SOIL FUMIGATION FOR LIATRIS PRODUCTION

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Liatris spicata (L.) Willd. also known as gay feather is grown commercially in California in open fields as a cut flower. Many weed species can quickly overgrow the sparse canopy of the crop. It is susceptible to several soil borne pathogens, including *Sclerotinia sclerotiorum*, which causes stem rot. Pre-plant soil fumigation with a 67/33 formulation methyl bromide/chloropicrin is commonly employed as a means of weed and disease control. The soil is usually fumigated using shank application with a polyethylene tarp over the soil. Two experiments were established to evaluate alternative fumigants applied through drip irrigation tape for Liatris production.

Experiments in the fall 2002 and fall 2003 were initiated in a field belonging to Hilltop Flowers located approximately 11 km south east of Carpinteria, CA. The field is composed of Pico sandy loam (2 to 9 % slope; sand: 58%, silt: 25%, clay: 17%; o.m.: 1.7%). The field was tilled and free of weeds before fumigation began. Plot design was a randomized complete block with 6 replications. Four beds (91 cm wide and 122 cm between bed centers) were utilized for each trial. Fumigants and irrigation water were applied through 4 irrigation tapes evenly spaced over the width of the bed, and buried approximately 2 cm deep. The tape was Ro-Drip model 5-8-40 (Roberts Irrigation Products, San Marcos, CA) which delivers 508 LPH/100 m @ 0.69 bar and has emitters on a 20 cm spacing. All plots were covered with polyethylene sheeting before chemigation. All data were analyzed by the SAS software system (PROC GLM) and means were separated by Fisher's Protected LSD, as indicated by the error bars in the charts.

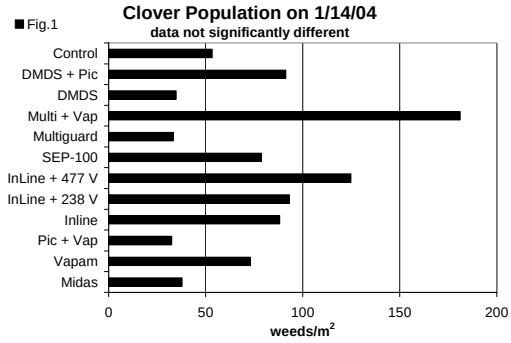
The 2002 trial included 8 treatments: (1) 448 kg/ha Midas (28.5% Iodomethane + 66.5% chloropicrin), (2) 336 kg /ha Chloropicrin, (3) 577 kg/ha InLine (60.8% 1,3-dichloropropene + 33.3% chloropicrin), (4) 560 kg/ha SEP-100 (20% Sodium azide), (5) 477 kg/ha Vapam HL, (42% Metham sodium), (6) 672 kg/ha Multiguard FFA (75%) furfural + 25% allyl isothiocyanate), (7) 672 kg/ha Multiguard Protect + Vapam (50% furfural + 50% Vapam) and (8) a non-treated control. The materials were applied in 50 mm of water. The applications were made on 18 & 19 November 2002 with half the treatments made on each day. The soil temperature at the time of application was 14°C. The Liatris corms were transplanted the last week of December. Data from this trial were reported in last year's proceedings and will be compared with the recent trial.

The 2003 trial, in a different area or the same field, included 12 treatments: (1) 448 kg/ha Midas (47.5% Iodomethane + 47.5% chloropicrin), (2) 477 kg/h Vapam HL, (3) 336 kg per Chloropicrin followed a week later with 477 kg/ha Vapam, (4) 251 kg/ha InLine, (5) 251 kg/ha InLine followed a week later with

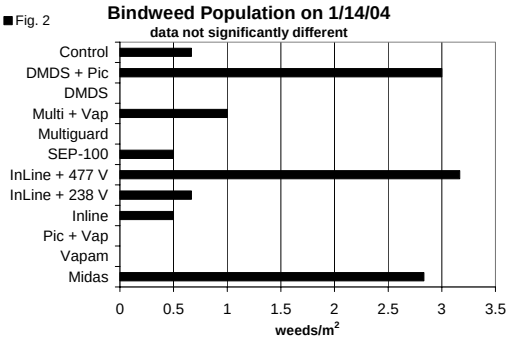
238 kg/ha Vapam, (6) 251 kg/ha InLine followed a week later with 477 kg/ha Vapam, (7) 560 kg/ha SEP-100, (8) 672 kg/ha Multiguard Protect , (9) 672 kg/ha Multiguard Protect + Vapam(50%-50%), (10) 448 kg/ha dimethyl disulfide (DMDS), (11) 448 kg/ha DMDS + Vapam (50%-50%), and (12) a non-treated control. The materials were applied in 38 mm of water on 7 November 2003. The soil temperature at the time of application was 17°C. The sequential applications of Vapam were made on 14 November in 13 mm of water. The trial was planted with corms on 24 November 2003. On 14 January 2004 weed counts were made 1 square meter in each plot. Weed pressure was extremely heavy in this trial and weed control was poor among all treatments. The average weed counts are presented in Figures 1-9. Mostly no significant differences were present between treatments. The grass counts indicated that the DMDS and Multiguard alone treatments were larger than the non-treated control. Significant differences were observed for average *Pythium ultimum* populations (Fig 10). The Midas, Chloropicrin plus Vapam, Multiguard plus Vapam, and Vapam alone had the lowest *P. ultimum* counts. Multiguard alone, SEP-100, DMDS plus chloropicrin, and DMDS alone did not control *Pythium ultimum*. The soil assays for *Fusarium oxysporum* showed very few differences with the non-treated control actually having the lowest counts (Fig. 11). Final data was collected on 6 April 2004. On this date no significant difference existed for percent weed covered as estimated visually (Fig. 12). Plant vigor, visually rated on a scale of 1-5, was greater than the non-treated control for all treatments except for Multiguard alone, Vapam alone, InLine alone, and the 2 DMDS treatments Fig. (13). Average plant height was significantly greater than the non-treated control for all treatments except for the 2 Multiguard treatments and the DMDS alone treatment (Fig. 14.). The average numbers of salable stems counted in 1 square meter of each plot were not significantly different between any of the treatments (Fig.15). The trial was concluded at this point.

The best drip applied fumigants did a good job of controlling *P. ultimum* both years. This organism seems particularly easy to control with these chemicals. Control of *F. oxysporum* seems more difficult with better results the first year compared to the second. No stem rot caused by to *S. sclerotiorum* appeared in the second year so control of this disease could not be evaluated. Weed control, although better the first year, was not adequate for either trial. Weed pressure was much greater in the second year and control of it was minimal. Even the sequential application a week apart did a poor job of controlling weeds. Over all, at this point I feel that some of the alternative chemicals do a fair job at disease control, but weed control is proving more difficult. No in-season herbicides are available for a crop like Liatris, and growing this crop without methyl bromide is going to be difficult. Pre-irrigation and the sequential applications of chemicals will probably improve weed control, but these techniques take the land out of production for a longer period of time. The work is continuing.

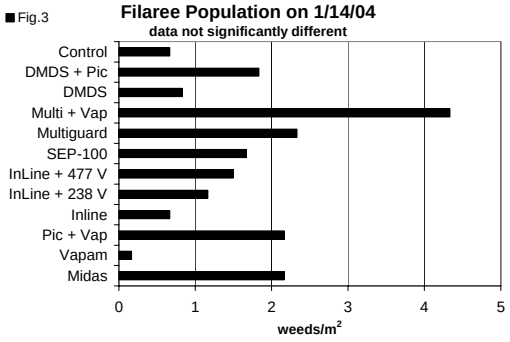
■Fig.1



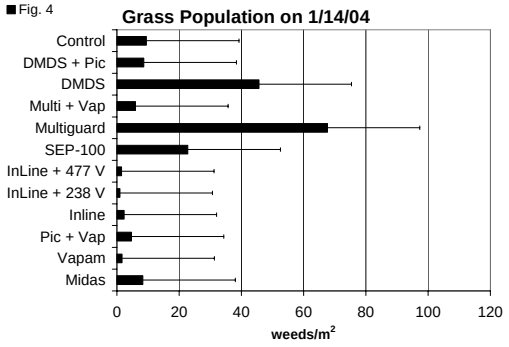
■Fig. 2



■Fig.3



■Fig. 4



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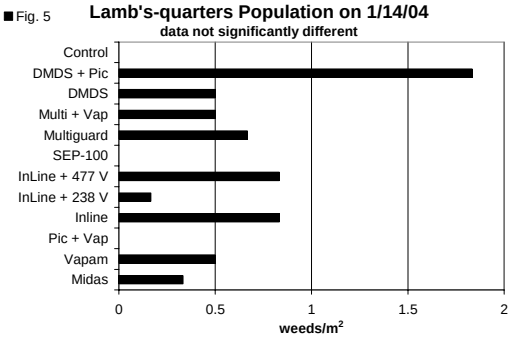

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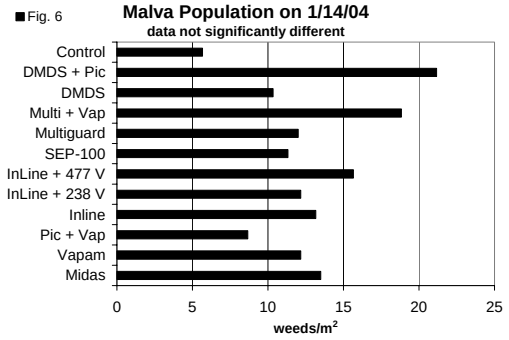

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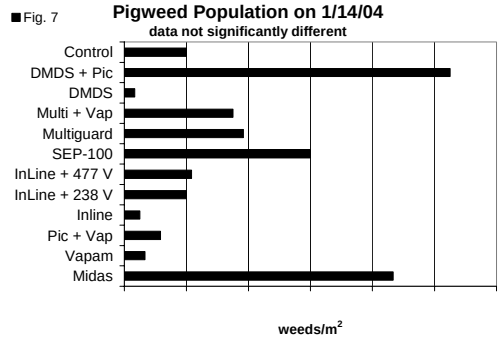

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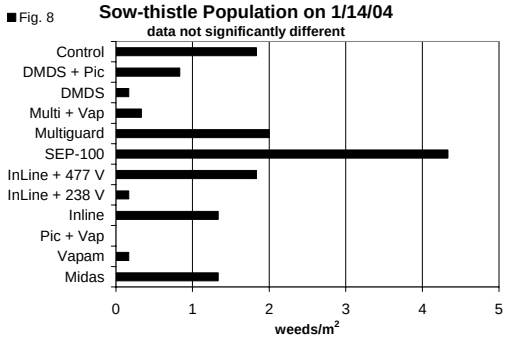


Fig 9

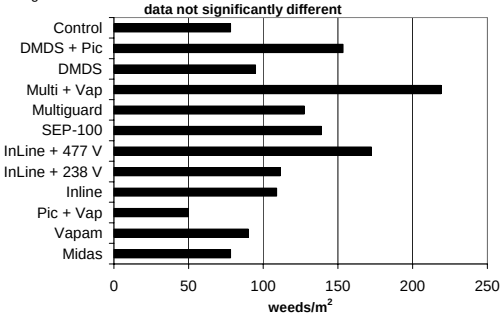
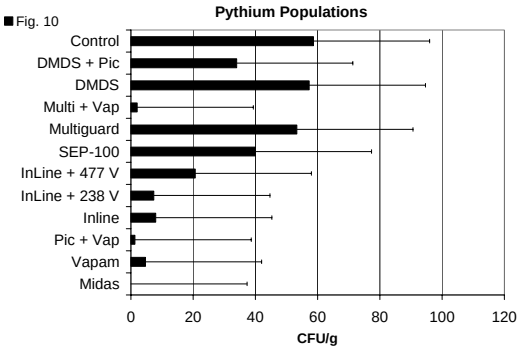


Fig. 10



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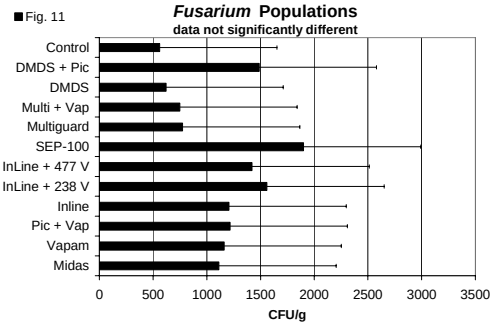

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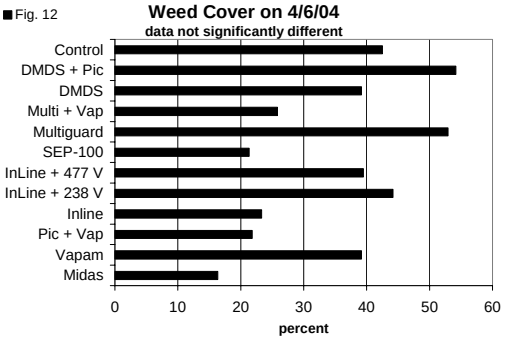

Fig.13

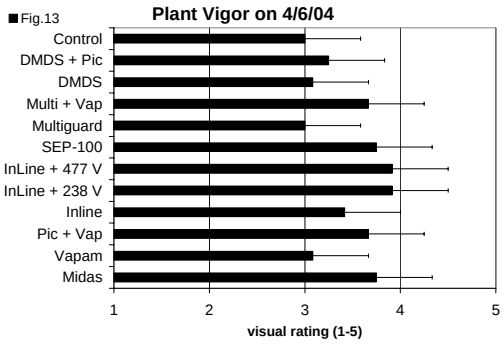

Fig.14

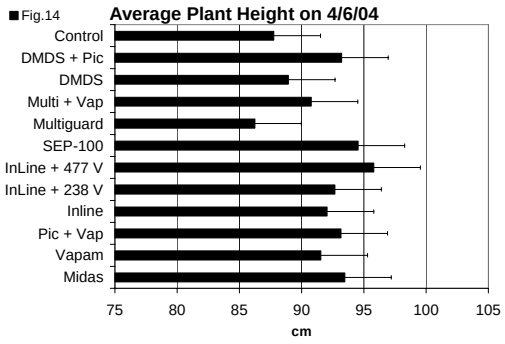

Fig. 15