nine/Alar (daminozide) 1 to 2 applications at 5,000 ppm (6.0 g/l, 85% formulation or 7.8 g/l, 64% formulation) as a spray. The first application should be made when plugs have 2 to 3 true leaves. A second application can be made 7 days later; this can improve basal branching of the mature plant.

In Northern European conditions: 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l, 85% formulation or 2.0 g/l, 64% formulation) spray have been effective.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Transplanting "Dibble 2 Method"

A single dibble-hole should be made in the center of the pot. One plug of each desired variety should be transplanted in the same dibble-hole so the two, or three, plants grow together.

Container Size

6-in. (15-cm) pots: 1 plant of each variety per pot (2 plants, not recommended for the 3 variety Medleys)

8-in. (20-cm) pots: 1 plant of each variety per pot (2 or 3 plants)

10-in. (25-cm) baskets: 1 or 2 plant of each variety per pot (2-4 plants)

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2

Temperature

Nights: 57 to 65°F (14 to 18°C) **Days:** 61 to 75°F (16 to 24°C) Easy Wave and Shock Wave petunias can tolerate temperatures as low as 35°F (2°C); however, crop timing (time to flower) is related to daily average temperature when grown under proper day-length. Plants will take longer to flower when grown at cooler temperatures.

Light

Keep light levels as high as possible while maintaining moderate temperatures.

Fertilizer

Easy Wave and Shock Wave petunias require more fertilizer than is usually recommended for petunias. For best results, apply nitrateform with low phosphorus fertilizer at rate 4 (225 to 300 ppm N/1.5 to 2.0 mS/cm EC) every other irrigation. Apply a balanced ammonium and nitrate-form fertilizer with low phosphorus as needed to encourage growth and balance medium pH. Maintain medium pH 5.8 to 6.2. For constant fertilizer program, can apply fertilizer at rate 3 (175 to 225 ppm N or 1.2 to 1.5 mS/cm EC)

while maintaining the above recommended EC and pH ranges.

Growth Regulators

Apply a Bonzi spray of 10 ppm 7 days after transplant. Repeat Bonzi spray 7 days later and 1 to 2 weeks later use a Bonzi drench of 2-4 ppm to control further stretch. 10 and 12-in hanging baskets may need an additional Bonzi drench at 2-4 ppm to hold for finishing.

Note: Topflor can be used in place of Bonzi at approximately 2/3 the rate of Bonzi. To determine the best rate for your conditions, conducting in-house trials is highly recommended.

Crop Time from Plug Transplant to Sale:

Container Size	Number of Plants	Summer
6 in. pot	2	4-5 weeks
8 in. pot	2 or 3	4-5 weeks
10 in basket	2-4	6-7 weeks
12 in basket	2-4	6-7 weeks

Temperature: 68 to 72°F (20 to 22°C) days; 64 to 68°F (18 to 20°C) nights. **Light:** Can be up to 5,000 f.c. (54,000 Lux) while maintaining temperatures. Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

are used.

Silver Crest & Silver **Shield Plectranthus**

Plug Production Media

Use a well-drained, disease-free media with a pH range of 5.8 to 6.2, and EC less than 0.75mS/cm (2:1 extraction).

Sowing

Plug tray size: Can be produced in a 406, 288 (European size: 264) or a similar size plug tray with 1 seed per cell. Do not cover the seed.

Stage 1 – Germination takes approximately 4 to 5 days for Silver Crest and 5 to 7 days for Silver Shield. Germination temperature: 64 to 72°F (18 to

uniformly at lower range.

light. Media moisture: Keep the media medium wet (level 4) during germination. Relative humidity: Maintain 95 to 97% relative humidity until cotyledons emerge. Avoid excess humidity later in the plug production, as this will create conditions favorable for disease incidence.

Stage 2

Temperature: 68 to 72°F (20 to 22°C) days; 64 to 68°F (18 to 20°C) nights. Light: Can be up to 2,500 f.c. (26,900 Lux) during Stages 2 and 3.

Media moisture: Keep the media medium (level 3) to medium wet (level 4) during stage 2.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3

PanAmerican Seed.

Common Problems

Iron chelate may be applied to avoid iron deficiency in petunias. No major problems will occur if good cultural and IPM practices

22°C). Germinates slightly slower but more

Light: Light is required for germination. The seed will not germinate until it receives

Stage 4

Temperature: 65 to 72°F (18 to 22°C) days; 57 to 65°F (16 to 18°C) nights. Light: Can be up to 5,000 f.c. (54,000 Lux) while maintaining temperatures. Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. **Fertilizer:** Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Growth Regulators:

Silver Crest: PGRs are not required. If needed, foliar sprays of B-Nine/Alar (daminozide) at 600 to 1,200 ppm (0.7 to 1.4g/l 85% formulation or 0.9 to 1.8g/l 64% formulation) work well in toning the plugs. Silver Shield:

In North American conditions: Use 1 to 2 foliar sprays of B-Nine/Alar (daminozide) at 2,500 ppm (3g/l 85% formulation or 3.8g/l 64% formulation) to tone the plugs.

In Northwestern European conditions: For Silver Shield, use 1 to 2 foliar sprays of B-Nine/Alar (daminozide) at 600 to 1,200 ppm (0.7 to 1.4g/l 85% formulation or 0.9 to 1.8g/l 64% formulation).

Growing On To Finish

Media

Use a well-drained, disease-free soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 61 to 68°F (16 to 20°C) **Days:** 64 to 80°F (18 to 27°C) Plectranthus can be grown both under warm as well as under more moderate conditions, however crop time increases under moderate conditions.

Light

Light level should be as high as possible while maintaining proper temperature.

Irrigation

Allow the media to dry slightly between watering. Dryer growing will result in more silver leaf color.

Fertilization

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm EC) once a week from a nitrate-form fertilizer with low phosphorus. A balanced ammonium and nitrate-form fertilizer may be applied as needed. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2.

For constant fertilizer program, can apply fertilizer at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm) while maintaining the above recommended EC and pH ranges.

Silver Crest & Silver Shield Plectranthus continued

Plant Growth Regulators

High light levels, spacing and drought stress will keep plants from stretching. Both Silver Shield and Silver Crest react very well to B-Nine/Alar.

North American conditions:

Silver Shield: Use 2 foliar sprays of B-Nine/ Alar (daminozide) at 2,500 ppm (3g/l 85% formulation or 3.8 g/l 64% formulation). Silver Crest: use 1 to 2 foliar sprays of B-Nine/Alar (daminozide) at 2,500 to 5,000 ppm (3 to 6g/l 85% formulation or 3.8 to 7.6 g/l 64% formulation).

Northwestern European conditions:

For both Silver Shield and Silver Crest, use 1 to 2 foliar sprays of B-Nine/Alar (daminozide) at 1,600 to 3,200 ppm (2 to 4 g/l 85% formulation or 2.5-5 g/l 64% formulation). Use the higher concentration for small pot and pack sizes and at low light conditions.

Pinching

No pinching is required.

Container Size

Silver Crest can be produced in 4 to 4.5-in. (to 11-cm) pots or similar size containers and packs with 1 plant per pot. Use 3 plants per pot in a 10-in. (25 cm.) basket. Silver Shield can be produced in 4 to 4.5-in. (10 to 11-cm) pots to 1-gallon (18 to 19 cm. containers with 1 plant per pot. Both Plectranthus species are very suitable to combine in mixed baskets. Use Silver Shield as a large centerpiece and Silver Crest as a spreading plant on the side. Due to directional stem arching, it is advisable to position Silver Crest plugs with the growing shoot facing outward, toward the outside of the container.

Crop Scheduling

Sow to transplant (288-cell plug tray): 5 to 6 weeks

Transplant to finish:

Silver Shield: 8 to 9 weeks for smaller pot sizes, 9 to 10 weeks for large pots and hanging baskets.

Silver Crest: 4 to 6 weeks for smaller pot sizes, 6 to 7 weeks for large pots and hanging baskets.

Common Problems

No major problems when using good culture and IPM practices.

Happy Hour & Happy **Trails Series Portulaca**

Plug Production

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.8 to 6.2 and an EC less than 0.75 (mmhos/cm with a 1:2 extraction). Portulaca is very sensitive to high salts, particularly high ammonium, during germination.

Sowing

Happy Hour and Happy Trails portulaca is offered as multi-seeded pellets and as raw seed. Each multi-seeded pellet will generally yield 2 to 4 plants. Suggested plug tray size is a 288-cell tray. Do not cover the seed.

Photoperiod

Portulaca is sensitive to short days, even during the plug stage. When daylength is shorter than critical, plants can rosette (stop growing without flowering). Once plants rosette, they will not recover even when given long day treatment. To prevent plants from rosetting, sow seed when the natural daylength is longer than 10 hours, 30 minutes for Happy Hour (30 minutes less than Margarita, which means that Happy Hour can be sown two weeks earlier than Margarita), and 10 hours for Happy Trails (15 minutes less than Tequila. Therefore, Happy Trails can be sown one week earlier than Tequila.). If sowing earlier than suggested here, provide long day conditions (daylength extension to 12 to 13 hours) during all phases of production until critical natural daylength is achieved.

Media

Use a well-drained, disease-free soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Stage 1 - Germination takes 2 to 3 days. Soil temperature: 71 to 79°F (22 to 26°C) Light: Light (more than 10 f.c.) is not required, but beneficial for germination. Moisture: Keep soil moist but not saturated (level 4) during Stage 1 for optimal germination.

Humidity: Maintain 95% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 71 to 73°F (22 to 23°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 3) to allow the soil to dry out slightly before watering for best rooting. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous. Keep ammonium levels less than 10 ppm.

GROWER FACTS

Stage 3 Soil temperature: 68 to 73°F (20 to 23°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to further dry till the surface becomes light brown (level 2) before watering. Keep the moisture to wet-dry cycle (moisture level 4 to 2).

Portulaca prefers warm, high light and dry conditions. Best root growth will be obtained under these conditions.

Irrigate early in the day so foliage is dry by nightfall to prevent diseases. Damping off (Rhizoctonia) is the most common problem when the plants are grown too wet. Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Growth Regulators: Growth regulators are not needed.

Stage 4

Soil temperature: 65 to 67°F (18 to 19°C) to reduce stretching. Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled.

Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On To Finish

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 65 to 67°F (18 to 19°C) **Days:** 68 to 76°F (20 to 25°C) Flower buds may not develop or open if temperatures are too low.

Light

Maintain light levels as high as possible while maintaining recommended temperatures. Flower buds may not open if light levels are too low.

Photoperiod

If transplanting plugs when the daylength is shorter than 10 hours, 30 minutes for Happy Hour and 10 hours for Happy Trails, provide long day conditions after transplanting. Daylength extension to 12 to 13 hours can be used. Make sure that the plugs/plants have been produced with the proper daylength as noted under Plug Production - Photoperiod.

Irrigation

Do not overwater. Allow the media to dry thoroughly between watering. Plants can be allowed to wilt slightly after the roots reach the side of the container.

Fertilizer

Fertilize every other irrigation with 15-0-15 alternating with 20-10-20 at 150 to 200 ppm N.

Growth Regulators

PGRs are generally not needed unless grown under very warm conditions. Height can be controlled by allowing the soil to dry thoroughly between waterings. Plants can be allowed to wilt slightly after the roots reach the side of the container.

Height can also be controlled by withholding fertilizer, especially phosphorous and ammonium-form nitrogen.

Crop Scheduling

Sow to transplant (288-cell plug tray): 4 to 5 weeks.

Portulaca is very sensitive to cool temperatures and low light levels. Plants grown under these conditions are likely to have longer crop times than noted below.

Container	Plugs* Per Flat/Pot	Weeks From Transpl
606 flat	36	5
4 in. (10 cm) pot	1	5-6

*Plugs are grown from multi-seeded pellets. Each multi-seeded pellet will generally yield 2 to 4 plants.

Common Problems

Insect: Spider Mites, Thrips Disease: Rhizoctonia, Pythium

Primlet[®] Series Primula acaulis

Plug Production

- germination, but is not required • Provide high moisture but do not saturate (4+)

Stage 2

- Maintain light levels below 1,500 f.c. (15,000 Lux)
- Begin fertilizing with 14-0-14 at 100 ppm
- Maintain medium moisture (3 to 4)
- Maintain temperatures at 64 to 68°F (17 to 20°C)

Stage 3

- Increase light to 2,000 to 2,500 f.c. (20,000 to 25,000 Lux)
- Increase fertilizer to 200 ppm, alternating 14-0-14 and 20-10-20
- Allow moisture levels to alternate
- between 1 (dry, not wilted) to 4 (moist) • Keep media pH below 6.0
- Maintain temperatures at 64 to 68°F (17 to 20°C)

(20,000 and 35,000 Lux). Humidity Relative humidity between 60 and 70% prevents stress on the plant and reduces the water requirement. Provide good air circulation in the area to prevent

- (17 to 20°C)

Plug Crop Times

below 6.0.

Media

Planting

forcing)

Light

0	1	
Container	Plugs* Per Flat/Pot	Weeks From Transpla
606 flat	36	5
4 in. (10 cm) pot	1	5-6

Stage 1

- Germination: 7 to 10 days at 64°F (17°C) • Recommended plug sizes are 512 to 72 • Cover seed lightly with coarse vermiculite
- to maintain moisture levels
- 10 f.c. (100 Lux) of light benefits

• Increase light to 2,500 f.c. (25,000 Lux), maintaining cool temperatures • Maintain dry to medium moisture levels • If pH is above 6.0, apply Iron Sulfate at 1 pound per 100 gallons as a soil drench • Maintain temperatures at 64 to 68°F

512/406-cell sizes: 5 to 6 weeks 288-cell size: 6 to 7 weeks

Important Plug Production Tips

• Maintain high light levels, but shade if necessary to avoid high temperatures. • Severe wilting can cause leaf tip burn. • Primula have a high pH sensitivity. Fe deficiency causes interveinal chlorosis on new growth and stunting. Maintain pH

• Watch for fungus gnats, especially if staying wet due to cool temperatures or shading. • Apply preventative fungicide for *Pythium* and *Theileviopsis* during late Stage 3 and early Stage 4.

Growing On to Finish

Use a peat-lite mix with good drainage; peat should be 50 to 60% of the mix. Maintain pH between 5.5 and 6.2. Plants in pots should be placed on a surface that allows good drainage.

Plant in moist growing media. Set the plant even or slightly above the soil line of the liner - do not bury the plug or liner.

Temperature

Weeks 1 to 4 after transplant (Establishing stage – goal is to establish 10 leaves) • Nights: 55 to 60°F (12 to 15.5°C) • Days: 60 to 65°F (15.5 to 18°C) Weeks 5 to 10 (Bud initiation stage) • Nights: 35 to 45°F (2 to 7°C) • Days: 45 to 48°F (7 to 9°C) Weeks 11 to 16 (Flower development and

• Nights: 56 to 58°F (13 to 14.5°C) • Days: 60 to 62°F (15.5 to 16.5°C) Note: Plants can be held at 40 to 45°F (4.5 to 7°C) for later forcing.

Provide full sun at lower temperatures. Reduce light levels to avoid high temperatures. Excessive high light may lead to 'blind plants' or bud abortion. Optimum light is usually between 2,000 and 3,500 f.c.

condensation and Botrytis

Water

Water quality should be good with alkalinity below 140 ppm. Maintain EC below 0.5 mmhos.

Fertilization

Primula is a cool crop and does not have a high fertilizer requirement. Start the plants with 20-10-20 at 200 ppm. When ready for cold treatment, change fertilizer to 15-0-15 at 50 ppm. Maintain media EC under 1.2 mmhos.

Crop Scheduling

Plug timing (based on 288-plug size): 6 to 7 weeks

Plant establishment: 4 weeks Bud initiation and cooling: 6 weeks Flower development and forcing: 5 to 6 weeks

Total crop time from sow to flower: 22 weeks

Note: Growing-on time in weeks depends on how large a plant is required. A large plant requires a longer time at 60 to 65°F (15.5 to 18°C) nights. From bud visibility to first opening of flower is approximately 4 to 5 weeks, depending on temperature.

Common Problems

Insect: Aphids, White Flies, Fungus Gnats Disease: Botrytis on flowers, Pythium, Rhizoctonia

Common Problem	Causes
Botrytis	 Plants have wet foliage and flowers at night Lack of circulating air which can prevent condensation No fungicide control for <i>Botrytis</i> Be sure to water early in morning and avoid high humidity
Premature bud set and small plants	 Temperature too cold during growing-on period Low fertility Not enough weeks of warm growing-on temperatures
Flower stems too short	 Cold temperature below 40°F (4.5°C) for too long Forcing at high temperatures above 65°F (18°C) nights
Flower stems long and weak	 Light levels too high High day/night temperature above 70°F (21°C)
Chlorotic plants	 Media too wet – poor drainage High pH causing iron and nitrogen deficiency Ammonium toxicity Magnesium deficiency

Toucan Series Purslane

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Sowing

Sow seed in 288-cell trays. In Europe, 264-cell trays can be used. It is recommended to sow 4 seeds per cell for the most uniform result. Do not cover seed.

Stage 1 - Germination takes 3 to 4 days. Soil temperature: 68 to 74°F (20 to 23°C) Light: Not required.

Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 72 to 75°F (22 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 64 to 68°F (18 to 20°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2). Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Not needed.

Stage 4

Soil temperature: 65 to 68°F (18 to 20°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature Nights: 65 to 68°F (18 to 20°C) **Days:** 68 to 75°F (20 to 24°C)

Light Maintain light levels as high as possible if temperature can be controlled.

Photoperiod

Toucan Purslane can flower under any daylength but will flower slightly faster under shorter days.

Irrigation

Grow on the dry side.

Fertilizer

Apply fertilizer at rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cmEC) using predominantly nitrate-form fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 6.0 to 6.5.

Growth Regulators

Grown from multi-seed pellets, Toucan Purslane generally does not need a PGR treatment if produced under low feed, dry watering and high light conditions. However, if necessary, Topflor (flurprimidol) 30 ppm (7.9 ml/l, 0.38% formulation) spray can be used at 1 week after transplant. Repeat the spray 2 weeks later. Or alternatively, Bonzi (paclobutrazol) 5 ppm (1.3 ml/l, 0.4% formulation) drench can be used at 1 week after transplant.

Pinching

Not needed. Spacing

Space when plants touch each other.

Crop Scheduling

Sow to transplant (288 cell plug): 4 to 5 weeks

Transplant to flower: 6 to 7 weeks; hanging baskets, 8 to 9 weeks

Container Size	Number of Plants	Weeks From Transplant	Total Weeks
1801 flats, 306 pack	1 plug per cell	6-7	11-12
4 in. (10 cm) pot	2-3 plugs per pot	6-7	11-12
6 in. (15 cm) pot	2-3 plugs per pot	6-7	11-12
10 in. (25 cm) basket	3-4 plugs per basket	8-9	13-14

Common Problems

Southern Star Series Ruellia

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Sowing

Sow seed in 288-cell trays. In Europe, 264cell trays can be used. Cover seed with vermiculite.

Stage 1 - Germination takes 5 to 6 days. Soil temperature: 72 to 76°F (22 to 25°C) Light: Not required.

Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 72 to 75°F (22 to 24°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous. Stage 3

Soil temperature: 68 to 72°F (20 to 22°C)

Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2).

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrateform fertilizer with every other fertilization. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Soil temperature: 65 to 68°F (18 to 20°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 65 to 68°F (18 to 20°C) **Days:** 68 to 75°F (20 to 24°C)

Light

Maintain light levels as high as possible. Light intensity will significantly affect the number of flowers.

Photoperiod

Southern Star Ruellia can flower under any daylength but will flower about 5 to 7 days faster under shorter days.

Irrigation

Maintain even moisture and do not allow plants to wilt.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominately nitrateform fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 6.0 to 6.5.

Growth Regulators

Not needed.

Pinching Not needed.

Spacing Not needed.

Container Size

1801 pack: 1 plug per cell 4 to 4.5-in. (10 to 11-cm) pot: 1 plug per pot 6-in. (15-cm) pot: 1 to 3 plugs per pot 1-gallon (18-cm) pot: 1 to 3 plugs per pot

Crop Scheduling

Sow to transplant (288-cell plug): 5 to 6 weeks

Transplant to flower: 8 to 10 weeks

Total Crop Time:

Container	Number of Plants	Spring	Summer
1801 pack	1 plug	15-16	13-14
	per cell	weeks	weeks
4-4.5 in.	1 plug	15-16	13-14
(10-11 cm) pot	per pot	weeks	weeks
6 in. (15 cm) pot	3 plugs	15-16	13-14
	per pot	weeks	weeks
1 gallon	3 plugs	15-16	13-14
(18 cm) pot	per pot	weeks	weeks

Note: For 6-in. (15-cm) and 1-gallon (18-cm) pots, using fewer plants per pot results in a longer crop time to finish.

Common Problems Insect: None Disease: None

SimplySalad

Plug Production

Media

Sowing SimplySalad can be sown into 105/128 cell size plug tray or directly sown into finish containers. A light cover of coarse vermiculite helps maintain moisture levels while letting light pass through to the seeds for improved germination.

Total crop time can be reduced by 1 week by directly sowing into the final container.

2 to 3 days. Germination temperature: 65 to 73°F (18 to 22°C) Light: Light is optional. Media moisture: Keep the media medium wet (level 4) during germination. **Relative humidity:** SimplySalad can be germinated on bench. As long as the soil is kept evenly moist, high air humidity is not required for germination.

Stage 2 during Stages. stage 2.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction). Stage 3

Temperature: 65 to 67°F (18 to 19°C) Light: Can be up to 2,500 f.c. (26,900 Lux) Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4 **Temperature:** 62 to 64°F (16 to 17°C). Light: Can be up to 5,000 f.c. (54,000 Lux) Media moisture: Moisture level can be reduced to medium to medium dry (level 3 to 2). Do not allow the seedlings to wilt. **Fertilizer:** Keep the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction). Growth Regulators: None.

Crop Time

	P - P		
6 in. (15 cm) pot	2-3 plugs per pot	6-7	11-12
10 in. (25 cm) basket	3-4 plugs per basket	8-9	13-14

Insect: Watch for Aphids. Disease: None



Use a well-drained, disease-free soilless media with a pH of 5.8-6.2 and an EC of 0.75 mmhos/cm (2:1 extraction).

Stage 1 – Germination takes approximately

Temperature: 68 to 70°F (20 to 21°C) Light: Can be up to 2,500 f.c. (26,900 Lux)

Media moisture: Keep the media medium (level 3) to medium wet (level 4) during

Growing On to Finish Media

Use a well-drained, disease-free soilless media with a pH of 5.8 to 6.2 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 56 to 61°F (13 to 16°C). Davs: 62 to 70°F (16 to 21°C).

Cooler temperatures with high light will enhance foliage colors, but if average daily temperatures (ADT) are below 50°F (10°C), crop time could be significantly delayed. To achieve faster production with good foliage color, SimplySalad can be grown at moderate to warm temperatures (55 to 70° F/13 to 21°C), and then finished at 45 to 55°F (7 to 13°C) for 3 to 5 days. Colored varieties develop pigment very quickly at cooler temperatures.

Light

As high as possible, while maintaining moderate temperatures. Provide shade to reduce temperatures under warmer conditions.

Irrigation

Maintain media moisture.

Fertilizer

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) once a week. A balanced ammonium and nitrate-form fertilizer may be applied as needed to encourage growth and balance the media pH.

Growth Regulators None

Pinching Pinching is not needed.

Crop Scheduling

Sow to transplant (105/128-cell plug tray): 2-3 weeks

Transplant to finish and total crop time:

Container Size	Plants Per Pot/Basket	Weeks from Transplant to Finish	Weeks from Sow to Finish
4 in. (11-cm) pot	1	2-4	4-7
8 in. Color Bowl	3-4	2-4	4-7
10 in. Color Bowl	4-5	4-6	6-9
12 in. Color Bowl	5-6	4-6	6-9

If directly sown into final containers, plants can be finished even faster. Total crop time can be reduced by one week.

Note: SimplySalad can be re-harvested in 2 to 3 weeks after cutting back to 2 to 3 inches from soil surface.

Common Problems

Insect: Watch for Aphids. Disease: No serious problems

Kauai Series Torenia

Plug Production

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.0 and a medium initial nutrient charge (EC 0.75 mmhos/cm with a 1:2 extraction).

Sowing

Plug tray size 288 cells. Do not cover or bury the seed.

Stage 1 - Germination takes 4 to 6 days. Soil temperature: 71 to 76°F (22 to 24°C) Light: Light is required. Moisture: Keep soil moist but not saturated

(level 4) during Stage 1 for optimal germination.

Humidity: Maintain 95% relative humidity (RH) until radicle emergence.

Stage 2

Soil temperature: 68 to 73°F (20 to 23°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Start to slightly reduce soil moisture (level 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 68 to 70°F (20 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux) **Moisture:** Allow the media to further dry until the surface becomes brown to dark brown (level 3) before watering. Keep the moisture level at wet-dry cycle (moisture level 4 to 3). Do not allow the seedlings to wilt as they do not recover very well. Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). **Growth Regulators:** Growth regulators are not needed.

Stage 4

Soil temperature: 65 to 67°F (18 to 19°C) **Light:** Up to 5,000 f.c. (53,800 Lux) if optimal temperature can be maintained. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.8 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 62 to 64°F (17 to 18°C) **Days:** 65 to 70°F (18 to 21°C) Light

Keep light as high as possible while

maintaining recommended temperatures.

Irrigation Avoid both excessive watering and drought.

Fertilizer

Starting a week after transplant, apply fertilizer weekly at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominately nitrate-form fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2.

Growth Regulators

Cycocel (chlormequat) can be used at rate of 500-750 ppm (4.2 to 6.4 ml/l 11.8% formulation or 0.7 to 1.0 g/l of 75% formulation) at two weeks after transplant, repeat as necessary.

Bonzi (paclobutrazol) 20 to 30 ppm (5.0 to 7.5 ml/l, 0.4% formulation) spray also works but slightly less effective than Cycocel.

Avoid using B-Nine/Alar or tank mix of B-Nine/Cycocel as B-Nine will bleach flower color to become less intense. B-Nine will also delay flower timing.

Pinching

No need.

Crop Scheduling

Sow to transplant (288-cell plug tray): 5 to 6 weeks.

Transplant from 288-tray to saleable finished container:

Container Size	Number of Plants	Weeks From Transplant	Total Weeks
804 pack	1	5-6	10-12
4 in. (10 cm) pot	1	6-7	11-13

Common Problems Insect: No serious problems Disease: No serious problems

Ouartz Series Verbena XP and Original Colors

Plug Production

Plug Tray Size 392-cell or similar size.

Sowing

- Top-dress the plug trays with a medium covering of coarse-grade vermiculite at sowing.
- Moisture management is the key to successful verbena germination.
- · Verbena germinates best under mediumdry (level 2) to medium (level 3) plug media moisture levels; medium-wet (level 4) and wet (level 5) conditions will tend to decrease germination performance.

• Moisture levels in the plug media at sowing can be controlled by adjusting the water pressure, number of misting nozzles and the speed of the misting tunnel in the sowing line.

Stage 1 (Sow to radicle emergence; 4 to 6 days)

Germination temperature: 72 to 75°F (22 to 24°C)

Light: Not required for germination. Relative humidity: 95 to 97%.

Stage 2 (Radicle emergence to cotyledon expansion; 10 to 14 days)

Temperature: The day air temperatures can be set at 70 to 72°F (21 to 22°C) and the night temperature at approximately 60°F (15°C). **Light**: Up to 2,500 f.c. (26,900 Lux) during Stages 2 and 3.

Moisture: Once the plug trays come out of the germination chamber, grow them under medium-wet (level 4) moisture conditions. Avoid wet (level 5) moisture conditions until the seedlings establish.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous. Maintain a media pH of 5.8 to 6.2 and EC at 0.5 to 0.7 mS/cm (1:2 extraction).

Stage 3 (Cotyledon expansion to growth of all set of true leaves; 10 to 14 days) Temperature: The day air temperatures can be set at 68 to 70°F (20 to 21°C) and the night temperature at approximately 60°F (15°C). **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/ 0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4 (Development of all true leaves to shipping/transplant; 7 days) Maintain the recommended growing temperatures and fertilizer regime as in Stage 3. Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained. Check for powdery mildew from this stage onwards.

Growth Regulators:

In North American conditions: If plant growth regulator treatments are necessary for holding/toning the plugs, apply A-Rest (ancymidol) at 10 ppm (37.6ml/l, 0.0264% formulation) as a foliar spray. In Northern European conditions: If needed, 1 to 3 applications of B-Nine/Alar (daminozide) at 1,250 ppm (1.5 g/l 85% formulation or 2 g/l 64% formulation) spray has been tested and shown to be effective.

Growing On to Finish

Container Size 606-cell packs.

Media

Use a well-drained, disease-free soilless medium with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Maintain day temperatures at 65 to 70°F (18 to 21°C) and night temperatures at about 60°F (15°C) until finish. Verbena can be grown as low as 55°F (13°C), but the crop time will be longer.

In Northern European conditions: For the

first 2 weeks following transplant, maintain night temperatures at 61 to 66°F (16 to 19°C). After this, night temperatures may be dropped to 57 to 63°F (14 to 17°C).

Light

Keep light levels as high as possible while maintaining appropriate temperatures.

Humidity

Avoid high humidity in the growing environment as this can induce powdery mildew.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrateform fertilizer with low phosphorus. If needed, a balanced ammonium and nitrateform fertilizer may be used as needed to encourage growth and balance the media pH.

Growth Regulators

In North American conditions: Use 2 applications of A-Rest (ancymidol) at 20 ppm (75ml/l, 0.0264% formulation) as a foliar spray. One application can be done 1 week after transplant, and the second application can be done 10 to 14 days later.

B-Nine/Alar (daminozide) at 3,500 ppm (4.1 g/l 85% formulation or 5.4 g/l 64% formulation) applied as a foliar spray also works well. Use the same spray schedule as recommended for A-Rest.

In Northern European conditions: 2 to 3

applications of B-Nine/Alar (daminozide) at 3,200 ppm (3.8 g/l 85% formulation or 5 g/l 64% formulation) plus Cycocel (chlormequat) at 375 ppm (3.18 ml/l 11.8% formulation or 0.5 ml/l 75% formulation) has been tested and shown to be effective.

Crop Scheduling

Sow to transplant (392-cell plug): Quartz XP varieties: Approximately 4 weeks Quartz original varieties: Approximately 5 weeks

Transplant to flower in 606-cell packs: 6 to 8 weeks

to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain medium pH of 5.8 and EC between 1.0 and 1.5

moles·m⁻²·d⁻¹

Total Crop Time:

Container 606 cell 1p pack per

Common Problems Insect: Mites, Thrips Disease: Powdery Mildew



Plug Production

Media

Sowing

Can be produced in 288, or similar cell size plug trays. Cover the seed with vermiculite. Allow 3 to 5 days for germination.

Light: Not required Stage 1. Stage 2 10 moles·m⁻²·d⁻¹

into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 70 to 72°F (21 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux), DLI≥10 moles·m⁻²·d⁻¹ Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2). Fertilizer: Increase fertilizer to rate 2 (100

mS/cm (1:2 extraction). Stage 4 Soil temperature: 70 to 72°F (21 to 22°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. DLI≥10

PanAmerican Seed.

nber Plants	Spring	Summer
lant • cell	10-12 weeks for XP, 11-13 weeks for original	9-11 weeks for XP, 10-12 weeks for original

Titan[®] and Valiant Series F1 Vinca

Use a well-drained, disease-free, soilless medium with a pH of 5.8 to 6.0 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Stage 1 – Germination takes 3 to 5 days. Soil Temperature: 75 to 78°F (24 to 25°C)

Moisture: Keep soil wet (level 4) during

Humidity: Maintain 95% relative humidity (RH) until the cotyledons emerge.

Soil temperature: 70 to 72°F (21 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux), DLI 8 to

Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate

Moisture: Same as Stage 3.

Fertilizer: Same as Stage 3. Growth Regulators: Not needed.

Growing On to Finish

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.0 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 65 to 68°F (18 to 20°C) **Days:** 75°F (24°C) or above

Light

As high as possible (DLI≥10 moles·m⁻²·d⁻¹) while maintaining optimal production temperatures.

Irrigation

Maintain even moisture. Avoid excessive media and foliage wetness as these conditions are favorable for disease incidence.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 4 (225 to 300 ppm N/1.5 to 2.0 mS/cm) once a week using predominately a nitrate-form fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.5 to 2.0 mS/ cm and pH at 5.8. For constant fertilizer program, fertilizer can be applied at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Plant growth regulators may not be necessary for this series. Negative DIF can be used to control height. Note: Phytotoxicity has been reported on *Catharansus roseus* with Bonzi, Sumagic and Topflor. B-Nine and A-Rest can be used for height control if needed.

Crop Scheduling

Sow to transplant (288 cell): 5 weeks Transplant to finish in 306-packs or 4-in. (10-cm) pot: 3 to 5 weeks Total crop time from sow to finish:

8 to 10 weeks. The timing is dependent on temperature and light levels.

Common Problems

Insect: Spider Mites, Thrips, Aphids and Mealy Bugs Disease: Rhizoctonia, Botrytis, Phytophthora, (for Valiant, see note below) Rhizopus, Pythium, Thielaviopsis, Alternaria, Ulocladium

and Tomato Spotted Wilt Virus Note: Valiant has intermediate resistance to *Phytophthora* as determined by the International Seed Federation guidelines.
Sorbet[®] Series Viola

Plug Production

Plug Tray Size

Use 406-cell plug trays. Finish time is about 4 weeks.

Media

Use a well-drained, disease-free seedling medium with apH of 5.4 to 5.8. Avoid plug media mixes with a high initial nutrient charge. Keep phosphorus levels as low as possible to avoid initial stretch.

Sowing

A medium covering of coarse grade vermiculite is recommended to help maintain high humidity around the germinating seed for better germination performance. Bench germination takes 3 to 4 days. Chamber germination will yield better results.

For optimal germination performance, maintain the plug media at "wet" moisture levels, i.e., the media is glistening, but water will not ooze out from the bottom of the tray and will penetrate only slightly from the top around the fingertip. Avoid germination temperatures above 70°F (21°C) to prevent seedling stretch.

- Stage 2 timing: 10 days
- Stage 3 timing: 14 days
- Stage 4 timing: 7 days

Temperature

Germination: 68°F (20°C) Stage 2: 65 to 70°F (18 to 21°C) days; 60°F (15°C) nights

Stage 3: 65°F (18°C) days; 60°F (15°C) nights **Stage 4:** 60°F (15°C) days; 55°F (13°C) nights

Water

Beginning at Stage 3, reduce the moisture level in the media once the seedlings are established. Stage 4 plugs can be grown under wet/dry cycles to tone the seedlings and avoid soft growth.

Light

Light is not required for germination. Quality seedlings can be produced with light levels up to 3,000 f.c. (30,000 Lux).

Humidity

Maintain 95 to 97% relative humidity.

Fertilizer

Beginning at Stage 3, start fertilizing the seedlings twice a week with 50 ppm N from 14-0-14, alternating with a 20-10-20 type fertilizer for pH balance and supplying the required calcium. Increase the nitrogen concentration to 100 ppm after a week, and continue this program until finishing the plugs.

Maintain an EC of 0.5 to 0.75 mmhos/cm and a pH of 5.4 to 5.8 at Stage 2; at Stage 3 and 4, EC and pH values can be at 1.0 and 5.6 to 5.8, respectively. A high pH (greater than 6.0) can induce boron deficiency and also encourages fungal black root rot, caused by Thielaviopsis sp.

Growth Regulators

Viola seedlings are naturally compact and stretch-free. Plant growth regulators may therefore not be required in the plug stage if transplanted on time. Otherwise, a foliar spray of A-Rest at 10 ppm is recommended for plug production. One application is sufficient, applied when the first set of true leaves is fully developed (when plugs are approximately 3 weeks old). If necessary, the foliar spray can be applied a few days earlier than week 3.

Note: Transplant the plugs "on time" to avoid initiation in the plug stage. Plugs that are initiated will not fill out the finished container well at the time of flowering.

Growing On to Finish

Container Size 606 jumbo cell packs

Media

The level of starter nutrient charge incorporated into the growing mix influences crop quality. A starter charge that is too low can result in a viola crop that will flower before enough foliage has grown to fill the packs/container. Incorporate a medium level of supplemental nutrient charge in the growing media mix to encourage good foliar growth before the crop flowers.

Temperature

Provide day temperatures of 60°F (15°C) and night temperatures of 50 to 55°F (10 to 13°C) for greenhouse production.

Light

No supplemental lighting is required.

Fertilizer

A week after transplant, begin fertilizing with 150 ppm N once a week when grown in the greenhouse. Additional fertilization may be needed if grown outside. Maintain an EC of 1.5 and a pH of 5.6 to 5.8 after transplant until finish. Alternate between an acidic fertilizer, such as 20-10-20, and a basic fertilizer, such as 15-5-15 calcium/magnesium, for pH balance. If the media pH is greater than 6.0, then take corrective measures to lower the pH to the desired level.

Growth Regulators

The use of plant growth regulators on violas is largely dependent on day/night temperatures, location and time of year. If the day/night temperatures are optimal, i.e., not too high for viola production (days in 60s°F (16 to 20°C) and nights in 50s°F (11 to 15°C), then foliar sprays of A-Rest at 10 to 20 ppm, applied 2 to 3 times beginning a week after transplant with 7 to 10 days interval, will work. When grown under warmer day/night temperatures, B-Nine at 5,000 ppm and A-Rest at 5 to 10 ppm applied 2 to 3 times beginning a week after transplant with 7 to 10 days interval will work. Temperature is the best natural growth-controlling factor. Minimal to no plant growth regulators are needed when the crop is produced at lower temperatures during the Spring.

To produce the best-quality violas, grow them outside beginning a week after transplant under cold frame-type conditions. Optimal outside growing temperatures are 60 to 70°F (15 to 21°C) days, and nights in the low 50s°F (11 to 15°C) for the first few weeks. Violas can also tolerate lower night temperatures – in the 40s°F (5 to 9°C).

Crop Scheduling

Sow to transplant: 4 weeks in a 406-cell plug tray Transplant to finish in 606 jumbo cell pack: 3 to 5 weeks seasonally Total crop time to flower: 7 to 9 weeks seasonally

Common Problems

Insect: Fungus Gnats and Shore Flies can be problem pests during plug production. Aphids, Thrips, Mites and White Flies can be a problem during finishing stages. Disease: Damping-off, Black Root Rot, Foliar Leaf Spots and *Botrytis* blight are common.

Zahara[®] Series Zinnia

Plug Production

Media

Use a well-drained, disease-free media with a pH range of 5.5 to 6.0, and EC less than 0.75mmhos/cm (2:1 extraction).

Sowing

Plug tray size: Can be produced in 200, 288 or similar cell size plug trays. Cover the seed with a medium layer of vermiculite at sowing.

Stage 1 – Germination takes approximately 2 to 3 days.

Germination temperature: 68 to 72°F (20 to 22°C)

Light: Light is not required for germination. **Relative humidity:** Maintain 95 to 97% relative humidity (RH) until cotyledons emerge.

Stage 2

Temperature: 70 to 75°F (21 to 24°C) days; 60 to 65°F (16 to 18°C) nights **Light:** Can be up to 2,500 f.c. (26,900 Lux) during Stages 2 and 3. Media moisture: Keep the media medium (level 3) to medium wet (level 4). Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low

Stage 3

phosphorous.

Temperature: 70 to 75°F (21 to 24°C) days; 60 to 65°F (16 to 18°C) nights Media moisture: Keep the media medium wet (level 3) during Stages 3 and 4. **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 65 to 70°F (18 to 21°C) days; 60 to 65°F (16 to 18°C) nights Light: Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained.

Fertilizer: Same as Stage 3. Growth Regulators: PGRs are generally not required during plug production. If needed, plants can be treated once during the plug stage at about 10 to 14 days after sowing with a foliar spray of B-Nine/Alar (daminozide) at 1,250 to 2,500 ppm (1.5 to 3

g/l 85% formulation or 2 to 3.9 g/l of 64% formulation).

Growing On to Finish

Container Size

Zahara can be produced in 306 premium packs, 1801s, 4-in. (10-cm) pots or similar size containers.

Media

Use a well-drained, disease-free media with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 60 to 65°F (16 to 18°C) Days: 65 to 70°F (18 to 21°C)

Light

Keep light levels as high as possible while maintaining appropriate temperatures.

In Northwestern Europe: Zahara will require less PGRs under northwestern European conditions. Can use 2 applications of B-Nine/Alar (daminozide) at 1,600 ppm (1.9 g/l 85% formulation or 2.5 g/l of 64% formulation).

Crop Scheduling

Total crop time (sow to flower): 11 to 12 weeks in Spring, 8 to 9 weeks in Summer. Crop time will be shorter under long days than under short days.

Common Problems Insect: Monitor for Aphids early in production, and Thrips during flowering. **Disease:** Avoid high humidity and condensation in the greenhouse, as these conditions are favorable for *Botrytis* and Powdery Mildew incidence.

Zahara[®] XL Zinnia

Plug Production Media

Use a well-drained, disease-free media with a pH range of 5.5 to 6.0, and EC less than 0.75 mmhos/cm (2:1 extraction).

Sowing

sowing.

140 630 231-1400 panamseed.com

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrateform fertilizer with low phosphorus. If needed, alternate with a balanced ammonium and nitrate-form fertilizer to encourage growth and balance the media pH. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.8 to 6.2. Irrigation

Maintain optimal media moisture (not too wet or too dry). Avoid overhead irrigation. Irrigation should take place during times when foliage will dry quickly, to prevent any disease incidence.

Plant Growth Regulators B-Nine/Alar (daminozide) at 3,500 ppm (4.1 g/l 85% formulation or 5.5 g/l of 64% formulation) applied twice as a foliar spray will control the plant growth. First application can be done 1 week after transplant, followed by a second application 7 to 10 days later.

Sow to transplant: Approximately 3 weeks Transplant to flower: 8 to 9 weeks in Spring, 5 to 6 weeks in Summer

Plug tray size: Can be produced in 200, 288 or similar cell size plug trays. Cover the seed with a medium layer of vermiculite at

Stage 1 - Germination takes approximately 2 to 3 days.

Germination temperature: 68 to 72°F (20 to 22°C)

Light: Light is not required for germination. Relative humidity: Maintain 95 to 97% relative humidity (RH) until cotyledons emerge.

Stage 2

Temperature: 70 to 75°F (21 to 24°C) days; 60 to 65°F (16 to 18°C) nights **Light:** Can be up to 2,500 f.c. (26,900 Lux)

during Stages 2 and 3.

Media Moisture: Keep the media medium (level 3) to medium wet (level 4).

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous.

Stage 3

Temperature: 70 to 75°F (21 to 24°C) days; 60 to 65°F (16 to 18°C) nights

Media Moisture: Keep the media medium wet (level 3) during Stages 3 and 4.

Fertilizer: Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 65 to 70°F (18 to 21°C) days; 60 to 65°F (16 to 18°C) nights **Light:** Light levels can be up to 5,000 f.c. (53,800 Lux) if temperatures can be maintained.

Fertilizer: Same as Stage 3.

Growth Regulators: PGRs are generally not required during plug production. If needed, plants can be treated once during the plug stage at about 10 to 14 days after sowing with a foliar spray of B-Nine/Alar (daminozide) at 1,250 to 2,500 ppm (1.5 to 3 g/l 85% formulation or 2 to 3.9 g/l of 64% formulation).

Growing On to Finish

Container Size

Zahara XL can be produced in 306 premium packs, 1801s, 4-in. (10-cm) pots or similar size containers.

Media

Use a well-drained, disease-free media with a pH of 5.5 to 6.2 and a medium initial nutrient charge.

Temperature

Night: 60 to 65°F (16 to 18°C) **Day:** 65 to 70°F (18 to 21°C)

Light

Keep light levels as high as possible while maintaining appropriate temperatures.

Zahara® XL Zinnia continued

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrateform fertilizer with low phosphorus. If needed, alternate with a balanced ammonium and nitrate-form fertilizer to encourage growth and balance the media pH. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.8 to 6.2.

Irrigation

Maintain optimal media moisture (not too wet or too dry). Avoid overhead irrigation. Irrigation should take place during times when foliage will dry quickly, to prevent any disease incidence.

Plant Growth Regulators

B-Nine/Alar (daminozide) at 3,500 ppm (4.1 g/l 85% formulation or 5.5 g/l of 64% formulation) applied twice as a foliar spray will control the plant growth. First application can be done 1 week after transplant, followed by a second application 7 to 10 days later. For premium pack production, one additional B-Nine treatment may be needed.

Northwestern Europe: Zahara XL will require less PGRs under northwestern European conditions. Can use 2 applications of B-Nine/Alar (daminozide) at 1,600 ppm (1.9 g/l 85% formulation or 2.5 g/l of 64% formulation).

Crop Scheduling

Sow to transplant: Approximately 3 weeks Transplant to flower: 8 to 9 weeks in Spring,

5 to 6 weeks in Summer

Total crop time (sow to flower): 11 to 12 weeks in Spring, 8 to 9 weeks in Summer Crop time will be shorter under long days than under short days.

Common Problems

Insect: Monitor for Aphids early in production, and Thrips during flowering. Disease: Avoid high humidity and condensation in the greenhouse, as these conditions are favorable for *Botrytis* and Powdery Mildew incidence.

Double Zahara Series Zinnia

142 630 231-1400 panamseed.com

Plug Production

Media

Use a well-drained, disease-free media with a pH range of 5.8 to 6.2, and EC less than 0.75mmhos/cm (2:1 extraction).

Sowing

or similar cell size plug trays. Cover the seed with a medium layer of vermiculite at sowing. **Stage 1** – Germination takes approximately

Plug tray size: Can be produced in 288, 200

2 to 3 days. Germination temperature: 68 to 73°F (20

to 22°C) **Light:** Light is not required for germination. Moisture: Keep the soil wet (level 4) during

Stage 1 Relative humidity: Maintain 95 to 97% relative humidity (RH) until cotyledons emerge.

Stage 2

Temperature: 68 to 76°F (20 to 24°C) days; 59 to 64°F (15 to 17°C) nights Light: Can be up to 2,500 f.c. (26,900 Lux)

during Stages 2 and 3. Media Moisture: Keep the media medium (level 3) to medium wet (level 4).

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) with a nitrate-form fertilizer with low phosphorous.

Stage 3

Temperature: 68 to 76°F (20 to 24°C) days; 59 to 64°F (15 to 17°C) nights. Media Moisture: Keep the media medium wet (level 3) during Stages 3 and 4. **Fertilizer:** Increase the fertilizer rate to 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Maintain a media pH of 5.8 to 6.2 and EC at 0.7 to 1.0 mS/cm (1:2 extraction).

Stage 4

Temperature: 65 to 70°F (18 to 21°C) days; 59 to 64°F (15 to 17°C) nights **Light:** Light levels can be up to 5,000 f.c. (53,800 Lux) if optimal temperatures can be maintained.

Fertilizer: Same as Stage 3.

Growth Regulators: PGRs are generally not required during plug production. If needed, plants can be treated once during the plug stage at about 10 to 14 days after sowing with a foliar spray of B-Nine/Alar (daminozide) at 1,250 to 2,500 ppm (1.5 to 3.0 g/l 85% formulation or 2.0 to 3.9 g/l of 64% formulation).

Growing On to Finish

Container Size

Double Zahara can be produced in 4-in. (10cm), quarts, gallon (18-cm) pots or similar size containers.

Media

Use a well-drained, disease-free media with a pH of 5.8 to 6.2 and a medium initial nutrient charge.

Temperature

Nights: 59 to 64°F (15 to 17°C) **Days:** 65 to 70°F (18 to 21°C)

Light

Keep light levels as high as possible while maintaining appropriate temperatures. Flowers will be more double with intense color under high light levels.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrateform fertilizer with low phosphorus. If needed, alternate with a balanced ammonium and nitrate-form fertilizer to encourage growth and balance the media pH. Maintain the media EC at 1.50 to 2.00 mS/cm and pH at 5.8 to 6.2. Avoid fertilizer/ nutritional stress during production as this can cause the flowers to be less double.

Irrigation

Maintain optimal media moisture (not too wet or too dry). Avoid overhead irrigation. Irrigation should take place during times when foliage will dry quickly, to prevent any disease incidence.

Plant Growth Regulators

B-Nine/Alar (daminozide) at 3,500 to 5,000 ppm (4.1 to 6.0 g/l of 85% formulation or 5.5to 7.8 g/l of 64% formulation) applied twice as a foliar spray will help in controlling the plant growth. First application can be done 1 week after transplant, followed by a second application 7 to 10 days later.

In Northwestern Europe: Zahara will require less PGRs under northwestern European conditions. Can use 2 applications of B-Nine/Alar (daminozide) at 1,600 ppm (1.9 g/l 85% formulation or 2.5 g/l of 64% formulation).

Crop Scheduling

Sow to transplant: Approximately 3 weeks Transplant to flower: 8 to 9 weeks in Spring, 5 to 6 weeks in Summer Total crop time (sow to flower): 11 to 12 weeks in Spring, 8 to 9 weeks in Summer. It may take 1 additional week to finish in gallon size containers.

Common Problems

Insect: Monitor for Aphids early in production, and Thrips during flowering. Disease: Avoid high humidity and condensation in the greenhouse, as these conditions are favorable for Botrytis and Powdery Mildew incidence.

Kieft Seed Grower Facts

NOTE: Growers should use the information presented here as a starting point. Crop times will vary depending on the climate, location, time of year and greenhouse environmental conditions. Chemical and PGR recommendations are only guidelines. It is the responsibility of the applicator to read and follow all the current label directions for the specific chemical being used in accordance with all regulations.

Revolution F1 Series Gerbera

Plug Production

Media

Use a well-drained peat lite mix with good aeration, with a pH of 5.5 to 6.0.

EC range:

Stages 1 to 2: 0.5 to 0.7 Stages 3 to 4: 0.7 to 1.0

Light: Light is optional.

radicle emergence.

f.c. (25,000 Lux).

penetrate into the media.

Stage 2

Moisture: Keep soil saturated (level 5)

during Stage 1 for optimal germination.

Humidity: Maintain 95% relative humidity

Soil temperature: 68 to 70°F (20 to 21°C)

Moisture: Start to slightly reduce soil

moisture (level 4) to allow the roots to

Light: Maintain moderate levels, up to 2,500

Humidity: Following radicle emergence 85

to 90% RH is preferred. Reduce to 80 to 85%

humidity can result in decreased uniformity.

Fertilizer: Apply at less than 100 ppm N/less

than 0.7 mmhos/cm EC from nitrate-form

fertilizers with minor elements added.

RH by end of Stage 2. Rapid reduction in

Sowing

Plug tray size from 144 to 128. Sow 1 seed per plug. Dibble is important to ensure central seed placement in the cell. Cover the seeds lightly with coarse to extra-coarse vermiculite to prevent drying out. Some of the top of the plug tray should be visible after covering but seed should be covered completely. Preventative fungicide (for example, Decree/fenhexamid or Rovral/ iprodion) against damping-off diseases

directly after sowing is beneficial. Stage 1 - Germination takes 4 to 7 days. Soil temperature: 68 to 70°F (20 to 21°C)

Container Size

Media

Micro Revolutio Mini Revolution (RH) in chamber or germ tent on bench until Revolution

Uniformity at all stages will greatly increase uniformity of overall crop. Fill pots 100% and with a uniform soil level. Do not compress soil. Place plugs in a dibbled hole in the center of the pot. Transplant uniform graded plugs approximately 0.25 in. above the soil level in the pot. They will settle a little after watering. Crown should be at soil level after watering. Do not pot too deep as this may result in crown rot.

Midi Revolution Mega Revolution

Potting

KieftSeed

Soil temperature: 68 to 72°F (20 to 22°C) Light: Moderate light levels – 2,500 to 3,500 f.c. (25,000 to 35,000 Lux).

Stage 3

Stage 4

maintained.

Moisture: It is critical to allow media to dry until surface becomes light brown (level 2) before watering. Keep the moisture level at wet-dry cycle (moisture level 4 to 2).

Humidity: During this stage, continue humidity reduction to build stress tolerance and support normal seedling growth. Fertilizer: Increase fertilizer to 100 to 125 ppm N/0.7 to 1.0 mmhos/cm EC from nitrate-form fertilizers plus trace elements. Growth Regulators: None

Soil temperature: 68 to 72°F (20 to 22°C) Light: 3,500 to 5,000 f.c. (35,000 to 50,000 Lux) if optimal temperature can be

Moisture: Same as Stage 3.

Humidity: Same as Stage 3. Fertilizer: Increase fertilizer to 125 to 150 ppm N/0.7 to 1.0 mmhos/cm EC from nitrate-form fertilizer plus trace elements. **Note:** During plug production, fine drip or mist is best. Avoid water below 58°F (15°C). Cold water will cause foliage to cup or become hard and brittle. Research shows a slightly hungry plug promotes a faster takeoff after transplanting; avoid over-rooting of plugs prior to transplant.

Growing On to Finish

Use well-drained, disease-free, soilless medium with pH of 5.5 to 6.0 and a medium initial nutrient charge.

n	3 in. (8 cm) and smaller pots
	3.5-4 in. (9-10 cm) pots
	3.5-4.5 in. (9-11 cm) pots
	4.5-5.5 in. (11-13 cm) pots, quarts
n	6 in. (15 cm) and larger pots

Temperature

Nights: 62 to 66°F (17 to 19°C) are preferred. **Days:** 66 to 68°F (19 to 20°C) are preferred; temperatures above 85°C (29°C) are detrimental to quality.

65°F (18°C) nights are beneficial for the first 2 weeks after transplant. After that, nights as low as 60°F (16°C) can be tolerated. In darker periods, day and night temperatures can be reversed (negative DIF) to keep stem length somewhat shorter.

Light

Gerbera prefers high light conditions. After potting: Range is 4,000 to 6,000 f.c. (40,000 to 60,000 Lux). Plants tolerate higher levels as they mature. Shade should be applied when levels are above 7,000 f.c. (70,000 Lux).

Irrigation

Gerbera likes a moderate to drier soil condition. Even immediately after transplanting, moderate watering will suffice. Overwatering is a common cause of lower quality and crop losses. Overhead watering is possible until the flower buds appear, but watering directly into pot or growing with ebb/flow floors is preferred. Drip tube culture also works well.

Fertilizer

See below for general guidelines in different stages.

Growth Regulators

PGRs can be used to reduce stretching. B-Nine/Alar (daminozide) can be applied at 1,000 to 2,500 ppm (1.2 to 3.0 g/l of 85% formulation or 1.6 to 4.0 g/l of 64% formulation) 1 to 2 times with an interval of 9 to 10 days. Do not apply when flower buds are the size of a pea or larger to prevent decrease of flower size and a delay in flowering.

Pinching

None

Spacing

Space plants when the leaves of the plants are touching each other, 4 to 6 weeks after transplanting, depending on pot size.

Crop Scheduling

Sow to transplant (144 to 128-cell plug tray): 6 to 7 weeks

Bulking after transplant: 4 to 6 weeks Finishing the crop: 4 to 6 weeks Note: Crop schedule is dependent on sowing date, available light and required pot/plant

ratio. Total crop time is approximately 14 to 15 weeks from sowing to 50% flowering. 100% color will appear 10 to 14 days later.

Revolution F1 Series Gerbera continued

Common Problems

Insect: Thrips are a major pest. Also watch for White Flies, Leaf Miners, Spider Mites, Shore Flies, and Fungal Gnat larvae and adult flies.

Disease: Good air movement over the crop is critical. Powdery Mildew is most common. Downy mildew is problematic in moist warm conditions. Crown rot, Botrytis, Fusarium.

Postharvest Sleeving

Special wrapping sleeves are available in most countries. Do not use plastic; paper or polypropylene is preferred.

Fertilizer

Gerbera are moderate feeders. Fertilization frequency depends on light and temperature - less feed for lower light/shorter days, more feed for higher light/longer days. Use clear water 1 time each week or when necessary to maintain EC below 1.5 mmhos/ cm.

Avoid excessive ammonia nitrogen levels as this will cause excessive leaf growth and lower bud counts. Extreme levels will burn roots and deteriorate crop quality. Once every 2 to 3 weeks, drench the crop with a solution containing 1 lb. MgSo4 and 1 oz. FeEDDHA per 100 gallons of water (1:100 injector).

pH range: 5.6 to 6.2

Suggested appoximate ppm ratios under normal conditions:

Stage of Production	Plug Production (6-7 weeks)	At Transplant **	At bud initiation and at spacing until flowering ****
N	See stage recommendations above.	150 ppm	75 ppm
Р	25-75 ppm	25 ppm	25 ppm
К	50-100 ppm	100 ppm	150 ppm
CA	50 ppm	50 ppm	75 ppm
MG (MgSo4)*	25 ppm	25 ppm	25 ppm
Micro	***	***	***
E.C.	See stage recommendations above.	1.2-1.5	1.2-1.5

*A good source of Magnesium is MgSo4 (Epsom salt).

are 17-5-17; 14-4-14.

***Maintain micro-nutrient minimums

throughout production cycle.

144

****From spacing and bud initiation onward use fertilizer blend 13-5-23 or similar.

Winky Series Aquilegia Vernalization

Required; minimum 8 to 10 weeks at 41°F (5°C). Plants should have at least 10 to 12 true leaves before vernalization starts.

Temperature

Cool growing towards the winter period to get a full and bushy plant development and a good settled root-system is important. Don't allow the plants to become stretched and leggy before winter.

After winter period/vernalization

Nights: 50 to 59°F (10 to 15°C) **Days:** 60 to 72°F (16 to 22°C)

Light

No additional light is required, but could be beneficial for flower induction after vernalization period.

Photoperiod

Aquilegia is a day-neutral plant after vernalization. Long day of 14 hours or longer could stimulate stem elongation and slightly hasten flowering after the vernalization period.

Irrigation

Keep media medium moist (level 3). Avoid both excessive watering and drought. During overwinter/vernalization period, maintain plants dry to medium dry as overwatering could result in plant loss from root rot.

Fertilizer

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mmhos/cm EC) from Nitrate form fertilizer.

Add some extra Nitrate fertilizer early spring (EC 1.3-1.5 mmhos/cm) when plants start to re-grow after overwintering.

Growth Regulators

In general no PGR is needed (especially when grown under cool conditions), but if necessary B-Nine/Alar (daminozide) at 2,500-5,000 ppm (3.0-6.0 gr/l 85% formulation or 4.0-8.0 gr/l 64% formulation) can be applied as needed.

Pinching

Pinching is not needed.

Spacing

Space plants when foliage is touching.

Crop Scheduling

Sow to transplant (288 cell plug): 7 to 8 weeks

Transplant to flower: 30 to 40 weeks Total crop time: 38 to 46 weeks Production: Sow middle June to late July for natural flowering late April to early May of

the following year.

Common Problems Insect: Aphids, Spider Mites, Leaf Miners,

White Flies Disease: Sclerotinia, Downy Mildew

Lotti Arabis

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.5 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Sowing

Sow 3 to 4 seeds per cell in 288 or larger plug trays. Do not cover the seeds. Spray preventively with fungicide against damping off.

Stage 1 – Germination takes 4 to 7 days. Soil temperature: 65 to 68°F (18 to 20°C) Light: Light is optional. Moisture: Keep soil wet (level 4) during

Stage 1.

Humidity: Maintain 95 to 97%+ relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) Light: Can be up to 2,500 f.c. (26,900 Lux). **Moisture:** Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media. Don't let the media dry out. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC) from nitrate-form fertilizers.

Stage 3

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). **Moisture:** Allow the soil moisture to dry to level 3 (surface becomes brown to dark brown) before watering.

Fertilizer: Maintain fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC) from nitrate-form fertilizers and keep media with a medium pH of 5.8 to 6.5 Growth Regulators: Not needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Increase fertilizer to rate 1-2 (up to 175 ppm N; up to 0.75 mmhos/cm EC) from nitrate form fertilizers.

Growing On to Finish

Container Size 3.5 to 5-in. (9 to 13-cm) square/quart pots: 1 plug per pot Gallon (7 in./18 cm): 1 to 3 plugs per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.5 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Vernalization: Required for flower induction; approximately 8-10 weeks with temperature at 35-44°F (2-7°C). Keep frost-free and use fleece cover for outside overwintering.

Temperature **Nights:** 46 to 50°F (8 to 10°C) Days: 50 to 65°F (10 to 18°C)

Note: Lower temperatures don't harm plants, but delay growing-on time. A day temperature of 16-18°C results in approx. 6-7 weeks crop time.

Light

Photoperiod Lotti is a day-neutral plant after cold treatment.

Irrigation

re-saturating.

Fertilizer at 5.8 to 6.5.

Growth Regulators Arabis is responsive to B-nine/Alar (daminozide) 2500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation). Start treatments in early bud stage and repeat as needed.

Pinching Not needed.

Spacing Space plants when foliage is touching. **Crop Scheduling** Sow to transplant (288 cell plug): 5 to 6 weeks Transplant to flower: 25 to 28 weeks Total crop time: 30 to 34 weeks

Normal production: Sowing late July to early September will give natural flowering from mid-February to late March the following year.

Note: Do not sow later than week 33-34 for NW Europe to prevent enlarging flowering gap between Deep Rose and White.

Common Problems Insect: Aphids Disease: Botrytis, Downy Mildew, Pythium Physiological: Leaves may turn reddishpurple during winter.

3 plugs per pot

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.4 and an EC of 1.2-1.5 mmhos/cm).

**From transplant common fertilizer blends

Media

Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Soil temperature: 65 to 68°F (18 to 20°C)

Growing On to Finish

Plug Production

0.75 mmhos/cm).

Use a well-drained, disease-free, soilless

media with a pH of 5.8 to 6.2 and an EC of

Sow 2 to 3 seeds per cell in 288 plug tray

(depending on series single or double).

Spray after sowing preventively against

Stage 1 – Germination takes 7-12 days.

Humidity: Maintain 95 to 97% relative

Soil temperature: 68 to 72°F (20 to 22°C)

Moisture: Reduce media moisture slightly

(level 2-3) to allow the roots to penetrate

Fertilizer: Apply fertilizer at rate 1 (less

Soil temperature: 65 to 68°F (18 to 20°C)

Moisture: Allow media to dry further until

the surface becomes light brown (level 2)

Fertilizer: Apply fertilizer at rate 2 (100 to

175 ppm N/0.7 – 1.2 mmhos/cm EC) from

Growth Regulators: Not necessary.

Light: Up to 2,500 f.c. (26,900 Lux)

into the media. Don't let the media dry out.

than 100 ppm N/less than 0.7 mmhos/cm EC)

humidity (RH) until radicles emerge.

Light: Up to 2,500 f.c. (26,900 Lux)

from nitrate-form fertilizers.

Soil temperature: 68 to 72°F (20 to 22°C)

Moisture: Keep soil medium moist (level 3)

Cover seed lightly with vermiculite.

Light: Requires light to germinate.

Media

Sowing

fungi.

in Stage 1.

Stage 2

Stage 3

Stage 4

before watering.

nitrate-form fertilizers.

Container Size 5 in. (13 cm) or square/quart pots: 1 plug per pot 1 gallon (18 cm): 1-3 plugs per pot 1½ gallon (23 cm):

KieftSeed

No additional light is required. High light will enhance flowering; at higher temperatures, additional lightning is advised for optimizing plant quality.

Maintain media between medium moist and medium wet (level 3-4). Avoid both excessive watering and drought. Let media dry until substrate color is light brown (level 2) before

Apply fertilizer at rate 2 to 3 (150 to 225 ppm N; 1.0 to 1.5 mmhos/cm EC). Maintain the pH

Note: Larger pots and/or more plugs per pot may add one more week crop time.

Ballerina Series Armeria

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Sowing

Sow 2 to 4 seeds per cell in 288 or larger plug trays. Do not cover the seeds.

Stage 1 – Germination takes 3 to 6 days. Soil temperature: 60 to 65°F (16 to 18°C) Light: Needs light to germinate. Moisture: Keep soil wet (level 4) during

Stage 1. Humidity: Maintain 95 to 97%+ relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). **Moisture:** Allow the soil moisture to dry to level 3.

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC). Growth Regulators: Generally not needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 4 to 5-in. (10 to 13-cm) square/quart pots: 1 plug per pot

Gallon (7 in./18 cm): 1-3 plugs per pot Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature (optimum)

Nights: 50 to 58°F (10 to 14°C) **Days:** 60 to 65°F (16 to 18°C) Note: For early Spring sales, grow in a frostfree greenhouse/tunnel.

Light

No additional light is required.

Photoperiod

Ballerina is a day-neutral plant.

Ballerina Series Armeria continued

Irrigation

Keep media moisture dry (level 2; substrate color is light brown) to medium moist (level 3; substrate color is brown to dark brown). Ballerina is relatively drought tolerant. For overwinter production, grow plants on the dry side during cold period as overwatering could result in plant loss from root rot.

Fertilizer

Ballerina generally needs low to medium fertilization. Apply fertilizer at rate 1 to 2 (70 to 175 ppm N; 0.5 to 1.2 mmhos/cm). After overwintering, apply an extra fertilizer application (150 to 175 ppm Nitrate fertilizer; 1.0 to 1.2 mmhos/cm) when plants start to grow in early Spring.

Growth Regulators

Generally not needed. If necessary, a Bonzi (paclobutrazol) spray at 5 ppm (1.25ml/l 0.4%) formulation could be effective.

Pinching

Not needed.

Crop Scheduling

Sow to transplant (288 cell plug): 5 to 6 weeks

Annual

Transplant to flower: 12 to 15 weeks Total crop time: 16 to 21 weeks

Overwintered frost-free Transplant to flower: 28 to 36 weeks Total crop time: 32 to 40 weeks

Spring production:

Sow January to mid-March for natural flowering from mid-May to July. Overwinter production: Sow August to September for natural flowering late March to May of the following year. Note: Plants from overwinter production will have a better plant habit with many more flowering stems per plant (approximately 20 to 30 stems per plant).

Common Problems

Insect: Sciara in plug stage **Disease:** Colletotrichum Physiological: When grown too cold during growing season, leaves may turn redpurplish and could twist.

Rapido F1 Campanula

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and an EC of 0.75 mmhos/cm.

Sowing

Sow 4 seeds per cell in 288 or larger plug trays. Do not cover the seeds. Grow at less than 13 hours daylength to keep plants vegetative; spray preventively with fungicide against damping off.

Stage 1 - Germination takes 7 to 9 days. Soil temperature: 65 to 72°F (18 to 22°C) Light: Light is required.

Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95 to 97% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) Light: Can be up to 2,500 f.c. (26,900 Lux). **Moisture:** Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 60 to 65°F (16 to 18°C) **Light:** Can be up to 2,500 f.c. (26,900 Lux). **Moisture:** Keep soil moisture at level 3 to 4. Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC). Growth Regulators: Not needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

4 to 5-in. (10 to 13-cm): 1 plug per pot 1 Gallon (17-cm): 2 to 3 plugs per pot (3 to 4 plugs per pot when grown under daylength longer than 16 hrs.)

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and an EC of 1.0 to 1.2 mmhos/cm.

Temperature (optimum)

Nights: 50 to 57°F (10 to 14°C) **Days:** 60 to 65°F (16 to 18°C) **Note:** Cool night temperature below 50°F (10°C) could cause foliage curling or puckering. Warmer temperature (>68°F/20°C) could reduce plant and flower size.

Light

Keep as high as possible while maintaining moderate temperature.

Photoperiod

Rapido F1 is a long day crop. It requires minimum of 14 hours daylength for flowering, until visual bud stage. Rapido Campanula flower buds can be induced during plug stage under long-day conditions, which causes plants flower too quickly before bulked optimal plant size. Therefore, keeping plug production at less than 13 hours is recommended. Otherwise, it may be necessary to transplant an extra 1 or 2 plugs for larger pot size.

Irrigation

Keep media moisture medium moist (level 3; substrate color is brown to dark brown).

Fertilizer

Rapido F1 generally needs moderate fertilization. Apply fertilizer at rate 2 (125 to 175 ppm N; 1.0 to 1.2 mmhos/cm).

Growth Regulators

In general, not needed when grown under proper advised conditions; but if desired, chlormequat (Cycocel) 750 ppm (6.36 ml/l, 11.8 % formulation or 1.00 ml/l, 75% formulation) could be used; 1 to 2 applications is often sufficient. Frequent spray (3 to 5 times depending on temperature) of daminozide (B-Nine, Alar) at 2,000 ppm (2.4 g/l 85% formulation or 3.1 g/l, 64% formulation) is also effective on plant size control but it may delay flowering about 5 to 7 days.

Pinching

Not needed.

Crop Scheduling

Sow to transplant (288 cell plug): 7 to 10 weeks

Transplant to flower: 8 to 12 weeks when grown under proper long-day conditions. Total crop time: 15 to 22 weeks

Common Problems

Insect: Spider Mites, Aphids Disease: Botrytis, Pythium, Rhizoctonia

Early Sunrise, Rising Sun, Sunfire & Sun Up Coreopsis

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Sowing

Sow 1 to 2 seeds per cell in 288; 2 to 4 seeds per cell in larger plug tray. Covering seed with vermiculite lightly is recommended. **Stage 1** – Germination takes about 5 to 6 days.

Soil temperature: 65 to 68°F (18 to 20°C) Light: Light is optional.

Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95 to 97% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 71 to 73°F (21 to 22°C) **Light:** Up to 2,500 f.c. (26,900 Lux) **Moisture:** Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with phosphorous.

Stage 3

Soil temperature: 68 to 70°F (20 to 21°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture level to wet-dry cycle (moisture level 4 to 2). Fertilizer: Same as Stage 2. Growth Regulators: Generally not needed.

Stage 4

Soil temperature: 65 to 67°F (18 to 19°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 2.

Growing On to Finish

Container Size 4 to 5-in. (10 to 12-cm) square/quart pots: 1 plug per pot Gallon (18-cm) pots: 1 to 3 plugs per pot

Insect: Aphid, Thrips, White Flies Disease: Powdery Mildew

Spacing good ventilation and air flow. Crop Scheduling

Transplant to flower: Sun Up: 7 to 9 weeks Rising Sun and Sunfire: 8 to 10 weeks Early Sunrise: 9 to 12 weeks Common Problems

Media

Light

on variety.

Irrigation

Fertilizer

necessary.

Pinching

KieftSeed

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 55 to 60°F (13 to 16°C) **Days:** 60 to 70°F (16 to 21°C)

Maintain light levels as high as possible while maintaining moderate temperature.

Photoperiod response

Coreopsis is a long-day crop with critical daylength from 12.5 to 14 hours depending

Early Sunrise: 14 hours

Rising Sun and Sunfire: 13 hours

Sun Up: 12.5 hours

In Spring production, Sun Up flowers about 1 week earlier than Sunfire and Rising Sun and about 2 to 3 weeks earlier than Early Sunrise.

Maintain media moisture wet-dry cycle (moisture level 4 to 2). Avoid both excessive watering and drought.

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrate-form fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2. For constant fertilizer program, apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Coreopsis is responsive to B-Nine/ Alar at 2,500 to 5,000 ppm (3.0 to 5.9 g/l 85% formulation or 3.9 to 7.8 g/l of 64% formulation) spray at bud initial stage if

Pinching is not needed.

Coreopsis can be grown pot tight, but assure

Sow to transplant (288-cell): 5 to 6 weeks

Dasante Blue Delphinium

Plug Production

Media

Use a well-drained, disease-free soilless medium with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC less than 0.75 mmhos/cm with a 1:2 extraction).

Sowing

Sow in a 288-cell size plug tray. In Europe, seed can be sown in 264-cell trays. A medium vermiculite cover is recommended.

Stage 1 – Germination takes approximately 5 to 7 days.

Soil temperature: 65 to 70°F (18 to 21°C) Light: Optional.

Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95%+ relative humidity (RH) until radicle emergence.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce soil moisture slightly (level 3) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 68°F (18 to 20°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry until the surface becomes light brown (level 2) before watering.

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). Growth Regulators: Generally not needed during plug production.

Stage 4

Soil temperature: 60 to 65°F (15 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Media

Use a well-drained, disease-free soilless medium with a pH of 5.8 to 6.2 and a medium initial nutrient charge.

Dasante Blue Delphinium continued

Temperature

After transplant, provide day temperatures of 65 to 70°F (18 to 21°C) and night temperatures of 55 to 63°F (13 to 17°C) for greenhouse production. If the outside temperatures/conditions are optimal/ favorable, then 3 to 4 weeks after greenhouse production the crop can be grown outside under cold frame-type conditions to flower/finish. Optimal outside growing temperatures can be 60 to 70°F (15 to 21°C) days, and nights in low 50s°F (10 to 12°C). Delphiniums can also tolerate lower night temperatures – in the low 40s°F (5s°C). They can flower prematurely under high temperatures, and under cooler temperatures will finish slowly.

Under northwestern European

conditions: This crop can also be grown at 41 to 70°F (5 to 20°C) temperature ranges. Does very well in a cool greenhouse or poly house with high light levels.

Light

No supplemental lighting is required, but keep light levels as high as possible while maintaining optimal temperatures.

Under northwestern European

conditions/low light conditions: For early season production, HID lights can improve plant habit and quicken the growth.

Irrigation

Avoid both excessive watering and drought. Do not allow the plants to wilt.

Fertilizer

Starting 1 week after transplant, apply fertilizer at rate 4 (225 to 300 ppm N/1.5 to 2.0 mS/cm) once a week using predominately a nitrate-form fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2. For constant fertilizer program, fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) can be applied while maintaining the above recommended EC and pH ranges.

Growth Regulators

Apply foliar spray of Bonzi at 20 ppm (5.0 ml/l, 0.4% formulation) twice after transplant. First application can be done 3 weeks after transplant, and the second 2 weeks later.

Stage 2

Under northwestern European

Pinching

Pinching is not needed.

1 gallon: 1 to 2 plants per pot

use 2 plants per pot for 1 gallon.)

(When producing under warm season, can

Sow to transplant: 6 to 7 weeks (288-cell plug)

Transplant to finish: 12 to 17 weeks. It takes

a longer crop time for cool-season production;

however, the quality of the finished product is

Ship this crop when the bottom one-third

of the florets on the first flower spike are

open to reduce the risk of flower shattering

2 gallon: 3 plants per pot.

better under cool conditions.

Container Size

Crop Scheduling

during shipping.

Digitalis

Media

Sowing

Tray Size

288 cell tray

180 cell tray

84 cell tray

damping off.

Light: Required.

(level 4) in Stage 1.

5-6 days.

Do not cover the seed.

Plug Production

Common Problems

Diseases: Powdery Mildew.

Dalmatian Series

Use a well-drained, disease-free, media

with a pH of 5.5 to 6.5 and a medium initial

Seeds Per Plug

1 seed/cell

1 seed/cell

4 seeds/cell

nutrient charge (EC 0.7–1.0 mmhos/cm).

Spray preventively with fungicide against

Soil temperature: 65 to 68°F (18 to 20°C)

Moisture: Maintain soil constantly moist

Humidity: Maintain 95 to 97% relative

humidity (RH) until radicles emerge.

Stage 1 – Germination takes approximately

conditions: Can use 1 to 2 foliar spray Soil temperature: 65 to 68°F (18 to 20°C) applications of Bonzi at 5 to 7 ppm (1.25 **Light:** Up to 2,500 f.c. (26,900 Lux) to 1.75 ml/l, 0.4% formulation). Tilt Moisture: Soil moisture can be slightly (propiconazool) applied weekly at 0.2 to 0.3 reduced (level 3-4) to allow the roots to ml/l (250 g/l formulation) can also work. penetrate into the media. Don't let the media dry out.

> Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mmhos/cm EC) from nitrate-form fertilizers.

Stage 3

Soil temperature: 65 to 68°F (18 to 20°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes brown to dark brown (level 3) before watering. Keep the moisture level to medium moist (moisture level 3). Fertilizer: Maintain fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mmhos/cm EC) from nitrate-form fertilizers, and keep media with a medium pH of 5.5 to 6.2. Growth Regulators: Digitalis is responsive to B-Nine/Alar (daminozide), and Bonzi. B-Nine/Alar (daminozide) at 2000 ppm (3.0 g/l of 64% formulation or 2.5 gr./l.of 85% formulation) can be applied at 2-3 weeks after sowing. Repeat a week later if necessary. In warmer conditions, Bonzi (paclobutrazol) spray at about 5 ppm (1.25 ml/l 0.4% formulation) or Sumagic (uniconazole) spray at 3ppm (5.5 ml/l of 0.055% formulation) can be used. In Northwest Europe, Tilt (propiconazole) is also effective for Digitalis height control. A weekly spray with 0.3 ml/l is advised.

Stage 4

Soil temperature: 57 to 65°F (14 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Apply fertilizer to rate 1-2 (up to 150 ppm N/up to 0.5 mmhos/cm EC) from nitrate-form fertilizers.

Growing On to Finish

Container Size	
6 in. (15 cm)	1 plug/pot from 288
1 Gallon (18 cm)	1 plug/pot
2 Gallon (30 cm)	3-4 plugs/pot from 288 or 1 plug/pot from 84

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 1.0 mmhos/cm).

EC schedule from start to finish

Start production stage	EC= 1.0 - 1.2
Final production stage	EC= 1.3 - 1.5

Temperature

Nights: 50 to 65°F (10 to 18°C) Days: 60 to 68°F (16 to 20°C) Avoid temperatures below freezing.

Light

No additional light is required. High light will enhance flowering.

Photoperiod

Digitalis is a facultative long-day plant and has a critical day length of approximately 14 hours.

Irrigation

Maintain media constantly moist. Avoid both excessive watering and drought.

Fertilizer

Apply constant fertilizer at rate 1-2 (75 to 100 ppm N/0.5 to 0.7 mmhos/cm EC). Maintain the pH at 5.8 to 6.2. A pH of 7 or higher may cause younger leaf yellowing, short plants and stress flowering.

Growth Regulators

Digitalis is responsive to multiple applications of B-Nine/Alar (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation). If necessary, the first application can be done at 2 weeks after transplanting. In warmer conditions, Bonzi (paclobutrazol) spray at 5 to 10 ppm (1.25 to 2.50 ml/l 0.4% formulation) or Sumagic (uniconazole) spray at 5 ppm (9.1 ml/l of 0.055% formulation) can be used before flower spike begins to elongate. In Northwestern Europe, Tilt (propiconazole) 0.3 ml/l weekly spray is also effective. **Note:** Use Topflor with caution as it is very strong for Digitalis and could stunt plant and significantly delay flowering.

Pinching

Pinching is not needed.

Spacing

Space plants when foliage is touching. Crop Scheduling Sow to transplant (288 cell plug): 5 to 6 weeks Sow to transplant (180 cell plug): 6 to 7 weeks Sow to transplant (84 cell plug): 6 to 7 weeks

than other varieties. late June. **Common Problems**

PowWow[®] and 'Chevenne Spirit' Echinacea **Plug Production**

Media

Sowing

recommended. Light: Optional.

Stage 2 moles·m-2·d-1.

Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC).

Stage 3 Soil temperature: 68 to 70°F (20 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux), DLI about 10 moles·m⁻²·d⁻¹ Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture level to wet-dry cycle (moisture level 4 to 2).

KieftSeed

Transplant to flower: 11 to 12 weeks

- Under proper day length and temperature
- range from 60°F (16°C) to 68°F (20°C)
- Total crop time: 15 to 18 weeks

Under proper day length and temperature range from 60° F (16° C) to 68° F (20° C)

- Note: Dalmatian Purple will flower about a week earlier and Peach about a week later
- **Spring Production:** Sow middle to late February for natural flowering in middle to

Insect: Aphids, White Flies Disease: Botrytis, Downy Mildew, Leafspot

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Sow 1 seed per cell in 288 or larger plug tray. In Europe, 264-cell trays can be used. Covering seed with vermiculite is

Stage 1 – Germination begins at day 4 to 5 continuing through day 14.

Soil temperature: 71 to 76°F (21 to 24°C)

Moisture: Keep soil wet (level 4).

Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge.

Soil temperature: 71 to 73°F (21 to 22°C) Light: Up to 2,500 f.c. (26,900 Lux), DLI 5 to 8 Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Generally not needed

Stage 4

Soil temperature: 65 to 67°F (18 to 19°C) Light: Up to 5,000 f.c. (53,800 Lux), DLI ≥10 moles·m⁻²·d⁻¹, if temperature can be controlled. Moisture: Same as Stage 3.

Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

4.5-in. (11-cm) square/quart pots: 1 plug per pot

6-in. (15-cm) or gallon (18-cm) pots: 1 plug per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm). For overwinter production, bark media is recommended for better drainage purpose to protect plants from root rot due to too wet.

Temperature

Nights: 60 to 65°F (15 to 18°C) **Days:** 65 to 75°F (18 to 24°C) Note: Keep average daily temperature (ADT) above 55°F (13°C). Otherwise, plants will stop growing.

Light

Maintain light levels as high as possible (DLI \geq 20 moles·m-2·d-1) while maintain moderate temperature.

Photoperiod

PowWow and 'Cheyenne Spirit' are short day-long day plants. The best flowering occurs when plants are grown under short day (12 hours or shorter) conditions until 7-mature leaf stage followed by long day conditions.

Note: Echinacea plants won't perceive day length induction until 2 mature true leaf stage. Plants are in juvenile stage until 2 mature leaves.

Irrigation

Maintain media moisture. Avoid both excessive watering and drought.

PowWow® and 'Cheyenne Spirit' Echinacea continued

For overwinter production, keep plants on the dry side during cold period as overwatering could result in plant loss from root rots.

Fertilizer

Apply balanced fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm). Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 6.0 to 6.5.

For constant fertilizer program, can apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm) while maintaining the above recommended EC and pH ranges.

Key to dark foliage and the prevention of purple foliage: Phosphorous is the key to maintaining dark green foliage and to preventing leaves from turning purple and becoming hard and brittle, particularly for PowWow Wild Berry. Pale foliage is primarily due to low phosphorus. This is not strictly temperature related. Lack or loss of phosphorous may be related to low/poor nutrition resulting from poor uptake, depletion of phosphorus due to excessive watering (predominately overhead watering), or being tied up in the soil. Target 30-35 ppm phosphorus via constant liquid feed. Soil additives, such as finely ground rock phosphates, are not recommended as uptake and availability to the plant can be erratic or delayed when soil is too wet, too cold or when the additive is not well mixed into the soil.

Growth Regulators

For height control: Echinacea is responsive to tank mix of B-Nine/Alar (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) mixed with Cycocel (chlormequat) 500 to 750 ppm (4.2-6.4 ml/l 11.8% formulation or 0.67-1.0 g/l of 75% formulation). PGR application can be applied at the point when stem starts elongation, about 4 weeks after transplant. If necessary, repeat the application two weeks later. **Optional PGR treatments:** 1 to 2 applications of B-Nine at 3,500 to 5,000 ppm (4.1-5.9 g/l 85% formulation or 5.8-7.8 g/l of

64% formulation) or Sumagic (uniconazole) at 20 ppm (36.4 ml/l 0.055% formulation) spray also work well.

Note: Higher PGR rates may cause plant height to be less uniform. It is recommended using lower rate with multiple applications.

For branching: PowWow and 'Cheyenne Spirit' are naturally well branched. To augment or increase branching, use Configure (active ingredient N-phenylmethyl-1H-purine-t-amine, commonly called benzyladenine or 6-BA). Configure can be applied at 300 ppm two weeks after transplanting and repeated two weeks later.

In northern European conditions: 3,200 ppm B-Nine/Alar (3.8 g/l 85% formulation or 5.0 g/l of 64% formulation) works well.

Pinching Pinching is not needed.

Spacing

Space plants when foliage is touching. Crop Scheduling

For the following production scenarios: Sow to transplant (288 cell plug): 5 to 6 weeks crop time.

1. Spring production for late Spring flowering, target market weeks 23 or later, under natural day-length condition Sow in January, weeks 1 to 3, for natural flowering in mid to later June. Transplant to flower: 13 to 17 weeks Under temperature range from 60°F (15°C) to 68°F (20°C)

Total crop time approximately: 18 to 23 weeks

Under temperature range from 60°F (15°C) to 68°F (20°C)

2. Overwinter production for late Spring flowering, target market weeks 21 or later, under natural day-length conditions:

Sow in July to early September for natural flowering late May to early June of the following year.

Note: Plants from overwinter production will flower slightly earlier than those from Spring production with better branching and shorter flower stems. Forcing: Below are three key elements

necessary for best production results. These elements can be manipulated to achieve your market target ship weeks:

- Understanding when juvenility stage ends so plants can perceive light
- Applying the appropriate duration of short or long day conditions
- a. Short day = 12 or less hours
- b. Long day = 14 or more hours
- Providing optimum temperatures

3. Forcing for Summer and Fall sales target market weeks 35 or later: • Sow week 14 to 16, using 288, 72 or 50 trays.

• Grow plugs to the 2 mature true leaf stage (see below photo). It takes about 4 to 5 weeks during Summer production.



• If using a 288 tray, transplant to larger liner or final container.

- At the 2 mature true leaf stage, start short day such as with black cloth. Continue short day until plant reaches 7 mature leaves, which takes about 6 weeks at ADT of approx. 72 to 75° F (22 to 24°C).
- The **fundamental guidelines** for successful uniform flowering:
- Give 6 weeks short day after 2 mature leaves.
- Or give short day from 2 mature leaves to 7 mature leaves. This means 5 leaves added.
- After short day treatment, transplant to final container and grow under natural long days. Outdoor production is recommended.

• Total crop time is approximately 20 to 21 weeks.

- Sow to 2 mature leaf stage: 4 to 5 weeks - SD treatment from 2 to 7 mature leaves: 6 weeks

- End of SD to flowering: 10 to 11 weeks

4. Forcing for Spring sales target market weeks 18 to 19, such as Mother's Day sales:

• Sow week 45 to 46, using 288, 72 or 50 trays. • If using a 288 tray, transplant to larger liner or finish container at the 2 mature true leaf stage.

- Bulking options:
- 1. Bulk in the larger liner
- 2. Bulk in finish container
- Bulk under natural short day at
- temperature about 65 to 68°F (18 to 20°C)
- until minimum 7 mature leaf stage.
- It takes about 13 to 15 weeks from sowing to 7 leaf stage.

• Transplant liners to final container, if bulking in liner.

• Provide night interruption (NI,10 p.m. to 2 a.m.) until knot is visible on stem, about 3 to 4 weeks.



- After visible knot, turn light off and grow the plants under natural daylength.
- Plants ready approximately week 18 • Total crop time approximately 23 to 25 weeks
- Sow to 2 mature leaf stage: 5 to 6 weeks - SD bulking from 2 to 7 mature leaves: 8 to 9 weeks
- NI treatment: 3 to 4 weeks until visible
- End of NI to flowering: 7 to 8 weeks • The fundamental guidelines for

successfully delivering uniform flowering plants on time:

- Bulked plants under natural short day conditions until minimum 7 mature leaves.
- Provide night interruption until visible knot stage.
- Night interruption should be started 10 to11 weeks before targeting market date.

Common Problems

knot

Insect: Aphids, Fungus Gnats, etc. Disease: Powdery Mildew

Mesa Series Gaillardia

Plug Production

Media Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

1 plant per pot 1 plant per pot

conditions.

KieftSeed

Sow seed in 288 or larger plug tray. In Europe, 264-cell trays can be used. Covering seed with vermiculite is recommended.

Sowing

Stage 1.

Stage 2

phosphorous.

Stage 3

extraction).

Stage 4

Stage 1 - Germination takes 4 to 5 days. **Soil temperature:** 68 to 73°F (20 to 23°C) Light: Optional.

Moisture: Keep soil wet (level 4) during

Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge.

Soil temperature: 68 to 73°F (20 to 23°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low

Soil temperature: 65 to 67°F (15 to 19°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2).

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2

Growth Regulators: Generally not needed. If necessary, B-Nine/Alar (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) can be applied at Stage 3. In Northern European conditions: Use Alar/B-Nine 1,300 ppm (1.5 g/l 85% formulation or 2.0 g/l of 64% formulation).

Soil temperature: 59 to 64°F (15 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 5-in. (13-cm) square or quart pots: 6-in. (15-cm) or gallon (18-cm) pots:

Note: In a 10-in. (25-cm) pot, 3 plants per pot are recommended; however, 1 plant per pot is doable when sown in early Spring

and grown under moderate temperature

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 50 to 61°F (10 to 16°C) **Days:** 59 to 70°F (15 to 21°C) Mesa Gaillardia can be grown at lower temperatures (frost-free cold frame/poly house in Spring); however crop times will increase.

Light

Maintain light levels as high as possible while maintaining moderate temperature.

Photoperiod

Mesa Gaillardia is a facultative long-day plant and requires 14 hours or longer daylength for uniform and faster flowering.

Irrigation

Maintain media moisture. Plants can dry out quickly when they are large. Water thoroughly when irrigation is needed.

Fertilizer

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominately nitrate-form fertilizer with low phosphorus and high potassium. Maintain the media EC at 1.5 to 2.0 mS/cm and pH at 6.0 to 6.5. For constant fertilizer program, can apply fertilizer at rate 2 (100 to 175 ppm N or 0.7 to 1.2 mS/cm) while maintaining the above recommended EC and pH ranges.

Growth Regulators

PGRs are not necessary if grown under cooler temperatures. If necessary, B-Nine/ Alar (daminozide) 2,500-5,000 ppm (6.0 g/l 85% formulation or 8.0 g/l of 64% formulation) is good for plant size control.

In Northern European conditions:

2,500 ppm Alar (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) works well.

Pinching

Pinching is not needed.

Spacing

Space plants when foliage is touching. Crop Scheduling

Sow to transplant (288 cell plug): 5 to 6 weeks

Transplant to flower: 11 to 14 weeks Total crop time: 16 to 20 weeks. Generally, Mesa Bright Bicolour and Mesa Peach flower about 1 to 2 weeks faster than Mesa Yellow dependent on daylength conditions. The longer daylength (longer than 14 hours) they are grown under, the bigger the difference in flower timing.

Mesa Series Gaillardia continued

Note: The total crop time of about 16 to 20 weeks is based on Spring production under night temperatures of about 50 to 61°F (10 to 16°C) and day temperatures of about 59 to 70°F (15 to 21°C) with natural daylength. Crop time will be shorter under warmer temperature and long day conditions, or longer under cooler temperature and short day conditions.

Spring to Autumn production: Sow from early February to July, for finishing May to September.

Overwinter production: Sow in July to early September for natural flowering late April of the following year.

Common Problems

Insect: Watch for Fungus Gnat larva and Thrips.

Disease: INSV, White Smut, Powdery Mildew.

Germination: Occasionally there are albino seedlings which will not develop into viable plants. Frequency can vary up to 9%.

'Sparkle White' Gaura

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Sowing

Sow 1 seed per cell to 288-plug tray. Covering seed with vermiculite is recommended.

Stage 1 - Germination takes 5 to 6 days. Soil temperature: 65 to 68°F (18 to 20°C) Light: Not required.

Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95%+ relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 66 to 70°F (19 to 21°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 67°F (18 to 19°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture to wetdry cycle (moisture level 4 to 2).

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N/0.7 to 1.2 mS/cm EC). If growth is slow, apply a balanced ammonium and nitrate-form fertilizer with every other fertilization. Maintain medium pH of 5.8 to 6.2 and EC between 1.0 and 1.5 mS/cm (1:2 extraction).

Growth Regulators: Generally not needed. Stage 4

Soil temperature: 59 to 64°F (15 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Note: Gaura seed is a nutlet and may have up to 4 seeds, so there may be greater than one seedling per cell.

Growing On to Finish

Container Size

4.5 to 6-in. (11 to 15-cm) or quart pots: 1 plant per pot Gallon (18-cm) pots: 1 plant per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

For overwinter production, bark-based media is recommended for better drainage to protect plants from root rot due to being too wet.

Temperature

Nights: 50 to 64°F (10 to 18°C) Days: 59 to 70°F (15 to 21°C) Sparkle Gaura can be grown at lower temperatures (frost-free cold frame/ poly house); however, crop times will be increased.

Light

Maintain light levels as high as possible (DLI >= 15 mol) while maintaining moderate temperature.

Photoperiod

Sparkle Gaura is a facultative long-day plant and requires 13 hours or longer daylength for uniform and faster flowering.

Irrigation

Grow plant on slightly dry side but do not allow plant dry to wilt.

Fertilizer

Apply fertilizer at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrate-form fertilizer with low phosphorus and high potassium. Maintain media EC at 1.5 to 2.0 mS/cm and pH at 5.8 to 6.2.

For a constant fertilizer program, apply fertilizer at 75 to 100 ppm N (0.5 to 0.7 mS/cm) while maintaining the above recommended EC and pH ranges.

Growth Regulators

Sparkle Gaura is responsive to tank mix of B-Nine/ Alar (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) and Cycocel (chlormequat) 750-1000 ppm (6.4-8.5 ml/l 11.8% formulation or 1.0-1.3 g/l of 75% formulation). Repeat if necessary.

In northern European conditions: 2,500 ppm B-Nine/Alar (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) works well. Multiple applications may be necessary.

Pinching

Pinching is not needed.

Spacing

Can be grown pot tight.

Crop Scheduling

Sow to transplant (288-cell plug): 5 to 6 weeks

Transplant to flower (annual production):

Container Size	Number of Plants	Warm Production (@68°F/20°C)	Cold Production (@55°F/13°C)
4.5-5 in. (11-13 cm) or quart pot	1 plant per pot	7-8 weeks	11-13 weeks
Gallon (18 cm) pot or 6 in. (15 cm)	1 plant per pot	8-9 Weeks	12-14 Weeks

Spring production: Sow in January for natural flowering in early May to early June dependent on temperature.

Overwinter production: Sow in July to early September for natural flowering mid to late May of the following year.

Plants from overwinter production flower about 1 to 2 weeks earlier and are about 1/3taller and bushier than plants from Spring production under the same environmental conditions.

Disease: None

Pixie Splash Gypsophila

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.5 and an EC of 0.6 mmhos/cm.

Sowing

Sow 4 seeds (Tuned seeds preferred) per cell in a 288 tray. Do not cover the seeds. Spray preventively against fungi after sowing.

Stage 1 - Germination takes 3 to 4 days. Soil temperature: 60 to 65°F (16 to 18°C) Light: Light is required for germination. Moisture: Keep soil moist (level 4) in Stage 1. Humidity: Maintain 95 to 97% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Reduce media moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC).

Stage 3

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). **Moisture:** Allow media to dry further until the surface becomes light brown (level 2) before watering. Do not allow seedlings to wilt.

Fertilizer: Apply fertilizer at rate 2 to 3 (150 to 200 ppm N/1.0 to 1.3 mmhos/cm EC). Growth Regulators: Not needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Apply fertilizer at rate 3 (175 to 225 ppm N; 1.2 to 1.5 mmhos/cm EC).

Growing On to Finish

Container Size 3 to 5-in. (3 to 13-cm) pots: 1 plug per pot

Vernalization

Vernalization is required for flower induction; approximately 8 weeks with a temperature below 39°F (4°C).

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.5 and an EC of 0.75 mmhos/cm.

Light

Photoperiod plant.

Irrigation

Fertilizer

Moderate feeder at fertilizer rate 2 (100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC). When plants start regrowing after Winter, it is advised to add 1 or 2 extra applications of Nitrate fertilizer in a well-balanced mix including micro-elements.

Growth Regulators Not needed. Pinching

Not needed. Spacing in./25 cm).

Crop Scheduling weeks

Transplant to flower: **Overwintered outside:** 36 to 40 weeks (under Northern European circumstances) Normal production: Sowing early July until early August will give natural flowering from later April to May the following year (under Northern European conditions).

Common Problems Insect: Aphids, Spider Mites, White Flies **Disease:** Botrytis

Melting Fire & Malachite Heuchera

Plug Production Media

Use a well-drained, disease-free, soilless media with a pH of 5.6 to 6.2 and an EC of 0.75 mmhos/cm.

Common Problems

Insect: Watch for Aphids.

KieftSeed

Temperature (optimum)

Nights: 50 to 58°F (10 to 14°C) **Davs:** 60 to 65°F (16 to 18°C) Leaves may become purplish when grown at temperatures below 46°F (8°C).

Keep light as high as possible while maintaining moderate temperatures.

Pixie Splash Gypsophila is a day-neutral

Keep media dry (level 2; substrate color is light brown) to medium moist (level 3; substrate color is brown to dark brown).

Space plants when foliage is touching (10

Sow to transplant (288 cell plug): 5 to 6

Sowing

Sow 8 seeds for Melting Fire and 6 to 8 seeds for Malachite per cell in 288 or larger plug tray.

Do not cover the seed.

Spray after sowing to prevent fungi.

Stage 1 – Germination takes 10 to 14 days for Melting Fire and 8 to 10 days for Malachite.

Soil temperature: 68 to 72°F (20 to 22°C) Light: Requires light to germinate. Moisture: Keep soil medium moist to medium wet (level 3-4) in Stage 1. Humidity: Maintain 95 to 97% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce media moisture slightly to medium moist (level 3) to allow the roots to penetrate into the media. Don't let the media dry out.

Humidity: Maintain 75 to 80% relative humidity (RH).

Fertilizer: None.

Stage 3

Soil temperature: 63 to 65°F (17 to 18°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce media moisture slightly to medium dry to medium moist (level 2-3). Avoid both excessive watering and drought. Fertilizer: Apply fertilizer at rate 1 (between 40 to 60 ppm N with an EC of 0.3 to 0.4 mmhos/cm) from nitrate-form fertilizers. Keep a low soluble salt level in plug stage. Growth Regulators: Not needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Maintain fertilizer at rate 1 but increase slightly (75 to 100 ppm Nitrate fertilizer / 0.5 - 0.7 mmhos/cm EC) from nitrate-form fertilizers.

Growing On to Finish

Container Size

4 to 5 in. (10.5 to 13 cm) or square/quart pots: 1 plug per pot Gallon (18 cm): 1-3 plugs per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge of EC 0.8 mmhos/cm.

Melting Fire & Malachite Heuchera continued

Vernalization Not needed.

Optimum Temperature

Nights: 58 to 60°F (14 to 16°C)

Days: 60 to 68°F (16 to 20°C)

Light No additional light is required.

Photoperiod

No direct influence as Heuchera's attractiveness is leaf color and texture of the foliage and therefore sold for its ornamental foliage.

Irrigation

Keep media constantly medium dry to medium moist (level 2 to 3). Avoid both excessive watering and drought.

Fertilizer

Apply fertilizer at rate 1 to 2 (75 to 100 ppm Nitrate form fertilizer/0.7 to 0.9 mmhos/cm EC) or 150 ppm as needed. Maintain media pH 5.8 to 6.2 and EC 1.2 to 1.4 mmhos/cm.

Growth Regulators

Not needed.

Pinching

Not needed.

Spacing

Space plants when foliage is touching.

Crop Scheduling Sow to transplant (288 cell plug):

Malachite: 7 to 9 weeks Melting Fire: 8 to 10 weeks

Transplant to finished product:

Malachite Annual:		
4 in./10.5 cm pot	11-13 weeks	
5 in./13 cm pot	13-15 weeks	
Gallon/17 cm pot 12-15 weeks		
Malachite Overwintered: 30-34 weeks		

ng Fire Annua

4 in./10.5 cm pot	12-14 weeks
5 in./13 cm pot	14-16 weeks
Gallon/17 cm pot	14-16 weeks
1	. 1 1

Melting Fire Overwintered: 32-36 weeks

Plug Production

Temperature

Keep air temperature at 68 to 75°F (20 to 24°C) and soil temperature at 68 to 70°F (20 to 21°C) from germination to transplant.

Light

Supplemental lighting is not required, but will decrease total crop time.

Fertilizer

At radicle emergence, apply 50 to 75 ppm N. Increase to 100 to 150 ppm N as leaves develop.

Moisture

Keep soil media evenly moist. Do not allow the seedlings to wilt.

Plant Growth Regulators

A Cycocel spray at 300 ppm applied 10 days after sowing can be used if needed. This treatment will reduce the plug height by about 50% and make the foliage darker green as compared to non-treated plugs. **European rate:** 0.4ml/1, 75% a.i.

Growing On to Finish

Container Size

Luna Hibiscus is best suited to quart, gallon or larger containers (6 in./15 cm or larger). For quart and gallon containers (6 to 7.5 in./15 to 19 cm), use 1 plant per pot. For large containers (larger than 7.5 in./19 cm), use 1 to 3 plants per pot.

Media

Use a disease-free, peat-based, soilless medium with a pH of 6.0 to 6.5 and a medium initial nutrient charge (EC 0.75 mmhos/ cm with a 1:2 extraction). "Nursery mixes" that contain soil can also be used, but may require an additional week of crop time and plants will have darker green foliage.

Temperature

Nights: 65 to 70°F (18 to 21°C) **Days:** 70 to 85°F (21 to 30°C) Warmer growing conditions result in shorter crop times. Do not allow average daily temperatures to drop below 68°F (20°C). Plants can become chlorotic and sensitive to pesticide spray (phytotoxicity) when grown at cooler temperatures.

Light

Keep light levels as high as possible. Plants grow best under full sun. Space plants to allow light to reach basal area, as this promotes better branching.

Photoperiod

Luna Hibiscus requires a minimum of 12 hours of daylength to flower. Flowering is faster when daylength is 14 hours or longer. Supplemental lighting should be used under shorter days.

Watering

Keep media moist to wet. Consistent soil moisture is important and plants should not be allowed to wilt. Growing plants too dry will result in flower bud abortion.

Fertilizer

Feed plants weekly at 200 to 250 ppm N in a complete fertilizer.

Pinching

Pinching is not recommended. Luna Hibiscus branches naturally without pinching. Best branching occurs when plants are spaced when the foliage touches the sides of the pot.

Plant Growth Regulators

A tank mix of Cycocel at 750 to 1,000 ppm and B-Nine at 2,500 ppm has been tested in different climates in the U.S. and shown effective. Apply PGRs 2 weeks after transplant. Repeat application 2 weeks later if necessary.

Optional treatment: Bonzi drench at a very low rate of 0.25 to 0.5 ppm with multiple applications (2 to 3 times) is also effective. Be careful when using Bonzi drench as it is very easy to stunt plants, especially for northern growers.

If you are growing in a nursery mix that includes soil, less PGRs may be needed. One application 3 to 4 weeks after transplanting may be sufficient.

PGRs for Northern Europe: A weekly spray of a low concentration Cycocel (0.5 ml/1,75% a.i.) has been tested and shown effective in Risjenhout, Netherlands. If there is additional clay in the soil, it may turn out to be an alternative for the use of PGRs.

To determine the best rate for your conditions, we recommend that you run an in-house trial.

Crop Scheduling

Germination: 3 to 5 days Finish time for 200 plugs: 3 to 4 weeks (add 1 week for 72 liners) Transplant to flower: 10 to 13 weeks Total crop time (quarts & gallons): 14 to 16 weeks

The shorter crop times occur under warmer growing temperatures and longer daylength. If using a nursery mix, add one week to total crop time.

adults.

Whiteout Iberis

Plug Production Media

Sowing

Stage 1 - Germination takes 4 to 7 days. **Soil temperature:** 65 to 68°F (18 to 20°C) Light: Light is optional. Moisture: Keep soil wet (level 4) during Stage 1.

Stage 2 into the media. phosphorous.

Stage 3

to 4. Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC). Growth Regulators: Not needed.

Stage 4 Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Malachite Annual: 4 in./10.5 cm pot 5 in./13 cm pot

Gallon/17 cm pot

Malachite Overwintered: 36-40 weeks

Total crop time:

Weiting Fire Annual:	
4 in./10.5 cm pot	20-24 weeks
5 in./13 cm pot	22-26 weeks
Gallon/17 cm pot	22-26 weeks

18-22 weeks

20-24 weeks

19-24 weeks

Melting Fire Overwintered: 38-42 weeks

Production

Sow beginning to middle of January for a finished product middle of May to end of June under Northwestern European conditions.

Common Problems

Insect: Leaf Nematodes Disease: Powdery Mildew, Botrytis, Leafspot, Rust, Root Rot

Luna Series Hibiscus

Germination

Media

Use a well-drained, disease-free, soilless medium with a pH of 5.5 to 6.3 and a medium initial nutrient charge (EC 0.75 mmhos/cm with a 1:2 extraction).

Plug Tray Size

The recommended size is 200-cell or larger plug.

Sowing

Cover the seed with plug media. Seed can be germinated in a germination chamber or directly on the bench. When germinated in a chamber, the plug trays should be moved out as soon as radicle emergence occurs, to prevent seedling stretch.

Temperature

Germinate at 68 to 75°F (20 to 24°C). Germination is slower but more uniform at the lower temperature range.

Humidity

As long as the soil is kept evenly moist, high air humidity is not required for germination. Light

Light is not required for Stage 1.

KieftSeed

Common Problems

Insect: Thrips, Aphids, Spider Mites, Fungus Gnats. Note: Use caution when using Adept, an insect growth regulator, as it could cause phytotoxicity on Hibiscus. To control fungus gnats, it is recommended to use Gnatrol or Distance as a drench for the larvae, and Decathlon or Talstar as a foliar spray for

Disease: No serious problems.

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2.

Sow 3 to 4 seeds per cell in 288 plug trays. Cover the seeds lightly with vermiculite.

Humidity: Maintain 95 to 97%+ relative humidity (RH) until radicles emerge.

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). **Moisture:** Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC) from nitrate-form fertilizers with low

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Maintain soil moisture at level 3

Growing On to Finish

Container Size 4-in. (10-cm) / square/quart pots: 1 plug

per pot

Gallon (7-in./18-cm): 1 to 2 plugs per pot Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and an EC of 1.2 to 1.4 mmhos/cm.

Vernalization

Required. Minimum 8 to 10 weeks between 35 and 41°F (2 and 5°C). Plants should be bulked for about 8 to 10 weeks before being receptive to cold treatment.

Temperature (optimum)

Nights: 41 to 50°F (5 to 10°C) **Days:** 60 to 72°F (16 to 22°C)

Light

As high as possible while maintaining moderate temperature.

Photoperiod

Whiteout is a day-neutral plant.

Irrigation

Keep media moisture medium wet (level 4; substrate color is dark brown) for the first 4 to 6 weeks after potting in bulking stage; hereafter reduce the moisture level to level 2 to 3 (medium dry to medium moist).

Fertilizer

Whiteout generally needs average fertilization. Apply fertilizer at rate 3 (175 to 210 ppm N; 1.2 to 1.4 mmhos/cm).

Growth Regulators

Generally not needed.

Pinching

Not needed due to strong branching habit.

Crop Scheduling

Sow to transplant (288 cell plug): 7 to 8 weeks

Transplant to flower: 26 to 36 weeks Total crop time: 33 to 44 weeks Normal production:

Sowing May to mid-August will give natural flowering from March to May the following vear.

Common Problems

Insect: Mites, Slugs Disease: Botrytis, Downy Mildew Note: Downy Mildew will cause leaf dropping.

Cheron Series Incarvillea

Plug Production

Media

Use a well-drained, disease-free media with a pH of 5.5 to 6.3 and an EC of 0.75 mmhos/cm.

Sowing

Sow 2-3 seeds per cell in 288 or larger plug tray. Covering seed lightly with vermiculite is advised.

Stage 1 - Germination takes 4 to 6 days. **Soil Temperature:** 65 to 68°F (18 to 20°C) Light: Not required but beneficial. Moisture: Maintain the moisture level constantly medium moist to medium wet (level 3 to 4) in Stage 1.

Humidity: Maintain 95 to 97% relative humidity (RH) until cotyledons emerge.

Stage 2

Soil temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Reduce media moisture slightly towards medium moist (level 3). Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC).

Stage 3

Soil temperature: 68 to 72°F (20 to 22°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Maintain the moisture level constantly medium moist (level 3). Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mS/cm EC). Do not fertilize plug heavier than 100 ppm or EC greater than 0.7 mS/cm as it could stimulate stretch with long internodes.

Growth Regulators: Generally not needed, but if necessary B-Nine/Alar (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 4.0 g/l of 64% formulation) can be used.

Stage 4

Soil temperature: 68 to 72°F (20 to 22°C). Avoid toning plugs at a cooler temperature as it could shock plants and will take time to resume plant growth after transplanting. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3. General remark for plug stage: Spray

preventively against fungi after sowing.

Growing On to Finish Media

Use a well-drained, disease-free media with a pH of 5.5 to 6.3 and an EC of 0.75 mmhos/cm.

Temperature

Nights: 63 to 65°F (17 to 18°C) **Days:** 67 to 70°F (19 to 21°C)

Incarvillea is a warm season crop. Cooler conditions could significantly delay flower timing, especially for Cheron Pink.

Light

Maintain light levels as high as possible.

Photoperiod

Incarvillea Cheron is a day-neutral plant.

Irrigation

Moderate; maintain the moisture level constantly medium moist (level 3).

Fertilizer

Apply fertilizer every other week at rate 3 (175 to 225 ppm N/1.2 to 1.5 mS/cm) using predominantly nitrate form fertilizer with low phosphorus to avoid plant stretch.

Growth Regulators

Plant final height does not respond very well to plant growth regulators, but Topflor (flurprimidol) about 15 ppm (4.0 ml/l 0.38 formulation) spray could make plant stronger with darker foliage and slight height control. Avoid using B-Nine/Alar in later application as it could significant delay flowering.

Pinching

Not necessary. Crop Scheduling

Sow to transplant (288 cell plug): 3 to 4 weeks

Transplant to flower:

Container Size	Plants Per Pot	Weeks From Transplant	Total Weeks
4 in. (10.5 cm)	1	7-8	10-12
5 in. (13 cm)	1	8-9	11-13

Note: Pink takes approximate 7 to 10 days longer crop time compared to White.

Common Problems Insect: Aphids, White Flies

Disease: Botrytis

Bandera Purple Lavandula

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.0 and an EC of 1.0 to 1.2 mmhos/cm.

Sowing

Sow 1 seed per cell in 288 or 180 plug trays. Cover the seeds lightly with vermiculite. **IMPORTANT:** Do not cover the seeds too heavily as it will significantly decrease germination.

Stage 1 - Germination takes 3 to 5 days. Pull from germination chamber at 10-15% visible radicle emergence and grow at 60-65°F (15-18°C) to avoid stretch.

Soil temperature: 65 to 68°F (18 to 20°C) Light: Light is optional for germination but beneficial for reducing early stretching. Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95 to 97% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). **Moisture:** Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC) from nitrate-form fertilizers with low phosphorous.

Humidity: Maintain 80 to 85% relative humidity (RH).

Stage 3

Soil temperature: 50 to 58°F (10 to 14°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Allow the soil moisture to dry to level 3.

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC). Growth Regulators: Not needed but if necessary B-Nine /Alar (daminozide) 2500 ppm (3.0 g/l 85% formulation or 3.9 g/l of)64% formulation) in stage 3 can be applied. Humidity: Maintain 70 to 75% relative humidity (RH).

Stage 4

Soil temperature: 50 to 58°F (10 to 14°C) Light: Up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Same as Stage 3. **Note:** In plug phase *L. stoechas* may stretch easily due to higher temperatures. It is advised to reduce temperature in early plug stage and remove plug trays from germination chamber when 10 to 15% of radicles have emerged. To prevent damping off, spray fungicide and keep an active growing environment with enough ventilation for low relative humidity.

Growing On to Finish

Container Size

4 to 6-in. (10 to 15-cm) square/quart pots: 1 plug per pot

Gallon (7-in./18-cm): 1 to 2 plugs per pot Media

Use a well-drained, disease-free, soilless media with coarse parts with a pH of 5.5 to 6.0 and an EC of 1.0 to 1.2 mmhos/cm.

Temperature (optimum)

Nights: 54 to 60°F (12 to 16°C) **Days:** 65 to 68°F (18 to 20°C) Note: Use frost protection when temperature is under 37 to 39°F (3 to 4°C).

Light

Keep as high as possible while maintaining moderate temperature.

Photoperiod

Bandera Purple is a facultative long-day plant.

Irrigation

Keep media medium moist (level 3; substrate color is brown to dark brown); let top soil dry in between waterings but do not allow medium to get too dry as high EC could cause root damage.

Before shipping, do not over-water the plant Keep soil medium moist (level 3) and keep plant foliage dry.

Humidity

Avoid medium to high relative humidity levels above 75 to 80%, especially during late afternoon and nights.

Ellagance and Lavance. Shipping advice: High humidity inside shipping box could promote disease and damage plants, especially under warm conditions. Therefore, keeping soil medium moist (level 3) and keeping plant foliage dry before shipping are very important. In addition, using open box or box with ventilation will help to prevent disease and damage.

Shelf life at retail: Never use overhead watering as it could cause *Botrytis* easily.

Fertilizer

Pinching

later growing-on stage. irrigation to prevent salt stress. **Growth Regulators**

KieftSeed

Bandera Purple generally needs light to moderate fertilization. Apply fertilizer at rate 2 (145 to 175 ppm N; 1.0 to 1.2 mmhos/ cm). Increase potassium to nitrate ratio in

Note: A weekly spray with Bittersalt (0.5 to 1.0 gr/ltr) improves plant quality and reduces plant loss; pay extra attention to

Not needed, but if necessary, B-Nine/ Alar (daminozide) 2,500 ppm (3.0 g/l 85% formulation or 3.9 g/l of 64% formulation) in early growing stage can be applied.

Not needed, as Bandera has a naturally well-branched habit.

Crop Scheduling

Sow to transplant (288 cell plug): 5 to 6 weeks; 180 cell plug may take a week longer Transplant to flower: 11 to 15 weeks (when

transplanted Late Winter to Spring) Total crop time: 16 to 21 weeks

Overwinter production for California

and partly SW USA: Sow in early to later September (week 36 to 40) for natural flowering later February to March (week 9 to 12) the following year.

Sow to transplant: 7 to 8 weeks Transplant to flower: 18 to 19 weeks

Total crop time: 25 to 28 weeks

Common Problems

Insect: Mites, Aphids

Disease: Botrytis, Colletotrichum, Phytophthora, Leafspot, Root Rot

Physiological: When grown too dry during growing season, flowers may not express themselves and will not open totally. Schedule: Bandera Purple, being listed as cool crop, should be scheduled for cool season sales. Warm season will decrease flag and spike size. For warm season sales, growers can schedule Lavandula angustifolia

Ellagance Series, Lavance Purple & Mini Blue Lavandula

Plug Production

Media

Use a well-drained, disease-free, media with a pH of 5.5 to 6.5 and a medium initial nutrient charge (EC 0.7-1.2 mmhos/cm).

Sowing

Sow 4 seeds per cell in a 288 cell tray, 6 seeds per cell in a 180 cell tray or 8 seeds per cell in an 84 cell tray. Cover seed lightly with vermiculite.

Spray with fungicide against Alternaria/ Phoma.

Stage 1 – Germination takes 4-5 days. Soil temperature: 65 to 68°F (18 to 20°C) Light: Not required but beneficial. Moisture: Keep soil medium moist to moist (level 3-4) in Stage 1.

Humidity: Maintain 95-98% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) Light: Up to 2,500 f.c. (26,900 Lux) **Moisture:** Maintain the moisture level constantly medium moist to medium wet (level 3-4), to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm Nitrate/0.2 - 0.5 mmhos/cm EC) from nitrate-form fertilizers.

Stage 3

Soil temperature: 59 to 63°F (15 to 17°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce media moisture slightly towards medium dry to medium moist (level 2-3). Avoid both excessive watering and drought.

Fertilizer: Apply fertilizer to rate 2-3 (140 to 225 ppm N/1.0 to 1.5 mmhos/cm EC). Maintain medium pH of 5.8 to 6.5 Growth Regulators: Lavandula is responsive to B-Nine/Alar (daminozide) 2,000 ppm (2.5 g/l 85% formulation or 3.0 g/l of 64% formulation). Depending on weather, a weekly spray is advised starting approximately 2 to 2½ weeks after sowing with a maximum of 3 to 4 times. Note: Ellagance Purple is for cool/early season productions and Lavance Purple is scheduled for middle to late season (warmer) productions. Plant development will vary between Ellagance and Lavance and therefore PGR treatments need to be watched carefully before applied.

Ellagance Series, Lavance Purple & Mini Blue Lavandula continued

Stage 4

Soil temperature: 59 to 63°F (15 to 17°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size

4 to 5-in. (10.5-13-cm) square/quart pots: 1 plug per pot

1 to 1½ gallon (17 to 23-cm pots): 1-3 plugs per pot

Media

Use a well-drained, disease-free media (with coarse or bark parts) with a pH of 5.8 to 6.5 and a medium initial nutrient charge (EC 1.0 mmhos/cm).

Nitrate schedule from start to finish:

Start production stage	N = 1.0 - 1.2
Final production stage	N = 1.4 – 1.5

Temperature

Ellagance series Nights: 54 to 60°F (12 to 16°C) **Days:** 60 to 72°F (16 to 22°C) Lavance Nights: 57 to 60°F (14 to 16°C)

Days: 60 to 72°F (16 to 22°C) **Note:** Ellagance Purple is for cool/early season productions and Lavance Purple is scheduled for middle to late season (warmer) productions.

Lavance requires higher minimum temperature (58-61°F/14-16°C) to start growth.

Light

As high as possible while maintaining controlled moderate temperatures.

Photoperiod

- Ellagance Pink and Purple are facultative long day plants (Long Day Beneficial) which will flower under all day length conditions but will flower faster under long day conditions.
- Ellagance Sky, Snow and Ice; Lavance and Mini Blue are obligated long day plants which have a critical day length of 13 to 14 hours.

Irrigation

Maintain medium moisture (level 3). Avoid both excessive watering and drought. For overwinter production, keep plants on the dry side during winter period as overwatering could result in plant loss from root rot.

Fertilizer

Apply constant fertilizer at rate 1-2 (100 to 125 ppm N/0.7 to 1.2 mmhos/cm EC or 150 ppm as needed). Maintain the pH at 5.8 to 6.5 and EC 1.2 to 1.5 mmhos/cm. For overwintering outside, add some extra Nitrate form fertilizer early spring (EC 1.5 – 1.6 mmhos/cm) when plants start to re-grow.

Growth Regulators

Lavandula is responsive to B-Nine/Alar (daminozide) 2,500 ppm (3.0 gr/l) but can also be mixed with Cycocel (chlormequat) 500-750 ppm (4.2 to 6.4 ml/l of 11.8% formulation or 0.7 to 1.0 ml/l of 75% formulation) for more compact plants. Lavandula is also responsive to Sumagic (uniconazole) 10 to 15 ppm (18 to 27 ml/l of 0.055% formulation) spray. PGR can be applied about 1 to 2 weeks after transplant. If necessary, repeat the applications as needed. In Northwestern Europe, Tilt (propiconazole) 0.3ml/l weekly spray is also effective. Note: Ellagance Pink and Purple are faster development varieties than others. They may require more frequent PGR applications.

Pinching Annual:

Pinching is not needed. Overwintered:

To control shape, pinching or trimming is possible when plants have started to flower or stretch too much before winter, or after re-growth.

Note: It is not necessary to pinch or trim Mini Blue Lavandula.

IMPORTANT: Don't pinch too low (minimum 10 cm from heart of the plant/soil level) or too late if pinch is done before winter to protect plants from disease infection.

Spacing

Space plants before foliage is touching.

Crop Scheduling

Sow to transplant (288 cell plug): 5 to 6 weeks

Sow to transplant (180 cell plug): 7 to 8 weeks Annual:

Transplant to flower:

• Ellagance Pink and Purple: 9 to 12 weeks

- Ellagance Sky: 10 to 13 weeks
- Ellagance Snow, Ice: 12 to 15 weeks

• Lavance Purple: 12 to 16 weeks Under proper day length and temperature range from 60°F (16°C) to 68°F (20°C)

- Total crop time: • Ellagance Pink and Purple: 15 to 18 weeks • Ellagance Sky: 16 to 19 weeks
- Ellagance Snow, Ice: 18 to 21 weeks
- Lavance Purple: 18 to 24 weeks Under proper day length and temperature range

Overwintering:

Transplant to flower: 36 to 42 weeks Under proper day length and temperature range

Total crop time: 41 to 48 weeks Under proper day length and temperature range

Ellagance Purple is 1-2 weeks earlier than Mini Blue and Lavance Purple.

Note: Larger pots and/or more plugs per pot may cause a slightly longer crop time of approx. 1 to 2 weeks.

Spring production: Sow mid February for natural flowering in late May to June. Overwinter production: Sow mid to end of July for natural flowering late May to early June of the following year.

Common Problems

Insect: Aphids, Leaf Nematodes, Mites Disease: Pythium, Phytophtora, Botrytis, Leafspot, Root Rot

Starship F1 Lobelia

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Sow 1 seed per cell in 288 or 4 seeds per cell in 84 plug trays. Lightly cover only when grown under dry conditions. Note: During plug stage, L. speciosa Starship

needs to be grown at less than 12 hours short-day conditions for at least the first 6 weeks from sowing to keep vegetative growth (leaf rosette) and avoid premature flowering. Long days together with warm conditions make plants stretch easily, resulting in weaker and floppy plants in growing-on phase (see photoperiod for detail).

Stage 1 - Germination takes 7 to 10 days. Soil temperature: 65 to 72°F (18 to 22°C) Light: Light is optional but can improve germination.

Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95 to 97%+ relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Maintain soil constaintly moist (level 4).

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC).

Stage 3

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). **Moisture:** Allow the soil moisture to dry to level 3.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC). Growth Regulators: Not needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC). **Note:** During plug stage, *L.speciosa* needs to be grown at less than 13 hours shortday conditions to keep vegetative growth and avoid premature flowering. Long days together with warm conditions make plants stretch easily, resulting in weaker plants in growing-on phase.

Growing On to Finish

Container Size

5-in. (13-cm): 1 plug per pot Gallon: 1 to 2 plugs per pot 2-Gallon: 3 to 4 plugs per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 60 to 65°F (16 to 18°C) Days: 65 to 70°F (18 to 21°C) Note: Cooler temperatures (from 8 to 13°C) will increase production time. Avoid growing plants at a minimum temperature below 40°F (3°C) as Starship Scarlet Lobelia is frost sensitive.

Light

Keep as high as possible while maintaining proper temperature.

Photoperiod

Starship Scarlet is a facultative long-day plant. It will flower faster at daylength 13 hours or longer.

Starship Deep Rose is an obligate long day plant. It requires 13 hours or longer daylength for flowering.

Common Problems Insect: Leafminers, Aphids, Thrips, Snails, Slugs. Control thrips as Lobelia is very susceptible to INSV damage. Disease: INSV, Phytium, Phytophtora, Root and Crown Rot

for larger pot size. treated plugs.

Irrigation

problems.

Fertilizer mmhos/cm)

Growth Regulators

Generally not needed, but if necessary, Bonzi (paclobutrazol) 30 ppm (7.5 ml/l, 0.4% formulation) or Sumagic (uniconazole) 5 ppm (9.1 ml/l, 0.055 % formulation) can be applied in early growing stage.

Pinching Not needed.

Crop Scheduling Sow to transplant (288 cell plug): 7 to 9 weeks; 84 cell plug takes a week longer. Add one more week for Starship Deep Rose. Transplant to flower: 12 to 16 weeks when grown under proper daylength (13 hours or longer). Add one more week for Starship

Deep Rose. Total crop time: 19 to 25 weeks. Starship Deep Rose will take about 2 more weeks total to finish than Starship Scarlet.

Starship flower can be induced during plug stage under long-day conditions, which causes premature flowering with weaker, thinner as well as floppy stems. A period of short day after sowing is required to keep the plant vegetative growth, which allows the plant to form rosette with good basal branching and strong stems. Therefore, keeping plug production at less than 12 hours for at least first 6 weeks from sowing is recommended. Otherwise, it may be necessary to transplant an extra 1 or 2 plugs

When transplanting to extremely long day conditions (16 hours or longer), extra plugs may also be needed even from short-day

Keep media moisture medium moist (level 3; substrate color is brown to dark brown). Let topsoil dry in between waterings but avoid drought stress. Avoid growing in too-wet conditions as it can cause disease or insect

Starship Scarlet generally needs moderate fertilization. Apply fertilizer at rate 2 (between 100 to 190 ppm N; 0.7 to 1.3

Vulcan Red Lobelia

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and EC about 0.75 mS/cm (1:2 extraction).

Sowing

Sow 1 seed per cell in 288 or 4 seeds per cell in 84 plug trays. Lightly cover only when grown under dry conditions.

Note: L. speciosa Vulcan Red needs to be grown at less than 13 hours short day conditions for at least the first 6 weeks after sowing to keep vegetative growth and avoid premature flowering. Long days together with warm conditions make plants stretch easily, resulting in weaker plants in growingon phase.

Stage 1 - Germination takes 7 to 9 days. **Soil temperature:** 65 to 72°F (18 to 22°C) Light: Light improves germination. Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95 to 97%+ relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Maintain soil moisture at level 4. Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC).

Stage 3

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Allow the soil moisture to dry to level 3.

Fertilizer: Increase fertilizer to rate 2 (100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC) Growth Regulators: Not needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3.

Fertilizer: Same as Stage 3.

Note: *L.speciosa* needs to be grown at less than 13 hours short-day conditions to keep vegetative growth and avoid premature flowering. Long days together with warm conditions make plants stretch easily, resulting in weaker plants in growing-on phase.

Vulcan Red Lobelia continued

Growing On to Finish

Container Size

Gallon: 1 to 2 plugs per pot **2 Gallon:** 3 to 4 plugs per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and and a medium initial nutrient charge (EC 0.75 mmhos/cm).

Temperature

Nights: 60 to 65°F (16 to 18°C) **Days:** 65 to 70°F (18 to 21°C) Note: Vulcan Red is frost sensitive, so grow at a minimum of 40°F (3°C).

Light

Keep as high as possible, as this will improve foliage, more intense purpling.

Photoperiod

Vulcan Red is an obligate long-day plant and requires daylength minimium 14 hours for flowering.

Vulcan Red flower can be induced during plug stage under long day conditions, which causes premature flowering with weak and thinner stems. A period of short day after sowing is required to keep the plant vegetative growth, which allows the plant to form rosette with good basal branching and strong stems. Therefore, keeping plug production at less than 13 hours is recommended. Otherwise, it may be necessary to transplant an extra 1 or 2 plugs for larger pot size.

When transplanting in extreme long day conditions (16 hours or longer), extra plugs may also be needed even from short day treated plugs.

Irrigation

Keep media moisture medium moist (level 3; substrate color is brown to dark brown). Let topsoil dry in between waterings but avoid drought stress; grow evenly moist but not wet.

Fertilizer

160

Vulcan Red generally needs moderate fertilization. Apply fertilizer at rate 2 to 3 (between 150 to 225 ppm N; 1.0 to 1.5 mmhos/cm).

Growth Regulators

Bonzi (paclobutrazol) 30 ppm (7.5 ml/l, 0.4% formulation) or Sumagic (uniconazole) 5 ppm (9.1 ml/l, 0.055 % formulation) in early growing stage can be applied for height control.

630 231-1400 kieftseed.com

Pinching

Not needed. **Crop Scheduling** Sow to transplant (288 cell plug): 7 to 9 weeks; 84 cell plug takes a week longer.

Transplant to flower: 14 to 19 weeks when grown under proper daylength of 14 hours or more. Total crop time: 21 to 28 weeks

Common Problems

Insect: Leafminers, Aphids, Thrips, Snails, Slugs.

Control thrips as Lobelia is very susceptible to INSV damage. Disease: INSV, Phytium, Phytophtora, Root and Crown Rot

Carillo Series Penstemon

Plug Production

Media Use a well-drained, disease-free, soilless

media with a pH of 5.8 to 6.5 and an EC of 0.75 mmhos/cm.

Sowing

Sow 3 to 4 seeds per cell in 288 or larger plug tray.

Do not cover the seed. Spray after sowing preventively against fungi.

Stage 1 – Germination takes 3 to 6 days. Soil temperature: 65 to 68°F (18 to 20°C) Light: Requires light to germinate Moisture: Keep soil medium moist to medium wet (level 3-4). Humidity: Maintain 95 to 97% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce media moisture slightly to

medium moist (level 3) to allow the roots to penetrate into the media. Don't let the media dry out.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mmhos/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 60 to 65°F (16 to 18°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Maintain the moisture level constantly medium moist (level 3). Avoid both excessive watering and drought.

Fertilizer: Maintain fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mmhos/cm EC) from nitrate-form fertilizers. Growth Regulators: Not needed for height control, however plant quality seems improved in a later stage when using 2 applications of B-Nine/Alar (daminozide) of 2,000 ppm (2.5 gr/l 85% formulation or 3.0 gr/l 64% formulation) applied about 2 to 2½ weeks after sowing.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Apply fertilizer at rate 2 (100 to 175 ppm N/0.7 – 1.2 mmhos/cm EC) from nitrate-form fertilizers.

Growing On to Finish

Container Size

4 to 5-in. (10 to 13 cm) quart pots or gallons: 1 plug per pot 2 gallons: 3 plugs per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.5 and an EC of 1.2 mmhos/cm).

Vernalization

Not required; Penstemon mexicali doesn't need vernalization for flower induction.

Temperature

Nights: 55 to 59°F (13 to 15°C) **Days:** 65 to 72°F (18 to 22°C)

Light

No additional light is required.

Photoperiod

Carillo is a facultative long-day plant.

Irrigation

Keep media constantly medium dry to medium moist (level 2 to 3). Root-system of Carillo is sensitive to both excessive watering and drought.

Fertilizer

Apply fertilizer at rate 2 to 3 (150 to 225 ppm N/1.1 to 1.5 mmhos/cm EC) from Nitrate form fertilizer. Avoid high ammonium levels.

Growth Regulators

In general, PGR is not needed for height control when grown cool, however Penstemon mexicali is responsive to B-Nine/ Alar (daminozide) in an early stage after transplant. An application of 2,500 ppm (3.0 gr/l 85% formulation or 4.0 gr/l 64% formulation) can be applied about 10 days to 2 weeks after transplant. If necessary, repeat the application after approximately 10 days depending on growth, temperature and light level. Best reaction to PGR treatments may be expected the first month after transplant.

Note: Avoid using Bonzi (paclobutrazol) as it may cause a wild, open and coarse plant habit. Plants also tend to stretch earlier.

Pinching

Not needed; however for pot-culture, pinching approximately 1 week after transplant could be done to get more flower stems; this enlarges crop time by approximately 3 to 5 weeks.

Spacing

Space plants when foliage is touching.

Crop Scheduling Sow to transplant (288 cell plug): 6 to 8 weeks Transplant to flower: • Red and Purple: 12 to 14 weeks • Rose: 13 to 15 weeks Total crop time: • Red and Purple: 18 to 22 weeks • Rose: 19 to 23 weeks Note: Bigger pot size, cool temperatures, pinching or the use of PGR may cause a longer crop time.

Production

Sow early to middle of January for natural flowering in May to June under Northwest European circumstances.

Common Problems

Insect: Aphids, Spider Mites, White Flies Disease: Downy Mildew

Tubular Bells Series Penstemon

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.5 and an EC of 0.75 mmhos/cm).

Sowing

Sow 4 seeds per cell in 288 or 6 seeds per cell in 180 or larger plug tray. Do not cover the seed. Spray after sowing preventively against fungi.

Stage 1 – Germination takes 3 to 6 days. Soil temperature: 65 to 68°F (18 to 20°C) Light: Requires light to germinate. Moisture: Keep soil medium moist to medium wet (level 3-4). Humidity: Maintain 95 to 97% relative humidity (RH) until radicles emerge.

Optimum Temperature **Nights:** 50 to 59°F (10 to 15°C) **Days:** 60 to 72°F (16 to 22°C) Note: Growing Tubular Bells outdoors when frost free or in tunnels with cooler temperatures will give the best plant quality but could increase crop time by 2 to 4 weeks depending on season, temperature and light level.

dry out.

Stage 2

phosphorous.

Stage 3

to 2 weeks.

Stage 4

Media

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Maintain the moisture level constantly to medium moist (level 3). Avoid both excessive watering and drought. Fertilizer: Apply fertilizer at rate 2 (100 to 175 ppm Nitrate fertilizer/0.7-1.2 mmhos/ cm EC) from nitrate-form fertilizers. Growth regulators: Penstemon hartwegii is responsive to B-Nine/Alar (daminozide) 2,000 ppm (2.5 g/l 85% formulation or 3.0 g/l of 64% formulation) in early stage. Depending on weather, a weekly spray is advised starting approximately 2 to 2¹/₂ weeks after sowing.

KieftSeed

Soil temperature: 65 to 68°F (18 to 20°C) Light: Up to 2,500 f.c. (26,900 Lux) Moisture: Reduce media moisture slightly to medium moist (level 3) to allow the roots to penetrate into the media. Don't let the media

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N/less than 0.7 mmhos/cm EC) from nitrate-form fertilizers with low

Note: PGR in plug stage is beneficial for uniformity but could delay crop time by 1

Soil temperature: 60 to 65°F (16 to 18°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 1 gallon (17 cm): 3 plugs per pot 2 gallon (30 cm): 5 plugs per pot

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.5 and an EC of 1.2 – 1.3 mmhos/cm).

Vernalization

Not required; Penstemon hartwegii doesn't tolerate frost and is a tender perennial.

Light

As high as possible. Low light intensity will make plants more stretching and soft, so additional light during winter or early spring will be beneficial.

Photoperiod

It is a facultative long-day plant (long day beneficial) and flowers most rapidly and uniformly at 14 hours or longer day length. Irrigation

Keep media constantly medium moist (level 3). Root-system of Tubular Bells is very sensitive to too wet or too dry conditions. Avoid both excessive watering and drought.

Fertilizer

Constantly fertilize at rate 1 to 2 (75 to 125 ppm/1.1 to 1.5 mmhos / cm EC) or apply 150 ppm N as needed.

Use a well-balanced Nitrate form fertilizer including micro nutrients.

Avoid high ammonium and high nitrogen levels and also prevent for magnesium and Iron deficiency.

Nitrate schedule from start to finish:

Start production stage	N = 1.1 - 1.2
Final production stage	N = 1.4 – 1.5

Growth Regulators

Penstemon hartweaii is responsive to B-Nine/ Alar (daminozide) in an early stage. An application of 2,500 ppm (3.0 gr/l 85% formulation or 4.0 gr/l 64% formulation) can be applied about 1 week to 10 days after transplant. If necessary, repeat the application after approximately 5 to 7 days depending on growth, temperature and light level. Low light and low temperatures may influence the reaction of the plant on the growth regulator.

Note: Penstemon hartwegii reacts best to plant growth regulator treatments in early stages (plug or just after transplant). The reaction will reduce to minimum approximately 4 to 6 weeks after transplant.

Pinching

For pot-culture, pinching after 4 pairs of leaves could be done to get more flower stems; however, this will delay crop time approximately 3 weeks.

Spacing

Space plants when foliage is touching.

Crop Scheduling

Sow to transplant (288 cell plug): 6 to 8 weeks

Tubular Bells Series Penstemon continued

Sow to transplant (180 cell plug):

7 to 9 weeks Transplant to flower: 13 to 16 weeks Under proper day length and temperature range using a 288 plug tray Total crop time: 19 to 24 weeks Under proper day length and temperature range using a 288 plug tray Note: Larger plug size or bigger pot size may cause a slightly longer crop time of approximately one week.

Production

Sow early to middle of January for natural flowering in June under Northwest European conditions.

Common Problems

Insect: Aphids, Spider Mites, White Flies, Thrips

Disease: Powdery Mildew, Leafspot

New Dimension Series Salvia

Plug Production

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and an EC of 0.5 mmhos/cm).

Sowing

Sow 4 seeds per cell in 288 or larger plug tray. In Europe 180-cell trays can be used with 4 to 6 seeds per cell for overwintering production or for early sowing spring production. Cover seed lightly with vermiculite.

Spray with fungicide to prevent damping off and against Alternaria/Phoma.

Stage 1 – Germination takes 3-4 days. Soil temperature: 68 to 72°F (20 to 22°C) Light: Light is optional.

Moisture: Keep soil medium moist (level 3) in Stage 1.

Humidity: Maintain 95 to 97% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Keep soil moisture at the same level (level 3), to allow the roots to penetrate into the media, don't let the media dry out. Fertilizer: None. Salvia is sensitive to high salt level during early plug stage. Do not fertilize until true leaves develop (maximum 0.5 EC).

Stage 3

Soil temperature: 65 to 68°F (18 to 20°C) **Light:** Up to 2,500 f.c. (26,900 Lux) Moisture: Allow media to dry further until the surface becomes light brown (level 2) before watering. Keep the moisture level to wet-dry cycle (moisture level 3 to 2). **Fertilizer:** Apply fertilizer to rate 2 (100 to 175 ppm Nitrate/0.7-1.0 mmhos/cm EC) from nitrate-form fertilizers. Growth regulators: Not necessary.

Stage 4

Soil temperature: 65 to 68°F (18 to 20°C) Light: Up to 5,000 f.c. (53,800 Lux) if temperature can be controlled. Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Growing On to Finish

Container Size 4 to 5-in. (10 to 13 cm) or square/quart

pots: 1 plug per pot 1 to 1½ gallon (17 to 23 cm): 1 to 3 plugs per pot

Media

Use a well-drained, disease-free, soilless media with a pH of 5.5 to 6.2 and an EC of 0.75 mmhos/cm).

Nitrate schedule from start to finish:

Start production stage	N = 0.8 - 1.0
Final production stage	N = 1.2 – 1.3

Temperature

Nights: 50 to 59°F (10 to 15°C) **Days:** 60 to 72°F (16 to 22°C) During overwinter period, plants will do best under minimum 36-38°F/2-3°C protected circumstances.

Light

Natural daylight during season, preferably as high as possible; no additional light is required.

Photoperiod

It is a long-day plant and flowers most rapidly and uniformly at 14 or longer day length with critical day length about 14 hours.

Irrigation

Keep media medium dry to medium moist (level 2 - 3). Avoid both excessive watering and drought but allow pots to dry in between waterings.

For overwinter production, keep plants on the dry side during winter period as overwatering could result in plant loss from root rot.

Fertilizer

Apply fertilizer at rate 1-2 (100 to 125 ppm N/1.2 to 1.5 mmhos/cm EC) or 150 ppm as needed. Maintain the pH at 5.5 to 6.2.

The ratio of N : K should be 1:1 at start production stage and increase to 1:2 at later stage.

Growth Regulators

In general, no PGR is needed, especially when grown under cool conditions, but if necessary New Dimension is responsive to B-Nine/Alar (daminozide) 2,500 ppm (3.0 gr/l 85% formulation or 4.0 gr/l 64% formulation) applied about 10 days to 2 weeks after transplant. If necessary, repeat the application 2 weeks later depending on growth, temperature and light level.

Pinching

Annual: Pinching is not needed.

Overwintered:

Pinch only those plants which flower before winter.

IMPORTANT: Don't pinch too low (minimum 8 to 10 cm from heart of the plant/soil level) or too late if pinch is done before winter to prevent plants from disease or infection.

Spacing

Space plants when foliage is touching. **Crop Scheduling** Sow to transplant (288 cell plug): 5 to 6 weeks Sow to transplant (180 cell plug):

6 to 7 weeks Annual:

Transplant to flower from 288 cell:

• Blue: 9 to 11 weeks • Rose: 8 to 10 weeks Total crop time: 13 to 15 weeks Under proper day length and temperature range

Overwintering:

Transplant to flower: 32 to 38 weeks Total crop time: 38 to 44 weeks Spring production: Sown in mid-March for natural flowering in middle to late June. Overwinter production: Sown in middle to late of July for natural flowering late May to early June of the following year. Do not sow too early for preventing flowering before winter.

Common Problems

Insect: Spider Mites, Aphids, Thrips, White Flies

Disease: Rhizoctonia, Crown and Root Rot (under wet conditions), Leafspot, Pythium, Phytophtora, Botrytis, Powdery Mildew, Phoma

Physiological: To enhance foliage color and quality add 1 g/l Bittersalt (MgSO4) on a weekly basis starting from two weeks after transplant.

Rocco Red Saxifraga

Plug Production

Media Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2.

Sowing

Sow 2 seeds per cell in 288 plug trays. Cover the seeds lightly with vermiculite. Spray preventive fungicide against damping off.

Stage 1 - Germination takes 7 to 11 days. Soil temperature: 65 to 68°F (18 to 20°C) Light: Light is optional.

Moisture: Keep soil wet (level 4) during Stage 1.

Humidity: Maintain 95 to 97% relative humidity (RH) until radicles emerge.

Stage 2

Soil temperature: 65 to 68°F (18 to 20°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Reduce soil moisture slightly (level 3 to 4) to allow the roots to penetrate into the media.

Fertilizer: Apply fertilizer at rate 1 (less than 100 ppm N; less than 0.7 mmhos/cm EC) from nitrate-form fertilizers with low phosphorous.

Stage 3

Soil temperature: 65 to 68°F (18 to 20°C) Light: Can be up to 2,500 f.c. (26,900 Lux). Moisture: Retain soil moisture at level 3 to 4. **Fertilizer:** Increase fertilizer to rate 2 (100 to 175 ppm N; 0.7 to 1.2 mmhos/cm EC). Growth regulators: Not needed.

Stage 4

Soil temperature: 60 to 65°F (16 to 18°C) Light: Can be up to 5,000 f.c. (54,000 Lux). Moisture: Same as Stage 3. Fertilizer: Same as Stage 3.

Container Size 3.5 to 5-in. (10 to 13-cm): 1 plug per pot

Media

to 1.2 mmhos/cm. Vernalization:

Required about 12 weeks at 41°F (5°C). Plants should be bulked for about 8 to 10 weeks before receiving a cold treatment. Temperature (optimum)

Nights: 40 to 50°F (4 to 10°C) Days: 60 to 65°F (16 to 18°C) Light

flowers.

Photoperiod

Irrigation

Grows best at medium dry to moderate irrigation (level 2 to 3). Irrigation strategy is to water thoroughly and allow plants to dry back to moderate moisture level.

Fertilizer

Rocco Red generally needs moderate fertilization. Apply fertilizer at rate 2 (145 to 175 ppm N; 1.0 to 1.2 mmhos/cm); pH level can be brought up between 5.8 and 6.2. Add micronutrient to prevent Mg and Fe deficiency.

Growth Regulators Not needed.

Pinching Not needed.

Crop Scheduling weeks

Common Problems Insect: Spider Mites **Disease:** Botrytis

KieftSeed

Growing On to Finish

Use a well-drained, disease-free, soilless media with a pH of 5.8 to 6.2 and an EC of 1.0

Low light (in combination with higher temperatures) will result in bleaching of

Rocco Red is a day-neutral plant.

Sow to transplant (288-cell plug): 9 to 10

Transplant to flower: 28 to 38 weeks Total crop time: 37 to 48 weeks

Notes

Grower Facts

Kabloom[™] Calibrachoa

Calibrachoa x hybrida

Seed Form and Sowing Recommendations: Pelleted Seed, 1 Seed per Cell						
Stage	Plug Stage 1	Plug Stage 2	Plug Stage 3	Plug Stage 4	Transplant to Finish	Comments
Plug Stage and Time	Germination to Radicle Emergence, 5-7 Days*	Radicle Emergence to Cotyledon Expansion	Cotyledon Expansion to True Leaves	Pullable Plug		
Photo	1		S			
Media Moisture	Level 5, saturated	Level 4	Cycle between levels 2 and 4	Cycle between levels 2 and 4		Do not allow to wilt
Temperature	73°F (22.5°C) media temperature	68°F (20°C)	64°F (18°C)	55-64°F (13-18°C); no less than 55°F (13°C)		Morning DIP/Drop of -5°F (-21°C) for height control
Light Requirements	Light or dark, cover not required	≥10 moles·m ⁻² ·d ⁻¹	≥10 moles·m ⁻² ·d ⁻¹	≥10 moles·m ⁻² ·d ⁻¹	≥10 moles·m ⁻² ·d ⁻¹	
ph and EC Management	Similar to Petunia	Similar to Petunia	Similar to Petunia	Similar to Petunia	Similar to vegetative Calibrachoa or Petunia	The recommended pH is 5.5-5.8. Kabloom can be grown with the same nutrition program as vegetative calibrachoas.
Plant Growth Regulators		Flurprimidol (Topflor): 2-3 ppm spray on day 7-10	Every 10-14 days as needed	Every 10-14 days as needed	Paclobutrazol* 1-3 ppm drench 7-10 days from	Pinch or shear if pullable plugs are stretched*,
		Daminozide*: 2,500 ppm spray on day 7-10			needed	overgrown or spinaly
		Paclobutrazol*: 3 ppm spray on day 7-10				
Disease and Pest Management	Similar to vegetative Calibrachoa	Similar to vegetative Calibrachoa	Similar to vegetative Calibrachoa	Similar to vegetative Calibrachoa	Similar to vegetative Calibrachoa	

* See other pages for additional information

rop Times				
Plug Crop	Time	Finished Crop Time from Non-Pinched Plugs		Tatal Const Time in Minches
Plug Tray Size	Crop Time in Weeks, from Sow to Pullable	Container Size/PPP	Crop time in weeks from 288 plug to 100% flowering	from Sowing to 100% Flowering
288	5-6	4 to 6-in. (10 to 15-cm) pots and quarts/1 PPP	7-8	12-13
128	7-8	10-in. (25-cm) basket/ 3 PPP	9-11	14-15
105	7-8	12-in. (30-cm) basket/ 5 PPP	9-11	14-15
72	7-8			

Minimum Day Length Requirement*		
In Hours	Variety	
10	Kabloom Yellow, Kabloom White	
11	Kabloom Deep Blue	
12	Kabloom Deep Pink	

Plug Stage and Time By Variety				
Fast-Germinating Varieties	Slow-Germinating Varieties			
Kabloom White	Kabloom Deep Blue			
Kabloom Deep Pink				
Kabloom Yellow				
Stage 1 at 75°F (25°C) for 5 days	Stage 1 at 75°F (25°C) for 7-10 days			
Stage 1 at 68°F (20°C) for 5-7 days	Stage 1 at 68°F (20°C) for 10+ days			

Variety List
Kabloom White 'PAS1020307' PPAF; EU PBRAF; CA PBRAF; JP PBRAF
Kabloom Yellow 'PAS1020308' PPAF; EU PBRAF; CA PBRAF; JP PBRAF
Kabloom Deep Blue 'PAS1020344' PPAF; EU PBRAF; CA PBRAF; JP PBRAF
Kabloom Deep Pink

Kabloom[™] Calibrachoa

Calibrachoa x hybrida

Plug PGR and Pinch Information

It is possible to manage plugs for improved bulk and stacked internodes. Manage with PGR applications and pinching.

PGRs

Stretched, long internodes and strong apical dominance: Dense, bulky and stacked internodes via PGR use:





With PGR



Stretched, long internodes and

strong apical dominance:

Without PGR

Unpinched

Dense, bulky and stacked internodes via PGR use:



With PGR



Pinching

Recommendations: Pinch at transplant:

- Soft pinch, leaving 4 basal nodes.
- Pinching can be beneficial for small pot production.

• Pinch can delay flowering.

• Delay depends on timing and extent of pinch. Kabloom Yellow



Pinched



Unpinched

Daminozide Use Details

Daminozide is a good option for plug production. Note: Daminozide can cause slight chlorotic stippling on Kabloom Yellow. The following photo demonstrates the chlorotic stipple appearance. No stippling with Paclobutrazol or Flurprimodol.

Kabloom Yellow

166



630 231-1400 panamseed.com







Daminozide-treated plugs (left) compared with Paclobutrazol-treated plugs (right), post-transplant:



Comparison of different control obtained with Paclobutrazol on Kabloom White and Yellow.

Kabloom Calibrachoa Variety Timing and Habit Details				
Variety	Earlienss to Saleable	Photoperiod	Finished Plant Vigor	Habit
Kabloom White	earlier	10 hours	less vigor	mounded
Kabloom Yellow	earlier	10 hours	more vigor	upright
Kabloom Deep Blue	average	11 hours	average	semi upright
Kabloom Deep Pink	earlier	12 hours	average	spreading

Grower Facts

Kabloom[™] Calibrachoa

Calibrachoa x hybrida

Paclobutrazol Use Details

Paclobutrazol in plug production offers good control. Note: Kabloom White is more receptive to Paclobutrazol and may slow grow-out rate. Paclobutrazol in finished production provides good height control for the Kabloom varieties. In finished production, Kabloom White is more receptive and sensitive to Paclobutrazol. Too-heavy or too-frequent applications may result in a too-compact or stunted plant.



For more information contact your PanAmerican Seed sales representative or PanAmerican Seed at 800 231-7065.

Kabloom Yellow

Crave Calibrachoa

Calibrachoa x hybrida

Seed Form and Sowing Recommendations: Pelleted Seed, 1 Seed per Cell Plug Stage 2 Plug Stage 3 Plug Stage 4 Transplant to Finish Comments Stage Plug Stage 1 Germination to Radicle Radicle Emergence to Cotyledon Expansion to Pullable Plug mergence, 5-7 Days* Cotyledon Expansion True Leaves Cycle between levels 2 Level 5, saturated Level 4 Do not allow to wilt Cycle between levels 2 and 4 and 4 Morning DIP/Drop of -5°F (-21°C) for height control 73°F (22.5°C) media 68°F (20°C) 64°F (18°C) 55-64°F (13-18°C); no less than 55°F (13°C) emperature ≥10 moles·m⁻²·d⁻¹ ≥10 moles·m⁻²·d⁻¹ ≥10 moles·m⁻²·d⁻¹ Light or dark, cover not ≥10 moles·m⁻²·d⁻¹ required Similar to vegetative Calibrachoa or Petunia Similar to Petunia Similar to Petunia Similar to Petunia Similar to Petunia The recommended pH is 5.5-5.8. Crave can be grown with the same nutrition program as vegetative calibrachoas. Flurprimidol (Topflor): 2-3 ppm spray on day 7-10 Every 10-14 days as needed Every 10-14 days as Paclobutrazol 1-3 ppm Pinch or shear if pullable drench 7-10 days from transplant; reapply as plugs are stretched*, overgrown or spindly Daminozide*: 2,500 ppm spray on day 7-10 needed Paclobutrazol: 3 ppm spray on day 7-10 Similar to vegetative Similar to vegetative Similar to vegetative Similar to vegetative Similar to vegetative

Calibrachoa

Plug Stage and Time	
Crave Sunset	Stage 1 at 75°F (25°C) for 7-10 days
Crave Sunset	Stage 1 at 68°F (20°C) for 10+ days

Calibrachoa

nimum Day Length Requirement*		
In Hours	Variety	
11	Crave Sunset	

Calibrachoa

Calibrachoa

Variety List Crave Sunset

	Crop Times				
Plug Crop Time		Finished Crop Time from Non-Pinched Plugs		Total Cron Time in Mosks	
	Plug Tray Size	Crop Time in Weeks, from Sow to Pullable	Container Size/PPP	Crop time in weeks from 288 plug to 100% flowering	from Sowing to 100% Flowering
	288	5-6	4 to 6-in. (10 to 15-cm) pots and quarts/1 PPP	7-8	12-13
	128	7-8	10-in. (25-cm) basket/ 3 PPP	9-11	14-15
	105	7-8	12-in. (30-cm) basket/ 5 PPP	9-11	14-15
	72	7-8			

Calibrachoa

Grower Facts

Crave Calibrachoa

Calibrachoa x hybrida

Plug PGR and Pinch Information

It is possible to manage plugs for improved bulk and stacked internodes. Manage with PGR applications and pinching.

PGRs

Stretched, long internodes and strong apical dominance:

Dense, bulky and stacked internodes via PGR use:





Without PGR

With PGR

Pinching

Recommendations: Pinch at transplant:

• Soft pinch, leaving 4 basal nodes.

- Pinching can be beneficial for small pot production.
- Pinch can delay flowering.
- Delay depends on timing and extent of pinch.



Crave Calibrachoa Variety Timing and Habit Details				
Variety	Photoperiod	Finished Plant Vigor		
Crave Sunset	11 hours	more vigor		

Stretched, long internodes and strong apical dominance:



Dense, bulky and stacked internodes via PGR use:



Without PGR

With PGR

Daminozide Use Details

Daminozide is a good option for plug production. Note: Daminozide can cause slight chlorotic stippling on Crave Sunset. The following photo demonstrates the chlorotic stipple appearance. No stippling with Paclobutrazol or Flurprimodol.

Crave Sunset



Habit
mounded upright

Kieft Seed Award Winners

All-America Selections

Coreopsis Early Sunrise Echinacea 'Cheyenne Spirit' Echinacea PowWow Wild Berry Gaillardia Mesa Yellow Gaura 'Sparkle White'

Fleuroselect Gold Medal

Armeria Ballerina Red Armeria Ballerina White Celosia Bombay Purple Coreopsis Early Sunrise Coreopsis Rising Sun Echinacea 'Cheyenne Spirit' Gaillardia Mesa Yellow Gaura 'Sparkle White' NEW Lavandula Bandera Purple Lavandula Ellagance Purple Lavandula Ellagance Sky Lavatera Twins Hot Pink Monarda Bergamo Penstemon Carillo Red



Ammi Graceland Aquilegia Clementine Mixture Aquilegia Winky Single Red-White Aquilegia Winky Rose-Rose Asclepias Silky Gold Bellis Bellissima Rose Bellis Bellissima Rose Bicolour Bellis Bellissima White Celosia Spiky Pink Coreopsis Sunfire Gomphrena QIS Carmine Lavatera Twins Cool White Nepeta Pink Cat Penstemon Tubular Bells Rose Salvia Patio Deep Blue Salvia Patio Sky Blue Sanvitalia Orange Sprite Scabiosa Pink Diamonds



Aquilegia Clementine Blue Aquilegia Clementine Dark Purple Aquilegia Clementine Rose Aquilegia Clementine Salmon Rose Aquilegia Winky Single Early Sky Blue Aquilegia Winky Double Red-White Aquilegia Winky Double White-White Armeria Ballerina Lilac Coreopsis Sun Up Digitalis Dalmatian Purple Heuchera Malachite Heuchera Melting Fire Iberis Whiteout Lavandula Ellagance Snow Lavandula Mini Blue Penstemon Tubular Bells Red Penstemon Tubular Bells Wine Red With White Throat Penstemon Carillo Purple Penstemon Carillo Rose Rudbeckia Moreno Salvia New Dimension Blue Salvia New Dimension Rose Sanvitalia Vanilla Sprite Silene Starry Dreams

Royal Horticultural Society Award of Garden Merit Aquilegia Songbird Dove



Aquilegia Swan Burgundy and White Aquilegia Swan Yellow

PanAmerican Seed Award Winners

All-America Selections

Angelonia Serenita Pink NEW Basil Dolce Fresca Basil Purple Ruffles Basil Sweet Dani Lemon Dianthus Ideal Select Violet (All-America Classic) NEW Interspecific Dianthus Jolt Pink Diascia Diamonte Coral Rose Dill Fernleaf Eggplant Patio Baby (Regional Award) Lisianthus Forever Blue Marigold Golden Gate Marigold First Lady Ornamental Millet Purple Majesty (Gold Medal Winner) Ornamental Pepper Black Pearl Ornamental Pepper Chilly Chili Osteospermum Akila Daisy White Pepper Cajun Belle Petunia Daddy Orchid Petunia Pirouette Purple NEW Petunia Tidal Wave Red Velour Petunia Tidal Wave Silver Petunia Wave Blue Petunia Wave Lavender Petunia Wave Purple Classic (All-America Classic) Snapdragon Rocket Bronze Snapdragon Rocket Golden Snapdragon Rocket Orchid Snapdragon Rocket Red Snapdragon Rocket Rose Shades Snapdragon Rocket White Vinca Jams 'N Jellies Blackberry Vinca Pacifica XP Burgundy Halo Zinnia Double Zahara Fire Zinnia Zahara Starlight Rose

Alyssum Snow Crystals Celosia Arrabona Red Cosmos Sonata White Marigold Honeycomb Marigold Orange Boy Marigold Orange Jacket Petunia Wave Blue Petunia Wave Lavender Zinnia Zahara Sunburst

Aster Meteor Violet Blue Cosmos Sonata Carmine Cosmos Sonata Pink Cosmos Sonata Pink Blush Cosmos Sonata Mixture Dahlia Figaro Red Shades Dianthus Ideal Select Rose Lobelia Regatta Rose Lobelia Riviera Rose Lobelia Riviera Sky Blue Marigold Orange Gate Petunia Tidal Wave Silver Phlox Ethnie Velvet Red Phlox Promise Peach Phlox Promise Rose Phlox Promise White

Fleuroselect Gold Medal

Nemesia Sundrops Mixture Osteospermum Akila Daisy White NEW Petunia Tidal Wave Red Velour Phlox Grammy Pink & White Viola Sorbet XP Delft Blue Zinnia Double Zahara Fire

Fleuroselect Quality Award

Alyssum Easter Bonnet Violet Dahlia Figaro Orange Shades Dahlia Figaro Violet Shades Dahlia Figaro Yellow Shades Lobelia Regatta Blue Splash Lobelia Riviera Midnight Blue Ornamental Pepper Black Pearl Phlox Ethnie Pastel Mixture Sunflower (Helianthus) Prado Gold Vinca Pacifica XP Burgundy Halo

Fleuroselect Novelty



Royal Horticultural Society Award of Garden Merit

Alvssum Easter Bonnet Lavender Alyssum Easter Bonnet Violet Dianthus Amazon Neon Purple Dianthus Amazon Rose Magic Dianthus Dynasty Orchid Dianthus Ideal Select Rose Dianthus Ideal Select White Fire Dianthus Sweet Coral Dianthus Sweet Scarlet **NEW New Guinea Impatiens** Divine Violet Improved Viola Sorbet XP Yellow Frost



Protection Information

<u>US 7,915,504</u>

Alyssum Clear Crystal® Lavender Shades Alyssum Clear Crystal® Mixture Alyssum Clear Crystal® Purple Shades Alyssum Clear Crystal® White

<u>US 7,982,110</u>

Echinacea 'Cheyenne Spirit' Echinacea PowWow® Wild Berry

<u>US 7,642,436</u>

Fuseables® Petunia Berry Bold Fuseables® Petunia Blueberry Lime Jam Fuseables® Petunia Lime Coral Petunia Debonair Black Cherry Petunia Debonair Lime Green Petunia Sophistica® Antique Shades Petunia Easy Wave® Berry Velour Petunia Easy Wave® Burgundy Velour Petunia Easy Wave® Red Velour Petunia Sophistica® Blackberry Petunia Sophistica® Lime Bicolor Petunia Sophistica® Lime Green Petunia Sophistica® Twilight Petunia Tidal Wave® Red Velour

<u>US 5,986,188</u>

Impatiens Super Elfin® Red Starburst XP Impatiens Super Elfin® Violet Starburst XP

US 7,087,819 AND US 7,393,995

Pepper, Ornamental Chilly Chili Pepper, Ornamental Medusa

US 7,393,995 AND US 7,696,416

Pepper, Ornamental Sangria

U.S. Patents Applied For

Calibrachoa Kabloom Deep Blue Calibrachoa Kabloom White Calibrachoa Kabloom Yellow French Marigold Hot Pak Flame French Marigold Hot Pak Gold French Marigold Hot Pak Harmony French Marigold Hot Pak Orange French Marigold Hot Pak Spry French Marigold Hot Pak Yellow **Tagetes** Fireball Vinca Valiant Apricot Vinca Valiant Burgundy Vinca Valiant Lilac Vinca Valiant Orchid Vinca Valiant Punch Vinca Valiant Pure White

U.S. Plant Variety Protections

Basil Sweet Dani Lemon - 9500027 Celosia Kosmo Vanilla - 200400021 Celosia Kosmo Pink - 200400022 Coleus Kong[®] Red* - 200500015 Coleus Kong[®] Rose* - 200500017 Coleus Kong[®] Salmon Pink - 200900035 Erysimum Citrona® Orange - 200600167 Erysimum Citrona® Yellow - 200600168 Helenium Dakota Gold - 200600009 Lobelia Regatta Lilac Splash - 200600188 Lobelia Riviera Blue Splash - 9400206 Lobelia Riviera Lilac - 9300313 Matthiola Katz Ruby - 201200438 Myosotis Mon Amie Blue - 200800070 Pepper, Ornamental Black Pearl - 200500020 Pepper, Ornamental Medusa - 200000140 Vinca Jams 'N Jellies Blackberry - 201100526 Vinca Mediterranean Dark Red XP - 200900043 Vinca Mediterranean Hot Rose XP - 200900084 Vinca Mediterranean Peach XP - 200900080 Vinca Mediterranean Red XP - 200900081 Vinca Mediterranean Rose XP - 200900082 Vinca Mediterranean Strawberry XP -200900083

Vinca Mediterranean White XP - 200900053 Vinca Mediterranean Lilac - 9800182 Vinca Pacifica Apricot XP - 9800181 Vinca Pacifica Burgundy Halo XP - 200700272 Vinca Pacifica Dark Red XP - 200600189 Vinca Pacifica Magenta Halo XP - 200500216 Vinca Pacifica Punch XP - 9400248 Vinca Pacifica Really Red XP - 200600190 Vinca Pacifica Rose Halo XP - 200500218 Zinnia Zahara® Coral Rose - 200700357 Zinnia Zahara[®] Fire - 201000090 Zinnia Zahara® Scarlet - 200700356 Zinnia Zahara® XL Fire – 201200484 Zinnia Zahara® XL Pink - 201200482 Zinnia Zahara® XL White - 201200485 Zinnia Zahara® XL Yellow - 201200483

* Bred By Sakata Seed Corporation

U.S. Plant Variety Protections Applied For

Zinnia Zahara® Cherry Improved Zinnia Zahara® Raspberry Zinnia Zahara® Red Zinnia Zahara® Yellow Improved Zinnia Zahara® White Zinnia Double Zahara Cherry Improved Zinnia Double Zahara Salmon Rose Zinnia Double Zahara Yellow

European Community Plant Variety Rights

Begonia Dragon Wing[®] Pink - EU 10351 Celosia Bombay Bordeaux - EU 28163 Celosia Bombay Fivio - EU 28164 Celosia Bombay Green - EU 37645 Celosia Spring Green - EU 18737 Celosia Sunday Red - EU 28165 Echinacea PowWow[®] Wild Berry - EU 35233 Heuchera Melting Fire - EU 20557 Lavandula Lavance Purple - EU 17706 Scabiosa Blue Note - EU 27547

European Community Plant Variety Rights Applied For

Calibrachoa Kabloom Deep Blue Calibrachoa Kabloom White Calibrachoa Kabloom Yellow Lavandula Ellagance Pink Saxifraga Rocco Red

Canada Plant Breeders' Rights Applied For

Calibrachoa Kabloom Deep Blue Calibrachoa Kabloom White Calibrachoa Kabloom Yellow

European Utility Patents Applied For

Fuseables® Petunia Berry Bold Fuseables® Petunia Blueberry Lime Jam Fuseables® Petunia Lime Coral Petunia Debonair Black Cherry Petunia Debonair Lime Green Petunia Sophistica® Antique Shades Petunia Easy Wave® Berry Velour Petunia Easy Wave® Berry Velour Petunia Easy Wave® Red Velour Petunia Sophistica® Blackberry Petunia Sophistica® Lime Bicolor Petunia Sophistica® Lime Green Petunia Sophistica® Twilight Petunia Tidal Wave® Red Velour

Grower Facts Index

Anemanthele Sirocco
Angolonia Screnita Scries
Angelonia Serenica Series
Arguitegia Willky Series
Arabis Louis Dellevice Covies
Armeria Ballerina Series
Bacopa Biutopia & Snowtopia
Begonia
BabyWing Series
Dragon Wing Series
Gryphon
Calibrachoa
Crave
Kabloom Series
Campanula
Campana Series
Rapido Series146
Carex Amazon Mist85
Carex Bronco
Carex Phoenix Green
Carex Red Rooster
Celosia
Arrabona Red88
Bombay Series88
First Flame Series88
Ice Cream Series 89
Kosmo Series
Sunday Series90
Coleus
Kong & Kong Jr. Series91
Premium Sun Collection
Coreopsis Early Sunrise,
Rising Sun, Sunfire & Sun Up147
Corynephorus Spiky Blue
Delphinium Dasante Blue
Dianthus Dash Series
Dianthus Jolt Series
Dichondra Silver Falls
Digitalis Dalmatian Series
Echinacea
'Chevenne Spirit' 149
PowWow Series
Euphorbia Glamour
Euphorbia Glitz
Festuca Festina
Fuseables
Bacopa
Coleus
Iuncus
Multi-Species
Petunia
Gaillardia Mesa Series
Gaura Sparkle White
Gerbera Revolution Series
Gomphrena Fireworks
Gypsophila Pixie Splash
Heuchera Melting Fire & Malachite 153
0

Hibiscus
Luna Series154
Mahogany Splendor102
Iberis Whiteout155
Impatiens
Impreza Series103
Divine Series (New Guinea)104
Incarvillea Cheron156
Isotoma Gemini Series105
Juncus Starhead105
Lavander Bandera Purple
Lavander Ellagance Series,
Lavance Purple & Mini Blue157
Leycesteria Jealousy106
Lisianthus Flare Series107
Lobelia
Starship Series158
Vulcan Red
Luzula Lucius & Starmaker
Marigold, French Dwarf
Bonanza Series
Durango Series
Hot Pak Series
Janie Series
Matthiola Hot Cakes Series 109
Millet Ornamental
Iade Princess 110
Jacer Purple Majesty & Purple Baron 111
Osteospermum Akila Series 112
Panev
Cool Wave Series 113
Matrix Spring Matrix Danola YD
Fizzy & Frizzla Sizzla Sarias
Ponstomon
Carillo Series 160
Tubular Balls Sarias
Poptas
Buttarfly Sarias 116
Duttering Series
Coiun Bollo, Cuto Stuff Cold II
Cuto Stuff Pad & Sweet Heat
Plack Doorl Calico & Durple Flach
(Ormamontal) 118
(Undificilial)
(Ormamontal) 110
(Offidillelital)
Debaneir Collection 120
Easy Ways Sories
Easy wave series
La Didar Series
Lo Rider Series
Dretty Grand Series
Shock Ways Series
Sophistica Collection 125
Tidal Wayo Sories
Mayo Sorios Dlug & Linor
Wave Series Flug & Liner
wave Series Growing On to Finish 129

Wave & Tidal Wave Series
Landscape Tips131
Wave Family Supplemental
Lighting Chart123
Wave Medleys132
Plectranthus Silver Crest & Silver Shield 133
Portulaca Happy Hour &
Happy Trails Series134
Primula Primlet Series135
Purslane Toucan Series136
Ruellia Southern Star Series136
Salvia New Dimension Series162
Saxifraga Rocco Red163
SimplySalad Series137
Torenia Kauai Series138
Verbena Quartz Series138
Vinca
Titan Series139
Valiant Series139
Viola Sorbet Series140
Zinnia
Zahara Series140
Zahara XL Series141
Double Zahara Series142

Note: Growers should use the information presented here as a starting point. Crop times will vary depending on the climate, location, time of year and greenhouse environmental conditions. Chemical and PGR recommendations are only guidelines. It is the responsibility of the applicator to read and follow all the current label directions for the specific chemical being used in accordance with all regulations.



Order at ballseed.com/webtrack.

Talk to us. Ball Seed: 800 879-BALL Ball ColorLink®: 800 686-7380

Visit ballseed.com for current Terms & Conditions of Sale.

©2015 Ball Horticultural Company 15187-BSC ♣ Printed in the U.S. on 10% post-consumer recycled paper with soy-based inks. ™ denotes a trademark of and ® denotes a registered trademark of Ball Horticultural Company in the U.S. It may also be registered in other countries.

PanAmerican Seed.

