REPLANTING STONE FRUIT ORCHARDS WITHOUT SOIL FUMIGATION

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The conventional program of pushing old trees, soil profile modification, followed by fumigation and then spring replanting on Nemaguard rootstock has enabled growers of these crops to successfully replant second, third, and even fourth generation orchards. At least 85% of *Prunus* cropland currently utilizes Nemaguard Peach rootstock because of several qualities including its resistance to all California populations of the root knot nematode, *Meloidogyne* spp.

What steps should a grower undertake if fumigant use is not desired or not permitted?
The replant problem for Nemaguard after Nemaguard is at minimum the result of: a rejection component, a soil pest and disease component, a soil physical and chemical component, and a nutritional component (www.uckac.edu/nematode). Importantly, the first year of poor growth is seldom the result of known pathogens or parasites or soil physical/chemical problems but usually a result of the rejection component as new roots fail to invade or actually turn away when confronted by replant soil. The rejection component of the replant problem occurs among all perennial crops but with regional influences. It is not usually the result of allelopathy or known pathogens but instead the result of an unfriendly soil ecosystem that rejects entry of a new root system, particularly roots coming from a replant of similar parentage. Without a year of fallow Nemaguard replanted after Nemaguard commonly achieve only 15% of the first-year tree size they attain when fumigated. One full year of land fallow provides 50% relief from the rejection component. We have demonstrated that application of Roundup herbicide to trunks of old *Prunus* trees on Nemaguard plus one full year of fallow can alleviate 85% of the rejection component.

In 1998 we concluded a 2-year field trial demonstrating that switching rootstocks from Nemaguard to Hansen 536 (a peach x almond hybrid with no Nemaguard parentage) can also alleviate much of the rejection component. This experiment was repeated in 2001 following use of Roundup and one year of fallow then replanting on Nemaguard versus Hansen 536. Tree growth of the hybrid was improved due to its extra vigor but also the uniformity of tree growth down rows of Hansen 536 compared to Nemaguard was similar to that of a fumigated comparison. Results from this second trial confirmed that switching rootstocks after an application of Roundup followed by a year of fallow could be as useful as methyl bromide fumigation. In this trial site there were no nematodes present. We were dealing only with the rejection component of the problem. Diagnosis for nematode presence or absence is one of the first considerations when deciding the steps for replanting a specific orchard.

Since 2004 we have conducted 2-year screens of 45 *Prunus* rootstocks from around the world to determine their resistance to the major endoparasitic nematodes *Meloidogyne incognita*, and *Pratylenchus vulnus*. Many of these rootstocks are still being screened against *Mesocriconema xenoplax*. Our goal has been to find a rootstock alternative that

has a level of nematode resistance similar to that of Nemaguard but preferably with minimal Nemaguard parentage. For stone fruit growers we also seek less vigor than that in the Hansen 536 hybrid. Presence of soil pests such as nematodes can persist for the lifetime of the orchard and must be dealt with when replanting. A new rootstock could provide resistance to some or all of the above-listed nematode species while providing avoidance of the rejection component of the replant problem.

Nemaguard is completely resistant to all currently identified root knot populations in California but it is not necessarily tolerant of feeding by root knot nematode. Serious first year damage can occur if Nemaguard is planted into sandy sites having population levels of *Meloidogyne* spp. greater than 100 juveniles /250 cc soil. These population levels commonly occur following grapes, tomatoes, or kiwifruit but do not occur after Nemaguard. Tolerance to nematode feeding can also be an important rootstock quality.

Our five-step approach to solve the rejection component without fumigation includes: 1) Roundup to cut stumps followed after 60 days with trunk removal 2) waiting one full year 3) soil ripping or backhoeing as needed 4) replanting on a rootstock without Nemaguard parentage 5) starter fertilizer at planting time followed with 1.4 lb/ac NPK/tree in mid April and again in early August.

Which rootstock should growers choose for stone fruits when switching away from Nemaguard? We can currently name three rootstocks that would be of interest for commercial plantings. **Viking** rootstock has been planted since 1998 and commercial evaluations have recently increased. In summary, it exhibits vigor, broad scion compatability, resistance to *Meloidogyne* spp., and host status to *P. vulnus* that is similar to Nemaguard. Its host status to *M. xenoplax* is more similar to that of Lovell rootstock as it supports half the ring nematode population of Nemaguard. In preliminary experiments it does not exhibit complete tolerance to first-year feeding by combinations of *P. vulnus* and *M. incognita* in the absence of the rejection component. It also appears to be another *Prunus* hybrid that achieves best first-year growth when roots have not been permitted to dry prior to planting. **Krymsk 1** is a plum rootstock with limited scion compatabilites but provides substantial dwarfing compared to Nemaguard. This rootstock provides root knot nematode protection only to roots that are several months old. Small galls do appear on the periphery of the root system where root diameters are less than 5 mm in diameter. Since the only root knot nematodes in an old Nemaguard orchard are feeding on cover crops, the orchard populations seldom exceed 1 or 2 / 250 cc of soil. Thus, Krymsk 1 should be a suitable rootstock when following removal of a Nemaguard-rooted orchard that has received a treatment of Roundup and a year of waiting. This is the only *Prunus* rootstock that we rank as resistant to *P. vulnus*. It also tolerates the presence of first-year feeding by *P. vulnus* and *Meloidogyne* spp. **Flordaguard** rootstock has peach parentage but its compatability with other *Prunus* scions is unknown. It exhibits vigor similar to Nemaguard but is more difficult to propagate by seed. Thus, plants of this rootstock are currently difficult to obtain. Like Nemaguard it is resistant to all the known root knot populations but also supports fewer *P. vulnus* nematodes than Nemaguard. Its performance against *M. xenoplax* is being tested. It does not exhibit first-year tolerance to feeding by *P. vulnus* and *M. incognita*.

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