

Comparison of PGRs for Drench Applications on “Sensitive” Perennials

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OBJECTIVE: Evaluate perennials previously identified as sensitive to drench applications of the triazoles with a comparison against ancymidol.

PLANT SPECIES:

Heemerocallis ‘Happy Returns’

Veronica longifolium ‘Icicle’

Delphinium elatum ‘Blue Bird’

CHEMICAL TREATMENTS: Applied as a drench (10 oz per trade gallon or 2 oz per quart)

Concise (uniconazole-P, 0.5 mg a.i./ml, Fine Americas): at 0, 0.25, 0.5, 0.75 or 1.0 ppm

Piccolo (paclobutrazol, 4 mg a.i./ml, Fine Americas): 0, 2, 4, 6, or 8 ppm

Abide (ancymidol, 0.264 mg ai/ml, Fine Americas): 0, 2, 4, 6, or 8 ppm

EXPERIMENTAL DESIGN: Each species will be set up as an individual experiment with plants arranged in a randomized complete block design with 6 single plant replications.

DATA TO BE COLLECTED:

At 2, 4, 6, 8 WAT and flowering: plant height and width, flowering status

TIMELINE:

Daylily ‘Happy Returns’

Planted at Riverbend: 1/09/08

Transported to Tech: 4/02/08

Treatment application: 4/04/08

Picked up from Riverbend with nursery media

Veronica longifolium ‘Icicle’

Plugs arrived: 4/04/08

Transplant plugs: 4/07/08

Treatment application: 4/23/08

Potted in quarts with Fafard 3B

Delphinium elatum ‘Blue Bird’

Plugs arrived: 5/15/08

Transplant plugs: 5/15/08

Treatment application: 6/03/08

Potted in gallons with Fafard 52

Data collections: Day 0 and subsequently: 2, 4, 6, 8 WAT; plants held for flowering.

NOTES ON MATERIALS AND METHODS:

--Precooled plugs (size 72) of Veronica and Delphinium were donated by Yoder-GreenLeaf

Ent., Inc. Veronica was planted in quart pots filled Fafard 3B and the Delphinium was planted in trade gallon plastic pots filled with Fafard 52. Daylilies were donated by Riverbend Nursery. Plants were watered as necessary to prevent stress and fertilized CLF with 200 ppm N using Peter's 20-10-20. Veronica was grown in the greenhouse; daylily and Delphinium were grown in the cold frame at the Urban Hort Center.

--PGR treatments were applied to actively growing plant material as drenches applied as 10 oz of PGR solution poured evenly over the surface of the moist medium for trade gallon pots or 2 oz PGR solution for quart pots.

Environmental Conditions at time of PGR Application:

Daylily Date: 4/04/08 Time: 11:30 a.m.
Temperature: 30°C Relative humidity: 27%
Skies: Sunny

Veronica Date: 4/23/08 Time: 12:00 p.m.
Temperature: 30°C Relative humidity: 26%
Skies: Sunny

Delphinium Date: 6/03/08 Time: 12:30 p.m.
Temperature: 26°C Relative humidity: 42%
Skies: Cloudy

--Data collected included plant height (from rim of pot to top of plant, vegetative or flowers, unless otherwise noted, in cm) and plant width (average of the largest width and the width perpendicular to the largest width, in cm), and presence of flowers (per cent plants flowering). In the case of daylily, width was the measurement of the widest point of the fan. Data were subjected to GLM with LSD mean separation within a species and chemical. Plant height and width data were subjected to linear and quadratic regression analysis.

RESULTS AND DISCUSSION

A summary table for plant height of each crop is included below. For full data results, see the attached Excel spreadsheet, PP71 Drench Final Tables.xls. A PowerPoint presentation, PP71Drench.ppt, is also attached with pictures of each crop.

Hemerocallis 'Happy Returns'

In previous studies, vegetative growth of daylily was moderately responsive to paclobutrazol and uniconazole drenches. However, flower stalk height was excessively reduced with even the lowest drench rates tested. In this study, we saw significant reductions in vegetative height with Piccolo at all drench rates, in the 25% to 38% range (Table 1). Plant height reductions were at 8 WAT. These growth reductions did persist in the flower stalk heights at 12 WAT. However, the significance doesn't meet the 5% level established but 8 ppm Piccolo reduced flower stalk height 60% relative to the untreated control. The regression of flower stalk height over Piccolo rate was a significant quadratic relationship which is typical of overdose responses. Reductions in flower stalk height with the lowest Piccolo rate, 2 ppm, was 23% at 12 WAT as compared to a vegetative height

reduction of 35% at 8 WAT. *(Note: the ppt shows photos from 14 WAT. There was little change in the number of plants flowering or height at 14 WAT but there were a couple of questionable measurements in the 14 WAT data set. So we used the 12 WAT data because we had more confidence in it. Also, the plants for the flowering photos, which were taken only at 14 WAT, were selected improperly. They were selected as representative of plant growth as opposed to flower development. So we will need to rely on the data for conclusions in this crop.)*

Daylily response to Abide was similar with vegetative height reductions in the 27% to 32% range over the study (Table 1). The height response was quadratic with respect to rate at 4 and 8 WAT but linear at 6 WAT. However, plant width was not significantly reduced by treatment with Abide. With respect to flower stalk height, two Abide treatments (2 and 6 ppm) were significantly different from controls but the rate response was not significant. This suggests that the significance relates more to variability in the plant response than to the treatment. However the low number of plants flowering in the 8 ppm treatment gives a poor representation of the effect of that rate. Based on these results I would not conclude that Abide was any less detrimental to flowering of daylily than the triazoles.

Concise, at the drench rates selected had less effect on vegetative growth than did Piccolo or Abide (Table 1). Plant height reductions were significant only at 6 and 8 WAT with 20% height reductions. Again the response was quadratic with respect to rate. Plant width was less affected. However, even with so little growth reduction during production, Concise drenches decreased flower stalk height in a quadratic manner up to 44% with the 1.0 ppm drench.

In conclusion, I do not think that we should recommend PGR drenches for daylilies. Although very low rates may have moderate effects on flower stalk height, they have little effect on plant growth. The rate range is too narrow for safe applications.

***Veronica longifolium* 'Icicle'**

As previously identified, the Veronica genus is very sensitive to PGRs, especially the triazoles. This study confirmed that with the drench rates used as well. Piccolo reduced plant height and width significantly and quadratically at all measurement periods (Table 2). Even the lowest drench rate, 2 ppm Piccolo, reduced plant height by 38% to 58% over the course of the study. Flowering did not seem to be affected but the overdose effects of bronzing and epinasty became increasingly obvious especially between the 6 and 8 WAT measurements (see photos).

Veronica was also very sensitive to Abide with a "saturation" rate somewhere between the 2 and 4 ppm drench rates (Table 2). Plant width was significantly reduced by the 2ppm treatment as well. The lower rates, 2 and 4 ppm exhibited less overdose response (bronzing and epinasty) than seen on the higher rates, especially at the later measurement dates. Flowering was not affected. I would recommend the 2 ppm Abide rate or a lower rate with the suggestion of subsequent applications if necessary for Veronica 'Icicle'. Abide may be a good alternative to the triazoles for the Veronica genus.

Veronica response to Concise was very interesting. As expected, the height and width response to Concise rate was quadratic (Table 2). The rates selected gave moderate growth control through 6 WAT, with the lower rates, 0.25 and 0.5 ppm, having little to no effect on plant height. Plant width was more responsive to these rates with a 26% reduction at 6 WAT in plants treated with 0.25 ppm drench. And, note that these plants were in active growth. However, between 6 and 8 WAT, the effect of even these lower rates was exacerbated along with the evidence of overdose symptoms, especially the bronzing and epinasty (compare the 6 WAT and 8 WAT pictures in the ppt). Flowering was not affected. Based on these results, I would not recommend drench applications of Concise for Veronica 'Icicle' and based on my experience with other Veronica spp., I would not recommend Concise for drench applications to plants in this genus.

***Delphinium elatum* 'Blue Bird'**

Delphinium elatum 'Blue Bird' was very sensitive to Piccolo with plant height reductions exceeding 60% at all measurements at and beyond 4 WAT (Table 3). Plant width was less affected but quadratically reduced over these measurement periods. The percent of plants flowering was reduced by the higher rates. However, the plants treated with the 2 ppm drench flowered normally and were attractive plants. I would not recommend a rate that high, but a low rate Piccolo drench (perhaps a 1 ppm drench) may be an excellent PGR treatment for Delphinium.

Abide, at the rates trialed, provided moderate control of plant height through 6 WAT with less effect on plant width (Table 3). A rate higher than the 8 ppm Abide drench or a second application would be required to hold plants at an acceptable height through flowering. Abide did not affect the percent of plants flowering.

Concise, at the rates trialed, had no significant effects on plant height or width (Table 3). Flowering was also unaffected (this photo was corrupted). I find this response surprising since the crop was so sensitive to Piccolo at the 2 ppm rate. I expected similar response from the 1 ppm Concise rate. Jim Barrett and I have discussed how few crops are more responsive to paclo than to uniconazole and to my knowledge (unless he has worked on this recently), there has been no clear documentation of direct comparisons of these two chemicals showing paclo to be more effective.

SUMMARY

Abide did not conclusively result in less affect on daylily flower stalk height. Therefore, my recommendation to growers will be to NOT use PGR drenches on daylilies. However, Abide presented an excellent alternative to the triazoles for Veronica. Although I would like to test it on other species in this genus, based on these results, I would still recommend it over the triazoles for this entire genus. However, Abide rates would have to be significantly higher to provide sufficient control for Delphinium. Would cost become an issue?

Table 1. Effect of PGRs on height and flowering of *Hemerocallis* 'Happy Returns' (n=6).

Treatment rate (ppm)	Plant height (cm)					Flowering at 8 WAT (% plants)	Flower ht at 12 WAT (cm)	Flowering at 12 WAT (% plants)
	0	Weeks after treatment			8			
		2	4	6	8			
Piccolo								
0	6.8	12	24.3a	34.2a	40.5a	0	25.8	83
2	6.3	11	18.3b	22.7b	26.3b	0	19.8	67
4	7.2	10	18.2b	24.2b	29.7b	33	18.3	67
6	6.7	10.2	15.8b	21.4b	26.3b	0	16.9	67
8	6.1	10.8	17b	22.2b	25.3b	17	10.4	83
Rate effect	NS	NS	0.0055	0.0004	0.0006		0.0658	
LSD	1.379	2.9675	4.4001	5.6154	6.9123		**	
Regression	NS	NS	0.001Q	0.0003Q	0.001Q		0.0136Q	
r ²	---	---	0.399187	0.456281	0.399912		0.363725	
Abide								
0	6	12	21.7	29a	34.3a	33	29.5a	67
2	5.9	9.7	16	20.7b	24.3b	0	11.7c	50
4	5.8	9.1	16.8	24.3ab	27.7b	0	23.9ab	67
6	6.8	10.8	16.7	22.2b	26.7b	17	17.3bc	100
8	6.5	10.4	15.8	20.3b	23.3b	17	20.5ab	33
Rate effect	NS	NS	0.073	0.0481	0.0168		0.0275	
LSD	1.1498	2.9524	4.5143	6.1984	6.5331		**	
Regression	NS	NS	0.0421Q	0.0325L	0.0338Q		0.1913L	
r ²	---	---	0.209079	0.153049	0.221972		0.098262	
Concise								
0	5.4	10.3	21.5	31ab	35.5	17	27.7	83
0.25	6.3	11.5	25.2	33.8a	39.2	33	25.8	100
0.5	5.8	10.9	21.3	27.3bc	32.8	17	20.5	67
0.75	6.6	13	22.8	28.7abc	32.7	0	20	50
1	6.3	11.6	20.7	24.9c	29.7	0	15.6	83
Rate effect	NS	NS	NS	0.0432	0.0657		0.0509	
LSD	1.164	2.8414	5.4012	5.8698	6.5295		**	
Regression	NS	NS	NS	0.0373Q	0.0431Q		0.0086Q	
r ²	---	---	---	0.216226	0.207777		0.378658	

** LSDs not calculated due to missing data/unequal sample sizes since all plants not flowering.

Table 2. Effect of PGRs on height and flowering of *Veronica longifolium* 'Icicle' (n=6).

Treatment Rate (ppm)	Plant height (cm)					Flowering at 8 WAT (% plants)
	0	Weeks after treatment				
		2	4	6	8	
Piccolo						
0	5.5	10.9a	15a	26a	33.8a	100
2	4.75	6.75b	8.8b	12.75b	15.3b	83
4	4.5	5.9b	8.3b	9.75c	12.3bc	100
6	4.8	6b	7.1b	7.5cd	8.7cd	100
8	4.7	5.4b	7b	6.7d	7.1d	83
Rate effect	NS	<.0001	<.0001	<.0001	<.0001	
LSD	---	1.5412	2.8723	2.7176	4.0817	
Regression	NS	<.0001Q	<.0001Q	<.0001Q	<.0001Q	
r ²	---	0.682095	0.598955	0.885306	0.858862	
Abide						
0	5	9.1a	13.7a	23.7a	30.2a	100
2	6.3	7.3b	11.9a	17.1b	21.4b	83
4	5.7	6.5b	9.3b	12.3c	16.8c	100
6	5.3	6.7b	8.3b	10.5cd	13.5d	100
8	4.9	6.5b	8.3b	8.9d	11.7d	83
Rate effect	NS	0.0003	<.0001	<.0001	<.0001	
LSD	---	1.1374	2.2634	2.7491	2.4451	
Regression	NS	<.0001Q	<.0001Q	<.0001Q	<.0001Q	
r ²	---	0.53735	0.590044	0.862115	0.921884	
Concise						
0	4.9	8.7	14.1a	23.5a	31.4a	100
0.25	5.9	8.1	15a	21.8ab	23b	100
0.5	4.75	7.1	14a	19.2b	22.1b	100
0.75	4.8	6.9	10.3b	13.2c	14.8c	83
1	4.4	5.9	7.9b	12.8c	14.8c	83
Rate effect	NS	0.0613	0.001	<.0001	<.0001	
LSD	---	1.9653	3.465	3.6643	4.6945	
Regression	NS	0.0112Q	<.0001Q	<.0001Q	<.0001Q	
r ²	---	0.283101	0.489226	0.665035	0.704221	

Table 3. Effect of PGRs on height and flowering of *Delphinium elatum* 'Blue Bird' (n=6).

Treatment rate (ppm)	Plant height (cm)					Flowering at 8 WAT (% plants)
	0	Weeks after treatment				
		2	4	6	8	
Piccolo						
0	14.8	20.2a	37a	68.2a	112a	100
2	16.2	13b	12.7b	22.7b	42.3b	100
4	16.2	12b	8.2b	15.3b	29bc	83
6	16.7	13.8ab	8.5b	11.3b	24.3bc	67
8	14.5	9.7b	9.7b	10.8b	16.2c	50
Rate effect	NS	0.0391	<.0001	<.0001	<.0001	
LSD	---	6.629	8.8568	12.274	19.293	
Regression	NS	0.0237Q	<.0001Q	<.0001Q	<.0001Q	
r ²	---	0.242137	0.678927	0.791641	0.792757	
Abide						
0	14.8	17.8	31.3ab	75.5a	109.2	83
2	15.3	15.7	35.5a	80.3a	99.5	100
4	15.5	15	22.5bc	57.8ab	89.5	100
6	14.8	11.3	18.2c	51.5ab	81.3	100
8	15.2	12.8	17.3c	35.5b	83.5	100
Rate effect	NS	NS	0.0009	0.0299	NS	
LSD	---	---	9.1936	29.708	---	
Regression	NS	0.0454Q	0.001Q	0.0063Q	0.0207L	
r ²	---	0.204709	0.402296	0.313084	0.176747	
Concise						
0	15.2	18.3ab	26.3	69.3	93.8	83
0.25	14.8	19.5a	24.7	54.7	99.8	83
0.5	14.3	12c	23.5	72	89.8	83
0.75	15.3	14.2bc	26.5	70.1	104	100
1	15	11.8c	27.7	43	70.4	83
Rate effect	NS	0.0118	NS	NS	NS	
LSD	---	5.1803	---	---	---	
Regression	NS	0.0164Q	NS	NS	NS	
r ²	---	0.262398	---	---	---	