IMPACTS OF ALTERNATIVE FUMIGANTS ON SOIL PEST CONTROL AND TOMATO YIELD

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During spring 2000, a single replicated field experiment was conducted to evaluate preplant applications of Propargyl bromide for control of yellow nutsedge, Cyperus esculentus, the southern root-knot nematode, Meloidogyne incognita, and resultant impacts on tomato plant growth and yield (cv FL 47). Treatments included broadcast equivalent propargyl bromide application rates of 40, 80,120, 160, and 200 lb/a compared with metham sodium (75 gal/a), Basamid (400 lb/a), methyl bromide 98/2 , Telone II (18 gal/a), Telone C17 (35 gal/a), Telone C35 (26 gal/a), and an untreated control. Propargyl bromide and all Telone soil injections were made using a Hamilton Gas Tight syringe installed with a 25 cm long stainless steel needle. After an appropriate soil aeration period, tomato plants were grown to maturity and harvested twice. Assessments of plant growth were made as appropriate during the course of the season to characterize differences in plant health and vigor. At each of two harvests, fruit was sorted and weighed into 3 size categories including medium, large, and extra large tomatoes. Following harvest, these same plants were cut at the soil line and the foliage weighed. Immediately after foliage removal the plants were uprooted and the root systems evaluated for root gall severity based on a visual rating scale of zero to ten. Final soil population density samples were then removed after root gall assessment.

All treatments were arranged within the experimental area as a completely randomized design with 9 replications per treatment. Five week old tomato transplants (cv.FL 47) were obtained from Speedling Corporation and planted within the microplots following treatment. Water and nutrients were supplied to each microplot via pressure regulated (15PSI) E-2 drip emitters (7.5 l/hr) on a daily/ twice daily basis (unless sufficient rainfall occurs) for a period of 1-2 hours each irrigation. Fertigation rates were seasonally defined based on crop growth stage. Fertilization rates were based on a field equivalent of 225 lbs NPK per acre per season. Other pest and disease control measures were maintained primarily on both a prophylactic and as needed basis. Following soil preparation, yellow nutsedge nutlets of uniform size and weight were seeded in a pentagonal (5 per microplot) pattern one-half inch deep into all microplots prior to chemical treatment. After the nutsedge was planted, each microplot was then covered with standard 1.25 mil polyethylene tarps. Following chemical treatment, nutsedge germination within each microplot were monitored and recorded on a weekly basis for the first month following treatment. Following tomato planting, all nutsedge plants which subsequently germinated were removed from microplots to avoid significant yield reducing influences.

Results:

All fumigant treatments produced significantly (P=0.05) greater total fruit weights of large

(6x6) and extra large (5x6) size fruit than the nematode infested, untreated control. With the exception of Metham sodium, Basamid, and Telone II, total fruit yield was increased over two fold by fumigant treatment. No significant (P=0.05) dose response relationship between Propargyl bromide application rate and fruit yield was observed for total fruit yield.

All fumigant treatments significantly (P=0.05) reduced final harvest root gall severity below that of the untreated control. Use of Basamid (400 lb/a) reduced root gall severity to an intermediate level compared to the untreated control and other fumigant treatments. No fumigant treatment completely eliminated final harvest root galling. Tomato yields were directly correlated with root gall severity. A significant (P=0.05) dose response relationship was observed between propargyl bromide application rate and level of root gall severity. The relationship between log10 propargyl bromide dose and root gall severity was linear and highly significant (P=0.0001). However, in separate analysis, no differences (P=0.594) in the level of root gall severity was observed between Propargyl bromide application rates at or above 80 lb/a.

Germination of yellow nutsedge nutlets baited to each microplot was near complete within the untreated control treatments (4.5 of 5 seeded nutlets germinated). Of all the fumigants, only Telone II failed to produce a significant (P=0.05) reduction in yellow nutsedge germination compared to the untreated control. Previous field research has repeatedly demonstrated the lack of significant herbicidal activity with Telone II. Combinations of 1,3 dichloropropene and chloropicrin (Telone C17 and Telone C35) did however enhance yellow nutsedge control compared either to Telone II or the untreated control. The relationship between log10 propargyl bromide dose and nutsedge germination was linear and highly significant (P=0.0001). Nutsedge germination was reduced (P=0.05) only 53% at the 40 lb/a propargyl bromide application rate compared to the untreated control. No differences (P=0.05) in nutsedge control (87% - 100%) was observed between propargyl bromide treatments when application rates were equal to or exceeded 80 lb/a.

GENERAL CONCLUSIONS:

1. Application rates of Propargyl bromide as low as 40 lb/a provided equivalent tomato yield to that of most alternative fumigants and to the nematode free controls produced by application of methyl bromide.

2. Propargyl bromide application rates between 40 and 80 lb/a was required to achieve effective control of the southern root-knot nematode, *Meloidogyne incognita*.

3. Propargyl bromide application rates between 40 and 80 lb/a was required to achieve effective control of yellow nutsedge seeded into the microplots.

4. Propargyl bromide effectively eliminated buried inoculum of *Fusarium oxysporum f.sp. lycopersici* Race 3 at application rates equal to or greater than 80 lbs/A.

5. Application rates between 40 and 100 lb/a should be examined more comprehensively for pest control efficacy and crop yield response.

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TABLE 1. Influence of various soil fumigant treatments on yellow nutsedge (Cyperus esculentus) germination, final harvest root gall severity caused by Meloidogyne incognita, and tomato yield (cv. Florida 47) in field microplots, CREC, Lake Alfred, FL, Spring 2000.

	TREATMENTS	Broadcast Equivalent Rate/Acre	No. NUTSEDGE GERMINATING (OF 5 SEEDED)	FRUIT YEILD (g / Plant)	ROOT GALL SEVERITY (0-8)
1	Nematode Free Control	---	0.2 c	5911.1 a	0.0 e
2	Metham Sodium	75 gal	0.0 c	5097.0 abcd	3.0 bc
3	Basamid (Dazomet)	400 lb	0.0 c	4235.0 d	4.9 b
4	Propargyl Bromide	40 lb	2.1 b	5569.8 ab	2.7 cd
5	Propargyl Bromide	80 lb	0.6 c	5349.3 abc	1.0 cde
6	Propargyl Bromide	120 lb	0.3 c	4884.6 bcd	1.6 cde
7	Propargyl Bromide	160 lb	0.0 c	5154.3 abcd	1.4 cde
8	Propargyl Bromide	200 lb	0.0 c	6015.6 a	0.9 de
9	Telone II	18 gal	4.1 a	4451.8 cd	2.8 cd
10	Telone C-17	35 gal	0.0 c	5429.9 ab	1.1 cde
11	Telone C-35	26 gal	0.1 c	5785.0 ab	0.7 de
12	Nematode Infested Control	----	4.5 a	2625.3 e	7.6 a
	LSD Value		0.6903	939.28	2.0945
	Probability Level		0.0001	0.0001	0.0001