



Great Lakes Fruit, Vegetable & Farm Market Expo  
DeVos Place Convention Center  
Grand Rapids, MI  
December 9-11, 2003



## Vegetable Transplant Production

Wednesday morning 10:00 am

**Where:** Grand Gallery Room A (lower level)

**Moderator:** Hannah Stevens, Macomb Co. MSU Extension

10:00 a.m. Vegetable transplant production tips for the new and experienced producer

- Dean Krauskopf, MSU Extension Southeast
- Mary K. Hausbeck, Michigan State University

11:15 a.m. Questions and answers

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# Be on the Alert for Vegetable Seedling Diseases

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Disease prevention and prompt diagnosis are key components in vegetable seedling production because there are few fungicides registered for controlling diseases on these crops (see Table 1).

**Damping-off** (caused by *Pythium* spp. and *Rhizoctonia* sp.) affects all vegetable seedlings and is also common among flowering bedding plants. Damping-off results in collapse of the plant at the soil surface. Terraclor controls *Rhizoctonia* and lists broccoli, brussels sprouts, cabbage, cauliflower, peppers, and tomatoes on its label. Most of the fungicides used on ornamental crops to control damping-off do not include vegetable bedding plants on their label, so preventive disease-controlling measures are critical. Avoid overwatering because some fungi that cause damping-off prefer wet conditions.

Good sanitation is key and ensures that root rot problems from one crop are not carried over to another crop. Root rot pathogens survive in the greenhouse in soil particles or plant parts clinging to containers, benches, walkways, and equipment. If root rot occurs, remove and destroy the diseased plants. Also, remove healthy-appearing plants that are immediately adjacent to the dead plants because the disease may have already spread to them although they are not yet showing symptoms. Plug sheets containing diseased transplants should not be reused.

**Botrytis gray mold** can infect all vegetable transplants causing an irregular brown spotting or “blight” of leaves and stem cankers. This is the same *Botrytis* that infects a wide range of floriculture crops producing gray masses of powdery spores. In vegetable transplants, *Botrytis* is a threat when plants grow and form a canopy of leaves keeping the relative humidity high which favors disease. Since the fungus that causes gray mold depends on water to germinate on the plant surface, increasing air circulation through fans and reducing the relative humidity by venting or heating (depending on outside temperatures) will help prevent condensation of water on plant surfaces and thereby reduce the occurrence of gray mold. Watering early in the day will help ensure that the plants dry by evening, thereby reducing the occurrence of disease.

**Alternaria blight** is caused by a fungus of the same name and causes leaf spotting and a stem canker on tomato and other vegetable transplants in the greenhouse. This disease is not as common as gray mold, but can be destructive when conditions are wet and the foliage thick. Often, *Alternaria* blight does not become a problem until the plants are held in the greenhouse for an extended period of time due to a delay in shipping or selling.

Fungicides are available to control *Botrytis* and *Alternaria* diseases on tomato seedlings and some other vegetable seedlings. On tomatoes, Exotherm Termil will provide protection against *Botrytis* (NOTE: Other forms of chlorothalonil such as Daconil are not registered for use in the greenhouse on vegetable transplants). Although Botran 75-W is registered to control *Botrytis* on tomato seedlings, this fungicide should be used with caution due to concern regarding damage to the plant stem. The fungicide Dithane is also registered for use on tomato and other vegetable seedlings including onions and cucurbits (melons,

pumpkins, etc.). None of the fungicides mentioned above are registered for use on pepper seedlings in the greenhouse. However, not all spotting on the foliage is caused by fungi.

**Bacterial diseases** can infect tomatoes and peppers resulting in blighting. It is important to distinguish between spots caused by fungi and bacteria because disease management differs. On tomato transplants, three bacterial diseases can be problems and include bacterial canker, bacterial speck, and bacterial spot. Peppers are affected by bacterial spot only. Of the bacterial diseases that cause problems on tomatoes, bacterial speck is probably the easiest to identify because of the small, dark-brown spots surrounded by a yellow “halo” that occur on the leaves. Bacterial spot that occurs on tomato and pepper is not as easy to identify as bacterial speck. Bacterial spot results in larger spots or blotches on the leaves and stems than bacterial speck. Symptoms of bacterial canker on tomato transplants include small, tan “blister-like” lesions on the leaves and petioles and progress to form brown streaking and cankering. A diagnosis from an extension agent or other knowledgeable professional is often warranted to separate symptoms of bacterial diseases from symptoms caused by fungi or other causes.

Tomatoes with bacterial diseases should be immediately removed from the greenhouse and destroyed. In addition, tomato seedlings immediately adjacent to those showing symptoms should also be removed and destroyed. In some situations, all tomatoes within a block or greenhouse will have to be destroyed. Although epidemics may seem to appear overnight, chances are it began in just a few plants and progressed unnoticed for a couple of weeks. Plug sheets containing infected transplants should not be reused. Removing infected transplants from the greenhouse is the most critical component of managing bacterial diseases once they’ve been introduced.

Bacteria move readily in a film of water and can spread through splash droplets. It is important, therefore, to water plants early enough in the day to insure that the foliage dries completely by evening. Good ventilation, circulation, and low relative humidity are also important in helping to maintain dry foliage. Clipping, pruning, or any other type of injury provides a means for the bacteria to enter the plant and should be avoided.

Until recently, growers have had to manage bacterial canker as it occurred in the field. Our research team approached this problem by testing fungicide applications to transplants while in the greenhouse. The greenhouse was targeted because the spread and increase of bacteria is favored by the wet, humid conditions of the greenhouse and the close spacing of tomato transplants. Multiplication and spread of the bacterium is less likely in the field because of the lowered relative humidity and increased plant spacing. Also, it is more economical and efficient to spray transplants while in the greenhouse than to spray plants once placed in the field.

We focused on the health of tomato transplants because it has been our observation that establishing a field with transplants that are infected with the bacterium responsible for bacterial canker results in devastating yield losses. Transplants can be infected while in the greenhouse, yet appear healthy at the time of planting in the field.

Applying a copper hydroxide product alone or in combination with a mancozeb fungicide at five-day intervals to transplants in the greenhouse once true leaves had emerged, even when a bacterial canker epidemic occurred, resulted in transplants that produced yields comparable to that of healthy plants. In our studies, these copper applications were not continued once the transplants were planted in the field. For tomatoes, the efficacy of the copper fungicides may be enhanced by mixing them with a mancozeb-based fungicide. Although mancozeb does not have any action against bacteria, the combination of mancozeb + copper is considered by some to provide a synergistic action against these bacteria. This combination would also provide some control of the foliar diseases caused by fungi (such as *Botrytis* and *Alternaria*).

While Agri-mycin alone or in combination with copper hydroxide was also effective in our studies, this product does not list greenhouse on its label. However, current interpretations indicate that this product can be used on seedlings in the greenhouse since the label does not prohibit this use. We have not determined whether a 7-day interval of bactericides affords the same protection as the 5-day application interval that we tested. Continued application of copper hydroxide to transplants once in the field may be helpful in reducing fruit spotting.

**Impatiens necrotic spot virus (INSV)** should be a primary concern of all growers who raise both vegetable transplants and flowering plants. This virus infects a large number of plant species and occurs frequently in bedding impatiens, New Guinea impatiens, dahlia, cineraria, cyclamen, gloxinia, and buttercup. This virus moves from infected flowering plants to healthy vegetable seedlings via western flower thrips. A grower may not know that plants are diseased because expression of symptoms may be slow. Meanwhile, if western flower thrips are present, the disease can be spread throughout the greenhouse. It is advisable, therefore to keep vegetable and ornamental bedding plants separated within the greenhouse.

**Table 1. Products labeled for vegetables in the greenhouse.**

Product	Active ingredient	Company
Botran 75-W	dicloran	Gowan Company
Camelot 58EC	copper salts	Whitmire Micro-Gen
Champ DP, Champ Formula 2F	copper hydroxide	Nufarm Americas, Inc.
Champion WP	copper hydroxide	Nufarm Americas, Inc.
Dithane DF, M-45	mancozeb	Dow AgroSciences LLC
Exotherm Termil	chlorothalonil	Rigo Company
Kocide 2000	copper hydroxide	Griffin LLC
Micro Sulf	sulfur	Nufarm Americas, Inc.
MilStop	potassium bicarbonate	Bioworks, Inc.
Mycostop	<i>Streptomyces griseoviridis</i>	AgBio, Inc.
Nordox 75WG	copper oxide	Monterey Chemical Company
Nu-Cop 50DF	copper hydroxide	Albaugh Inc./Agri Star
PlantShield HC	<i>Trichoderma harzianum</i>	Bioworks, Inc.
Sulfur 90W	sulfur	Drexel Chemical Company
Terraclor 400, Terraclor 75WP, Terraclor Flowable	pentanitrochlorobenzene	Crompton/Uniroyal Chemical
Turfcide 10G	pentanitrochlorobenzene	Crompton/Uniroyal Chemical

NOTE: These recommendations are not intended to replace the specific product labels. Always read and follow label instructions carefully.