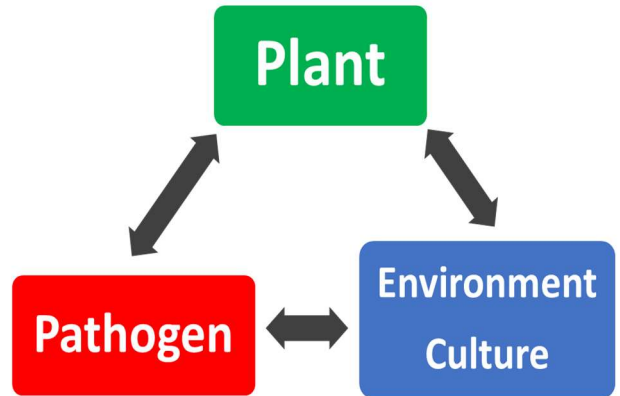


AT RISK CROP' CONTROL STRATEGIES

'At Risk Crops' (i.e. Pepper, Tomato, 'Bor' kale, *Zinnia elegans*, Basil, and *Impatiens walleriana*) are successfully produced when good growing practices using appropriate pest and disease control strategies are followed. If the environment or cultural conditions favor the infection or disease spread, then '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 manage each portion of the triangle. The better the management, the less likelihood of a disease outbreak.



Managing the Disease Triangle:

Host

When producing 'At Risk Crops' it is critical to use seeds that are tested (no pathogen detected) or unrooted cuttings or young plants from suppliers who use clean production protocols. Even when using certified-tested seeds and treated young plants; grown under strict sanitation protocols, disease infection can still occur once planted into their final container. Co-mingling sources (clean & tested versus not) in the same greenhouse will put the entire production at risk of infection. Continuous management of the disease triangle, **throughout the entire production process**, is required to insure crop success.

Pathogen

Controlling these disease takes multiple strategies. Here are a few to consider.

- ❖ **Facility Sanitation-** 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 and surfaces with a disinfectant. Make sure to clean and disinfect all carts and other greenhouse equipment that comes 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

Chemical Disinfectants

- ✓ Quaternary Ammonia
Greenshield, Physan20, KleenGrow
- ✓ Bleach
1:10 dilution
- ✓ Hydrogen dioxide
ZeroTol, Oxidate, Sanidate

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-** An active disease scouting program includes timely inspections and roguing affected plants. When growing 'At Risk Crops' be vigilant! Daily scouting of the plants is critical to prevent rapid spread of the disease. Leaving a sick plant in a tray or production block overnight can result in a large spread by the next morning! Carefully remove suspect plants completely from the greenhouse and production areas.

❖ **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.

Chemical Controls		
Bacterial	Pepper	Phyton 27/35
	Ornamental Pepper	Camelot/Koicide
	Tomato	Mancozeb
	Cabbage	Cease
	Kale	Triathalon
Fungal	Impatiens walleriana	Subdue Stature
	Basil	Segovis Micora
	Coleus	Segway Adorn
	Zinnia elegans	Orvego
		Mancozeb

❖ **Biological Control-** Many growers successfully use biological controls for pest and disease management. Keep in mind that these should be considered as preventative strategies and combined with appropriate sanitation. Inconsistent results due to cultural and environmental conditions that affect the biological control agents must be managed.

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 infection during environmental extremes. Review the specific crop production guidelines to determine how to manage the adverse conditions.

➔ **Young plant production-** Germination and propagation conditions are also ideal conditions for infection and spread of many 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. If using subirrigation, ensure proper water treatments are implemented.

- ➔ **Plant nutrition-** Maintain optimum nutrient levels to prevent plants from becoming stressed due to low or excessive 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 Holding Feed” to provide ample amounts of other nutrients, especially micronutrients, to ensure the plant remain healthy.

- ➔ **Temperature and relative humidity (RH)-** Normal production temperatures are also the optimum range for many pathogens. When temperatures fluctuate, the relative humidity can increase above 85% where disease infection and spread occur more easily. 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 infection if conditions are suitable. Once the crop canopy closes, the risk of infection increases 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 tone the plants. Continue to scout the older leaves on the plants where many of the diseases arise.