In this experiment the results indicated that nutrient sprays made a positive difference in the growth and rooting of the cuttings.

The treatment most effective was the ammonium nitrate spray. In both trials it significantly enhanced root weight and height of cuttings and in trial 2 it also increased total cutting weight. Leaf numbers were also counted with the other data. Fertilizer treatments averaged seven or eight leaves while the control averaged six leaves per cutting.

Literature Cited


WETTABLE POWDER DUSTS

Jay S. Kothe
Extension Floriculturist

Wettable powder formulations of fungicides, insecticides and miticides have been used as dusts in greenhouses for more than 40 years. The practice has slowly gained popularity even though little research has been published and chemical companies have not included this usage on their labels.

For a few years, such a use of wettable powders was considered illegal since it was not labelled. This now appears to have been resolved with the FIFRA (Federal Insecticide, Fungicide and Rodenticide Act) interpretation of 1979 (10,11,12). Applying a rate of less than that on the label in conjunction with air as the conveyance medium instead of water is now considered to be legal.

Advantages of wettable powders as dusts:

1. Less pesticide is consumed.
2. Exposure time for the applicator is less than 5% of that required for spraying.
3. Residues on plants are decreased and spray spotting is not present.
4. Plant coverage is excellent.
5. Residual activity of the pesticide is enhanced.
6. Labor requirement is lower.
7. Costs of pest control are greatly reduced.

The procedure is simple. Mix equal parts of materials selected from the following incomplete list. Then dust weekly at a rate of only 1 to 2 oz. of the mixture per 1000 sq. ft.

General Contact

Bendiocarb (Ficam) 7b WP
Malathion 25 WP
Endosulfan (Thiodan) 5J WP
Uiazinon 5U WP
Hiteticide

Dienochlor (Pentac) 5U WP (use 1/2 part)*
Cyhexatin (Plictran) 5U WP
Fenbutatin-oxide (Vendex) 5U WP
Propargite (Umite) 3U WP
Ulcofol (Keltlane) 18.5 WP
Stomach and Contact Poison

Carbaryl (Sevin) 50 WP
Methoxychlor (Marlate) 50 WP

Fungicide

Captain 50 WP or 30 WP
Ferbam 76 WP
Mancozeb (Fore) 80 WP
Chlorothalonil (Daconil 2787) 75 WP
Zineb (Uthane Z-78) 80 WP
Folpet (Phaltan) 50 WP
Sulfur WP or dust
Maneb (Uthane M22) 80 WP

Aphicide

Pirimicarb (Pirimor) 50 WP (use 1/2 part)*
Lindane 25 WP

* These materials are effective at lower concentrations in the mixture.

Some common materials cannot be used. Benomyl (Benlate) clogs the duster. Many pesticides are not formulated as wettable powders that can be used as dusts.

Once the mixture is made, it is blown into the greenhouse atmosphere over the crops. The particles are so fine that they remain suspended in the air for hours. The tiny particles appear to acquire a positive charge as they leave the duster and as a result, or since they remain suspended so long, the lower surfaces of the leaves are also protected. Uniform coverage is enhanced in greenhouses equipped with horizontal air flow. No research has been reported on the individual components to ascertain whether or not all the wettable powders listed above provide the same coverage on both upper and lower plant surfaces.

To reduce exposure to personnel, most greenhouse operators prefer to use wettable powder dusts prior to a relatively inactive day each week, possibly the last thing Friday or Saturday. They find that it is essential to dust every week since this is a minimal pesticide application used only as a preventative measure. Less material is generally required for exclusion than for eradication of a pest.

During the summer, when temperatures are high, it may be necessary to dust late at night since ventilators should be closed for at least 4 hours.

Results and Discussion

Fifteen days after treatment, the chrysanthemum cuttings were lifted and measured for total weight, root weight, height (not including roots) and leaf number.

Immediately after the data was recorded, the cuttings were recut above the roots and stuck back into the rooting medium and the treatments were continued for thirty additional days when they were evaluated on the same basis.

The data was evaluated by finding the mean ± the standard error for each treatment in both trials. By comparing this information significant statistical difference between groups was determined (See Table 3).

Table 3. Effect of Nutrient Sprays on the Total weight, height and Root weight of Chrysanthemum morifolium Cuttings Under Propagation

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Total Cutting Weight (gms.)</th>
<th>Root Weight (gms.)</th>
<th>Height of Cutting (cm.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Trial</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Tap water</td>
<td>4.75±0.19</td>
<td>0.93±0.05</td>
<td>12.41±0.30</td>
</tr>
<tr>
<td>2) Complete Fertilizer</td>
<td>5.03±1.0U</td>
<td>1.15±0.05</td>
<td>13.0±0.30*</td>
</tr>
<tr>
<td>3) KN03</td>
<td>5.14±0.13</td>
<td>1.16±0.05</td>
<td>14.1±0.18*</td>
</tr>
<tr>
<td>4) NH4NO3</td>
<td>5.09±0.2U</td>
<td>1.33±0.10*</td>
<td>14.01±0.40*</td>
</tr>
<tr>
<td><strong>Second Trial</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Tap water</td>
<td>3.12±0.14</td>
<td>1.02±0.09</td>
<td>7.42±0.39</td>
</tr>
<tr>
<td>2) Complete Fertilizer</td>
<td>3.24±0.15</td>
<td>1.04±0.06</td>
<td>8.00±0.21</td>
</tr>
<tr>
<td>3) KN03</td>
<td>3.01±0.13</td>
<td>1.16±0.05</td>
<td>7.99±0.22</td>
</tr>
<tr>
<td>4) NH4NO3</td>
<td>3.81±0.22*</td>
<td>1.42±0.07*</td>
<td>9.33±0.30*</td>
</tr>
</tbody>
</table>

1 Each datum represents the mean ± SE of three replications for a total of thirty cuttings in each treatment.

* datum significantly varied from the control.
Methods and Materials

The 'Bright Golden Anne' cuttings were graded to a uniform fresh weight (between 2.3 and 2.9 grams) and leaf number in October, 1983.

Three fertilizer treatments plus a control were replicated three times with 10 cuttings per treatment for a total of 120. A 14 x 20" greenhouse wooden flat was used with cuttings stuck two inches apart in rows (other species in the flats are not reported here). The rooting medium was 1:2 sand:perlite. Before sticking into the medium, the cuttings were dipped in Hormodin 1.

The flats were placed under mist in a greenhouse where temperatures ranged from 60°F at night to 70°-80° in the daytime. Overhead incandescent lights provided an extended photoperiod.

Treatments were initiated two days after sticking the cuttings. They were as follows: Treatment 1, tap water control; Treatment 2, 100 ppm N from 20-20-20; Treatment 3, 130 ppm N from potassium nitrate and Treatment 4, 264 ppm N from ammonium nitrate.

The dilution of .01 mole of fertilizer per liter of water was used because it approximated the strength of fertilizer solution (ounces per gallon) used in the experiments in the literature. Because potassium and nitrogen are two of the nutrients most easily leached from plant tissue it was decided to use KN03 and NH4NO3 mono-nutrient fertilizer sprays. A complete fertilizer spray was also applied as a second form of control.

The treatments were randomized in each replication. Each treatment was applied with a plastic trigger spray bottle and amounted to about 1 ml per cutting. One hour before each treatment, a plastic canopy was placed over each flat to intercept the water mist and allow the foliage to dry. This prevented dilution of the treatment sprays with water from the mist system. The plastic sheets were removed during treatments and replaced until the plant surfaces were dry once again. To prevent spray drift between treatments, a cardboard barrier was held between each treatment during spray application.

The cuttings received one treatment per day at random times (from 9:00 a.m. to 4:00 p.m.) five days a week.

The temperature of the propagation medium was maintained at about 70°F with bottom heat during the experiment.
The Effect of Nutrient Spray on the Propagation of Chrysanthemum Cuttings

By Barbara A. Stiehl
Graduate Student
and Sidney Waxman
Professor of Plant Science

Abstract

Unrooted cuttings* of Chrysanthemum morifolium 'Bright Golden Anne' were subjected to fertilizer (KNO₃, NH₄NO₃ and 20-20-20) and a water spray control to determine if there would be any difference in root weight, total cutting weight, leaf number and linear cutting height. A solar controlled (Solatrol) water mist system was used before and after treatment application. Nutrient sprays, especially NH₄NO₃, positively influenced the growth and rooting response of the cuttings.

Introduction

It is generally recognized that the propagation of plants under a water mist causes leaching of metabolites, both organic and inorganic, from the exposed plant surfaces. Long (1956) found a ten percent reduction in calcium, potassium, magnesium, nitrogen and phosphorus in green beans when exposed to mist. Tukey (1962) surveyed an assortment of plant species for leachability under mist. He found leaching to be greater in mature leaves and in herbaceous cuttings than in immature leaves and in hardwood cuttings. Tukey also related leachability to the nutrients' function within the plants' metabolic processes and to environmental factors such as light intensity and humidity.

As a means of reducing nutrient losses through leaching, nutrients can be applied to cuttings during propagation through intermittent mist (Wott and Tukey, 1967). Dick (1960) found faster and greater root formation, increased weight, better color and faster growth of chrysanthemums under nutrient mist resulting in an increase in productivity.

This paper studies the effect on the rooting and vigor of chrysanthemum cuttings when sprayed on the cuttings rather than in the mist.

* Supplied through the courtesy of Stafford Conservatories, Stafford Springs, Connecticut.
Perennials are finally gaining the national recognition they deserve! The Perennial Plant Association was formed last year after the 1983 Symposium which attracted 300 participants from 28 states and Canada. A bouquet to Connecticut's own Pierre Bennerup, Sunny Border Nurseries, Kensington, one of the organizers of the association.

This three day Symposium sponsored by the Perennial Plant Association covers a wide variety of subjects by speakers from Oregon to Minnesota to Massachusetts to Virginia, not to mention Ohio, and of course, Connecticut. Pierre says that the popularity of perennials is cyclic and that we are on an upswing. Perhaps the Perennial Plant Association will perpetuate the rise in popularity and these plants will continue to be a more significant segment of the horticultural industry.

For more information and a registration form, contact Steven Still or Elton Smith (a former Conn. County Agent) at the Dept. of Horticulture, 2001 Fyffe Court, Columbus, Oh 43210. Or call Steve who is Interim Secretary-Treasurer of PPA on 614-422-0027.

CONTROLLING WEEDS IN OR NEAR THE GREENHOUSE

J. F. Ahrens
Plant Physiologist
The Connecticut Agricultural Experiment Station
Valley Laboratory, Windsor, CT

Dr. Ahrens has conducted many herbicide trials in the greenhouse over the years. The last issue (#120) summarized the control aspects of herbicide use in the greenhouse as interpreted by Mr. Maisano. The following article presents details of Dr. Ahrens' research.

Numerous experiments have been conducted at the Valley Laboratory over the past 10 years to evaluate the usefulness and potential hazards of herbicides in and around greenhouses. In addition, many grower problems involving herbicides in greenhouses have been investigated. The following is a brief summary of our findings.

To use herbicides effectively in or around greenhouses, it is essential to understand their potential hazards. These hazards include:

A. Production of vapors toxic to plants.
B. Contamination of ground water wells.
C. Injury to plants in flats or pots from root uptake.
D. Mistaking herbicides for other pesticides.
E. Use of field soils that contain residues for potting mixes.
F. Misuse of herbicides by gross overapplication or by sabotage or vandalism.

A. To be safely used under benches or under flats or pots in greenhouses, a herbicide should not produce phytotoxic vapors. Herbicides that we or others have found to produce phytotoxic vapors include:

- 2,4-D
- Casoron
- Diclofop
- Horosac
- Tordon
- Lasso
- Tordon
- Dual
- Aatrex
- Scott's Ornamental Herbicide II

Spike - tebuthiuron
Treflan - trifluralin
dichlobenil - oxyfluorfen
Pramitol - prometon
picloram - Vapam
alachlor - Dowfume
metolachlor - Pentachlorophenol
atrazine
oxyfluorfen+pendimethalin
Other herbicides in our tests that produced vapors that were mildly toxic to plants included:

- Chloro IPC
- chlorpropham
- Konstar
- Furloe
- Scott's Ornamental
- herbicide I
- Devrinol - napropamide
- oxadiazon

All of these would be hazardous to use in greenhouses with live plants other than those listed on the labels.

B. Contamination of ground water can occur from soluble herbicides applied too heavily or dumped in the vicinity of wells. Two herbicides that have contaminated wells supplying greenhouses are Tordon (picloram) and Banvel (dicamba). Both are highly toxic to annual plants, highly water soluble and neither has any place in or near greenhouses. Water from ponds or streams where Tordon is used on the watershed is best not used to irrigate plants without testing.

C. Application of many residual herbicides in ground beds is hazardous to flats or pots of plants placed on the treated areas. Problems occur as roots grow into treated soil and absorb the herbicide or as ponding occurs and the herbicides dissolve in the water and penetrate the containers. Safe herbicides for pretreatment of ground beds include Diquat, Paraquat and Roundup for preplant control of established weeds, and Surflan at 2 to 3 teaspoons per 100 ft² for preemergence control under flats or containers. Surflan inhibits roots but does not translocate in the plant. Tilling soil treated with Diquat, Roundup or Paraquat before plants are planted in the soil reduces danger of root uptake.

A current experiment indicates that at least one week should elapse after Roundup application and placement of flats or pots with exposed roots. However, Roundup sprays on soilless potting mixes such as peat, perlite and sand may seriously injure herbaceous plants for several weeks after application. Roundup is not rapidly detoxified in such mixes as it is in soil. Spraying of weeds growing on stored piles of soilless potting mixes is therefore dangerous.

D. Mistaking herbicides for other pesticides can be minimized by storing herbicides apart from other pesticides and by reserving a separate sprayer for herbicides.
with the pulse treatment, fertilization was started a week after the seedlings were planted while continual fertilization began the day after planting.

Fertilizer usage was in the ratio of 7(continual): 4(pulsing). This should have been 7:3 with 600 ppm N. This means that less than half the nitrogen would have been used with pulsing. In these experiments, all the root media had sufficient background nutrition to provide good initial growth (Table 2). This may explain the lack of difference in growth. It may be concluded that it is not feasible to use continuous fertilization on bedding plants since the same results are obtained while using less fertilizer and that 20-20-20 (ca $.75/lb) gave results equal to 15-0-18 (ca $.22/lb).

If we average the values for all plants similarly treated (an invalid statistical procedure), the following values are obtained.

1. 15-U-18 produced plants 28% heavier than 20-20-20.
2. Continual fertilization plants were 5% heavier than pulse application.
3. Plants grown in the UConn soil were 16% heavier than in ProMix BX; those in Arisco soil 11% heavier.

While we might conjecture that 15-U-18 is better than 20-20-20 and that the soil mixes produced larger plants than the peat-lite, even a complete statistical analysis would not convince the authors that any particular treatment was superior to another.

Table 2. Spurway Soil Tests, before planting seedlings.

<table>
<thead>
<tr>
<th>Exp. 1.</th>
<th>pH</th>
<th>Salts</th>
<th>Ca</th>
<th>P</th>
<th>K</th>
<th>NO$_3$-N</th>
<th>NH$_4$-N</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arisco</td>
<td>6.0</td>
<td>75</td>
<td>085</td>
<td>4.9</td>
<td>18</td>
<td>30</td>
<td>u4</td>
<td>44</td>
</tr>
<tr>
<td>Pro Mix</td>
<td>5.9</td>
<td>36</td>
<td>08u</td>
<td>03.0</td>
<td>02</td>
<td>07</td>
<td>u4</td>
<td>20</td>
</tr>
<tr>
<td>UConn</td>
<td>7.0</td>
<td>55</td>
<td>07u</td>
<td>15.0</td>
<td>29</td>
<td>02</td>
<td>30</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exp. 2</th>
<th>pH</th>
<th>Salts</th>
<th>Ca</th>
<th>P</th>
<th>K</th>
<th>NO$_3$-N</th>
<th>NH$_4$-N</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arisco</td>
<td>6.0</td>
<td>80</td>
<td>09u</td>
<td>05.1</td>
<td>16</td>
<td>30</td>
<td>06</td>
<td>48</td>
</tr>
<tr>
<td>Pro Mix</td>
<td>5.9</td>
<td>65</td>
<td>130</td>
<td>06.4</td>
<td>04</td>
<td>18</td>
<td>04</td>
<td>19</td>
</tr>
<tr>
<td>UConn</td>
<td>7.1</td>
<td>36</td>
<td>075</td>
<td>12.3</td>
<td>22</td>
<td>05</td>
<td>10</td>
<td>37</td>
</tr>
</tbody>
</table>

E. Contaminated field soil. If field soil is obtained for greenhouse use, it could be contaminated with herbicide residues such as atrazine or simazine that are used on corn fields. If the cropping history of the soil is unknown, it can be bioassayed, using seeded and transplanted annuals as test plants. Oat is a good test plant for simazine or atrazine. For a control planting, one can thoroughly mix 3 tablespoons of activated carbon (such as Gro-Safe) into a flat of the same soil. The carbon detoxifies most field residues of herbicides. If growth is much better in the carbon-treated flat than in the untreated one, herbicide contamination is suspected.

F. Misuse of herbicides by gross over-application or by sabotage can occur with any herbicide. Sabotage has occurred with disgruntled (or fired) employees, where herbicides were readily available. Diagnosing the problem is often difficult. Herbicides are best stored under lock and key and out of the greenhouse area.

In the case of the soil fumigants (Vapam, methyl bromide), sufficient time and warmth of soil is necessary before planting to allow the vapors to dissipate. Cold soils in the late fall or early spring greatly delay dissipation. Plants placed in treated houses or soil under these conditions are killed. Using 2,4-D herbicides around greenhouses is hazardous because of potential drift of vapors and spray droplets into the houses.

Herbicides that we have found to cause no injury to plants in tests in plastic enclosures included:

- Asulox - asulam
- Daetal - DCQA
- Diquat - diquat
- Parquat - paraquat
- Gramoxone - paraquat
- Asulam - asulam
- Princep - simazine
- Roundup - glyphosate
- Sulfan - oryzalin
- Tenoran - chloroxuron
- Karmex - diuron

It is possible even these could be hazardous if sprayed onto heating pipes, which would greatly increase vaporization. Many other herbicides have not been evaluated for indoor use and should be considered hazardous until proven otherwise.

If a greenhouse is contaminated with a herbicide producing phytotoxic vapors, it may be possible to decontaminate it with activated carbon (Gro-Safe or Aqua Nuchar). Our earlier research showed that 100 to 200 lbs of activated carbon will detoxify 1 lb of most organic herbicides. Thus, if a herbicide were applied at 4 lbs/A,
up to 800 lb/A of activated carbon would be required. The carbon can be mixed with water and sprayed on. Sometimes it is necessary to incorporate the carbon into the soil.

Effective treatments to control established weeds and prevent regrowth under benches include:

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Per Gal of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Princep 80W plus Diquat*</td>
<td>3 tablespoons plus 2 tablespoons</td>
</tr>
</tbody>
</table>

An alternative treatment:

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Per Gal of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surflan 75W plus Diquat*</td>
<td>2-3 tablespoons plus 2 tablespoons</td>
</tr>
</tbody>
</table>

Apply about 1 qt of mix per 100 sq. ft. Avoid spraying of heat pipes.

* Roundup at 2 tablespoons may be substituted for Diquat.

**OUR APOLOGIES**

This issue is late - it should have been labelled "May." Instead, it is "June, #121".

We hope that it will be possible to bring the Newsletter back into schedule so please remember that your subscription is not truly on a yearly basis. Each "year" will consist of six issues no matter how long the year is.

Experiment #2: April 9 - May 7. Tomatoes, peppers, Savoy cabbage and kale were grown for four weeks in the same root media and under the same fertilizer treatments as in Exp. #1. Even less difference was noted in plant growth (Table 1). With pulse feeding the kale plants were shorter and stronger while with continual fertilization they were taller and more spindly.
PULSE AND CONTINUAL FERTILIZATION OF BEDDING PLANTS
By Michael Arisco, Student and Jay S. Kohts, Extension Floriculturist

In the 1950's and 60's fertilizer injectors came into widespread use. They are quite accurate and a large area can be fertilized with one batch of concentrated stock solution. By varying the concentration, fertilizer may be applied every irrigation (continuous) or pulsed, a more concentrated solution being applied at a given interval such as every week or 10 days.

In an experiment conducted at the University of Connecticut, pulsing and continual fertilization were compared. A literature survey disclosed no definitive information on the subject. The purpose of the experiment was to ascertain which method would give better plant growth.

Experiment #1; February 20 - April 2. Four bedding plants were grown; statice, ageratum, dahlia and verbena. Three soils were used: ProMix BX, UConn 3 compost : 2 (peat) : 1 (sand) and a typical Connecticut bedding plant soil mix (Arisco). Six seedlings of each were planted in each of six packs under two fertilizers and 3 root media and under continual or pulse fertilization and grown for 6 weeks.

Along with the two fertilizer practices, two types of fertilizers were used: 15-0-18 (3:2 calcium:potassium nitrates) and 20-20-20 (Peters). Under continual fertilization, plants were irrigated daily with 150 ppm nitrogen beginning two weeks after planting. With pulsed, a weekly application of 800 ppm nitrogen was applied due to an error in calculation (normal application is 500 ppm nitrogen).

No significant difference in plant size (Table 1) was found in Exp. 1, due to continual or pulsing fertilization. In general, the plants receiving 15-0-18 appeared to be darker green. 'Dahlia' and 'Verbena' grown in the Arisco medium bloomed earlier in both fertilization treatments.
Needless to say, the All-America Selections are the cream of the crop and home gardeners look forward to growing the newest selections each year. It is interesting to note that once chosen, some selections remain popular for many years. Some are still being grown today that were selected in the thirties and forties.

Because the All-Americas have been around for over 50 years, it would seem that producers and consumers would be aware of their unique contribution to gardening. Some are, but unfortunately many are not. There are new people, and even new generations of people, becoming interested in gardening. They must be educated and made aware of the All-Americas.

Growers must also continue their education and become familiar, not only with the new All-America Selections, but with the large numbers of new varieties and cultivars introduced by seed companies each year.

An excellent way to do this is to visit an All-America trial or display garden each summer. Although vegetables are tested at the University of Connecticut in Storrs and flowers at the University of Massachusetts in Waltham, MA, the only location in New England where both flowers and vegetables are tested is at the Comstock, Ferre & Co. trial grounds in Wethersfield, CT.

The All-America trials in Wethersfield are located on a three-acre site near I-91. This will be the fourth year of the trials. Vegetables are judged by Mr. Richard (Dick) Willard and the flowers by Mrs. Corinne Willard. Both are graduates of the University of Connecticut.

The plants being tested are grown in rows next to one or more existing cultivars for comparison. Although the trial plants are only numbered at this time, it is possible to check with the trial grounds after February 15 of the following year for the names of those designated as winners.

With the current trials a number of All-America award winners from previous years are grown for display purposes. Other outstanding cultivars are also included. For the first time this year, demonstration gardens are being added to suggest the use of vegetables and flowers in the home garden.

Fortunately it will be possible for us to see all of these trials and displays this summer. Field days are being planned for Saturday, August 11 and Sunday, August 12 from 10:00 a.m. to 3:00 p.m. Both Corinne and Dick Willard as well as their staff will be on hand to guide you and answer your questions. The Willards suggest taking exit 26 from I-91 and following the signs. Or, stop at the store at 263 Main Street, Wethersfield for directions to the farm.

The field days are open to all home gardeners as well as growers. If these dates are inconvenient, it is possible to see the grounds by appointment by calling Comstock, Ferre and Co.

We are fortunate to have the display and trials at such a central location within our state. Don't miss the opportunity to see what you have been growing, or might be growing in the future. Encourage your customers to come out and learn more about gardening.

About Your Subscription

Your address plate carries an identification signal which gives the issue number through which your subscription will be honored. For instance, if it reads 132, you have about two years coming, or the middle of 1986.

If, on the other hand, it contains letters, you may be special. RCPL means that a reciprocal mailing is made in return for the many publications we receive to maintain the best library on greenhouse culture in New England. CNTR means that you have contributed significantly to our research or extension effort. OK, on the other hand, means that your status is in doubt and that you may be dropped if we don't hear from you.

A sincere regret is the dropping of schools and extension agents from our mailing list. More than two hundred will no longer receive the newsletter. Perhaps some day we will have an endowment fund which will enable us to once again support these educational activities.
Needless to say, the All-America Selections are the cream of the crop and home gardeners look forward to growing the newest selections each year. It is interesting to note that once chosen, some selections remain popular for many years. Some are still being grown today that were selected in the thirties and forties.

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We are fortunate to have the display and trials at such a central location within our state. Don't miss the opportunity to see what you have been growing, or might be growing in the future. Encourage your customers to come out and learn more about gardening.

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A sincere regret is the dropping of schools and extension agents from our mailing list. More than two hundred will no longer receive the newsletter. Perhaps some day we will have an endowment fund which will enable us to once again support these educational activities.
PULSE AND CONTINUAL FERTILIZATION OF BEDDING PLANTS
By Michael Arisco, Student and Jay S. Koths, Extension Floriculturist

In the 1950's and 60's fertilizer injectors came into widespread use. They are quite accurate and a large area can be fertilized with one batch of concentrated stock solution. By varying the concentration, fertilizer may be applied every irrigation (continuous) or pulsed, a more concentrated solution being applied at a given time interval such as every week or 10 days.

In an experiment conducted at the University of Connecticut, pulsing and continual fertilization were compared. A literature survey disclosed no definitive information on the subject. The purpose of the experiment was to ascertain which method would give better plant growth.

Experiment #1; February 20 - April 2. Four bedding plants were grown: statice, ageratum, dahlia and verbena. Three soils were used: ProMix BX, UConn 3:2:1 (compost):2:2:0:1:2:2:1:2:2:2:1:2:2:2:1:2:2:2:1:2:2:2 and a typical Connecticut bedding plant soil mix (Arisco). Six seedlings of each were planted in each of six packs under two fertilizers and 3 root media and under continual or pulse fertilization and grown for 6 weeks.

Along with the two fertilizer practices, two types of fertilizers were used; 15-0-15 (3:2 calcium:potassium nitrates) and 20-20-20 (Peters). Under continual fertilization, plants were irrigated daily with 150 ppm nitrogen beginning two weeks after planting. with pulsing, a weekly application of 600 ppm nitrogen was applied due to an error in calculation (normal application is 500 ppm nitrogen).

No significant difference in plant size (Table 1) was found in Exp. 1, due to continual or pulsing fertilization. In general, the plants receiving 15-0-15 appeared to be darker green. 'Dahlia' and 'Verbena' grown in the Arisco medium bloomed earlier in both fertilization treatments.
up to 800 lb/A of activated carbon would be required. The carbon can be mixed with water and sprayed on. Sometimes it is necessary to incorporate the carbon into the soil.

Effective treatments to control established weeds and prevent regrowth under benches include:

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Per Gal of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Princep 80W</td>
<td>3 tablespoons</td>
</tr>
<tr>
<td>plus</td>
<td></td>
</tr>
<tr>
<td>Diquat*</td>
<td>2 tablespoons</td>
</tr>
</tbody>
</table>

An alternative treatment:

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Per Gal of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surflan 75W</td>
<td>2-3 tablespoons</td>
</tr>
<tr>
<td>plus</td>
<td></td>
</tr>
<tr>
<td>Diquat*</td>
<td>2 tablespoons</td>
</tr>
</tbody>
</table>

Apply about 1 qt of mix per 100 sq. ft. Avoid spraying of heat pipes.

* Roundup at 2 tablespoons may be substituted for Diquat.

---

Table 1. Bedding plant growth in 3 root media as influenced by continuous or pulse fertilization with 20-20-20 or 15-0-15.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Arisco Pro Mix</th>
<th>UConn Pro Mix</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ageratum</td>
<td>127.7</td>
<td>123.1</td>
<td>170.4</td>
<td>170.3</td>
</tr>
<tr>
<td>Dahlia</td>
<td>150.2</td>
<td>158.1</td>
<td>183.5</td>
<td>180.1</td>
</tr>
<tr>
<td>Statice</td>
<td>265.0</td>
<td>242.0</td>
<td>293.4</td>
<td>286.8</td>
</tr>
<tr>
<td>Peppers</td>
<td>314.2</td>
<td>306.4</td>
<td>366.8</td>
<td>355.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crop</th>
<th>Arisco Pro Mix</th>
<th>UConn Pro Mix</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ageratum</td>
<td>157.7</td>
<td>161.7</td>
<td>176.6</td>
<td>176.6</td>
</tr>
<tr>
<td>Dahlia</td>
<td>184.3</td>
<td>170.3</td>
<td>203.2</td>
<td>207.4</td>
</tr>
<tr>
<td>Statice</td>
<td>265.0</td>
<td>263.4</td>
<td>288.2</td>
<td>284.3</td>
</tr>
<tr>
<td>Peppers</td>
<td>314.2</td>
<td>312.6</td>
<td>366.8</td>
<td>355.6</td>
</tr>
</tbody>
</table>

Table 1. Bedding plant growth in 3 root media as influenced by continuous or pulse fertilization with 20-20-20 or 15-0-15.

Experiment 1: April 9 - May 7. Tomatoes, peppers, Savoy cabbage and kale were grown for four weeks in the same root media and under the same fertilizer treatments as in Exp. 1. Even less difference was noted in plant growth (Table 1). With pulse feeding the kale plants were shorter and stronger while with continual fertilization they were taller and more spindly.
with the pulse treatment, fertilization was started a week after the seedlings were planted while continual fertilization began the day after planting.

Fertilizer usage was in the ratio of 7(continual):4(pulsing). This should have been 7:3 with 600 ppm N. This means that less than half the nitrogen would have been used with pulsing. In these experiments, all the root media had sufficient background nutrition to provide good initial growth (Table 2). This may explain the lack of difference in growth. It may be concluded that it is not feasible to use continuous fertilization on bedding plants since the same results are obtained while using less fertilizer and that 20-20-20 (ca $.75/lb) gave results equal to 15-0-18 (ca $.22/lb).

If we average the values for all plants similarly treated (an invalid statistical procedure), the following values are obtained.

1. 15-u-18 produced plants 28% heavier than 20-20-20.
2. Continual fertilization plants were 5% heavier than pulse application.
3. Plants grown in the UConn soil were 16% heavier than in ProMix BX; those in Arisco soil 11% heavier.

While we might conjecture that 15-u-18 is better than 20-20-20 and that the soil mixes produced larger plants than the peat-lite, even a complete statistical analysis would not convince the authors that any particular treatment was superior to another.

Table 2. Spurway Soil Tests, before planting seedlings.

<table>
<thead>
<tr>
<th>Exp. 1.</th>
<th>pH</th>
<th>Salts</th>
<th>Ca</th>
<th>P</th>
<th>K</th>
<th>NO₃-N</th>
<th>NH₄-N</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arisco</td>
<td>6.0</td>
<td>75</td>
<td>085</td>
<td>4.9</td>
<td>18</td>
<td>30</td>
<td>04</td>
<td>44</td>
</tr>
<tr>
<td>Pro Mix</td>
<td>5.9</td>
<td>36</td>
<td>080</td>
<td>03.0</td>
<td>02</td>
<td>07</td>
<td>04</td>
<td>20</td>
</tr>
<tr>
<td>UConn</td>
<td>7.0</td>
<td>55</td>
<td>070</td>
<td>15.0</td>
<td>29</td>
<td>02</td>
<td>30</td>
<td>32</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exp. 2</th>
<th>pH</th>
<th>Salts</th>
<th>Ca</th>
<th>P</th>
<th>K</th>
<th>NO₃-N</th>
<th>NH₄-N</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arisco</td>
<td>6.0</td>
<td>80</td>
<td>090</td>
<td>05.1</td>
<td>16</td>
<td>30</td>
<td>06</td>
<td>48</td>
</tr>
<tr>
<td>Pro Mix</td>
<td>5.9</td>
<td>65</td>
<td>130</td>
<td>06.4</td>
<td>04</td>
<td>18</td>
<td>04</td>
<td>19</td>
</tr>
<tr>
<td>UConn</td>
<td>7.1</td>
<td>36</td>
<td>075</td>
<td>12.3</td>
<td>22</td>
<td>05</td>
<td>10</td>
<td>37</td>
</tr>
</tbody>
</table>

E. Contaminated field soil. If field soil is obtained for greenhouse use, it could be contaminated with herbicide residues such as atrazine or simazine that are used on corn fields. If the cropping history of the soil is unknown, it can be bioassayed, using seeded and transplanted annuals as test plants. Oat is a good test plant for simazine or atrazine. For a control planting, one can thoroughly mix 3 tablespoons of activated carbon (such as Gro-Safe) into a flat of the same soil. The carbon detoxifies most field residues of herbicides. If growth is much better in the carbon-treated flat than in the untreated one, herbicide contamination is suspected.

F. Misuse of herbicides by gross over-application or by sabotage can occur with any herbicide. Sabotage has occurred with disgruntled (or fired) employees, where herbicides were readily available. Diagnosing the problem is often difficult. Herbicides are best stored under lock and key and out of the greenhouse area.

In the case of the soil fumigants (Vapam, methyl bromide), sufficient time and warmth of soil is necessary before planting to allow the vapors to dissipate. Cold soils in the late fall or early spring greatly delay dissipation. Plants placed in treated houses or soil under these conditions are killed. Using 2,4-D herbicides around greenhouses is hazardous because of potential drift of vapors and spray droplets into the houses.

Herbicides that we have found to cause no injury to plants in tests in plastic enclosures included:

- Asulox - asulam
- Daithal - DCPA
- Diquat - diquat
- Paraquat - paraquat
- Gramoxone - paraquat

It is possible even these could be hazardous if sprayed onto heating pipes, which would greatly increase vaporization. Many other herbicides have not been evaluated for indoor use and should be considered hazardous until proven otherwise.

If a greenhouse is contaminated with a herbicide producing phytotoxic vapors, it may be possible to decontaminate it with activated carbon (Gro-Safe or AquaNuchar). Our earlier research showed that 100 to 200 lbs of activated carbon will detoxify 1 lb of most organic herbicides. Thus, if a herbicide were applied at 4 lbs/A,
Other herbicides in our tests that produced vapors that were mildly toxic to plants included:

- Chloro IPC
- Chlorpropham
- Konstar
- Furloe
- Scott's Ornamental Herbicide I
- Devrinol - napropamide
- oxadiazon

All of these would be hazardous to use in greenhouses with live plants other than those listed on the labels.

B. Contamination of ground water can occur from soluble herbicides applied too heavily or dumped in the vicinity of wells. Two herbicides that have contaminated wells supplying greenhouses are Tordon (picloram) and Banvel (dicamba). Both are highly toxic to annual plants, highly water soluble and neither has any place in or near greenhouses. Water from ponds or streams where Tordon is used on the watershed is best not used to irrigate plants without testing.

C. Application of many residual herbicides in ground beds is hazardous to flats or pots of plants placed on the treated areas. Problems occur as roots grow into treated soil and absorb the herbicide or as ponding occurs and the herbicides dissolve in the water and penetrate the containers. Safe herbicides for pretreatment of ground beds include Diquat, Paraquat and Roundup for preplant control of established weeds, and Surflan at 2 to 3 teaspoons per 100 ft² for preemergence control under flats or containers. Surflan inhibits roots but does not translocate in the plant. Tilling soil treated with Diquat, Roundup or Paraquat before plants are planted in the soil reduces danger of root uptake.

A current experiment indicates that at least one week should elapse after Roundup application and placement of flats or pots with exposed roots. However, Roundup sprays on soilless potting mixes such as peat, perlite and sand may seriously injure herbaceous plants for several weeks after application. Roundup is not rapidly detoxified in such mixes as it is in soil. Spraying of weeds growing on stored piles of soilless potting mixes is therefore dangerous.

D. Mistaking herbicides for other pesticides can be minimized by storing herbicides apart from other pesticides and by reserving a separate sprayer for herbicides.

Table 3. Root media components

<table>
<thead>
<tr>
<th>Pro-Mix BX: a commercial soilless mix containing peat moss, Vermiculite, perlite and limestone. It contains some background nutrition listed as a starter fertilizer.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UConn Mix: 3 loam, 2 sphagnum peat and 1 sand plus 10 lbs. dolomitic limestone, 5 lbs. 0-20-0 and 2 lbs. 5-10-3 Electra per cubic yard.</td>
</tr>
</tbody>
</table>
Perennials are finally gaining the national recognition they deserve! The Perennial Plant Association was formed last year after the 1983 Symposium which attracted 300 participants from 28 states and Canada. A bouquet to Connecticut's own Pierre Bennerup, Sunny Border Nurseries, Kensington, one of the organizers of the association.

This three day Symposium sponsored by the Perennial Plant Association covers a wide variety of subjects by speakers from Oregon to Minnesota to Massachusetts to Virginia, not to mention Ohio, and of course, Connecticut. Pierre says that the popularity of perennials is cyclic and that we are on an upswing. Perhaps the Perennial Plant Association will perpetuate the rise in popularity and these plants will continue to be a more significant segment of the horticultural industry.

For more information and a registration form, contact Steven Still or Elton Smith (a former Conn. County Agent) at the Dept. of Horticulture, 2001 Fyffe Court, Columbus, Oh 43210. Or call Steve who is Interim Secretary-Treasurer of PPA on 614-422-0027.

CONTROLLING WEEDS IN OR NEAR THE GREENHOUSE

J. F. Ahrens
Plant Physiologist
The Connecticut Agricultural Experiment Station
Valley Laboratory, Windsor, CT

Dr. Ahrens has conducted many herbicide trials in the greenhouse over the years. The last issue (#120) summarized the control aspects of herbicide use in the greenhouse as interpreted by Mr. Maisano. The following article presents details of Dr. Ahrens' research.

Numerous experiments have been conducted at the Valley Laboratory over the past 10 years to evaluate the usefulness and potential hazards of herbicides in and around greenhouses. In addition, many grower problems involving herbicides in greenhouses have been investigated. The following is a brief summary of our findings.

To use herbicides effectively in or around greenhouses, it is essential to understand their potential hazards. These hazards include:

A. Production of vapors toxic to plants.
B. Contamination of ground water wells.
C. Injury to plants in flats or pots from root uptake.
D. Mistaking herbicides for other pesticides.
E. Use of field soils that contain residues for potting mixes.
F. Misuse of herbicides by gross overapplication or by sabotage or vandalism.

A. To be safely used under benches or under flats or pots in greenhouses, a herbicide should not produce phytotoxic vapors. Herbicides that we or others have found to produce phytotoxic vapors include:

- 2,4-D Spike - tebuthiuron
- Casoron Treflan - trifluralin
- Diclofem dichlobenil Goal - oxyfluorfen
- Horosac Premitol - prometon
- Tordon picloram Vapam - metham
- Lasso - alachlor Dowfume - methyl bromide
- Dual metolachlor Pentachlorophenol - PCP
- Aatrex atrazine Scott's Ornamental Herbicide II - oxyfluorfen+pendimethalin
THE EFFECT OF NUTRIENT SPRAY ON THE PROPAGATION OF
CHRYSANTHEMUM CUTTINGS

By Barbara A. Stiehl
Graduate Student
and Sidney Waxman
Professor of Plant Science

Abstract

Unrooted cuttings* of Chrysanthemum morifolium 'Bright Golden Anne' were subjected to fertilizer (KNO₃, NH₄NO₃, and 20-20-20) and a water spray control to determine if there would be any difference in root weight, total cutting weight, leaf number and linear cutting height. A solar controlled (Solatrol) water mist system was used before and after treatment application. Nutrient sprays, especially NH₄NO₃, positively influenced the growth and rooting response of the cuttings.

Introduction

It is generally recognized that the propagation of plants under a water mist causes leaching of metabolites, both organic and inorganic, from the exposed plant surfaces. Long (1956) found a ten percent reduction in calcium, potassium, magnesium, nitrogen and phosphorus in green beans when exposed to mist. Tukey (1962) surveyed an assortment of plant species for leachability under mist. He found leaching to be greater in mature leaves and in herbaceous cuttings than in immature leaves and in hardwood cuttings. Tukey also related leachability to the nutrients' function within the plants' metabolic processes and to environmental factors such as light intensity and humidity.

As a means of reducing nutrient losses through leaching, nutrients can be applied to cuttings during propagation through intermittent mist (Wott and Tukey, 1967). Dick (1960) found faster and greater root formation, increased weight, better color and faster growth of chrysanthemums under nutrient mist resulting in an increase in productivity.

This paper studies the effect on the rooting and vigor of chrysanthemum cuttings when sprayed on the cuttings rather than in the mist.

* Supplied through the courtesy of Stafford Conservatories, Stafford Springs, Connecticut.
Methods and Materials

The 'Bright Golden Anne' cuttings were graded to a uniform fresh weight (between 2.3 and 2.9 grams) and leaf number in October, 1983.

Three fertilizer treatments plus a control were replicated three times with 10 cuttings per treatment for a total of 120. A 14 x 20" greenhouse wooden flat was used with cuttings stuck two inches apart in rows (other species in the flats are not reported here). The rooting medium was 1:2 sand:perlite. Before sticking into the medium, the cuttings were dipped in rinsodin 1.

The flats were placed under mist in a greenhouse where temperatures ranged from 60°F at night to 70°-80° in the daytime. Overhead incandescent lights provided an extended photoperiod.

Treatments were initiated two days after sticking the cuttings. They were as follows: Treatment 1, tap water control; Treatment 2, 100 ppm N from 20-20-20; Treatment 3, 130 ppm N from potassium nitrate and Treatment 4, 264 ppm N from ammonium nitrate.

The dilution of 0.1 mole of fertilizer per liter of water was used because it approximated the strength of fertilizer solution (ounces per gallon) used in the experiments in the literature. Because potassium and nitrogen are two of the nutrients most easily leached from plant tissue it was decided to use KNO₃ and NH₄NO₃ mono-nutrient fertilizer sprays. A complete fertilizer spray was also applied as a second form of control.

The treatments were randomized in each replication. Each treatment was applied with a plastic trigger spray bottle and amounted to about 1 ml per cutting. One hour before each treatment, a plastic canopy was placed over each flat to intercept the water mist and allow the foliage to dry. This prevented dilution of the treatment sprays with water from the mist system. The plastic sheets were removed during treatments and replaced until the plant surfaces were dry once again. To prevent spray drift between treatments, a cardboard barrier was held between each treatment during spray application.

The cuttings received one treatment per day at random times (from 9:00 a.m. to 4:00 p.m.) five days a week.

The temperature of the propagation medium was maintained at about 70°F with bottom heat during the experiment.
Results and Discussion

Fifteen days after treatment, the chrysanthemum cuttings were lifted and measured for total weight, root weight, height (not including roots) and leaf number.

Immediately after the data was recorded, the cuttings were recut above the roots and stuck back into the rooting medium and the treatments were continued for thirty additional days when they were evaluated on the same basis.

The data was evaluated by finding the mean + the standard error for each treatment in both trials. By comparing this information significant statistical difference between groups was determined (See Table 3).

Table 3. Effect of Nutrient Sprays on the Total weight, height and Root weight of Chrysanthemum morifolium Cuttings Under Propagation

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Total Cutting Weight (gms.)</th>
<th>Root Weight (gms.)</th>
<th>Height of Cutting (cm.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Trial</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Tap water (Control)</td>
<td>4.75±0.19</td>
<td>0.93±0.05</td>
<td>12.41±0.30</td>
</tr>
<tr>
<td>2) Complete Fertilizer</td>
<td>5.03±1.00</td>
<td>1.15±0.08</td>
<td>13.60±0.30*</td>
</tr>
<tr>
<td>3) KNO&lt;sub&gt;3&lt;/sub&gt;</td>
<td>5.14±0.13</td>
<td>1.16±0.05</td>
<td>14.1±0.18*</td>
</tr>
<tr>
<td>4) NH_4NO&lt;sub&gt;3&lt;/sub&gt;</td>
<td>5.09±0.20</td>
<td>1.33±0.10</td>
<td>14.01±0.40*</td>
</tr>
<tr>
<td><strong>Second Trial</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Tap water (Control)</td>
<td>3.12±0.14</td>
<td>1.02±0.09</td>
<td>7.42±0.39</td>
</tr>
<tr>
<td>2) Complete Fertilizer</td>
<td>3.24±0.15</td>
<td>1.04±0.06</td>
<td>8.00±0.21</td>
</tr>
<tr>
<td>3) KNO&lt;sub&gt;3&lt;/sub&gt;</td>
<td>3.01±0.13</td>
<td>1.16±0.05</td>
<td>7.99±0.22</td>
</tr>
<tr>
<td>4) NH_4NO&lt;sub&gt;3&lt;/sub&gt;</td>
<td>3.81±0.22*</td>
<td>1.42±0.07*</td>
<td>9.33±0.30*</td>
</tr>
</tbody>
</table>

Each datum represents the mean + SE of three replications for a total of thirty cuttings in each treatment.

* datum significantly varied from the control.
In this experiment the results indicated that nutrient sprays made a positive difference in the growth and rooting of the cuttings.

The treatment most effective was the ammonium nitrate spray. In both trials it significantly enhanced root weight and height of cuttings and in trial 2 it also increased total cutting weight. Leaf numbers were also counted with the other data. Fertilizer treatments averaged seven or eight leaves while the control averaged six leaves per cutting.

Literature Cited


WETTABLE POWDER DUSTS

Jay S. Koths
Extension Floriculturist

Wettable powder formulations of fungicides, insecticides and miticides have been used as dusts in greenhouses for more than 40 years. The practice has slowly gained popularity even though little research has been published and chemical companies have not included this usage on their labels.

For a few years, such a use of wettable powders was considered illegal since it was not labelled. This now appears to have been resolved with the FIFRA (Federal Insecticide, Fungicide and Rodenticide Act) interpretation of 1979 (10,11,12). Applying a rate of less than that on the label in conjunction with air as the conveyance medium instead of water is now considered to be legal.

Advantages of wettable powders as dusts:
1. Less pesticide is consumed.
2. Exposure time for the applicator is less than 5% of that required for spraying.
3. Residues on plants are decreased and spray spotting is not present.
4. Plant coverage is excellent.
5. Residual activity of the pesticide is enhanced.
6. Labor requirement is lower.
7. Costs of pest control are greatly reduced.

The procedure is simple. Mix equal parts of materials selected from the following incomplete list. Then dust weekly at a rate of only 1 to 2 oz. of the mixture per 1000 sq. ft.

**General Contact**

Bendiocarb (Ficam) 7b WP
Malathion 25 WP
Endosulfan (Thiodan) 5J WP
Diazinon 5J WP

**Miticide**

Dienochlor (Pentac) 5J WP (use 1/2 part)*
Cyhexatin (Plictran) 5J WP
Fenbutatin-oxide (Vendex) 5J WP
Propargite (Omite) 3O WP
Ulicofol (Keltname) 18.5 WP