# CHEMICAL ALTERNATIVES TO METHYL BROMIDE FOR FLORIDA ORNAMENTAL PRODUCTION

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This project is a cooperative effort among USDA, ARS and University of Florida researchers, Florida in-ground ornamental producers, and fumigant industry representatives. Funding is provided through the USDA-ARS Area-wide Pest Management Program for Alternatives to Methyl Bromide. The ornamental industry faces unique problems with respect to implementation of alternatives to methyl bromide for soil fumigation. Problems include proximity to urban areas, use of flat fumigation requiring gluing of wide VIF tarps, and large varieties of crops and cultivars produced, making development of disease and nematode resistance difficult, and necessitating control of rogues in successive crops. Studies were designed to test the efficacy of the available chemical alternatives, Midas™ (iodomethane:chloropicrin (pic) 50:50 [MI 50:50] and 98:2 [MI98:2], Arysta LifeScience Corp., Cary, NC) and dimethyl disulfide:pic (Paladin™ 79:21 [DMDS], United Phosphorous, Inc., King of Prussia, PA) compared with methyl bromide (MeBr). All fumigants were applied with standard equipment by commercial applicators. Trials were conducted in two locations in commercial cut flower and caladium production fields. Studies were replicated, randomized complete blocks with split plots to accommodate multiple cultivars. Treatments were applied in exactly the same plots over multiple seasons. Two years of research on delphinium has been completed, with the second year of trials on caladium on-going. The delphinium trial was performed in Hobe Sound, FL, and treatments were MeBr 400lb/A (98:2), MI 50:50 at 300 lb/A, and DMDS (79:21) at 74 gal/A. Treatments were replicated three times with each main plot measuring 26' x 110'. Plots were split to contain two rows each of delphinium cultivars 'Belladonna' and 'Bellamosum'. All materials were applied by commercial applicators using standard broadcast application equipment and 1 mil clear plastic mulch (Cadillac). A second study on caladium was located in Zolfo Springs, FL. Preliminary data was collected from a trial conducted by the grower which included a standard application of MeBr (360 lb/A of 89.5:10.5 MeBr:pic) compared to MI 50:50 (300 lb/A) and DMDS (79:21 at 74 gal/A). All materials were applied as previously described with the addition of a prefumigation deep shank application of Telone C-35 at 12-14" over the entire test area. Each treatment was replicated four times and each plot ranged from 0.23 to 0.28 A, and were planted to the cultivar Candidum Senior. The first year of the area-wide trial at Zolfo Springs included two formulations of MI 98:2 (100 lb/A) and MI 50:50 (160 lb/A), DMDS (79:21 at 60 gal/A), and MeBr:pic (98:2 at 180 lb/A), all applied under high barrier, Blockade® plastic mulch (Pliant Corp., Chippewa Falls, WI) using raised beds. A deep shank application of Telone C-35 was

applied as previously described. Each treatment was replicated four times and split into sub-plots planted to four cultivars. In all trials, nematode and fungal populations were assessed prior to fumigation, two-to-five days following tarp removal, at mid-season, and at harvest. In-field disease ratings were performed as needed through the season, continuing through root condition ratings at harvest. Plots were harvested by the growers. Dominant weed species were identified and time-to-weed data was collected by the growers. Galling was assessed and nematodes were extracted from roots at harvest.

In the delphinium trial there were no significant differences between treatments with regard to total weeding time. Cultivar 'Bellamosum' had significantly higher germination than the 'Belladonna', but this was not related to soil treatment. 'Bellamosum' plants in the MI 50:50 treatments were the fastest growing plants, but early in the season there were a greater number of cut stems harvested from the MeBr and DMDS 'Bellamosum' plots than in the Midas plots. This trend did not continue to the end of the season, when total cuts and average number of cuts per plant did not differ between treatments. There were no significant populations of root-knot or other parasitic nematodes at the Hobe Sound location in either year 1 or 2 and no galling occurred on roots in any treatment in either season.

In the initial caladium trial conducted by the grower, there were no differences among MeBr, Midas, and DMDS treatments in total weeds/A, total rogues/A, and total hours to weed. In addition, the numbers of root-knot nematodes (RKN) in soil prior to harvest were similar in all treatments. Total yield/A was higher in MeBr compared to DMDS. Based on both quantity and quality of bulbs, only MeBr provided a profitable return. In year 1 of the caladium trial, pretest, post-Telone, and post fumigation soil populations of RKN taken January '08 to April '08 were near zero and did not differ among treatments. RKN populations began to rebound in soil by July but did not differ among treatments. By November '08, RKN populations had substantially rebounded in all treatments to the same degree. However, cultivars differed in their level of infestation in soil and roots with significant interactions among cultivars and fumigants. 'Sweetheart' and 'Candidum Senior' sustained the highest levels of RKN in soil and roots, and the highest levels of galling in all fumigants, with 'John Peed' and 'Pink Beauty' having less galling and lower RKN numbers in soil and roots. Total fungal cfu in soil did not differ among treatments immediately following fumigation, however, there were significant cultivar by fumigant interaction with high fungal populations in 'Sweetheart' planted in MeBr treated soil. No differences occurred among fumigants for total weeds/A, total rogues/A, and total weeding time/A. Although higher populations of soil fungi were isolated from plots planted with 'Sweetheart', this variety had the lowest levels of *Pythium* isolated from roots, and highest number of tubers harvested/A and highest yield/A in the first year of this study. Data collection from the current caladium trial is in progress. A full-field demonstration trial using MI 98:2 has also been established for the

production of multiple cut flower species.  In that application, the use of VIF film was accomplished with standard tarp glue.