RESEARCH RESULTS FOR FLOWER GROWERS

CHRYSANTHEMUM STUDIES 1966-67

Kenneth C. Sanderson and Willis C. Martin, Jr.

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RESEARCH RESULTS FOR FLOWER GROWERS[1/]

Chrysanthemum Studies 1966-67[2/]

I. INFLUENCE OF VARIOUS ADDITIVES ON THE EFFECTIVENESS OF N-DIMETHYLAMINO SUCCINAMIC ACID ON POT CHRYSANTHEMUM HEIGHT AND NUMBER OF FLOWERS PER PLANT

A. Boron and Sucrose

Twenty-four pots each of two cultivars of chrysanthemums, 'Golden Yellow Princess Anne' and 'Delaware', were treated with the growth retardant B-Nine (Uniroyal's trademark name for N-dimethylamino succinamic acid), Table 1. Two spray applications were made: one on June 1, 1966 and a second on June 22, 1966. Plant height was recorded above the pot rim. The number of flowers per plant was observed. A difference of 0.2 flowers per plant adds one flower to a pot.

Table 1. Influence of Boron and Sucrose Additions on N-dimethylamino Succinamic Acid Sprays Applied to Chrysanthemums

Treatment	Mean height	Flowers/plant
	In.	No.
Check, 0.25% B-Nine	11.5	3.9
+ 5% Sucrose	11.5	4.1
+ 5% + 10% Sucrose	11.8	4.1
+ 50 ppm Boron	12.3	3.7
+ 50 ppm Boron + 5% Sucrose	12.5	3.6
+ 50 ppm Boron + 5% + 10% Sucrose . .	12.2	3.9
Mean	12.2	3.9

The addition of boron to sprays containing B-Nine reduced the effectiveness of growth retardation. Plants that did not receive boron were shorter than those that did (Table 1). The addition of boron also reduced the number of flower per plant. Sucrose additions had very little effect on height and flower number when combined with B-Nine alone. B-Nine plus boron and sucrose produced the tallest plants and fewest flowers.

B. Antitranspirants

Three experiments were conducted on chrysanthemums utilizing various anti-transpirants in combination with B-Nine.

In Experiment I, 24 pots each of the 2 chrysanthemum cultivars, 'Golden Yellow Princess Anne' and 'Delaware', were given 2 applications of B-Nine as follows:

1/ For more detailed information on specific questions, contact the authors at Department of Horticulture, Funchess Hall, Auburn University, Auburn, Alabama 36830. Note: Trade names of materials appearing in this report do not imply endorsement by Auburn University Agricultural Experiment Station.

2/ All cuttings utilized in chrysanthemum research are donated by Yoder Brothers, Barberton, Ohio.

(1) 0.25% B-Nine in 50% Green-Glo (Green-Glo is the registered trade mark of the Green-Glo Company for a foliar wax material).

(2) 0.25% B-Nine plus Celaseal 2.5 ml./qt. (Celaseal is an anti-transpirant consisting primarily of phenyl mercuric acetate. It, along with Stoma-seal was supplied by the Aquatrol Corporation of America).

(3) 0.25% B-Nine plus Stoma-seal 2.5 ml./qt.

(4) 0.25% B-Nine, check.

Spray applications were made on June 29, 1966, and July 20, 1966. The flowering time from potting, plant height above the pot rim, and number of flowers per plant were recorded.

The addition of Green-Glo to B-Nine sprays resulted in a longer flowering time and shorter plants (Table 2). B-Nine plus Stoma-seal reduced both height and flower number and increased flowering time of 'Golden Yellow Princess Anne' but resulted in death of the terminal growing point of 'Delaware'. Stoma-seal may be phytotoxic to certain cultivars of chrysanthemums.

Table 2. Influence of Selected Antitranspirants on Action of N-dimethylamino Succinamic Acid (B-Nine) on Mean Flowering Time, Height and Number of Flowers per Plant of Chrysanthemum

Treatment	Flowering Time			Height			Flower per Plant		
	Anne	Del.	Mean	Anne	Del.	Mean	Anne	Del.	Mean
	Days	Days	Days	In.	In.	In.	No.	No.	No.
0.25% B-Nine + Green-Glo .	90	90	90	12	9	11	3.6	3.8	3.1
0.25% B-Nine + Celaseal. .	86	86	86	14	10	12	3.8	3.8	3.8
0.25% B-Nine + Stoma-seal .	93	No1/	--	11	No	--	3.0	No	--
0.25% B-Nine	86	86	86	13	11	12	3.8	3.4	3.6

1/ Phytotoxic, killed terminal, no records.

Following up on the results of Green-Glo in Experiment I, an experiment (Experiment II) was conducted utilizing various concentrations of Green-Glo in combination with B-Nine. Two weeks after pinching the following treatments were sprayed on the cultivar 'Golden Yellow Princess Anne': 1) Check, 0.25% B-Nine, 2) 0.25% B-Nine in 10% Green-Glo, 3) 0.25% B-Nine in 20% Green-Glo, 4) 0.25% B-Nine in 30% Green-Glo, 5) 0.25% B-Nine in 40% Green-Glo, 6) 0.25% B-Nine in 50% Green-Glo.

The addition of various concentrations of Green-Glo to B-Nine sprays produced very small differences in mean plant height (Table 3). Green-Glo additions may have produced differences in the number of flowers per plant. Plants sprayed with B-Nine in a 50% Green-Glo mixture had the most flowers per plant.

Table 3. Influence of Varying Concentrations of Green-Glo on Action of N-dimethylamino Succinamic Acid (B-Nine) on Mean Height and Number of Flowers per Plant of Chrysanthemum, cv. 'Golden Yellow Princess Anne'

Treatment	Height	Flowers
	In.	No.
Check, 0.25% B-Nine	13.1	3.1
0.25% B-Nine in 10% Green-Glo . . .	13.3	3.2
0.25% B-Nine in 20% Green-Glo . . .	12.9	3.2
0.25% B-Nine in 30% Green-Glo . . .	12.4	3.1
0.25% B-Nine in 40% Green-Glo . . .	13.2	3.3
0.25% B-Nine in 50% Green-Glo . . .	12.6	3.4

In Experiment III, Stopwilt (a vinyl resin based antitranspirant manufactured by the Doggett-Pfeil Company, Springfield, N. J.) was combined with B-Bine, Table 4. Plants of the cultivar 'Golden Yellow Princess Anne' were sprayed 16 days after pinching.

The results in Table 4 indicate that Stopwilt combined with B-Nine produces slightly shorter plants than B-Nine alone. The number of flowers per plant showed very little differences.

Table 4. Influence of Antitranspirant, Stopwilt, in Combination with N-dimethylamino Succinamic Acid (B-Nine) on Mean Height and Number of Flowers per Plant of Chrysanthemum,cv.'Golden Yellow Princess Anne'

Treatment	Height	Flower per Plant
	In.	No.
Check, 0.25% B-Nine	12.6	2.7
0.25% B-Nine in 1 part Stopwilt, 6 parts water . . .	11.6	2.5
0.25% B-Nine in 1 part Stopwilt, 8 parts water . . .	12.0	2.7
0.25% B-Nine in 1 part Stopwilt, 10 parts water . . .	11.6	2.7
0.25% B-Nine in 1 part Stopwilt, 12 parts water . . .	12.0	2.6
0.25% B-Nine in 1 part Stopwilt, 14 parts water . . .	12.3	2.7
0.25% B-Nine in 1 part Stopwilt, 16 parts water . . .	11.6	2.6

C. Fungicide Compatibility

Twenty-seven pots each of the chrysanthemum cultivars 'Golden Yellow Princess Anne' and 'Delaware' were divided into three replications and sprayed as follows. 1) 0.25% B-Nine check, 2) 0.25% B-Nine plus Ferbam, 1.7 g./qt., 3) 0.25% B-Nine plus Zineb, 1.7 g./qt. The spray applications were made 2 weeks after the plants were pinched. A second application was made 5 weeks after the pinch.

The addition of a fungicide seems to reduce effectiveness of the growth retardant (Table 3). Metallic ions in the fungicide may be responsible for this result.

Table 5. Influence of Fungicides Ferbam and Zineb in Combination with N-dimethylamino Succinamic Acid (B-Nine) on Mean Height and Number of Flowers per Plant of the Chrysanthemum Cultivars 'Golden Yellow Princess Anne' and 'Delaware'

Treatment	Height			Flowers per Plant		
	Anne	Del.	Mean	Anne	Del.	Mean
	In.	In.	In.	No.	No.	No.
0.25% B-Nine check	11.0	10.0	10.5	3.1	2.8	3.0
+ Ferbam 1.7 g./qt	12.0	10.5	11.3	3.0	3.0	3.0
+ Zineb 1.7 g./qt	12.3	10.5	11.4	3.4	2.7	3.1
Mean	11.8	10.3	11.1	3.2	2.8	3.0

D. Pyrimidine and Purine Bases

Uracil, Caffeine, and Xanthine were added (50 ppm of each) to 0.25% B-Nine sprays and applied to the two cultivars of chrysanthemums, 'Golden Yellow Princess Anne' and 'Delaware'. Applications were made 2 and 5 weeks after the plants were pinched.

The addition of Pyrimidine and Purine bases to B-Nine sprays did not influence the height of chrysanthemums. Plants that were sprayed with B-Nine combined with a Pyrimidine and Purine base had less flowers than those sprayed only with B-Nine (Table 5).

E. Yeast and Ascorbic Acid

Yeast (50 ppm) or ascorbic acid (1,5000 ppm) were added to B-Nine spray solutions. Plants of two chrysanthemums cultivars were sprayed 2 and 5 weeks after pinch. The check consisted of B-Nine 0.25%.

The addition of yeast or ascorbic acid to a B-Nine spray solution did not influence the growth-retarding action of B-Nine. Plants receiving B-Nine combined with ascorbic acid or yeast had more flowers per plant (Table 6).

F. Fertilizers

B-Nine sprays were amended with: 1) potassium nitrate 2.5 g./qt.; 2) 20-20-20 2.5 g./qt.; 3) iron chelate 1 g./qt. The check consisted of 0.25% B-Nine alone. 'Golden Yellow Princess Anne' cultivars of chrysanthemum were sprayed with the above solutions 2 and 5 weeks after pinching.

Addition of fertilizer materials to the B-Nine spray does not influence the height of the plant (Table 6). Flower number per pot was slightly increased when 20-20-20 was added to the spray. Iron chelate-B-Nine spray severely damaged the foliage of both cultivars. This combination also delayed flowering.

G. pH of the Spray Solution

The pH of the 0.25% B-Nine was adjusted with hydrochloric acid or sodium hydroxide to give the following spray solutions: pH 4.5, and pH 8.5. A check (no adjustment) had a pH of 7.4. The cultivars, 'Golden Yellow Princess Anne' and 'Delaware' were sprayed with these solutions 2 and 5 weeks after the pinch.

Plants that received a spray solution adjusted to pH 8.5 were shorter than plants receiving spray solutions of pH 7.4 and pH 4.5. Flowers per plant were reduced when the pH of the B-Nine solution was adjusted to 4.5 (Table 6).

Table 6. Influence of N-dimethylamino Succinamic Acid (B-Nine) Combined with Various Additives on Mean Height and Number of Flowers per Plant of Chrysanthemum

Treatment	Height			Flower per Plant		
	Anne	Del.	Mean	Anne	Del.	Mean
	In.	In.	In.	No.	No.	No.
Pyrimidine and Purine						
Check, 0.25% B-Nine . . .	15.5	12.0	13.8	3.2	3.8	3.5
+ 50 ppm Uracil	15.5	12.0	13.8	3.0	3.0	3.0
+ 50 ppm Caffeine	15.0	12.5	13.8	3.0	3.4	3.2
+ 50 ppm Xanthine	15.5	12.5	14.0	3.0	3.2	3.1
Mean	15.4	12.2	13.8	3.0	3.2	3.2
Yeast and Ascorbic Acid						
Check 0.25% B-Nine	17.0	13.5	15.2	3.1	3.3	3.2
+ 50 ppm Yeast	17.0	13.0	15.0	3.2	3.5	3.4
+ 1500 ppm Ascorbic acid .	17.5	13.5	15.5	3.2	3.7	3.5
Mean	17.2	13.3	15.2	3.1	3.5	3.3
Fertilizers						
Check, 0.25% B-Nine . . .	16.5	13.0	14.8	3.0	3.3	3.2
+ KNO_3 2.5 g./qt	16.5	13.5	15.0	3.1	3.3	3.2
+ 20-20-20 2.5 g./qt . . .	16.0	13.0	14.5	3.0	3.5	3.2
+ Fe Chelate 1 g./qt . . .	16.5	13.0	14.8	2.9	2.9	2.9
Mean	16.4	13.1	14.8	3.0	3.3	3.1
pH of Spray Solution						
Check, Tap H_2O 7.4	19.5	13.0	16.5	3.3	3.8	3.5
pH 4.5	19.0	13.5	16.3	3.1	3.2	3.2
pH 8.5	18.0	13.0	15.5	3.5	3.6	3.5
Mean	18.8	13.2	16.0	3.1	3.5	3.4

II. A COMPARISON OF PEAT AND BAGASSE-AMENDED SOILS ON GROWTH OF SEVERAL CUT CHRYSANTHEMUM CULTIVARS

Two experiments were conducted during 1966-67 comparing peat and bagasse on cut chrysanthemums. In Experiment I, 19 cultivars of chrysanthemums were grown in 2 soil mixtures; one mixture consisted of half sandy loam and half imported peat moss, the other was half sandy loam and half bagasse (a sugar cane by-product furnished by the McCarthey Company and sold under the trade name of Bet-R-Growth). Both soil mixtures were limed to adjust the pH to 6.0 and steam sterilized. The same soil mixtures (steamed and adjusted to the proper pH) were used in Experiment II. Only two cultivars, 'Giant #4 Indianapolis White'and 'Giant #4 Indianapolis Yellow', were grown in Experiment II.

The original fertilizer scheduled for Experiment I was 1 oz. of 25-10-10 per 5 gal. of water each week. Early in the experiment it was revised to 1 oz. of 25-10-10 per 4 gal. of water each week. Experiment II was fertilized according to this revision. The revision was necessary to maintain good leaf color in plants grown in the bagasse-amended soil. The rapid breakdown and leaching of bagasse or both may have been responsible for increased fertilizer requirements. Bagasse-amended soil was observed to dry out sooner and require more frequent watering.

In both experiments flowering stems of plants grown in peat-amended soil weighed more than those grown in bagasse-amended soil (Tables 7 and 8). In Experiment I, peat-grown stems were longer than those grown in bagasse. In Experiment II mean stem length was greater when the plants were grown in the bagasse-amended soil, however, Giant #4 Indianapolis Yellow had longer stems when grown in a peat-amended soil. Flower diameter did not differ in these experiments. Nutrient deficiency symptoms observed with bagasse in Experiment I were not evident in Experiment II.

Table 7. Influence of Peat-and Bagasse-Amended Soils on Mean Fresh Weight, Stem Length and Flower Diameter of Several Cut Chrysanthemum Cultivars

Cultivar	Stem weight		Stem length		Flower diameter	
	Peat	Bagasse	Peat	Bagasse	Peat	Bagasse
	g.	g.	In.	In.	In.	In.
Akron News	64.0	67.6	30.9	28.4	4.7	4.9
Calvert's Gold Shoesmith	68.0	53.0	22.2	21.2	5.0	4.6
CF #2 Good News	63.4	56.2	27.4	25.1	4.7	4.6
Columbia	92.7	76.3	31.6	31.5	4.4	4.8
Condor	95.1	87.1	29.3	26.1	4.5	4.4
Dark Yellow Buckeye	71.3	64.3	27.9	24.0	5.1	5.4
Detroit News	52.4	57.7	24.2	24.0	4.2	4.3
Envoy	58.5	54.0	20.4	18.8	4.6	4.7
Giant Betsy Ross	58.0	62.2	26.8	27.8	5.0	4.9
Gt. #4 Indianapolis White	63.2	62.9	23.1	23.2	4.7	4.7
Gt. #4 Indianapolis Yellow	67.9	63.4	24.9	22.0	5.0	4.9
Good News #2	51.8	50.6	26.5	25.1	4.1	4.1
Indianapolis Pink	66.7	62.6	24.4	22.0	4.8	4.8
Indianapolis Pink #3	63.0	60.2	24.4	23.3	4.8	4.7
Rainier	88.7	49.3	33.0	29.7	5.0	4.9
Rosamund	72.8	71.9	25.8	23.2	4.3	4.2
Star Streamer	59.2	57.7	29.7	28.2	4.8	4.8
Streamer	124.3	87.0	32.7	27.8	5.0	5.1
Yellow Knight	49.5	47.3	27.0	25.1	6.1	5.8
Trident	56.7	51.6	25.6	22.0	4.2	5.8
Mean	69.3	62.1	26.9	24.9	4.8	4.8

Table 8. Influence of Peat-and Bagasse-Amended Soils on Mean Fresh Weight, Stem Length, and Flower Diameter of Cut Chrysanthemum Cultivars, Giant #4 Indianapolis White and Giant #4 Indianapolis Yellow

Cultivar	Stem weight		Stem length		Flower diameter	
	Peat	Bagasse	Peat	Bagasse	Peat	Bagasse
	g.	g.	In.	In.	In.	In.
Gt. #4 Indianapolis White .	65.9	66.6	24.6	26.0	5.0	5.0
Gt. #4 Indianapolis Yellow.	71.6	66.2	25.2	24.6	5.0	5.0
Mean	68.8	66.4	24.9	25.3	5.0	5.0

III. GROWTH AND KEEPING QUALITY COMPARISONS OF POTTED CHRYSANTHEMUMS GROWN IN SEVERAL MEDIA

Rooted chrysanthemum cuttings of the two cultivars, 'Golden Yellow Princess Anne' and 'Delaware' were potted in 10 different soil mixtures. Equal portions of ingredients were used in all mixtures. The mixtures were: 1) soil and peat; 2) soil and bagasse; 3) soil, perlite and peat; 4) soil, perlite, and bagasse; 5) sand and peat; 6) sand and bagasse; 7) vermiculite and peat; 8) vermiculite and bagasse; 9) calcined clay (Sorbolite clay furnished by Clay Products Co., Bradenton, Fla.) and peat; 10) calcined clay and bagasse. Lime requirements were determined for each mixture and lime added accordingly. Other fertilization consisted of 2 lb. of superphosphate and 2 lb. of 8-8-8 fertilizer per cubic yard of mixture. Following planting, the plants were fertilized on a twice weekly basis with 25-10-10 at the rate of 1 oz. per 4 gal. of water.

The experiment was repeated four times during 1966 and each time with 3 replications, 2 varieties and 10 soil mixtures. Growth measurements were made on all plants. Two plants from each soil mixture were selected for keeping quality determinations at a stage prior to complete petal expansion. Keeping quality determinations were made in a controlled environmental chamber. Plants were maintained on 9-hour days at 450 foot candles of incandescent light and a temperature of 70° F. (night and day). The keeping quality of the pot plants was determined by the number of days in the room when 75% of the flowers showed aging.

Most plants grew satisfactorily with the exception of those potted in sand-peat and sand-bagasse mixtures. Plants in these mixtures both in the greenhouse and growth chamber often exhibited chlorosis (probably overwatered), were delayed in flowering, were slightly shorter, and had less flowers than plants in the other mixtures.

The tallest plants were grown in media mixtures of soil and peat and soil, peat and perlite. Plants grown in peat-amended mixtures had a mean height of 14.7 in., whereas those grown in bagasse-amended mixtures were only slightly shorter (14.4 in.).

A soil and peat medium produced the most flowers per plant 3.9, whereas calcined clay and peat, sand and peat, and sand and bagasse had the fewest flowers 3.4, (Table 9). Sand-amended mixtures had less flowers per pot than the other mixtures (Table 10). Mixtures containing soil and an amendment had the most flowers. Peat (3.6) and bagasse (3.5) amended soils produced essentially the same number of flower per plant.

Plants grown in a medium consisting of calcined clay and peat moss had the best mean keeping quality: 29.4 days (Table 9). The poorest keeping quality (24.8 days) was that of plants grown in soil, perlite and bagasse, and vermiculite and peat. Media mixtures containing calcined clay had the best keeping quality (Table 10). Media combinations consisting of soil and perlite amended with peat or bagasse had the poorest keeping quality. Peat-amended media (26.3 days) were not very different in keeping quality than bagasse-amended media (26.6 days).

Table 9. Influence of Media on the Mean Height, Number of Flowers per Plant, and Keeping Quality of Potted Chrysanthemums 1/

Media 2/	Height	Flowers per plant	Keeping quality
	In.	No.	Days
Soil & Peat	15.1	3.9	25.8
Soil & Bagasse	14.5	3.7	26.7
Soil, Perlite & Peat	15.2	3.6	25.1
Soil, Perlite & Bagasse	14.6	3.5	24.8
Sand & Peat	13.7	3.4	26.2
Sand & Bagasse	14.3	3.4	25.9
Vermiculite & Peat	14.8	3.8	24.8
Vermiculite & Bagasse	14.3	3.5	27.7
Calcined clay & Peat	14.9	3.4	29.4
Calcined clay & Bagasse	14.4	3.6	27.8
Mean	14.6	3.6	26.4

1/ Two cultivars of chrysanthemum were used in this study: 'Golden Yellow Princess Anne' and 'Delaware'. Data of 4 experiments are presented.

2/ Equal portions of materials were used in all media. Limed according to test, each media contained 2 lb.of superphosphate and 2 lb. of 8-8-8 per cu. yd.

Table 10. Influence of Media Mixture on the Mean Height, Number of Flowers per Plant, and Keeping Quality of Potted Chrysanthemums 1/

Media Combinations 2/	Height	Flower per plant	Keeping quality
	In.	No.	Days
Soil & amendment	14.8	3.8	26.3
Soil, perlite & amendment	14.9	3.5	25.0
Sand & amendment	14.0	3.4	26.1
Vermiculite & amendment	14.6	3.7	26.3
Calcined clay & amendment	14.7	3.5	28.6
Mean	14.6	3.6	26.5

1/ Two cultivars of chrysanthemum were used in this study: 'Golden Yellow Princess Anne' and 'Delaware'. Data of four experiments are presented.

2/ Equal portions of materials were used in all media. Amendment was either peat or bagasse (mean represents plants grown in both).Each medium was limed according to test and contained 2 lb. of superphosphate and 2 lb. of 8-8-8 per cu. yd.

IV. EFFECTS OF ADDITIONAL CARBON DIOXIDE ON THE GROWTH OF THE CHRYSANTHEMUM CULTIVAR 'GOLDEN YELLOW PRINCESS ANNE'

Three crops of the chrysanthemum cultivar 'Golden Yellow Princess Anne' were grown in pots(five cuttings per pot) during November 1966 to March 1967. Two similar greenhouses were used, one with the normal level of carbon dioxide (CO_2) of the atmosphere and the other supplied with 1000 ppm. CO_2 (from a Hy-Lo CO_2 generator furnished by G. J. Ball, Inc., West Chicago, Ill.). The gas was added during the daylight hours and when the ventilators were closed. A time clock controlled the operation of the generator and supplied two injection periods daily: 1) one hour before sunrise until one hour after sunrise, and 2) one hour before sunset until one hour after sunset. The greenhouses were maintained at a temperature of 60° F. All crops were subjected to CO_2 on January 9, 1966 with CO_2 being applied 28 days after pinching for Crop I, 14 days after pinching for Crop II and at pinching for Crop III. Pinching was done 2 weeks after potting. The height and number of flowers per plant were recorded.

None of the crops showed any differences in height because of CO_2 treatment. The mean height for crops with and without CO_2 was the same 12.5 inches.

The mean number of flowers per plant was slightly increased when the plants received additional CO_2 (3.1 vs. 3.0 flowers). The increase might have been greater if Crop II had not exhibited an opposite trend. Crop II had 2.7 flowers per plant with CO_2 and 2.9 flowers without CO_2.

V. EFFECT OF MANUAL AND CHEMICAL PINCHING ON THE CHRYSANTHEMUM CULTIVAR 'DELAWARE'

Four experiments were conducted with chemical pinching of the chrysanthemum cultivar 'Delaware' from April to August 1967. The chemical pinching materials used were: Emery C-9 supplied by Emery Industries, Inc., Cincinnati, Ohio, and P & G supplied by Proctor and Gamble Inc., Cincinnati, Ohio. Approximately 60 pots (five cuttings per pot) were used in each experiment. Treatments were applied 2 weeks after potting in all experiments.

The first experiment was conducted in cooperation with the Society of American Florists as part of a nationwide test. Experiment I consisted of three treatments (manual pinch, 3% Emery and 3% P & G), four plants per treatment and five replications. The manual pinch was a soft pinch with 1/2 - 1 in. of the apex of the plant being removed. Chemical pinching agents were applied with a low pressure, high volume sprayer. A high pressure, low volume sprayer was recommended but was unavailable at spray time. Plants were sprayed overhead until the leaves were covered but run-off was avoided. Ten minutes after spraying, the plants were thoroughly washed with water.

The mean height of the manually pinched plants (11.7in.) and the P & G-treated plants (11.9in.) was less than the mean height of the Emery-treated plants (12.4 in.). Plants pinched chemically with P & G had more breaks (4.7) than those pinched with Emery (3.8) and those pinched manually (3.9). All plants were at the salable stage in 78 days. The manually pinched treatments produced more uniform and better appearing pots than the chemically pinched plants. Chemical pinching produced angular breaks that were quite similar to those obtained from a rollout pinch (less than 1/4 in. removed). Upon application the pinching agents killed the two youngest leaves around the meristem. Both chemical materials caused a reduction in leaf size and slight

distortion in the leaves developing immediately after pinch. In some instances plants were killed by the chemical pinching agents (6 plants out of the 300 plants were killed). Death of the plants was caused by an excess amount of material running down the stem, accumulating at the soil line and girdling the stem of the plant. While the spray tenchique was probably responsible for these dead plants, soil conditions (improper or too deep planting, soil mixture) and insufficient wash-off may have contributed to the problem.

Experiments I, III and IV treatments were applied with an electric mist blower. The nozzle was removed from the sprayer and the plants were sprayed overhead until the leaves glistened. In these experiments the feasibility of using stored, refrigerated and unrefrigerated mixed solutions of the chemical pinching agents was investigated. In Experiment II,the chemicals were mixed and stored in a refrigerator at 45° F. for 15 days prior to application. Solutions refrigerated for 30 days were compared with freshly made materials in Experiment III. In Experiment IV, a 15-day-old unrefrigerated (stored at room temperature of 75° F.) spray solution was compared with a fresh solution. A manual pinch was included in all experiments as a check.

The injury experienced in Experiment I was not as severe in subsequent experiments. No plants were killed in Experiments II, III and IV. In Experiment II, the mean height of the plants was essentially the same for all treatments. The P & G material that had been refrigerated for 15 days was ineffective as a pinching agent. The refrigerated Emery material produced 3.8 breaks per plant and the manual pinch produced 3.7 breaks.

The mean height of the plant varied over an inch in Experiment III. Freshly mixed P & G sprays produced the shortest mean height (14.8 in.). The manually pinched plants had greatest mean height (16.1 in). The number of breaks per plants for various treatments were: 3.3 for fresh P & G, 3.6 for 30-day refrigerated P & G, 3.4 for fresh Emery,2.7 for 30-day refrigerated Emery, and 2.8 for manual pinch. In Experiment IV the mean height of the plants that had been sprayed with room stored pinching agents was only 0.3 in. less than the tallest treatment (15.3 in. for fresh P & G). Fresh Emery treatments and the manual pinch had a mean height of 15.2 in. The largest number of breaks (3.6) were produced on plants sprayed with the P & G material that had been stored at room temperature for 15 days in a glass jar.

VI. AN EVALUATION OF RECENTLY INTRODUCED POT CHRYSANTHEMUM CULTIVARS GROWN UNDER ALABAMA CONDITIONS ON SELECTED SCHEDULES

Rooted cuttings of 19 recently introduced pot chrysanthemums were received from Yoder Brothers on three shipping dates, July 22, July 29, and August 5. Three schedules were used for these shipments: short (black cloth applied 1 week after pinch for short-growing, 9-and 10-week plants); medium (black cloth and pinch the same day for medium-growing, 10-week plants); and tall (black cloth applied 1 week before the pinch for tall-growing, 10-and 11-week plants). Ten pots of five cuttings each were potted. All cultivars except cv. Sunstar and cv. Warhawk were treated with B-Nine on August 22 and September 6.

Records were taken on height of the plant above the pot rim and number of flowers per plant. Outstanding characteristics of the cultivars were noted. All plants were in flower on October 7, 1966. The results are presented in Table 11.

Table 11. An Evaluation of Recently Introduced Pot Chrysanthemum Cultivars Grown Under Alabama Conditions on Selected Schedules

Cultivar	Height	Flowers per Pot	Comments
	In.	No.	
Short schedule Pot 7/8, pinch 7/22 Blackcloth 7/29			
Deep Mermaid	17.2	3.7	Scorch-like marginal leaf injury common.
Light Pink Mermaid	16.3	4.1	Compact plant-delicate color, marginal leaf injury.
Mandalay	15.6	4.0	Excellent variety-Gold, bronze blend color.
Short schedule Pot 7/29, pinch 7/29 Blackcloth 8/5			
Neptune	20.2	4.0	White flower with pink tinged center, good foliage.
Vermillion	16.0	2.9	Dull, dull red color-foliage damaged by Pentac fog.
Medium schedule Pot 7/18,pinch 7/29 Blackcloth 7/29			
Dark Red Star	17.8	2.7	Medium to large flowers-tall plant.
Envoy	14.5	2.9	Formal, stiff looking, attractive flowers; short.
Festival	18.6	3.4	Nice bronze color-makes a good disbud.
Sunstar	13.9	3.3	Petals somewhat quilled-good plant, delicate yellow.
Yellow Delaware	15.9	3.5	Formal large flowers.
Red Star	18.9	3.0	Nice bronze-good flowers & foliage.
Warhawk	14.2	2.7	Large red-bronze flowers. ResemblesDelaware.
Tall schedule Pot 7/22, pinch 7/29 Blackcloth 7/22			
Snow Ridge	15.9	4.4	Bold petals yet fragile looking-susceptible to petal burn.
Velvet Ridge	16.4	3.5	Large flowers-susceptible to petal burn (sun and botrytis).
Tall schedule Pot 7/22, pinch 8/4 Blackcloth 7/29			
Gay Anne	17.1	3.1	Nice uniform coppery bronze.
Improved Princess Anne	17.7	2.9	More intense color and better plant shape than P.A.
Princess Anne	18.6	3.6	Taller than other Annes-color not uniform.
White Carnival	20.4	3.1	Interesting flower form-pure white-strong stems.
Yellow Tokyo	20.2	3.1	Weak stems-large light yellow spider.

1/ All plants except cv. Warhawk and cv. Sunstar received 0.25% B-Nine sprays on 8/22/66 and 9/6/66.

2/ Red Star was potted on 7/8. Warhawk was potted on 7/22.

VII. EFFECT OF VARIOUS MEDIA ON HEIGHT, FRESH WEIGHT, DRY WEIGHT AND NUMBER OF FLOWERS PER PLANT OF POTTED CHRYSANTHEMUM, CV. 'DELAWARE'

The influence of 12 media mixtures on the height, fresh weight, dry weight, and number of flowers per plant of potted chrysanthemum, cv. Delaware', was studied in two experiments. Rooted cuttings (five per pot) were planted in the 12 mixtures shown in Table 12. All mixtures consisted of equal portions of materials and were limed according to test. Each mixture received 2 lb. of superphosphate and 2 lb. of 8-8-8 per cu. yd. Additional fertilization consisted of 1 oz. of 25-10-10 per 4 gallons twice a week. Experiment I was potted on September 21, pinched October 5, and flowered December 14, 1966. Experiment II was potted October 5, pinched October 19 and flowered December 23, 1966. Records were taken on all plants at flowering.

The tallest plants occurred in the calcined clay[1/], vermiculite and peat mixture and the calcined clay, vermiculite and bagasse mixture (Table 12). The shortest plants were grown in a sand and peat mixture. Calcined clay and vermiculite combined with peat or bagasse produced the tallest plants of any media mixture (Table 9). Mixtures of sand and peat or bagasse had the shortest plants. The mean height of plants grown in peat-amended mixtures (13.7 in.) was essentially equal to those grown in bagasse-amended mixtures (13.6 in.).

Plants grown in calcined clay, vermiculite and bagasse had the greatest mean fresh weight (99.9 g). The mean fresh weight of plants grown in sand and peat (53.0 g.) was considerably less than that of other mixtures. Media mixtures containing calcined clay, vermiculite and peat or bagasse produced plants with the greatest mean fresh weight (Table 13). Sand mixtures with either peat or bagasse produced much less fresh weight per plant than the other media mixtures. Bagasse-grown plants (81.2 g.) outweighed peat-grown plants (73.2 g.).

Plants grown in calcined clay, vermiculite and bagasse had the greatest dry weight (9. 6 g.), however, plants grown in calcined clay, vermiculite and peat (9.3 g.) and soil and peat (9. 2 g.) were almost comparable. The least dry weight occurred with plants grown in sand and peat (5.8 g.). Plants grown in media mixtures containing calcined clay, vermiculite and peat or bagasse had the most dry weight of any of the media mixtures. The mean dry weight of plants grown in sand and peat or bagasse was less than that of plants grown in the other mixtures. The mean dry weight of plants grown in bagasse was 83 g. , whereas peat-grown plants had a mean dry weight of 8.1 g.

The most flowers per plant were observed with plants grown in calcined clay, vermiculite and bagasse (3.9) and in soil and peat (3.8). Vermiculite and peat-grown plants averaged the fewest flowers (2.6). Soil media mixtures and calcined clay - vermiculite media mixtures produced the most flowers per plant. Plants grown in media mixtures containing vermiculite and peat or bagasse had the fewest flowers. Bagasse-grown plants had 0.2 more flowers per plant than peat-grown plants.

1/ "Sorbolite", furnished by the Clay Products Co., Bradenton, Fla.

VII. EFFECT OF VARIOUS MEDIA ON HEIGHT, FRESH WEIGHT, DRY WEIGHT AND NUMBER OF FLOWERS PER PLANT OF POTTED CHRYSANTHEMUM, CV. 'DELAWARE'

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Plants grown in calcined clay, vermiculite and bagasse had the greatest dry weight (9. 6 g.), however, plants grown in calcined clay, vermiculite and peat (9.3 g.) and soil and peat (9. 2 g.) were almost comparable. The least dry weight occurred with plants grown in sand and peat (5.8 g.). Plants grown in media mixtures containing calcined clay, vermiculite and peat or bagasse had the most dry weight of any of the media mixtures. The mean dry weight of plants grown in sand and peat or bagasse was less than that of plants grown in the other mixtures. The mean dry weight of plants grown in bagasse was 83 g. , whereas peat-grown plants had a mean dry weight of 8.1 g.

The most flowers per plant were observed with plants grown in calcined clay, vermiculite and bagasse (3.9) and in soil and peat (3.8). Vermiculite and peat-grown plants averaged the fewest flowers (2.6). Soil media mixtures and calcined clay - vermiculite media mixtures produced the most flowers per plant. Plants grown in media mixtures containing vermiculite and peat or bagasse had the fewest flowers. Bagasse-grown plants had 0.2 more flowers per plant than peat-grown plants.

1/ "Sorbolite", furnished by the Clay Products Co., Bradenton, Fla.

Table 12. Mean Height, Fresh Weight, Dry Weight and Number of Flower per Plant of Potted Chrysanthemum cv. 'Delaware' Grown in Various Media 1/

Media 2/	Height	Fresh weight	Dry weight	Flowers per plant
	In.	G.	G.	No.
Soil and peat	14.1	78.7	9.2	3.8
Soil and bagasse	13.5	72.6	7.6	3.2
Soil, perlite and peat	14.2	79.1	8.4	3.4
Soil, perlite and bagasse	13.2	74.5	7.8	3.4
Sand and peat	12.6	53.0	5.8	3.0
Sand and bagasse	13.3	75.7	8.2	3.1
Vermiculite and peat	14.0	75.3	8.7	2.6
Vermiculite and bagasse	13.3	78.8	7.9	3.0
Calcined clay and peat	12.9	67.8	7.1	2.6
Calcined clay and bagasse	13.7	85.7	8.8	3.4
Calcined clay, vermiculite and peat	14.5	88.1	9.3	3.1
Calcined clay, vermiculite and bagasse.	14.5	99.9	9.6	3.9
Mean	13.7	78.4	8.2	3.2

1/ Mean obtained from two experiments.

2/ Equal portions of materials were used in all media. Each medium was limed according to test and contained 2 lb. of superphosphate and 2 lb. 8-8-8 per cu. yd.

Table 13. Effect of Media Mixture on Mean Height, Fresh Weight, Dry Weight, Number of Flowers per Plant of Potted Chrysanthemum cv. 'Delaware' 1/

Media Combinations 2/	Height	Fresh weight	Dry weight	Flowers per plant
	In.	G.	G.	No.
Soil and amendment	13.8	75.5	8.4	3.5
Soil, perlite and amendment	13.7	76.8	8.1	3.4
Sand and amendment	13.0	64.4	7.0	3.1
Vermiculite and amendment	13.7	77.1	8.3	2.8
Calcined clay and amendment	13.1	76.8	8.0	3.0
Calcined clay, vermiculite and amendment	14.5	94.0	9.5	3.5
Mean	13.7	78.4	8.2	3.2

1/ Mean obtained from two experiments.

2/ Equal portions of materials were used in all media. Amendment was either peat or bagasse (mean represents plants grown in both). Each medium was limed according to test and contained 2 lb. of superphosphate and 2 lb. of 8-8-8 per cu. yd.