

## IPM-Based Guidelines for Replanting Walnuts in 2002 without Methyl Bromide

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In California 85% of walnut orchards are infested with nematodes including root lesion, *Pratylenchus vulnus*, ring, *Mesocriconema xenoplax*, or root knot, *Meloidogyne* spp. The two main rootstocks are equally susceptible to these nematodes but an extensive search for resistance has been underway four years. There are no registered post-plant nematicides for root lesion on walnut so the primary tool for nematode management has been pre-plant fumigation with methyl bromide (MB). Without MB the IPM strategy is as follows: Use an auger or backhoe to diagnose soil physical, chemical and biological problems while collecting soil samples for nematodes or other soil borne pathogens>kill old roots>wait 18 months before replanting>during the wait correct soil physical, chemical and biological problems but also dry the soil deeply if use of Telone II is planned>replant with small amounts of macro and micronutrients. These guidelines have received limited commercial testing at this time and are largely based on years of small plot experimentation. As commercial trials provide better information this web site is updated. Underlined information is in need of commercial evaluation as soon as possible.

Walnut replanted to walnut

1. Determine if soil pests/diseases, especially *P. vulnus* and *M. xenoplax* occur.
2. Harvest old trees>irrigate deeply>cut trunks exposing cambium>paint cut surface with solution of 50 ml Garlon 3A plus 100 ml MorAct per tree prior to end of October. To avoid kill of adjacent root-grafted trees use a deep ripper blade to sever roots emanating from the treated tree or avoid applications to the outside row of trees.
3. Wait at least 60 days before pushing trees>rip soil and level the land as appropriate.
4. Spring plant sudan grass or safflower into moistened soil and do not irrigate after mid June in an effort to deep-dry the soil. Harvest and remove when sudan grass reaches four feet in height.

One full year after the Garlon treatment the old roots are beginning to yellow and darken. Nematode populations throughout the root system have already declined by 99% (fewer than 0.2 nematodes per gram of root remain). Of major benefit, the first year growth of trees replanted in the coming spring will be much improved and with greater uniformity of growth from tree to tree. We currently estimate the first-year growth benefit to be about 85% of that provided by MB. If nematodes were diagnosed to be in the field the "soil" population is scarcely affected by Garlon. A planting of sudan grass can reduce soil populations by 85%. If the land is left fallow expect only a 50% population reduction in soil populations. If Garlon was not applied, expect natural root death to require 2½ years before populations are reduced to 0.2 nematodes per gram of root.

5. If soil samples collected in Step 1 indicated presence of more than one *P. vulnus* per sample there are too many nematodes to replant without some pre-plant protection. If ring nematode counts exceeded several hundred from a 250 cc soil sample expect this nematode to also pose a problem for future walnuts. Adequate control of the “nematode component” of the replant problem (99.9% population reduction) requires delivery of a nematicidal agent throughout the surface five feet of soil. The goal is to achieve six years of nematode relief or 99.99% control. Control at the level of 98% in soil or roots will provide no more than one full year of nematode relief and tree growth will begin to slow in the second and third years after replanting. At application rates of 330 pounds per acre to sand or sandy loam soils Telone II, Telone C35, In-Line, Metam Sodium, Metam Potassium and chloropicrin all have the ability to deliver adequate nematode control, particularly when the root refuge for root lesion nematode has already been destroyed. Unfortunately, walnuts are usually grown on the best, deep draining soils which are also of finer texture than sandy loam.

**Telone II or Telone C35** – If soil moisture levels in the surface five feet exceed 12% on a dry weight basis, the 1,3-D will not be adequately delivered throughout five feet. Sandy loam soils can oftentimes be reduced to 12% moisture with one year of fallow. Many silt or clay loam soils never reach this low of moisture level but some may if sudan or safflower are used to pull deep soil moisture during the waiting year. If the soil moisture levels range between 12 and 18% at least 500 pounds (53 gallons Telone II) of 1,3-dichloropropene are needed per acre. This application rate exceeds California regulations so 1,3-D can only be applied as a strip treatment. There are many walnut soils that will contain too much moisture for effective treatment with Telone II. If Telone C35 is chosen the rate must be as high as 49 gallons per acre but greater delivery of nematicide into the soil should not be expected. Chloropicrin is a relatively poor root penetrant. Also, since it will be moving through soil already treated with the 1,3-D (Telone C35) do not expect increased nematode control. Chloropicrin use does provide striking plant growth benefit referred to as the “increased growth response”. InLine is an emulsified formulation of Telone C35. It is applied via buried or covered drip lines and effective treatment rates can be the same as those applied by shank, 330 pounds of 1,3-D. An adequate treatment rate of InLine is not currently registered for California walnut orchards.

**Chloropicrin** – At 330 pounds per acre this product has utility when remnant root systems no longer contain nematodes. Not enough data are available but at these rates it will move further through soil than 330 pounds per acre of 1,3-D.

**Metam Sodium (MS) and Metam Potassium (MP)** – These products sold as Vapam, Sectagon, and Kapam liberate methyl isothiocyanate as they contact soil particles. Seventy-five gallons of Vapam HL liberates 330 pounds of the active ingredient per acre. When uniformly applied and infiltrated within 6 to 9 inches of water the active ingredient can reach as deep as five feet. The fact that this product is a poor root penetrant is unimportant where Garlon has been used. Growers oftentimes select MS because it appears simple to apply. Unfortunately, MS only replaces 1,3-D when it is applied with due deliberation and effort. Products delivered into soil with water are best applied to

soils that are already moist so applications should be planned for the springtime following tree removal. At other times the soil may need to be pre-irrigated. A springtime drench of MS should be followed by the growing of a crop such as sudan grass to restore a more diverse biological activity to the soil without increasing nematode population levels. Data from a single field trial indicates good growth of walnut trees following a fall drench of MS. Until more field data become available we only recommend spring drenches with the product.

6. When Telone products are to be applied re-work the soil surface in the fall to enable the chisel application as deep as possible. The surface of the field must also receive about an inch of rain or sprinkler irrigation to meet California pre-fumigation requirements. Once the field has received more than 2 acre inches of fall rains (usually occurs about mid November) performance of Telone can be reduced.
7. The lack of post-plant nematicides and resistant rootstocks for walnut growers necessitates that **broadcast applications** of biocidal agents be applied and that nematode control in the field surface is important. The nematode control benefit of Telone II as a strip treatment or without additional nematode control at the field surface may not last beyond one year. **Strip applications** of up to 12 feet wide have value only when resistant rootstocks or post-plant nematicides become available or when damaging nematodes are not present.
8. As new bare root trees are replanted there is growth benefit to the addition of minute amounts of macro and micronutrients at the time of planting. For each tree fill a bucket with 2 gallons water and add 75 grams (1/6 pound) of Peters 20-20-20 plus 8.3 ml of Super Micro. This is one example of a starter mix that can double first-year tree size but these ingredients can undoubtedly be replaced by other recipes.

Additional data gaps need field evaluation including:

- A. Population reduction value of 2-years and 3-years of sudan grass compared to that same length of time in fallow.
- B. In-field evaluation of the nematode control value of additional biocidal or nematicidal agents applied where root populations have already been controlled. Products of interest include propylene oxide, sodium azide, chlorine dioxide, and water extracts from walnut limbs and roots.
- C. Field evaluations of root lesion resistant rootstocks as soon as possible.
- D. Methods of avoiding Garlon translocation across to adjacent root-grafted trees.
- E. Rates of nematode return in additional commercial settings.