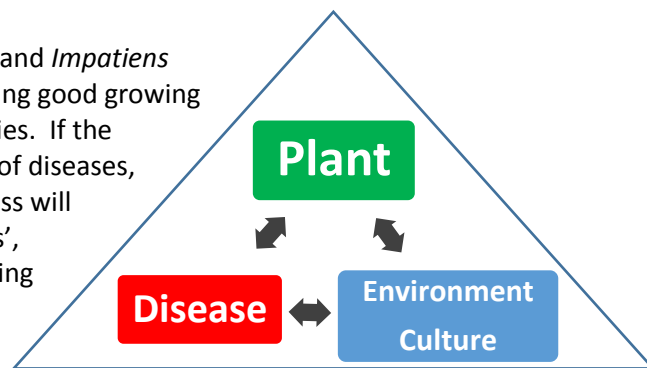


# 'At Risk Crop' Control Strategies

'At Risk Crops' (Pepper, Tomato, 'Bor' kale, *Zinnia elegans*, Basil, and *Impatiens walleriana* are examples) are successfully produced when following good growing practices which use appropriate pest and disease control strategies. If the environment or cultural conditions favor the infection or spread of diseases, then the 'At Risk Crops' can quickly become infected and plant loss will occur. To minimize disease infection and spread in 'At Risk Crops', consider implementing sanitation and best practices when planning the production program.



The disease triangle helps focus the management strategies for 'At Risk Crops.' To prevent a disease outbreak, the goal is to control each leg of the triangle. The better the legs of the triangle are managed, the less likelihood of a disease outbreak.

***Growers are responsible for preventing the spread of pests and disease in their operations.***

## Managing the Disease Triangle:

**Plant.** When producing 'At Risk Crops' it is critical to use seeds that are certified clean or unrooted cuttings or young plants from suppliers who use clean production protocols. Even when using certified seeds and young plants, grown under strict sanitation protocols, disease infection can still occur once planted into their final container. Co-mingling certified and non-certified plants in the same greenhouse put the entire production at risk of infection. Continuous management of the disease triangle, ***throughout the entire production process***, is required to insure clean plants for consumers.

## Disease.

Controlling these diseases takes several strategies since using a single strategy usually isn't successful.

- ❖ **Facility Clean Up.** Make sure that all production areas are thoroughly washed down and treated with a disinfectant. Use water to wash down onto the floor the spores, algae and plant residue from greenhouse walls, screens and benches. Once it is washed down onto the floor, remove debris completely from the greenhouse and thoroughly treat the floor with a chemical disinfectant. Make sure to clean and disinfect all carts and other greenhouse equipment that come into contact with the plants or containers. Growing 'At Risk Crops' on wooden benches, water-saturated ground, or other areas that can harbor the disease is not recommended. Make sure that all containers are new, or disinfected if re-used, to prevent re-infection from other crops. When using transplanting equipment, thoroughly disinfect the equipment (especially the pick-up needles) to prevent spreading disease during transplanting. When dealing with any disease, a small number of spores or microbes can spread rapidly if the conditions are optimum. Remember to eliminate weeds as they can be symptomless carriers and harbor insects or other pests that transmit pathogens. Plant residue can harbor active bacteria for up to 18 months, so cleaning up dead foliage is a critical part of the control strategy.
- ❖ **Scouting.** Start an active disease scouting program that includes rogueing infected plants. When growing 'At Risk Crops' be vigilant! Daily scouting of the plants is critical to prevent explosive spread of the disease. Leaving a couple of sick plants in a tray or production block overnight can result in a larger number of plants infected by the next morning! Carefully remove suspect plants completely from the greenhouse and production areas.

Chemical Disinfectants
✓ Quaternary Ammonia Greenshield, Phyan20, KleenGrow
✓ Bleach 1:10 dilution
✓ Hydrogen dioxide ZeroTol, Oxidate, Sanidate

- ❖ **Chemical Suppression.** Most chemicals are effective at suppressing or preventing infection but once an infection has occurred, it is difficult to eradicate the disease. The chemicals in the table to the right are effective in controlling the various diseases that affect 'Crops at Risk'. Refer to the crop specific production guides for optimum timing and rotations.
- ❖ **Biological Control.** Many growers successfully use biological controls for pest and disease management. However, keep in mind that these should be considered only as preventative strategies. Some growers have experienced inconsistent results due to various cultural and environmental conditions that affect the biological control agents.

Chemical Controls	
<b>Bacterial</b>	Phyton 27/35
Pepper	Camelot/Koicide
Tomato	Mancozeb
'Bor' Kale	Cease
	Triathalon
	Zerotol
<b>Fungal</b>	Subdue Stature
Impatiens walleriana	Segovis Micora
Basil	Segway Adorn
Zinnia elegans	Orvego
	Mancozeb

## Environment & Culture

- ❖ **Environmental Conditions.** When 'At Risk Crops' are grown outdoors, disease infection, and rapid spread of diseases can occur. During periods of high night temperature, frequent rainfall and high relative humidity (>85%), the risk of rapid disease spread is further enhanced - regardless of indoor or outdoor production. During periods when high risk conditions occur, make sure that frequent scouting and appropriate cultural and chemical control strategies are used to detect and reduce outbreaks.
- ❖ **Cultural Conditions.** 'At Risk Crops' are more sensitive to environmental extremes where the diseases can infect and develop rapidly. Review the specific crop production guidelines to determine how to manage the adverse conditions.
  - ➔ **Young plant production.** The challenge is that germination and propagation conditions are also the ideal conditions for infection and spread of most pathogens. Ensure that the plants are protected at the earliest stages. It is critical to begin the disease prevention treatments shortly after the cotyledons unfold or the unrooted cuttings are stuck. Continue the treatments until the plants are transplanted. Refer to the product labels for appropriate treatment intervals.
  - ➔ **Irrigation protocol.** The most common method to spread disease infections is by overhead irrigation (splashing water). Using drip irrigation whenever possible will reduce disease spread. If using overhead irrigation, make sure to have appropriate control strategies in place and frequent scouting to detect potential outbreaks.
  - ➔ **Plant nutrition.** Maintain optimum nutrient levels to prevent plants from becoming stressed due to low nutrition. Avoid excess fertilization as this can promote soft growth that is susceptible to disease infection. If restricting nitrogen to control growth, use a formulation like 0-7-5 to provide ample amounts of other nutrients, especially micronutrients, to ensure the plants remain healthy.
  - ➔ **Temperature and relative humidity (RH).** Normal production temperatures are unfortunately also the optimum range for many pathogens to spread. When high temperatures fluctuate during the course of the day, the relative humidity can increase above 85% where disease infection and spread occur. To minimize high RH conditions, which promote disease spread, use horizontal air flow, dehumidification cycles and other techniques to manage the RH. Irrigate early in the day to allow the foliage to dry is also a good production practice to minimize disease spread.
  - ➔ **Finished production.** As plants mature, they remain susceptible to disease infection if the conditions are suitable. Once the crop canopy closes, the risk of infection increases dramatically since air flow within the canopy is reduced. Continue to manage the pesticide applications, moisture, nutrition and RH to minimize spread of the disease. When applying chemicals or biological controls, make sure to thoroughly treat the undersides of lower leaves to insure good preventative control. As the plants reach shipping stage, reduce the amount of ammonium nitrogen (increase the nitrate) to harden the plants. Continue to scout the older leaves on the plants where many of the diseases get started.