

## Control of Soilborne Plant Diseases of Vegetables in Transplant Production Systems, Plant Protection Pointer NO. 25 <sup>1</sup>

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Transplants are often an ideal method for establishing production fields of vegetables. However, during the production of transplants, certain soilborne plant diseases can occur. **Healthy transplants can be produced by using a thorough disease control program. Such a program begins prior to the actual production period and does not end until the plants are set in the field and the transplant production area is made devoid of residual sources of inocula that can cause disease in the future.**

Often the term "soilborne disease" relates to a disease that affect roots (root rot), lower stems (stem rot), or other plant parts in contact with the soil (tubers, bulbs, fruits, etc). The most common fungi that cause such soilborne diseases on transplants are *Fusarium* spp., *Pythium* spp., and *Rhizoctonia* spp. Some fungi and bacteria that cause disease on other plant parts (leaves, flowers, fruits, etc.) may be considered to be soilborne as they may have originated in the soil on undecomposed plant material from previous plant growth (weeds or crops). **Thus a**

**thorough disease control program for root and stem rot diseases will also assist in control of certain other types of plant diseases .**

An accurate diagnosis of any plant problem is prerequisite for solving the problem. The problem at hand may or may not be related to a biotic cause; certain chemicals or production practices may cause symptoms similar to those caused by fungi, bacteria or viruses. Laboratory tests should be considered a must for diseases on transplants, particularly those diseases where infection of roots and lower stems is suspected. Identification of the fungi associated with root and stem rots without laboratory tests can be misleading. Accurate identification is necessary if a salvage chemical treatment is to be used. Some of the fungicides on the market are effective against *Pythium* spp. and not *Fusarium* spp. and vice versa. Also, obvious symptoms of one disease do not preclude the possibility of other diseases being present simultaneously. For example, it is common for young plants to be infected with *Rhizoctonia* spp, as sometimes indicated by sunken, red-orange-brown

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lesions on stems, and at the same time have a not so obvious root rot caused by *Pythium* spp. For a fee, the Florida Department of Agriculture will provide an inspection service for establishing "apparently disease-free plants" which would allow for certification status.

### Control of Soilborne Plant Disease On Plants Grown In Ground Level Beds

1. Rotate site of the transplant bed after each transplant crop. Avoid using sites that are near vegetable plantings of the same or closely related crops. Also, avoid a site that was near vegetable production fields within the last few years.

**Isolate transplant production systems to the extent possible .**

2. Choose a site that has adequate exposure to sunlight and good water drainage away from the site.
3. Bottom plow the site early enough so that plant material from weeds or previous crops are well decomposed prior to soil fumigation.
4. Repeated discing or harrowing of the site to destroy new weeds and to condition the soil for fumigation may be necessary after plowing.
5. Continually mow or control weeds and grass around the site. Try to encourage grass (e.g. bahia) to grow around transplant beds; this will reduce weeds in the vicinity. Some weeds can harbor plant diseases but exact relationships in this regard are not always established. Certainly, volunteers and suckers of the same or related crops should be considered weeds in this situation and they should be destroyed.
6. Consider the use of a broad spectrum soil fumigant as it can reduce populations of fungi, nematodes and insects in the soil at the time of fumigation. Liquid products such as Vorlex, Vapam, and Fume V can be injected into the soil through tubes attached to injector-type chisels spaced according to directions on the label. Following injection, the soil surface must be immediately resealed and packed to prevent the vapor phase of the fumigant from escaping too

rapidly. Tarping the treated soil area for seven days will enhance the sealing process and possibly allow for lower rates to be used. After the seven day period, whether sealed with the tarp or not, allow for an additional 1-3 week waiting period before planting. Soil temperature, soil type and soil tilth influence the overall effectiveness and waiting periods for these products. Clay soils or soils with high organic matter content coupled with low soil temperatures and high soil moisture will require higher rates and longer waiting periods than sandy or well tilled soils that are above 60° C and with ideal soil moisture content. Labels of these products provide the necessary specific information for wise use of these products.

- Broad spectrum fumigants, such as Brom-O-Gas, Asgow MB, Asgrow MCB, and Terr-O-Gas, are liquids under pressure in their containers but quickly turn to gas upon release during application and therefore, **the use of a plastic tarp immediately after application and subsequent periods of time is required for gaseous fumigants** . See the labels of these products for specifics on application techniques and safety precautions. Labels of such products will also indicate ratios or percentages of methyl bromide or chloropicrin within the formulation (e.g. Terr-O-Gas 33, Asgrow MB 68). Because of the innate toxicity of these products, they should not be used by individuals who have not been properly instructed. Injection of these products from gas cylinders will require separate nitrogen tanks, strategically connected to the injection system, for aiding in pushing the fumigant through the lines and into the soil via tubes attached to injection chisels.
- One to one and half pound cans of these pressurized fumigants are available when small areas are to be fumigated, but the area **must be presealed with a plastic tarp prior to release of product from the container**. Two methods are generally available for this type of use pattern. One method is to place a collection container and the fumigant can

under the plastic prior to sealing the plastic ends with soil. The top end of the pressurized can is gently placed on a puncturing device such as a broad shanked nail that is firmly secured to the base of the container which is slightly wider than the fumigant can. The nail can be made secure by piercing a thin flat piece of wood that is sized to fit firmly within the base of the collection container prior to placing the fumigant can within the collection container. The container should be about 2 inches shorter than the fumigant can and no more than twice the width of the fumigant can; old coffee cans are ideal for the 1 or 1 1/2 pound fumigant cans as they will collect the liquid and provide for a method of vertical support for the fumigant can. Simplex applicators with a puncturing device and support structures for the fumigant can are commercially available for this purpose and can be used with either 1 or 1 1/2 pound cans. The collection container with the fumigant can must be secured from slippage by ridging and packing soil around the base of the collection container. Only after all the above procedures are properly done, including the sealing of the ends of the plastic with soil and covering hole in the plastic, should the cans be pressed down on the nail-like object. The plastic tarp must be loose enough to walk on to press the fumigant can onto the nail and yet raised above the soil slightly to allow for fumigant gases to dissipate over the area to be treated.

- Commercially available Starr Applicators can be used to release the pressurized liquid from the 1 or 1 1/2 pound cans into a collection container. With this method, the Starr Applicator grips the base of the fumigant can (like an oil filter wrench) and when squeezed, gasket-seals the puncture in the fumigant can. The liquid and resulting gases flow through a tube that was previously secured under the plastic tarp and directed into a shallow pan-like collection container. Prior to securing the edges of the

plastic tarp with soil, the end of the tube in the collection container must be made secure prior to assure deposit of the chemical into the collection container.

**When squeezing the puncturing device, wear gloves, a long sleeved shirt, full length pants, shoes with socks or high topped-boots, and a clear plastic face shield to avoid direct contact of the liquid fumigant should the puncturing procedure malfunction.**

- Remember, cold, wet, poorly tilled, and heavy soils restrict vapor movement of all fumigants which is likely to result in less than desirable effectiveness of the chemical. Also, use a nitrate fertilizer as a nitrogen source after fumigation because microbes in the soil that are involved with the conversion of nitrogen sources to the nitrate form will be temporarily reduced by soil fumigation.
7. Avoid recontamination of fumigated soil by preventing introduction of external soil while and after the plastic is removed. This can be accomplished by shaking off as much soil as possible from the edge of the plastic before removing it, by not walking on the fumigated soil, by not using tools in the fumigated soil unless they have been washed free of soil, by raising the plant bed in relation to surrounding areas before fumigation to allow for water drainage away from the fumigated soil so that unfumigated soil will not wash in from external areas, etc. **Recontamination of fumigated soil may result in more disease than if the soil was not fumigated at all.**

## **Control of Soilborne Plant Diseases On Plants Grown In Containerized-Plant Production Systems**

1. It is best not to establish a plant production system (greenhouse, slathouse, etc) adjacent to production fields, particularly those where the same or related crops are to be grown.

2. Vegetation around the production area should be mostly grass (e.g. bahia grass). It should be well maintained to minimize the development of weeds of any kind.
3. Access ways into the production area should be made of concrete or a material that can be easily washed. Placement of "boot baths" that contain a sanitizing solution at the point of entry can minimize movement of external soil into the production area.
4. During the time of plant production, containers should be placed on raised benches or support devices, not on the ground soil. If a container makes contact with the soil, remove it from the production area until it has been sanitized.
5. Benches, support structures for benches and other surfaces that collect soil and debris should be sanitized from time to time. This operation should be done when the area is devoid of plant production.
6. The ground-level soil should be devoid of growing plants (weeds, crop plants, etc.)
7. Should a plant be removed from the container, for whatever reason, discard the plant by removing it from the premises and disposing of it away from the production area. This practice should be done for any weeds or other plants growing in the ground-level soil within the production area. Never replace a plant into the container that has been dropped on the floor or ground-level soil.
8. Store all soil amendent for the growing medium on a clean surface such as concrete, plastic, etc, not on soil. This area should not receive water wash from surrounding soil. Likewise, the same principle of sanitation should be used for all tools used in the plant projection system, including water hoses.
9. Use pasteurized or sterilized soil media or a soil medium that is likely to be free of plant parasitic organisms. Pasteurized soil can be achieved by heating it to 180°F for 30 minutes. This temperature must be achieved throughout the volume of soil, not just some areas. Lower temperatures might suffice, but the use of 180°F offers a safety margin. Fumigation of soil can be done with methyl bromide (e.g. Brom-O-Gas) at 1#/cu yd of soil within a plastic wrap. Do not use methyl bromide without such a plastic wrap. The soil temperature should be 60°F or above for such fumigation and the soil should be placed loosely within a plastic wrap, not in a compact manner. Collection containers within the plastic wrap must be spaced to provide for even distribution of the vapors. See the label of this product for proper technique. Allow for a 1-2 day fumigation period plus a 1-3 day aeration period.
10. Use certified seed, if available. Find out what seed sources are least likely to result in disease problems.
11. When conducting tests with new or different seed lots:, plant them away from the major production area.
12. Separate planting of different seed lots so that if a problem develops in one lot, it is less likely to spread to other seed lots.
13. Seed should be treated with a labeled, seed treatment fungicide.
14. Containers used for transplant production should be free of soil and organic plant debris from previous usage. The containers should be thoroughly pressure washed (e.g. water stream from hose) prior to sanitizing them. Do not wash the containers near any area involved with planting, production of plants, or storage of equipment or soil media used for plant production. Personnel who wash the containers should not be allowed to work in planting or production areas until they have replaced contaminated clothing with clean apparel and have washed their hands, forearms, etc.
15. Sanitize the containers in a water solution of a sanitizing agent such as bleach (sodium hypochlorite), HTH (calcium hypochlorite). Addition of an adjuvant with surfactant properties to the solution may assist in more complete contact of the sanitizing solution with all necessary surfaces of the containers,

particularly where air bubbles are likely to be trapped.

16. Do not use pond, ditch or recycled water for watering plants.
17. Use a soil medium that drains water well.
18. Avoid excess irrigations and fertilizer amounts.
19. Harden the plants slightly, prior to transplanting time by reducing the amount of irrigation.  
Transplants that are not wet when handled are less likely to become infected with some disease causing organisms.
20. Do not establish cull piles and trash areas in the vicinity of the plant production areas.
21. Use fungicide soil drenches of labeled materials as needed.