DRIP APPLIED ALTERNATIVES FOR FLORICULTURE PRODUCTION

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Cut flower growers in California have routinely used methyl bromide and chloropicrin for pre-plant soil fumigation to control soilborne pathogens and weeds. Because of the pending prohibition on methyl bromide production and import, alternative treatments will be required. Combinations of 1, 3-dichloropropene and chloropicrin, and of iodomethane and chloropicrin have been proposed as alterative to methyl bromide and chloropicrin. In June of 2004, three field trials were established near Goleta, Ca in flower production fields to test alternative treatments.

Fumigants and irrigation water were applied through three irrigation tapes evenly spaced over the width of the bed. The tape was Ro-Drip model 5-8-40 (Roberts Irrigation Products, San Marcos, CA) which delivers 496 LPH/100 m @ 0.69 bar and has emitters on a 20 cm spacing. All plots were covered with polyethylene sheeting (3 mil) before chemigation. All three trials contained the same four treatments: 1) 448 kg ha^{-1}methyl bromide + chloropicrin (50:50); 2) 448 kg ha^{-1} iodomethane + chloropicrin [50:50 (Midas; Arvesta, San Francisco)]; 3) 443 kg ha^{-1} 1, 3-dichloropropene + chloropicrin [61:33 (Inline; Dow AgroSciences, Indianapolis)]; and 4) a water control. All chemicals were emulsified by the formulator and the rates given are based on the active ingredient and bed width.

In all three trials the field was tilled and free of weeds before fumigation began. The beds were 91 cm wide and 122 cm between bed centers. Trial 1 was an open field, had plots 7 m long, and had 6 replications in a randomized complete block design. The soil was Baywood loamy sand (sand: 88%, silt: 3%, clay: 9%, organic matter: 1.9%). The treatments were applied on 22 June 2004 in 266 L of water per plot. Trials 2 and 3 were under shade, had plots 3 m long and had 5 replications in a randomized complete block design. The soil was Camarillo fine sandy loam (sand: 77%, silt: 12%, clay: 11%, organic matter: 2.0%). The treatments were made on 23 June 2004 in 106 L of water per plot.

Two weeks following treatment, 5 soil cores (2.5 cm x 15 cm) were collected from each plot in all trials. The soil samples from each plot were pooled, returned to the laboratory and allowed to dry at room temperature. Populations of *Pythium* spp. and *Fusarium oxysporum* were determined in each sample by dilution plating on selective media.

Four weeks after treatments, trial 1 was seeded with stock (*Matthiola* spp.), trial 2 was transplanted with seedlings of snapdragon (*Antirrhinum majus*), and trial 3 was planted with bulbs of Dutch iris (*Iris xiphium*).

Plant height was measured in trials 2 and 3 on 22 September 2004 and in trial 1 on 17 November 2004. Weed counts were made in all plots on 22 September. Stem rot, caused by *Sclerotinia sclerotiorum*, appeared in trial 1 and counts of infection centers were made on 2 December 2004.

The results indicate that all the chemical treatments reduced the populations of *Pythium* spp. relative to the control plots (Tables 1-3), but there were no significant differences among the three chemical treatments. *F. oxysporum* was more difficult to control. Only in trial 3 did the iodomethane + chloropicrin treatments significantly reduce the population of this soilborne fungus. All three chemical treatments significantly reduced the number of weeds in trial 1 (Table 1). Weed pressure was extremely light in trials 2 and 3 and there were no differences among treatments (data not shown). Plant height was not significantly different among any treatment for all 3 trials, but the control consistently had the lowest value in all three trials (Tables 1-3). In trial 1 stem rot was not significantly reduced by any of the treatments.

At this time the iodomethane + chloropicrin treatment is not registered for use on flower crops; the 1, 3-dichloropropene + chloropicrin treatment is registered for use on flower crops, but only at a maximum rate of 237 kg ha^{-1}; a higher rate is needed for these crops.

In conclusion, these two alternative treatments appear to perform as well as the standard methyl bromide + chloropicrin treatments. Weed and pathogen pressures in these trials were extremely light and the evaluation under more strenuous conditions is warranted.

Table 1. Populations of *Pythium* spp. and *Fusarium oxysporum* in soil samples, weed counts, plant height, and counts of sclerotinia stem rot infection centers in a stock trial treated by drip irrigation with various chemical combinations in Goleta, CA in June 2004 (values are the average of six plots).

Treatment[z]	*Pythium* spp. (cfu/g soil)	*F. oxysporum* (cfu/g soil)	Total weeds[y]	Plant height (cm)[x]	Stem rot (no.)
Control	10.0	306	5.2	29.5	1.2
MB/CP	0.0	374	1.3	34.3	0.7
DP/CP	0.0	128	2.5	32.0	0.5
IM/CP	0.0	119	1.2	34.7	1.5
P	0.0003	0.0686	0.0275	0.2539	0.3477
LSD	4.3		2.8		

[z]Treatments included (control) water, (MB/CP) methyl bromide + chloropicrin (50:50) at 448 kg ha^{-1}, (DP/CP) 1, 3-dichloropropene + chloropicrin (61:33) at 443 kg ha^{-1}, and (IM:CP) iodomethane + chloropicrin (50:50) at 448 kg ha^{-1}.

[y]Weed counts were made on 22 September 2004.

[x]Plant height was measured on 17 November 2004.

Table 2. Populations of *Pythium* spp. and *Fusarium oxysporum* in soil samples, and plant height in a snapdragon trial treated by drip irrigation with various chemical combinations in Goleta, CA in June 2004 (values are the average of five plots).

Treatment[z]	*Pythium* spp. (cfu/g soil)	*F. oxysporum* (cfu/g soil)	Plant height (cm)[y]
Control	34.4	1151	87.4
MB/CP	0.8	793	86.6
DP/CP	3.2	520	88.0
IM/CP	1.6	647	87.2
P	<0.0001	0.1281	0.9706
LSD	7.8		

[z]Treatments included (control) water, (MB/CP) methyl bromide + chloropicrin (50:50) at 448 kg ha^{-1}, (DP/CP) 1, 3-dichloropropene + chloropicrin (61:33) at 443 kg ha^{-1}, and (IM:CP) iodomethane + chloropicrin (50:50) at 448 kg ha^{-1}.

[y]Plant height was measured on 17 November 2004.

Table 3. Populations of *Pythium* spp. and *Fusarium oxysporum* in soil samples, and plant height in a Dutch iris trial treated by drip irrigation with various chemical combinations in Goleta, CA in June 2004 (values are the average of five plots).

Treatment[z]	*Pythium* spp. (cfu/g soil)	*F. oxysporum* (cfu/g soil)	Plant height (cm)[y]
Control	22.4	984	74.4
MB/CP	0.0	985	80.6
DP/CP	0.0	574	79.4
IM/CP	0.0	472	77.8
P	0.0454	0.0495	0.5232
LSD	18.1	444	

[z]Treatments included (control) water, (MB/CP) methyl bromide + chloropicrin (50:50) at 448 kg ha^{-1}, (DP/CP) 1, 3-dichloropropene + chloropicrin (61:33) at 443 kg ha^{-1}, and (IM:CP) iodomethane + chloropicrin (50:50) at 448 kg ha^{-1}.

[y]Plant height was measured on 17 November 2004.