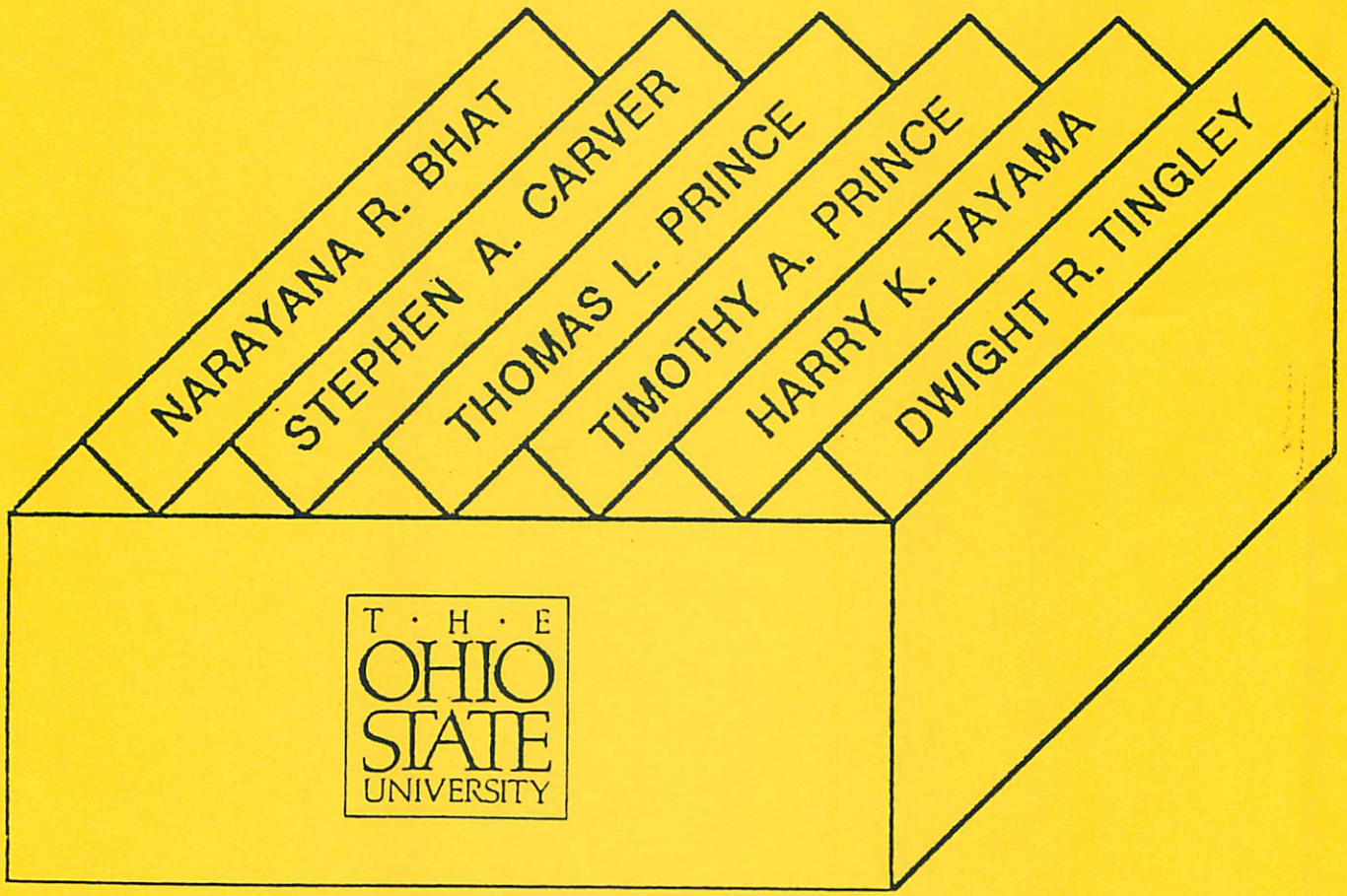
THE OHIO STATE UNIVERSITY

DEPARTMENT OF HORTICULTURE

FLORICULTURE RESEARCH REPORT

PRODUCTION & POSTPRODUCTION

NOVEMBER 1989



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CONTRIBUTORS TO RESEARCH

1. American Cyanamid, Princeton, NJ (Cycocel).
2. Aquatrols Corporation of America, Pennsauken, NJ (Aqua-Gro).
3. Ball Seed Company, West Chicago, IL (Seeds, cell packs).
4. BFG Supply Co., Burton, Ohio (Pots).
5. Cleveland Floral Products Co., Cleveland, OH (Pots).
6. Dean's Greenhouse, Westlake, OH (Geranium cuttings).
7. Earl J. Small Growers, Pinellas Park, FL (Gloxinia plants).
8. Paul Ecke Poinsettias, Encinitas, CA (Poinsettia cuttings, and New Guinea impatiens plants).
9. Elanco Products, Eli Lilly and Company, Indianapolis, IN (Cutless).
10. Fison Western Corporation, Vancouver, CN (Sphagnum peat moss).
11. W.R. Grace and Company, Cambridge MA (Metro-Mix, fertilizers, perlite, vermiculite, pine bark, and bark ash).
12. Great Lakes Chemical Corporation, West Lafayette, IN (Agribrom)
13. Hill Floral Products Company of Ohio, Columbus, OH (Fresh cut-evergreens).
14. Kord Products, Ltd., Bramalea, Ontario, CN (Pots).
15. Krueger-Maddux Greenhouse, Cincinnati, OH (Bedding plants).
16. Mikkelsens Inc, Ashtabula, OH (New Guinea impatiens plants).
17. Plantco Inc, Brampton, Ontario CN (Nutricote).
18. Rhone-Poulenc Ag Company, Kalamazoo, MI (Anti-transpirant and Florel).
19. Rough Brothers Inc., Cincinnati, OH (Ebb & Flow benches).
20. Sandoz Protection Corporation, Chicago, IL (Bonzi).
21. Sierra Chemical Company, Milpitas, CA (Osmocote).
22. Smithers-Oasis, Kent, OH (Oasis Strips).
23. Ulrey's Greenhouse Company, Springfield, OH (Bedding and geranium plants).

24. Uniroyal Chemical Inc, Midway, CT (B-Nine).

25. Valent USA Corp, Walnut Creek, CA (Sumagic).

26. West Hills Greenhouse Inc., Cincinnati, OH (Geranium cuttings).

27. Yoder Brothers Inc., Barberton, OH (Chrysanthemum cuttings).

B-NINE/CYCOCEL - POTTED PLANT STUDIES

OBJECTIVE: To evaluate the efficacy of B-Nine/Cycocel combination sprays on potted chrysanthemum and zonal geranium.

PROCEDURE:

CHRYSANTHEMUM

3/1 - Rooted cuttings of 'Bright Golden Anne' received courtesy of Yoder Brothers, Inc.
3/1 - Cuttings planted five per 6.5-inch pot in Metro Mix 350 with one teaspoon Osmocote (19-6-12) per pot topdressed. Additional fertilization by injection at 200 ppm each of N and K at every irrigation.
3/1 - Long days
3/15 - Short days
3/15 - Pinched to seven-leaves, root growth to sides and bottom of the pot
3/29 - First treatment, shoots 1.5 to 2-inches long
4/12 - Second treatment
4/26 - Disbud
4/26 - Third spray treatment
5/24 - Data collected

ZONAL GERANIUM

2/19 - Seventy-five zonal geraniums ('Yours Truly') received in four-inch plastic pots from Ulery's Greenhouse
2/23 - Plants pinched to three-nodes
3/20 - First treatment, new growth two-inches long
4/5 - Second treatment
5/9 - Data collected

RESULTS:

CHRYSANTHEMUM

TREATMENT	HEIGHT(cm)	DIAMETER(cm)	FLOWER #	DAYS TO FL
CONTROL	56.3	67.7	16.3	60
B-NINE 5,000 ppm	46.0	57.3	15.0	66
B-NINE/CYCOCEL 2,500/1,500 ppm	45.0	59.0	15.3	66

ZONAL GERANIUM

TREATMENT	HEIGHT(cm)	DIAMETER(cm)	FLOWER #	DAYS TO FL*
CONTROL	19.3	26.0	4.3	17
CYCOCEL 1,500 ppm	18.7	24.7	4.3	18
B-NINE/CYCOCEL 2,500/1,500 ppm	19.0	25.0	4.0	19

*From the date of the last application

RECOMMENDATIONS: The B-Nine/Cycocel combination provided a level of control equal to that of B-Nine alone (on chrysanthemum) or Cycocel alone (on geranium). The addition of B-Nine to Cycocel on geraniums reduced the degree of Cycocel induced marginal leaf yellowing. The addition of Cycocel to B-Nine resulted in some minor marginal leaf yellowing of chrysanthemum.

DEMONSTRATION STUDIES:

CHRYSANTHEMUM

5/9 - Rooted cuttings of 'Yellow Favor' received courtesy of Yoder Brothers, Inc.
5/9 - Cuttings planted five per 6.5-inch pot in Metro Mix 350 with one-teaspoon Osmocote (19-6-12) per pot topdressed. Additional fertilization by injection at 200 ppm each of N and K at every irrigation.
5/23 - Short days
5/23 - Pinch to seven-leaves, root growth to sides and bottom of the pot
6/5 - First treatment, shoots 1.5 to 2-inches long
6/16 - Second treatment
6/30 - Disbud
6/30 - Third spray treatment

ZONAL GERANIUM

4/9 - Seventy-five zonal geraniums ('Yours Truly') received in four-inch plastic pots courtesy of West Hills Greenhouses, Inc. Cuttings of these plants stuck into Oasis Strips
5/2 - Rooted cuttings planted in 4.5-inch plastic pots filled with Metro Mix 350
5/22 - First treatment, new growth two-inches long
6/9 - Second treatment

B-NINE/CYCOCEL - BEDDING PLANT STUDIES

OBJECTIVE: To evaluate the efficacy of B-Nine/Cycocel combination sprays on various bedding plants.

PROCEDURE:

3/7 - Plugs received courtesy of Ulrey's Greenhouse and planted
3/2 - First application of all treatments. All plants at the 3 to 4-true leaf stage (or 1.5 to 2-inches of new growth evident)
4/6 - Second application
4/20 - Data collected, **height and diameter measurements in cm.**

RESULTS:

CELOSIA

TREATMENT	HEIGHT	DIAMETER
Control	10.3	16.0
B-Nine 5,000 ppm	8.7	16.0
B-Nine/Cycocel 2,500/1,500 ppm	7.7	15.0

PETUNIA

HEIGHT	DIAMETER	FLOWER #
12.7	26.7	1.7
8.7	24.0	0
9.0	24.3	0

ZINNIA

TREATMENT	FLWR HGT	VEG HGT	DIAMETER	FLOWER #
Control	20.3	17.3	15.3	1.0
B-Nine 5,000 ppm	13.7	12.3	12.0	0.3
B-Nine/Cycocel 2,500/1,500 ppm	13.3	12.0	12.7	0.0

SNAPDRAGON

HEIGHT	DIAMETER	FLORET #
18.7	24.3	6.0
18.7	23.0	5.3
16.7	23.0	3.3

SALVIA

TREATMENT	FLWR HGT	VEG HGT	DIAMETER
Control	16.3	10.3	16.7
A-Rest 66 ppm	14.0	9.3	16.3
B-Nine/Cycocel 2,500/1,500 ppm	12.3	8.7	15.0

RECOMMENDATIONS: The combination of B-Nine/Cycocel provided a level of growth control equal to or slightly better than B-Nine alone. Characteristic Cycocel marginal leaf chlorosis can be a problem as it was for us on zinnia.

SUMAGIC - POTTED PLANT STUDIES

OBJECTIVE: To evaluate the efficacy of various spray and drench concentrations of the chemical growth regulator, Sumagic, on potted chrysanthemum and zonal geranium.

PROCEDURE:

CHRYSANTHEMUM

1/11 - Rooted cuttings of 'Bright Golden Anne' received courtesy of Yoder Brothers, Inc.
1/11 - Cuttings planted five per 6.5-inch pot in Metro Mix 350 with one-teaspoon Osmocote (19-6-12) per pot topdressed. Additional fertilization by injection at 200 ppm each of N and K at every irrigation.
1/11 - Long days
1/28 - Short days
1/28 - Pinched to seven-leaves, root growth to sides and bottom of the pot
2/13 - First treatment, shoots 1.5 to 2-inches long. Spray applied at one-gallon per 200-sq ft Drench applications applied in four-oz of solution per pot
2/28 - Second spray and drench treatments
3/14 - Disbud
3/14 - Third spray treatment
4/24 - Data collected

ZONAL GERANIUM

1/5 - Zonal geraniums ('Yours Truly') received in 4-inch plastic pots from Ulery's Greenhouse.
1/19 - Plants pinched to three-nodes
2/14 - First treatment, new growth two-inches. Spray treatments applied in one-gallon per 200- sq ft. Drench treatments applied at two-oz of solution per 4.5-inch pot
3/1 - Second treatments
4/5 - Data collected

RESULTS:

CHRYSANTHEMUM

TREATMENT	HEIGHT(cm)	DIAMETER(cm)	FLOWER #	DAYS TO FL
CONTROL	43.0	66.7	21.3	59
SUM SP 10 ppm-3 appl	37.0	57.3	20.0	61
SUM SP 20 ppm-3 appl	31.3	55.7	21.7	61
SUM DR 5 ppm -1 appl	27.0	49.0	19.3	61
SUM DR 5 ppm -2 appl	24.3	47.3	20.0	61
SUM DR 10 ppm-1 appl	25.7	49.7	19.3	61
SUM DR 10 ppm-2 appl	25.0	47.7	19.7	61
SUM DR 15 ppm-1 appl	23.7	46.3	18.0	62
SUM DR 15 ppm-2 appl	22.3	44.7	18.7	63
B-NINE 5,000 ppm-3 appl	31.9	56.4	19.3	61

RECOMMENDATIONS: When Sumagic is labeled for use on potted chrysanthemum, 20 ppm sprays or a single five ppm drench, begining when 1.5 to 2-inches of new growth is evident following the pinch should provide the desired level of control for 'Bright Golden Anne' chrysanthemums. Cultivar sensitivity to Sumagic is variable just as it is to B-Nine. Growers will need to trial Sumagic on other cultivars and keep accurate records of concentrations used, application dates, level of control obtained, and weather conditions.

ZONAL GERANIUM

TREATMENT	HEIGHT(cm)	DIAMETER(cm)	FLOWER *	DAYS TO FL *
CONTROL	15.3	23.3	4.3	17
SUM SP 10 ppm-2 appl	14.7	22.0	4.3	20
SUM SP 15 ppm-2 appl	15.0	21.0	4.3	19
SUM SP 20 ppm-2 appl	14.7	21.0	4.7	17
SUM DR 5 ppm-1 appl	9.3	13.7	4.3	18
SUM DR 5 ppm-2 appl	9.7	13.0	3.3	21
SUM DR 10 ppm-1 appl	9.0	12.7	3.7	17
SUM DR 10 ppm-2 appl	9.3	12.7	3.7	18
SUM DR 15 ppm-1 appl	9.3	12.7	4.0	20
SUM DR 15 ppm-2 appl	10.0	12.0	4.0	19
CYCOCEL SP 1,500 ppm-2 appl	14.2	22.1	4.7	20

*From the date of the last application

RECOMMENDATIONS: When Sumagic is labeled for use on zonal geraniums, 20 ppm sprays, begining when 1.5 to 2-inches of new growth is evident following the pinch, should provide the desired level of control.

DEMONSTRATION STUDIES:

CHRYSANTHEMUM

5/9 - Rooted cuttings of 'Yellow Favor' received courtesy of Yoder Brothers, Inc.
5/9 - Cuttings planted five per 6.5-inch pot in Metro Mix 350 with one-teaspoon Osmocote (19-6-12) per pot topdressed. Additional fertilization by injection at 200 ppm each of N and K at every irrigation.
5/23 - Short days
5/23 - Pinch to seven-leaves, root growth to sides and bottom of the pot
6/5 - First treatment, shoots are 1.5 to 2-inches long
6/16 - Second treatment
6/30 - Disbud
6/30 - Third spray treatment

ZONAL GERANIUM

4/9 - Seventy-five zonal geraniums ('Yours Truly') received in four-inch plastic pots courtesy of West Hills Greenhouses Inc. Cuttings of these plants stuck into Oasis Strips
5/2 - Rooted cuttings planted in 4.5-inch plastic pots filled with Metro Mix 350
5/22 - First treatment, new growth two-inches long
6/9 - Second treatment

SUMAGIC - BEDDING PLANT STUDIES

OBJECTIVE: To evaluate the efficacy of various spray and drench concentrations of the chemical growth regulator, Sumagic, on various bedding plants.

PROCEDURE:

1/10 - Plugs received courtesy of Ulrey's Greenhouse, and planted
1/20 - First application of all treatments. All plants at the 3 to 4-true leaf stage (or 1.5 to 2-inches of new growth evident)
2/3 - Second application, spray treatments only
2/23 - Data collected, **height and diameter measurements in cm.**

CELOSIA

		SUMAGIC SPRAY				SUMAGIC DRENCH				B-NINE
TREATMENT	CONTROL	1 ppm	2ppm	5 ppm	10ppm	1 ppm	2ppm	5 ppm	10ppm	5,000
HEIGHT	16.5	13.7	14.0	12.2	12.5	11.7	10.5	7.8	7.3	12.1
DIAMETER	19.0	17.8	17.0	17.5	17.7	16.8	15.8	15.7	15.0	16.5

RECOMMENDATIONS: When Sumagic is labeled for use on bedding plants, five ppm sprays should provide the desired level of control for celosia.

GERANIUM

		SUMAGIC SPRAY				SUMAGIC DRENCH				CYCOCEL
TREATMENT	CONTROL	1 ppm	2ppm	5 ppm	10ppm	1 ppm	2ppm	5 ppm	10ppm	1,500
				FIRST READING - FEBRUARY 23						
HEIGHT	6.7	6.3	6.3	5.7	4.7	3.7	3.0	2.7	2.3	5.7
DIAMETER	10.7	10.0	9.3	9.0	9.0	6.0	5.3	5.0	5.7	9.4
				SECOND READING - MAY 1						
HEIGHT	12.0	11.3	14.0	11.0	11.0	7.7	7.3	5.3	2.0	11.5
DIAMETER	19.0	16.2	21.2	18.8	17.7	13.3	12.0	8.7	4.0	17.6

RECOMMENDATIONS: When Sumagic is labeled for use on bedding plants, five ppm sprays should provide the desired level of control for geranium. There appears to be too much residual activity to consider Sumagic drench applications for seed geranium.

IMPATIENS

		SUMAGIC SPRAY				SUMAGIC DRENCH				B-NINE
TREATMENT	CONTROL	1 ppm	2ppm	5 ppm	10ppm	1 ppm	2ppm	5 ppm	10ppm	5,000
HEIGHT	8.0	7.7	7.3	8.0	6.7	5.3	5.3	5,0	4.7	7.8
DIAMETER	20.3	18.0	17.7	17.0	15.7	12.3	12.0	10.7	10.7	19.4
FLOWER#	1.3	0.3	0	0	0	1.3	0.7	0.7	0	1.3

RECOMMENDATIONS: When Sumagic is labeled for use on bedding plants, 10 ppm sprays should provide the desired level of control for impatiens.

MARIGOLD

		SUMAGIC SPRAY				SUMAGIC DRENCH				B-NINE
TREATMENT	CONTROL	1 ppm	2ppm	5 ppm	10ppm	1 ppm	2ppm	5 ppm	10ppm	5,000
HEIGHT	16.8	15.7	14.5	14.0	13.0	12.8	12.5	11.2	10.5	14.4
DIAMETER	24.0	21.0	21.0	20.3	19.0	18.7	18.3	18.3	17.0	22.6

RECOMMENDATIONS: When Sumagic is labeled for use on bedding plants, 10 ppm sprays should provide the desired level of control for marigolds

PEPPER

		SUMAGIC SPRAY				SUMAGIC DRENCH				B-NINE
TREATMENT	CONTROL	1 ppm	2ppm	5 ppm	10ppm	1 ppm	2ppm	5 ppm	10ppm	5,000
HEIGHT	20.5	18.17	18.0	17.0	15.5	11.2	9.3	6.3	5.7	13.9
DIAMETER	27.8	25.2	24.0	23.7	22.3	20.5	19.3	16.5	15.5	24.2

RECOMMENDATIONS: When Sumagic is labeled for use on bedding plants, 10 ppm sprays should provide the desired level of control for peppers.

PETUNIA

		SUMAGIC SPRAY				SUMAGIC DRENCH				B-NINE
TREATMENT	CONTROL	1 ppm	2ppm	5 ppm	10ppm	1 ppm	2ppm	5 ppm	10ppm	5,000
HEIGHT	5.6	5.0	5.3	5.3	5.0	5.0	4.0	4.3	4.3	5.2
DIAMETER	21.0	19.0	19.3	19.3	18.3	17.0	16.3	14.0	13.7	18.9

RECOMMENDATIONS: When Sumagic is labeled for use on bedding plants, 10 ppm sprays should provide the desired level of control for petunia.

SALVIA

		SUMAGIC SPRAY				SUMAGIC DRENCH				A-REST
TREATMENT	CONTROL	1 ppm	2ppm	5 ppm	10ppm	1 ppm	2ppm	5 ppm	10ppm	66 ppm
HEIGHT	12.3	9.7	9.0	7.7	7.0	7.0	8.3	6.7	6.0	8.0
DIAMETER	24.3	17.0	15.0	12.3	10.0	10.3	13.7	10.3	8.3	13.5

RECOMMENDATIONS: When Sumagic is labeled for use on bedding plants, five ppm sprays should provide the desired level of control for salvia.

VINCA

TREATMENT	CONTROL	SUMAGIC SPRAY 1 ppm	2ppm	5 ppm	10ppm	SUMAGIC DRENCH 1 ppm	2ppm	5 ppm	10ppm	B-NINE 5,000
				FIRST READING - FEB 23						
HEIGHT	9.3	9.0	7.3	5.3	4.7	4.3	4.0	4.0	4.0	9.0
DIAMETER	13.0	12.0	11.7	10.3	10.0	9.7	9.0	8.7	8.7	12.9
				SECOND READING - MAY 1						
HEIGHT	24.3	25.7	25.0	20.7	18.7	11.7	10.0	8.0	7.5	22.6
DIAMETER	23.0	24.8	21.5	20.7	18.7	13.2	11.2	10.0	8.7	22.8

RECOMMENDATIONS: When Sumagic is labeled for use on bedding plants, five ppm sprays should provide the desired level of control for vinca. There appears to be too much residual activity to consider Sumagic drench applications for vinca.

ZINNIA

TREATMENT	CONTROL	SUMAGIC SPRAY 1 ppm	2ppm	5 ppm	10ppm	SUMAGIC DRENCH 1 ppm	2ppm	5 ppm	10ppm	B-NINE 5,000
HEIGHT	18.0	17.3	17.3	16.7	16.7	17.3	18.0	13.0	12.3	11.6
DIAMETER	13.0	13.3	12.3	11.7	11.3	11.3	11.0	10.0	9.7	10.5
FLOWER #	0.3	0.3	0	0.3	0	0.7	0.3	0	0.7	0.3

RECOMMENDATIONS: In this study, Sumagic did not provide an adequate level of growth control and so is not recommended at this time for zinnia.

DEMONSTRATION STUDY:

5/15 - Marigold and geranium seeded into plug trays
5/26 - Transplanted to 4.5-plastic pots filled with Metro Mix 350
6/9 - First treatment
6/23 - Second treatment

EFFECT OFSUMAGIC TABLETS ON POTTED CHRYSANTHEMUM

OBJECTIVE: To evaluate the efficacy of tablet formulations of the chemical growth regulator, Sumagic 50 WP, on potted chrysanthemum.

PROCEDURE:

5/9 - Rooted cuttings of 'Yellow Favor' received courtesy of Yoder Brothers, Inc.
5/9 - Cuttings planted five per 6.5-inch pot in Metro Mix 350 with one-teaspoon Osmocote (19-6-12) per pot topdressed. Additional fertilization by injection at 200 ppm each of N and K at every irrigation.
5/23 - Short days
5/23 - Pinched to seven-leaves
6/5 - Treatments applied. Tablets buried approximately 0.25-inch below the medium surface. Drench applied in four-oz of solution per pot
6/30 - Disbud

TREATMENTS:

1. Control
2. One-tablet (= 2.5 ppm Sumagic)
3. Two-tablets (= 5 ppm Sumagic)
4. Four-tablets (= 10 ppm Sumagic)
5. Sumagic drench at 5 ppm

EFFECT OF CUTLESS ON POTTED CHRYSANTHEMUM

OBJECTIVE: To evaluate the efficacy of various spray and drench concentrations of the chemical growth regulator, Cutless, on potted chrysanthemum.

PROCEDURE:

5/9 - Rooted cuttings of 'Yellow Favor' received courtesy of Yoder Brothers, Inc.
5/9 - Cuttings planted five per 6.5-inch pot in Metro Mix 350 with one-teaspoon Osmocote (19-6-12) per pot topdressed. Additional fertilization by injection at 200 ppm each of N and K at every irrigation.
5/23 - Short days
5/23 - Pinched to seven-leaves.
6/5 - First treatment, shoots 1.5 to 2-inches long
6/16 - Second spray treatment
6/30 - Disbud
- Third spray treatment

TREATMENTS:

1. Control
2. Cutless spray at 1.25 ppm (12.5 mg/liter) applied three-times
3. Cutless spray at 2.5 ppm (25 mg/liter) applied three-times
4. Cutless spray at 5.0 ppm (50 mg/liter) applied three-times
5. Cutless drench at 0.25 ppm (0.3 mg in 4-oz solution/pot) applied once
6. Cutless drench at 0.5 ppm (0.6 mg in 4-oz solution/pot) applied once
7. Cutless drench at 1.0 ppm (1.2 mg in 4-oz solution/pot) applied once
8. B-Nine spray at 5,000 ppm applied three-times
9. Sumagic drench at 2.5 ppm applied once

EBB & FLOW / AGRIBROM STUDIES ON POTTED CHRYSANTHEMUM

OBJECTIVE: To evaluate to influence of the biocide, Agribrom, at 10 ppm injected into the fertilizer/irrigation stream on nutrient availability, nutrient uptake, and growth of 'Bright Golden Anne' potted chrysanthemum.

PROCEDURE:

1/23 - Rooted Cuttings of 'Bright Golden Anne' received courtesy of Yoder Brothers, Inc.
1/23 - Cuttings planted five per 6.5-inch pot in Metro Mix 350. Fertilization by injection at 200 ppm each of N and K at every irrigation.
1/23 - Long days (10 PM to 2 AM)
2/6 - Short days
2/6 - Pinched to seven-leaves, root growth to sides and bottom of the pot
2/20 - B-Nine at 5,000 ppm, new growth 1.5 - 2-inches long
3/7 - Second B-Nine application
3/21 - Disbud
3/21 - Third B-Nine application
4/17 - Data collected

RESULTS

PLANT GROWTH PARAMETERS

TREATMENT	HEIGHT(cm)	DIAMETER(cm)	FLOWER #	DAYS TO FL
WITH AGRIBROM	41.3	59.7	17.0	62.0
W/OUT AGRIBROM	41.3	60.7	16.7	62.3

FOLIAR ANALYSES

TREATMENT	% N	% P	% K	% CA	% MG	MN(ppm)	FE(ppm)	B(ppm)	CU(ppm)	ZN(ppm)
WITH AGRIBROM	5.69	0.81	6.46	1.62	0.57	320	93	65	12	46
W/OUT AGRIBROM	5.52	0.84	6.95	1.69	0.60	284	147	57	11	42
OPTIMUM	4.50	0.40	4.00	1.00	0.30	30.0	30	30-80	5	30

FLORAL GROWING MEDIUM ANALYSES

TREATMENT	P (ppm)	K (ppm)	CA (ppm)	MG (ppm)	pH	SS	NO_3(ppm)
WITH AGRIBROM	20	492	187	91	4.0	3.3	345
W/OUT AGRIBROM	16	432	161	85	4.1	3.0	327
OPTIMUM	6-8	175	250	80	5.5 - 6.0	2.0	200

COMMENTS: Algae build-up was minimal on the Agribrom-treated benches, but was significant on the non-Agribrom benches. One problem that developed on benches irrigated with Agribrom-amended fertilizer solution was a burn of the leaf margins that began to develop just prior to disbud.

An ongoing problem with subirrigation systems, typified by our ebb and flow system is that nutrient levels within the growing medium and in the plant are much higher than desirable. It is conceivable that these high nutrient levels are "sensitizing" Agribrom-treated plants to further problems.

DEMONSTRATION STUDY:

OBJECTIVE

In the current ebb & flow/Agribrom study we are evaluating the influence of four different rates of slow release fertilizer incorporated into the growing media and comparing their effect to that of water soluble fertilizer applied at every irrigation on nutrient availability, nutrient uptake, plant growth and leaf burn.

PROCEDURE

5/9 - Rooted Cuttings of 'Yellow Favor' received courtesy of Yoder Brothers, Inc.
5/9 - Cuttings planted one per 4.5-inch pot in Metro Mix 350.
5/9 - Long days
5/30 - Short days
5/30 - Pinched to seven leaves, root growth to sides and bottom of pots
6/5 - Pruned lateral breaks leaving only the most vigorus top three stems per plant
6/5 - B-Nine at 5,000 ppm
6/16 - Second B-Nine application
6/30 - Disbud
6/30 - Third B-Nine application

TREATMENTS

1. Peter's 20-20-20 injected at 200 ppm N - no Agribrom
2. Peter's 20-20-20 injected at 200 ppm N - with Agribrom
3. Nutricote Type 100; at 0.5x, 1.0x, 2.0x, and 4.0x the recommended rate - no Agribrom
4. Nutricote Type 100; at 0.5x, 1.0x, 2.0x, and 4.0x the recommended rate - with Agribrom

1.0x rate = 11-pounds per cubic yard

GROWTH REGULATOR - POINSETTIA

OBJECTIVE: To evaluate the efficacy of various chemical plant growth regulators on poinsettia.

PROCEDURE:

7/29 - 'Annette Hegg Diva Starlight' poinsettia cuttings stuck in net pots filled with Metro Mix 350.
8/19 - Panned rooted cuttings into 6 1/2-inch pots filled with Metro Mix 350.
- Fertilized with Osmocote (19-6-12) at one-teaspoon per pot.
9/2 - Pinch to eight-leaves, roots to sides and bottoms of pots
9/16 - Treatments begun, 1.5 to 2-inches of new growth
9/30 - Second treatment
10/14 - Third treatment
12/10 - Flower, **height and diameter measurements in cm.**

RESULTS:

TREATMENT	HEIGHT	DIAMETER	BRACT DIA.	FLOWER #	DAYS FL DELAY
CONTROL	42.0	70.7	35.0	6.0	0
BONZI 30 ppm	38.3	69.7	34.3	6.3	4
SUMAGIC 15 ppm	32.7	62.3	33.0	5.7	5
CUTLESS 40 ppm	39.0	66.7	34.3	6.3	4
CUTLESS 80 ppm	31.3	55.7	32.7	6.0	6
CYCOCEL 1,500 ppm	37.7	64.7	34.0	6.7	3
B-NINE/CYCOCEL 2,500/1,500 ppm	32.3	59.0	32.7	6.0	4

RECOMMENDATIONS: Sumagic and Cutless hold the promise of being excellent chemical growth regulators for poinsettia. The Sumagic and the higher of the two Cutless concentrations, though, did cause some minor leaf cupping. When Sumagic is labeled for use on poinsettia, 10 ppm sprays should provide the desired level of control. The B-Nine/Cycocel combination also provided excellent results. **Note:** the weather conditions last summer and fall favored more vigorous growth than "normal" and the growth reduction, in response to the various materials and concentrations, may not have been as pronounced as would be expected.

LILO SPLITTING STUDY

OBJECTIVE: To evaluate the influence of stock plant stem development (i.e. number of stem nodes) on subsequent splitting of 'Eckespoint Lilo' cuttings.

PROCEDURE:

5/12 - Rooted cuttings of 'Eckespoint Lilo' received and potted in four-inch clay pots filled with Metro Mix 350
6/3 - Pinched to seven-leaves
6/23 - Transplanted into 6.5-inch pots filled with Metro Mix 350
8/15 - Treatment cuttings taken, stuck in net pots filled with Metro Mix 350 and placed under mist
9/6 - Panned rooted cuttings in 6.5-pots, one-teaspoon Osmocote (19-6-12) topdressed per pot
9/19 - Cycocel (1,500 ppm) applied
10/3 - Cycocel (1,500 ppm) applied
10/17- Cycocel (1,500 ppm) applied

RESULTS:

TREATMENT	PERCENT SPLIT
Cuttings from stems with 4-nodes	22
Cuttings from stems with 8-nodes	77
Cuttings from stems with 12-nodes	100

RECOMMENDATIONS: Cuttings for finish plants should be taken from stock plant laterals at or shortly after they reach a size adequate for propagation. Taking cuttings from more mature laterals dramatically increases the subsequent risk of splitting.

RESEARCH UPDATE ON AQUA-GRO

A substantial amount of organic materials such as sphagnum peat moss, hardwood bark, and pine bark is being used in the blending of greenhouse growing media to 1) lower the weight of the medium per unit volume, 2) to avoid variability from one blended lot to the another, 3) reduce medium compaction, and 4) allow increased control of plant growth. With the widespread use of organic materials in the blending of soilless growing media, flower growers have experienced difficulty in achieving adequate wetting of these mixes.

Growing media manufacturers and growers who blend their own mix often incorporate wetting agents such as Aqua-Gro to ensure rapid and uniform penetration of water and fertilizer solutions into, out of, and throughout the medium, and to create ideal growing conditions. One of the major aspects which should be considered in the use of wetting agents is their possible toxicity to plants. Although wetting agents are being routinely incorporated in soilless growing media, data relative to their optimum concentrations and possible phytotoxicity are currently insufficient. Studies reported here were conducted to determine the possible phytotoxic effects of Aqua-Gro in different aspects of commercial flower production.

EFFECT OF AQUA-GRO ON SEED GERMINATION AND SEEDLING DEVELOPMENT

Objective

To determine possible phytotoxicity of Aqua-Gro in seed germination and seedling development.

Procedure

The experiment was conducted in January, and March, 1989.

A. Germination medium: Sphagnum peat moss and perlite in 1:1 v/v.

B. Crops tested:

1. Geranium
2. Impatiens
3. Pepper
4. Petunia
5. Tomato

C. Treatments:

1. Control
2. 0.562 oz Aqua-Gro 'G' per cu ft
3. 1.125 oz Aqua-Gro 'G' per cu ft
4. 2.250 oz Aqua-Gro 'G' per cu ft
5. 4.500 oz Aqua-Gro 'G' per cu ft
6. 9.000 oz Aqua-Gro 'G' per cu ft

D. Design

Randomized block design with six-treatemnts and three-replications per treatment. Each replication consists of 100-seeds. The experiment was repeated once.

Results

The incorporation of 2.25-oz or more of Aqua-Gro in to the germination medium affected germination and seedling development in geranium, impatiens, pepper, petunia, and tomato (Table 1). The recommended rate is 1.00-oz per cu ft. Of all the plants tested, impatiens was found to be most sensitive to Aqua-Gro in the germination medium.

Recommendation

Aqua-Gro, at the recommended rate (1.0-oz per cu ft), does not have any phytotoxic effects on either seed germination or seedling development. However, at concentrations above 2.25-oz per cu ft, it had phytotoxic effects.

Short Course Demonstration

A. Germination medium: Sphagnum peat moss and perlite in 1:1 v/v.

B. Crops to be tested:

1. Geranium
2. Impatiens
3. Pepper
4. Petunia
5. Tomato

C. Design:

Randomized block design with six-treatemnts and three-replications per treatment. Each replication consists of 112-seeds.

Table 1. Effect of Aqua-Gro on seed germination and seedling development in geranium, impatiens, and petunia.

Treatments (oz/ cu ft)	Days required for: Initiation of germination	Days required for: 50% germination	Total germination (%)	Transplantable seedlings (%)	Height (cm)	Spread (cm)	Rooting (scale)
			Geranium				
Control	4.0	7.0	87.2	68.0	2.44	3.28	4.97[z]
0.562	4.3	7.5	82.5	69.8	2.03	3.06	4.93
1.125	3.5	7.2	79.0	42.3	2.07	3.13	4.90
2.250	4.1	7.5	81.5	55.5	2.14	3.06	4.93
4.500	4.0	8.6	64.8	35.0	1.79	2.77	4.44
9.000	4.5	15.0	49.3	19.2	1.34	2.52	3.56
			Impatiens				
Control	6.2	7.5	94.0	82.0	1.78	1.85	5.0[z]
0.562	6.3	8.0	95.2	87.3	1.75	1.52	4.5
1.125	6.6	8.5	93.7	76.5	1.35	1.36	4.03
2.250	7.0	8.2	94.7	59.7	1.89	1.18	3.31
4.500	7.2	8.7	91.7	47.3	1.10	1.00	2.85
9.000	7.0	8.8	95.8	36.7	0.96	0.97	2.47
			Petunia				
Control	5.0	7.7	77.3	30.7	1.07	2.09	4.59[z]
0.562	5.3	7.7	79.5	30.5	1.02	2.04	4.81
1.125	5.2	8.0	78.7	26.2	0.83	1.72	4.29
2.250	5.2	8.2	75.2	11.7	0.57	1.24	3.29
4.500	6.0	7.8	78.7	3.5	0.45	0.91	1.95
9.000	6.2	7.8	79.8	0.0	0.00	0.00	0.00
			Pepper				
Control	7.5	9.5	89.3	80.8	4.57	3.42	4.93[z]
0.562	7.5	9.3	92.7	85.5	4.71	3.77	5.00
1.125	7.5	9.6	80.7	73.2	4.80	3.90	4.73
2.250	8.5	10.7	57.5	51.7	4.11	3.43	4.61
4.500	8.0	10.7	56.2	71.2	3.85	3.53	4.07
9.000	8.0	12.0	73.0	47.3	3.39	2.90	3.89
			Tomato				
Control	5.3	8.8	93.7	93.3	6.98	6.65	4.76[z]
0.562	5.2	9.0	95.0	94.3	7.60	6.90	4.97
1.125	5.7	8.7	93.5	93.2	6.88	6.83	4.94
2.250	5.7	9.0	90.8	87.3	5.88	6.93	4.28
4.500	6.2	9.3	88.7	77.5	6.02	6.41	4.01
9.000	6.3	9.3	85.5	73.0	3.84	5.47	3.52

[z] Rooting was recorded on a six point scale where a rating of 5.0 indicated profuse root growth at the bottom and both sides of the cell. A rating of 0 denotes no rooting.

EFFECT OF AQUA-GRO ON THE ESTABLISHMENT AND DEVELOPMENT OF SEEDLING PLUGS

Objective

To determine possible phytotoxicity of Aqua-Gro in the establishment and development of seedling plugs.

Procedure

This experiment was conducted in March, and April, 1989.

A. Growing medium: Sphagnum peat moss and perlite in 1:1 v/v.

B. Crops tested:

1. Begonia
2. Geranium
3. Impatiens
4. Pepper
5. Petunia
6. Tomato

C. Design:

Randomized block design with six-treatemnts and three-replications per treatment. Each replication consists of 100-seedling plugs.

Results

The incorporation of 2.25-oz or more of Aqua-Gro into the growing medium affected the seedling development in begonia, geranium, impatiens, pepper, petunia, and tomato (Table 2). The recommended rate is 1.00-oz per cu ft. Of all the plants tested, impatiens was found to be most sensitive to Aqua-Gro in the germination medium.

Recommendation

Aqua-Gro, at the recommended rate (1.0-oz per cu ft), is not phytotoxic relative to the establishment of seedling plugs of begonia, geranium, impatiens, pepper, petunia, and tomato. However, it is phytotoxic if applied at rates above 2.25-oz per cu ft.

Table 2. Effect of Aqua-Gro on the establishment begonia, geranium, impatiens, and petunia plug seedlings.

Treatments (oz/ cu m)	Establishment (%)	Height (cm)	Spread (cm)	Rooting (scale)
		Begonia		
Control	100.0	3.43	6.45	3.89[z]
0.562	100.0	3 67	6.65	4.71
1.125	100.0	3.13	6.41	4.64
2.250	100.0	3.53	6.97	4.37
4.500	100.0	3.32	6.26	3.48
9.500	99.7	2.78	5.36	2.81
		Geranium		
Control	98.8	7.40	9.50	4.67[z]
0.562	99.7	6.80	8.98	4.62
1.125	99.3	6.89	9.03	4.17
2.250	99.7	6.61	8.73	4.60
4.500	97.0	5.72	7.46	4.50
9.000	98.8	4.56	7.30	3.80
		Impatiens		
Control	100	10.36	8.75	4.85[z]
0.562	100	10.21	8.00	4.90
1.125	100	8.78	8.04	4.65
2.250	100	7.54	7.11	4.16
4.500	100	5.59	5.31	2.70
9.000	100	4.08	4.87	1.96
		Petunia		
Control	100.0	9.19	11.36	5.00[z]
0.562	100.0	10.51	12.28	4.93
1.125	100.0	10.35	12.01	4.98
2.250	100.0	8.74	11.48	4.89
4.500	100.0	7.89	10.44	4.70
9.000	99.7	6.06	9.34	3.60
		Pepper		
Control	100.0	14.90	11.62	4.66[z]
0.562	100.0	13.88	11.52	4.30
1.125	100.0	14.20	11.14	4.52
2.250	100.0	12.78	10.69	4.30
4.500	100.0	12.33	10.69	4.40
9.000	100.0	10.98	9.98	4.21
		Tomato		
Control	100.0	21.04	15.30	4.53[z]
0.562	100.0	20.95	14.24	4.66
1.125	100.0	19.57	14.40	4.59
2.250	100.0	18.44	14.31	4.38
4.500	100.0	17.35	13.84	4.13
9.000	100.0	13.52	12.08	4.18

[z] Rooting was recorded on a six point scale where a rating of 5.0 indicated profuse root growth at the bottom and both sides of the cell. A rating of 0 denotes no rooting.

EFFECT OF AQUA-GRO ON ROOTING OF CUTTINGS

Objective

To determine possible phytotoxicity of Aqua-Gro on rooting of cuttings.

Procedure

The experiment was conducted in January and March, 1989.

A. Rooting medium: Sphagnum peat moss and perlite in 1:1 v/v.

B. Crops tested:

1. Geranium
2. New Guinea impatiens
3. Poinsettia
4. Chrysanthemum

C. Treatments:

1. Control
2. 0.562 oz Aqua-Gro 'G' per cu ft
3. 1.125 oz Aqua-Gro 'G' per cu ft
4. 2.250 oz Aqua-Gro 'G' per cu ft
5. 4.500 oz Aqua-Gro 'G' per cu ft
6. 9.000 oz Aqua-Gro 'G' per cu ft

D. Design:

Randomized block design with six-treatemnts and three-replications per treatment. Each replication consisted of 48-unrooted cuttings.

Results

The presence of Aqua-Gro in the rooting medium did not influence the initiation of rooting in chrysanthemum cuttings, but slightly delayed it in New Guinea impatiens and geranium cuttings (Table 3). Higher doses, however, reduced shoot and root growth in all plant genera.

Recommendation

Aqua-Gro, at the recommended rate (1.0-oz per cu ft), does not have phytotoxic effects on rooting of cuttings. However, it advesley affects vegetative growth of New Guinea impatiens and geranium cuttings if applied at rates above 2.25-oz per cu ft.

Short Course Demonstration

A. Rooting medium: Sphagnum peat moss and perlite in 1:1 v/v.

B. Crops to be tested:

1. Geranium
2. New Guinea impatiens
3. Poinsettia
4. Chrysanthemum

C. Design:

Randomized block design with six-treatemnts and three-replications per treatment. Each replication consists of 48-unrooted cuttings.

Table 3. Effect of Aqua-Gro on the rooting of cuttings.

Treatments Aqua-Gro oz /cu ft	Days for root initiation	Rooting percent	Height (cm)	Spread (cm)	Rooting scale	Percentage of cuttings with more than a 4.5 rooting scale
			Chrysanthemum 'Bright Golden Anne'			
Control	8.00	100	23.1	8.6	4.58[z]	77.5
0.562	8.00	100	21.8	9.0	4.73	73.2
1.125	8.00	100	22.7	8.7	4.90	71.8
2.25	8.00	100	23.3	9.3	4.40	65.3
4.5	8.00	100	24.4	9.1	4.45	63.8
9.0	8.00	100	21.4	9.0	4.33	69.8
			Geranium 'Yours Truly'			
Control	14.66	86.7	18.2	11.0	3.94[z]	23.5
0.562	13.33	96.4	18.7	11.7	3.95	45.8
1.125	13.33	92.2	17.6	9.8	3.83	32.6
2.25	15.66	95.7	15.9	8.0	3.67	29.1
4.5	13.00	89.4	13.9	10.3	3.83	18.0
9.0	16.66	94.3	15.4	9.2	3.88	21.5
			New Guinea Impatiens 'Sesia'			
Control	7.00	99.1	7.4	11.5	5.00[z]	77.7
0.562	7.33	99.1	4.2	10.0	4.28	49.2
1.125	7.66	97.8	3.8	8.8	3.50	20.1
2.25	7.33	99.1	3.8	9.5	3.37	18.0
4.5	8.00	98.5	3.1	10.2	2.93	00.7
9.0	8.33	100.0	2.2	9.1	2.22	00.0
			Poinsettia 'Brilliant Diamond'			
Control	20.33	78.3	14.7	14.0	4.18[z]	14.4
0.562	20.00	85.3	15.9	13.3	4.00	49.2
1.125	18.33	95.7	15.2	11.9	4.68	76.4
2.25	18.33	94.3	15.3	13.8	4.31	49.0
4.5	18.33	96.4	12.6	10.1	4.52	62.0
9.0	18.00	86.7	9.4	9.6	3.63	11.6

[z] Rooting was recorded on a six-point scale where a rating of 5.0 indicated profuse rooting at the bottom and both sides of the cell. A rating of 0 denotes no rooting.

EFFECT OF AQUA-GRO ON THE ESTABLISHMENT OF ROOTED CUTTINGS

Objective

To determine possible phytotoxicity on the establishment and development of rooted cuttings.

Procedure

The experiment was conducted in March and May 1989.

A. Growing medium: Sphagnum peat moss and perlite in 1:1 v/v.

B. Crops tested:

1. Geranium
2. New Guinea impatiens
3. Poinsettia
4. Chrysanthemum

C. Treatments:

1. Control
2. 0.562 oz Aqua-Gro 'G' per cu ft
3. 1.125 oz Aqua-Gro 'G' per cu ft
4. 2.250 oz Aqua-Gro 'G' per cu ft
5. 4.500 oz Aqua-Gro 'G' per cu ft
6. 9.000 oz Aqua-Gro 'G' per cu ft

D. Design:

Randomized block design with six-treatemnts and three-replications per treatment. Each replication consisted of 48-unrooted cuttings.

Results

Aqua-Gro did not affect the establishment of rooted cuttings, but drastically reduced shoot and root growth following establishment (Table 4).

Recommendation

Aqua-Gro, at recommended rate (1.0-oz per cu ft), is not phytotoxic relative to the establishment of rooted cuttings of chrysanthemum, geranium, New Guinea impatiens, and poinsettia. However, at rates above 2.25-oz per cu ft, it drastically reduces vegetative growth of New Guinea impatiens cuttings.

Short Course Demonstration

A. Growing medium: Sphagnum peat moss and perlite in 1:1 v/v.

B. Crops to be tested:

1. Geranium
2. New Guinea impatiens
3. Poinsettia
4. Chrysanthemum

C. Design:

Randomized block design with six-treatemnts and three-replications per treatment. Each replication consists of 48-unrooted cuttings.

Table 4. Effect of Aqua-Gro on the establishment of rooted cuttings.

Treatments Aqua-Gro oz /cu ft	Establishment (%)	Height (cm)	Spread (cm)	Rooting scale	Percentage of cuttings with more than a 4.5 rooting scale
		Chrysanthemum 'Bright Golden Anne'			
Control	100	32.6	13.6	4.97[z]	92.0
0.562	100	35.5	14.8	4.96	95.5
1.125	100	34.0	14.4	4.98	97.6
2.25	100	36.1	15.5	5.00	97.2
4.5	100	33.1	14.2	4.98	93.8
9.0	100	31.6	13.8	4.96	91.9
		Geranium 'Yours Truly'			
Control	100.0	14.5	14.4	4.93[z]	93.5
0.562	99.3	14.8	15.5	4.93	95.8
1.125	99.3	15.1	14.4	4.95	92.6
2.25	99.3	15.2	15.3	4.95	99.1
4.5	99.3	14.1	14.1	4.92	98.0
9.0	100.0	13.8	14.0	4.92	91.5
		New Guinea Impatiens 'Kientzler'			
Control	87.4	10.3	14.3	4.67[z]	69.3
0.562	87.4	10.1	15.7	4.17	63.1
1.125	92.3	10.0	14.9	3.25	2.8
2.25	83.9	9.3	13.8	3.43	2.8
4.5	91.5	8.7	13.5	2.48	00.0
9.0	82.5	6.8	10.9	2.20	00.0
		Poinsettia 'Brilliant Diamond'			
Control	100.0	32.5	22.3	4.18[z]	74.4
0.562	100.0	28.5	23.6	4.10	79.2
1.125	100.0	27.6	21.2	3.90	56.4
2.25	100.0	22.9	20.8	3.78	59.0
4.5	100.0	24.4	17.6	3.70	52.0
9.0	100.0	18.0	18.3	3.47	51.6

[z] Rooting was recorded on a six-point scale where a rating of 5.0 indicated profuse root growth at the bottom and both sides of the cell. A rating of 0 denotes no rooting.

EFFECT OF AQUA-GRO SPRAY ON ROOTING OF CUTTINGS

Objective

To determine the effect of Aqua-Gro spray on rooting of cuttings.

Procedure

This experiment was conducted in January and March, 1989.

A. Rooting medium: Sphagnum peat moss; vermicultite (1:1 v/v).

B. Design:

Randomized block design with six-treatments and three-replications per treatment. Each replication consisted of 48-unrooted cuttings.

Results

Application of Aqua-Gro as a foliar spray prior to sticking of cuttings was slightly beneficial in improving rooting success and subsequent shoot and root growth (Table 5).

Recommendation

Foliar spray of Aqua-Gro'L' prior to sticking of cuttings was beneficial in improving the rooting success in poinsettia.

Table 5. Effect of Aqua-Gro'L' spray on rooting of cuttings.

Treatments Aqua-Gro	Days for root initiation	Rooting percent	Height (cm)	Spread (cm)	Rooting scale	Percentage of cuttings with more than a 4.5 rooting scale
			Chrysanthemum 'Bright Golden Anne'			
Control	8.00	100	50.5	14.6	5.00[z]	92.0
5 ppm	8.00	100	50.3	14.8	5.00	95.5
10 ppm	8.00	100	48.8	14.8	5.00	97.6
20 ppm	8.00	100	46.5	14.5	5.00	97.2
40 ppm	8.00	100	51.1	13.2	5.00	93.8
80 ppm	8.00	100	47.1	13.5	5.00	91.9
			New Guinea Impatiens 'Aurore'			
Control	9.00	97.8	7.9	11.1	4.73[z]	87.7
5 ppm	8.00	100.0	7.1	12.9	4.88	99.2
10 ppm	7.00	97.8	7.2	11.9	4.90	90.1
20 ppm	7.00	97.8	7.8	12.7	4.88	98.0
40 ppm	7.00	99.1	7.4	11.8	4.98	96.7
80 ppm	9.00	97.8	8.3	13.2	4.98	98.0
			Poinsettia 'Brilliant Diamond'			
Control	24.66	78.3	12.0	10.5	3.87[z]	14.4
5 ppm	24.33	85.3	14.5	10.2	4.13	49.2
10 ppm	21.00	95.7	12.5	10.7	4.08	76.4
20 ppm	21.66	94.3	12.1	11.7	4.05	49.0
40 ppm	19.00	96.4	10.0	9.4	3.57	62.0
80 ppm	19.66	86.7	11.4	8.0	3.87	11.6

[z] Rooting was recorded on a six-point scale where a rating of 5.0 indicated profuse root growth at the bottom and both sides of the cell. A rating of 0 denotes no rooting.

EFFECT OF AQUA-GRO ON THE GROWTH, FLOWERING, POSTPRODUCTION QUALITY, AND NUTRIENT UPTAKE IN POTTED CHRYSANTHEMUM

Objective

To determine the effect of Aqua-Gro on the growth, flowering, postproduction quality, and nutrient uptake of potted 'Bright Golden Anne' chrysanthemum.

Procedure

This study was conducted in June to April and March to June, 1989.

A. Growing medium: Sphagnum peat moss; vermicultite (1:1 v/v).

B. Design:

Randomized block design with 12-treatments and three-replications per treatment. Each replication consisted of five-four inch pots. The experiment was repeated once.

Results

The presence of higher doses of Aqua-Gro 'G' in the growing medium slightly reduced shoot growth (Table 6). Flowering and flower quality was, however, not affected by either formulations. Higher concentrations of the liquid formulation had a lesser adverse affect on growth and flower quality as compared to the higher concentrations of granular formulation.

Recommendation

Aqua-Gro, at the recommended rate (1.00-oz per cu ft), does not have any adverse effect on growth, flowering, flower quality, and nutrient uptake in potted chrysanthemum.

Table 6. Effect of Aqua-Gro on the growth, flowering, postproduction quality, and nutrient uptake in 'Bright Golden Anne' potted chrysanthemum.

Treatments Aqua-Gro	Height (cm)	Spread (cm)	Days to flower	Flower diameter (cm)	No.of flow-ers	Post-produc-tion life (Days)
Control	33.5	27.8	72.7	12.6	4.2	28.3
0.562 oz/cu ft	35.2	27.3	72.3	12.6	4.1	29.8
1.125	34.2	27.1	72.3	12.9	3.5	29.2
2.250	33.6	26.8	70.6	13.0	3.9	26.9
4.500	31.8	26.7	72.3	13.0	3.7	28.6
9.000	30.4	24.0	72.7	12.5	3.6	24.2
Control	33.5	27.5	72.7	12.4	3.9	30.9
5 ppm	33.7	27.5	72.0	12.5	3.7	25.0
10 ppm	33.5	27.8	72.3	13.3	3.8	29.6
20 ppm	34.8	27.6	73.0	12.8	4.1	29.2
40 ppm	34.4	28.0	73.0	12.9	3.7	29.2
80 ppm	32.6	25.8	72.7	12.5	3.9	30.6

Treatments	Nutrient uptake								
Aqua-Gro per cu ft.	N (%)	P %	K %	Mg %	Ca %	Mn ppm	Fe ppm	B ppm	Cu ppm
Control	6.2	1.1	6.4	0.6	0.8	22.2	11.3	42.3	8.1
0.562oz/cu ft	6.2	1.0	6.8	0.6	0.9	28.3	11.2	40.1	10.2
1.125	6.2	1.1	6.7	0.6	0.9	27.6	11.2	40.4	10.2
2.250	6.2	1.1	6.5	0.6	0.8	24.3	11.4	37.4	10.5
4.500	6.1	1.3	6.7	0.6	0.9	26.5	11.8	39.9	10.7
9.000	6.2	1.3	6.1	0.5	0.8	25.5	9.9	33.1	9.0
Control	6.2	1.1	6.5	0.6	0.8	25.4	10.9	37.3	8.7
5 ppm	6.0	1.0	6.7	0.6	0.9	26.7	19.8	39.4	9.9
10 ppm	6.1	1.0	6.7	0.6	0.9	25.7	10.5	41.4	8.9
20 ppm	6.1	1.0	7.0	0.6	0.9	27.5	10.2	38.3	9.6
40 ppm	6.1	1.1	6.8	0.6	0.9	25.8	10.9	39.6	10.0
80 ppm	6.1	1.1	6.4	0.6	0.8	23.7	10.5	40.1	9.6
Optimum	4.5	0.4	4.0	0.3	1.0	30.0	30.0	30-80	5.0

Table 6 (Continued)

Treatments	Soil nutrient levels (ppm)					
Aqua-Gro oz per cu ft	NO_3 ppm	P ppm	K ppm	Ca ppm	Mg ppm	SS mmhos
Control	149.3	32.6	144.4	103.2	69.4	2.7
0.562oz/cu ft	113.0	14.5	83.8	89.6	53.8	1.8
1.125	78.6	13.4	78.9	65.5	38.1	1.5
2.250	119.7	17.8	104.9	77.7	50.8	1.9
4.500	115.0	13.2	109.6	64.0	45.3	1.9
9.000	123.0	18.0	160.1	46.6	32.8	1.9
Control	116.0	19.7	103.3	83.5	53.1	2.4
5 ppm	108.0	24.5	119.0	62.4	37.7	2.0
10 ppm	186.0	27.0	145.3	90.0	57.2	1.8
20 ppm	84.0	14.9	80.1	75.4	42.9	2.0
40 ppm	152.7	21.6	134.8	93.7	48.0	2.3
80 ppm	170.3	30.2	198.5	75.9	50.2	2.6
Optimum	200.0	6-8	175.0	250.0	80.0	2.0

EFFECT OF AGRIBROM ON SEED GERMINATION

Short Course Demonstration

Objective

To determine possible phytotoxic effects of Agribrom in seed germination and seedling development.

Procedure

A. Germination medium: Metro Mix-350

B. Treatments:

1. Agribrom at 10 to 15 ppm
2. Control

C. Crops to be tested:

1. Geranium
2. Impatiens
3. Petunia
4. Tomato

D. Design:

Split plot design with two-treatments and four-replications per treatment. Each replication consists of 112-seeds.

SLOW-RELEASE FERTILIZER TRIALS ON PRODUCTION QUALITY AND POSTPRODUCTION LONGEVITY OF POTTED CHRYSANTHEMUM

OBJECTIVES:

To determine the effects of various slow-release fertilizer regimes in combination with water soluble fertilizer on the production quality and postproduction longevity of potted chrysanthemum.

VARIETIES:

'Bright Golden Anne' (Data presented)
'Torch' (Demonstration)

METHODS:

'Bright Golden Anne' Experiment

Five-cuttings were planted per 6 1/2-inch pot on 2/2/89. Standard cultural practices were followed. Plants were pinched to seven-leaves on 2/14/89, and spaced on 15-inch centers. Plants received three-applications of B-Nine SP at 5,000 ppm at 2-week intervals, with first application on 2/28/89. Plants began flowering on 4/21/89. The following were the fertilizer treatments:

TREATMENTS:

1. Control (water only at every irrigation)
2. Soluble fertilizer, 20-10-20 (200 ppm N), injected at every irrigation
3. Osmocote 14-14-14 at 10-pounds per cubic yard (inc.)
4. Osmocote 14-14-14 at 5-pounds per cubic yard (inc.) plus soluble fertilizer, 20-10-20 (200 ppm N), at every irrigation
5. Nutricote 14-14-14 at 10-pounds per cubic yard (inc.)
6. Nutricote 14-14-14 at 5-pounds per cubic yard (inc.) plus soluble fertilizer, 20-10-20 (200 ppm N), at every irrigation

DATA COLLECTION:

Production data was taken when plants flowered (50% of flowers at least 3-inches in diameter). Postproduction data was collected after plants received a three-day simulated shipping stress (plants sleeved, boxed, and in dark). Plants were evaluated in a controlled environment to simulate home or interior plantscape conditions (approximately 30 to 40 foot-candles of light, 50% relative humidity, 20 to 21 degrees C or 68 to 70 degrees F). (See attached data sheet)

SYNOPSIS:

The use of slow-release fertilizers, alone, resulted in slightly smaller, more compact plants, yet there was no significant decline in flower number. The addition of water soluble fertilizer to the slow release fertilizers resulted in the largest sized plants and the highest levels of nitrogen (N) in the foliage. Postproduction flower longevity was lowest for treatments containing both slow-release fertilizers and water soluble fertilizer. The use of slow-release fertilizers, alone, resulted in the greatest floral longevity. Higher concentrations of N in the foliage at harvest was associated with lower flower longevity.

RECOMMENDATION:

The results of this study suggests using slow-release fertilizers, alone, as they enhances the postproduction longevity of potted chrysanthemum, possibly due to lower concentrations of N in the foliage. Generally, potted chrysanthemums produced with slow-release fertilizers had a foliar nutritional status closer to the optimum levels for production, without excess concentrations of nutrients. Currently, we do not know the optimum foliar nutritional status of potted chrysanthemums during postproduction for the greatest longevity. We suspect, however, that the level should be lower than that for production.

These studies, and other studies by Gerberick and Prince (1989), suggest that slow-release fertilizers may be more effective if they are formulated such that nutritional levels in the foliage would be low (below the 4.5% level) near the disbud stage of production. With this in mind, the manufacture of slow-release fertilizers that last for only 8 to 9-weeks may be considered.

REFERENCES

Gerberick, J.O, and T.A. Prince, 1989. Potted chrysanthemum longevity is influenced by finishing nutritional regimes. J. Amer. Soc. Hort. Sci. (Submitted).

RESULTS FOR 'BRIGHT GOLDEN ANNE':

TREATMENTS	PRODUCTION DATA			POSTPRODUCTION DATA	
	HEIGHT (cm)	AVG.DIA. (cm)	FLOWERS (number)	LONGEVITY (days)	FOLIAR CHLOROSIS (% at two weeks)
CONTROL (Water only)	25	28	11.8	------	------
200 ppm N (Injection)	42	60	16.1	17.3	9
OSMOCOTE (1X rate)	42	49	15.8	19.8	2
OSMOCOTE (0.5X plus injection)	40	57	15.8	16.6	11
NUTRICOTE (1X rate)	37	48	16.3	17.8	2
NUTRICOTE (0.5X plus injection)	43	59	15.9	15.8	12

TREATMENTS	FOLIAR ANALYSIS									
	N %	P %	K %	CA %	MG %	MN ppm	FE ppm	B ppm	CU ppm	ZN ppm
CONTROL (Water only)	2.0	0.3	3.7	2.0	0.3	69	46	57	5.6	36.9
200 ppm N (Injection)	4.9	1.4	8.0	1.8	0.6	291	110	48	8.0	31.4
OSMOCOTE (1X rate)	4.4	0.4	5.5	2.3	0.7	187	88	20	7.7	39.5
OSMOCOTE (0.5X plus injection)	5.0	1.5	9.0	1.5	0.6	307	144	45	7.5	30.4
NUTRICOTE (1X rate)	4.8	0.3	5.5	2.1	0.8	210	90	27	7.1	42.4
NUTRICOTE (0.5X plus injection)	5.0	1.5	8.7	1.8	0.6	339	112	46	8.0	41.1
OPTIMUM LEVELS (during production)	4.5	0.4	4.0	1.0	0.3	30	30	30-80	5.0	30.0

EFFECTS OF ANTITRANSPIRANT APPLICATIONS ON PRODUCTION QUALITY AND POSTPRODUCTION LONGEVITY OF BEDDING PLANTS

PRODUCTION STUDY

OBJECTIVES:

To evaluate the efficacy of Rhone-Poulenc EXP-04464A, a chemical antitranspirant, relative to reducing the number of irrigations required during production.

PLANTS:

Impatiens
Marigold
Petunia

METHODS:

Seedling plugs of all three plants were transplanted into cell packs. Plants were grown under standard cultural practices to the two-true leaf stage, at which point antitranspirant treatments were initiated. Treatments continued until plants reached marketable size. The following treatments were applied:

TREATMENTS:

1. Control (no antitranspirant applied)
2. Antitranspirant applications at seven-day intervals

Each treatment contained three-replicates and each replicate consisted of four-plants.

DATA:

Height, diameter, and flower number were recorded immediately after the final antitranspirant application was made. Days to wilt following a thorough irrigation was recorded for three-consecutive wiltings (See Table 1).

RESULTS:

The use of the antitranspirant during the production cycle resulted in shorter and more compact plants. A delay in flowering of impatiens and petunia was also observed on antitranspirant treated plants. In most cases, days to wilt for antitranspirant-treated plants were slightly higher than the control. However, impatiens and marigold exhibited severe marginal leaf necrosis. Petunia exhibited a moderate foliar necrosis, and a severe fading of flower color (pink to white).

POSTPRODUCTION STUDY

OBJECTIVES:

To evaluate the effects of single and multiple antitranspirant applications on the postproduction keeping quality of bedding plants.

PLANTS:

Impatiens
Marigold
Petunia

METHODS:

Seedling plugs of all three plants were transplanted into cell packs. Plants were grown under standard cultural practices to the two-true leaf stage, at which point antitranspirant treatments began. Treatments continued until plants reached marketable size. Following the final antitranspirant application and irrigation, plants were boxed and moved to a controlled environment room for postproduction evaluation. Plants were removed from the boxes after two-days.

TREATMENTS:

1. Control (no antitranspirant applied)
2. Antitranspirant applications at seven-day intervals
3. Single antitranspirant application at harvest

Each treatment consisted of three-replicates and each replicate contained four-plants.

DATA:

Weight loss during the two-day simulated boxed shipment was recorded. Plants were weighed daily and days to wilt was recorded (Table 2).

RESULTS:

Plants treated with antitranspirant at seven-day intervals exhibited an increase in days to wilt compared to other treatments. Impatiens and marigold exhibited considerably lower weight loss during simulated shipment. Weekly applications of antitranspirant resulted also in a lower weight loss per day for all plants. These observations suggest that the chemical is acting as a barrier to transpiration. However, dry weight of the weekly treated plants was much less than control. Therefore, the low weight losses of the plants treated on seven-day intervals may be an artifact of smaller plants.

RECOMMENDATIONS:

Rhone-Poulenc EXP-04464A appears to be functioning as an antitranspirant. However, the phytotoxicity encountered at the rate of application recommended by the manufacturer makes this product unacceptable for use on bedding plants. At a lower application rate or by adjustment of the formulation, this chemical has the potential to be suitable for use in the bedding plant industry. In addition, this product may also be considered for use as a growth regulator on some crops.

Table 1. Effects of weekly antitranpirant applications on growth and wilting of impatiens, marigold, and petunia.

Treatment	Height (cm)	Diameter (cm)	No. of Flowers	Days to Wilt 1	Days to Wilt 2	Days to Wilt 3
			Impatiens			
Control	10.50	19.79	1.17	3.25	2.50	2.25
Weekly[1]	5.25	11.42	0.08	3.00	3.00	2.42
			Marigold			
Control	13.92	21.33	0.92	1.25	2.00	2.00
Weekly	11.58	16.54	1.17	1.50	3.00	2.17
			Petunia			
Control	12.42	22.88	0.67	1.25	2.25	2.00
Weekly	8.58	14.88	0.08	1.50	2.25	1.50

[1] Anti-transpirant applied at seven-day intervals throughout production.

Table 2. Effects of single and multiple antitranspirant applications on the postproduction quality of impatiens, marigold, and petunia.

Treatment	Days to Wilt	Wt. Loss in Boxes	Weight Loss to Wilt	Weight Loss/Day	Dry Weight
			Impatiens		
Control	7.83	25.00	122.83	16.65	1.47
Single[1]	6.92	22.04	123.00	27.16	1.26
Weekly[2]	9.33	12.00	116.17	13.15	0.64
			Marigold		
Control	5.42	19.25	91.08	16.85	2.55
Single	6.29	19.88	102.83	16.60	2.49
Weekly	9.25	10.58	125.00	13.92	1.34
			Petunia		
Control	5.00	30.17	131.25	26.61	2.58
Single	6.04	19.58	135.54	22.61	2.43
Weekly	6.50	23.25	137.83	21.64	1.94

[1] Single antitranspirant application made at harvest.
[2] Antitranspirant applied at seven-day intervals throughout production.

ETHYLENE PRODUCTION AND INFLUENCE OF STS ON ETHYLENE SENSITIVITY OF FRESH CUT-EVERGREENS

OBJECTIVES:

To clarify storage recommendations by determining ethylene production rates and sensitivities of fresh cut-holiday evergreens as well as to determine the efficacy of STS in preventing ethylene action and increasing longevity.

Ethylene Production

METHODS:

Sixteen kinds of fresh cut-evergreens were obtained from a local wholesale florist for evaluation. Samples of evergreens were placed in sealed canning jars and held at 2 or 21C. Samples were taken from each jar at the end of 1 or 3 days for the 21 and 2C treatments, respectively, and analyzed for ethylene content. Ethylene production rates were calculated from this data.

TREATMENTS:

1. Ethylene accumulation at 2C
2. Ethylene accumulation at 21C

There were three-replicates of each treatment with each replicate consisting of 35 to 60 grams of plant material.

RESULTS:

The evergreens were grouped according to ethylene production rates at both temperatures (Table 1). Group one consists of the highest ethylene producing evergreen, Redwood. The second group also contains only one member, Douglas Fir. This group is characterized by high ethylene production, but has a much lower temperature response than Group 1. Groups 3, 4, and 5 are moderate ethylene producing evergreens. Group 3 exhibits a high response to temperature, while Groups 4 and 5 exhibit a moderate and low temperature response, respectively. Members of Group 6 show low ethylene production.

Ethylene Sensitivity and STS Efficacy

METHODS:

Terminal cuttings were prepared from evergreen boughs, sprayed with STS, and allowed to dry. The plant material

was sealed in glass canning jars. Ethylene was then injected to produce the desired final concentration. Jars were randomly placed in a 2C cooler for 72-hours of simulated storage. Cuttings were then transferred to beakers of Floralife cut-flower preservative solution. The plant material was held in a light intensity, temperature, and relative humidity controlled room for postproduction evaluation. Floral preservative solution was replaced if it became cloudy or on five-day intervals. Days to senescence and senescence symptoms were observed.

TREATMENTS:

Silver thiosulfate:
1. Deionized water - control
2. 2mM STS

Ethylene:
1. 0 ppm ethylene - control
2. 0.1 ppm ethylene
3. 1.0 ppm ethylene

There were three-replicates of each treatment with each replicate consisting of three-subsamples.

RESULTS:

Only three evergreens exhibited significant ethylene effects. Scotch Pine and Oregon Juniper showed minor effects, 20% increase and 14% decrease in longevity, respectively. Six of the 16-evergreens showed significant STS effects, exhibiting an increase or decrease of 30% in longevity over the control. The negative effects to STS may be caused by silver toxicity. Since ethylene effects were minor, we would not expect STS to have any effect. Therefore, positive effects to STS could be due to silver working as an antimicrobial agent in the vase solution.

RECOMMENDATIONS:

We conclude that the kind of evergreen and quantity of material stored should determine storage practices. Evergreens in Group 1 and 2 should be stored separately from ethylene-sensitive fresh cut-flowers. If separate storage is not available, ethylene scrubbing and/or STS treatment of all ethylene-sensitive fresh cut-flowers in the storage is recommended. Moderate quantities of those evergreens (25-pounds) in Group 3, 4, and 5 may be stored with ethylene-sensitive fresh cut-flowers for 6 to 7-days without any significant ethylene buildup (>0.1 ppm) in an average sized refrigerator (164,000 liters). However, if a larger quantity of evergreens is stored, or if storage time is longer than seven-days, we recommend ethylene monitoring or storage as for Group 1 and 2. Those evergreens in Group 6

could likely be stored with ethylene-sensitive fresh cut-flowers without any significant ethylene effects. The ethylene production from evergreens in Groups 1 through 4 at 21C suggests that they may produce significant ethylene when used in floral designs that are displayed at room temperature. Fresh cut-flowers used with such evergreens should be pretreated with STS.

Table 1. Ethylene production rates (nl per Kg fresh weight per hour) of clustered groups[z] of various evergreens at 2 and 21C.

Fresh Cut-evergreens	Common Name	Temp 2C	Temp 21C
Group 1			
Sequoia sempervirens	Redwood	151	2803
Group 2			
Pseudotsuga Menziesii	Douglas Fir	104	604
Group 3			
Pinus resinosa	White Pine	34	335
Abies balsamea	Balsam Fir	17	325
Group 4			
Pinus resinosa	Red Pine	74	187
Juniperus virginiana	Western Red Cedar	12	174
Picea abies	Spruce	15	186
Calocedrus decurrens	Incense Cedar	35	193
Pinus sylvestris	Scotch Pine	26	210
Tsuga canadensis	Hemlock	17	213
Group 5			
Chamaecyparis Lawsoniana	Port Orford Cedar	22	119
Abies alba	Silver Fir	15	95
Juniperus scopulorum	Oregon Juniper	15	88
Group 6			
Abies procera	Noble Fir	5	56
Paxistima Myrsinites	Boxwood	9	63
Juniperus virginiana	Coned Cedar	4	26
Thuja occidentalis	Arborvitae	4	33

[z]Species grouped using Ward's Cluster Procedure.