Where soil fumigants are unavailable: Starve & Switch

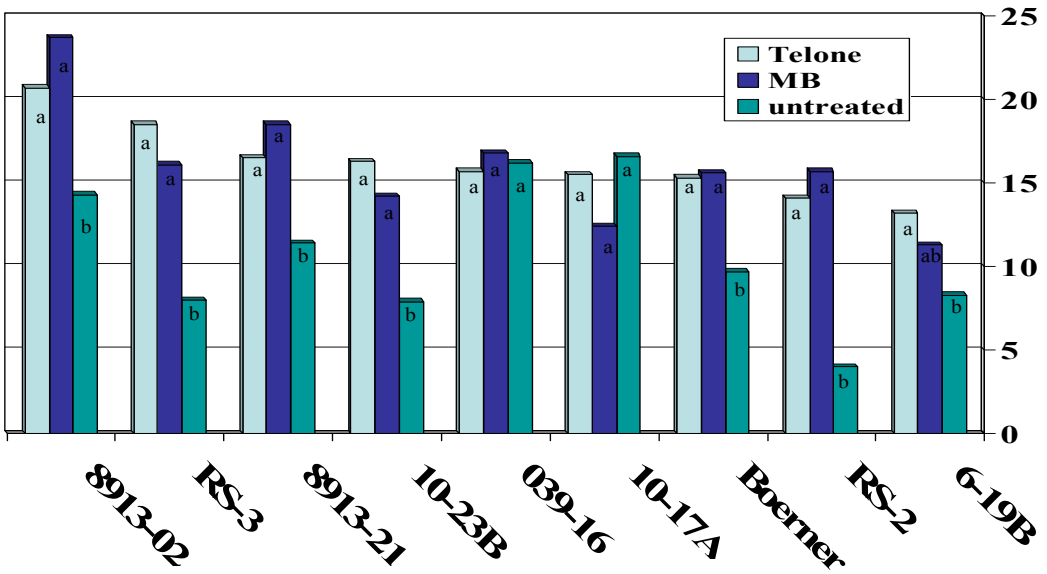
The **starvation** aspect of this approach relies on availability of systemic herbicides to kill complete root systems soon after their last harvest and then waiting for at least one full year prior to replanting.

The **switch** aspect of this approach relies on replanting with a rootstock that is of strikingly different parentage from the previous rootstock (tolerance to the rejection component) while also providing pest and disease resistance adequate for that particular field site.

Spot or strip treatments Rootstock selections available for rotation are limited. There is practical value to providing pest and disease relief for the first six months after planting. Spot treatments may include soil steaming as well as fuming products having reduced VOC issues. The value of these treatments is to provide root protection during the first year of plant growth, a period when successful root exploration is most critical. For more information visit the steaming heading of this web site.

Experiment #1This vineyard replanting involved 9 rootstocks, each genetically different from the previous Chardonnay roots with *Xiphinema index*, ring nematode and Grapevine Fan Leaf Virus present. No starvation activity performed adequately prior to this 1998 experiment. Note in the bar graph that when replanting onto O39-16 or 10-17A rootstocks there was no benefit to fumigating with either Telone II or methyl bromide. These two rootstocks tolerate rejection of RP. For the long term view O39-16 provides narrow nematode resistance while 10-17A provides broad nematode resistance but is quite sensitive to Grapevine Fan Leaf Virus.

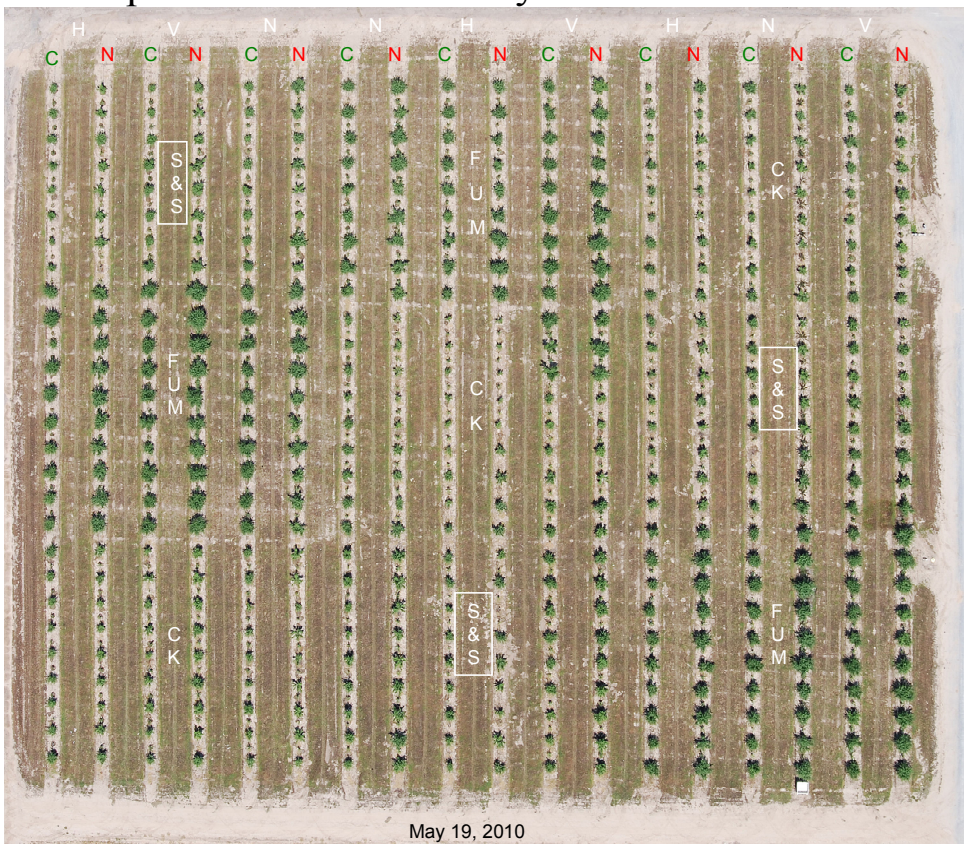
Chardonnay yield (kg/vine) of nine rootstocks in 2001 + 2002



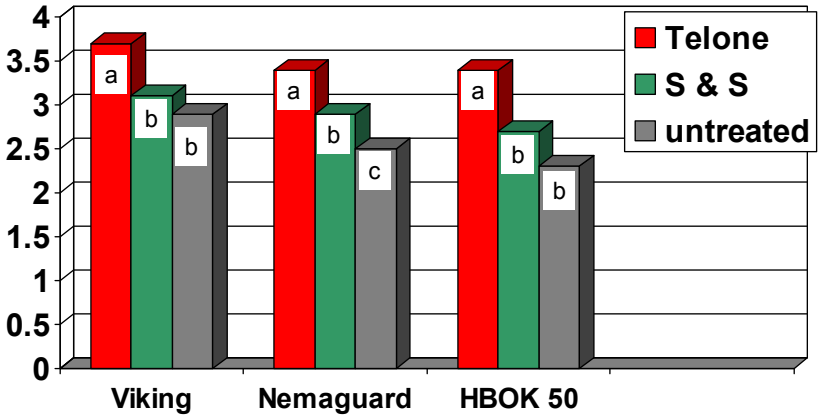
Experiment #2This almond/Nemaguard replant compared two rootstock choices. No known pathogens were present but pin nematode was at population levels in excess of 1,000/250 cc soil. To partially avoid the rejection component of RP we painted cut stumps with Roundup > waited one full year > replanted with Nemaguard (*Prunus persica*) compared to Hansen 536 (Okinawa peach x Titan almond).

Hansen 536 Nemaguard

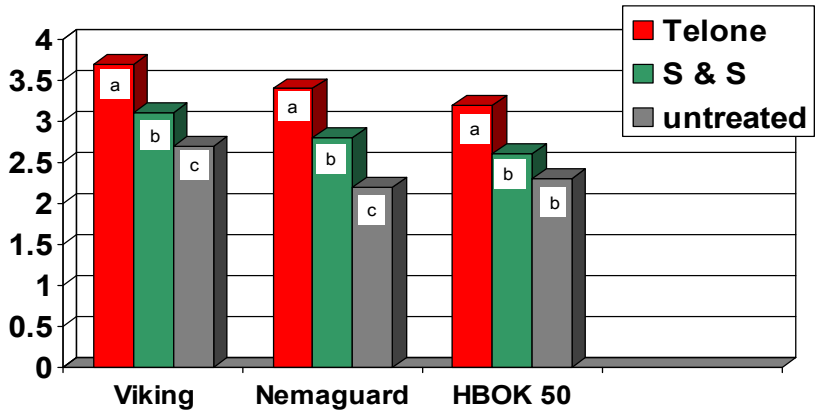
Experiment #3. This peach/Nemaguard setting was replanted to two almond cultivars (**C** = Carmel and **N** = Nonpareil) on three rootstocks (N = Nemaguard, V = Viking and H = HBOK-50) with the dominant pathogen being *Pratylenchus vulnus* in the presence of the rejection component of RP. Soil treatments included Fum = 332 lb/ac Telone II, S&S = Roundup + 1 yr and CK = untreated check. This photo was taken in May of the 2nd leaf.



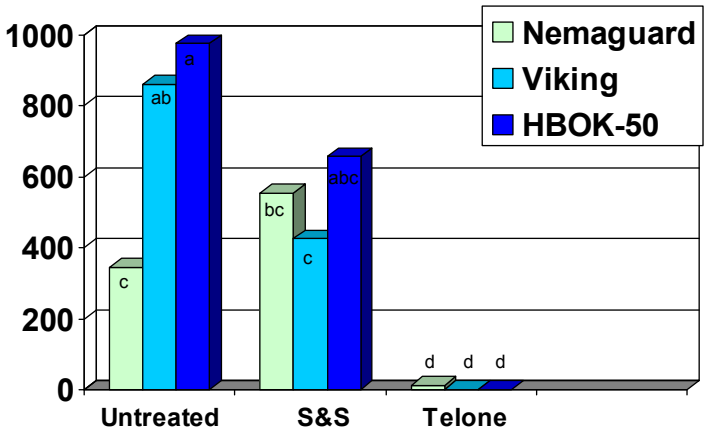
Starve & Switch-Nonpareil
first-year trunk diameter (cm)



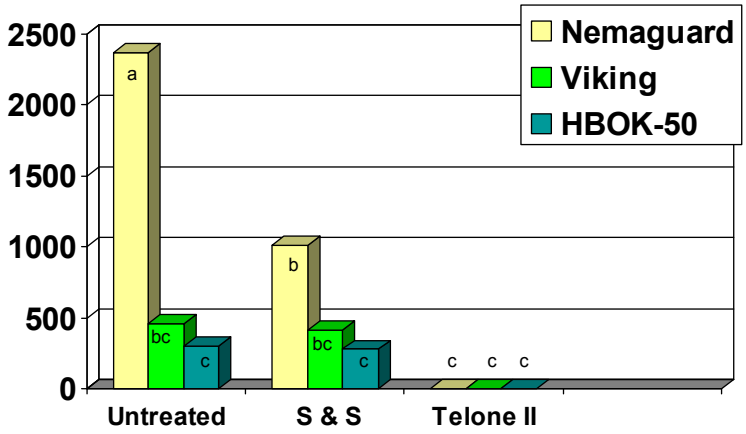
Starve & Switch-Carmel
first-year trunk diameter (cm)



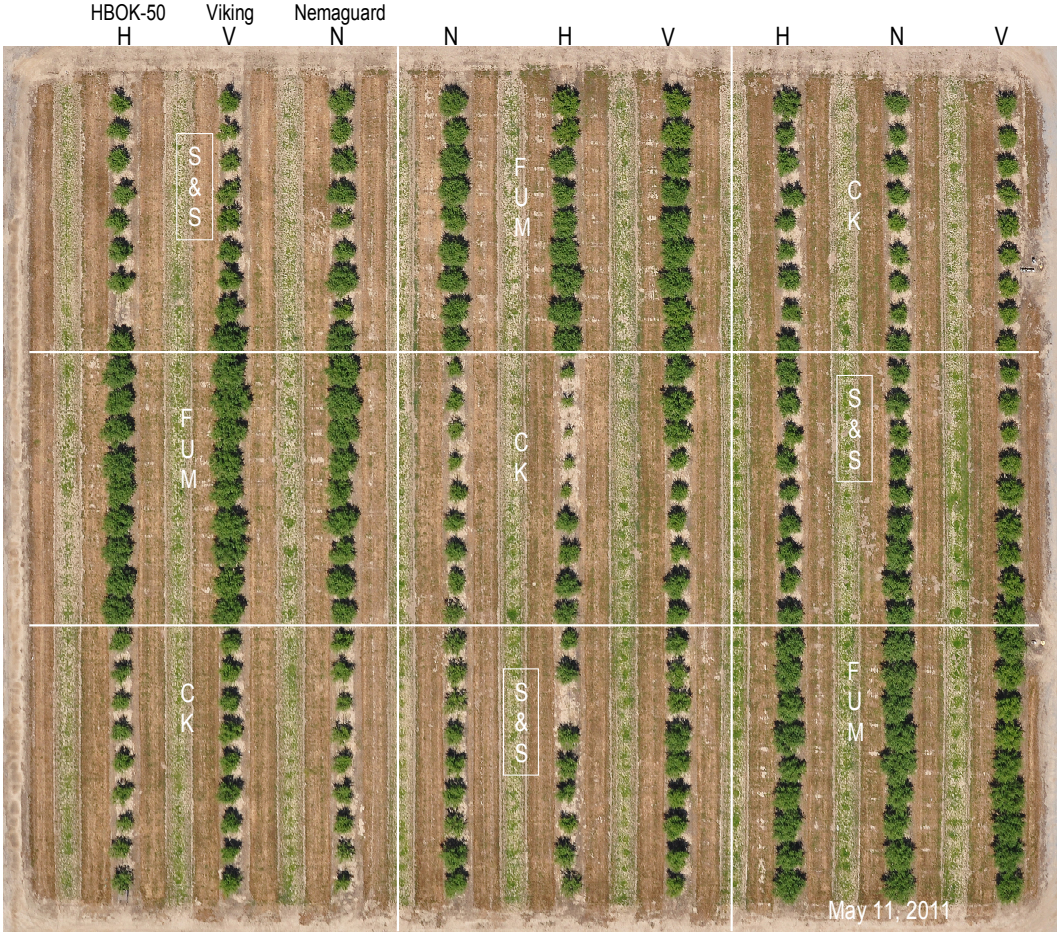
Root-lesion nematodes / 250 cc soil 14 mo after replanting 3 rootstocks into 3 field settings, with Nonpareil as the scion



Pin nematodes / 250 cc soil 14 mo after replanting 3 rootstocks into 3 field settings, with Nonpareil as the scion



Nonpareil almond replanted after Nemaguard using 3 rootstocks and 3 soil treatments

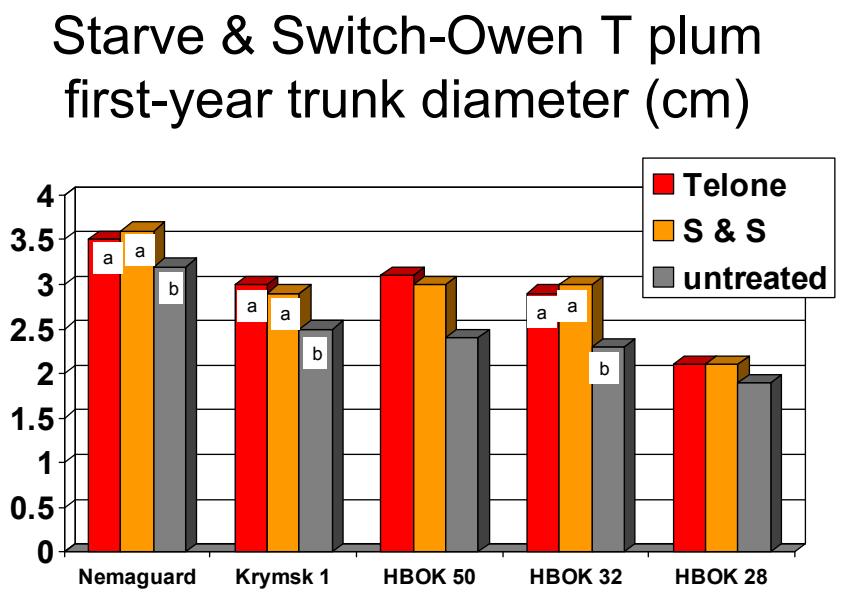


In this trial growth of Nemaguard rootstock was benefited by both starving and switching compared to the untreated. Rootstocks HBOK-50 and Viking received greatest growth benefit from switching away from Nemaguard rather than having the soil ecosystem starved. None of these rootstocks provides adequate relief from *Pratylenchus vulnus*.

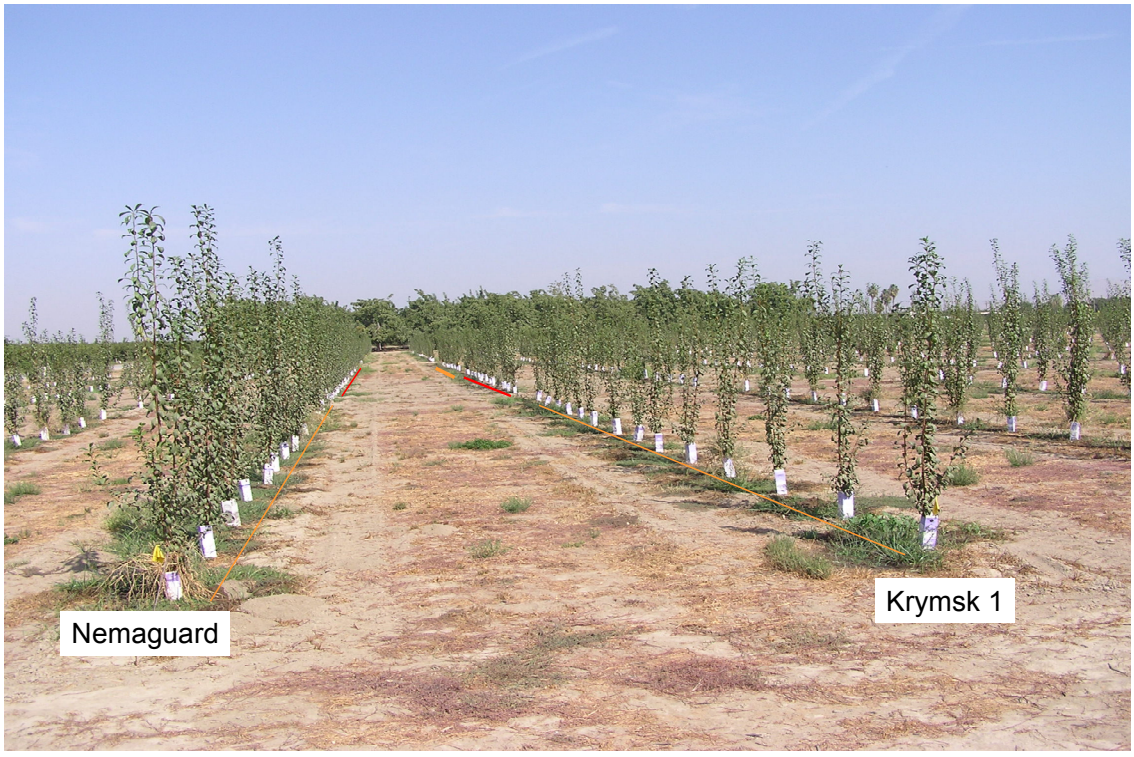
Experiment #4This plum/Nemaguard site was replanted to Owen T plum scion on five rootstocks. All plant parasitic nematodes including pin were essentially absent from this field but crown gall was occasionally present on remnant roots and it was most likely present within Krymsk 1 prior to planting.

Krymsk 1 is a hypersensitive host for Crown Gall

Provided by Jorge' Pinochet



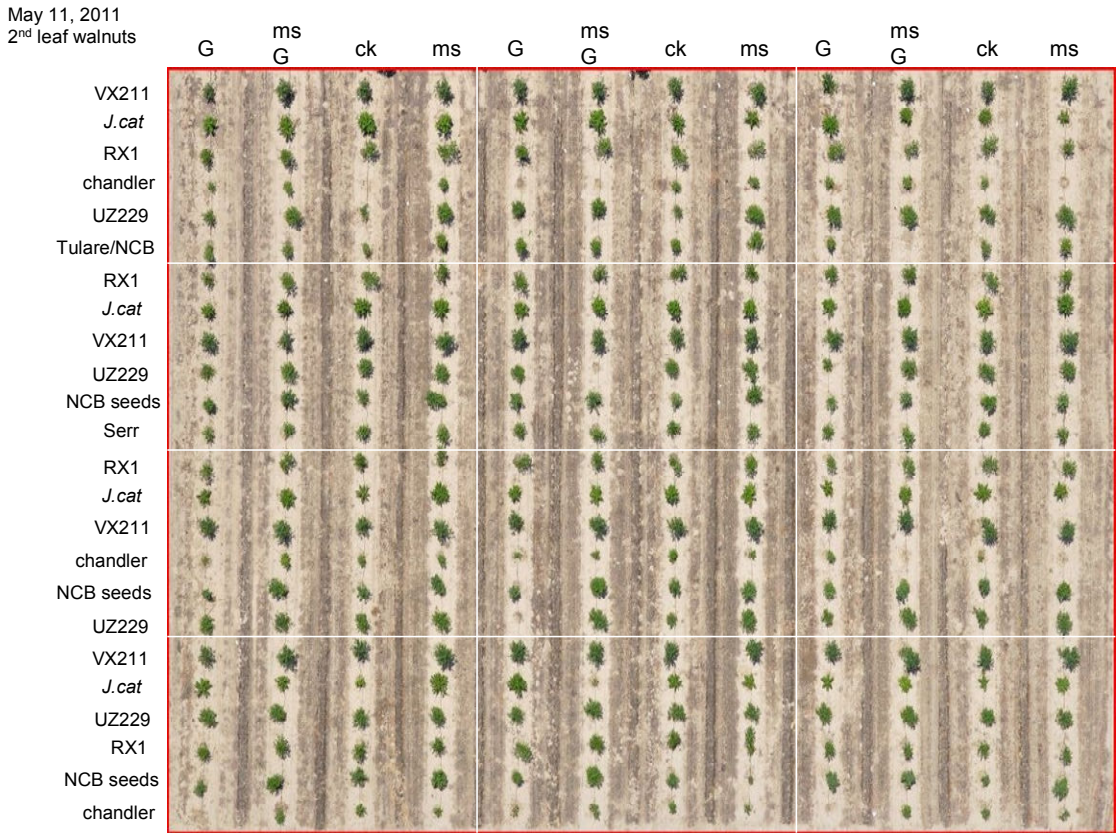
Owen T plum on Krymsk 1 and Nemaguard following S&S vs Telone II fume



Owen T plums replanted after 22 yr Nemaguard using 3 soil treatments then replanted with Krymsk1, Nemaguard, HBOK-32, HBOK 28 and HBOK-50. No rejection! No Nematodes!

In the 1999 text on the Replant Problem and its Management it is noted that nematode feeding might increase root leakage, the energy source for the entire soil ecosystem. Years ago it was documented that root knot nematode feeding can increase root leakage of tomatoes by 100-fold. Roots of the plum orchard previous to this one did not support nematodes and the rejection component of RP was not detectable. The field at Experiment #2 supported pin nematode. This weak pathogen caused enough root leakage to provide a good site to evaluate rootstocks for tolerance to the rejection that occurs following Nemaguard. The site at Experiment #3 showed the rejection component of RP in the first 1.5 years. The remaining 20 years for this orchard will be impacted by the pathogenic impact of *P. vulnus* on root systems half their normal size unless they were fumigated.

Experiment #5 Walnut trees growing on NCB rootstocks were infected by high populations of *Pratylenchus vulnus*. These were removed and replanted with six different clones or seedlings of walnut following a drench of metam sodium (ms), Garlon (G) systemic herbicide to cut trunks, both of the above treatments (msG) and an untreated (ck). Note that the NCB replants and to a degree the VX211 and UZ229 Paradox clones show greatest growth benefits due to fumigation.



First-year trunk diameters (cm), a measure of tolerance to rejection component of RP

Rootstock	*n*	non fumigated	Vapam drenched	% difference
UZ229, yr-1	12	1.92 a	2.35 b	+22%
VX211, yr-2	12	3.89 a	4.35 b	+12%
NCB seed, yr-1	9	3.50	4.02	+15%
Tulare/NCB yr-2	3	4.15	4.33	+4%
Serr, yr-2	3	2.97	3.15	+6%
Chandler, yr-1	9	1.53	1.62	+6%
J.cat seedling, yr-2	12	2.38	2.46	+3%
RX1, yr-2	12	3.16	3.23	+2%

At five rather large experimental sites we have demonstrated justification for considering the rejection component separate from the soil pest and disease component of RP. Although these terms are new this important distinction has been apparent for 60 years. Earlier researchers referred to this distinction as the General Replant Problem versus the Specific Replant Problem. However, there can be four or even five components to the replant problem; the fifth relating to allelopathy, so after 1999 this investigator saw reasons for further separation of RP.

These experimental sites encompassed rootstocks from Vitis, Juglans and Prunus. Even today this investigator does not believe there is a single pathogenic organism responsible for poor first year's growth occasioned by these three different genotypes. Rather, it is the entire soil ecosystem being fed by uniquely distinct root leachates. Microbes present in these more narrowly defined ecosystems are notably incompatible with new roots of similar genotype. We refer to it as the rejection component of RP. By separating RP components new remedies will appear faster.