RESEARCH RESULTS FOR ORNAMENTAL HORTICULTURISTS

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FLORISTS CROPS

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History and Nature of Research Results for Ornamental Horticulturists

Kenneth C. Sanderson

Issue number one of Research Results for Ornamental Horticulturists (originally titled Research Results for Nurseryman) was authored by Dr. Tok Furuta in 1960. Since that issue 31 issues have followed. Over 35 authors have contributed to RROH during the past 23 years. Dr. Tok Furuta was the author of most of the early issues. In the late 1960's Dr. Henry P. Orr organized RROH as a part of departmental participation in the Southern Nurserymen's Association Research Workers Conference. Dr. Kenneth C. Sanderson assumed the responsibility for its publication in 1970. Two author-subject indexes, issues numbered 22 (1976) and 28 (1982), have been produced.

RROH has considered a variety of topics of interest to ornamental horticulturists. Some issues were specifically targeted to either floriculture or woody ornamentals. Many considered cultural practices, pest control, and marketing. The contents of RROH have been as the name indicates - research results. Many of the reports have been status or progress reports. The research workers at Auburn University have not always had the opportunity to report to industry and RROH has often had to substitute for an annual report at a short course. While conclusions have not always been drawn from the research presented, the reader may gain an insight in a problem that is useful. The research methods involved may also contain valuable information.

Complete sets of RROH occur in libraries in England, Germany, and Taiwan and in major horticultural libraries throughout the United States.

A Comparison of A-Rest, Stemtrol, and B-Nine on Height Control in Poinsettia

Gary E. Murray, Kenneth C. Sanderson,
and Willis C. Martin, Jr.

Nature or Work: A new foliar spray growth regulator, Stemtrol, piproctanyl- bromide, (1-allyl-1-1-(3,7-dimethyloctyl)-piperidinium bromide) has been manufactured by Hoffmann-LaRoche. Piproctanyl-bromide is a quarternary ammonium derivative. It is manufactured as a liquid concentrate containing 5 percent active ingredient plus a wetting agent. It has been reported to demonstrate good growth reduction of chrysanthemums and certain other ornamentals.

The purpose of this research was to determine the effect of piproctanyl-bromide, B-Nine (2,2-dimethylhydrazide) and ancymidol (4 methoxyphenol)-5-pyrimidine-methanol) as foliar sprays on the plant height and foliage injury of poinsettias.

Cultivars used in this study were 'Annette Hegg', 'C-1 Red', and 'Annette Hegg Diva'. The test was conducted at Auburn University in a glass greenhouse. Standard cultural practices for commercial poinsettias were followed on the test plants.

A randomized complete block design with 2 replications, 5 treatments (table 1) plus a control, and 4 to 6 plants per treatment was used in applying the growth regulators.

A high pressure-low volume sprayer was used as the applicator. Plants were sprayed to leaf drip with a fine mist. The volume of spray applied per area is shown in table 1. The plants were sprayed between the hours of 9 a.m. and 1 p.m. on November 1, 1977.

Twenty-one days after spraying, the plants' heights were measured (table 2). Plant height was measured as the distance from the top of the pot to top or apex of the plant. Foliage injury was rated as follows: (1) 0-20 percent of the leaves burned, (2) 20-40 percent of the leaves burned, (3) 40-60 percent of the leaves burned, (4) 60-80 percent of the leaves burned, (5) 80-100 percent of the leaves burned. A leaf was considered burned if 50 percent of its margin was brown to a depth of 1/8 inch from the edge of the leaf.

Results and Discussion: It can be concluded from the results obtained that piproctanyl-bromide is not an effective growth retardant for poinsettias. None of the chemicals used greatly reduced stem elongation. This could be attributed to the lateness of the treatment and the short duration of the

experiment. Piproctanyl-bromide, however, did not reduce plant height in the low and medium concentration and only slightly in the high concentration. Ancymidol was the best material for reducing plant height, followed closely by B-Nine.

The important results of this experiment are represented by the foliage damage ratings. Piproctanyl-bromide severely burned the poinsettias, ancymidol caused some burning, and B-Nine did very little damage. Although all precautions were taken to avoid drifting, some burn was exhibited by the control. This, however, was extremely minimal and could be attributed to leaf contact of the controls and treatments on the bench after spraying.

Considering both plant height reduction and foliage damage, B-Nine and ancymidol showed fair responses. These may have been better if an earlier spray date had been used. Piproctanyl-bromide caused too much foliage damage and did not sufficiently retard plant growth of poinsettias.

Table 1. Chemicals Used as Foliar Sprays on Three Varieties of Poinsettias

Treatment number	Chemical	Concentration, p.p.m.	Amount used oz. per sq. ft.
1	Stemtrol (1-allyl-1-(3,7-dimethyloctyl)-piperidinium bromide)	100	0.39
2	" "	150	0.59
3	" "	200	0.54
4	B-nine	5,000	0.43
5	A-Rest (ancymidol)	150	0.41
6	Control	——	——

Table 2. Plant Height (inch) and Foliage Injury

Average	Treatment number 1 Ht.	1 Injury[1/]	2 Ht.	2 Injury	3 Ht.	3 Injury	4 Ht.	4 Injury	5 Ht.	5 Injury	6 Ht.	6 Injury
Annette Hegg	12.4	2.2	13.5	3.2	12.4	3.3	13.0	0.8	12.2	0.6	12.7	0.3
C1-Red	14.4	2.1	14.3	3.1	13.0	2.6	13.7	0.6	13.0	1.4	13.7	0.3
Annette Hegg (Diva)	13.7	2.8	13.4	3.4	13.2	3.5	12.0	1.1	12.4	1.2	13.7	0.4
Average	13.5	2.4	13.8	2.2	13.0	3.1	12.9	0.8	12.5	1.1	13.4	0.3

[1/] Foliage injury rating: 1 = 0-20% leaves burned, 2 = 20-40% leaves burned, 3 = 40-60% leaves burned, 4 = 60-80% leaves burned, and 5 = 80-100% leaves burned.

An Evaluation of Stemtrol as a Growth Retardant for *Fuchsia hybrida*

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

Nature of Work: Rooted cuttings (4 per 6 inch pot) of the Fuchsia cultivars, 'Bagdad', 'Dollar Princess', 'Winston Churchill' and 'Gartenmeister Bonstedt' were transplanted into a 1:1:1 (v/v/v) mixture of soil:peat moss and bark on September 27, 1977. Prior to steam pasteurization, the medium was amended with 0.5 lb. limestone, 0.3 lb. superphosphate, and 0.3 lb. gypsum per yd^3. A weekly application of 20-20-20 liquid fertilizer was applied to the plants at the rate of 2 lb. per 100 gal. On November 3, the growth retardants Stemtrol, B-Nine, and A-Rest were applied to the plants at the rates shown in table 1. Three replications with 4 plants per treatment were used in 'Bagdad' and 'Dollar Princess' tests. 'Winston Churchill' tests were replicated 2 times using 4 plant per treatment. For 'Gartenmeister Bonstedt' tests 3 replications and 3 plants per treatment were used. The height of the plants was measured on January 18, 11 weeks after treatment.

Results and Discussion: No adverse, visual effects were observed with any of the growth retardant treatments. At the time of height measurement the growth retardant effects were being overcome by some plants. Some cultivars seem to respond more effectively to certain retardants, especially Stemtrol. Stemtrol generally caused the greatest reduction in the height of all cultivars (table 1). Only a few plants were in flower at the end of the investigation.

Table 1. Height of Four Fuchsia Cultivars Treated with Growth Retardants

Spray treatment, p.p.m.	Cultivars height, inch			
	Bagdad	Dollar Princess	Winston Churchill	Gartenmeister Bonstedt
100 Stemtrol	14.6	12.9	10.6	13.0
150 Stemtrol	14.7	13.7	11.0	13.2
200 Stemtrol	13.7	12.3	11.1	13.1
5,000 B-Nine	14.5	12.6	13.8	15.0
150 A-Rest	16.4	13.4	11.8	13.8
None	15.9	12.9	12.8	16.0

Effect of Various Controlled-Release Fertilizers on the Growth of Ficus benjamina L.

Linda Gail Waterhouse Kenneth C. Sanderson,
Donald Y. Perkins, and John C. Williams

Nature of Work: Foliage plant production research indicates that in most situations, no single source or level of fertilization yields the best growth. The most common fertilizers used are water soluble forms, however slow release fertilizers are also used. Slow release fertilizer facilitates larger single applications of fertilizers, reduces luxury consumption of nutrients, reduces fertilizer application frequency, reduces labor, and reduces leaching loss and soil fixation of nutrients.

The purpose of this study was to examine the effects of several experimental controlled slow release fertilizers on the growth and development of Ficus benjamina L.

Rooted cuttings of Ficus benjamina L. were potted in 6-in. standard pots on April 2. Beginning April 16, the plants were fertilized with liquid fertilizer (Peters 20.0N-8.7P-16.6K) 1477 lb. per acre per year until the experimental fertilizers were applied on August 20.

The test fertilizers used included Precise, 12.0N-2.6P-5.0K, an encapsulated source of the 3 primary nutrients in the form of an aqueous solution of urea, ammonium superphosphate, and muriate of potash manufactured by 3M Company, Minneapolis, Minn.; Scott Pro-Grow 25.0N-4.4P-8.3K and Scott's impregnated vermiculite 18.0N-3.9P-7.5K, 20.0N-2.2P-8.3K, 16.0N-1.7P-10.0K, 20.0N-2.2P-4.2K, and 15.0N-8.7P-4.2K manufactured by O. M. Scott Company, Marysville, Ohio; Mag-Amp 7.0N-17.4P-4.1K, a combination of co-granulated magnesium ammonium phosphate and magnesium potassium phosphate manufactured by W. R. Grace, Co., Clarksville Md., and Osmocote 14.0N-6.1P-11.6K (a plastic resin coated inorganic water soluble fertilizer manufactured by Serria Chemical Co., Milpitas Calif.). The slow release fertilizers were spread uniformly over the medium surface of the pots and water was applied. Liquid fertilization, Peters 20.0N-8.7P-16.6K, was applied at the rate of 1,378 per acre per year. Treatments were replicated 6 times in a randomized block design.

The medium was a 1:1:1 (v/v/v) mixture of sand, sphagnum peat moss, and pinebark. Added amendments consisted of 0.8 lb. dolomite, 0.2 lb. Perk and 0.1 oz. Aquagro (a nonionic wetting agent, manufactured by Aquatrols, Inc., Pennsauken, N.J.) per yd^3. The experiment was conducted in a glass greenhouse cooled through the summer by evaporative pads. The plants were maintained under natural daylight at approximately 2,365 ft-c.

Height data were recorded after 4 months. Heights of the plants were made by measuring from the pot rim to the terminal meristem. Two leaves from new growth were taken from each plant to compare leaf color using a Hunterlab color difference meter.

A visual rating of plant appearance was made using a rating scale ranging from 1 to 4. A rating of 1 indicated an unacceptable plant, one that was stunted and chlorotic. A rating of 4 indicated a healthy, dark green plant with a full spreading habit. A rating of 3 or 2 indicated plants between desirable and unacceptable.

After the visual rating, the plants were cut at the medium surface and placed in paper bags for drying to measure dry weight. The bags were dried in a forced draft oven at 70 to 80°C for 48 hours.

Results and Discussion: Heights, dry weights, visual ratings, and green leaf color (table 1) of plants fertilized with high rates of several controlled-release fertilizers and Scott Pro-Grow 25.0N-2.2P-8.3K were equal or better than results with Precise and Osmocote 14.0N-6.1P-11.6K. Mag-amp 7.0N-17.4-4.1K plants at rates of 1,045 and 784 lb. per acre per year performed poorly in all growth parameters measured. Liquid fertilization, 20.0N-8.7P-16.6K, applied at the rate of 1,378 lb. per acre per year did not yield better growth than high rates of slow release fertilizers surface applied at the beginning of the experiment.

Results of this study reveal that when several different types and formulations of controlled-release fertilizers are applied at the rate of 1,045 lb. per acre per year similar growth of Ficus benjamina L. is produced. Also a single application on a surface broadcast, controlled-release fertilizer can produce plant growth equal to that obtained with applications of water soluble liquid fertilization every 2 weeks.

Table 1. Height, Dry Weight, Visual Ratings, and Hunter Color Difference values of Ficus benjamina L. Fertilized with Various Controlled Release Fertilizers

Fertilizer N-P-K		Yearly rate, lb. per acre	Plant height, inch	Dry weight, g	Visual rating[1/]	Green color, tan-l a/b
Mag Amp	7.0-17.4-4.1	1,045	19.8bcd[2/]	22.03de	1.33g	-5.7fg
	7.0-17.4-4.1	784	18.1cd	18.45ef	1.00g	-4.1fg
Osmocote	14.0-6.1-11.6	1,045	22.2abc	26.07a-d	2.17f	3.9cde
	14.0-6.1-11.6	784	22.3abc	24.68b-e	2.33ef	0.0efg
Precise	12.0-2.6-5.0	1,045	21.4a-d	28.17a-d	2.50ef	12.4a-d
	12.0-2.6-5.0	784	19.8bcd	24.17cde	2.33ef	9.6a-e
Scott	15.0-8.7-4.2	1,045	22.0abc	31.60ab	3.00b-f	12.4a-d
	15.0-8.7-4.2	784	24.9a	31.08abc	2.83c-f	6.8b-e
	16.0-1.7-10.0	1,045	21.0a-d	27.57a-d	3.50abc	17.4a
	16.0-1.7-10.0	784	21.8abc	30.70abc	2.67def	6.2b-e
	18.0-3.9-7.5	1,045	23.8ab	32.02ab	4.00a	9.6a-e
	18.0-3.9-7.5	784	21.8abc	30.38abc	3.00b-e	8.5b-e
	20.0-2.2-4.2	1,045	20.5a-d	30.02abc	3.67ab	15.1ab
	20.0-2.2-4.2	784	19.6bcd	25.43bcd	3.00b-e	6.2b-e
	20.0-2.2-8.3	1,045	23.2ab	31.42abc	2.50ef	7.9b-e
	20.0-2.2-8.3	784	23.1ab	31.17abc	2.50ef	5.7b-e
	25.0-4.4-8.3	1,045	22.0abc	32.90a	2.83c-f	11.9a-d
	25.0-4.4-8.3	784	20.6a-d	29.58abc	2.33ef	2.9def
Peters Liquid	20.0-8.7-16.6		22.2abc	28.32a-d	3.33a-d	13.0abc
Check			17.3d	13.82f	1.00g	-6.2g

1/A visual rating of 4 indicates a dark green color, full spreading habit, and nonspindly growth. A rating of 3 indicates medium to light green color and some spindliness. Rating 2 is indicative of light green color and a tall, spindly habit. Rating 1 indicates yellowish green to yellow color, short plants, thin growth, and unacceptable plants.

2/Means followed by the same letter(s) are not significantly different according to Duncan's multiple range test.

Maintaining the Growth of Schefflera Brassaia actinophylla Endl. with Chemical Inhibitors

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

Nature of Work: Tropical trees and shrubs are widely used in interior landscapes where they soon become overgrown and unkept looking. Reducing the size of the overgrown plants can be accomplished by pinching and pruning but this changes the appearance of the plant and the landscape, reduces attractiveness, and is expensive. Cost of maintenance of interior landscape plants is accelerated by the plants' rapid growth habits and labor and material required for frequent prunings and replacement. The object of this research was to find an effective growth retardant for schefflera, Brassaia actinophylla Endl., a very popular interior landscape tree.

Twenty-seven chemicals, including growth retardants, growth inhibitors, cytokinins, morphactins, and ethylene compounds, were applied to Brassaia plants growing in 6-inch pots on July 24, 1980 (table 1). The chemicals were applied as sprays at the rate 1.3 oz of spray per plant. A surfactant, Plyac, was added to each spray at the rate of 13 oz./100 gal. Concentrations of the chemicals used were determined from manufacturers recommendations and previous research. Ethrel (ethephon) was also combined with several of the other chemicals to test the additive effect of Ethrel observed in other growth regulator work. Three plants were used as an experimental unit in a randomized block design having 4 replications. Plants were grown in an air-cooled greenhouse with the thermostat set at 72°F and an irradiance of 6,000-8,000 ft-c. Fertilizer was applied to the plants every 2 weeks using 2 lb./100 gal. of 20-20-20 water soluble material. The height of the plant from the pot rim to the plant terminal was determined on September 12.

Results and Discussion: None of the chemicals tested significantly reduced the growth of Brassaia (table 1). There was a trend for the growth retardants, B-Nine and A-Rest, to cause some reduction (10%) in growth, however the rates used were extremely high and their use at higher rates would not be economically feasible and maybe phytotoxic. Higher rates of MBR 18337 merit investigation. A safe, nonphytotoxic, growth inhibitor for woody plants is still needed if the growth of most interior landscape plants is to be chemically controlled.

Table 1. Height of Schefflera, Brassaia actinophylla Endl. Following Spray Treatment with Various Chemicals

Treatment[1]	Common name	Rate, p.p.m.	Plant height, inch
Check	———	———	31.1abc[2]
Cytokinins			
6-benzylaminopurine	N-6BA	500	31.7abc
6-furfurylaminopurine	Kinetin	100	32.5ab
Ethylene compounds			
Ethrel	Ethephon	1,000	30.2a-d
Growth retardants			
A-Rest	Ancymidol	133	27.3dc
B-Nine	Daminozide	10,000	28.1bcd
Cycocel	Chlormequat	3,000	30.3a-d
B-Nine + Cycocel	———	5,000 + 1,500	27.5dc
Stemtrol	———	250	30.2a-d
Growth inhibitors			
Atrinal	Dikegulac	3,000	29.1a-d
Embark	Melfluidide	960	32.2ab
Embark	Melfluidide	920	29.3a-d
MBR 18337	———	480	29.4a-d
MBR 18337	———	960	27.6dc
Morphactins			
Maintain CF-125	Chlorflurenol	50	28.9abc
BAY 102612	———	50	31.0abc
BAY 102613	———	50	33.2a
BAY 102614	———	50	29.9a-d
Ethrel (E) combinations			
E + N-6BA	———	500 + 250	30.8a-d
E + A-Rest	———	500 + 67	30.2a-d
E + B-Nine	———	500 + 5,000	29.6a-d
E + Stemtrol	———	500 + 125	30.2a-d
E + Embark	———	500 + 480	29.1a-d
E + Embark	———	500 + 960	29.5a-d
E + MBR 18337	———	500 + 240	28.8a-d
E + BAY 102612	———	500 + 25	29.6a-d
E + BAY 102613	———	500 + 25	29.6a-d
E + BAY 102614	———	500 + 25	30.7a-d

[1] Approximately 1.3 oz. of spray applied per plant.

[2] Means followed by the same letter(s) are not significantly different according Duncan's multiple range test.

Comparison of Agriblend and Other Growth Stimulating Chemicals on the Growth of Schefflera, Brassaia actinophylla Endl.

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

Nature of Work: Chemicals that stimulate plant growth include auxins, gibberellins, and cytokinins. Recently, attention has centered on cytokinins, growth regulators that increase cell division. Several natural cytokinin products have been introduced for use on agricultural crops. Aqua 10 Agriblend, a seaweed concentrate containing 100 p.p.m. cytokinins and manufactured by the Aqua 10 Corp., Beauford, N.C. is such a natural cytokinin. The object of the present study was to compare Agriblend with an auxin, gibberellic acid, and 2 cytokinins on the growth of schefflera, Brassaia actinophylla Endl.

Schefflera seedlings were transplanted into 6-inch pots containing a 1:2 (v/v) builders sand and sphagnum peat moss medium on June 10, 1980. Prior to transplanting, the medium was amended with 3.6 oz. limestone, 1.5 oz. Perk minor nutrient additive, 1.5 oz $CaNO_3$ and 1.5 oz. granular Aqua-Gro wetting agent per ft^2. Fertilization consisted of 2 lb./100 gal. of 20-20-20 water soluble fertilizer every 2 weeks. Plants were grown in a lightly shaded, evaporative-cooled greenhouse. On July 9 and August 27, stimulating treatments were applied as sprays (3.3 oz. per ft^2) and drenches (3 oz. per pot). Sprays consisted of 100 p.p.m. each of Agriblend, NAA (napthaleneacetic acid), KGA (potassium salt of gibberellic acid), N-6BA (6-benzylaminopurine, a cytokinin), and kinetin (6-furfurylamino-purine, a cytokinin). DuPont spreader sticker was added to all sprays at the rate of 13 oz./100 gal. Agriblend drenches were applied at the rate of 2 oz./100 gal. or 6 p.p.m. The other chemicals were applied at a concentration of 100 p.p.m. Six plants were used as an experimental unit in randomized block design having 5 replications. Data on plant height and dry weight were recorded October 8, 1980.

Results and Discussion: One week after the second application, leaves of plants drenched with NAA appeared very distorted. Plant receiving the N-6BA spray showed some distortion. Minor leaf burn and destruction of terminal tissue was observed on KGA sprayed plants. Plants drenched with N-6BA exhibited dwarfing first, one week after application.

Drenched plants were shorter than sprayed plants. The heights and dry weights of plants drenched with NAA were significantly less than those of other drenched plants (table 1). KGA-sprayed plants were taller than Agriblend-, Kinetin-, N-6BA-, and NAA-sprayed plants. Generally, Agriblend treatments were similar to the other treatments except NAA drenches and KGA sprays; however, Agriblend plants did not differ from check plants. Results with Agriblend confirm results (unpublished) by the authors with gloxinia, Sinnigia speciosa Benth and Hook. Only KGA sprays showed any promise as a growth stimulating treatment for schefflera. Further research is warranted on various antilogs, concentrations, and phytotoxicity of GA on schefflera and other tropical foliage plants if there is a need for growth stimulation.

Table 1. Height and Dry Weight of Schefflera Brassaia actinophylla Endl. Plants Treated with Growth Stimulating Drenches and Sprays

Chemical treatment[1/]	Height, inch		Dry weight, g	
	Drench	Spray	Drench	Spray
Height (cm)				
Aqua 10 Agriblend	9.5a[2/]	9.5b	7.9a	7.7a
KGA	10.2a	12.1a	7.9a	9.1a
Kinetin	9.5a	9.2b	7.1a	7.7a
NAA	7.2b	8.7b	5.2b	6.7a
N-6BA	10.6a	9.2b	8.3a	7.5a

1/All drenches and sprays applied at the rate of 100 p.p.m. except for Agriblend which was applied at 6 p.p.m. Drenches consisted of 3 oz. of material per 6-inch pot. Sprays applied 3.3 oz. per ft^2.

2/Means followed by the same letter(s) are not significantly different according to Duncan's multiple range test.