

Potential for Phytotoxicity of Mogeton 25 WP  
(Quinoclamine) on  
Hydrangea (*Hydrangea macrophylla* 'Angel Song')

By

Heiner Lieth, Director  
Linda Dodge  
Ron Lane  
Dylan Hodgkiss

Project: Interregional Research Project #4  
Project Number 23688A – September 30, 2005

Donors/Supporters:  
Hines Horticulture, Vacaville, CA

UC Davis Environmental Horticulture IR4 Center  
Department of Plant Sciences  
University of California  
One Shields Ave.  
Davis, CA 95616  
<http://envhort.ucdavis.edu/ir4>

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

**IR-4 ORNAMENTAL DATA REPORTING FORM**

<b>Investigator</b> (Name, Address, Phone#, e-mail, etc)	Dr. Heiner Lieth Department of Plant Sciences University of California One Shields Ave. Davis, CA 95616 Ph 530-752-7198 FAX 530-752-1819 Email: <a href="mailto:jhlieth@ucdavis.edu">jhlieth@ucdavis.edu</a>				
<b>Location of Trial</b>	UC Davis				
<b>TRIAL TYPE:</b> (field, container, greenhouse, etc)	Greenhouse containers				
<b>Chemical - Common Name</b>	Quinoclamine				
- Formulation	Wettable Powder 25%				
- Batch Number					
- Product	Mogeton				
- EPA Registration Number	CAS number 2797-51-5				
- Manufacture	Crompton				
<b>USE INFORMATION</b>					
- Plant Common Name	Hydrangea				
- Plant Scientific Name	<i>Hydrangea macrophylla</i> 'Angel Song'				
- Pest (s) / Pathogen(s) / Weed(s)	Liverworts				
<b>Soil Type or Type of Potting Mix:</b>	<b>% Sand</b>	<b>% Silt</b>	<b>% Clay</b>	<b>% OM</b>	<b>pH</b>
UC Mix	35			65	6.5
<b>Enter each DATE for:</b>	<b>Seeding:</b>	<b>Emergence:</b>		<b>Transplanting:</b> 6/28/2005	
<b>Enter each SPACING for:</b>	<b>Plant or Pot:</b> 6 inches		<b>Row:</b> 6 inches		
<b>Enter each SIZE for:</b>	<b>Pot:</b> 6-inch		<b>Plot:</b> 45 feet <sup>2</sup>		
<b>Experimental Design:</b>	Randomized Complete Block				
<b>Number of Reps:</b>	3 blocks X 3reps/block = 9 replicates total for each treatment				

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

**IR-4 ORNAMENTAL DATA REPORTING FORM**

**APPLICATION PARAMETERS<sup>1</sup>**

<b>Type of Application:</b> (aerial, ground, foliar, drench, ppi, chemigation, broadcast, directed, etc)	Foliar spray
<b>Number of Applications:</b>	2, four weeks apart
<b>Application Type:</b>	Over the top
<b>Nozzle Type/Size:</b>	Manual spray bottles
<b>Nozzle Pressure:</b>	
<b>Delivery Rate:</b>	
<b>Calibration Date(s):</b>	

**APPLICATION SUMMARY**

<b>APPLICATION DATE</b>	<b>RATES (a.i./100 gallons water) (Be sure to provide units)</b>	<b>Brief Description of Growth Stage (Dormant, New Growth Present, Bud, etc)</b>
7/08/2005	0, 2, 4, 8 oz./gal	Vegetative, 10 days post-transplant
8/08/2005	0, 2, 4, 8 oz./gal	Vegetative, 4 weeks post-transplant

**RAINFALL/IRRIGATION RECORDS:** INCLUDE RAINFALL/IRRIGATION INFORMATION  
(printouts, IR-4 forms, etc.)

The plants were watered daily during the 12-week experiment with half-strength Hoagland's solution using a drip irrigation system delivering 1 gallon per hour.

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

**IR-4 ORNAMENTAL DATA REPORTING FORM**

**OTHER PESTICIDES, FERTILIZER, LIME AND ADJUVANTS USED:**

PRODUCT	AMOUNT	DATE
Dursban 50W	2.5 g/1 gal	9/23/2005
Pylon	1.5 mL/1 gal	9/23/2005
Silwett	0.5 tsp/1 gal	9/23/2005

**NARRATIVE SUMMARY OF METHODS AND RESULTS:** (Use more pages if needed)

**Materials and Methods**

**Plant Material and Culture.** Liners of *Hydrangea macrophylla* 'Angel Song' were received from Hines Nursery June 28, 2005. These were transplanted into 6-inch pots containing UC Mix on June 28, 2005 and maintained in a greenhouse under natural day length for 10 days until the experiment began on July 8, 2005. For the experiment, the plants were transferred to a greenhouse under natural day length with day/night temperatures of 80°/65°F (27°/18°C) (Figure 1). The plants were watered daily during the 12-week experiment with half-strength Hoagland's solution using a drip irrigation system delivering 1 gallon per hour. Applications of pesticides as part of a normal pest management program were made as needed (see above).

**Experimental Procedure.** Thirty-six plants were randomly chosen and individually tagged for treatment with 0 (Control), 2 (1X), 4 (2X), or 8 (4X) oz./gal Mogeton with 9 replicates per treatment. These dosages were prescribed in IR4 Ornamental Protocol 05-004 dated 5/05 (Appendix A). The plants received the first foliar spray application on July 8, 2005 and the second application 4 weeks later on August 8, 2005. The plants were arranged in a randomized complete block design with 3 blocks and 3 treatment replicates per block. Phytotoxicity ratings and plant height and width measurements were taken at week 0, 1, 2, 4, 8, and 12. Visual phytotoxicity evaluations were based on a numerical rating scale ranging from 0 (no injury) to 10 (complete kill) (Table 1). Plant height (cm) was measured from the container soil surface to the top of the canopy.

Plant width (cm) was measured twice along perpendicular lines at the widest part of the plant, resulting in  $W_1$  and  $W_2$ . For each observation a canopy volume index was calculated so as to be able to determine if canopy volume was affected by the application of Mogeton. The calculation was made as  $H*W_1*W_2$ , where H is the height and  $W_1$  and  $W_2$  are two width measurements. The usefulness of this index is based on the fact that many of the models for such a volume calculation are of the form  $a*H*W_1*W_2$ . The constant "a" depends on the assumption of the shape of the canopy. Since analyses of variance are scale-independent, the conclusion will thus be for the volume of the plant canopy.

**Statistical Analysis.** The data were analyzed using Proc GLM of the Statistical Analysis System (SAS). The phytotoxicity and change in mean value from the starting plant height, width and volume index were analyzed for significant differences using t-tests.

**Results**

The Control and 2 oz/gal (1X) Mogeton treatments showed no increases in phytotoxicity index (Table 2, Figure 2, Appendix B). Plants in the 8 oz/gal (4X) treatment had an average phytotoxicity index level of 1.8 to 2.2 at weeks 4 and 8. These

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

**IR-4 ORNAMENTAL DATA REPORTING FORM**

elevated levels were significantly greater than the control and represent slight phytotoxicity. Symptoms included leaf chlorosis and marginal necrosis (Figure 3).

The hydrangea plants grew substantially over the 12 week trial. The analysis of variance for the height increases showed that there was a significant treatment effect, but the mean-separation test did not result in any of the means of the treatments being significantly different from any of the others (Table 3, Figures 2 and 4, Appendix B). What is probably happening is that there is a gradual decline in height increase with increasing treatment concentration.

The width or plant volume index did not show significant differences between treatments (Table 3, Figure 2, Appendix B).

It should also be noted that the raw data manifest significant variability as some plants were unaffected by Mogeton while other plants in the 2X and 4X treatments were much smaller and showed phytotoxicity index ratings of 3.

**Discussion**

Mogeton did not have a deleterious effect on hydrangea, either through phytotoxicity or growth suppression, at the proposed labeled rate of 2 oz/gal. At the 4 oz/gal (2X) rate slight levels of phytotoxicity became evident. Also there was a significant trend of lower height increases with increasing treatment dosage.

Our conclusion is that while Mogeton is safe on hydrangea at the proposed rate, at 2X and 4X some damage is likely to occur and the plants may be slightly smaller.

Hydrangea is a florist crop that spends a considerable amount of time in the nursery during vernalization, followed by a greenhouse forcing period. During all this time, liverwort (the target for Mogeton) could well be a problem. The small levels of phytotoxicity seen on hydrangea are not an issue during the vernalization period or even at the start of the greenhouse forcing phase. It should be noted that we did not test this crop at a time when the plants showed flower buds or were in flower. We also did not subject our test plants to any soil drench treatments that are commonly used to control color of the flowers on hydrangea. Thus growers should be cautioned that tests should be conducted to assure that there will not be any phytotoxicity during the final forcing phase.

Also, applications of Mogeton over the top should be constrained to the time where growers feel that they can wash spray residue off the foliage. Once flowers begin to open this is not practical, so growers should avoid applying the material to the foliage at this time.

**GOOD RESEARCH PRACTICE STATEMENT:**

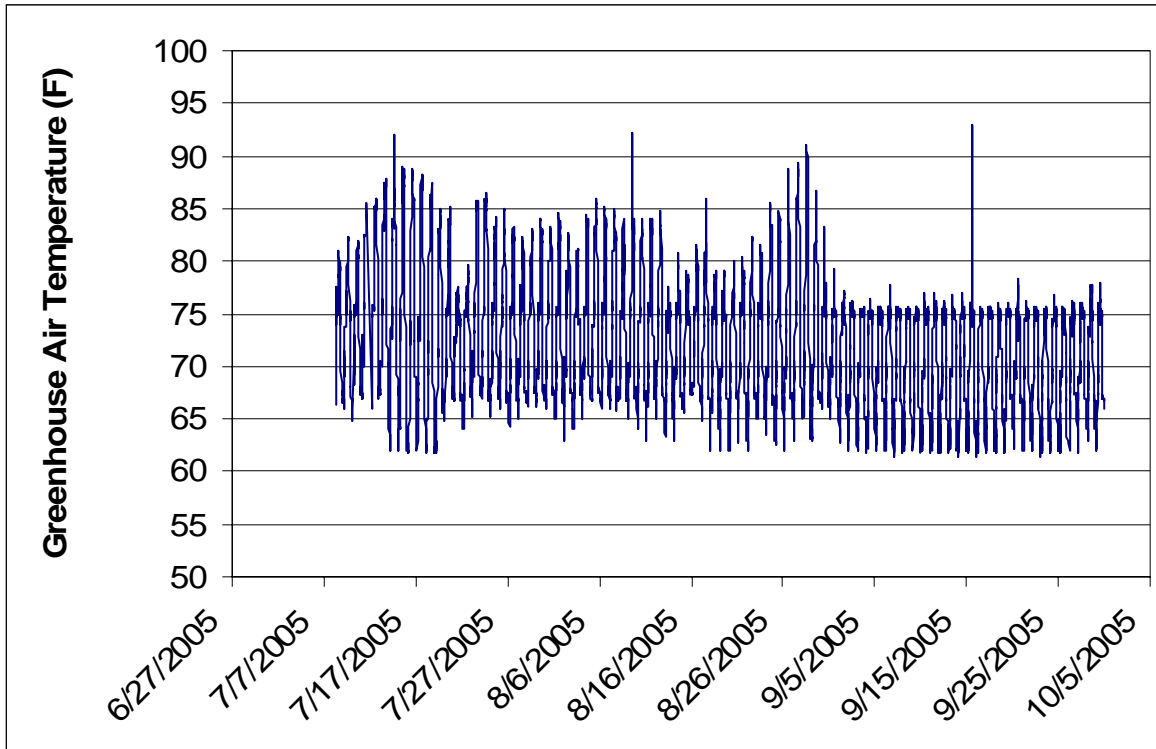
**I acknowledge that I have read and followed the IR-4 Research protocol and completed this trial following good agricultural practice, or reported any deviations (note any changes from authorized protocol in narrative).**

**SIGNATURE (PRINCIPAL INVESTIGATOR)** \_\_\_\_\_

**Date Completed:**

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

**IR-4 ORNAMENTAL DATA REPORTING FORM**



**Figure 1. Greenhouse air temperatures during the experiment to evaluate the phytotoxicity of Mogeton on *Hydrangea macrophylla* ‘Angel Song’.**

**Table 1. Numerical plant damage rating scale used for phytotoxicity determinations.**

Rating	Description of plant damage
0	No damage
1	No visible damage but unintended (non-permanent) impact
2	Slight leaf/tissue damage (curling leaves, necrosis, etc.)
3	Marginal chlorosis on some leaves (damage on up to 10% of plant)
4	10% – 20% of plant damaged
5	Significant damage to much of plant (30% - 40%)
6	40% – 60% of plant damaged
7	Chlorosis or necrosis on most of plant (60% - 70%)
8	Abscised leaves, branch dieback
9	Tissue severely damaged (80% - 100% of plant)
10	Complete kill

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

**IR-4 ORNAMENTAL DATA REPORTING FORM**

**Table 2. Phytotoxicity ratings over 12 weeks for *Hydrangea macrophylla* 'Angel Song' treated with 0 (Control), 2 (1X), 4 (2X), or 8 (4X) oz./gallon Mogeton, applied at weeks 0 and 4. Different letters within a column indicate significant differences between treatments (P < 0.05). "Yes"/"No" refer to significant treatment effects at the 5% level. Means ± SE (n = 9)**

Mogeton on Hydrangea

Phytotoxicity Increase at/after:

Treatment (oz/gal)	Week 1	no	Week 2	yes at 10%	Week 4	no	Week 8	yes	Week 12	no
0 (control)	0.33 ± 0.17	a	0.11 ± 0.11	a	0.56 ± 0.41	a	0.22 ± 0.28	a	0.11 ± 0.20	a
2 (1X)	0.33 ± 0.24	a	0.56 ± 0.24	ab	1.11 ± 0.42	ab	1.11 ± 0.42	ab	0.11 ± 0.11	a
4 (2X)	0.33 ± 0.24	a	0.33 ± 0.24	a	0.67 ± 0.37	ab	1.56 ± 0.38	bc	0.44 ± 0.18	a
8 (4X)	0.56 ± 0.24	a	1.00 ± 0.24	b	1.78 ± 0.36	b	2.22 ± 0.40	c	0.44 ± 0.24	a

**Table 3. Plant height, width and volume changes over 12 weeks for *Hydrangea macrophylla* 'Angel Song' treated with 0 (Control), 2 (1X), 4 (2X), or 8 (4X) oz./gallon Mogeton, applied at weeks 0 and 4. Different letters within a column indicate significant differences between treatments (P < 0.05). "Yes"/"No" refer to significant treatment effects at the 5% level. Means ± SE (n = 9)**

Treatment (oz/gal)	Height Increase after 12 weeks	yes	Width Increase after 12 weeks:	no	Relative Volume Index Increase after 12 weeks	no
0 (control)	23.72 ± 2.59	a	24.22 ± 2.71	a	82691.1 ± 14999.9	a
2 (1X)	23.39 ± 2.78	a	20.78 ± 4.64	a	79434.9 ± 28659.2	a
4 (2X)	20.72 ± 3.34	a	16.22 ± 2.62	a	56009.7 ± 14696.7	a
8 (4X)	18.22 ± 2.14	a	17.58 ± 3.01	a	50599.2 ± 11939.7	a

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

IR-4 ORNAMENTAL DATA REPORTING FORM

Species: *Hydrangea* -- Material: Mogeton

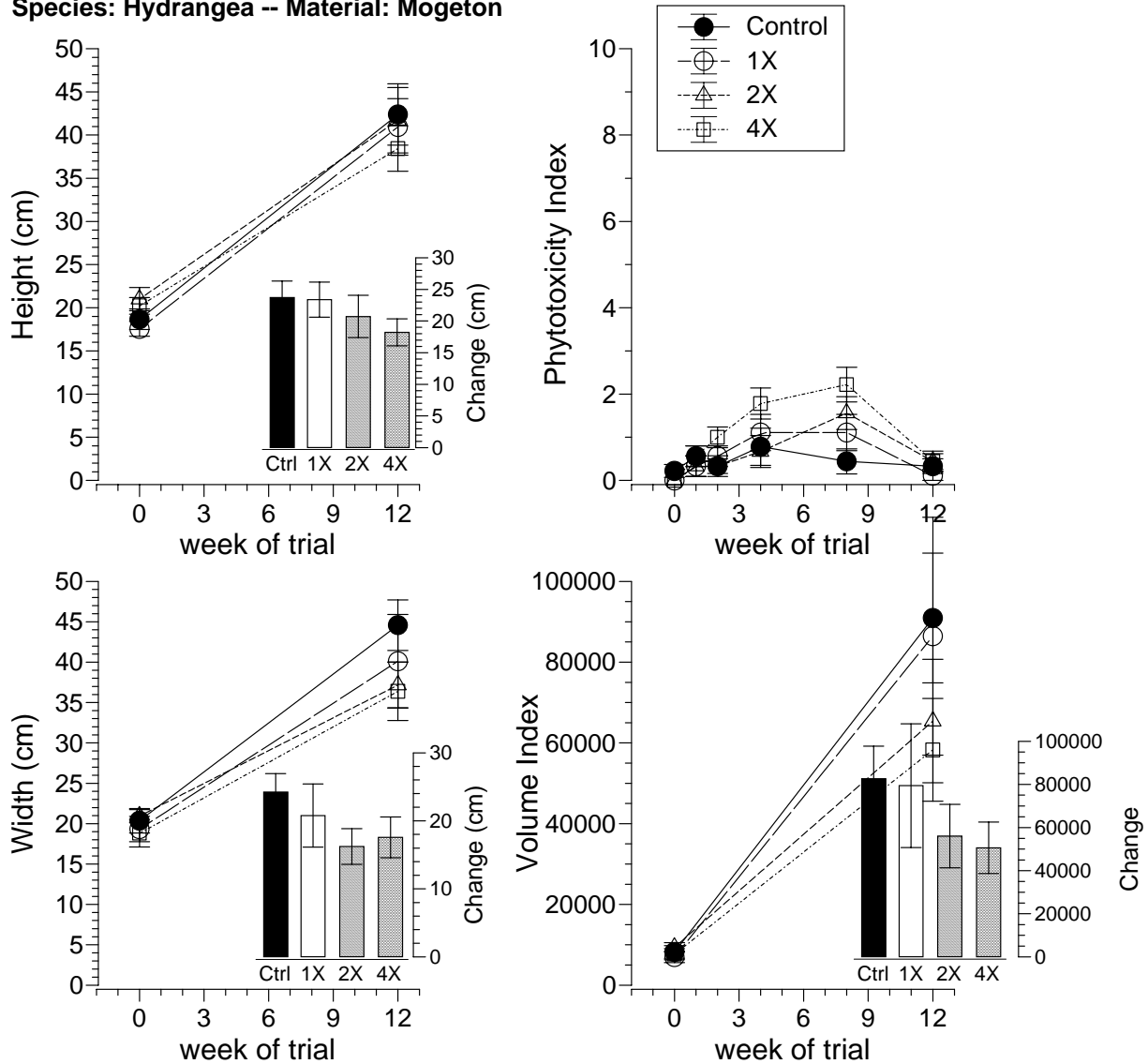


Figure 2. Summary of results for *Hydrangea macrophylla* 'Angel Song' treated with 0 (Control), 2 (1X), 4 (2X), or 8 (4X) oz./gallon Mogeton, applied at weeks 0 and 4. Both means and cumulative changes over time are plotted for phytotoxicity index, plant height, plant width and plant volume index. Histograms show changes over the 12-week trial period. SE bars shown. (n = 9)

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

IR-4 ORNAMENTAL DATA REPORTING FORM



Figure 3. Phytotoxicity symptoms seen on *Hydrangea macrophylla* 'Angel Song' 12 weeks after treatment with 4 (2X) at left or 8 (4X) oz./gallon (right) Mogeton, applied at weeks 0 and 4. Symptoms included leaf chlorosis and marginal necrosis.

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

IR-4 ORNAMENTAL DATA REPORTING FORM



Block A



Block B



Block C

CONTROL

1X

2X

4X

Figure 4. *Hydrangea macrophylla* 'Angel Song' plants 12 weeks after treatment with 0 (Control), 2 (1X), 4 (2X), or 8 (4X) oz./gallon Mogeton, applied at weeks 0 and 4.

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

**IR-4 ORNAMENTAL DATA REPORTING FORM**

**APPENDIX A**

**Phytotoxicity to herbaceous perennial plants with applications of Mogeton 25WP**

**Ornamental Protocol Number: 05-004**

**REVISED DATE: 05/05**

**Objective:** Determine phytotoxicity of Mogeton 25WP to perennial plants commonly grown in greenhouse and/or nurseries.

**Experimental Design:**

**Plot Size:** Must be adequate to reflect actual use conditions.

**Replicates:** Minimum of 3 replications (preferably 4) with 3 pots per replicate

**Application Instructions:** Two applications made approximately 4 weeks apart. Plant materials must be established in containers and have broken dormancy prior to first application. Use 2 qts of final spray solution per 100 sq ft or about 218 gal per acre. Applications should be made over the top of the plants using application equipment consistent with conventional commercial equipment. Please see table below for instructions for post-application irrigation.

**Plant Materials:** See attached list of plant materials. Plants must be growing in containers and not field grown.

**Evaluations:** Record phytotoxicity on a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill) at 1, 2, 4, 8, and 12 weeks after initial application. If appropriate, also include ratings for chlorosis, defoliation, stunting or other growth effects on a scale of 0 to 10 (0 = No effect; 10 = Complete plant affected). If any phytotoxicity is observed in treated plants, take pictures comparing treated and untreated plant material.

**Recordkeeping:** Keep detailed records of weather conditions including temperature and precipitation, soil-type or soil-less media, application equipment, application volume per acre, irrigation, liner size, plant height & width, and plant growth stage at application and data collection dates.

**Treatments:**

<b>Product</b>	<b>Rate</b>	<b>Post-Application Irrigation Instructions</b>
Mogeton 25WP (quinoclamine)	2.0 oz/gal 4.0 oz/gal 8.0 oz/gal	Do not overhead water for 24 h after application.
Untreated	--	--

**For labels, materials, and any required adjuvants contact:**

Mogetan - Crompton, Kevin Donovan, 203-393-2163 x 2028, [kevin.donovan@cromptoncorp.com](mailto:kevin.donovan@cromptoncorp.com)

**Reports:**

Report must include a brief summary paragraph of results, a summary table with appropriate statistical analyses, a section on experimental design and materials and methods, with raw data and recordkeeping information as listed above included as appendices. If pictures were taken, please include them.

An electronic report is preferred but not required. If the report is provided electronically, the basic report can be sent in MS Word or WordPerfect, the recordkeeping information as pdf or other electronic documents, and the raw data in MS Excel or other suitable program such as ARM.

**Please direct questions to:** Cristi Palmer, IR-4 HQ, Rutgers University, 681 US Hwy 1 S, North Brunswick, NJ 08902-3390, Phone 732-932-9575 x629, [palmer@aesop.rutgers.edu](mailto:palmer@aesop.rutgers.edu)

**OR**

Ely Vea, 308 Aston Forest Lane, Crownsville, MD 21032, Phone & FAX#: 410-923-488, E-mail: [evvea@comcast.net](mailto:evvea@comcast.net).

PR.NO. :	23688
TRIAL:	1
DATE:	9/30/2005

**IR-4 ORNAMENTAL DATA REPORTING FORM**

**APPENDIX B**

Phytotoxicity Report Form			Phytotoxicity at week						Plant Size at week 0			Plant Size at week 12		
Treatment	Block	Rep	0	1	2	4	8	12	Height (cm)	Width1 (cm)	Width 2 (cm)	Height (cm)	Width1 (cm)	Width 2 (cm)
			Control	A	1	0	0	0	0	0	1	20	21.5	20
Control	A	2	0	1	0	1	0	0	21.5	21.5	11	40	54	46
Control	A	3	0	0	0	0	0	0	12.5	18	16	25	34	25
Control	B	1	0	0	0	0	0	0	18	19	14.5	49	56	40.5
Control	B	2	1	2	1	3	2	1	24	27	20.5	56.5	49	39
Control	B	3	0	1	1	3	2	1	20	25	34.5	51	61	45
Control	C	1	0	0	0	0	0	0	14.5	17	15.5	30	39	32
Control	C	2	0	0	0	0	0	0	20.5	23	23.5	48	67	53
Control	C	3	1	1	1	0	0	0	17	19	20	34	49	37
Mean			0.2	0.6	0.3	0.8	0.4	0.3	18.7	21.2	19.5	42.4	49.9	39.3
1X	A	1	0	2	2	2	2	0	21	32.5	24	49.5	63	49
1X	A	2	0	0	0	0	1	0	13.5	16	13	31.5	24	23
1X	A	3	0	0	0	1	0	0	18	19.5	21	41.5	46	35
1X	B	1	0	0	0	0	0	0	18.5	17.5	12	40	33	29
1X	B	2	0	1	1	1	3	0	19	27	13	51	71	39
1X	B	3	0	0	0	1	0	0	21	23.5	18.5	46	37	29
1X	C	1	0	0	1	0	1	0	16	16.5	12.5	29	25	21
1X	C	2	0	0	1	4	3	1	15	17	17	27	29	24
1X	C	3	0	0	0	1	0	0	16	24	23.5	53	76	69
Mean			0.0	0.3	0.6	1.1	1.1	0.1	17.6	21.5	17.2	40.9	44.9	35.3
2X	A	1	0	0	0	0	2	0	13	20	15	32	36	30
2X	A	2	0	0	0	0	0	0	19	21	19	36	37	29
2X	A	3	0	0	0	2	1	0	27	26	20	54	50	47
2X	B	1	0	2	2	3	3	1	21	26.5	17	52.5	53.5	33.5
2X	B	2	0	0	0	0	2	1	23.5	30	18	60	53	46
2X	B	3	0	1	0	0	2	0	18	19	16.5	35	37	29
2X	C	1	0	0	0	1	3	1	24	23.5	22	26	26	25
2X	C	2	0	0	1	0	0	1	21.5	23	15.5	38	43	35
2X	C	3	0	0	0	0	1	0	22	24	21	42	31	28
Mean			0.0	0.3	0.3	0.7	1.6	0.4	21.0	23.7	18.2	41.7	40.7	33.6
4X	A	1	0	0	1	2	3	2	24.5	21	28	41	47	43
4X	A	2	0	0	1	2	3	0	21.5	21	22.5	49	65	40
4X	A	3	0	0	0	2	1	0	22.5	23	17	35.5	38	30
4X	B	1	0	2	2	2	2	0	20.5	19	15	41.5	46	46
4X	B	2	0	1	1	2	2	1	21.5	24.5	21	48	48	35
4X	B	3	0	0	1	0	0	0	20	16	9	38	27	34
4X	C	1	0	1	1	3	3	0	16.5	30	19.5	37	30	28
4X	C	2	0	0	0	0	2	0	20	14.5	14.5	33	38	26
4X	C	3	0	1	2	3	4	1	15	12	11	23	18	16
Mean			0.0	0.6	1.0	1.8	2.2	0.4	20.2	20.1	17.5	38.4	39.7	33.1