

# VEGETABLE CROPS HOTLINE

A newsletter for commercial vegetable growers prepared by the Purdue University Cooperative Extension Service

Liz Maynard, Editor  
600 Vale Park Road  
Valparaiso, IN 46383  
(219) 531-4200  
emaynard@purdue.edu



[vegcropshotline.org](http://vegcropshotline.org)

No. 597  
May 14, 2015

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**FUSARIUM CROWN AND ROOT ROT OF TOMATO -** (Dan Egel, [egel@purdue.edu](mailto:egel@purdue.edu), 812-886-0198) - Symptoms of this disease include tomato plants with lower leaves that become yellow (chlorotic) and die; plants that begin to wilt; a lesion on the lower stem at ground level (see Figures 1 and 2). If tomato plants are removed from the soil and carefully split open from the ground level, a discoloration of the vascular tissue can be observed (see Figure 3). It is important to note that this discoloration does not extend up the stem more than 6 to 8 inches. If the discoloration extends up into the plant canopy, the disease may be Fusarium wilt of tomato. Although growers may observe multiple plants begin to die of this disease over a period of days or even weeks, the fungus does not splash from plant to plant. Therefore, there should be no plant-to-plant spread in the high tunnel.



Figure 1. The tomato plants shown here are stunted, wilted and the lower leaves are dying due to Fusarium crown and root rot. (Photo by Dan Egel)



Figure 2. The lesion at the base of the stem is typical of Fusarium crown and root rot of tomato. (Photo by Dan Egel)



Figure 3. Vascular tissues are discolored in this tomato stem as a result of Fusarium crown and root rot. Note that discoloration only goes a few inches up the stem. Tomatoes with Fusarium wilt have a similar discoloration that goes up into the canopy of the plant. (Photo by Dan Egel)

Temperatures from 68 to 72°F favor Fusarium crown rot and may explain why I observed this disease last week when the weather was relatively cool. I often observe Fusarium crown rot in high tunnel or greenhouse situations where the tomato plants are grown in the ground. This is because the causal fungus, *Fusarium oxysporum* f.sp. *radicis-lycopersici*, survives very well in the soil in the absence of the host.

Crop rotations that do not include tomatoes or other solanaceous crops will help to lower the amount of fungal spores in the soil. However, since the causal fungus survives for years without a host, crop rotation is not a complete solution. I also realize that many growers who produce tomatoes in high tunnels do not feel it is economically practical to rotate to another crop. To such growers, I would point to this article about how to minimize diseases in high tunnels, <https://ag.purdue.edu/arp/swpap/Documents/VEGETABLE%20DISEASES%20IN%20GREENHOUSES.pdf>

Growers who plant tomatoes in bags or pots in a high tunnel instead of in the soil should avoid Fusarium crown rot since the fungus survives in the soil.

Check with your seed representative or seed catalog for tomato varieties with resistance to Fusarium crown rot. Most tomato varieties with resistance to Fusarium crown rot are indeterminate. (In contrast, there are many varieties with host resistance to Fusarium wilt.) It is possible to graft your favorite tomato variety as a scion onto a rootstock variety with resistance. This table, <http://www.vegetablegrafting.org/tomato-rootstock-table/>, will help one select tomato rootstocks with resistance to Fusarium crown rot and other diseases. Some tomato seed companies will sell grafted tomatoes.

There are no fungicides to control Fusarium crown rot. Most fungicides are for foliar use; I know of no fungicides that may be sprayed on the top of the soil. Read the label carefully and contact me if you have questions.

This article was original published on the **VeggieDiseases** blog on 4-29-15.



**SUCCESSFUL TRANSPLANT ESTABLISHMENT** - (Liz Maynard, [emaynard@purdue.edu](mailto:emaynard@purdue.edu), 219-531-4200) - Getting seedlings from the transplant tray into the field is essential for a good crop (see Figure 4). Healthy trans-



Figure 4. Waterwheel transplanters are commonly used for vegetables on plastic-covered beds. (Photo by K. Freeman)

plants treated well will quickly establish themselves in the field, setting the foundation for a productive crop. Here I offer some suggestions for successful transplant establishment.

Harden transplants by exposing them to higher light, cooler temperature, and slightly drier conditions than during transplant production (see Figures 5 and 6). One goal of hardening is to slow growth of the seedlings and increase their stored energy. A second aim is to acclimate the plants to the field environment. A properly hardened plant will recover from the stresses of transplanting more quickly and begin to grow sooner than a plant that has not been hardened. Seedlings are commonly hardened by putting them outside in a partially shaded and protected location, often on a wagon so they can be moved indoors if low temperatures or high winds threaten, and moved to full sun after a few days.



Figures 5 & 6. Seedlings hardening off on benches under a wood frame structure suitable for a small operation. Lattice sides and shade cloth can be added to the structure shown in Figure 5 to create a more protected environment if needed. (Photos by E. Maynard)

Water seedlings well before taking them to the field, and be prepared to water them in the field if they dry out before transplanting.

Make sure there is moisture under plastic mulch if it is used. Apply plastic mulch over soil that is moist. If mulch is applied over dry soil, it is difficult to fully wet the future root zone of the crop. If soil is dry, run drip irrigation before transplanting.

If plastic mulch is used, apply so it fits tightly over a firm and level bed. According to M. Orzolek, vegetable specialist retired from Penn State, this will reduce problems of hot air collecting under the plastic and coming out through the transplant hole where it can injure stems. A tight fit will also reduce the chance of wind lifting up the plastic and covering seedlings.

Set transplanting equipment to proper depth. Seedlings should be planted at least a little deeper than the



root ball, and some species benefit from even deeper planting. For instance, research in Florida showed that tomatoes transplanted to the first true leaf produced more early yield and larger fruit in four of seven trials than when transplanted just deep enough to cover to the root ball (see Figure 7).



Figure 7. This tomato seedling will grow just fine, but it could have been planted deeper. (Photo by E. Maynard)

Assure good coverage of the root ball. If a portion of the seedling root ball remains uncovered, it will dry out quickly and wick moisture away from the roots.

Protect seedlings from hot plastic mulch. Black plastic mulch can get hot enough to damage tender seedling stems or leaves. Make adjustments so that plants are not lying on mulch and stems are not rubbing against edge of the hole in the plastic (see Figure 8).



Figure 8. The desiccated and/or broken stems and leaves on these cantaloupe seedlings could have resulted from contact with hot plastic mulch and/or wind. (Photo by E. Maynard)

Apply water to seedlings after transplanting, and consider including starter fertilizer. Water applied at transplanting helps to settle soil around the root ball and provides roots readily-available water. A starter fertilizer in the transplant solution assures nutrients are available in the root zone of the young plant; this is more important if soil is cool. If using a starter fertilizer, take care

to mix it at the rate recommended for transplants and make sure the fertilizer is completely dissolved and well mixed in the tank. High concentrations of fertilizer can injure and kill transplants (see Figure 9).



Figure 9. The tan/brown leaf edges on this tomato seedling suggest burn from high salt levels in the soil, possibly caused by starter solution applied at a concentration that was too high. (Photo by E. Maynard)

Protect transplants from wind. Wind can desiccate small seedlings as well as cause physical injury. Strips of cover crops left standing are commonly used as windbreaks in some areas. Temporary fencing can also work as a windbreak. It is also possible to seed strips of a fast growing crop such as oats and kill it with a grass herbicide once the wind protection is no longer needed.

Check transplants in a few days. Depending on conditions it may take a little while for them to root in and start growing. If establishment is uneven or seems to be too slow, try to determine what the problem is so it can be remedied soon, if possible, and avoided in the future. For example, in Figure 10, the tomato on the left in the top image appears more wilted and with smaller leaves that are not as green as the tomato on the right, suggesting that it has not established well. In the bottom image, root balls of tomatoes similar to those in the top photo are shown. On the right, new white root tips are visible coming out of the root ball, and new root growth is holding soil together. In contrast, the root ball on the left has no new roots; the only visible new root growth is coming from the stem above the root ball. Close examination reveals that the stem of that plant appears constricted just above and below those roots. It is possible that this is the result of a disease like *Rhizoctonia*, and that could be the reason for poor establishment. To confirm that suspicion, a sample of plants could be sent to the Purdue Plant and Pest Diagnostic Lab. In addition to diseases, physical, and physiological problems, be on the lookout for insect problems like maggots or cutworms that have been mentioned in previous issues of this newsletter (see Figure 11).



Figure 10. In the top image, the tomato on the left appears more wilted and with smaller leaves that are not as green as the tomato on the right, suggesting that it has not established well. In the bottom image, root balls of similar tomatoes are shown, showing more root growth on the right. (Photo by E. Maynard)



Figure 11. A cutworm has chewed leaves off the pepper seedling on the left; some cutworms chew through the stem close to the soil. To find cutworms it is often necessary to dig in the soil near the plant. On the right, seed corn maggots are visible once the stem of a dying cantaloupe seedling is sliced open. (Photos by E. Maynard)

If applicable, let pesticide applicators in the area know the crop has been transplanted so they can take necessary precautions.

Reference: Vavrina, C.S. et al. 1996. Transplant Depth Influences Tomato Yield and Maturity. HortScience 31(2):190-192. 1996.



**PARTICIPANTS NEEDED FOR COVER CROP INTERVIEWS** - Do you use cover crops in your vegetable operation? Dr. James Farmer, Assistant Professor at Indiana University, is looking for farmers who use cover crops to participate in interviews about the use of cover crops, education/training in using cover crops, and the outcomes of cover crop usage. The interviews will be either in person or over the telephone and should last about 20-30 minutes. A \$25 visa gift card will be provided to interviewees. If you would like to be considered for an interview, please contact Dr. Farmer at 812-856-0969 or [jafarmer@indiana.edu](mailto:jafarmer@indiana.edu).



**UPCOMING EVENTS - MANAGING EMPLOYEES AND GAPs A TO Z**

**Effective Management of Farm Employees - Webinar.** Thursday, May 28, 2015. 12:00 P.M. - 1:00 P.M. EDT. Register at <http://goo.gl/NvQ1eL>. This webinar will be facilitated by Phil Durst and Stan Moore from Michigan State University. These Extension Senior Extension Educators will discuss the impact of personnel management on the engagement of employees based on phone interviews with dairy farm employees. Topics include training, communicating performance standards, encouraging mental involvement, and feedback. They will also address issues related to employing Latino labor. The webinar will be recorded. Sponsored by Purdue Women in Agriculture. For more information contact Amanda Veenhuizen, [aveenhuizen@purdue.edu](mailto:aveenhuizen@purdue.edu), 765-825-8502.

**Good Agricultural Practices A to Z Workshop - Marion County.** Wednesday, May 27, 2015. 9:00 A.M. - 4:00 P.M. EDT. Indiana Farm Bureau Building, 225 S. East Street, Indianapolis. Register at <https://tinyurl.com/RegistrarGAPsAtoZ>. This GAPs A to Z workshop will cover the basics of good agricultural practices for fruit and vegetable growers. Participants will receive a certificate of attendance for attending the program. For more information, contact Christina Ferroli at the Marion County Extension Office, 317-275-9305.



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