FIELD EVALUATIONS/INPUTS FOR GROWER REPLANT SETTINGS AND NEW LINES OF NEMATODE RESISTANCE

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ABSTRACT

We are beginning to see the practical value of pre-infection resistance that we previously associated with NX seedlings. Our results come from a fifth-leaf orchard receiving three reps each of various qualities of soil fumigation. The comparative paradox seedling (DN) grows similar to paradox seedling NX where nematode control to 6-foot depth was achieved using methyl bromide. However, where nematode control was from metam sodium and delivered only to the four-foot depth the growth of Chandler/NX is significantly greater than that of Chandler/DN. Meanwhile the wet springs of 2005 and 2006 have resulted in loss of 2 of 200 NX trees and several other NX trees needed to be heavily pruned and inarched. This tree damage is not significant but will be monitored. We will not be cloning NX but in 2006 we received from Wes Hackett thirteen clones of UZ229 in order to confirm original findings. UZ seedlings expressed pre-infection resistance in 3 of 10 trees; very similar to that in NX. After 7 years in our mother block of trees, UZ229 was the best growing of the three saved siblings and it is the 6th most vigorous tree of our 50-tree mother block. A screening of own-rooted Serr versus Serr on NCB was initiated in an effort to confirm the extent of nematode resistance in Serr. This study is accomplished by removal of the entire tree after 1 year and dissecting the root system into three parts. A preliminary root evaluation indicated that roots of Serr at 4 months after inoculation were still free of root knot nematodes. Root dissections indicated Serr after 4 months had 192 root tips / tree averaging 1 to 5 cm length compared to 22 root tips / tree averaging 3 to 15 cm length for NCB roots. In 2006 we initiated screening of *P. vulnus* and *Meloidogyne* spp. on 8 diverse *Juglans* species provided by the National *Juglans* Repository. NCB and Southern California Black have the highest vigor of the species under examination. A tree collected in 1999 and referred to as RX032 is of *J. microcarpa* parentage and approximately the 7th most vigorous tree in our mother block. This tree will be submitted for cloning this winter because of its different parentage. Diverse parentage sources can provide benefit when dealing with the rejection component of the replant problem.

OBJECTIVES

1. Using the IPM-based guidelines for replanting of walnut we will become involved in grower replanting efforts to gain knowledge as to the performance of individual steps in the process.

2. Continue to evaluate the potential nematode resistance present in various paradox and black walnut seedlings.

PROCEDURES

Replant Sites – Objective 1.

1. In 1998 we identified a replant site near Rio Oso that was high in root lesion nematode. Several strategies were implemented including Garlon in fall 1999 to the trunks to minimize the rejection component of the replant problem. In spring 2001 trees of a standard paradox (DN) and the NX paradox were planted across replicates of: MB, stripped Telone/Vapam, or Vapam drench. Beginning in the first leaf we have monitored nematode populations in 27 DN and 27 NX trees located across the fumigation treatments. Each winter we monitor tree circumferences of 125 representative trees located across the replicates.

Nematode Resistance Evaluated – Objective 2.

1. Assessment of the NX source of pre-infection resistance continues to receive field evaluation in Rio Oso. In summer 2004 we dug backhoe pits across each pre-plant fumigation site in an effort to follow root penetration as deep as 6 feet, the depth to which methyl bromide penetrated. Since planting in 2001 we have sampled 27 NX and 27 DN trees every six months and assessed for nematode return within the surface 18 inches of soil. We also collect girth measurements once each fall-winter.

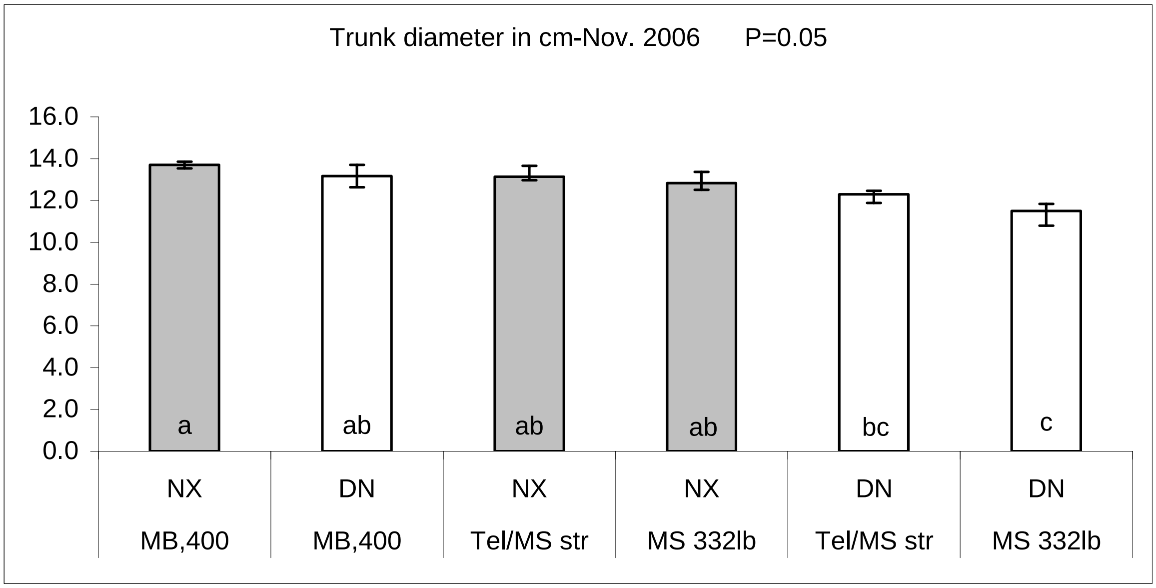
2. In February 2004 we planted 48 clones each of VX211 paradox and a standard AX1 paradox from Gale McGranahan/Wes Hackett. One tree of each was planted into each of 48 1/100th acre macroplots made available at Kearney Ag Center. These macroplots have concrete-lined walls that reach 5 feet into the soil with open bottoms. These non-fumigated, nematode-free sites were planted into 2.5 cubic feet of soil infested either with 0, 1, 20, or 500 nematodes for each 250 cc of soil. These trees were only pencil-sized and roots were likely within the inoculated zone for at least 4 months till they grew past. Trees were stressed by simulating grafting in 2005. We assess tree growth at the end of each year. Development of the nematode populations is being assessed annually in summer and fall. Our goal is to determine if the exceptional growth of VX211 is due to hybrid vigor or nematode tolerance. These different inoculation levels should reveal the importance of different field population levels at time of planting, but without any rejection component whatsoever.

3. In spring 2006 we received (from Wes Hackett) rooted cuttings of UZ229 that were planted into our lathe house for preliminary nematode assessments in fall 2006.

RESULTS AND DISCUSSION

A. Field evaluation of pre-plant soil treatments

Site 1 – Our standard July soil sampling of 27 NX and 27 DN trees revealed that nematode counts did not become apparent until fall 2004. Incidence of *P. vulnus* has slowly increased across the treatments since that time. Samplings involve collection of soil along the microsprinkler-irrigated berms to the depth of 18 inches. However, this 8-acre planting can be viewed from a high levee bank and there does appear to be visible occurrences of somewhat reduced growth within the Telone/Vapam strip-treated treatments compared to the broadcast-treated methyl bromide treatments. The effect is subtle and erratic. This was a 50 gpa Telone treatment that reached 4.5 feet into the soil profile. Trunk circumferences of the trees in 2004 and 2005 have revealed a decline in tree biomass associated with the strip treatment of Telone and the drench application of metam sodium compared to that from methyl bromide treated soil



(See walnut board report for 2005). In fall 2006 the growth differences between NX and DN became significant (*P*=0.05) where pre-plant nematode control was poorest and nematodes were slowly becoming more prevalent. Our current assessment is that the pre-infection mechanisms for resistance to root knot and root lesion nematode at root terminals of NX appear to have practical value.

B. Evaluation of rootstocks with potential nematode resistance

Paradox selection VX is planted into several rootstock trials from the paradox diversity studies. In no case has a large tree or group of VX trees appeared across those plots. Yet, VX211 appeared to exhibit tolerance or high vigor in the presence of *P. vulnus* screens conducted at Kearney. In February 2004, Wes Hackett and Gale McGranahan provided us with 48 clones each of VX211 and AX1. One of each clone was planted into 1/100th of an acre inoculated either with 0, 1, 20 or 500 *P. vulnus* per 250 cc soil. The value of this trial is to confirm the high vigor of VX211 and determine if the extra growth is due to hybrid vigor or nematode tolerance. These trees have now completed their third-leaf. Regardless of how the trees are compared, VX211 clones always express greater vigor than clones of AX1, yet they usually do not support higher nematode populations. VX211 has extreme hybrid vigor, not unlike that seen in Vlach rootstock. But, it appears to also possess some mechanism for slight resistance to *P. vulnus*. In fall of 2005 and 2006 the VX211 hosted significantly fewer *P. vulnus* than AX1 when planted into soil infested with only 1 *P. vulnus* /250 cc surrounding each root system (see Fig. 2). At infestation levels of 20 or 500 *P. vulnus* at the time of planting this potential resistance mechanism has not yet been observed. We do not have a suggestion to explain this discrepancy among differing infestation levels but visible tree size plus the greater abundance of roots found around VX211 leads us to suggest that in some manner the number of *P. vulnus* per root tip is being reduced at all infestation levels by VX211. Trunk diameters collected each of the three years are recorded in Figure 2. In each of the three years VX211, even when exposed to the greatest number of nematodes, has outgrown AX1 in the absence of nematodes. The extremely vigorous VX211 has not slowed its growth in the presence of nematode build-up but it also supports fewer numbers of nematodes than AX1.

In the second-leaf all these rootstocks were grafted to Chandler but none of the scions survived. This left us with what we called a simulated graft. Ten-foot tall trees had been topped at 18-inch height which creates a stress, particularly for the most vigorous trees. When we measure the diameter of the re-growth two years later (see bottom panel of Figure 2) the regrowth of 2-year old wood of VX211 exceeds that of AX1 in every case. Even more convincing, the regrowth diameters at 6 cm above the simulated graft union of VX211 do not appear to have been impacted by nematode inoculum level except where 20 P. vulnus was the inoculum level. Meanwhile the regrowth diameters of AX1 rootstock are significantly lower than that of the uninoculated AX1 regardless of the inoculation level. Regrowth by AX1 after a graft is impacted by the presence of nematodes.

One third of this trial (4 reps) received a garlon application in fall 2006. The remaining trees (8 reps) will be grafted with Chandler in 2007. Following the garlon application a series of nematode reducing treatments will receive evaluation and evenutally provide a site for screening all favored rootstocks against *P. vulnus.*

Fig. 2 Performance of VX 211 compared to AX1 over three years.