Occurrence and Management of Tomato Canker

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ABSTRACT

Bacterial canker recently has been one of the most important disease problems on tomatoes grown in New York. The goals of this project were to determine the sources of bacterial canker in New York and to examine the impact on disease development of management practices used in commercial settings. Canker was not observed in any of the fields, which was very surprising considering the regularity with which this disease has been occurring. Possible explanations include: 1) conditions were not favorable for canker development, 2) seed has been the source and the seed lots the cooperating growers used were pathogen-free, and 3) growers used effective management programs in 2000. However, none of these explanations seems highly likely. Valuable information was gathered during discussions with growers about implementation of recommended management practices for canker. Growers also benefited. Several decided to start using practices they had not been using. In sharp contrast with canker, bacterial spot was widespread in 2000. Infested seed is a possible source of the bacteria causing spot. Additional work is needed to obtain a better picture of the occurrence and manageability of canker and other bacterial diseases of tomatoes in New York and to investigate possible sources of the pathogens. Additional work is warranted because reducing the occurrence of canker and other bacterial diseases of tomatoes would improve grower profitability, decrease use of copper pesticides, and enable growers to resume using TOM-CAST which also can decrease pesticide use. TOM-CAST, a forecasting system for scheduling fungicide applications for early blight, was an important component of the tomato IPM program in New York until canker became important.

BACKGROUND AND JUSTIFICATION

Bacterial canker has become one of the most important disease problems on tomatoes grown in New York. Canker is very difficult to control once it develops. Weekly applications of copper fungicides are recommended. Consequently, when canker occurs, growers no longer use TOM-CAST for scheduling fungicide applications for early blight. The need to spray weekly for canker and other bacterial diseases has also been cited as the primary reason TOM-CAST is not longer being used in New England. Furthermore, weekly copper applications are often not adequately effective for controlling canker. Therefore it is critical to control the source. The goals of this project were to determine the sources of bacterial canker in New York and to examine the impact on disease development of management practices used in commercial settings. The

pathogen could be reintroduced each year in infested seed or it could be surviving in the greenhouse or in fields, in debris or on planting materials such as plug trays or stakes.

METHODS

A list of management practices for growers was prepared. It includes a description of symptoms and procedures on how to treat seed. A checklist was also prepared with practices rated as to whether they can increase or decrease the risk of canker occurring. These materials are included at the end of the report.

Four farms where canker has occurred previously were selected from each region (Long Island, Capital District, Lake Plains). An informal on-farm meeting was held with each grower during the spring. Management practices for canker were discussed to determine what practices were being used. The checklist was used to evaluate each grower's practices.

To determine if the pathogen was present before transplanting, seedlings were examined for symptoms and some plants were collected and sent to Agdia Diagnostic Laboratory. This company tested the plants for tomato bacterial pathogens using an immunological assay.

Production fields were scouted routinely throughout the growing season. Some leaf tissue with symptoms of bacterial spot were photographed and then sent to Agdia Diagnostic Laboratory to confirm that this was spot. Technical problems with this test were discovered during the course of this work, therefore additional samples were sent to a diagnostic laboratory at the University of Florida that does fatty acid analysis for identifying bacteria.

RESULTS AND DISCUSSION

Information was obtained on management practices being used through the on-farm meetings with individual growers during the spring. These meetings also revealed that some growers were not as informed, and thus not as concerned, about bacterial canker and its management as they should be considering the impact it has had. These growers, consequently, have generally not been disinfecting their greenhouses with Greenshield, they have not been treating their seed with hot water or Clorox, and they have not been applying copper fungicides in the greenhouse. Some other growers have been too nervous about potential negative impact on germination to treat their own seed.

New York growers were already using some of the recommended management practices for canker, although not always intentionally to manage canker. Most rotate their land rather than grow tomatoes successively in the same area. Fortunately they rarely clip tomato transplants prior to transplanting. They also rarely brush their transplants for height control. These two practices could spread bacterial pathogens. Copper fungicides are a popular part of the spray program.

In addition, some practices were identified as infeasible. Small-scale growers with one small greenhouse cannot effectively separate their seed lots. Some growers do not have enough land to adequately rotate. Thus they sometimes plant tomatoes in a different section of the same field where tomatoes were the previous year. It would be difficult to get migrant workers to wear plastic gloves and to routinely dip them in disinfectant while pruning, trellising, and harvesting. Educating workers about the need would be too difficult, particularly considering there typically is a language barrier. Growers with only air blast sprayers cannot afford to purchase another sprayer.

Some management changes were made following these meetings. Several growers decided to start disinfecting, or to use a more effective technique for disinfecting, the stakes they use to trellise their tomatoes. For example, one grower pressure-washed his stakes to remove soil and debris, then soaked them for at least 10 minutes in a solution of Greenshield. Previously he had only dipped them in Clorox.

All growers produced their own transplants. None of the sampled plants tested positive for the presence of any bacterial pathogens. This does not confirm that these pathogens were not present in these greenhouses; but if present, they were not widespread.

Symptoms of canker were not seen in any production fields during routine scouting throughout the growing season. This suggests that management programs used in 2000 were effective, conditions were not favorable for disease development, or that seed were not infested in 2000, but perhaps have been an important source in previous years. Weather was wetter and cooler than normal in New York.

In contrast, bacterial spot was widespread in New York and also elsewhere in the US, which has not occurred in recent years. It was confirmed to be spot through fatty acid analysis and hypersensitive tests by a laboratory specializing in bacterial identification at the University of Florida. Infested seed is a possible source of the bacteria causing spot. Due to technical problems with the Agdia test for the bacterium causing spot, this pathogen would not have been detected if it had been present on the seedlings sampled before transplanting. This problem was not realized until negative results for the 3 bacterial pathogens were obtained in tests of symptomatic tissue from the field. Bacterial streaming was observed in leaf sections of this tissue; therefore we knew the symptoms were caused by a bacterial pathogen. Bacterial speck also occurred in the Capital District.

CONCLUSIONS

Although canker was not detected, there were important benefits from this project. Interacting one-on-one with growers was a good educational experience for all. We learned a lot about what was being done, and what could not feasibly be done, to manage canker. Growers learned more about bacterial diseases. Several made changes to their management program.

Some activities are planned for the winter of 2000/01 as a follow up to this project. A page will be prepared for the "Vegetable MD Online" web site on identifying and managing bacterial diseases of tomatoes. Some growers expressed an interest in learning more about what seed companies are doing to test and disinfect seed. This information will be obtained and distributed in a newsletter.

Additional work is needed to obtain a better picture of the occurrence and manageability of canker and other bacterial diseases of tomatoes and to investigate possible sources of the pathogens. The commercial fields examined in this study, and others when the opportunity arises, should be monitored for bacterial diseases in the future. When these diseases occur, information should be obtained from the grower on management practices used and the seed source. Observations on disease development should be made to try to determine factors most affecting spread of the pathogen. For example, if the disease starts in one variety this suggests that seed might have been the source. If the disease starts where old stakes were used, then the pathogen might have survived on the stakes. If the disease starts in the section of a field nearest the section where canker occurred previously, then the rotation may have been inadequate. If

disease appears to progress down rows following the movement of workers, then sanitation during these activities is probably important.

Additional work is warranted because reducing the occurrence of canker and other bacterial diseases of tomatoes would improve grower profitability, decrease pesticide use, and enable growers to resume using TOM-CAST which also can decrease pesticide use.

Checklist on Managing Tomato Bacterial Canker

Practice	Risk of Bacterial Canker* Low	Moderate	High
In the Greenhouse:			
Clean and disinfect greenhouse with Greenshield.	Y		N
Treat seed with hot water or Clorox.	Y		N
Keep seed lots separate.	Y	N	
Inspect plants routinely; remove infected plants.	Y	N	
Avoid handling plants, especially when wet.	Y	N	
If plants are brushed, do only when they are dry.	Y	N	
Disinfect brushing tool between benches.	Y	N	
Do not clip transplants.	Y	N	
Minimize injury to plants.	Y	N	
Apply copper fungicides.	Y	N	
In the Field:			
Select a field where tomato, potato, eggplant or pepper have not been grown for at least 3 years.	Y		N
Use new or disinfected stakes if no disease previously.	Y		N
Control solanaceous weeds in crop.	Y	N	
Use conventional boom, not high pressure air blast, sprayer.	Y	N	
Inspect plants routinely; remove diseased plants.	Y	N	
Work only when plants are dry.	Y	N	
Wear gloves when handling plants.	Y	N	
Disinfect gloves + tools routinely.	Y	N	
Apply copper fungicides	Y	N	
Plow immediately after harvest. Clean tractor + plow.	Y	N	
Discard stakes if canker occurred.	Y	N	
Control solanaceous weeds and volunteer crop plants during subsequent years.	Y		N

*Y=Yes practice used; N= Practice not used.

Managing Bacterial Canker in Tomatoes

In the Greenhouse:

Clean and disinfect greenhouse. First remove debris; next thoroughly wash trays, benches, floors, and equipment with soap and water; then disinfect by applying a quaternary ammonium product.

Select certified disease-free seed or transplants from a reputable company.

Treat seed with hot water or Clorox (see details below). Starting with clean seed is the most important step as seed is thought to be the primary source and only 1 infected seed in 10,000 is sufficient to lead to a major outbreak.

Disinfect tools and equipment (see details below).

Copper hydroxide applied weekly to seedlings for bacterial spot or speck may also suppress canker; however, canker is not specified on the label.

Inspect plants routinely; remove infected plants and several healthy-appearing neighbors.

Avoid handling plants, especially when wet.

Do not brush plants when wet. Disinfect brushing tool between benches.

Do not clip over-sized transplants.

Minimize injury to plants. Pruning and other injuries provide means for bacteria to enter plant.

In the Field:

Select a field where tomato, potato, eggplant or pepper have not been grown for at least 3 years.

Use new or disinfected stakes. Do not re-use stakes if canker occurred previously.

Control solanaceous weeds.

Apply copper hydroxide fungicide plus mancozeb on a 7-day interval beginning shortly after transplanting. Apply at least three times or until the first harvest. Treatment must be started before symptoms are seen to be effective. Agitating the spray solution in the tank for 90 minutes before spraying will increase the concentration of copper in the solution. Also, there is more available copper in spray solutions with newer formulations of Kocide compared to older ones (e.g. Kocide 2000 versus Kocide 101).

Do not use high pressure air blast sprayer.

Inspect plants routinely; remove diseased plants and several healthy-appearing neighbors.

Do not work when plants are wet.

Wear gloves when handling plants; disinfect gloves and tools routinely. Bacteria are easily disseminated during pruning, tying, staking, and harvesting.

Plow immediately after harvest. Clean tractor + plow afterwards. Discard stakes if canker occurred.

Control solanaceous weeds and volunteer solanaceous crop plants during subsequent years.

Disinfectants:

10-15% chlorine bleach

quaternary ammonium (Greenshield, Physan)

hydrogen peroxide (ZeroTol)

Seed Treatment:

One of the most important practices is to use treated seed. Seed can be treated with hot water or Clorox® Regular Bleach, which has been labeled for tomato seed treatment (EPA Reg. No 5813-1). There is less chance of seed being damaged with Clorox; however, chemical controls such as Clorox are effective only for pathogens on the seed surface; only hot-water treatment can kill bacteria inside as well as on the outside of seed. Some seed companies routinely use Clorox treatment, which may be described as 'calcium hypochlorite' on the label. To Clorox treat seed: mix 1 quart Clorox with 4 quarts water plus 1/2 teaspoon of surfactant (any spreader sticker used for fungicide application or dishwashing detergent), put up to 1 pound of seed in a cheesecloth bag, dip seed up and down vigorously for 1-2 minute, rinse seed under running tap water for 5 minutes, then dry seed thoroughly on paper towel in a location free of mice. Prepare a fresh batch of Clorox for each 1-pound batch of seed. Hot-water treatment can adversely affect germination if proper precautions are not taken, therefore it is best to have seed custom treated, which some seed companies will do. Hot-water treatment can be done successfully using a large pot on a stove top and a precision laboratory thermometer. Put seed in a cheesecloth bag; treat at 122 F for 25 minutes with constant agitation; cool under running tap water; then dry. Either treatment should be done within a few weeks of planting. Afterwards dust seed with 1 teaspoon Thiram 75W per pound of seed. If you treat the seed yourself, the seed company's liability and guarantees are null and void.

Symptoms:

Dark brown to black, irregularly-shaped spots develop on leaves, petioles, stems and fruit when the pathogen invades a plant through its surface. Spots on fruit become raised and turn white often with a dark center. The pathogen can also invade a plant systemically. Early symptoms of systemic infection include wilting (often on 1 side of a leaf or plant), curling of leaflets, browning of leaves (often only on 1 side), and yellowish brown discoloration of vascular tissue inside the stem. Leaf edges become brown with a yellow inner border. Open cankers develop on stems. Unfortunately symptoms may not develop shortly after infection occurs. It is possible for plants to be infected yet appear healthy until exposed to specific stresses and/or environmental conditions in the field (it is not known what these are). Symptoms may not be seen until plants begin to blossom, which could be as long as 84 days after infection.