Flw & Nur Rpt, March '73

4. Using aseptic techniques, wound the bud with a sharp razor blade or scalpel, as described.

5. Implant on Knudson C agar solidified medium containing 2 mg./L. NAA.

6. Remove rooted adventitious shoots as they form and transfer plantlets to fresh Knudson C medium. Handle like seedlings.

7. To ensure continued formation of adventitious buds, transfer original node pieces to new medium whenever adventitious buds are removed or as the medium dries out.

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STABY - OSU

CARNATION BUD OPENING WITH 23 SOLUTIONS

Seward T. Besemer*

Besemer '73

This carnation experiment compared combinations of bud-opening solutions containing 2 or 5 percent sugar, 100 ppm or 200 ppm 8-Quinolin citrate (8-QC), and 0.5 or 1.0 percent of two surfactant-type products (Amway L.O.C.® or Water-In®)[1] in their effects on bud opening and extending the vase life. Three proprietary flower preservatives, also part of the test, included Everbloom®, Petalife®, and Floralife®.

New improved 'White Sim' carnation buds (½ to ¾ inch of petals extending above the calyx) were stored dry at 40° F. for 1 week. On June 9, 1971, the stems were re-cut to an 18-inch length and placed in the solutions to determine the solutions' suitability for bud opening and flower keeping life. Ten stems were placed in each of the 23 solutions. The room in which the test was conducted was maintained at a constant 80° F. temperature. Fluorescent lights supplied approximately 100 foot-candles of light, and an exhaust fan in the ceiling assured a continuous change of air in the room. All solutions were made using Colorado River water, which contained 800 ppm total dissolved salts.

RESULTS

Table 1 shows the maximum number of buds that opened, the number of days elapsed until they opened, and the average days of keeping life of the 23 solutions. The treatments are arranged in a descending order by a performance rating that combines bud opening and keeping life results.

The three solutions that resulted in the best combination of bud opening and keeping life were those which contained Everbloom®; 100 ppm 8-QC plus 5 percent sugar plus 0.5 percent Water-In®; and 100 ppm 8-QC plus 5 percent sugar plus 0.5 percent L.O.C.® (table 1).

If the ten solutions containing 2 percent sugar are compared with the ten with 5 percent sugar (table 2), an average of 85 percent of the buds were successfully opened with 5 percent sugar. Only 62 percent of the buds were opened with 2 percent sugar. Also, the 5 percent sugar solutions had the larger average keeping life of 9.67 days, against 7.56 days for the 2 percent sugar solutions.

Table 3 shows the solutions containing 100 ppm 8-QC compared with those containing 200 ppm 8-QC. The 100 ppm 8-QC solutions averaged 81 percent buds opened versus 68 percent for the 200 ppm 8-QC solutions. Unlike the parallel relationship between buds opened and average keeping life in the sugar rates in table 2, there is an inverse relationship in table 3. The 100 ppm 8-QC solutions averaged 8.32 days keeping life, and the 200 ppm 8-QC solutions averaged 9.07 days.

The effects of the two surfactants and their respective rates in the various solutions are given in table 4. More buds opened in the solutions containing no surfactant or 0.5 percent surfactant than in the solutions with 1.0 percent surfactant. There was little difference in average keeping life between solutions with no surfactant, 0.5 percent, and 1.0 percent surfactant.

[1] L.O.C.® is a product of Amway Corp., Ada, Michigan; Water-In® is a product of Water-In, Inc., Altadena, California.

Based on these trends, it appears that, in this experiment, 100 ppm 8-QC may be equal to or better than 200 ppm 8-QC; 5 percent sugar is superior to 2 percent sugar; and 1.0 percent of a surfactant-type material such as L.O.C.® or Water-In® is excessive. It is also interesting to note that, in each case where 0.5 percent surfactant was present in four of the ten best solutions, that solution also contained 5 percent sugar. None of the ten best solutions contained 1.0 percent surfactant.

* Farm Advisor, San Diego County.

TABLE 1. Carnation Bud Opening and Average Days of Keeping Life (of Buds Opened) for 23 Solutions.

Solution	Number of Buds Opened	Days To Open	Average Days Life[1]	Performance Rating[2]
Everbloom® 12 gm./liter	10	2	7.0	35.0
8-QC 100 ppm, 5% sugar, 0.5% Water-In®	10	5	10.7	21.4
8-QC 100 ppm, 5% sugar, 0.5% L.O.C®	10	5	9.5	19.0
8-QC 200 ppm, 5% sugar, 0.5% L.O.C®	10	5	9.3	18.6
8-QC 200 ppm, 2% sugar	10	5	9.0	18.0
8-QC 100 ppm, 2% sugar	10	5	8.8	17.6
8-QC 200 ppm, 5% sugar, 0.5% Water-In®	8	5	10.6	17.0
8-QC 200 ppm, 5% sugar	8	5	10.1	16.2
8-QC 100 ppm, 5% sugar	10	5	8.0	16.0
Petalife® 20 gm./liter	8	5	9.9	15.8
8-QC 100 ppm, 5% sugar, 1.0% Water-In®	9	5	8.7	15.7
Floralife® 20 gm./liter	9	5	8.4	15.1
8-QC 100 ppm, 5% sugar, 1.0% L.O.C.®	8	6	9.6	12.8
8-QC 200 ppm, 2% sugar, 1.0% L.O.C.®	7	5	7.7	10.8
8-QC 200 ppm, 5% sugar, 1.0% Water-In®	6	5	8.8	10.6
8-QC 200 ppm, 5% sugar, 1.0% L.O.C.®	6	6	10.5	10.5
8-QC 100 ppm, 2% sugar, 0.5% L.O.C.®	7	5	7.3	10.2
8-QC 200 ppm, 2% sugar, 0.5% Water-In®	7	5	7.0	9.8
8-QC 100 ppm, 2% sugar, 0.5% Water-In®	6	5	6.3	7.6
8-QC 100 ppm, 2% sugar, 1.0% Water-In®	4	5	8.8	7.0
8-QC 200 ppm, 2% sugar, 0.5% L.O.C.®	5	5	6.0	6.0
8-QC 100 ppm, 2% sugar, 1.0% L.O.C.®	5	5	5.0	5.0
8-QC 200 ppm, 2% sugar, 1.0% L.O.C.®	1	5	9.0	1.8

[1] Average days keeping life is from start of experiment, including the period of bud opening.

[2] Number of buds opened × average days keeping life ÷ days to open.

TABLE 2. Comparison Between Solutions Containing 2 Percent and 5 Percent Sugar.

2% Sugar			5% Sugar		
Number of buds opened	Total days keeping life[1]	Average days keeping life[1]	Number of buds opened	Total days keeping life[1]	Average days keeping life[1]
10	90	9.0	10	107	10.7
10	88	8.8	10	95	9.5
7	54	7.7	10	93	9.3
7	51	7.3	8	91	11.4
7	49	7.0	8	85	10.6
6	38	6.3	10	80	8.0
4	35	8.8	9	78	8.7
5	30	6.0	8	77	9.6
5	25	5.0	6	63	10.5
1	9	9.0	6	53	8.8
62 (total or %)	469 (total)	7.56 (average)	85 (total or %)	822 (total)	9.67 (average)

[1] Keeping life (both total days and average days) is only for buds that opened and includes time for opening. Each treatment started with 10 buds.

TABLE 3. Comparison Between Solutions Containing 100 and 200 ppm 8-QC.

100 ppm 8-QC			200 ppm 8-QC		
No. of buds opened	Total days keeping life[1]	Average days keeping life[1]	No. of buds opened	Total days keeping life[1]	Average days keeping life[1]
10	107	10.7	10	93	9.3
10	95	9.5	8	91	10.1
10	88	8.8	10	90	9.0
10	80	8.0	8	85	10.6
9	78	8.7	6	63	10.5
8	77	9.6	7	54	7.7
9	51	7.3	6	53	8.8
6	38	6.3	7	49	7.0
4	35	8.8	5	30	6.0
5	25	5.0	1	9	9.0
81 (total or %)	674 (total)	8.32 (average)	68 (total or %)	617 (total)	9.07 (average)

[1] Keeping life (both total days and average days) is only for buds that opened and includes time for opening. Each treatment started with 10 buds.

TABLE 4. Comparison Between Solutions Containing No Surfactants and One of Two Surfactants Present at 0.5 Percent and 1.0 Percent Levels.

		No Surfactant		0.5% Water-In®		0.5% L.O.C.®		1.0% Water-In®		1.0% L.O.C.®		Totals		
PPM 8-QC	Percent Sugar	Open buds	Total days	Open buds	Total days	Open buds	Total days	Open buds	Total days	Open buds	Total days	Open buds	Total days	Average days[1]
100	2	10	88	6	38	7	51	4	35	5	25	32	237	7.4
100	5	10	80	10	107	10	95	9	78	8	77	47	437	9.3
200	2	10	90	7	49	5	30	7	54	1	9	30	232	7.7
200	5	8	91	8	85	10	93	6	53	6	63	38	385	10.1
Totals		38	349	31	279	32	269	26	220	20	174	147	1,291	8.8
Average days[1]		9.2		9.0		8.4		8.5		8.7				

[1] Average days keeping life of buds opened.

LIVERWORT CONTROL ON LINERS

Richard G. Maire and Clyde L. Elmore*

Marchantia, a form of thallose liverwort, has long been present in California nurseries. In the spring of 1972, this weed pest became so serious that inquiries were made for possible control measures. One grower had three to four employees weeding the liverwort from liners on a nearly full-time basis. In nurseries where there is a large liverwort population, hand weeding may cost as much as $5,000 per year.

Since no work had been done to control this plant, a project was started to find a control.

Consan®,[1] a combination of ammonium salts plus wetting agents, was selected to test for liverwort control. It was initially used in an area of heavy infestation.

On May 12, 1972, liverwort was sprayed at three rates: 200, 400, and 800 ppm active ingredient. This test was in a plastic house on the ground in a sunny location, with temperatures in the low 80's during the day. Consan® was most effective at the 800 ppm rate; it completely killed the liverwort. The 400 and 200 ppm rates seemed to only partially kill the weed plants. The effect of the application was apparent the day after treatment. No regrowth appeared in 6 weeks.

On May 18, 1972, new plots were established using heavily infested liners and rooted cuttings. The following species were used as liners: oleander, carob, pyracantha, cypress, camellia, and thuja (rooted cuttings). All were treated at the high rate of the previous trial: 800 ppm (2 tablespoons per 2 gallons) Consan®. These plants were under saran (55 percent shade). There was a heavy overcast the morning of treatment, with temperatures in the high 60's. However, the afternoon was sunny, with a high of 78° F. No damage was observed on any of the species. Liverwort control was nearly 100 percent.

A treatment was applied on May 26 to try to establish a tolerance of various plant species to the Consan®. Two rates were used: 1,600 ppm and 2,400 ppm. Liners of carob, pyracantha, camellia, and cypress were treated. No damage was observed at these rates.

Another test was conducted using Consan® on oleander liners. A large block was treated with 6 tablespoons per gallon (4,200 ppm). This rate caused leaf spotting on the oleanders. Liverwort control was complete and no regrowth occurred.

Further tests need to be conducted to establish the most effective time and temperature for treatment and the most economical rate for satisfactory control.

Consan® is not registered for use for the control of liverwort on woody plants. The information in this article is a progress report of current research and is not a recommendation for commercial use at this time.

[1] Consan® = N-alkyl (60% C14, 30% C16, 5% C12, 5% C18) dimethyl benzyl ammonium chloride 9%; N-alkyl (50% C12, 30% C14, 17% C16, 3% C18) dimethyl ethylenezyl ammonium chloride 9%; N-alkyl (50% C12, 30% C14, 17% C16, 3% C18) dimethyl benzyl ammonium chloride 2%; other materials 80%; produced by Consan Pacific, Inc., Box 208, Whittier, California.

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METHYL BROMIDE FUMIGATION OF CHRYSANTHEMUM SOILS

R. H. Sciaroni and A. H. McCain*

Methyl bromide, when used as a soil fumigant, controls many soilborne diseases, insects, nematodes, and weeds. It does not completely destroy some fungi, notably *Verticillium albo-atrum*, the cause of Verticillium wilt. In fact, Verticillium wilt is often more severe in soil fumigated with only methyl bromide. Chloropicrin does kill the Verticillium fungus, and a combination of methyl bromide and chloropicrin at the proper rates makes an ideal fumigant for many situations.

Most greenhouse chrysanthemums are grown in soil steamed by the Thomas method (steam pipes on the soil surface). Heat penetration in ground bed plantings is frequently only 5 to 6 inches. This does not adequately control some pests and disease-producing organisms at greater depths. It has been previously demonstrated that Verticillium wilt is no longer a problem in soils that have been steamed for several years.[1] One pest that is not always adequately controlled by steaming is the garden centipede.[2] Methyl bromide fumigation does an excellent job of controlling this pest.

Steam treatment allows rapid successive plantings. Methyl bromide also allows rapid cropping since the treatment time is 48 hours and the aeration period following removal of polyethylene covers can be as short as 48 hours. (Longer aeration is recommended for some crops.)

In order to determine whether chrysanthemums grow as well in soil fumigated with methyl bromide as in soil steam treated by the Thomas method, a replicated trial was conducted at the H. Nakano & Sons Nursery in Redwood City, California. Four 40-inch-wide ground beds with 4-inch redwood sideboards were divided and 100 square feet, or 30 feet of each bed, were covered with a 4-mil polyethylene tarp held down on the outside of the boards (in the aisles) with sand-filled, canvas "snakes." One pound of 98 percent methyl bromide plus 2 percent chloropicrin per 100 square feet was released under the polyethylene cover.[3] The remainder of the bed—about 40 feet—was steamed by the Thomas method. Before fumigation, redwood sawdust had been added to the soil, which was thoroughly tilled with a post-hole auger to a depth of 2 feet.

The polyethylene covers remained in place for 48 hours. The four beds were planted with 'Albatross' chrysanthemum plants on May 31, 1972, 6 days after the methyl bromide application. Since the soil had been tilled to a depth of 2 feet, which was not a normal practice, all of the plants except those in the 12 feet at the end of each bed were sprayed with 50 percent benomyl at 4 pounds per 100 gallons water 7 days after planting to ensure that Verticillium wilt would not be a problem. No Verticillium wilt developed in the nonsprayed areas and there was no beneficial effect from the benomyl treatment.

On August 14, 1972—approximately 7 days before harvest—the trial was evaluated. The planting was exceptionally even except for the normal drop-off at the ends of the beds near the fans or near the cooling pads. No measurements were taken since the crop was so uniform. The obvious conclusion was that methyl bromide could be used instead of steaming on an intermittent basis or as a necessary substitution.

One word of caution. Methyl bromide is a toxic gas and its use in confined areas, such as the greenhouse, must be carefully supervised. During fumigation and aeration, there must be continuous exchange of the greenhouse air with the outside air. Normal fan and pad cooling (air flow rate—8 cubic feet per minute per square foot of ground area) is adequate ventilation to ensure that toxic levels of methyl bromide do not build up. As an additional precaution, entries and exits to the treated areas should be plainly marked with warning signs that instruct people to stay out. Always use methyl bromide with 2 percent chloropicrin as a warning agent. This amount of chloropicrin does not significantly contribute to the pest control qualities of the fumigant.

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[1] McCain, A. H., and R. H. Sciaroni. 1972. "Steam and chemical treatments of chrysanthemum soils." *Flower and Nursery Report*, January 1972:3-4.

[2] Allen, William W., and Peter J. Lert. 1972. "Chemical control of garden centipedes." *Flower and Nursery Report*, January 1972:1.

[3] The polyethylene covers, snakes, and methyl bromide for this trial were donated by Namco, Milpitas, California.

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VERTICAL MULCHING FOR CHRYSANTHEMUM PLANTINGS

R. H. Sciaroni and R. L. Branson*

The soil in ground bed plantings of greenhouse chrysanthemums is generally in excellent physical condition to a depth of 8 to 10 inches. This is because of the common practice of thorough rototilling between crops and the addition of redwood sawdust when needed. Incorporation of redwood sawdust, particularly in the finer textured soils, improves aeration and makes it easier to work and handle the soil. However, rototilling with L-shaped blades can cause soil compaction at the layer where no redwood sawdust has been incorporated.

Recent studies have shown that water mold root rot problems in ground bed plantings are very common. This is probably because, in the Thomas method of steaming (pipes on top of the soil), the heat does not penetrate to a sufficient depth to kill all of the water mold root rot organisms. In many cases, soil incorporation and drench applications of the fungicides diazoben (Dexon®) and ethazol (Truban®) have been very beneficial in controlling water mold root rot. However, the difficulty with poor drainage still persists.

John Kyne, Yoder Bros., and Shozo Mayeda, chrysanthemum grower of Mountain View, California, tried to prevent this problem by incorporating redwood sawdust by means other than rototilling. Shozo used a soil auger (post-hole digger) to mix the sawdust to a depth of about 2 feet. This practice is a form of vertical mulching and has been used in field agriculture for many years.

Jim and Kei Nakano, chrysanthemum growers of Redwood City, California, tried the same technique. They broadcast a 2-inch layer of redwood sawdust on the surface of ground beds. A 6-inch-diameter soil auger (post-hole digger) was used at a spacing of 12-inch centers to mix the sawdust in the soil to a depth of 20 to 24 inches. In addition, they switched from L-shaped tiller blades to the hook type in order to avoid any further compaction. Shozo Mayeda and the Nakanos immediately observed a marked improvement in drainage.

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CALCIUM NITRATE INJECTION

D. S. Farnham and R. L. Branson*

Several greenhouse growers have recently encountered scum formation on fertilizer concentrate tanks that contained calcium nitrate. We have learned that calcium nitrate produced in Norway is given a light coating of paraffin wax and oil conditioning agent. This keeps the calcium nitrate from absorbing moisture that can cause caking when it is shipped in bulk to the United States.

Tests are under way in Norway to develop a coating that will not create scum. Meanwhile, growers can reduce this problem by adding a small amount of any commercial agricultural wetting agent. The wetting agents will emulsify the paraffin and oil coating so it will easily pass through the injector and irrigation systems. Tween 20®, Triton B1956®, or X-77® are examples of the wetting agents that can be used.

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ANCYMIDOL ON AZALEAS

James R. Breece and Tokuji Furuta*

Ancymidol was evaluated for controlling azalea vegetative growth and flower bud initiation at Ruline Nursery, Fallbrook, California, during the spring of 1972. The ancymidol formulation used was EL-531 WP. Four varieties were treated—two ('Knute Erwin' and 'Ambrosiana') as small plants in flats in a greenhouse and two ('Red Wing' and 'Pink Supreme') in 6-inch pots in a shade house. The same concentrations of ancymidol—150 and 300 ppm—were used as foliar sprays for both sets of plants.

The first application was made on March 14, 1972. For the plants that were re-treated, a second application was made on March 20, 1972. The plants in each flat received 80 ml. of solution. The flats' inside dimensions were 12½ inches by 17 inches and outside dimensions 13½ inches by 18 inches. Each flat contained 20 plants. The larger plants in 6-inch pots were sprayed until the foliage was wet. However, the amount of spray used was not determined. Observations on growth were made continuously until June 27, 1972.

OBSERVATIONS ON POTTED PLANTS

Varietal differences were quite evident. All treatments severely retarded 'Pink Supreme' plants. At the highest dosage, the leaves were reduced in size and deformed. Internode elongation was so severely retarded that a "witches broom" effect was noted, with many buds or short shoots clustered at the end of the shoot. Response of 'Red Wing' plants was directly related to dosage. However, 'Red Wing' retardation at the highest dosage was not as severe as that at the lowest dosage on 'Pink Supreme' plants.

OBSERVATIONS ON SMALL PLANTS IN FLATS

The response of 'Knute Erwin' and 'Ambrosiana' plants was related to dosage (table 1). Treatment with ancymidol resulted not only in shortened shoots but also in earlier flower bud initiation on both varieties tested.

When the same dosage was applied, the effectiveness of one application versus split applications varied with the azalea variety. Comparing two applications of 150 ppm each with one application of 300 ppm, two applications were more effective on plants of 'Knute Erwin.' However, the reverse held for plants of 'Ambrosiana.'

PLANT INJURY

No foliage burn occurred on plants treated with ancymidol. Overdose effects were severe dwarfing and foliage deformity.

SUMMARY

The treatments were so effective that the nursery manager is anxious to repeat this study on all azalea varieties. This should add further information on varietal responses. Ancymidol is

TABLE 1. Response of Azalea Cultivars 'Ambrosiana' and 'Knute Erwin' to Ancymidol.

Treatment		'Ambrosiana'		'Knute Erwin'	
Concentration	Number of Applications	Number of Nodes	Shoot Length (inches)	Number of Nodes	Shoot Length (inches)
150 ppm	1	15.9(6.3)[1]	4.1(2.2)	20.6(4.4)	4.3(1.3)
	2	17.1(4.0)	3.9(1.1)	10.7(3.7)	2.1(0.6)
300 ppm	1	13.3(2.9)	3.0(1.1)	13.7(4.2)	2.7(0.8)
	2	9.1(2.2)	2.0(0.2)	9.2(2.3)	1.8(0.5)
Control		—[2]	—	23.6(2.7)	6.5(0.8)

[1] Standard deviation placed in parenthesis ().

[2] Plants had been destroyed before these data were gathered.

effective on azaleas. However, the effect of formulation should be tested.

Ancymidol (A-Rest®) is not registered for azaleas. The information in this article is a progress report of current research and is not a recommendation for commercial use at this time.

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FOLIAR NEMATODE ON ORNAMENTAL PLANTS

B. Lear, S. T. Miagawa, and R. H. Sciaroni*

The foliar nematode has long been known to be a serious pest on such greenhouse plants as African violet, begonia, coleus, and chrysanthemum. Symptoms of infection are brown specks or triangular-shaped dead areas between the veins on the foliage. These specks or triangular areas join and eventually the entire leaf dies.

Foliar nematodes are microscopic worms that move in a film of water on foliage, stem, and flower surfaces. They are spread from plant to plant by splashing water and enter leaves through the stomata. Infected cuttings are the principal means of introduction to plantings. Severe losses can occur in the greenhouse when the tops of plants are watered excessively. Outdoor plantings can also be affected in areas of frequent rainfall.

Heavy foliar nematode infestations were recently found on Reiger begonia in a San Mateo County commercial greenhouse. This nematode was identified as *Aphelenchoides fragariae*. Foliar nematode was also found on baby's tears (*Urtica* species) and identified as *Aphelenchoides ritzemabosi*. This is the same species as the nematode found on chrysanthemum and African violet. The late Dr. A. W. Dimock did considerable research on this pest and reported that parathion sprays were effective in a control program on chrysanthemums. Unfortunately, parathion can no longer be recommended for greenhouse application.

In recent experiments, spray treatments on Reiger begonia with several commonly recommended insecticides were not effective. Tests are now in progress using experimental nematicides; at least one product seems to be very good. Studies are also being made to determine whether hot water treatment of propagating material will do the job. When more conclusive results are obtained, they will be released to growers and industry representatives.

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WARNING ON CHEMICAL RESIDUES

These recommendations are based on the best information currently available for each chemical listed. Treatments based upon these recommendations should not leave residues that will exceed the tolerance established for any particular chemical. To avoid excessive residues, follow directions carefully with respect to dosage levels, number of applications, and minimum interval between application and harvest.

THE USER IS LEGALLY RESPONSIBLE for problems caused by drift from his property to other properties or crops.

Geo. B. Alcorn

Director of Agricultural Extension