Seventh Year Evaluation of 13 Almond Rootstocks in a Sandy Location With Nematodes

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Introduction:

This replicated trial was established on a site in Winton, CA in Atwater Sand in January 2011. The trial compares the performance of 'Nonpareil' on 13 rootstocks, and the performance of 'Fritz' and 'Monterey' on six rootstocks. Each rootstock and variety combination has six trees within a block, with six replicate blocks. Many of the rootstocks are peach/almond hybrids (P/A-Hybrids), a type of rootstock the grower developed an interest in after participating in a previous UCCE rootstock trial. Prior to planting, the site was cover cropped with Merced Rye, tree sites were back-hoed, and the row-strips were fumigated with Telone®-II (1,3-dichloropropene) at 33 gallons per acre. Trees are spaced 22'x18' and are irrigated using double-line drip. Soil was sampled for nematodes and found non-detectable levels of Ring, Lesion, and Root-knot nematodes. The rootstocks within this trial can be found in Table 1.

Table 1: The 13 rootstocks used within the 2011 rootstock trial located near Winton, CA.

Rootstocks planted on **Nonpareil, Fritz**, and **Monterey**	Rootstocks planted on **Nonpareil** only
Nemaguard	Rootpac-R
Hansen	TemproPac
BH5	Krymsk-86
Viking	Cornerstone*
Atlas	Cadamen*
Empyrean-1	BB106
	Floridaguard x Alnem (USDA)

* Trees were planted in late January 2011 with the exception of Cadamen and Cornerstone. These potted trees were planted in April 2011 and are only for tissue comparative and nematode studies.

Objectives:

Rootstocks were compared based growth, yield, nematode counts, leaf tissue, and irrigation water nutrient analysis, on a site characterized by low exchange capacity soil (with areas of shallow soils and hardpans), the potential for plant parasitic nematodes, and sodium and nitrate content in irrigation water. Much of this has been presented on in past reports. Current efforts are characterizing nematode populations and susceptibilities of the selected rootstocks.

Methods:

Soil mapping was done using Veris Electrical Conductivity Mapping (Strategic Farming, Inc.). Zones of soil differences were identified, analyzed, and used to help block the trial. Nematode samples were collected annually in October by sampling multiple plugs of soil within the irrigation zone of the tree. Soil was sampled at 4-18 in depths. Samples from the same rootstock and block were pooled and sent in for analysis by Nematodes, Inc. (Selma, CA). Nematode extraction with the sugar-sieve centrifugation method occurred using 500g of soil. This method tends to favor counts of Ring nematode, decreasing the count numbers of Root-knot and Lesion nematodes.

Results: Nonpareil Nematode analysis

Table 2: Ring nematode (*Mesocriconema xenoplax*) detected from soil sampled within the rootzone of 13 different rootstocks from the years 2011 through 2017. Soil samples were taken at 4-18 in depths from within the dripline of rootstocks grafted to 'Nonpareil'. Nematodes were isolated using the sieve and sugar centrifugation using a commercial lab.

	Ring nematodes per 500 grams of soil						
Rootstock	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Atlas	0	0	0	0	75	418	290
BB106	0	0	0	46	1	122	978
BH5	0	0	0	123	282	934	824
Cadaman	0	0	0	1	624	510	702
Cornerstone	0	0	0	0	150	610	861
Empyrean-1	0	0	0	0	229	91	630
Floridaguard x Alnem	0	0	0	12	656	774	2506
Hansen 536	0	0	1	1832	1066	470	1367
Krymsk-86	0	0	8	247	319	730	926
Nemaguard	0	0	0	0	8	230	265
Rootpac-R	0	0	0	0	530	1586	909
TemproPac	0	0	0	0	86	188	811
Viking	0	0	0	0	6	11	923

Table 3: Lesion nematode (*Pratylenchus vulnus*) detected from soil sampled within the rootzone of 13 different rootstocks from the years 2011 through 2017. Soil samples were taken at 4-18 in depths from within the dripline of rootstocks grafted to 'Nonpareil'. Nematodes were isolated using the sieve and sugar centrifugation using a commercial lab. This method reduces the counts of Lesion nematode, in which populations can be 8-10 times higher than what is found.

	Lesion nematodes per 500 grams of soil						
Rootstock	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Atlas	0	0	0	0	0	0	16
BB106	0	0	0	0	0	12	0
BH5	0	0	0	38	6	46	0
Cadaman	0	0	0	0	0	0	0
Cornerstone	0	311	31	0	2	13	51
Empyrean-1	0	0	0	0	0	0	29
Floridaguard x Alnem	0	0	0	0	0	0	0
Hansen 536	0	0	0	0	131	34	0
Krymsk-86	0	0	33	547	160	0	47
Nemaguard	0	0	0	0	0	0	0
Rootpac-R	0	0	0	9	33	2	25
TemproPac	0	0	0	34	26	0	0
Viking	0	0	0	0	41	55	26

Table 4: Root-knot nematode (*Meloidogyne* sp.) detected from soil sampled within the rootzone of 13 different rootstocks from the years 2011 through 2017. Soil samples were taken at 4-18 in depths from within the dripline of rootstocks grafted to 'Nonpareil'. Nematodes were isolated using the sieve and sugar centrifugation using a commercial lab. This method reduces the counts of Root-knot nematode, in which populations can be 8-10 times higher than what is found.

	Root-knot nematodes per 500 grams of soil						
Rootstock	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Atlas	0	0	0	0	0	0	0
BB106	0	0	0	0	0	0	0
BH5	0	0	0	0	0	0	0
Cadaman	0	0	0	0	0	0	0
Cornerstone	0	0	0	0	0	0	0
Empyrean-1	0	0	0	0	0	0	0
Floridaguard x Alnem	0	0	0	0	0	0	15
Hansen 536	0	0	0	0	0	0	0
Krymsk-86	0	0	1	131	88	13	312
Nemaguard	0	0	0	0	0	0	0
Rootpac-R	0	0	0	0	0	0	0
TemproPac	0	0	0	0	0	0	0
Viking	0	0	0	0	0	0	0

Discussion:

- Nematode counts varied across rootstocks (Tables 2-4). Sampling prior to planting in 2010 found non-detectable populations of plant parasitic nematodes, suggesting that the populations present are feeding and reproducing on the rootstocks.

- Even with fumigation, nematodes were detected within two years of plantings, with consistent detection among all rootstocks within four years. This suggests the limited ability of soil fumigation in long-term management of these pests and stresses the importance of selecting resistant rootstocks.

- Ring nematodes (*Mesocriconema xenoplax*) were detected in high levels across all rootstocks (Table 2). Populations levels do not indicate high levels of resistance, although some trees may be more tolerant of this pest.

- Lesion (*Pratylenchus vulnus*) nematodes have been consistently detected on Cornerstone, Krymsk-86, Rootpac-R, and Viking, even though other rootstocks do appear to host this nematode (Table 3). The damage threshold is unknown for Lesion nematode, and stunting may occur when other stressors are present (e.g., poor water management, other nematodes, etc.).

- Similar to other nematode sampling experiences, differences were not statistically significant due to high variability which obscure results.

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