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Michigan State University  
Cooperative Extension Service  
D.C. Ramsdell and G.W. Bird  
Extension Plant Pathologist and Extension Nematologist  
Department of Botany and plant Pathology, and Entomology  
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# Vineyard Preparation for Nematode and Virus Disease Control

*D. C. Ramsdell and G. W. Bird*

*Extension Plant Pathologist and Extension Nematologist  
Departments of Botany and Plant Pathology, and Entomology*

Plant-parasitic nematodes are microscopic worms that feed on the roots of grape vines and result in diseased vines of low productivity. Some nematodes live and feed within roots. Others live in soil and feed on the surface of roots. Both types migrate through soil from root to root and can be moved longer distances in rootstocks, irrigation water, or on equipment. Plant-parasitic nematodes damage vines by feeding on the roots and inhibiting normal growth and development of root systems. This prevents absorption of water and nutrients required to maintain healthy and productive vines. Nematodes can also be vectors of viruses that cause diseases of grape vines. Nematode problems of grapes can be associated with vine propagation, new vineyard sites, replanted vineyards or individual vine replant sites. In Michigan, particular precaution should be taken when old tree fruit land is to be used for the establishment of new vineyards.

Root-lesion, dagger, root-knot, and lance nematodes are four plant-parasitic types frequently found in Michigan vineyards and potential vineyard sites. The presence of these nematodes is known to be detrimental to grapevines. The dagger nematode is the only one capable of being a vector of virus diseases of grapes. Spiral and ring nematodes are frequently found in vineyards; however, their overall influence on the growth and development of grapevines is unknown.

## SYMPTOMS CAUSED BY NEMATODES

Poor growth of vines is the most obvious symptom. Above-ground parts of plants are stunted, have poor cane growth and small leaves. Root systems are small, discolored and have poorly developed feeder roots. Vines may die after the first or second growing season, or may remain in a severely stunted condition for many years. In some cases, surviving vines may improve with age and grow well during the next few growing seasons. Plant-parasitic nematodes can cause decline of individual vines or large areas of a vineyard.



Figure 1. — Peach Rosette Mosaic Virus infection symptoms in 'Concord' grape. (Top) typical umbrella-like growth habit of an infected vine. (Middle) crooked short internodal growth and deformed leaves. (Bottom) berry cluster shelling and reduced yield.

## VIRUS DISEASES ASSOCIATED WITH NEMATODES

In Michigan, peach rosette mosaic virus is the main cause of Concord grapevine "degeneration" or "shelling." This virus is present throughout southwestern Michigan, and causes delayed budding in the spring; reduced, crooked cane growth; deformed leaves; berry shelling; and drastically reduced yields (Figure 1). It is soil-borne and apparently slowly spread by the dagger nematode [*Xiphinema americanum*]. The influence of peach rosette mosaic virus on French hybrid cultivars is presently unknown, but being investigated.

Tobacco ringspot and tomato ringspot viruses are present in Michigan and spread by the dagger nematode. These viruses apparently do not cause diseases of American-type grapes, (i.e. Concord, Niagara, Delaware, Catawba, etc.). They are, however, devastating to many French hybrid cultivars. These viruses reduce leaf size, cane growth and plant health so severely that many vines do not survive the winter (Figure 2). Vines in some vineyards infested with the dagger nematode and tobacco ringspot virus or tomato ringspot virus die within 3 to 5 years.

The virus vector (dagger nematode) has been found as deep as 7 feet in sandy soil beneath grapevines in Michigan. Since many grapevine and tree roots can penetrate to this depth, and frequently survive for five or more years after removal of the vine or tree, vector control is difficult. This is especially important where there is a history of peach rosette mosaic virus, tobacco ringspot or tomato ringspot virus in the soil. Conventional soil fumigation at depths of 6 to 10 inches generally will not control virus vector nematodes at depths below 2 feet. Research is underway to control at depths below 2 feet.

### DETECTION OF NEMATODE PROBLEMS

Because nematodes are microscopic and the symptoms they cause are similar to those produced by other factors, it is necessary to run a laboratory analysis to determine if a nematode problem or potential problem exists.

Soil and root samples must be sent to the MSU Nematode Diagnostic Service Laboratory. Instructions for submitting samples can be obtained from any Michigan County Extension Office or by writing for Extension Bulletin E-800, "Nematode Detection" from the MSU Bulletin Office, P.O. Box 231, East Lansing, MI 48824.



Figure 2. — Disease symptoms in French hybrid grape caused by tobacco or tomato ringspot virus. (Top) healthy vine on left and diseased on right. (Bottom) winter top kill of virus infected vine.

## VINEYARD SITE PREPARATION

**Prior to Removal of Old Vineyard or Orchard.** Before removing old vineyards or orchards, determine the severity of the potential nematode or virus problem as follows:

1. Examine cane or shoot system for general vigor and virus symptoms. Also observe root condition of the vines or trees.
2. Examine the soil structure for problems such as faulty drainage and hardpans.
3. Make a complete chemical analysis of the soil and foliage to serve as a basis for adjusting soil pH and fertility (information concerning the various soil and leaf analyses are available through the Michigan State University Soil Testing Laboratory, and may be obtained from your County Extension Office).
4. Analyze the soil and roots of old vines or trees for plant-parasitic nematodes (information concerning the nematode assay is available through the Michigan State University Nematode Diagnostic Service Laboratory and may be obtained from your County Extension Office—see Extension Bulletin E-800).

### *Soil Preparation Immediately After Vineyard or Orchard Removal.*

1. Work the soil and remove as many of the remaining roots as possible.
2. Fallow or plant a suitable cover crop (Sudan grass, sudax, rye or corn are suitable cover crops for controlling plant-parasitic problems).
3. Do not plant new vines until *at least* one year after removal of the old vineyard or orchard.

**Purchasing Nursery Stock.** High quality, indexed, virus-tested nursery stock propagated in nematode-free, fumigated, or nematicide-treated media is essential for the development of a healthy young vineyard. Since many plant parasitic nematodes live in root tissue, they can be introduced into vineyards in nematode-infested vines produced on nematode-infested media. Vines from the Michigan certification program will be commercially available in 1976 or 1977. To assure that vines are free of plant-parasitic nematodes, the small additional cost of purchasing high quality vines propagated in nematode-free or treated media should be considered as an im-

portant step towards the prevention of nematode problems in Michigan vineyards. Until certified virus-tested vines are available in Michigan, other sources should be used.

### *Soil Preparation During the Fall Before Planting New Vines.*

1. Work the soil and remove any remaining vine or tree roots.
2. Subsoil if necessary.
3. If recommended, apply an appropriate soil fumigant (See Extension Bulletin E-154). The fumigant should be injected 6-10 inches deep in the soil, using a chisel injector (Figure 3). Soil temperature should be above 50°F and the soil lightly sealed with a cultipacker or similar instrument after fumigating.
4. Follow appropriate pH and fertilizer recommendations.

### *Spring Soil Preparation and Planting.*

1. Aerate soil to release the fumigant.
2. Follow appropriate fertilizer and planting recommendations.
3. Plant healthy vines produced in nematode-free, fumigated or nematicide-treated nursery soils.

### *Maintenance of Non-Bearing Vines.*

1. Maintain the best possible weed control program.
2. Additional nematode control may be obtained with applications of postplant soil fumigants.



**Figure 3.** — A typical chisel type fumigant injector for use in pre-plant soil fumigation.

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