

Potential for Phytotoxicity of Mogeton 25 WP
(Quinoclamine) on
English Lavender (*Lavandula angustifolia* 'Munstead')

By

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Project: Interregional Research Project #4
Project Number 24853A – August 24, 2005

Donors/Supporters:
Hines Horticulture, Vacaville, CA

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PR.NO. :	24853
TRIAL:	1
DATE:	8/24/2005

IR-4 ORNAMENTAL DATA REPORTING FORM

Investigator (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: jhlieth@ucdavis.edu				
Location of Trial	UC Davis				
TRIAL TYPE: (field, container, greenhouse, etc)	Greenhouse containers				
Chemical - Common Name	Quinoclamine				
- Formulation	Wettable Powder 25%				
- Batch Number					
- Product	Mogeton				
- EPA Registration Number	CAS number 2797-51-5				
- Manufacture	Crompton				
USE INFORMATION					
- Plant Common Name	English Lavender				
- Plant Scientific Name	<i>Lavandula angustifolia</i> 'Munstead'				
- Pest (s) / Pathogen(s) / Weed(s)	Liverworts				
Soil Type or Type of Potting Mix:	% Sand	% Silt	% Clay	% OM	pH
UC Mix	35			65	6.5
Enter each DATE for:	Seeding:	Emergence:		Transplanting: 5/27/2005	
Enter each SPACING for:	Plant or Pot: 6 inches		Row: 6 inches		
Enter each SIZE for:	Pot: 6-inch		Plot: 45 feet ²		
Experimental Design:	Randomized Complete Block				
Number of Reps:	3 blocks X 3reps/block = 9 replicates total for each treatment				

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APPLICATION PARAMETERS¹

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

APPLICATION SUMMARY

APPLICATION DATE	RATES (a.i./100 gallons water) (Be sure to provide units)	Brief Description of Growth Stage (Dormant, New Growth Present, Bud, etc)
6/02/2005	0, 2, 4, 8 oz./gal	Vegetative, 5 days post-transplant
6/29/2005	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.

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OTHER PESTICIDES, FERTILIZER, LIME AND ADJUVANTS USED:

PRODUCT	AMOUNT	DATE
Pylon	6 mL/4 gal	6/17/2005
Marathon II	4 oz/4 gal	6/17/2005

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

Materials and Methods

Plant Material and Culture. Cuttings of *Lavandula angustifolia* 'Munstead' were propagated from stock plants at the Environmental Horticulture Dept. on Sept. 19, 2004. These were transplanted into 6-inch pots containing UC Mix on May 27, 2005 and maintained in a greenhouse under natural day length for 5 days until the experiment began on June 2, 2005. For the experiment, the plants were transferred to a greenhouse under natural day length with day/night temperatures of 77°/67°F (25°/19°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 June 2, 2005 and the second application 4 weeks later on June 29, 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 phytotoxicity index values ranged from 0 – 2.3 during the trial, indicating relatively minor damage to the lavender plants (Table 2, Figure 2, Appendix B). At week 4, phytotoxicity values for the control plants were significantly lower than those for the Mogeton-treated plants. What plant damage occurred appeared as necrotic leaves near the base of plants (Figure 3).

All plants grew substantially during the trial, increasing in both height and width (Table 3, Figures 2 and 4, Appendix B).

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For the plants treated with Mogeton, the mean values showed no overall trend at the 5% level; at the 10% significance level some significant differences were noted. However, the largest reduction in height increase was found in the 2 oz/gal (1X) treatment, while the plants in the 8 oz/gal (4X) treatment had nearly the same height and width increases as the control plants. Significant volume index differences were noted between the control and the plants treated with 2 oz/gal (1X) Mogeton. At the same time, the average volume indexes for the 4 (2X) and 8 oz/gal (4X) treatments were not significantly different from the control.

Discussion

All phytotoxicity levels were relatively small, so that although mean values were found to be significantly different, the level of damage was so small as to be negligible. Unfortunately, the level of variation in the height and width data made it impossible to reach a conclusion regarding the effect of Mogeton on plant size. The problem is that in this study the highest dosage resulted in plants that were no different from the control, while plants exposed to the lowest treatment rate grew to be much smaller plants. We conclude that any reduction in plant size increase is not significant.

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:

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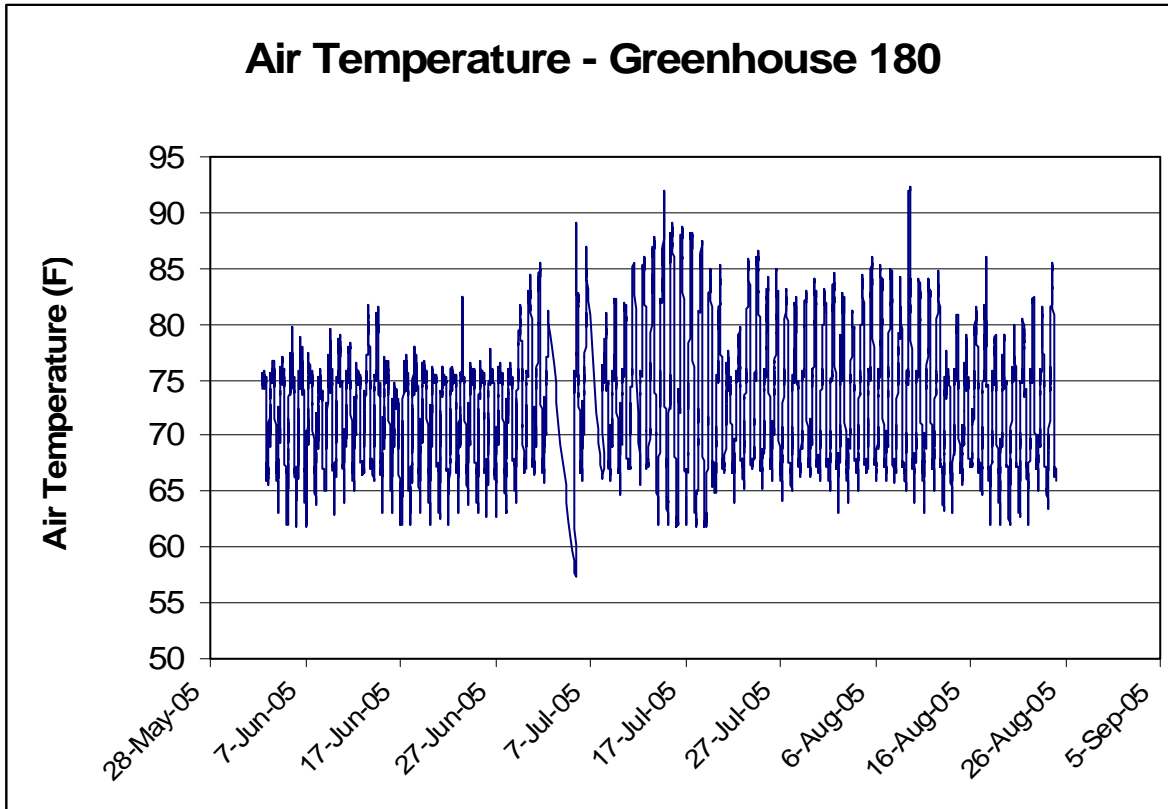


Figure 1. Greenhouse air temperatures during the experiment to evaluate the phytotoxicity of Mogeton on *Lavandula angustifolia* 'Munstead'.

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

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Table 2. Phytotoxicity ratings over 12 weeks for *Lavandula angustifolia* ‘Munstead’ 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)

Phytotoxicity Increase at/after:

Treatment (oz/gal)	Week 1 no	Week 2 no	Week 4 yes	Week 8 yes	Week 12 no
0 (Control)	0.89 ± 0.39 a	1.78 ± 0.15 a	1.11 ± 0.20 a	-0.22 ± 0.15 a	0.22 ± 0.36 a
2 (1X)	1.33 ± 0.33 a	2.22 ± 0.22 a	2.33 ± 0.37 b	0.44 ± 0.24 b	1.56 ± 0.47 b
4 (2X)	1.33 ± 0.33 a	2.11 ± 0.11 a	2.11 ± 0.11 b	0.78 ± 0.22 b	0.89 ± 0.31 ab
8 (4X)	0.89 ± 0.35 a	2.11 ± 0.20 a	2.11 ± 0.26 b	0.22 ± 0.15 ab	0.78 ± 0.28 ab

Table 3. Plant height, width and volume changes over 12 weeks for *Lavandula angustifolia* ‘Munstead’ 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	at 10%	Width Increase after 12 weeks:	at 10%	Relative Volume Index Increase after 12 weeks	yes
0 (Control)	30.50 ± 4.51	a	38.53 ± 4.32	a	124414 ± 27342.1	a
2 (1X)	19.00 ± 4.75	a	26.97 ± 5.34	a	54459.6 ± 15782.2	b
4 (2X)	25.67 ± 4.55	a	34.64 ± 4.81	a	84603.7 ± 18337.6	ab
8 (4X)	30.28 ± 4.32	a	38.94 ± 4.77	a	118121 ± 25014.1	a

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Species: *Lavandula* -- Material: Mogeton

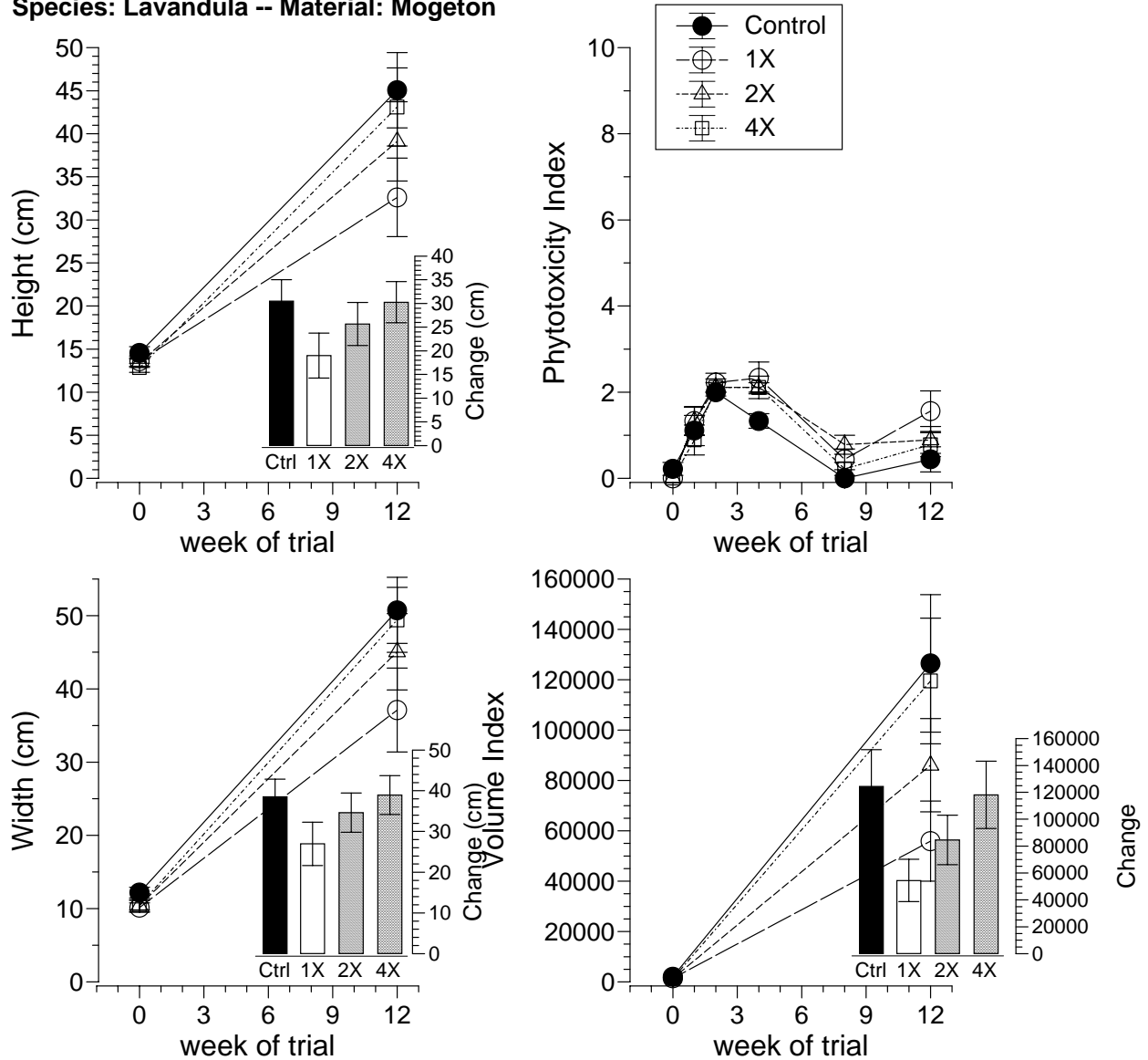


Figure 2. Summary of results for *Lavandula angustifolia* 'Munstead' over 12 weeks treated with 0 (Control), 2 (1X), 4 (2X), or 8 (4X) oz./gallon Mogeton, applied at weeks 0 and 4. Both means and cumulative changes over time are plotted for phytotoxicity index, plant height, plant width and plant volume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

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Figure 3. Phytotoxicity symptoms seen on *Lavandula angustifolia* 'Munstead' 2 weeks after the second foliar application of 4 oz./gallon (2X) Mogeton. Symptoms included necrosis of leaves that came in direct contact with the product.

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Block A



Block B

CONTROL

1X

2X

4X

Figure 4. Representative plants of *Lavandula angustifolia* 'Munstead' twelve weeks after treatment with 0 (Control), 2 (1X), 4 (2X), or 8 (4X) oz./gal Mogeton, applied at weeks 0 and 4.

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Block C

CONTROL

1X

2X

4X

Figure 4. Representative plants of *Lavandula angustifolia* 'Munstead' twelve weeks after treatment with 0 (Control), 2 (1X), 4 (2X), or 8 (4X) oz./gal Mogeton, applied at weeks 0 and 4.

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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:

Product	Rate	Post-Application Irrigation Instructions
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

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

OR

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

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APPENDIX B

Phytotoxicity Report Form			Phytotoxicity at week						Growth at week 0			Growth 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	2	2	2	0	0	16	15	8
Control	A	2	0	2	2	1	0	0	9.5	10.5	11.5	55	65	68
Control	A	3	1	0	2	1	0	0	14	18.5	7	36	57	55
Control	B	1	0	2	2	2	0	0	14	19	13	31	57	60
Control	B	2	0	2	2	1	0	0	16	17	10	70	57	67
Control	B	3	0	0	2	1	0	0	14	10	8	51	59	46
Control	C	1	0	0	2	1	0	2	15.5	16.5	11.5	28	58	30
Control	C	2	1	2	2	2	0	0	15	17	7	48.5	44	54
Control	C	3	0	0	2	1	0	2	17	11.5	8.5	47	26	14
Mean			0.2	1.1	2.0	1.3	0.0	0.4	14.6	15.0	9.4	45.1	52.7	48.8
1X	A	1	0	0	1	1	0	2	14.5	12.5	14	40	62	51
1X	A	2	0	2	3	4	2	5	15	8	5	15.5	9	5
1X	A	3	0	0	2	2	0	1	11	10	8	52	24	13
1X	B	1	0	2	2	2	0	1	13.5	11.5	7	30	45	48
1X	B	2	0	2	3	3	0	0	15	10	12.5	52	53	46
1X	B	3	0	2	2	2	0	1	12.5	14.5	6	20	54	26
1X	C	1	0	2	3	4	1	2	16.5	13.5	10	26	22	20
1X	C	2	0	0	2	1	1	1	11.5	10	11	38	49	44
1X	C	3	0	2	2	2	0	1	13	10	9	20	54	43
Mean			0.0	1.3	2.2	2.3	0.4	1.6	13.6	11.1	9.2	32.6	41.3	32.9
2X	A	1	0	0	2	2	0	0	14	18	7	70	77	34
2X	A	2	0	0	2	2	0	0	13	15	10.5	43	58	45
2X	A	3	0	0	2	2	2	1	14	7	9	44.5	18	16
2X	B	1	0	2	2	2	0	0	14.5	16	14	41	66	47
2X	B	2	0	2	2	2	1	0	10	13	7	36	80	40
2X	B	3	0	2	2	2	1	2	15.5	8.5	7.5	35	46	47
2X	C	1	0	2	3	3	1	2	15	11.5	6	25.5	50	60
2X	C	2	0	2	2	2	1	1	13	13	7	35	45	39
2X	C	3	0	2	2	2	1	2	12	8	9.5	22	20	23
Mean			0.0	1.3	2.1	2.1	0.8	0.9	13.4	12.2	8.6	39.1	51.1	39.0
4X	A	1	0	2	3	3	0	1	12.5	11	6	40	47	43
4X	A	2	0	0	2	2	1	0	15	15.5	9.5	47	81	43
4X	A	3	0	0	2	2	0	1	12.5	11	8.5	53	77	52
4X	B	1	0	2	2	2	0	2	10.5	16	9	34	44	50
4X	B	2	0	2	3	2	0	0	14	11	9	53	73	33
4X	B	3	0	0	1	1	0	0	12	9	8	59	56	61
4X	C	1	0	2	2	3	1	2	13	15	12	21	20	32.5
4X	C	2	0	0	2	1	0	0	15	10	6.5	55	60	54
4X	C	3	0	0	2	3	0	1	11	8	13.5	26	42	21
Mean			0.0	0.9	2.1	2.1	0.2	0.8	12.8	11.8	9.1	43.1	55.6	43.3