

EFFECT OF DAMINOZIDE ON GROWTH AND FLOWERING OF BEDDING PLANTS

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(Received November 12, 2002/Accepted September 8, 2003)

A B S T R A C T

The experiments were carried out at two locations paralelly. Seedlings of five cultivars of three bedding plant species: *Tagetes patula*, *Impatiens walleriana* and *Petunia hybrida* were sprayed with daminozide (B-Nine 85 SP) at 1275 mg l⁻¹ and 2550 mg l⁻¹. Plant height and diameter, as well as number of flowers and flower buds were compared. Daminozide inhibited growth and stimulated flowering. The optimal concentration of this retardant was 1275 mg l⁻¹, i.e. B-Nine at 0.15%, and a double spray of plants was most efficient.

Key words: daminozide, growth control, *Tagetes patula*, *Impatiens walleriana*, *Petunia hybrida*

INTRODUCTION

In flower production, retardants have been used for many years in order to improve the plant habit and decorative value. One of the most frequently applied agent is B-Nine 85 SP (85% daminozide), which has found a wide application primarily in growing pot plants as well as many bedding ornamentals. B-Nine is

recommended for plant spray, usually twice or three times at 0.15-0.5%. Bailey (1991) applied daminozide as Alar 85 at 0.35% in the production of more than twenty species of bedding plants. This retardant was the most effective for very young plants sprayed twice at 2-3 week interval. However, Borkowski and Grzesik (1993) suggested that Alar 85 should be applied at 0.12-0.5%. Since the reaction of species and

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even of cultivars is not identical, it is necessary to work out actual recommenda-

tions referring to the frequency of treatments and retardant concentration. This opinion has been confirmed by Startek (2000) in the recent studies on several new cultivars of pansies.

The aim of our work was to inhibit the plant growth, stimulate shoot branching and to increase flowering abundance by daminozide application in the production of *Tagetes patula*, *Impatiens walleriana* and *Petunia hybrida*.

MATERIAL AND METHODS

Two experiments were carried out parallelly: A – in a commercial glasshouse (Gamaflora Horticulture, Witoszów Dolny), from February 21 to mid-June; B – at the Ogrody Experimental Station (University of Agriculture, Poznań) from March 27 to early June, 2000. *Tagetes patula* L. ‘Jumbo Bicolor’, *Impatiens walleriana* Hook ‘Impuls Orange’ and three cultivars of *Petunia hybrida* Vilm. ‘Bravo Pink’, ‘Flash Red’ and ‘Prism Sunshine’ were examined. Seedlings, originating from the Syngenta Seeds Co., were delivered in Multicell pallets with 6 cm cells. The plants were transplanted into 9 cm pots.

In experiment A, the substrate was a mixture (1:2/v:v) of compost soil and peat type T (with increased content of iron) from the Frühstorfer Co. It was limed to pH 6.5 and enriched with Osmocote 6 M fertilizer in the amount of 0.5 kg m^{-3} . Every 7-10 days, the plants were additionally fed with solutions of Peters Universol Blue and Peters Universol Violet fertilizers. At the

beginning of flowering Blossom Booster fertilizer was applied twice.

In experiment B, substrate was prepared of peat and sand mixed in 3:1/v:v proportion. It was limed to pH 6.5 and enriched with Osmocote 3 M and brown Superba in the amounts of 1.3 kg m^{-3} and 340 g m^{-3} , respectively. Every 7-10 days, additional nutrition was applied with Kristalon Blue and Kristalon White. All plants received a single feeding with calcium nitrate, and petunia additionally, at every second fertilization was supplemented with ferric chelate Tenso Fe. All supporting fertilizers were applied at a concentration of 0.1%.

In both experiments daminozide was applied once or twice at 1275 mg l^{-1} , i.e. 0.15% of B-Nine. Some plants at the second application were sprayed with daminozide at 2550 mg l^{-1} , i.e. 0.3% of B-Nine (Tab. 1 and 2). There were 30 plants in each treatment. The plants were sprayed until a complete wetting of leaves avoiding however, any dripping of the solution into the substrate. The first application was carried out 21-25 days after potting, i.e. on March 21 in experiment A and on April 17 in experiment B. The second spray was applied 10 days later. On the day preceding the treatment, the plants were abundantly irrigated, and a successive irrigation took place 20-24 hours after daminozide spray. During the whole period of cultivation, the glasshouse temperature was maintained within $16\text{-}22^\circ\text{C}$. Measurements of the

height and diameter of plants were carried out and the number of flowers and flower buds was determined when the plants had fully opened 1-3 inflorescences in *Tagetes*, 3-5 flowers in *Petunia* and 5-7 flowers in *Impatiens*. The results were statistically analysed separately for each experiment and each cultivar. An analysis of variance was carried out and the Duncan's multiple range t-test was used at P=0.05.

Rate of daminozide [mg l ⁻¹]	Species and cultivar	Height of plant [cm]	Diameter of plant [cm]	Number of flowers/inflorescences	Number of flower buds
0	<i>Tagetes patula</i> 'Jumbo Bicolor'	12.3 a*	10.2 a	1.3 a	1.0 a
1275		11.4 b	10.0 a	1.3 a	1.3 a
1275+1275		11.3 b	10.0 a	1.4 a	1.4 a
1275+2550		11.3 b	9.9 a	1.5 a	1.4 a
0	<i>Impatiens walleriana</i> 'Impuls Orange'	15.3 a	25.7 bc	15.5 a	14.3 c
1275		14.5 a	24.3 c	16.8 a	16.8 b
1275+1275		12.0 b	27.1 ab	16.7 a	18.5 a
1275+2550		10.8 c	27.4 a	16.6 a	18.5 a
0	<i>Petunia hybrida</i> 'Bravo Pink'	14.2 a	20.1 a	6.3 b	4.3 ab
1275		12.2 b	18.6 b	6.2 b	3.9 b
1275+1275		11.6 b	18.7 b	8.6 a	4.5 a
1275+2550		11.8 b	19.9 a	8.9 a	4.8 a
0	<i>Petunia hybrida</i> 'Flash Red'	15.5 a	19.7 a	5.1 a	6.1 c
1275		14.0 b	19.5 a	5.1 a	7.0 b
1275+1275		13.6 b	19.6 a	5.0 a	8.6 a
1275+2550		12.6 c	19.9 a	5.3 a	8.3 a
0	<i>Petunia hybrida</i> 'Prism Sunshine'	18.3 a	21.2 a	6.8 ab	5.4 a
1275		13.8 b	20.1 b	7.1 a	5.1 a
1275+1275		12.7 c	20.1 b	6.8 ab	5.2 a
1275+2550		12.7 c	20.2 b	6.5 b	5.3 a

*Means followed by the same letter in columns do not differ significantly, separately for each cultivar, according to Duncan's multiple range t-test at P=0.05

flowers and flower buds was determined when the plants had fully opened 1-3 inflorescences in *Tagetes*, 3-5 flowers in *Petunia* and 5-7 flowers in *Impatiens*. The results were statistically analysed separately for each experiment and each cultivar. An analysis of variance was carried out and the Duncan's multiple range t-test was used at P=0.05.

RESULTS

In experiment B, *Tagetes* 'Jumbo Bicolor' was growing more intensively and flowering more abundantly than in experiment A (Tab. 1 and 2). A distinct growth inhibition followed the repeated application of daminozide. To obtain a stronger branching of plants and to increase the number of inflorescence buds, the use of the daminozide solution at 1275 mg l⁻¹ for the second spraying proved to be sufficient (Tab. 2).

Impatiens cultivar 'Impuls Orange' is characterized by compact growth, and the daminozide spray clearly decreased plant height mainly in experiment A. However, retardant stimulated the shoot branching and enlarged a number of flower buds. Thanks to the use of daminozide

Table 2. Effect of daminozide on the growth and flowering of *Tagetes*, *Impatiens* and *Petunia*. Experiment B (Ogrody Experimental Station, University of Agriculture, Poznań)

Rate of daminozide [mg l ⁻¹]	Species and cultivar	Height of plant [cm]	Diameter of plant [cm]	Number of flowers/ inflorescences	Number of flower buds
0	<i>Tagetes patula</i> 'Jumbo Bicolor'	20.0 a*	7.6 c	3.3 a	3.1 b
1275		19.2 ab	10.9 b	3.4 a	2.5 b
1275+1275		19.0 b	16.7 a	3.2 a	5.1 a
1275+2550		17.9 c	16.0 a	3.3 a	4.6 a
0	<i>Impatiens walleriana</i> 'Impuls Orange'	11.8 a	15.5 b	6.5 ab	58.6 b
1275		11.9 a	16.0 b	7.0 a	57.7 b
1275+1275		11.6 a	17.0 a	7.5 a	63.2 a
1275+2550		10.9 b	16.0 b	6.0 b	58.8 b
0	<i>Petunia hybrida</i> 'Bravo Pink'	17.5 a	17.7 a	6.1 b	0.7 a
1275		17.3 a	15.1 b	5.9 b	0.6 a
1275+1275		16.4 b	15.0 b	6.8 ab	0.5 a
1275+2550		16.8 ab	17.6 a	7.1 a	0.6 a
0	<i>Petunia hybrida</i> 'Flash Red'	16.5 ab	14.9 a	4.4 a	2.3 c
1275		16.9 a	13.7 b	4.7 a	2.8 b
1275+1275		15.9 bc	14.1 b	4.4 a	2.7 bc
1275+2550		15.6 c	14.1 b	4.4 a	3.4 a
0	<i>Petunia hybrida</i> 'Prism Sunshine'	18.3 a	27.6 a	8.0 bc	1.0 b
1275		17.1 b	24.8 c	7.6 c	1.7 a
1275+1275		17.2 b	25.5 bc	8.7 ab	1.5 a
1275+2550		17.1 b	26.0 b	9.0 a	1.6 a

*Explanations see Table 1

twice, at 1275 mg l⁻¹, in both trials the plants had a better quality than those untreated (Tab. 1 and 2). The number of flower buds on *impatiens* grown in experiment B was four times larger than in experiment A (Tab. 2).

In *petunia*, daminozide application had a significant effect on the improvement of the plant habit and its decorative value, but the reaction of cultivars varied. The growth inhibition was very strong for 'Prism Sunshine' cultivar in experiment A. After two daminozide sprays, the

plants were lower by about 30% than the controls but no increase in flowering abundance was recorded (Tab. 1). In both trials retardant reduced plant height of 'Bravo Pink' and 'Flash Red' (Tab. 1 and 2) but only for the first cultivar the number of flowers was clearly increased.

DISCUSSION

For many species and cultivars of bedding plants, the treatment with retardant is an obligatory

commercial procedure. Catalogues dealing with the production of seedlings do not always include information referring to the recommended concentration and frequency of treatment, because the effectiveness of retardants depends on many factors as temperature, light intensity and fertilization. Therefore, the present work analyses separately the results of two experiments carried out in the particular locations. In scientific literature, there are only a few publications referring to the effect of daminozide on the growth and flowering of bedding plants, and the conclusions are often divergent regarding a retardant concentration as well as the time and frequency of its application. Borkowski and Grzesik (1993) applied daminozide as Alar 83 at 0.12-0.5% and suggested the first treatment should be performed 3-4 weeks after planting the seedlings into pots, and if necessary, it should be repeated 1-2 weeks later. These recommendations were used in our experiments in which daminozide was applied at 1275 mg l⁻¹, i.e. B-Nine at 0.15% and for a treatment repeated after ten days, at the same concentration or double.

Latimer (1991) in the experiments with bedding plants (e.g. *Tagetes patula* and *Impatiens walleriana*) applied daminozide even at 0.5% and showed that the retardant had the strongest effect when applied to very young plants. Krause and Schroeter (2001) used this agent in the production of little known

of companies balcony plants and found that it inhibited the growth but did not stimulate branching nor accelerated flowering. Somewhat different action of this retardant was obtained by Startek (2000) in pansies. Daminozide slightly inhibited the growth and its action was the shortest in comparison with chlormequat and flurprimidol. However, it increased plant resistance to low temperatures and accelerated flowering by 2-4 days. Daminozide also proved to be little effective in both the dwarfing of plants and habit improvement in geranium (Pobudkiewicz and Nowak, 1999).

In the present research, in the majority of the studied taxons, a stronger action was found in experiment A. It can be presumed that a better reaction of plants was achieved there mainly by the advanced treatment. In experiment B, the daminozide spray was performed in the second half of April, when due to a sudden warming up and sunny weather, it was difficult to keep the optimal temperature in the glasshouse in spite of provided shading. Only for *Tagetes* better effects were obtained in experiment B. These results can be explained by the recent studies of Kuehny et al. (2001), indicating that at different places of seedling production the results can vary because the effect of the retardant on the same species and cultivars depends on the external conditions and the applied production technology.

CONCLUSIONS

1. Treatment with daminozide (B-Nine 85 SP) had a significant effect on the growth and flowering of all studied bedding plants, especially in experiment A.
2. Irrespective of the place of cultivation, the best results were obtained when daminozide was used at 1275 mg l⁻¹, once or twice.

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WPŁYW DAMINOZYDU NA WZROST I KWITNIENIE ROŚLIN RABATOWYCH

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S T R E S Z C Z E N I E

Doświadczenia przeprowadzono równocześnie w dwóch gospodarstwach ogrodniczych. Siewki 5 odmian należących do 3 gatunków: *Tagetes patula*, *Impatiens walleriana* i *Petunia hybrida* opryskiwano roztworem daminozydu (w preparacie B-Nine 85 SP) o stężeniu 1275 mg l⁻¹ i 2550 mg l⁻¹. Porównano wysokość i średnicę roślin, a także liczbę kwiatów i pąków kwiatowych. Daminozyd hamował wzrost i stymulował

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kwitnienie. Optymalne stężenie wynosiło 1275 mg l⁻¹ (0,15% B-Nine 85 SP) i najlepsze wyniki uzyskano stosując dwukrotne opryskiwanie roślin.

Słowa kluczowe: daminozyd, regulowanie wzrostu, *Tagetes patula*, *Impatiens walleriana*, *Petunia hybrida*