

Phytotoxicity and Efficacy of Fascination
(6-Benzyl Adenine + Gibberellic Acid)
for Enhanced Branching of
English Ivy (*Hedera helix*)

By

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Linda Dodge
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Project: Interregional Research Project #4
Project Number 23191A – November 26, 2004

Donors/Supporters:
CDFA Minor Crops Research Grant, Project 2: Enhancement of the Western
Region IR-4 Program to Address California Needs

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Department of Environmental Horticulture
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One Shields Ave.
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PR.NO.:	23191A
TRIAL:	1
DATE:	11/26/04

IR-4 ORNAMENTAL DATA REPORTING FORM
(Please type or print)

1. INVESTIGATOR (Name, Address, Phone#):

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LOCATION OF TRIAL:

TRIAL TYPE:(check one) FIELD CONTAINER GREENHOUSE INTERIOIRSCAPE

2. PESTICIDE:

COMMON NAME: 6-Benzyl Adenine + Gibberellic Acid A₄ A₇ FORMULATION: 1.8% + 1.8% (w/w)

BATCH NO.: _____ PRODUCT: Fascination
 EPA REG. NO. 27135 MFG: Valent

3. USE INFORMATION:

COMMON NAME

SCIENTIFIC NAME

PLANT: _____ English Ivy Hedera helix

REASON: enhanced branching of potted crops

SOIL TYPE OR TYPE OF POTTING MIX: UC Mix

% SAND 35 % SILT _____ % CLAY _____ % OM 65 % pH 6.5

SEEDING DATE _____ EMERGENCE DATE _____ TRANSPLANTING DATE 9/14/04

PLANT OR POT SPACING 6" ROW SPACING 6" POT SIZE 4-inch

PLOT SIZE 50 sq. ft. EXPERIMENTAL DESIGN randomized complete block NO.OF REPS 9
(3 blocks)

4. APPLICATION PARAMETERS:

TYPE OF APPLICATION: foliar

NO. OF APPLICATIONS 2 APPLICATION TYPE manual spray bottle

NOZZLE TYPE/SIZE _____ NOZZLE PRESSURE _____ DELIVERY RATE _____
 CALIBRATION DATE(S) _____

5. APPLICATION SUMMARY:

APPL.DATE	RATES (ppm)*	GROWTH STAGE
10/14/04	0, 125 (0.5X), 250 (1X), 500 (2X)	4 weeks post-transplant
11/4/04	0, 125 (0.5X), 250 (1X), 500 (2X)	7 weeks post-transplant

*Be sure to provide units

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6. RAINFALL/IRRIGATION RECORDS:

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

Plants were watered as needed (at least once daily) with half-strength Hoagland's solution

7. OTHER PESTICIDES, FERTILIZER, LIME AND ADJUVANTS USED:

PRODUCT	<u>Tame</u>	AMOUNT	<u>0.16 oz./gal</u>	DATE	<u>10/26/04</u>
PRODUCT	<u>Pedestal</u>	AMOUNT	<u>0.08 oz./gal</u>	DATE	<u>10/26/04</u>
PRODUCT	<u>Azatin</u>	AMOUNT	<u>5 oz./acre</u>	DATE	<u>10/26/04</u>
PRODUCT	<u>Pylon</u>	AMOUNT	<u>1.5 mL/gal</u>	DATE	<u>11/10/04</u>
PRODUCT	<u>Conserve</u>	AMOUNT	<u>6 mL/gal</u>	DATE	<u>11/10/04</u>
PRODUCT	<u>Conserve SC</u>	AMOUNT	<u>0.22 oz./gal</u>	DATE	<u>11/16/04</u>
PRODUCT	<u>Avid</u>	AMOUNT	<u>0.08 oz./gal</u>	DATE	<u>11/16/04</u>

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

Materials and Methods

Plant Material and Culture. Cuttings (two nodes) of *Hedera helix* were taken from stock plants in the Environmental Horticulture Dept., treated with 0.1% IBA (TakeRoot, Schultz Co.) and stuck in a medium of 50% perlite and 50% vermiculite on July 27, 2004. The cuttings were allowed to root for six weeks in a mist bench with bottom heat of 75°F. The cuttings were transplanted to 4-inch pots containing UC Mix on September 14, 2004 and maintained in a greenhouse under natural day length for 4 weeks until the experiment began on October 14, 2004. For the first three weeks of the experiment, the plants were grown in a greenhouse under natural day length with day/night temperatures of 80°F/63°F (27°C/17°C) (Figure 1). For the last three weeks of the experiment, the plants were grown in a greenhouse under natural day length with day/night temperatures of 78°F/65°F (26°C/18°C) (Figure 2). The plants were watered as needed (at least once daily) during the 6-week experiment with half-strength Hoagland's solution. Applications of pesticides as part of a normal pest management program were made as needed (see No. 7 above).

Experimental Procedure. Thirty-six plants were randomly chosen and individually tagged for treatment with 0, 125 ppm (0.5X), 250 ppm (1X) or 500 ppm (2X) Fascination with 9 replicates per treatment. These dosages were prescribed in an IR4 Fascination protocol dated 6/04 (Appendix A). The plants received the first of two foliar spray applications of the designated treatments on October 14, 2004 using manual spray bottles to spray leaves to runoff. The second application was made 21 days later on November 4, 2004. The plants were arranged in a randomized complete block design with 3 blocks and 3 treatment replicates per block. Phytotoxicity and efficacy measurements were taken at day 0 (October 14, 2004), day 21 (November 4, 2004) and day 42 (November 25, 2004). Phytotoxicity evaluations were based on a numerical rating scale of 0 (no injury) to 10 (complete kill) (Table 1). Efficacy measurements consisted of overall plant height (cm) measured from the surface of the container medium to the top of the canopy and width (cm) reported as the average of two horizontal canopy measurements taken perpendicular to each other. In addition, the numbers of branches per plant were counted. At 6 weeks, the numbers of branches with dead stem tips per plant were counted.

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 Fascination. The calculation was made as $H*W_1*W_2$ for observations where two width measurements were available and as $H*W*W$ where only one width measurement was available. The usefulness of this index is based on the fact that many of the models for such a volume calculation are of the form $a*H*W_1*W_2$, where H is the height, W_1 and W_2 are two width measurements. 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.

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Statistical Analysis. The data were analyzed using Proc GLM of the Statistical Analysis System (SAS). The phytotoxicity and change in mean value for all variables were analyzed for significant differences using t-tests.

Results

Phytotoxicity Index. Phytotoxicity index values were low for all plants at week 3 (Figure 3, Table 2, Appendix B). By week 6, some plants in the highest (500 ppm) Fascination treatment showed significant tip burn (Figure 4). Thus the phytotoxicity index of the 2X treatment at week 6 was significantly higher than the other treatments and the control. The 1X treatment showed no significantly greater increases than the control or 0.5X treatments.

At 6 weeks, the plants were inspected for stem tip burn and it was found that the 2X treatment showed substantially greater incidence of dead stem tips (Table 2, Figure 4).

Efficacy. *Hedera helix* plants treated with Fascination were substantially taller and wider at week 3 and 6 (Figures 3 and 5, Table 2, Appendix C). The average height increase of the control was 2.5 cm by week 3, compared with an increase ranging from 4.2 to 4.5 cm in the plants exposed to Fascination. By week 6 the control plants had only increased slightly more to 2.7 cm, while the height increases in the Fascination treatments were 3.9, 4.8, and 6.4 cm for the 0.5X, 1X, and 2X treatments, respectively. Width was also affected this way, although there were no differences between the widths of the various dosages of Fascination (Figures 3 and 5, Table 2, Appendix C). The calculated volume index showed considerable variability so that no major effects were found. However, in comparing only the control with the 2X treated plants at weeks 3 and 6, significant differences were seen (Figure 3, Table 2).

Branch counts showed a lot of variation from plant to plant (Figures 3 and 5, Table 2, Appendix C). Thus, while the mean branch count increases for the control, 0.5X, 1X and 2X treatments were 1.8, 2.3, 3.7, and 5.9, these changes were not statistically significant at the 5 or 10% level. Treatment-wise comparison showed the 2X treatment to have resulted in greater branching. By week 6 the differences in the branch count increases were more substantial and the mean values were significantly different.

Discussion

Phytotoxicity. At the proposed 1X rate of 250 ppm Fascination, no phytotoxicity was found on *Hedera helix* plants. Even at the 2X rate the level was very low and did not affect plant marketability. Stem tip burn was a noted feature of the highest dosages, but the slight unsightliness is very easy to mitigate and compensated for by the increased branching.

Efficacy. Fascination was effective at increasing branching in *Hedera helix*. As the dosage increased so did branching. The proposed 1X rate is generally adequate, but a greater effect can be achieved with the 2X rate, if the grower finds that the noted stem tip burn is not a problem.

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9. 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 _____ DATE _____
PRINCIPAL INVESTIGATOR

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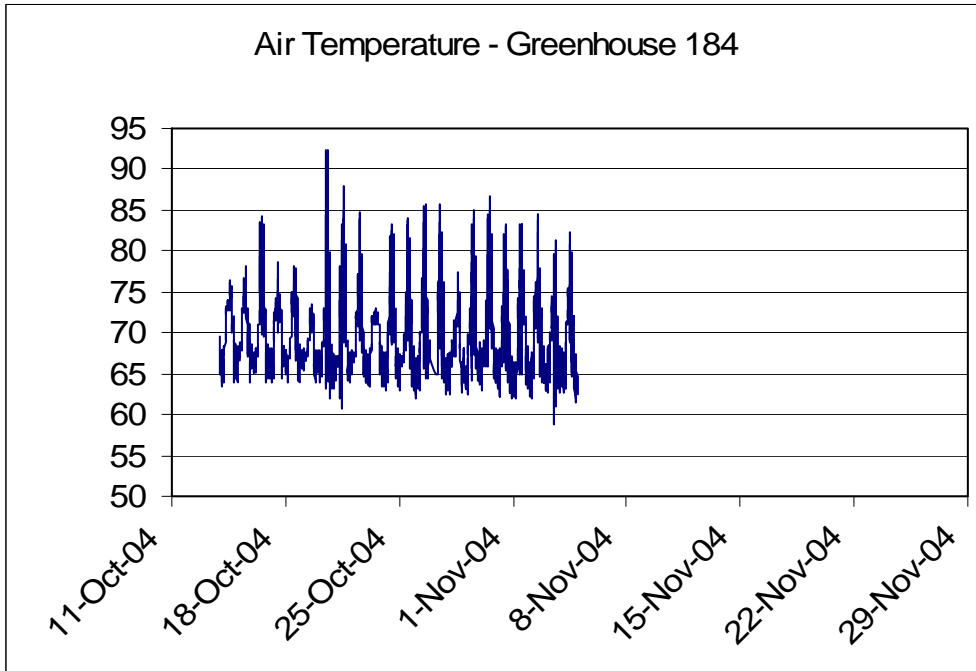


Figure 1. Greenhouse temperatures during the first three weeks of the experiment to evaluate the effects of Fascination on *Hedera helix*.

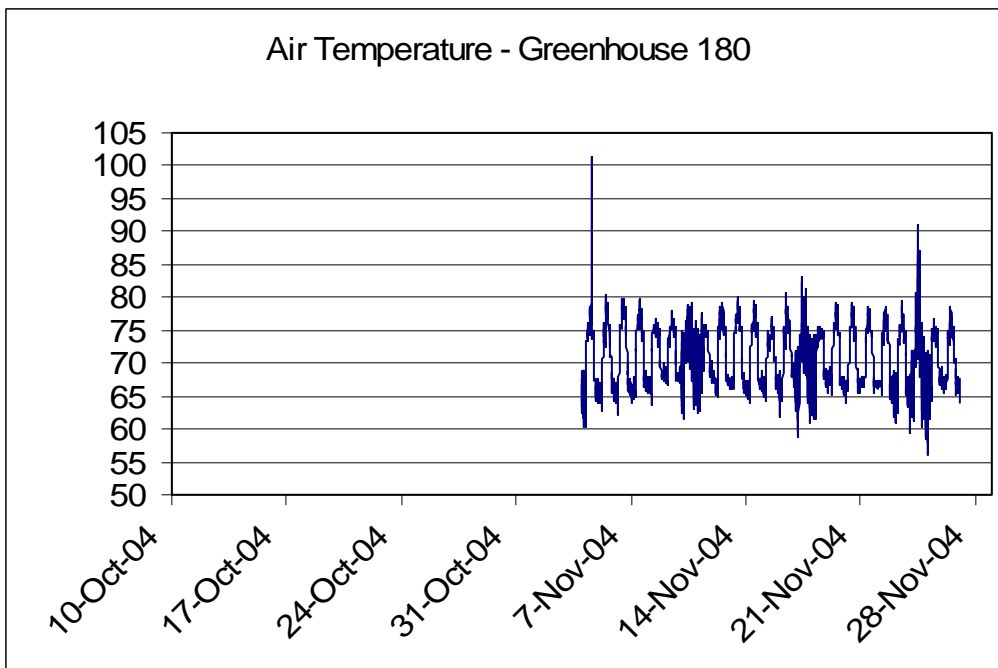


Figure 2. Greenhouse temperatures during the last three weeks of the experiment to evaluate the effects of Fascination on *Hedera helix*.

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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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Species: Hedera -- Material: Fascination

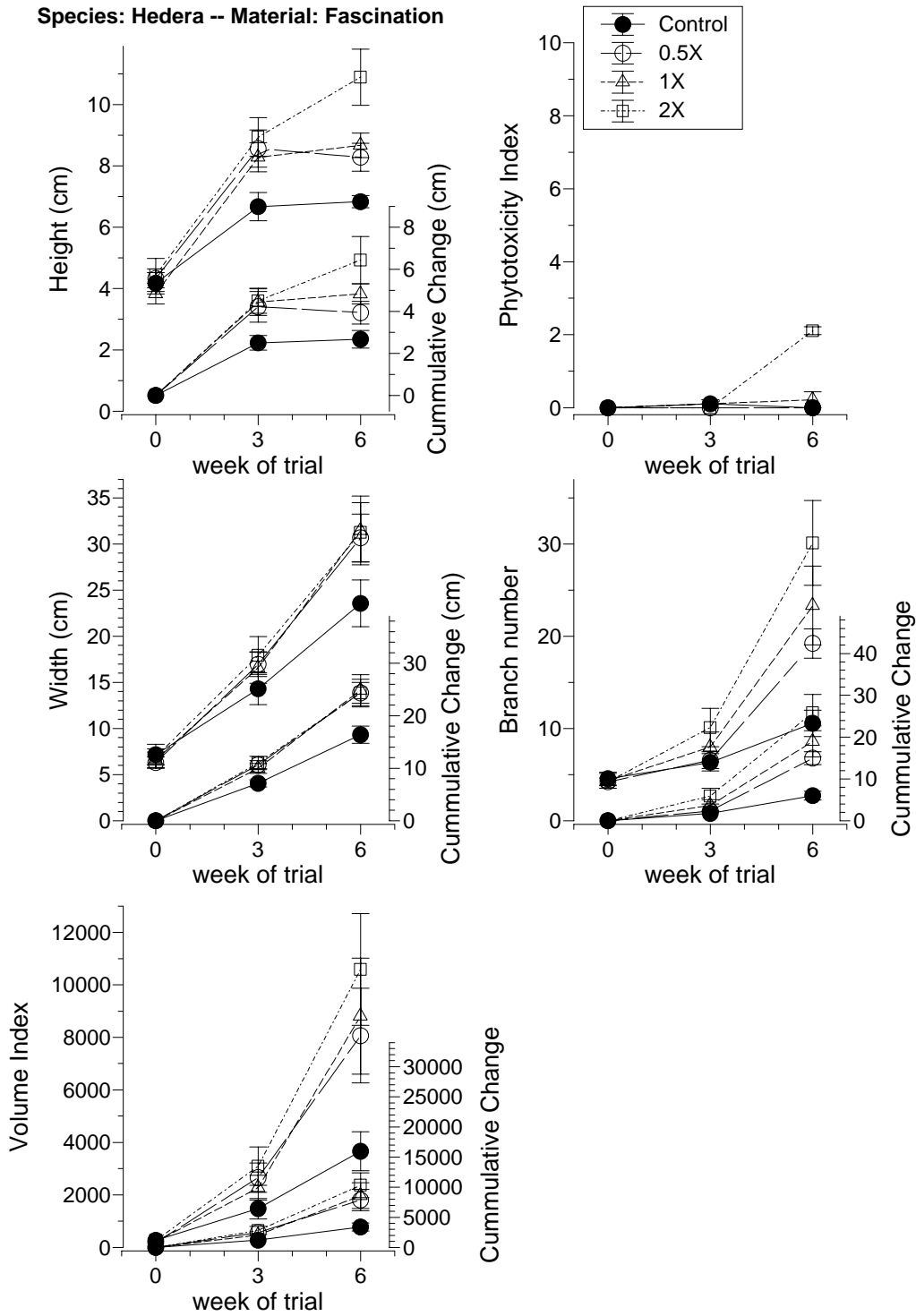


Figure 3. Summary of results for *Hedera helix* treated with 0, 125, 250 or 500 ppm Fascination. Both raw data and cumulative changes over time are plotted for phytotoxicity index, plant height, plant width, branch number and volume index. SE bars shown. n=9.

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Table 2. Summary of results for *Hedera helix* treated with 0, 125, 250 or 500 ppm Fascination. Cumulative changes over time are reported for phytotoxicity index, plant height, plant width, branch number and volume index. 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 \pm SE ($n=9$).

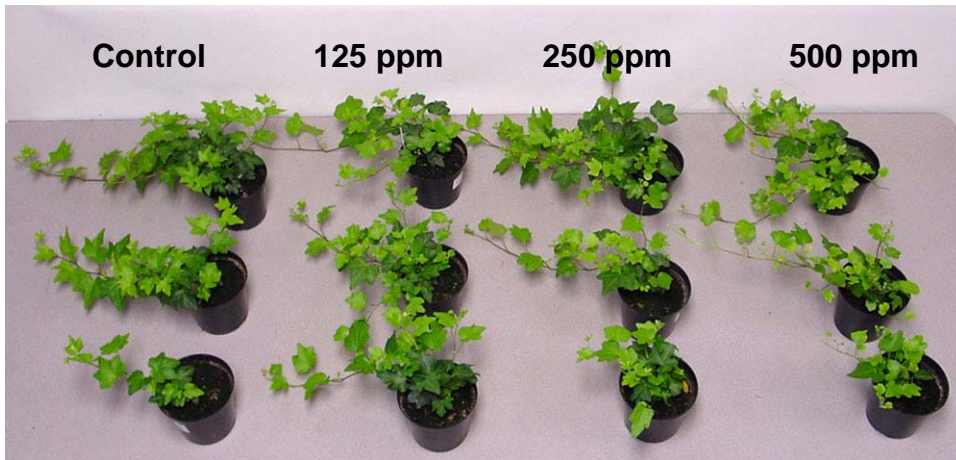
Fascination on Hedera				
Phytotoxicity Increase after:				
Treatment	3 weeks	no	6 weeks	yes
0 ppm	0.11 \pm 0.11	a	0.00 \pm 0.00	a
125 ppm	0.00 \pm 0.00	a	0.00 \pm 0.00	a
250 ppm	0.11 \pm 0.11	a	0.22 \pm 0.22	a
500 ppm	0.00 \pm 0.00	a	2.11 \pm 0.11	b
Height Increase after:				
Treatment	3 weeks	at 10%	6 weeks	yes
0 ppm	2.50 \pm 0.35	a	2.67 \pm 0.42	a
125 ppm	4.22 \pm 0.73	b	3.94 \pm 0.54	ab
250 ppm	4.44 \pm 0.63	b	4.83 \pm 0.48	bc
500 ppm	4.50 \pm 0.60	b	6.44 \pm 1.12	c
Width Increase after:				
Treatment	3 weeks	at 10%	6 weeks	at 10%
0 ppm	7.14 \pm 0.69	a	16.39 \pm 1.64	a
125 ppm	10.67 \pm 0.80	b	24.36 \pm 1.99	b
250 ppm	9.97 \pm 0.93	b	24.86 \pm 2.96	b
500 ppm	11.00 \pm 1.25	b	24.33 \pm 2.64	b
Relative Volume Index Increase after:				
Treatment	3 weeks	no	6 weeks	no
0 ppm	1206.83 \pm 293.77	a	3393.83 \pm 655.55	a
125 ppm	2473.35 \pm 519.24	ab	7881.04 \pm 1768.68	ab
250 ppm	2056.54 \pm 397.90	ab	8589.97 \pm 2141.44	ab
500 ppm	2823.17 \pm 653.48	b	10311.5 \pm 2065.76	b
Branch number Increase after:				
Treatment	3 weeks	no	6 weeks	yes
0 ppm	1.78 \pm 0.60	a	6.00 \pm 1.07	a
125 ppm	2.33 \pm 0.67	ab	15.00 \pm 1.53	b
250 ppm	3.67 \pm 1.34	ab	19.00 \pm 3.70	bc
500 ppm	5.89 \pm 1.87	b	25.89 \pm 4.32	c
Dead Stem Tips				
Treatment			6 weeks	yes
0 ppm			0 \pm 0	a
125 ppm			0 \pm 0	a
250 ppm			0.33 \pm 0.33	a
500 ppm			2.67 \pm 0.75	b

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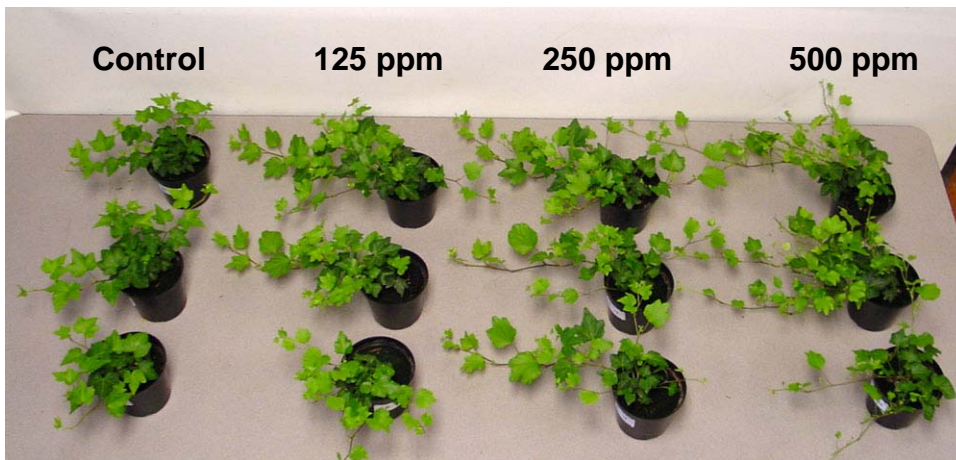


Figure 4. Dead stem tips were seen on some branches of *Hedera helix* plants 6 weeks after treatment with 2X (500 ppm) Fascination.

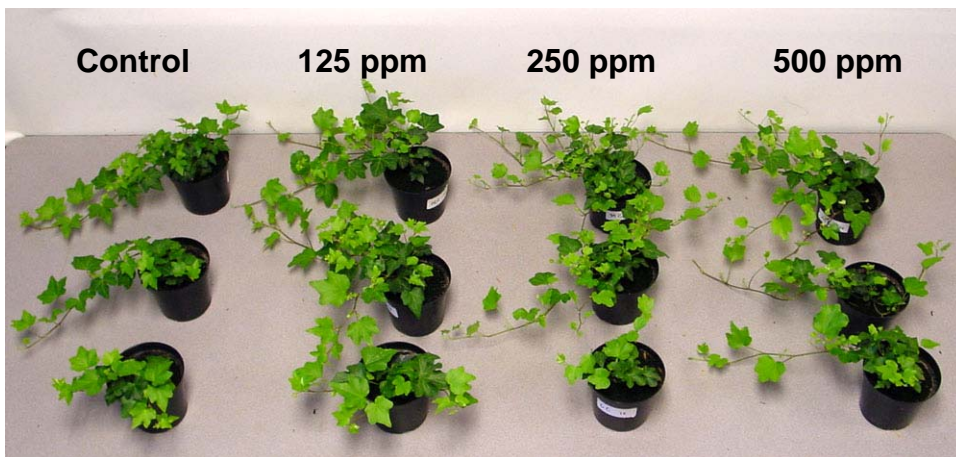
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Block A



Block B



Block C

Figure 5. *Hedera helix* plants 6 weeks after 2 foliar applications of 0, 125, 250 or 500 ppm Fascination (Week 0 and Week 3).

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Appendix A:

GROWTH ENHANCEMENT OF ORNAMENTAL PLANTS WITH FOLIAR APPLICATIONS OF 6-BENZYL ADENINE + GIBBERELIC ACID (FASCINATION)

Date: 6/04

Ornamental Protocol Number: 670

General label directions: Refer to product label or Technical Bulletin.

Research program:

Pest(s)/Plants – Plants other than labeled species.

Pesticide (common name and trade name): Refer to treatment list shown below.

For label, material & if needed, spray surfactant contact:

Valent USA, Joe Chamberlin, 770-985-0303, icham@valent.com

Plot size (must be adequate to reflect actual use condition)

Replicates Minimum of 4 Treatment Units

Controls (untreated controls to be included in all experiments)

Application: **FASCINATION**

Dosages - 1/2x 125 ppm or 0.125 pt/5 gal.

1x 250 ppm or 0.25 pt/5 gal.

2x 500 ppm or 0.5 pt/5 gal.

Active Ingredient: 6-benzyl adenine + gibberellic acid (FASCINATION).

Volume - Minimum of 100 gal/A.

Timing - 2 Applications, 21 day spray interval. Record number of branches and length, then increased branching, increased extension and crop safety at 7, 14, 21 (then 2nd appl.), 28 and 42 DAT.

Reports:

Method of application: Treatments should be applied according to product label instructions. application equipment consistent with conventional commercial equipment. Report completely on experimental design and method of application. Report plant size height x width before treatment and throughout the experiment.

Weather – Maintain temperature and precipitation (including irrigation) data.

Soil type – Identify soil type used in experimental area.

Product – When submitting data, include EPA registration number of product used.

Efficacy – Data should include percent control as well as an indication that infestation was light, heavy, etc.

Record all application and evaluation dates.

Phytotoxicity – Record phytotoxicity data at all rates. Use a 0-10 scale. 0 = No Phytotoxicity 10 = complete kill.

Please direct questions to: Dr. Robert M. Herrick, IR-4 Project, 681 US Highway #1 South, North Brunswick, NJ Phone: (732) 932-9575, Ext. 629.

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Appendix B: PHYTOTOXICITY REPORT FORM

Hedera Data			Phyto	Phyto	Phyto
			Rating	Rating	Rating
Treatment	Block	Rep	10/14/2004	11/4/2004	11/26/2004
Control (0 ppm)	A	1	0	0	0
Control (0 ppm)	A	2	0	0	0
Control (0 ppm)	A	3	0	0	0
Control (0 ppm)	B	1	0	0	0
Control (0 ppm)	B	2	0	0	0
Control (0 ppm)	B	3	0	0	0
Control (0 ppm)	C	1	0	0	0
Control (0 ppm)	C	2	0	1	0
Control (0 ppm)	C	3	0	0	0
Mean			0.00	0.11	0.00
Std. Dev.			0.00	0.33	0.00
1/2 X (125 ppm)	A	1	0	0	0
1/2 X (125 ppm)	A	2	0	0	0
1/2 X (125 ppm)	A	3	0	0	0
1/2 X (125 ppm)	B	1	0	0	0
1/2 X (125 ppm)	B	2	0	0	0
1/2 X (125 ppm)	B	3	0	0	0
1/2 X (125 ppm)	C	1	0	0	0
1/2 X (125 ppm)	C	2	0	0	0
1/2 X (125 ppm)	C	3	0	0	0
Mean			0.00	0.00	0.00
Std. Dev.			0.00	0.00	0.00
1X (250 ppm)	A	1	0	0	0
1X (250 ppm)	A	2	0	0	0
1X (250 ppm)	A	3	0	0	0
1X (250 ppm)	B	1	0	1	0
1X (250 ppm)	B	2	0	0	0
1X (250 ppm)	B	3	0	0	0
1X (250 ppm)	C	1	0	0	2
1X (250 ppm)	C	2	0	0	0
1X (250 ppm)	C	3	0	0	0
Mean			0.00	0.11	0.22
Std. Dev.			0.00	0.33	0.67
2X (250 ppm)	A	1	0	0	2
2X (250 ppm)	A	2	0	0	2
2X (250 ppm)	A	3	0	0	2
2X (250 ppm)	B	1	0	0	3
2X (250 ppm)	B	2	0	0	2
2X (250 ppm)	B	3	0	0	2
2X (250 ppm)	C	1	0	0	2
2X (250 ppm)	C	2	0	0	2
2X (250 ppm)	C	3	0	0	2
Mean			0.00	0.00	2.11
Std. Dev.			0.00	0.00	0.33

NOTE: DEFINE MEASUREMENT OF PHYTOTOXICITY, OR INDEX OF INJURY (0=NO INJURY, 10=COMPLETE KILL) (See Table 1)

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Appendix C: EFFICACY REPORT FORM

Hedera Data			Plant	Plant	Plant	Plant	Plant	Plant				# dead
			Height (cm)	Height (cm)	Height (cm)	Width (cm)	Width (cm)	Width (cm)	# branches	# branches	# branches	stem tips
Treatment	Block	Rep	10/14/04	11/4/04	11/26/04	10/14/04	11/4/04	11/26/04	10/14/04	11/4/04	11/26/04	11/26/04
Control (0 ppm)	A	1	5.5	6	7	8.75	18.25	30	5	7	12	0
Control (0 ppm)	A	2	3	5.5	6	3	7.75	13	2	3	5	0
Control (0 ppm)	A	3	5	8	7	14.75	25	35.75	9	12	17	0
Control (0 ppm)	B	1	3.5	6	6.5	7.25	12.75	22.25	4	4	11	0
Control (0 ppm)	B	2	4	7	7	6	12	23	3	6	8	0
Control (0 ppm)	B	3	2.5	4.5	8	6	13	18.5	3	4	6	0
Control (0 ppm)	C	1	4	6.5	7	4.25	9.25	15.5	6	5	7	0
Control (0 ppm)	C	2	4.5	9	6	7.25	14.25	22.5	5	7	15	0
Control (0 ppm)	C	3	5.5	7.5	7	7.25	16.5	31.5	4	9	14	0
Mean			4.17	6.67	6.83	7.17	14.31	23.56	4.56	6.33	10.56	0.00
Std. Dev.			1.06	1.37	0.61	3.33	5.16	7.57	2.07	2.83	4.28	0.00
1/2X (125 ppm)	A	1	4.5	7.5	8	4.75	13	25.25	3	3	15	0
1/2X (125 ppm)	A	2	4	9	7.5	7.25	17.75	32	4	6	17	0
1/2 X (125 ppm)	A	3	5.5	7.5	7	6.5	17.5	30.25	6	9	15	0
1/2X (125 ppm)	B	1	4	8	10	8.25	21.5	41.25	4	9	27	0
1/2X (125 ppm)	B	2	3.5	10	7.5	5	17	27.5	4	6	18	0
1/2X (125 ppm)	B	3	4	6	7	4.5	10.75	23.5	4	6	17	0
1/2X (125 ppm)	C	1	4.5	12.5	11	9.5	22.5	40.75	5	10	24	0
1/2X (125 ppm)	C	2	3	8.5	8	4	13	19	3	2	15	0
1/2X (125 ppm)	C	3	6	8	8.5	7	19.75	36.5	5	8	25	0
Mean			4.33	8.56	8.28	6.31	16.97	30.67	4.22	6.56	19.22	0.00
Std. Dev.			0.94	1.84	1.37	1.87	4.03	7.72	0.97	2.74	4.76	0.00
1X (250 ppm)	A	1	5.5	10	9	11.75	24	48.25	6	14	40	0
1X (250 ppm)	A	2	3.5	8	9	4.25	10.5	15.75	6	3	12	0
1X (250 ppm)	A	3	3.5	8	7.5	5.25	15.5	27.25	1	6	11	0
1X (250 ppm)	B	1	3	10.5	8	5.5	13	31.5	3	4	17	0
1X (250 ppm)	B	2	5	6	7.5	8.75	22	41.75	5	12	25	0
1X (250 ppm)	B	3	4	7	8	6	16.5	30.5	3	10	18	0
1X (250 ppm)	C	1	4	9	11	8.5	20	39	9	14	47	3
1X (250 ppm)	C	2	4	7.5	10	5.75	18.25	34.5	3	8	27	0
1X (250 ppm)	C	3	2	8.5	8	3.75	9.5	14.75	3	1	13	0
Mean			3.83	8.28	8.67	6.61	16.58	31.47	4.33	8.00	23.33	0.33
Std. Dev.			1.03	1.42	1.20	2.56	5.00	11.17	2.40	4.82	12.80	1.00
2X (250 ppm)	A	1	3.5	8	16	8	17.75	28	4	9	23	2
2X (250 ppm)	A	2	3.5	7	9	3.5	10	13.5	2	5	12	1
2X (250 ppm)	A	3	5.5	7	9.5	9.75	25	35.75	6	13	42	2
2X (250 ppm)	B	1	5	10	12	9.25	21.25	31	5	21	53	8
2X (250 ppm)	B	2	6.5	11.5	11.5	9.75	23.5	40.5	4	13	35	4
2X (250 ppm)	B	3	2.5	9	14	5	12.25	32.25	4	4	26	2
2X (250 ppm)	C	1	3.5	6.5	7.5	4.25	15	27.5	3	3	19	1
2X (250 ppm)	C	2	7	11	10	8.75	25.5	47.5	5	17	43	3
2X (250 ppm)	C	3	3	10.5	8.5	4	11	25.25	5	6	18	1
Mean			4.44	8.94	10.89	6.92	17.92	31.25	4.22	10.11	30.11	2.67
Std. Dev.			1.61	1.89	2.76	2.67	6.14	9.66	1.20	6.27	13.79	2.24