'Fernleaf' and *Dendrocalamus membranaceus* samples ranged from 0.406 to 0.516 (mean = 0.456) and from 0.109 to 0.122 (mean = 0.112), respectively. While the healthy values were relatively high, the absorbance values of the infected plants were nevertheless at least two times the value of the healthy controls. Absorbance values from two to four times greater than the values of the healthy controls are commonly considered to be positive (Sutula et al., 1986).

Strong positive reactions were observed when sap from both infected bamboo species was blotted directly onto nitrocellulose membranes and incubated with bamboo mosaic virus antiserum. No reactions were observed between healthy bamboo sap and the bamboo mosaic virus antiserum, however.

Whereas bamboo mosaic virus has probably been present in the United States for many years, this is apparently the first definitive report of bamboo mosaic virus in Florida and only the second in the United States. The two infected bamboo species indexed in July 1993 had been imported from Taiwan and grown (apparently in quarantine) in California prior to being sold to collectors in Florida. Lin et al. (1995) also detected this virus in *Bambusa beecheyana* Munro growing at another location in California.

Inasmuch as this virus is mechanically transmitted, and bamboos are primarily propagated by division, the incidence of bamboo mosaic virus-infected plants is likely to increase. Due to the reproductive habits of bamboos, growers rarely have the opportunity to start virus free plants from seed. *Bambusa beecheyana*, a popular variety which is apparently widely infected with this virus, flowered and set seed several years ago, thereby providing the opportunity for growers to start healthy plants. Unfortunately "old generation", apparently virus-infected plants, are still being sold. Given the small numbers of growers and plants available in Florida, eradication is a possibility. However, growers are understandably reluctant to destroy their infected stock, and only a few have destroyed their virus-infected *B. dolichoclada* and *D. latiflorus* 'Mei Nung' plants. The best recourse to this situation is to follow good horticultural techniques such as isolating infected stock and using sterile cutting tools.

Bamboo mosaic virus symptoms range from very mild mosaic and striping on leaves to culm abortion. Thus, plant inspectors and quarantine officials may have difficulty identifying virus-infected plants. Careful inspection throughout the quarantine period is therefore necessary to prevent the importation of additional virus-infected bamboo species and varieties.

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PRELIMINARY INVESTIGATIONS WITH FUMIGANT ALTERNATIVES TO METHYL BROMIDE IN FLORICULTURAL CROPS[1]

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Abstract. **Dazomet, chloropicrin, 1,3-dichloropropene + chloropicrin, and metam-sodium were compared to methyl bromide combined with chloropicrin for weed control and crop response in preliminary field research with gladiolus (*Gladiolus* × *hortulanus* L.) and sunflower (*Helianthus annuus* L.) during 1995-96. Purple nutsedge (*Cyperus rotundus* L.) was controlled with methyl bromide, metam-sodium and dazomet. White clover (*Trifolium repens* L.) was controlled by chloropicrin and 1,3-dichloropropene + chloropicrin early in the winter; however, the time required to remove weeds manually from plots was greater with these two fumigants than with methyl bromide and was not different from the weeding time recorded**

for nonfumigated soil. Metam-sodium and dazomet generally produced higher yields of cut flowers than treatments containing chloropicrin.

Methyl bromide combined with chloropicrin for soil fumigation has been an important component of the cultural practices for most of the cut flowers produced in Florida for many years. The excellent efficacy of methyl bromide as a soil fumigant is well documented (Bewick, 1989); however, it also is a potential atmospheric ozone depletor (Methyl Bromide Technical Options Committee - UNEP, 1995). The relative contribution of agricultural uses of methyl bromide to the global atmospheric concentration is debatable, but the U.S. E.P.A. has decided to ban methyl bromide as a soil fumigant soon after the beginning of the next century. This action is in response to international agreements related to ozone depletors and in response to our own Clean Air Act. Although some groups believe this ban will be rescinded and methyl bromide will remain available for agricultural users, recent conversations with E.P.A. officials indicate that the agency remains committed to their present position.

Use of methyl bromide in ornamentals for soil fumigation was estimated as 3.7 million pounds in the United States in 1990 (U.S. Dept. Agr., 1993). This represents approximately 8% of the methyl bromide used in the United States for soil fumigation. A large percentage of this quantity is used in Florida. The impact of the loss of a reliable soil fumigant in ornamentals has been estimated to cost $5,414 per acre for hand weeding at the minimum wage of $4.50 per hour for 1303 hours per acre, assuming labor is available. Additionally, the annual U.S. economic loss associated with the loss of methyl bromide in ornamentals has been estimated to exceed $170 million, a figure considered conservative by many. Only 623 acres of the total 3,713 acres in the six state study area, representing 80% of the methyl bromide used in the U.S., was reported as Florida ornamental acreage and this figure is probably very conservative. This represents at least a $28.5 million annual loss to the Florida ornamental industry.

Control of weeds, soil-borne pathogens, and nematodes is very important in the production of cut flowers. Production of gladiolus is especially susceptible to the effects of soil-borne pests, as the crop is grown for both the flowers and corms. Since the planting stock is carried from season to season and pests can be carried externally or internally with the cormels and corms, it is important that soil-borne pests be controlled or maintained at minimum levels (Overman, 1985; Magie, 1958). Pest control is even more important in the production of corms from cormels because the smaller plants resulting from cormels are much more detrimentally affected by the deleterious effects of weeds and other pests (Gilreath, 1986). Sunflower is a relatively new cut flower and no information is available on its response to soil fumigation under Florida conditions.

Research was conducted during the fall of 1995 and the spring of 1996 to evaluate fumigant alternatives to methyl bromide for use in field-grown gladiolus and sunflower. The principal focus of this research was to assess the efficacy of these materials on purple nutsedge (*Cyperus rotundus* L.) and white clover (*Trifolium repens* L.) and the direct and indirect effects these soil fumigants might have on the crops.

Materials and Methods

Two experiments were conducted. A fall study concentrated on weed control and crop response, while a spring study predominately investigated crop response. The soil in the test area was an EauGallie fine sand with 0.7% organic matter and a pH of 6.9. Beds (6 to 8 inches tall and 30 inches wide) were constructed on 5 foot centers. Prior to fumigation, slow release fertilizer (Meister, 14N-6.2P-11.6K (14-14-14), a 4 to 6 month formulation) was incorporated into the bed at a rate of 180 lb N per acre. Treatments (Table 1) were assigned to 70-foot long, single row plots arranged in a randomized complete block design and were replicated 5 times.

Methyl bromide/chloropicrin (MBC, 67% methyl bromide and 33% chloropicrin), chloropicrin and 1,3-dichloropropene + chloropicrin (Telone C-17) were applied with a pressurized (nitrogen gas) system. Liquid fumigant was applied 8 inches deep into the bed through 3 knives or chisels per bed as the bed was formed with a bedder/press combination unit. Fumigant rate was controlled by a flow meter and ball valve system. Sodium methyldithiocarbamate (metam-sodium, Vapam HL) was sprayed in a 5-foot swath with a 6 nozzle, tractor mounted boom which delivered 75 gal/acre. Metam-sodium was incorporated 6 to 8 inches deep with a tractor powered rototiller immediately after application to the bed surface. Once incorporated, beds were reshaped with the bedder/press unit and were covered with white (fall) or black (spring) polyethylene mulch film. Tetrahydro dimethyl thiadiazinethione (dazomet, Basamid) was preweighed, applied manually to the bed surface, incorporated 6 to 8 inches deep and covered with mulch similar to metam-sodium. Beds were covered with polyethylene mulch within 1 minute of application of methyl bromide, chloropicrin and Telone C-17, and within 1 minute of rototilling metam-sodium and dazomet. Soil moisture content was approximately 16% by weight at the time of fumigant application in each experiment. Soil temperature at the 6- inch level was approximately 88F in the fall experiment (21 Sep. 1995) and 68F in the spring (21 Feb. 1996).

Mulch film was removed from the plots for gladiolus and sunflower just prior to planting on 21 Nov. in the fall experiment and 18 Apr. in the spring. 'Manatee White' gladiolus corms (30 number two size corms in the fall and 26 in the spring) were planted 4 inches apart in a single row. Ten sunflower plants were transplanted 1 foot apart in a single row in each plot. Plants were sprayed weekly on a preventative fungicide program and as needed for insect pests.

Crop plant stand counts and vigor ratings were made 61 and 67 days after planting in the fall and spring, respectively. Weed control was evaluated in the first experiment but not in the second. Weeds were less of a factor in the second experiment because plots were cultivated and received shielded applications of paraquat to reduce the effects of weeds on crop plant growth. The predominant weeds in the experimental area of the fall experiment were counted in four 1 ft^2 samples per plot 110 days after fumigant application or 47 days after planting and plastic removal from sections of each plot planted to gladiolus and sunflower. Plots were hand weeded twice (55 and 117 days after planting) in the first experiment and the time required was recorded for each treatment plot.

Crop plant vigor was evaluated visually with a 0 to 100% scale, where excellent plant growth represented 100% and 0% indicated that the plants were dead. Gladiolus flower spikes were harvested twice weekly, counted, weighed and the spike length was measured. Sunflower inflorescences and stems were harvested once, counted and weighed and the stem length and head diameter were recorded. Data were subjected to analysis of variance, and treatment means were

Table 1. Effect of fumigants on gladiolus and sunflower plant stand and vigor during the fall and spring experiments. Bradenton, FL.

		Number of plants per plot				Plant vigor[z] (%)			
	Rate (lb or gal/acre)	Fall 1995		Spring 1996		Fall 1995		Spring 1996	
Fumigant		Gladiolus	Sunflower	Gladiolus	Sunflower	Gladiolus	Sunflower	Gladiolus	Sunflower
Nontreated	0.0	30a[y]	9a	11.8a	4.8a	90a	80a	60abc	25b
MBC	350 lb	30a	9a	8.8a	6.4a	93a	83a	41c	44b
Chloropicrin	350 lb	30a	8a	5.0a	4.6a	96a	65a	44c	23b
Metam-sodium	75 gal	30a	10a	12.0a	8.6a	93a	84a	75ab	87a
Dazomet	400 lb	30a	10a	12.0a	7.8a	91a	84a	79a	84a
Telone C-17	35 gal	30a	10a	5.0a	5.6a	93a	69a	53bc	23b

[z]Plant vigor was evaluated on a 0 to 100% scale, where optimum plant growth was represented by 100% and 0% indicated the plants were dead.
[y]Treatment means within column followed by the same letter are not significantly different at the 5% level as determined by Duncan's new multiple range test.

ranked by Duncan's multiple range test at the 5% level of significance.

Results and Discussion

Fall experiment. Gladiolus and sunflower plant stand and plant vigor were not affected by treatment in the fall of 1995 (Table 1); however, flower production was influenced by treatment (Table 2). Neither the number nor weight of gladiolus flower spikes was affected, but spike length was greater with MBC and dazomet than in areas not treated with a soil fumigant. There was no difference in spike length among fumigant treatments. The number of sunflower inflorescences cut was not affected by fumigation; however, weight of the resultant inflorescences and stems was less with Telone C-17 and chloropicrin than with MBC.

Purple nutsedge (*Cyperus rotundus* L.) and white clover (*Trifolium repens* L.) were the two most populous weeds in this experiment when evaluated 110 days after fumigant application and 47 days after mulch film removal. MBC, metam-sodium, and dazomet reduced the number of purple nutsedge plants, whereas significantly more nutsedge was observed in areas treated with chloropicrin than in areas receiving other fumigants (Table 3). White clover was not controlled by any fumigant and populations were higher in areas treated with MBC, metam-sodium and dazomet than where no fumigant was applied or where the soil was treated with chloropicrin or Telone C-17. Several other broadleaf weeds were present in the field, but not in sufficient quantity to enumerate by species. Control of these miscellaneous species was effected by MBC, metam-sodium and dazomet. Less time was required to remove weeds from plots treated with MBC, metam-sodium and dazomet than from those receiving no fumigant. Less time was required with MBC than with chloropicrin or Telone C-17.

Spring experiment. Gladiolus plant stand and vigor were poor in the second experiment due to the cold weather which occurred during the spring of 1996 (Table 1). Gladiolus and sunflower plant stand were not affected by treatment. Gladiolus vigor was reduced by MBC, chloropicrin and Telone C-17 compared to dazomet. Soil fumigation with metam-sodium or dazomet resulted in significantly more vigorous sunflower plants than application of the other fumigants or no fumigant. More gladiolus flower spikes were produced in plots treated with dazomet than with MBC, chloropicrin or Telone C-17 and the weight of spikes produced was greatest with dazomet and metam-sodium (Table 2). Spike length also was influenced by treatment. Gladiolus plants growing in areas treated with dazomet produced longer spikes than plants in areas which received chloropicrin, but were not different from those receiving other treatments.

Sunflower production also was influenced by fumigant treatment (Table 2). More inflorescences were harvested from plants growing in soil treated with metam-sodium or dazomet than with any other treatment, except MBC. The weight of these inflorescences and stems was greater with metam-sodium and dazomet than with any other treatment, including MBC. Stem length and inflorescence diameter were greater with metam-sodium and dazomet than with all other treatments, except MBC.

Weed control varied depending upon weed species and fumigant. Whereas MBC, metam-sodium and dazomet reduced nutsedge populations, these same fumigants increased white clover, which can be a very serious problem in cut flowers during the winter months. Overall, the shortest weeding times were recorded where soil was fumigated with MBC,

Table 2. Effect of fumigant on production of cut flowers of gladiolus and sunflower during the fall and spring experiments. Bradenton, FL.

		Gladiolus flower spikes/plot						Sunflower inflorescences/plot					
		Fall 1995			Spring 1996			Fall 1995		Spring 1996			
Fumigant	Rate (lb or gal/acre)	No.	Wt. (lb)	Length (inches)	No.	Wt. (lb)	Length (inches)	No.	Wt. (lb)	No.	Wt. (lb)	Height (inches)	Diam (inches)
Nontreated	0.0	4.5a[z]	0.8a	35.3b	8.8ab	1.4b	29.0ab	7.4a	5.7abc	2.8b	3.7b	12.7b	1.6b
MBC	350 lb	4.0a	1.1a	42.0a	6.6b	1.1b	36.0ab	9.0a	7.2a	5.2ab	8.5b	23.8ab	3.2ab
Chloropicrin	350 lb	5.2a	1.2a	37.4ab	5.8b	0.8b	21.6b	8.0a	5.1bc	2.4b	3.7b	12.2b	1.7b
Metam-sodium	75 gal	6.8a	1.6a	39.2ab	15.6ab	4.0a	42.9ab	10.0a	5.9abc	8.8a	33.6a	41.4a	6.0a
Dazomet	400 lb	3.8a	1.0a	42.1a	17.6a	3.7a	53.1a	10.0a	6.4ab	7.2a	23.9a	36.5a	5.2a
Telone C-17	35 gal	4.2a	1.2a	38.9ab	7.0b	1.4b	30.2ab	10.0a	4.3c	2.2b	6.8b	14.6b	1.9b

[z]Treatment means followed by the same letter are not significantly different at the 5% level as determined by Duncan's new multiple range test.

Table 3. Effect of fumigant on weed population 110 days after application (47 days after planting) and on the total time required to manually remove weeds from plots of gladiolus and sunflower during the fall experiment. Bradenton, FL.

Fumigant	Rate (lb or gal/acre)	No. of plants/ft² Nutsedge	Clover	Broadleaf	Total[z] weeding time (Minutes/plot)
Nontreated	0.0	8.5ab[y]	10.2b	2.1a	17.2a
MBC	350 lb	0.1c	15.1a	0.0c	11.3c
Chloropicrin	350 lb	11.4a	8.5b	1.4ab	14.9ab
Metam-sodium	75 gal	0.0c	16.9a	0.1c	12.7bc
Dazomet	400 lb	1.2c	15.4a	0.4bc	13.3bc
Telone C-17	35 gal	5.3bc	10.7b	1.5a	14.4ab

[z]Total of two hand weedings.
[y]Treatment means followed by the same letter are not significantly different at the 5% level as determined by Duncan's new multiple range test.

metam-sodium and dazomet. Few differences existed in gladiolus and sunflower plant growth or flower production in the fall, but in the spring significant differences were observed. Fumigation with metam-sodium or dazomet generally improved plant vigor and flower production of gladiolus and sunflower. Delayed dissipation of chloropicrin containing compounds associated with cooler soil temperatures is not likely a factor in these results, as 56 days elapsed between fumigant application and planting in the spring. Although there was no indication of nematode or soil-borne pathogen infestation, that cannot be ruled out as a possibility. However, it is unlikely as metam-sodium and dazomet have not effectively controlled these pests in previous research with tomatoes at this Center (Gilreath et al., 1994; Jones et al., 1995), and plant growth was good in areas treated with these two fumigants in the current study. Additional work is underway to elucidate further the responses of gladiolus and sunflower to these compounds.

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ACATHRIX TRYMATUS FOUND ON COCONUT PALMS IN FLORIDA AND ITS POSSIBLE ASSOCIATION WITH LETHAL YELLOWING

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Abstract. ***Acathrix trymatus*, a mite in the Eriophyidae family, was found in 1962 in the Philippines, at the same time a locally named disease, Cadang Cadang, was killing vast numbers of coconut palms. In May of 1996, this same mite was found for the first time in the Western Hemisphere on Grassy Key, Florida, amidst an outbreak of Lethal Yellow on coconuts. Mites in the Eriophyidae family have proven to effect numerous agriculture and ornamental plants worldwide. Jon Rackley is looking for evidence that would show a relationship of this mite to coconut palm disease.**

Introduction

Coconut palms swaying in the gentle breeze was the popular image of tropical Florida. Hundreds of thousands of beautiful tropical coconut palm trees thrived along the coastlines from Stuart to Ft. Myers and throughout the Keys. Then in 1955, a disease which had devastated coconut palms in the Greater Antilles and West Africa for decades invaded Key West destroying 15,000 trees. Lethal Yellowing (LY) as this disease is known, broke out in Miami in 1971 creating an epidemic that swept across Florida's southern coasts. Elsewhere in the Caribbean and West Africa the coconut industries have