ALTERNATIVE FUMIGANT EFFICACY ON WEEDS IN STRAWBERRY NURSERY AND FRUITING FIELDS

S. Fennimore * [1], M. Haar [2], and H. Ajwa [3]
[1,2]University of California-Davis, Salinas, CA 93905
[3]USDA-ARS, Water Management Research Laboratory, Fresno, CA 93727

Introduction

Strawberry nursery and fruit production systems require the development of alternative fumigants. Alternative fumigants in evaluation include chloropicrin alone (Pic), iodomethane plus chloropicrin mixture 50:50 (IM/Pic), 1,3-D plus chloropicrin mixture 65:35 (Telone C35, Inline), metam sodium and dazomet. The objective of the work reported here was to evaluate the weed control efficacy of alternative fumigants in both nursery and fruiting fields. Several shank-applied alternatives were evaluated at both low and high elevation nurseries. Immediate-term fumigants, i.e., Pic, Inline, metam sodium and Telone C35, were evaluated in 1 to 2 acre plots in commercial fruiting fields to estimate weeding costs.

Methods

Nursery fumigant evaluation. The weed control efficacy of alternative fumigants were compared to methyl bromide in the spring and summer of 2001 at a low elevation nursery at Ballico, CA and a high elevation nursery at MacDoel, CA. Native weed densities were taken periodically prior to cultivation or hand weeding events, and the time required to hand weed was measured. All fumigant doses are based on broadcast rates. At Ballico, IM/Pic was applied at 350 lbs. per acre (lb/A), and methyl bromide plus chloropicrin mixture (MB/Pic) 57:43, was applied at 400 lb/A on Apr. 5, 2001. Treatments applied at MacDoel were Pic at 300 lb/A followed by (fb) a sequential application of dazomet at 250 lb/A, Telone C35 (Tel C35) at 386 lb/A fb dazomet at 250 lb/A, IM/Pic at 350 lb/A, and MB/Pic at 400 lb/A. All treatments except dazomet were shank-injected on Aug. 26, 2000. Dazomet was applied with a granular spreader on Sept. 8, 2001.

The effects of alternative fumigants on weed seed viability were determined by burying weed seed samples at 5 cm deep in each plot prior to fumigation. Weed species tested were common chickweed (*Stellaria media*), common purslane (*Portulaca oleracea*), little mallow (*Malva parviflora*), prostrate knotweed (*Polygonum aviculare*) and strawberry seed (at Ballico only) prior to fumigation. About 7 days after fumigation the weed seed were removed and viability was tested in the lab using tetrazolium.

Large-scale fumigant evaluation at Oxnard. A study was initiated in August 2000 in a fruit production field near Oxnard, CA. Emulsified fumigants were applied through two drip lines per bed. Drip-applied treatments were: Pic plus an

emulsifier (Pic EC) at 327 lb/A and Inline at 355 lb/A. Shank-applied materials were Tel C35 at 400 lb/A, Pic at 200 lb/A and MBPic at 250 lb/A. A sequential application of metam sodium at 37 GPA was applied to one set of Inline, Pic, Pic EC and Tel C35 plots while no metam was applied to the other set. Metam sodium was applied 5 days after the initial drip- or shank-applied materials were injected. 'Camarosa' was planted Oct. 5 to 8, 2000. Treatments were applied in unreplicated 1 to 2 acre plots. Subplots, one bed wide by 100 ft. long, were established within each plot from which weed counts and weeding times were measured. Weed counts and weeding times were measured on Nov. 30, 2000, Jan. 30, Mar. 29, and May 24, 2001.

Results and discussion

Iodomethane evaluation in nursery production. At Ballico the effects of IM/Pic at 350 lb/A and MB/Pic at 400 lb/A were equivalent in reducing common chickweed, common purslane, prostrate knotweed, and strawberry seed (Table 1). At MacDoel, the alternative fumigants reduced common chickweed, common purslane and prostrate knotweed seed viability to levels that were equivalent to MB/Pic. None of the fumigants were active on little mallow at either location.

The effects of fumigants on emergence of native weed populations were evaluated by periodically measuring the density of each weed species. Common weeds at Ballico were carpetweed (*Mollugo verticillata*) and prostrate spurge (*Euphorbia humistrata*) (Table 2). Both IM/Pic and MB/Pic reduced carpetweed and prostrate spurge densities compared to the untreated. All fumigants tested at MacDoel reduced hairy nightshade and pigweed densities compared to the untreated, and all alternative fumigants were equivalent to MB/Pic (Table 3). Less time was required to hand weed plots treated with MB/Pic or IM/Pic at Ballico compared to untreated areas, and there were no differences in weeding time between MB/Pic and IM/Pic (Table 4). At MacDoel the weeding times were similar for all fumigants, and all fumigated plots had lower weeding times than the untreated plots.

Large-scale fumigant evaluation at Oxnard. Among the drip-applied treatments Pic EC alone was the weakest treatment (Table 5). Pic EC fb metam sodium significantly reduced the number of weeds per acre and the weeding time compared to Pic EC alone. Inline fb metam sodium did not provide better weed control or reduce weeding time compared to Inline alone. Shank-applied Pic alone provided an intermediate level of weed control both with and without a sequential application of metam sodium. A sequential application of metam sodium following shank applied Pic reduced weeding times. Shank-applied Tel C35 provided good weed control both with and without a sequential application of metam sodium. MB/Pic had the lowest number of weeds per acre and the lowest weeding times.

Table 1. The effect of alternative fumigants and MB/Pic on common chickweed, common purslane, little mallow, prostrate knotweed, and strawberry seed viability in strawberry nursery field tests at Ballico and MacDoel.

		Viable seed (%)				
Fumigant	Rate (lb./A)	Common chickweed	Common purslane	Little mallow	Prostrate knotweed	Strawberry seed
				Ballico		
IM/Pic 50:50	350	0.0	0.0	68.0	0.0	0.0
MB/Pic 67:33	400	0.5	0.5	59.5	0.0	0.0
Untreated	0	87.5	85.5	74.0	86.0	74.0
$LSD_{0.05}$		25.0	23.7	22.0	24.0	28.9
				MacDoel		
Pic fb[1] dazomet	300 fb[1] 250	0.3	0.2	85.9	0.1	--
Tel C35 fb[1] dazomet	386 fb[1] 250	0.0	1.1	78.0	0.3	--
IM/Pic 50:50	350	0.0	0.6	78.9	0.0	--
MB/Pic 67:33	400	0.0	0.1	69.7	2.2	--
Untreated	0	94.7	--	85.9	99.9	--
$LSD_{0.05}$		2.0	1.4	13.9	2.0	--

[1] fb = followed by

Table 2. The effect of IM/Pic and MB/Pic on native weed emergence at the Ballico low-elevation nursery. Weeds were counted on June 1 and July 23, 2001.

		Weed density no. m^{-2}	
Fumigant	Rate (lb./A)	Carpetweed	Prostrate spurge
IM/Pic 50:50	350	5.2	5.6
MB/Pic 67:33	400	4.0	3.2
Untreated	0	357.2	154.4
$LSD_{0.05}$		64.6	24.4

Table 3. The effect of IM/Pic and MB/Pic on native weed emergence at the MacDoel high-elevation nursery. Weeds were counted on May 18, June 21 and July 12, 2001.

		Weed density no. m^{-2}	
Fumigant	Rate (lb./A)	Hairy nightshade	Pigweed
Pic fb dazomet	300 fb 250	0.0	0.0
Tel C35 fb dazomet	386 fb 250	0.0	0.0
IM/Pic 50:50	350	0.0	0.3
MB/Pic 67:33	400	0.0	0.0
Untreated	0	10.0	6.3
$LSD_{0.05}$		2.9	1.6

Table 4. The cumulative time (hrs/A) required to hand-weed fumigant treatments at Ballico and MacDoel.

		Time required to hand-weed (hr/A)	
Fumigant	Rate (lb./A)	Ballico [1]	MacDoel [2]
Pic fb dazomet	300 fb 250	--	3.8
Tel C35 fb dazomet	386 fb 250	--	3.4
IM/Pic 50:50	350	6.8	3.8
MB/Pic 67:33	400	7.3	3.7
Untreated	0	30.4	19.1
$LSD_{0.05}$		4.8	6.5

1 Timed on Jun. 1, 2001
2 Timed on Jun. 21, and Jul. 12, 2001

Table 5: The number of weeds per acre and weeding times in the fumigant evaluation at Oxnard, CA.

Fumigant/ method[1]	Rate lb/A	Metam sodium[2]	No. weeds /A[3]	Weed time hr/A[3]
Pic EC/ drip	327	none	10,105 a	47.7 a
Pic EC/ drip	327	37 GPA	5,627 b	37.3 b
Inline drip	355	none	7,006 ab	35.3 bc
Inline drip	355	37 GPA	4,501 bc	38.1 b
Pic/ shank	200	none	7,950 ab	38.4 b
Pic/ shank	200	37 GPA	5,264 bc	28.7 c
Tel C35 shank	400	none	4,102 bc	28.8 c
Tel C35 shank	400	37 GPA	2,468 bc	27.7 c
MBPic shank	250	none	2,105 c	26.5 c
$LSD_{0.05}$			3,320	8.0

[1] Fumigants were applied either through the drip irrigation system, or via shank injection.
[2] Metam sodium was applied as a sequential application 5 days after the initial fumigation.
[3] Means within a column sharing the same letter(s) do not differ at P = 0.05