PEST CONTROL WITH CALIFORNIA APPROVED NURSERY STOCK CERTIFICATION 1,3-D TREATMENTS

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Introduction:

Nursery producers of perennial crops including fruit and nut trees, grapevines, and ornamentals in California rely on preplant soil fumigation to meet requirements for nematode free planting stock. Certification is essential for intrastate, interstate, and international commerce of planting stock. Current CDFA regulations provide very specific treatment schedules and fumigant rates for certification (CDFA 2008). If an approved nematode treatment is not used, expensive and laborious sampling is required; thus, in practice, virtually all nursery fields are fumigated prior to the nursery cycle.

Adoption of methyl bromide alternatives in the perennial crop nursery industry has been slow due to the required duration and depth of nematode control, stringent regulations, and high economic risks. For example, many tree, vine, and woody ornamentals are grown in the field for 14 to 26 months and may produce roots that penetrate 1.5 meters into the soil. The current threshold for parasitic nematodes in California nurseries is "detection". Thus, if parasitic nematodes are detected in a nursery block at the end of the growing cycle, the planting stock is non-saleable which can result in complete economic loss of a crop valued at over $75,000/ha.

The only non-MB fumigant that meets the requirements of the CDFA's Nursery Stock Nematode Certification program (CDFA 2007) is 1,3-dichloropropene (1,3-D). Some of the factors limiting the adoption of 1,3-D in perennial crop nurseries include:

- Not an approved nematode treatment in fine textured soils.
- Requires greater attention to soil preparation and moisture management.
- Township caps and buffer zone requirements.
- Weed control concerns.
- Air quality concerns related to volatile organic compounds (VOC).`

This project is part of the USDA-ARS Area Wide Pest Management Program for Methyl Bromide Alternatives and initially is focusing on increasing nematode control efficacy at deeper soil depths using a modified application shank and decreasing fumigant emissions with application methods and surface seal techniques in order to meet evolving state and federal air pollution regulations that are likely to affect future fumigation procedures. The specific objectives of this research are to:

1. Determine the effects of a modified Buessing shank on 1,3-D emissions compared to standard application shanks.
2. Demonstrate effective nematode control with currently approved 1,3-D fumigation treatments in field nursery situations and determine if VOC mitigation procedures affect efficacy.
3. Determine the effects of approved nursery treatments applied with Buessing or straight shanks and several surface treatments on weed, pathogen, and nematode control efficacy and crop growth parameters.

Materials and Methods:

Fumigation trials were conducted near Parlier, CA at the University of California Kearney Agricultural Center in October 2007 and at the USDA-ARS San Joaquin Valley Agricultural Sciences Center in September 2008 to evaluate 1,3-D emissions and pest control. Two additional trials are ongoing in commercial nurseries to evaluate pest control and nursery stock response to the selected treatments. A garden rose nursery trial near Wasco, CA fumigated in November 2007 will continue through the end of 2009 and a stonefruit tree nursery trial near Hickman, CA fumigated in August 2008 will continue though early 2010.

Each of the trials was designed as a randomized split plot experiment with three or four replicates and included an unfumigated control and a methyl bromide standard treatment. Eight 1,3-D treatments were arranged as split plots with four surface seal main plots (HDPE film, VIF film, Vapam cap, and intermittent water seal) and each 1,3-D main plot was split to test the effects of the two application rigs (Buessing shank rig and standard Telone rig). A detailed explanation of the Buessing shank can be found in McKenry et al (2003) and Hanson et al. (2007).

Methods and results from the fumigant emission portion of this project will be presented separately (see Qin et al in these proceedings). Pest control data collection in the emission and nursery trials includes: soil fungal population assays after fumigation, a bioassay with citrus nematodes, soil sampling for resident nematode survival, weed seed viability, resident weed emergence, and crop growth assessments.

Results and Conclusions:

Preliminary pest control data from the 2007 emission trial and the 2007-09 garden rose nursery trial are presented in Table 1. Pest control tended to be similar between the two injection shank designs. When surface treatments affected pest control, VIF tended to be the best followed by HDPE, Vapam cap, and intermittent water seals; however, these differences were not always statistically significant. Reductions in *Pythium* spp. populations generally greatest in the methyl bromide and tarped 1,3-D treatments while *Fusarium* spp. did not differ

among treatments. In the citrus nematode bioassay, no live nematodes were found in any fumigated plot at depths up to 92 cm. Total weed populations were low in the rose nursery trial due to an application of trifluralin at planting (2.24 kg/ha incorporated into beds). Yellow nutsedge emergence was variable; however, only methyl bromide and one of the VIF treatments had no detectable nutsedge emergence by early June 2008. In the Parlier emission trial, weed counts in January and March 2008 generally were lower in all treated plots compared to the control and tended to be lowest in the methyl bromide and tarped 1,3-D treatments.

The second emission trial will continue until early 2009 and the two nursery trials will continue through early 2010. Future research and demonstration projects related to this area wide research program will focus on technology transfer and best management practices to maintain the use of methyl bromide alternatives in an evolving regulatory environment.

Literature Cited:

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Table 1. Fumigation and surface seal treatments and pest control efficacy in two nursery fumigation field trials in 2007-09.

	Fumigation treatment[2]	Surface Treatment	Shank system[3]	Wasco Rose Nursery Trial[1]					Parlier Emission Trial				
				Pythium	Fusarium	Citrus nema	YNS 6-5-08	Total weeds 6-5-08	Pythium	Fusarium	Citrus nema	Total weeds 1-17-08	Total weeds 3-11-08
				CFU / g soil	CFU / g soil	# / 250cc	# / 30 m^2	# / 6.5 m^2	CFU / g soil	CFU / g soil	# / 250cc	# / m^2	# / m^2
1	Untrt	--	--	27	20	3146	3	3	188	138	3964	365	448
2	MeBr	HDPE tarp	Noble plow	0	0	0	0	2	0	0	0	1	21
3	1,3-D	HDPE tarp	Standard	2	0	0	4	4	4	85	0	29	44
4	1,3-D	HDPE tarp	Buessing	12	0	0	18	7	23	114	0	29	42
5	1,3-D	Vapam cap	Standard	17	0	0	6	4	17	51	0	27	85
6	1,3-D	Vapam cap	Buessing	18	3	0	2	15	13	83	0	148	117
7	1,3-D	Water seal	Standard	13	7	0	9	8	17	147	0	229	191
8	1,3-D	Water seal	Buessing	17	2	0	4	4	125	116	0	119	206
9	1,3-D	VIF	Standard	0	0	0	8	5	1	13	0	4	36
10	1,3-D	VIF	Buessing	8	0	0	0	5	7	25	0	8	43
LSD $_{(0.05)}$				15	12	94	ns	ns	41	ns	147	211	151

[1] Wasco rose nursery was treated with 2.24 kg/ha trifluralin at planting in December 2007; thus total weeds are relatively low. YNS is yellow nutsedge.

[2] Fumigation treatments: MeBr is methyl bromide/chloropicrin 98:2 applied at 392 kg/ha; 1,3-D is Telone II applied at 373 kg/ha.

[3] Buessing shanks were spaced 61 cm apart and split fumigant injection at 40 and 66 cm; the standard Telone rig had shanks spaced 51 cm apart and an injection depth of 40 cm.