TOLERANCE OF PINE SEEDLINGS TO SHANK-INJECTED NEMATICIDES

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In the southern United States, forest tree nurseries typically fumigate fields with combinations of MBr/Chloropicrin once every three or four years. Following two or three years of seedling production, fields are taken out of production for one to two additional years. Some nursery managers are aware of potential problems that can occur during the second year following fumigation (Cary and Bickerstaff). In some fields, seedlings become chlorotic and stunted by midsummer. Nursery managers indicate they have to "push" these seedlings (with additional fertilization) more than usual to produce a shippable seedling. As our Nursery Cooperative began to follow-up on these problems it became clear that nematodes were frequently associated with these symptoms.

Several soil fumigants may be applied prior to forming seedbeds the second year but soil samples have not always indicated a potential nematode problem. Also, the cost of applying a soil fumigant after the first crop is expensive. There are several possible reasons why nematodes are a problem during the second year. It may be due to a decrease in the amount of methyl bromide being used as a result of UN and EPA regulations. It may be due to less than optimum environmental conditions during fumigation. It could also be due to contamination by nursery equipment as they move from field to field. There are probably other reasons, but a limiting factor is that no nematicides are registered for treatment once pines have germinated and are established in the seedbed.

The study objectives were as follows:

1. Can nematicides be applied without killing established pines seedlings?
2. What rate of nematicides will effectively reduce nematode populations?
3. Will the nematocide treatment affect seedling quality?

Methods and Materials: Two studies were conducted at the Rayonier Regeneration Center in Glennville, GA. Table 1 describes the chemicals, rates tested and year of the test. Post-treatment sampling indicated that the most common nematode both years was the Stunt nematode (*Tylenchorhynchus sp*.).

At treatment, the seedlings were approximately 15 weeks old in the first study (2006) and 10 weeks old in the second (2008). Treatments plots (4 ft wide by 40 ft long) were laid out in a randomized complete block design with either 4 (2006) or 5 (2008) replications. In 2008 buffer plots were placed between all treatment plots and at least one buffer row between each replication.

In 2006, a Yetter coulter rig with five 36" coulters was used to shank inject the chemicals between seedling drills. This rig was difficult to adjust to a typical, 8-drill nursery bed and resulted in mechanical damage to seedlings and mortality. In 2008, Hendrix & Dail modified a lateral root pruner from the nursery by adding a device consisting of swept back fumigation knives and wheels to close the chisel trace. This device was not only easy to remove after the chemicals were applied, but it provided more uniform injection of the chemicals across the seedbed.

Following application of all the treatments, irrigation (a water seals of ¼-inch per application) was applied. The first irrigation was applied immediately following application and the second irrigation was applied later that day in early evening. Four weeks after treatment, soil samples were taken and a visual estimation of seedling death was recorded.

Results and Discussion: In 2006, all chemical treatments reduced nematode levels. Trilone® at 10 gal/a reduced the nematode populations by 92% with little variation among replications. None of the Trilone® nor MBC 70/30® rates resulted in seedling mortality.

In 2008, a systematic soil sampling method was used to obtain pre- and post-treatment nematode samples. This sampling method provided lower levels of nematodes than expected from observations of stunted seedlings. As a result, the population levels were not correlated with the visual damage. However, when we sampled bed areas in the control plots based upon degree of damage, population levels were higher. Accurately assessing nematode levels is difficult. Trilone® at 10 gal/acre and both levels of Paladin® reduced nematode levels consistently. Nematode levels in the control plot increase significantly from the time of application. No seedling mortality or damage was observed at the two rates of Trilone®. However, Paladin® at 400 lb/acre caused significant mortality. Paladin® at 300 lb/acre caused less mortality in addition to stunting of the seedlings. Final nematode levels, seedling densities and quality (RCD, height and root morphology) will be collected at the end of the growing season.

Since DMDS is considered as a viable soil fumigant compared to methyl bromide, it may be worth repeating this study with lower rates of DMDS. DMDS is possibly a broader spectrum soil fumigant than 1,3-D.

Cary, W.A. and G. Bickerstaff. 1999. Assessing stunt nematodes on pine seedling roots. Auburn University Southern Forest Nursery Management Cooperative Research Report 99-9. 4pp.

Table 1 Soil fumigants tested in 2006 and 2008 at Glennville, GA

Year	Treatment	Composition	Rate/acre
2006	Control	----	----
	Trilone II®	94% 1,3-Dichloropropene	5.0 gal
	Trilone II®	94% 1,3- Dichloropropene	7.5 gal
	Trilone II®	94% 1,3- Dichloropropene	10 gal
	MBC 70/30®	70% 98/2 Mbr/Chl & 30% solvent	50 lbs
	MBC 70/30®	70% 98/2 Mbr/Chl & 30% solvent	75 lbs
	MBC 70/30®	70% 98/2 Mbr/Chl & 30% solvent	100 lbs
2008	Control	----	----
	Trilone II®	94% 1,3- Dichloropropene	7.5 gal
	Trilone II®	94% 1,3- Dichloropropene	10 gal
	Paladin®	98.8% Dimethyl Disulfide	300 lb
	Paladin®	98.8% Dimethyl Disulfide	400 lb