



Controlling Curly Top Virus of Tomato

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Introduction

Beet Curly Top Virus (BCTV) is responsible for the disease known as “Curly Top of Tomato.” This virus can infect a wide range of host plants and usually occurs in semiarid areas in western North America, including New Mexico, Utah, California, Washington, and Oregon (Damicone & Grantham, 2003). Beet Leaf Hopper (BLH) transmits the disease to a wide variety of plants, including more than 300 species of dicotyledons (broad-leaf plants).

Monocotyledonous hosts (typically grasses) have not been reported nor have there been reports of the disease being transmitted in seed. Crop plants affected by this virus include beets, tomatoes, Swiss chard, spinach, beans and cucurbits such as watermelon, cucumbers and squash. The disease is not a serious problem in processing (determinate) tomatoes, but can cause extensive damage in staked (indeterminate) tomatoes, which are more widely spaced. BLH vectors, or moves, the virus from infected to healthy plants and has been causing damage to crops in the West since the early 1900s. Rangeland host plants include both native and non-native species. The most frequently cited hosts are Kochia and other plants in the Chenopodiaceae family, including Lambsquarter, Halogeton, Russian thistle (Tumbleweed) Greasewood, and Atriplex (Four Wing Saltbush).

Infection

After the BLH initially ingests plant cell sap containing the virus, incubation takes 4 to 21 hours

before it can be transmitted. Once incubated, the BLH transmits the virus to other plants during feeding. The BLHs have a piercing-sucking feeding habit, and they inject and leave behind virus particles inside the plant. BLHs carrying the virus need only to feed for 1 minute on an uninfected plant to transmit the virus. The disease is transported within the plant through the phloem tissue. Symptoms usually begin to appear after 24 hours in hot temperatures and progress more slowly in cooler temperatures (Schalau, 2012). BLHs that have acquired BCTV can transmit the virus for the remainder of their life; however, the number of plants infected decreases when the insects are not continually or frequently feeding on infected plants.



The tomato plant on the right is infected with Curly Top.

Symptoms

When a susceptible plant becomes infected, leaves become puckered and stunted. Tomato leaves curl

and roll upward and the main leaf petiole curves downward. In time, the leaves also become leathery, veins turn a purplish color and the interveinal leaf area turns yellowish. Infected plants will not recover and eventually the plant stops growing and dies. Infected tomatoes may ripen even when immature; however, edible size fruits are likely to be bitter (Heflebower, Reid, Frank, & Evans, 2008). Once definite symptoms are observed, it is best to pull out the plant and destroy it.



The diseased plant in the center shows premature fruit drop.

Control Options

Control of CTV is best achieved through an integrated approach. Infection of new plants each year is dependent on the migration of BLH from infected weeds to healthy plants. Removal of host plants from adjacent fields should help but may not be practical. Consider one or more of the following methods when trying to control CTV (Rudig, 2009).

Insecticides

Spraying insecticides on tomato plants is not an effective leafhopper control strategy. In fact, leafhoppers do not prefer tomatoes as a food source. They inadvertently land on the plant, feed, and then move on. Most references indicate that once a plant has been infected there is no secondary spread. However, this is hard to document. There is usually some time (several days) between infection and when the plant actually dies. This may allow time for spread from a newly infected plant to a healthy plant. If this is the case it is important to remove the infected plant as soon as it shows symptoms. Growers who reported some control from

insecticides were applying sprays weekly throughout the season.

Resistance

From 2007 to 2011 four Curly Top Virus (CTV) resistant tomato varieties, Roza, Rowpac, Columbia, and Saladmaster, were grown in Arizona and Utah (Heflebower, Reid, & Winward, 2012). We could detect no more level of resistance (at least to the virus strains in our natural population) in these tomatoes than to other popular varieties. Most of the gardeners and growers concluded that these tomato varieties were rather small and lacked flavor and consequently went back to their favorite non-CTV resistant varieties. There are no CTV resistant tomato varieties currently available.

Double Planting

The idea of double planting simply means planting transplants at closer than normal spacing so that if some are killed by the CTV the remaining plants will fill the available space. This idea works well with processing tomatoes where the size and quality of individual fruits is not critical. It is not practical for staked tomato production intended for fresh market. Larger spacing of plants is necessary for higher fruit quality.

Shade

Shading is another possible management practice. Some observations have shown that plants grown in the shade do not contract the virus. This may be due to the insect's preference to feed in areas where sunlight is abundant. Shade cloth placed over tomato plants may help prevent infection. If shade is being considered as a control see "covers" in the next section.



Use row covers on young plants to prevent leaf hopper feeding.

Covers

Exclusion is accomplished when BLH feeding is prevented using some type of closure. The most practical closure is a “row cover” made of a synthetic material such as “Reemay” (a very fine random mesh netting). The most critical time to have the plants covered would be early to mid-season. The row cover is fairly inexpensive and should be placed over top of the plant row with the ends and sides buried in the soil. This should be effective until tomato vines become so large they can no longer be contained inside the cover. At this stage of development, plants can still be infected; however, they will likely have the ability to provide a suitable yield of tomatoes. BLH feeding pressure seems to be higher in the early part of the growing season. In most years covers may exclude feeding until BLH pressure has lessened. It should be noted in windy areas it can be difficult to keep plants protected by these covers.

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