CORF News

California Ornamental Research Federation

Vol. 2, Issue 2 **Spring 1998**

Alternatives to Methyl Bromide for Fusarium Wilt of Carnation

By Dr. James MacDonald, Dept. of Plant Pathology, UC Davis and Steve Tjosvold, UCCE Advisor

Methyl bromide is a widely used and highly efficacious pesticide. However, because it has been identified as an ozone depletor, production and use of this material will soon end under international treaty. This has made the development of alternatives to methyl bromide a high priority, and we have investigated chemical and physical (heat) alternatives that could be used in greenhouse production. Our research has focused on methyl bromide alternatives for Fusarium wilt of carnation.

The work reported here has been carried out with support from the California Cut Flower Commission, the California Association of Nurserymen, and the Salinas-based California Flower Co-op.

Experimental Methods

We have investigated disease control in both raised-bed and ground-bed production systems. Following is a report of our 1997 experiments in ground beds.

We established an experimental plot in 1996, using five adjoining 110 foot-long beds. The beds were initially heavily infested with *F. oxysporum f.sp. dianthi* as evidenced by 90-95% mortality in the previous crop. After removal of the old crop and associated debris, the ground was prepared (tilled) and the beds were divided into 20-foot-long microplots, with 9-foot-long buffer strips between each microplot (i.e., there were four microplots in each bed, separated by buffer strips—see Fig. 1 on page 9).

Treatments included (1) Methyl bromide (at 1 lb/100 sq.ft.), (2) Methyl iodide (at a 1 lb/100 sq.ft), (3) Methyl iodide (at 1.5 lb/100 sq.ft), (4) Basamid (at 1.22 lb/100 sq.ft.), and (5) Ohmic heating.

Ohmic heating was applied using a 220v, 20 amp circuit available in the greenhouse. A series of 3-ft-long steel rods were driven into the ground to a depth of 2 ft along the side edges of the microplots. The rods on one side of each microplot were wired in series to serve as anodes, while the rods on the opposite side were wired in series to serve as cathodes. Insulated plastic sheeting was laid on the soil surface to prevent evaporative cooling at the surface, and to help prevent radiation

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Floriculture Producers Adapt to New Rules

by Dr. Karen Robb, Steve Tjosvold and Julie Newman, UCCE Advisors

"How has your growing operation been impacted by the new regulations for methyl bromide use?" was asked of different growers throughout the state. *Wim Zwinkles, Pleasant Valley Flowers*- produces outdoor (and indoor) cut flowers such as gypsophila, statice, larkspur, delphinium, lilies, etc. on more than 70 acres. Zwinkles states, "We have 2 properties that are close to residential areas and we have a tremendous weed problem in the buffer areas. We predict that our yields will not be as high in these buffer areas because the methyl bromide has a growth stimulant effect. We grow a lot of larkspur and liatrus, which are very prone to diseases without methyl bromide fumigation. More research is desperately needed on the biology of soils so that biological control can become a feasible alternative."

Kazu Miyazono at Usui Greenhouse has a comment typical of many of the carnation growers in the Salinas area. "We used to have a commercial applicator come in with a tractor and shank methyl bromide in." Kazu continues, "But that is no longer legal. We had to learn the hot gas technique and apply methyl bromide ourselves." Studies found that there was a potential for significant worker exposure to the methyl bromide applied by the shank method so it was prohibited. Kazu and

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In This Issue

New Publications

Dr. Ann King, UC Cooperative Extension

- **Sticky trap monitoring of insect pests.** 1998. SH Dreistadt, JP Newman, and KL Robb. University of California DANR, publ #21572, tel. (800) 994-8849.
- **Fungus gnats, shore flies, moth flies, and march flies.** 1997. SH Dreistadt. University of California DANR, Pest Notes #7448, 4 pages; contact your local U.C. Cooperative Extension office for a copy.
- **Specialty and minor crops handbook, 2nd edition.** Contains information on specialty and herb crops. 1998. University of California DANR, publ #3346, 184 pages, $35, tel. (800) 994-8849.
- **Greenhouses: Advanced technology for protected horticulture.** JJ Hanan. 1998. CRC Press, 684 pages, $89.95

Internet Sites of Interest

Dr. Heiner Lieth, Environmental Horticulture, UC Davis

In the current and the previous issues of CORF News you find articles on methyl bromide. If you are one of the growers who will feel the loss of this chemical strongly, then you may well want more information than is provided by these articles. If you have a connection to the Internet and browser software, then you have a lot of information at your fingertips. You may, for example, have specific questions about methyl bromide, why it is being removed from use, and what the alternatives are.

The Environmental Protection Agency maintains a web page on the phase-out of methyl bromide at http://www.epa.gov/docs/ozone/mbr/mbrqa.html which answers many of these questions. Off this site you can get some basic information about why and when and who will be affected. For example, you can find out that production and importation of methyl bromide will be prohibited after Jan 1, 2001. There is a lot of information on alternatives; details on 30 case studies are available. The page also contains information on what other countries are mandated to do. There is also as a search utility where you can search through all the EPA on-line material associated with this issue.

As a flower grower you might be more interested in the agriculture side of things. The USDA maintains a web page: http://www.ars.usda.gov/is/mb/mebrweb.htm On this web site you also find the "Methyl Bromide Alternatives Newsletter" which has interesting articles directly on-line for your perusal. The Jan 98 issue, for example, has an article entitled "Phyto-Oils Control In-

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Internet Sites

Continued from page 2

sects in Stored Products and Cut Flowers" which might be of interest to cut-flower growers.

The underlying issue is the threat to the ozone layer in the atmosphere. Thus you will see references to ozone in many places when you are dealing with this issue. For example, there is a web site of the "Ozone Secretariat of the United Nations Environment Programme" (http://www.unep.org/unep/secretar/ozone/home.htm) which acts as a clearinghouse of information related to the ozone layer and the challenges in preserving it.

There are also various non-government organizations that have posted information on the web related to this issue. For example, PAN North America Regional Center (PANNA, http://www.igc.apc.org/panna/index.html) is a "non-profit organization working to advance ecological alternatives to pesticides" and the Environmental Working Group (EWG, http://www.ewg.org/) is a "content provider for public interest groups and concerned citizens who are campaigning to protect the environment".

There are of course, many more web sites where you can get additional information. You can find these by using your favorite search engine to look for "methyl bromide".

Keep aware however, that on issues such as the methyl bromide phase-out there are definite sides to the issue and at many web sites it is difficult to determine whether the authors are objective or biased.

Field Observations

New Pest & Diseases

Larkspur grown in a commercial greenhouse in Watsonville was observed this winter with typical symptoms of the bacterial disease caused by *Erwinia carotovora pv. carotovora.* Early symptoms included water-soaked lesions and a gelatinous rotting of succulent young leaf tissue. The tissue turned black and stems virtually melted back. This disease was first noted in California in 1986 in field-grown larkspur during rainy spring weather.

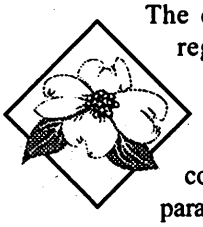
Bacteria are often dispersed by water splashing from infected plants to healthy plants. However, in this recent disease outbreak in greenhouse-grown larkspur, there was no overhead irrigation that one might expect could splash disperse the bacteria. One suggested method of dispersal could be by workers harvesting the cut flowers. Possibly contaminated pruning shears and/or the harvester's arms moving in and out of the crop may have been enough to disperse the bacteria. Additionally, the worker's movements and cuts might have created wounds that would allow the bacteria to infect the plant. Bacteria are noted for infecting small wounds or natural plant openings. Bacteria usually need considerable moisture for infection and certainly the wet winter could have enhanced the conditions for forming moisture, in the form of condensate, on plant surfaces.

The relatively warm conditions of the greenhouse would have enhanced disease too. University of California experiments in 1986 showed the disease to be progressively more severe as temperatures increase from 60 F. to 80 F. Also, they showed that wounding was necessary for infection and 100-200 ppm streptomycin controlled the disease when sprayed before the bacteria was applied to the wounds.

Regional Report

Santa Cruz & Monterey Counties

Tested Miticides Work Well on Two-spotted Spider Mites
Many Miticides Get Help from Surprise Showing of Predatory Mites



The development and registration of new miticide chemistries and their rotation into a mite control program is of paramount importance to slow the inevitable development of miticide resistance to registered miticides. In a recently completed field trial conducted in the Fall of 1997, I evaluated the effectiveness of new miticide chemistries as well as several commercially registered miticides. Inadvertently, an initially undetected, predatory mite in the trial demonstrated a profound effect on the ultimate control of the spider mites following many of the miticide treatments. It demonstrated to me that predatory mites may become an important component of integrated spider mite control. As evidenced in this experiment, a good monitoring program will aid in the detection and integration of a naturally introduced predator.

Miticide treatments:
Registered rates of Avid (abamectin), Hexygon (hexythazox), Mpede (insecticidal soap), Avid + Mpede, Hexygon + Mpede, Kelthane (dicofol), Tame (fenpropathrin), Triact (neem oil), Sanmite (pyrdiaben), and experimental pesticides AC303,630 (chlorfenapyr), and S-1283 (etoxazol). The experiment was conducted on roses (Rosa x hybrida cv. Kent) in field nursery rows in Watsonville, California. Plants were trained as tree roses. Spider mites were obtained from a local predatory mite nursery and heavily distributed onto the rose plants before the trial began. These spider mites were considered "pristine" since they had not been subjected to pesticides for many generations, so potentially they were not as resistant to some miticides used frequently in commercial nurseries.

Results:
A non-native predatory mite, *Galendromas (Metaseiulus) annectens*, was found in nearly all treatments following application of miticide treatments. In most treatments, the predator appeared to enhance spider mite control, especially after the first week the treatments were applied. As expected the predators worked well in conjunction with the contact miticides, insecticidal soap and neem oil. But there also was significant predator activity following applications with Avid, Hexygon, Sanmite, S-1283 and AC303,630. All miticides substantially knocked down the spider mites in 3 days from the initial moderate levels of mites. Although Mpede did not reduce the spider mites as well as the other treatments early on, it was very compatible with the predatory mites and, as in most other treatments, eventually nearly eliminated the spider mites in 27 days. A tank mix of Avid and Mpede did not improve effectiveness over the very good effectiveness of Avid alone. Apparently the "pristine" mites used in the experiment had no strong Avid resistance. Kelthane was one of the more effective products tested on mites but eliminated predatory mites throughout the experiment. Resistance, as is common with Kelthane, again, was probably not an issue because the test used "pristine" mites. Hexygon worked well alone or in combination with Mpede. Tame, Triact, S-1283, and Sanmite were all very effective. Tame, however, strongly reduced predatory mites. AC303,630, at the higher rate, completely controlled mites throughout the experiment. At the lower rate, the miticide was very compatible with predatory mites.

Please contact me if you want a research report with data and a more comprehensive analysis.

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Regional Report

San Diego County

Giant Whitefly Pest Status and Control

Giant whitefly is causing serious damage to many ornamental plant species found in nurseries, landscape gardens, and home gardens in Southern California. The plant species most affected by the giant whitefly are hibiscus, giant bird of paradise, orchid tree, banana, mulberry, xylosma, and aralia. Certain varieties of citrus and avocado are also being affected. At the current high pest levels, the list of affected host plants is likely to grow.

Giant Whitefly Biology

Giant whitefly gets its name from its large size (adults up to 3/16 in. (4 mm)) relative to many other whitefly species in North America. This species can also be identified by spirals of wax which are deposited by adults as they walk on leaves. These deposits occur on both upper and lower leaf surfaces. Eggs are often laid amongst these waxy deposits. The nymphs produce long, hair-like filaments of wax up to 2 in (50 mm) long. This imparts a bearded appearance to affected leaves.

Sanitation and Control

An effective sanitation strategy is the use of a strong stream of water directed to the undersides of infested leaves (syringing). In studies conducted by Karen Robb and Dave Shaw, side-by-side comparisons with several pesticides indicated that syringing performed as well or better than chemical treatments. With high whitefly populations, syringing is recommended at least once a week.

Leaf removal will work better on some plants than others. Giant whitefly is currently found on many different plant species, and on some of these it reproduces more successfully than on others. On less preferred hosts, such as yellow or white hibiscus, removal of leaves should be sufficient to control populations. On more preferred host plants, such as red hibiscus, giant bird of paradise, and xylosma, until the biological control agents become established, control will require early detection, rigorous sanitation, and syringing.

Biological Control Program at UC Riverside

A research program at UC Riverside has been developed to seek new natural enemies of this whitefly from its native home. An exploration trip to Mexico was conducted to obtain natural enemies. Collections showed that 80% of the whitefly nymphs were parasitized by two different species of natural enemy. One is Idioporus affinis LaSalle & Polaszek (Pteromalidae). The other is Encarsiella noyesii Hayat (Aphelinidae). The adults of these parasites are approximately 1/16 in. (1.5 mm) long. These natural enemies were brought to the quarantine facilities at UCR. The first field releases of these wasps were made in August 1997. Releases of Encarsiella are currently underway in San Diego County and are being monitored for establishment and effectiveness.

For more complete information, you can obtain a copy of the publication 'Giant Whitefly Pest Status and Control' by T. Bellows, D. Headrick, C. Meisenbacher, J. Kabashima, and K. Robb from the internet at:

http://www.co.san-diego.ca.us/cnty/cntydepts/landuse/farm/whitefly/index.html

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or by contacting my office.

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Field Observations

New Pest & Diseases

Chrysanthemum White Rust

A new case of this disease was discovered in February. Federal protocols are still in place to address this problem. Myclobutanil (Eagle) is registered for control of this rust.

El Nino Impacting Disease Incidence

The cool weather coupled with frequent rainfall has significantly increased the level of diseases observed this year. This has been especially true for field grown crops. For instance, Xanthomonas on ranunculus, Psuedomonas on delphinium, downy mildew on Limonium, and leaf smut on sunflowers have all been observed at much higher levels than normal. Botrytis is also occurring at high levels on numerous floral crops. (See the field observations by Julie Newman for control suggestions.) Antibiotics, such as Agrimycin, and copper containing materials, such as Phyton 27 and Champ, are available for control of bacterial diseases on some crops. Keep in mind that bacterial diseases can quickly become resistant to antibiotics, so rotate with applications of a copper material. Several materials are registered for control of downy mildews. These include Daconil, Kocide, Chipco Aliette, and Dithane . Dithane may have some effect on leaf smut of sunflowers, but it is a good idea not to plant sunflowers in the same location repeatedly.

Remember that not all chemicals are labeled for use on all crops. Read and follow the instructions on the label before using any material. Before using a pesticide for the first time or on a new crop or cultivar, treat a few plants and check for phytotoxicity.

Elevated levels of rainfall are predicted to continue for the next few months, so conditions will continue to be conducive for the development of these and other fungal and bacterial diseases.

Field Observations

New Pest & Diseases

What to watch for following flooding:

Chemical spills.
With severe flooding, the grower upstream may have had pesticides washed away, which are now in the water on your property. This can be a serious health hazard, so be aware of the possibility of contaminated water. Health concerns are immediate, but also watch for damage to plants, especially if herbicides are in the water.

Nematodes.
If soil moves onto your property, it will bring whatever pests were already in it. Following flooding in this area in 1982, some growers found an increase in nematode problems in their greenhouses.

Diseases.
Diseases can move in with mud, but root diseases can also be promoted by long periods of wet conditions. Watch for increases in soil-borne diseases such as pythium, phytophthora, and rhizoctonia.

Silt & poor drainage.
If silt and mud move into your greenhouse or nursery, you may be left with poor drainage due to the fine silt particles. Remove as much as the silt as possible. You will then need to work a lot of organic material into the soil to try to compensate for the increase in fine soil particles.

Weeds.
Weed seeds are easily moved about by flood water and mud. Watch for increased weed problems following flooding.

Regional Report

San Mateo & San Francisco Counties

San Mateo County growers are shoveling mud and recovering from the rainiest February on record. The county has been declared a federal disaster area and many growers suffered significant damage.

The coastal growing area in San Mateo County is bordered to the east by steep hills. Water from heavy rains drains from the hills and through the growing area on its way to the ocean.

In the hills above Half Moon Bay sits Pilarcitos Lake, which is part of the San Francisco Water District. When rain threatens to overflow the lake, water is released from the lake into Pilarcitos Creek, which runs through several farms along Highway 92 in Half Moon Bay.

In February, controlled water releases from the lake caused major flooding to several growers downstream. Cozzolino Flower Farm suffered a bridge washout, stream bank erosion, and loss of a lot of top soil. Daylight Nursery reported the loss of about five feet of top soil in its fields along the creek.

Driving rain, fierce winds, and wet soil caused young Christmas trees to blow over at 45-degree angles. Many acres of Christmas trees were blown over. After the soil dried a little, workers had to straighten and replant every tree by hand.

The worst flooding in the county occurred in Pescadero, where water and mud from Pescadero Creek entered many homes, businesses, and greenhouses in Pescadero.

Oku Nursery in Pescadero lost many of the 50,000 lily bulbs that they recently planted. Much of their rose crop was saved for Valentine's Day, though, due to the fact that most of their roses are now growing hydroponically above ground. If their roses were still in ground beds, the flooding would have been disastrous.

Harvesting of last season's Brussels sprouts, a major vegetable crop in this area, had finished just prior to the storms. If the rains continue and fields stay wet, spring planting of this year's sprouts may be delayed. Wet soil also promotes club root, a devastating disease for Brussels sprouts.

The effect of flooding on diseases and nematodes has yet to be determined. Heavy flooding and mud moving into greenhouses in this area in 1982 and in 1992 caused severe nematode problems for many years following. If soils stay wet for prolonged periods this winter, disease problems could also be severe.

Initial estimates of short-term crop loss in mid-February was $1.3 million, according to San Mateo County's Ag Commissioner. Losses will continue to be measured, and if the rains continue, losses will increase.

Growers and other residents are concerned about mud slides on local roads. In the north part of the county, Highway 1 through Devil's Slide has been closed intermittently during the storms due to mud slides. Highway 92, the only other major road into and out of Half Moon Bay, has also been threatened by mud slides. Closure of either highway affects traffic into and out of the coastside, including movement of flower and nursery crops.

Everyone is keeping their fingers crossed that the worst of El Nino is over.

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CORF News

California Ornamental Reseach Federation

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- **Field Observations**
- **Grower's Corner**
- **Ag Resources & Internet Sites**
- **Announcements & Calendar**

A Message to our Readers

CORF News is a publication that unites several major floriculture partners; the research community, the growers and their associations and the allied industry. It is unique to California's floriculture industry.

CORF News was created in response to grower feedback at the CCFC sponsored Research Focus Workshop to the question "How Can We Improve Communication Between the Growers and the Floriculture Research Community". A year, and a lot of hustle later, the first issue of CORF News was published.

Almost immediately, the newsletter proved its value as a means of communicating statewide. Growers and researchers in separate parts of the state battling independently a problem with downy mildew on limonium were made aware of each others efforts.

To date, the CORF News production costs have been underwritten by a grant from the CCFC and supported by advertisers who recognize the unique value of this industry publication. But one-time grants and the allied industries can not alone fund this newsletter. We need the support of growers like you who receive and read this publication and who participate in CORF's Grower Education Programs and find them of value to their business. We need the support of those who believe the California floriculture industry is poised for a competitive comeback in the agricultural marketplace of the world, and that strong and focused research and education is one of the foundations upon which this growth will occur.

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- a year of CORF News
- coupons worth a 10% discount to two CORF education programs (in-state programs only)
- and we will acknowledge your support in the CORF News.

Please use the form on the opposite side of this page and let us hear from you soon!

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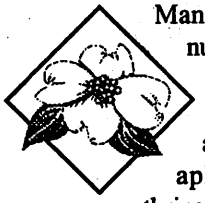
Regional Report

Ventura & Santa Barbara Counties

Use of Yellow Sticky Traps



Many floriculture and nursery managers use yellow sticky traps to monitor adult pests such as aphids, leafminers, thrips, fungus gnats, and shoreflies. Sometimes traps are also used to monitor adult parasite populations in biological control programs. I am pleased that growers recognize the value of this tool for monitoring programs, but it concerns me how often trap use is mismanaged. It is quite common to see traps mounted in a permanent position considerably above the crop. To maximize insect catches, traps should be positioned vertically just above the crop canopy. They should be positioned so that the trap can be raised as the crop grows. This can be achieved by mounting the traps with a clothes pin or clip on a stake. Alternatively, traps can be suspended over the crop with a string, wire, or chain that can be raised and lowered. With this method, the traps can turn with prevailing air currents, further maximizing insect catches.

A minimum of one sticky trap for every 10,000 ft2 of growing area is recommended. For crops where whiteflies are a significant problem, you have to use many more traps because these insects do not fly very far. One trap for every 1,000-2,000 ft2 usually works best for whiteflies. For the data to be useful, traps need to be counted on a regular basis, at least once per week. Too often you see traps that look like they haven't been examined or changed for months!

Some growers use blue sticky traps. These are fine as long as thrips are the only significant pest. Yellow traps are usually superior because other insects are more attracted to yellow, and most ornamental crops attract a broad spectrum of pests. Even if thrips are your only problem, you still may get better results with yellow traps. In a recent cooperative research project with Brook Murphy and Michael Parrella, Department of Entomology at UC Davis, conducted at Central Coast Wholesale Nursery in Goleta, we found that although blue traps placed in roses attracted more western flower thrips than yellow traps, yellow traps correlated better with the numbers of thrips found in flower buds. In our scouting demonstration sites, we found that it was quicker and easier to count insects on yellow traps because there is a stronger color contrast against the insect bodies. Use of yellow traps resulted in lower scouting labor costs.

Another way to minimize the labor costs is to take counts from a 1" central strip on both sides of the traps, holding the trap in the same direction that it was mounted. Use sticky traps which are sold with grids, or make a 1" template to do the counting. UC studies have shown that this rapid technique gives accurate data and can be extrapolated to whole trap data. (No, this doesn't mean you can cut your cards into 1" strips and save material as well as labor costs!) To facilitate accurate identification of insects, use a hand lens or optivisor when counting insects on traps in the field or greenhouse.

For further information on the use of sticky traps for monitoring insect pests, see the University of California publication on this subject described in the new publications section of this newsletter.

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Field Observations

New Pest & Diseases

Botrytis

Field flower growers produced bouquets of *Botrytis*, due to The El Nino, especially those who did not apply fungicides beforehand. Fungicides are an important management tool but must be used carefully. Resistance develops under conditions highy favorable to disease and on crops that are regularly treated because of high susceptiblity. Benzimidazole fungicides (e.g. Cleary's 3336, Domain FL) are often inefficaciouus because of *Botrytis* resistance, and reduced susceptibility to dicarboximide fungicides (e.g. Ornalin FL, Chipco 26019) has been reported. To maximize fungicide effectiveness, Dr. Mary Hausbeck, of Michigan State University, offered these suggestions at the recent SAF Conference in Del Mar, California.

Rotate dicarboximides with protectant fungicides. Rotating Chipco 26019 and Ornalin FL doesn't count, they're both dicarboximides! There are no documented cases of *Botrytis* resistance to protectant fungicides (e.g. Daconil, Phyton 27, Exotherm Termil, Dithane, Protect T/O, or Mancozeb), but their use alone may not be equally effective if disease pressure is severe.

Use tank mixtures of dicarboximides and protectant fungicides. Reduced rates of fungicides used in mixtures usually provide control comparable to full strength mixtures. Mixing a dicarboximide fungicide with a protectant, each at ½ the full rate, is effective and does not increase resistance. The protectant Daconil is especially effective in limiting *Botrytis reproduction and spread.* There is no benefit to mixing two dicarboximide fungicides or mixing more than two fungicides together at reduced rates. Always check the labels and treat a small number of plants first to check for phytotoxicity.

Continued from page 1

of heat out of the soil mass.

Methyl bromide and methyl iodide treatments were applied using the "hot gas" method of injection under plastic tarps. Basamid was applied by sprinkling granules evenly onto the soil surface, and incorporating them into the soil with a rototiller. Immediately after tilling, these plots were covered with clear plastic sheeting. All buffer strips between the microplots were fumigated with methyl bromide. After all treatments were applied and the tarps removed for soil ventilation, the beds were planted with the susceptible cultivar 'Nora'. Planting was done in mid-July, 1996.

Prior to treating the plots, soil cores were removed from the upper 12 inches and the 12-24 inch depths at three points in each microplot plot to assay for initial populations of *F. oxysporum f.sp. dianthi*. After all treatments were applied, and immediately prior to planting, a second series of soil samples were collected to quantify post-treatment populations and compare treatment efficacy.

Results and Conclusions

The post-treatment assays of soil showed that methyl iodide was more efficacious in reducing populations of *F. oxysporum f.sp. dianthi* than was methyl bromide (Fig. 2). Basamid gave good control in the upper 12 inches of soil, into which it was incorporated, but was relatively ineffective at greater depths. Ohmic heating of ground beds resulted in all parts of the soil profile being heated to temperatures above 50C within 48 hours, completely eliminating *Fusarium* to a depth of 2 ft (Fig. 3).

The long-term efficacy of treatments was determined by periodic assessments of disease loss in each microplot. For the first six months, disease loss was lowest in the ohmic-heated and methyl iodide fumigated beds, highest in the Basamid treatment, and intermediate in

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Fig. 1. Diagram of the lay-out of our 1996 ground-bed field experiments. Note the buffer strips between each plot area. These were treated with methyl bromide to prevent disease from spreading rapidly down rows if any treatment failed.

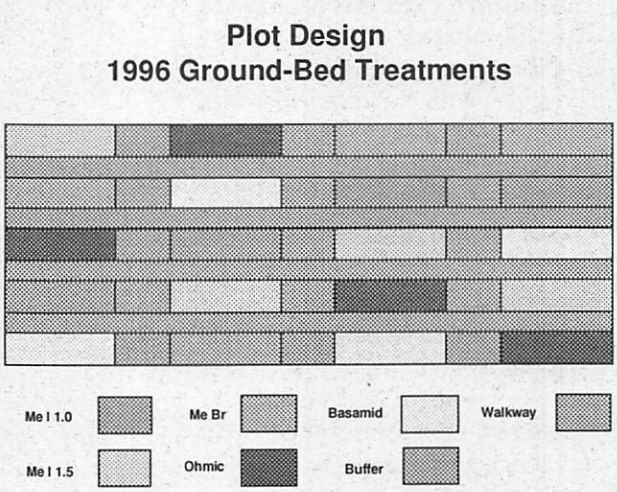


Fig. 2. Survival of Fusarium oxysporum f.sp. dianthi in the 1996 Ground Bed Experiment. Assays are of native inoculum levels. Note in the control that inoculum levels are highest in the upper foot of soil, but are still high even in the second foot of soil. Basamid gave good control in the upper foot of soil, but was ineffective at greater depths. Methyl iodide was the most efficacious fumigant.

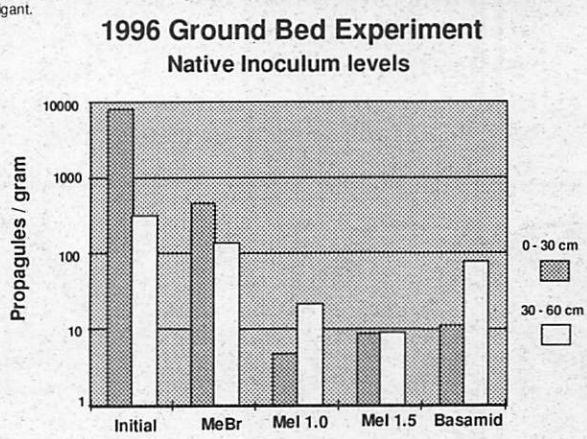
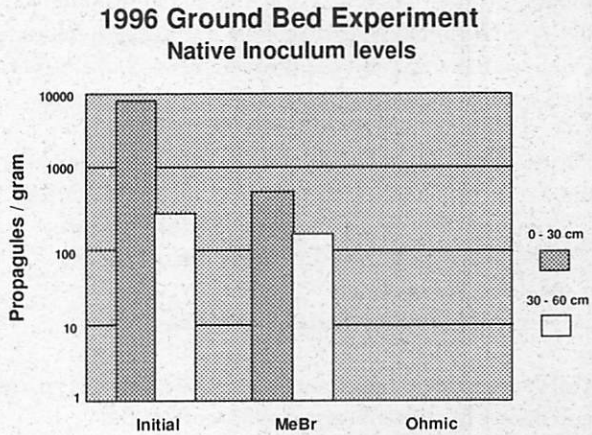


Fig. 3. Survival of *Fusarium oxysporum* f.sp. *dianthi* in the 1996 Ground Bed Experiment. Assays are of native inoculum levels. Note that Ohmic heating provided efficacy throughout the profile, resulting in undetectable levels of inoculum



Methyl Bromide

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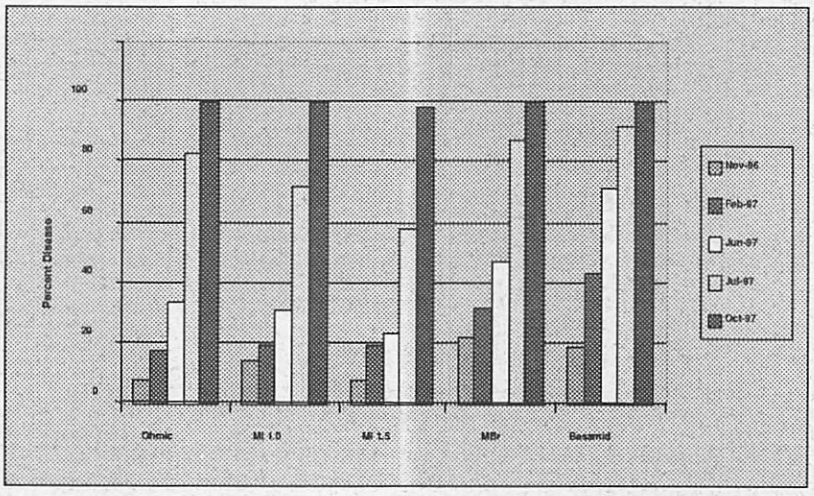
the methyl bromide treatment (Fig. 4). This pattern became very pronounced after 12 months, with up to 70% disease in the Basamid treatment. However, with the onset of warm summer temperatures, disease progressed rapidly in all treatments, resulting in virtually 100% disease throughout the plot after 15 months (Fig. 4).

Summary

After two full field experiments, it is clear that no treatment provides effective control of Fusarium wilt for carnations grown in ground beds. Indeed, since the conversion to hot gas application techniques that became necessary three years ago, methyl bromide itself is no longer effective in providing more than 6-12 months protection. We believe that the solution to Fusarium wilt lies in conversion to raised beds.

Experiments were conducted on raised beds. Results will be made available in forthcoming issues of *CORF News*.

Fig. 4. Disease lostt (percent of symptomatic plants) in the 1996-97 Ground bed experiment. Each value represents the mean of four replicate treatments. Each replicate treatment had an initial population of approximately 200 plants.



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Upcoming Grower Educational Events

MAY

14 ..... CORF Spray Applicator Workshop, Carpinteria (Spanish Only) 760/723-0807

17-22 ... CCFC Tentative Trade Mission, Philadelphia 916/852-5166

27 ..... CORF IPM Diagnostic Workshop, Watsonville (English & Spanish) 760/723-0807

28 ..... CORF IPM Diagnostic Workshop, Half Moon Bay (English & Spanish) 760/723-080

28 ..... San Diego County Flower and Plant Association Golf Tournament, TBD 760/431-2572

30 ..... KKRF "Heralding the California Heritage" Dinner and Presentation, San Francisco 408/724-1130

JUNE

4 ..... CORF Tour, Safeway Distribution Center & Post Harvest Technologgy, Tracy 760/723-0807

15-16 ... Cal Poly IPM Conference 805/756-2279

29 ..... San Francisco Flower Mart Annual Golf Tournament, San Francisco 415/392-7944

JULY

2-6 ..... AIFD National Symposium, Boston 410/752-3318

7 ..... CORF IPM Diagnostic Workshop, San Diego (English & Spanish) 760/723-0807

9 ..... CORF IPM Diagnostic Workshop, Ventura (English & Spanish) 760/723-0807

15-18 ... CAFG&S Fun 'N Sun Weekend, Santa Barbara 408/496-6187

AUGUST

2-4 ..... California State Floral Association Floriculture Retreat, Cal Poly, San Luis Obispo 916/448-5266

SEPTEMBER

13-18 ... CCFC Tentative Trade Mission, Chicago 916/852-5166

23-26 ... SAF Annual Convention, Puerto Rico 800/336-4743

24 ..... CORF Spray Applicator Workshop, Half Moon Bay (English Only) 760/723-0807

OCTOBER

3-4 ..... California State Floral Association Convention & Top 10 Competition, So. California 916/448-5266

8 ..... CAFG&S Golf Tournament, location to be announced 408/496-6187

15 ..... CORF Tour, San Diego 760/723-0807

NOVEMBER

8-13 ..... CCFC Tentative Trade Mission, Denver 916/852-5166

To add dates and activities, please contact the office at 916/852-5166.

UC Davis News

The University of California's Division of Agriculture and Natural Resources recently provided temporary (up to 3 years) funding to the College of Agricultural and Environmental Sciences at UC Davis for an Ornamental Horticulture Research and Information Center (OHRIC). The physical location for and the coordination of the OHRIC will be in the Department of Environmental Horticulture at UC Davis. However, the OHRIC will involve UC personnel County Advisors, Area Specialists, Cooperative Extension Specialists and Agriculture Experiment Station Faculty from around the state. An initial planning meeting was held on the Davis campus in February to establish the mission of the OHRIC. UC County Advisors, Extension Specialists and Faculty expect the OHRIC to: 1) serve as a source of comprehensive, reliable, practical and useful information, 2) provide assistance and support for statewide extension/outreach activities and 3) help coordinate UC programs focused on ornamental horticulture. Initially, the OHRIC will create a web site to provide easy access to the information that is collected and organized. Examples of the kind of information that may be found at the OHRIC include: electronic versions of existing UC Cooperative Extension publications, a database of UC personnel working in ornamental horticulture, a collection of various newsletters produced by County Advisors around California, an OH events calendar and links to other interesting sources of information.

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New Rules

Continued from page 1

other growers were forced to adopt the new application technique and new permit conditions to apply methyl bromide. Some of the permit conditions included: determining worker and resident buffer zones, new warning signs, and a requirement for air-supplied respirators during tarp cutting and removal. Since the growers had to make the methyl bromide applications themselves they had to understand the fumigation process better than they had before. Kazu says "We were not thinking too much about the fumigation process. The fumigator would come in and do his job. Now we pay much more attention to the preparation of the soil for fumigation. We know now we have to prewet the soil to get the soil to a 50% moisture content. The fumigant works better."

Dramm and Echter, Inc. in Encinitas, produces field grown and greenhouse-grown cut flowers. Bob Echter believes that the new regulations will have minimal impact on their growing operations. "We are fortunate in our field locations in that we have almost no residential neighbors. The greatest impact of the new regulations will be on the smaller growers with many neighbors. These smaller growers make up a significant proportion of producers in our area. We need to keep these growers operating and viable."

"At Dramm and Echter, we are adapting to the most recent regulations by utilizing 'strip' fumigating, i.e. fumigating smaller parcels at a time to ensure we don't exceed thresholds. This may or may not increase the costs of fumigation. "There will still be some field production areas which we cannot fumigate. Looking ahead to the time when methyl bromide is not available to us at all, we will be using these areas to trial alternatives to methyl bromide" continued Echter.

A concern of Echter's regarding methyl bromide is continued greenhouse use. Some of their greenhouse operations were already equipped with steam, and Echter has increased the use of steaming in these operations. "In greenhouses that do not have steam boilers, we are fortunate that we are moving toward soil-less production in the greenhouse, which avoids the problem of fumigation altogether."

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