

APPENDIX A

Seedbed Preparation

SEEDBED PREPARATION

Clean soil is necessary for good seedbed production. Organisms that cause damage to vegetable seedlings may be present in any soil or growing mixture. Soils may be sterilized by a number of chemical or physical techniques, such as steam or dry heat.

Warnings: All the listed fumigants may be used both in the seedbeds and to treat soils in which vegetables are grown to maturity, with the following exceptions: 1) METHYL BROMIDE and FORMALDEHYDE can be used only for seedbeds. 2) None of the materials can be used where living plants are growing. Carefully read the directions in the table below, and especially those of manufacturers, to avoid danger and to obtain successful results.

SEED TREATMENT

Dust method—place the seed and suggested wettable powders in a closed container and agitate vigorously for several minutes or until seed is coated with dust. For best results, use a container with twice the capacity of the seed treated.

Slurry method—to suggested wettable powders, add enough water to make a sloppy paste or slurry. Treat by stirring or swirling seed in the slurry until thoroughly coated. Dry the seed before planting. Slurries are preferred to dusts because they adhere to the seed better and are less irritating to use.

CHEMICALS SUGGESTED FOR SEEDBED STERILIZATION

CHLOROPICRIN
(E.G. CHLOR-O-PIC, PICFUME)

Warnings: Fumes are very irritating to eyes and are poisonous to growing plants. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator with the proper carbon filter.

Rate and Method of Application

Inject 1.6 to 2.3 cc of material 6 inches deep and at 8-inch intervals using a hand operated fumigation gun. Treat only when soil temperature 6 inches deep is above 65°F. Pack treated soil and apply water seal (wet to a depth of several inches) or cover with plastic for 48 hours. Cultivate to speed aeration and avoid planting for 2 weeks, or until odor of fumigant is no longer detectable.

FORMALDEHYDE

NOTE: Not effective for nematodes. Especially suited for cabbage and cauliflower.

Warnings: Fumes are irritating to eyes and nasal passages and poisonous to growing plants. Avoid prolonged contact with skin. Wash off with soap and water. Wear goggles, rubber footwear and rubber gloves when handling. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator with the proper carbon filter. Ventilate when treating a confined area. Rate of Method of Application

Mix 1 pt (37% to 40% strength) with 5 gallons of water and apply with a sprinkling can at the rate of 1/2 gal/sq ft of soil surface. Treat only if soil temperature 6 inches deep is above 60°F. Cover treated soil with a plastic cover. Leave undisturbed for 48 hours, then cultivate one or more times. Avoid planting for 2 weeks or until odor of fumigant is no longer detectable. Do not use near living plants. As a disinfectant for equipment and storage interiors or greenhouses, spray surfaces with a mixture of 1 pt (37% to 40% strength) in 5 gallons of water. Cover equipment with plastic and keep storage or greenhouse closed for 24 to 48 hours after treatment, then air out well before planting.

1,3-D (DICHLOROPROPENE; TELONE II)

Warnings: Fumes are irritating to eyes and nasal passages. Prolonged inhalation is dangerous; poisonous to growing plants. Avoid contact with skin. Wash off with soap and water. Wear goggles, rubber footwear and rubber gloves when handling. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator with the proper carbon filter.

Rate and Method of Application

Apply as a preplant broadcast treatment at least 14 to 21 days prior to planting. Late summer or early autumn is usually best for applying fumigants in Michigan. Inject at 8 inches deep with chisels spaced 10 to 12 inches apart when soil temperature is between 50° and 80°F. Seal immediately after application. If soil is waterlogged or temperature is below 60°F, allow additional time before planting. Use only on crops listed on the respective label.

1,3-D AND CHLOROPICRIN (E.G., TELONE C-17)

Warnings: Fumes are irritating to eyes and nasal passages. Prolonged inhalation is dangerous; poisonous to growing plants. Avoid contact with skin. Wash off with soap and water. Wear goggles, rubber footwear and rub-

ber gloves when handling. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator with the proper carbon filter.

Rate and Method of Application

Apply as a preplant broadcast treatment at least 14 to 21 days prior to planting. Late summer or early autumn is usually best for applying soil fumigants in Michigan. Inject 8 inches deep with chisels spaced 10 to 12 inches apart when soil temperature is between 50° and 80°F. Seal immediately after application. If soil is waterlogged or temperature is below 60°F, allow additional time before planting. Use only on crops listed on the respective label.

SODIUM METHYLDITHIOCARBAMATE
(METHAM) (E.G., VAPAM OR VAPAM HL)

Warnings: Avoid breathing vapor or spray mist. Do not get in eyes, on skin, or clothing. Causes skin irritation. May be fatal if absorbed through skin. Wash with soap and water. Wear full coverage protective clothing and a MSHA/NIOSH-approved respirator to reduce exposure.

Rate and Method of Application

With a sprinkling can, fill with 1 to 1 1/2 pt metham and water and sprinkle uniformly over 50 sq ft of well-prepared soil. Sprinkle immediately with water until soil is sealed, or tarp for 48 hours. Seven days after treatment cultivate area to a depth of 2 inches to aerate soil. Do not seed earlier than 21 days after application if tarp is used. For soil injection, space injectors 5 inches apart and inject metham 4 inches into well-prepared soil. Follow immediately with a roller to smooth and compact the soil surface. Light watering or a tarp after rolling helps to prevent gas escape. For seedbeds, 75 to 100 gal/A (1 1/2 pt to 2 pt per 100 sq ft) is recommended.

APPENDIX B

Nematodes and Michigan Vegetable Production

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Nematodes are believed to be the most common animals on our planet. They inhabit most soil, fresh water and marine environments. At least 12 types of nematodes are known to parasitize or cause infectious diseases of Michigan vegetable crops. Hundreds of other species are involved in making nutrients available for plant growth. The objectives of this article are to: 1) provide an overview of the nematode problems associated with vegetable production in Michigan, 2) discuss the management options for plant-parasitic nematodes, 3) describe how nematodes are involved in nitrogen mineralization and 4) provide some recommendations on how to enhance the role of nematodes in making nutrients available for plant growth.

The 12 types of plant parasitic nematodes that feed on vegetable crops in Michigan cause diverse symptoms, attack a wide variety of crops and have different behaviors.

ROOT-KNOT NEMATODES

Only one species, the Northern Root-Knot Nematode is known to over-winter under Michigan conditions. Other species can be brought into the state on transplants produced in the south.

Crop Symptoms -Root galls, yellowing, wilting, stunted top growth, stunted root growth, low crop yield and poor crop quality.

Crops Attacked -Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Cucumber, Eggplant, Garlic, Leeks, Lettuce, Melons, Onions, Parsnips, Peppers, Potatoes, Pumpkins, Squash, Tomatoes.

Nematode Behavior -Second-stage juveniles invade root tissue a short distance behind the root tip. They migrate towards the root tip, stop, turn and then migrate to where the vascular cylinder is being formed. Here, the plant forms nurse cells for use by the nematodes for their