

A GREATER NUMBER OF ROOTSTOCK CHOICES CAN PROVIDE A PARTIAL ALTERNATIVE TO METHYL BROMIDE FUMIGATION

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Abstract

In 2006 our major effort was to evaluate a dozen of the more interesting rootstocks for their tolerance to nematode feeding. The practical question is, do we need strip fumigation to reduce high nematode populations even if the trees are resistant to nematodes. The first year of visual comparisons indicate that Krymsk 1 and Myrobalan 29C appear to tolerate nematode feeding and in less than 10% of cases their first-year growth was not benefited by strip fumigation. At the other end of the spectrum Cadaman, Viking, and Marianna 2624 were visibly benefited by soil fumigation as much as 90% of the time. This indicates the latter rootstocks do not tolerate first-year feeding by root-lesion and root knot nematodes even if they possess some resistance to one or more of the nematodes. Measurements of tree biomass have not yet been collected and this study will continue one more full year. A second grouping of trees was evaluated for their tolerance to the rejection component of the replant problem. The practical question again, do we need strip fumigation even if we have switched to a different rootstock. In the presence of the rejection component but no nematodes, Hansen 536 continues to grow well without strip fumigation. Meanwhile some very vigorous rootstocks such as Empyrean 1 show the need for fumigation. Empyrean 1 has parentage that includes *Prunus davidiana*. From a nematode perspective the best dwarfing rootstock of the 45 we have tested is Krymsk 1. Its parentage includes *Prunus tomentosa* and *P. cerasiferae* and it is the only *Prunus* rootstock we have found to resist root-lesion nematode. It is susceptible to root-knot nematode but only along its root terminous. Further back on the roots it is resistant to root-knot. This stock is the best choice where dwarfing is desirable and the soil is sandy loam. Its evaluation against ring nematode is underway but no data currently available. Krymsk 1 is suspected to be incompatible with many scions and a broader evaluation of its incompatibilities will begin in 2007. Each rootstock has limitations just as there are limitations with Nemaguard. Our current evaluations for new rootstocks include Krymsk 1, Viking, Flordaguard, Myrobalan 29C, Torinel, Monegro, Cadaman, Empyrean 2, Hansen 536, Bright's Hybrid-5, Empyrean 1, Lovell, and Marianna 2624. We continue with the hypothesis that by applying Roundup to the old Nemaguard, waiting a full year, and switching to non-Nemaguard rootstocks at planting time provides a method for avoiding soil fumigation. What is exciting is the fact that we now have several rootstocks by which this hypothesis can finally be tested.

Objectives

- 1) In greenhouse or small plot settings determine first year growth rate of Nemaguard compared to eight alternative rootstocks in the presence of replant soil with or without nematodes compared to fumigated soil.
- 2) Determine first and second year growth rate of eight alternative rootstocks in various field settings previously planted to Nemaguard or Marianna Plum.
- 3) Interact with farm advisors, extension specialists, or the Protected Harvest group to insert field diagnosis, use of new rootstocks, Roundup treatments, and other strategies into the overall replanting process where MB and Telone II will not be used.

Procedures

Objective 1. In 2005 we installed in randomized complete blocks six replicates of six rootstocks, irrigated by drip for one full season. This was a small plot study. The rootstocks included Marianna 2624, Nemaguard, Viking, two sets of Torinel, Empyrean 2, and Atlas. We then harvested entire trees and their roots to determine tree biomass and nematode development.

Objective 2. Trees to be planted include some that are $\frac{1}{2}$ or $\frac{1}{4}$ Nemaguard parentage and a few with no Nemaguard parentage (Krymsk 1 and Flordaguard). They will be planted into a field with *P. vulnus* and *M. incognita* nematodes present. Trees will be planted on 8-foot spacings down the row with 15 feet between rows. In spring 2006 trees will be budded to a common plum or peach scion. The planting site consists of one row treated with Telone II adjacent to an untreated row with eight reps of each. Tree growth will be monitored along with nematode development. Selections include: Nemaguard, Empyrean 2, Monegro, Torinel, Viking, Krymsk 1, open space, Marianna 2624, Krymsk 8, Flordaguard, Garnem, and Cadaman. One of our goals is to eventually monitor yield and fruit size from these trees.

Objective 3. Interactions with personnel from the Protected Harvest group have been meager. This PI is submitting for a large grant to study the entire process of replanting without methyl bromide or Telone. If that grant is funded the work will be in grower settings and with the assistance of interested farm advisors.

Results and Discussion

Trees of Krymsk 1 and Nemaguard were planted into root-lesion nematode, *Pratylenchus vulnus*, and an aggressive population of root-knot nematode, *Meloidogyne incognita*, in spring 2004. The trunk girths of Krymsk 1 in 2006 are now half that of the Nemaguard. The roots of Nemaguard support 0 root-knot nematode but 114 root-lesion per gram of root. Meanwhile the roots of Krymsk 1 support 0.1 root-lesion nematode /gram of root and 7.8 root-knot /gram of root. These root-knot galls on Krymsk 1 are only present at the root terminous, indicating there is resistance to root-knot in roots that are larger in size than the lead within a pencil.

Krymsk 1 can provide the industry with the first Prunus rootstock having resistance to root-lesion nematode. It is dwarfing and it has scion incompatibilities that are not yet catalogued. Susceptibility of Krymsk 1 to ring nematode will not be known for one more year. Krymsk 1 provides the first opportunity to field evaluate use of Roundup on the old Nemaguard roots > wait one full year > replant to Krymsk 1 > apply starter nutrients without any fumigation. Krymsk 1 trees will likely be planted using double or triple the number of trees/acre. There will be slightly larger fruit sizes, earlier fruit production and the next generation orchard would be

replanted back to Nemaguard again without soil fumigation. Horticultural problems can also develop as acreage becomes planted because this is a relatively unknown rootstock for California. We suggest that the first plantings be in the desirable fine sandy loam soils until more is known about its ring nematode status.

Trees of Viking are benefited by strip fumigation. This rootstock is resistant to root-knot nematode because of its Nemaguard parentage. It supports a few more root-lesion nematodes than Nemaguard but is a poorer host of ring nematode. This is the tree that is needed for sites where ring nematode is a problem. It does lose first-year growth when fed upon by nematodes or planted into the rejection component of the replant problem. The positive value of strip fumigation seems apparent in all our Viking studies thus far but this rootstock may overcome some of these first-year problems in their second year.

Much less is known about Flordaguard rootstock and it will be another full year of research before comments will be useful.

Hansen 536 has 20% more vigor than Nemaguard and this will be a deterrent to many stone fruit growers. It does not have Nemaguard parentage. It provides our best evidence to indicate that, except in sandy soil harboring ring nematode, one could apply Roundup to old Nemaguard trees > wait a full year > replant on Hansen 536 > apply starter nutrients and do all this without seeing the benefit of soil fumigation. Use of this rootstock can be expected by the almond industry, but may not be of interest to the stone fruit industry.

Attached is a copy of our September 2006 summary sheet on these new rootstocks and our approach to replanting without soil fumigation.

Attachment of earlier report

A Brief Report to CTFA on research activities during 2006

Sept. 15, 2006

Michael McKenry

Based on findings from our 2004-05 nematode screens of 45 rootstocks the following *Prunus* rootstocks are of continued interest because their resistance level to root knot and root lesion nematodes is comparable to that of Nemaguard: Emyrean 1, Monegro, Bright's Hybrid-5, Hansen 536, Cadaman, Marianna 2624, Lovell, Viking, Nemaguard, Flordaguard, Myrobalan 29C, Emyrean 2, Torinel, and Krymsk 1. The above listing is in descending order from highest to lowest vigor without a scion. These are now being tested for their tolerance to feeding by these same nematodes (fumigated or not fumigated) but also to confirm earlier findings for resistance.

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 compatibility, 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 compatibilities 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 of 45 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 compatibility 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*.