



METHYL BROMIDE ALTERNATIVE WORK

I have been working with the California Cut Flower Commission (CCFC) since the middle of 2000 on methyl bromide alternatives research. Work started in the early 1990's with \$150,000 in granting over the past 12 years. Research has involved everything from alternative fumigants, solarization, treatment of soil with steam, microwave or UV, soil fertility and amendment with green manures and biological agents.

Current alternatives involve fumigants such as 1, 3-D (Telone), chloropicrin and metam sodium (Vapam) applied alone and in combination. In some cases, application through drip irrigation systems has been developed with excellent results. In addition, the use of granular Basamid has been researched extensively, often in conjunction with Telone or chloropicrin.

Trials conducted by Dr. Clyde Elmore at UC Davis have shown that these products can be very effective if they are used in combinations. While his work concentrated on weed control, he has collected data on nematode and disease control as well as yield and other economic data. Generally speaking the costs of applications and label restrictions for these products will limit their use, more than a lack of efficacy.

Iodomethane (Midas) is under EPA review at this time. Midas is a liquid at room temperature making it a little safer to handle than methyl bromide (gaseous at room temperature). Midas can be applied through a drip system making it more flexible in use patterns than MBr. It has much the same spectrum of activity – works on weeds, nematodes and fungal pathogens. Midas does appear to remain in the soil longer than MBr, again since it is a liquid at room temperature. When fields are planted too quickly after pulling the plastic some toxicity has been reported. The effective rate of Midas appears to be 300-350 lbs/acre when applied by injection. Mixtures with chloropicrin (this year 50-50%) have been tested and will probably be the norm when the product is registered. Drip application is interesting but not as clearly effective as the injected product.

Dr. Jim Gerik at the USDA in Parlier has been working in methyl bromide alternatives for the past two years. He has conducted at least five trials using drip applied materials including Telone, chloropicrin, Midas, Vapam and some experimental products.

A couple of weeks ago, I visited some field trials in San Diego County at Mellano and Company (cut foliage and cut flower producers). These trials are a repeat of those conducted last year, again with Dr. Elmore. Early top quality results for Ranunculus are shown in the table below. The combination of Midas and chloropicrin is as effective as methyl bromide and chloropicrin at this time.

Broadcast Fumigation		
Product	Rate	Top Quality*
MB/PIC (50/50)	350 lbs	4.0 b
Midas/PIC (50/50)	300 lbs	3.8 b
Midas/PIC (50/50)	350 lbs	3.7 b
Control	0	2.3 a

The other trial I rated is a drip trial that Clyde and Dr. Hussein Ajwa applied. Top quality was best for Inline (150 and 300 lbs) and chloropicrin (PIC) at 300 lbs. Only Vapam failed to do much compared to the untreated controls. Look for more trial updates in upcoming issues of Chase News.

Drip applied products		
Product	Rate/acre	Top Quality
Vapam	325 lbs	3.2 a
Midas/PIC (50/50)	350 lbs	3.8 ab
PIC	150 lbs	3.8 ab
PIC	300 lbs	4.2 b
Sodium azide	100 lbs	3.2 a
Inline	150 lbs	4.0 b
Inline	300 lbs	4.2 b
Control	0	2.5 a

*Numbers are the average top grade rated on a scale from 1 = dead to 5 = excellent. If they are followed by the same letter they are not statistically different.

Inside this issue:	
Cercospora Leaf Spot on Pansies	2
Botrytis Blight Control on Pansies	2
Fusarium Wilt Control on Cyclamen	3
Treating Gladiolus for Fusarium Corm Rot	4
Fusarium Crown Rot Control on Lisianthus	4

CERCOSPORA LEAF SPOT ON PANSIES

Sometimes it seems as though there are a multitude of things that can attack ornamentals during production. Fungal and bacterial leaf spots are a constant concern in production of ornamentals since blemishes really detract from the attractiveness of any plant that is sold for its looks alone.

Fungal leaf spots are caused by familiar pathogens such as *Alternaria* and *Colletotrichum* (anthracnose). Although less common, diseases caused by *Heterosporium* (leaf spot on *Dianthus*), *Sphaceloma* (scab on poinsettia) and *Myrothecium* (crown rot on pansy and leaf spot on foliage plants) are serious concerns for some growers.

Cercospora leaf spots fall somewhere in between. Anyone who grows woody ornamentals like pittosporum and ligustrum (especially in the Southeastern US) is probably familiar with angular leaf spot. One of the problems with *Cercospora* diseases is that the fungus is hard to isolate on culture media. It may take 2-3 weeks to grow enough to identify. It is easily overgrown in a culture plate by other fungi and thus diagnosis is difficult and slow.

Cercospora leaf spot on pansy has been a periodic problem occasionally in the past 10-20 years. Margery Daughtrey (Long Island Horticultural Research Laboratory) reported on a fungicide trial a few years ago. She found that the strobilurins BAS500 (16 oz) and Compass (2 oz), 3336 (12 oz), Protect T/O (24 oz), Spectro (24 oz), and Daconil Weather Stik (22 oz) all gave excellent control.



Cercospora leaf spot on pansy can be prevented with a wide variety of fungicides.

Fungicide	Rate/100	Percent
Agri-50	0.5%	0
BAS500	4 oz	100
Compass O	2 oz	100
Cygnus	3.2 oz	100
Heritage	2 oz	100
Medallion	1 oz	100
Phyton 27	25 oz	100
Rhapsody	2%	100
Terraguard	2 oz	65

Over the past three months we have conducted two trials for prevention of *Cercospora* on pansy. Fungicides were applied as sprays to drip on a weekly interval for 3 to 5 weeks. Then the severity of *Cercospora* was determined. The table to the right shows the percent control for each product tested. Preventative sprays of many products were 100% effective in protecting the plants from infection. All of the products in the strobilurin group were effective (BAS500, Compass, Cygnus and Heritage). Medallion was also very effective at a low rate (1 oz/100 gal). This fungicide has been an excellent product for *Alternaria* leaf spot in many of our trials and is one of the best products for *Myrothecium* leaf spot as well.

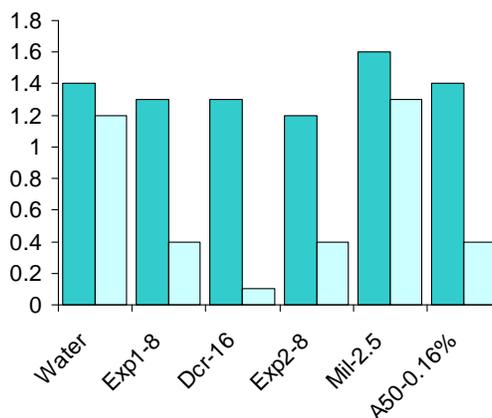
Terraguard has also been an effective leaf spot product but, at the rates tested here, was only 65% effective in preventing *Cercospora* leaf spot on pansy. Phyton 27 gave 100% control in this trial but was severely phytotoxic.

I have been reporting efficacy of Rhapsody (*Bacillus subtilis* from AgraQuest) in some bacterial leaf spots. I was pleased to see that it is also very effective in preventing *Cercospora* on pansy. I am hoping to continue work with this product on other foliar diseases. The national label for this biological control product should be approved sometime this year. Other researchers have shown very good control of powdery mildew diseases.

BOTRYTIS BLIGHT CONTROL ON PANSIES

We are still completing a few *Botrytis* and *Sclerotinia* trials for the season. This trial on Pansy shows the benefits of applying fungicides multiple times. We started with infected pansy plugs (*Botrytis*) and applied various fungicides weekly for a total of five weeks. The first set of bars (darker blue) shows the severity of *Botrytis* early in the trial (taller=worse disease). The lighter blue set shows disease severity at the end of the trial.

There are two experimental products



Botrytis primarily, while Exp2 is very broad-spectrum. Use of either one at 8 oz/100 gal resulted in very good reduction of *Botrytis*. Best control was seen with our standard—Decree. Milsana (an extract from giant knotweed) did not give any control in this trial while Agri-50 did perform quite well against *Botrytis*. We used a higher rate of Agri-50 as well and found phytotoxicity which resulted in more *Botrytis*. The same response was seen with Exp1. It is critical to use the correct amount of product—More is not only not better it is some-

FUSARIUM WILT CONTROL ON CYCLAMEN

Fusarium wilt and Fusarium crown rot are two of the most difficult diseases to control. Fusarium can also cause root rot. Although in ornamental production, the wilt and crown rot seem to be more problematic.

Fusarium is often found in isolations from roots but is not always the source of a problem. These fungi are good saprophytes and do not require a plant to feed on. Although there are fungicides and biological agents that affect Fusarium, it is usually very tough to control completely.

Fusarium wilt and crown rot are constant concerns in flower production. Gladiolus, Dutch iris, freesia, brodiaea (Fabiola), caladium and many other bulbs/corm crops can be infected with either a wilt Fusarium or basal rot (crown rot Fusarium). In addition, mini-carnations can be infected with a Fusarium wilt.

The wilt disease on Cyclamen appears to be seed-borne or at least present in poorly cleaned seed lots. The disease can appear as early as the plug stage and as late as the flowering stage. Margery Daughtrey told me a few years ago that I could make the disease worse if I subjected the plants to drought stress. We routinely put our experimental plants through wilting to induce symptom development.

We performed a trial over the past few months on Cyclamen. Plants were treated prior to inoculation with the pathogen (*F. oxysporum* fsp. *cyclamenis*). Treatments continued until the end of the trial on a 2-week interval. We included Endorse (0.55, 1.1 and 2.2 lb/100 gal) as a drench—but have only shown the 0.55 lb rate in the chart to the right. This product did a very good job of controlling Fusarium wilt in this trial. It was comparable to the chemical standard—Medallion (2 oz/100 gal).

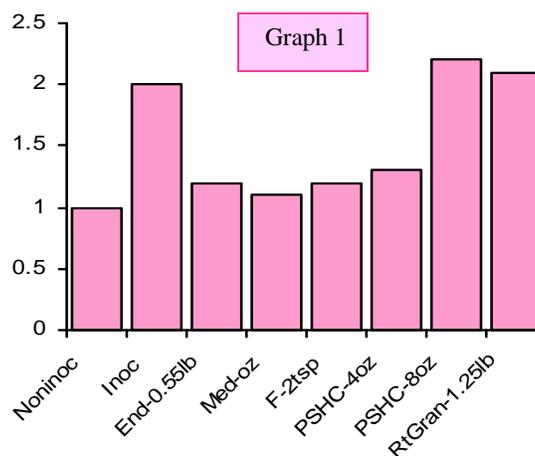
We also tested a fertilizer (F) that had shown good control of Pythium root rot on snapdragons in a couple of trials. We checked it at 1 tsp/gal and 2 tsp/gal and have presented only the higher rate.

The results speak for themselves. It is not unusual for plant nutrition to affect Fusarium wilt diseases but this new product is not based on nitrogen source for its efficacy.

The final set of treatments were for *Trichoderma harzianum* in various products from BioWorks. The best control was seen with PlantShield HC at 4 oz/100 gal. Neither incorporation of RootShield granules (1.25 lb/cubic yard) or PlantShield HC (8 oz/100 gal) gave any disease control in this trial.

An earlier trial was performed last fall-winter. In this case, we checked the possible benefits of mixing Medallion and Heritage as well as the new strobilurin fungicide BAS500. Plants were treated with drenches every 14 days starting before inoculation and continuing for 5 applications.

All products tested and combinations gave very good control (graph at bottom, right). The use of Medallion at 2 oz and Heritage at 0.9 oz shows that you can achieve Fusarium wilt control with these products and stay within their labeled rates. Top grade was lowest for the inoculated controls and the Heritage at 4 oz/100 gal. This rate is apparently too high for cyclamen at times. Top grade was best for the noninoculated controls and BAS500 at 8 oz/100 gal.

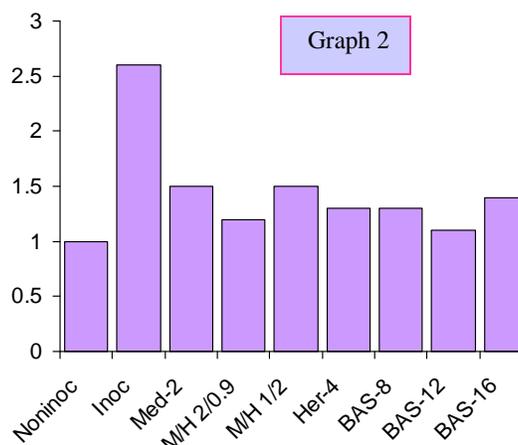


Graphs 1 and 2. Products were applied as drenches (except RtGran—1.25 lb/cubic yard of potting medium). Plants were rated from 1 = no disease, healthy to 5 = dead.

Average top grade for graph 2.

Treatment	Top grade
Noninoculated	3.9
Inoculated	3.1
Medallion-2 oz	3.6
Heritage-4 oz	3.2
BAS-8-12 oz	3.9

1=dead and 5=excellent



TREATING GLADIOLUS FOR FUSARIUM CORM ROT

One of the best things about doing research with professional growers is that new problems arise quite frequently. We have been doing a few trials on bulbs, corms and rhizome treatment for cut flower diseases. Since Fusarium is the most serious and common problem on bulbs and corms we wanted to see what the best Fusarium wilt fungicides would do for a Fusarium corm rot on gladiolus.

We collected some diseased corms and cultured to make sure they had Fusarium. Then we dipped them in various fungicides for 5 minutes, allowed them to air dry and planted them in pots.

Over the next 60 days or so we recorded when each bulb emerged. At the end of the trial, we rated the top quality and also cut the corms to assess Fusarium rot.

We included Terraclor (8 oz/100 gal) as the commercial standard. Compared to Medallion, Terraguard or Heritage at 4 oz/100 gal, Terraclor was the only product that did not delay emergence of the bulbs. As you can imagine, top grade was higher for the plants that emerged first so Terraclor and the water control had the highest top grades. Fusarium did not occur frequently in the

corms so significant differences between treatments could be determined. More work is needed - as usual.

Treatment	Rate/100 gal	Days from emergence
Water	—	44
Heritage	4 oz	38
Medallion	4 oz	33
Terraguard	4 oz	38
Terraclor	8 oz	44

FUSARIUM CROWN ROT CONTROL ON LISIANTHUS

Lisianthus are becoming increasingly popular as a cut flower crop, a potted flowering plant and a bedding plant. They unfortunately have several serious diseases including Botrytis stem rot, Pythium root rot, Tospo viruses (INSV) and Fusarium crown rot.

A few years ago, AFE supported the research efforts of University of Florida Professor Bob McGovern to identify and control Fusarium crown rot on Lisianthus. He found that *Fusarium avenaceum* could infect Lisianthus at the plug stage. Control with products such as Medallion was very helpful.

We have been working with some of the newer fungicides in development including BAS500 (a strobilurin from BASF) and some of the older products like chloroneb (Terraneb). In our most recent trial, we compared these products (at more rates than those shown) with Terraguard. Products were applied as drenches on a 14-day interval for a total of 5 applications. We used Balboa Yellow plugs (a susceptible cut flower variety) for the trial.

The ratings for disease started about a month after we infected the plants. The data in the table to the

right are for the end of the trial (2 months after inoculation).

In this test, BAS500 performed as well at 8 oz/100 gal as the standard Terraguard at the same rate. While 4 oz of BAS500 did not give as high a level of control, 16 oz did not perform better than 8 oz. Terraneb failed to give good control in this trial. We also tested 4 oz of Terraguard which was also too low for good disease control.



Treatment	Rate per 100 gal	Disease severity (1=no disease, 5=dead)	Top grade (1=dead, 5 = excellent)
Noninoculated	—	1.0	3.6
Inoculated	—	2.2	2.8
BAS500	8 oz	1.4	3.2
Terraneb	12 oz	2.7	2.5
Terraguard	8 oz	1.7	3.1

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