

The pistachio industry has had the unique advantage of nematode resistance in their rootstocks. This source of resistance appears to have been partially lost.

Meanwhile, pre-plant soil fumigants are also being lost.

Table 1. Ranking of *Prunus* rootstocks against *M. incognita*



	A 2-year study		
	nematodes/gr root		
<i>Pistacia atlantica</i>	0		
Nemaguard	0		
Garnem	0		
Bright's Hybrid-4	0		
Julior	0		
Bright's Hybrid-1	0		
Hansen 536	0		
Flordaguard	0		
Torinel	0		
Empyrean 2	0		
Hiawatha	0		
Cornerstone	0		
Viking	0		
Empyrean 1	0		
Okinawa	0		
Cadaman	0		
Pumiselect	0		
Ishtara	0		
Monegro	0		
Atlas	0		
Nickels	0		
Flor x Alnem	0		
Krymsk 8	0		
RedGlow	0		
Citation	0		
MRS 2-8	0		
HBOK 50	0		
Flor x weep peach	0		
Bright's Hybrid-5	0		
HBOK-10	0.08		
Empyrean 101	0.29		
Empyrean 3	0.91		
Challenger 9	11.6		
Guardian	12.1		
Krymsk 1	15.9		
Paramount	17		
Lovell	31		
Krymsk 2	31.4		
Challenger 7	42.9		
Krymsk 86	51.6		
		P=0.05	



Table 2. Ranking of *Prunus* rootstocks against *P. vulnus*

	A 2-year study		Soil counts reported as a % of those on Nemaguard		
	nematodes/gr root	2-year trial		3-year field trial	7-year field trial
Krymsk 2	0.03	0.40%			
Krymsk 1	0.17	2.4			
<i>Pistacia atlantica</i>	0.2	2.8			
Garnem	0.3	4.2			
Bright's Hybrid -4	0.5	7			
Bright's Hybrid -5	0.6	8.4			
Hansen 536	0.61	8.6		22	187
Bright's Hybrid-1	0.63	8.9			189
Paramount	1.2	16.9			
Challenger 9	1.6	22.5			
Flordaguard	1.6	22.5			
HBOK-10	3.3	46			
Empyrean 2	5	70.4		294	
Torinel	5.3	75			
Guardian	6.2	87.3		111	138
Hiawatha	6.8	96			
Nemaguard	7.1	100		(actual # 1.8) 100	(actual # 305) 100
Lovell	7.4	104		411	247
Cornerstone	8.5				
Viking	8.9			211	100
Empyrean 1	9			1133	
Okinawa	9.7				
Cadaman	10.8			1344	
Krymsk 86	11				
Pumiselect	11.7				
Ishtara	13.7				
Citation	17.4				
Monegro	17.7				
Atlas	23.9			1177	204
Nickels	26.3			22	183
Flor x Alnem	27.2				
Krymsk 8	28.9				
Redglow	32.3				
MRS 2-8	37.7				
HBOK-50	39				
Flor x Weep peach	40				
Challenger 7	51.6				
Empyrean 101	57.6				
Julior	71.4			38,611	
Empyrean 3	72.8				
			P=0.05		

Is there resistance in *P. atlantica*?

Yes, we have evaluated numerous sources from numerous nurseries over the years and most individual trees show resistance. But there appears to be less resistance today than 2-3 decades ago. Which *P. atlantica* trees become a parent for UCB1?

Reasons for resistance loss?

- 1) Mixed nematode populations could result in resistance loss.
- 2) During the selection of parentage for *P. atlantica* and UCB1 some nematode susceptible parentage has been included?
- 3) New biotypes of *P. vulnus* and *Meloidogyne* spp have developed?

Actionable Items!!

- Obtain parentage sources of UCB1 and *P. atlantica* and identify those sources that still have resistance after 2 years.
- Screen these susceptible and resistant seed sources against populations of *P. vulnus* and *Meloidogyne* spp. already identified to be aggressive on Pistachio. Evaluations should be carried out with and without ring nematode in the mixture.

Evaluation of nematodes in 250 cc of sandy soil around UCB1 in Sept 2007

	1	2	3	4	mean
<i>P v</i>	202	231	540	354	332/250 cc soil
<i>C x</i>	363	1384	812	19	645/250 cc soil

Pistachios and nematodes, a chronology of recent findings

Michael McKenry

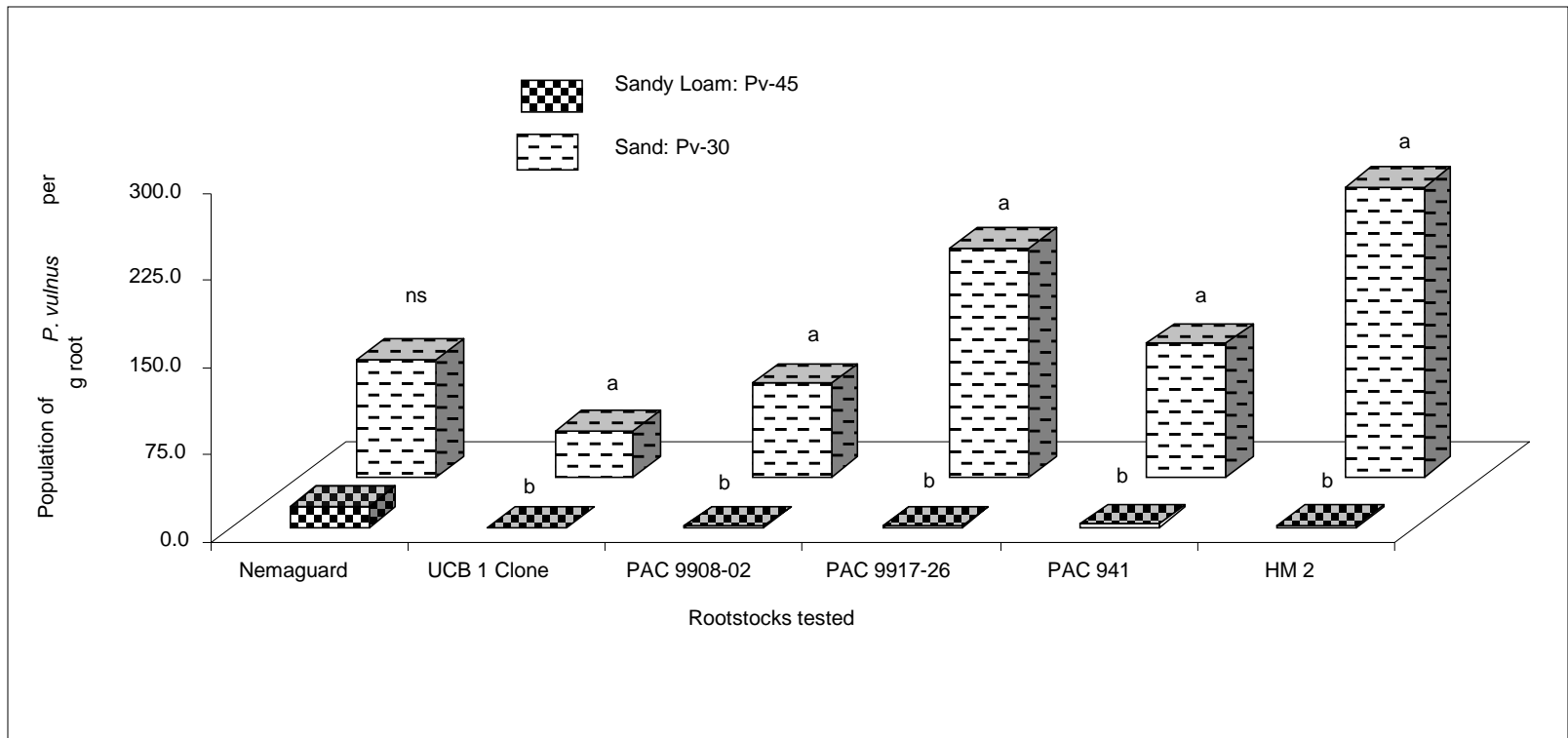
January 2008

January 2008 to January 2012

In 2008 I solicited grower input from field sites that might have nematode problems

- There was poor tree growth without presence of nematodes
- There was a new planting of UCB1 from Davis with abundant root galling but limited to 0.5% of the trees.
- Old vineyard or walnut orchards without soil fumigation can result in poor growth of pistachio

An aggressive biotype of *P. vulnus* in the presence of several new Prunus and UCB1 Pistachio rootstocks



Note: Although this aggressive population of *P. vulnus* broke resistance of UCB1 and all other Prunus listed it does not break resistance of Krymsk 1 Plum rootstock.

Are there aggressive root lesion
nematode populations?

YES

Does the presence of ring nematode
along with root lesion make root
lesion nematode more aggressive?

NO, it is the sand

Pv-45 nematodes/g root after 175 days

Sandy Loam Soil			
Year	rootstock-source	<i>Inoculum /tree</i>	<i>P. vulnus/g</i>
1989	<i>P. atlantica</i> -S	300	0.1
		3000	0.1
Sandy soil			
		150	62.1
		1500	71.4

Sandy soil in Spain*

Year	Rootstock-source (various sources)	Inoculum/tree	<i>P. vulnus</i> /g at 180d
1992	<i>P. terebinthus</i>	1000/tree	920
	<i>P. vera</i>	1000/tree	190
	<i>P. atlantica</i>	1000/tree	4160

* Report by Pinochet

Comparison of three pistachio rootstocks at 28 months after planting in 2010

Rootstock (seedlings)	<i>n</i>	<i>P. vulnus</i> /g fibrous root	DMRT
<i>P. atlantica</i>	5	6.9/g	ns
<i>P. integerrima</i>	5	20.1/g	
<i>P. terebinthus</i>	5	37.3/g	

These seedlings all from one nursery

Pv- 45: nematodes/g root in sandy loam soil

<i>Year</i>	Rootstock -source	<i>P. vulnus</i>	<i>M. incognita</i>
1997	<i>P. atlantica</i> -S	0.1	16.2
1998	<i>P. atlantica</i> -S	0.1	-----
2000	<i>P. atlantica</i> -S	2.3	0.95
2004	UCB1 -R	0.06	0
2004	Krymsk1 -D	0.17	65.0
2009	UCB1 -J	0.6	23.6
2009	UCB1 -J	0.07	0

Pv-30: nematodes/g root in sandy soil

Year	Rootstock -source	<i>P. vulnus</i>	<i>C. xenoplax</i>
2007	UCB1 -R	28.3 /g	60.7 / 250cc
2007	UCB1 -R	24.0	263
2007	UCB1 -R	117.	15
2007	UCB1 -R	30.6	-----
2007	UCB1 -R	331.7	644
2008	UCB1 -R	197	397
2009	UCB1 -J	324.6	75.8
2009	UCB1 -J	40.2	295

Pv-30 nematodes/g root in sandy soil
(continued)

Year	Rootstock - source	<i>P. vulnus</i>	<i>C. xenoplax</i>
2007	Krymsk1-D	0.5 /g root	85.0 /250 cc
2008	Krymsk1-D	1.7	819.0
2009	UCB1 -J	39.6	-----

P. vulnus (Pv-45) and *M. incognita* /
gram of root from 43 UCB1-R seedlings

nematode	Resist. 0 to 0.2	Mod. Resist. 0.21-0.6	Suscept. 0.61-180	High Suscept. 180+
<i>P. vulnus</i>	4 trees	2 trees	37 trees	1 tree
<i>M. incognita</i>	35 trees	2 trees	6 trees	0 trees

Top 6 trees for resistance to *Pv-45 P. vulnus* and *M. incognita*

Tree designation	<i>P. vulnus</i>	<i>M. incognita</i>
1-3-5A (<i>P. atlantica</i> '05)	0	39.6
1-3-3B (UCB1 '07)	0	0.19
1-3-4B (UCB1)	0	2.6
1-3-5B (UCB1)	0	6.6
1-3-2B (UCB1)	0.25	0
1-4-4D (UCB1)	0.30	0



Are there UCB1 rootstocks that resist aggressive root lesion nematode?

From 3 different sources of UCB1 we have a single tree from one nursery that appears resistant to common root lesion. In 2011 it was inoculated with our most aggressive root lesion nematode.

We will know its resistance level in fall 2012.

If it still shows resistance we will repeat our studies on five cloned trees before we call it resistant.

Today I have shown the process by which we find nematode resistant perennials

- We are now at a stopping point because there are not enough sources of *Pistacia* available to us.
- This type of work will not be done in petri plates. It needs to be done in sand with the aggressive nematode population.
- It will be plantings going into old orchards or vineyards on sandiest soil that are in jeopardy

Growers should expect:

P. vulnus, root-lesion nematode

Most UCB1 are susceptible

Probably all UCB1 are susceptible if aggressive Pv-30

M. incognita, root-knot nematode

Some percentage of UCB1 is susceptible

The industry needs pistachio rootstock parents that are resistant!