INFLUENCE OF THE PHOTOPERIOD, DAMINOZIDE APPLICATION AND FERTILIZATION ON NEW ENGLAND ASTER

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Introduction

The species *Aster novae-angliae* L., New England aster, is a short day perennial, flowering from the end of August to the end of October. It is branched out and reaches a height to 1.2 m. New England aster is grown in gardens and for cutting production. It has a flowering pot plant potential, but many of its cultivars are too tall to be grown in pots. Regulation of the day length may affect its flowering period while the application of growth retardants may regulate the shoot length and branching, as well as induce flowering in this *Aster* species. Growth regulators are applied in floriculture to reduce the vegetative growth of plants and to improve their aesthetic value by inducing shorter internodes (Gibson and Whipker, 2003; Marosz and Matysiak, 2005; Pinto et al. 2005; Pobudkiewicz and Treder, 2006). Balanced nutrition is an important tool in cultivation of agricultural plants as well as for flowering pot plants and it has to be adjusted to the plant requirements during particular development stages for which only orientational values are available for the majority of ornamental plants (Macz et al. 2001; Kant et al. 2005; Berzsenyi and Dang, 2006; Sharma and Sharma, 2006;).

The objectives of this work are to define the possibility of growing *Aster novae-angliae* L., ‘September Ruby’, as a flowering pot plant in the late summer period, determine the effect of day length and the cultivar’s response to one time application of growth retardant, as well as topdressing with liquid mineral fertilizer on its growth and flowering.

Material and methods

Influence of the photoperiod, growth retardant and fertilizer application upon the growth and flowering of potted New England aster 'September Ruby' was investigated in two separate trials (natural day length and short day conditions) during three years. In the second week of June (24^{th} week) of all three trial years, 10-cm long top cuttings were taken and placed in a cold frame to root. Three weeks later, 27^{th} week, rooted cuttings were planted into a mixture of loamy soil and peat (ratio 3:1) in plastic pots of 300 ml. One cutting was planted in each pot. Chemical analyses of the substrate gave the following findings: humus content amounted to 3.3%, and that of total nitrogen was 0.20%. The substrate was very abundantly supplied with plant available phosphorus (24.9 mg $100g^{-1}$ soil) and well supplied with potassium (16.7 mg $100g^{-1}$ soil) according to the Al method. Topdressing was applied two times, with 0.1 dl of a 1.5% solution of liquid mineral fertilizer (“Fertina 1” INA Petrokemija Kutina; NPK 4:6:8 + B +Mg+Fe+Zn+Cu) per pot: the first topdressing was in the 30^{th} week, and the second in the 32^{nd} week. In this way, 39.6 mg N l^{-1}; 59.94 mg P_2O_5 l^{-1}, and 79.92 mg K_2O l^{-1} was added into the substrate. Plants were decapitated ten days after planting in the 29^{th} week while in the 30^{th} week they were sprayed with a 0.2% or 0.4% solution of daminozide (Alar 85). Each plant received 10 ml of the solution. In the 31^{st} week, plants grown

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under shortened photoperiod started to be exposed to a cycle of 10 hours of natural light and 14 hours of darkness, which was continued for five weeks, until the 36^{th} week. The total number of light hours from planting to the end of covering of the darkened plants amounted to 753 hours. The trial finished at the beginning of October when the plants looked best to be offered for sale. Data obtained by measuring the plant height and diameter, counting number of buds per plant and number of inflorescence heads per plant were processed by the analysis of variance per trial years. Statistical analysis of interactive relations for the tested traits and years was done by the standard method, based on estimating the least squares for general linear models using the GLM procedure (SAS/STAT User Guide, 1990).

Results and discussions

Photoperiod

Comparing the mean values of plant height by the t test, higher values were recorded in variants involving natural day length conditions; in second trial year at p=1%, and in third trial year at p=5%.

Dalla Guda et al. (2001) also report higher aster plants with the long day compared to the short day conditions. Plant height is an aster trait that is strongly influenced by the photoperiod (Dall Guda and Scordo 1994).

Of all the measured traits, photoperiod had the strongest effect on plant diameter.

Plant diameter was significantly larger in the first two years in the natural day length conditions, in first trial year at p=5% and in second trial year at p=1%. In last trial year, plant diameter was by 0.4 cm larger in the short day conditions.

A significant difference was recorded in the number of buds per plant for different day lengths. The difference was highly significant in the first two years; in first trial year there were 2.9 buds more in the natural day length conditions while in second trial year there were 1.8 more buds than in short day conditions.

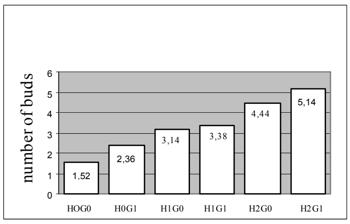
Daminozide

Application of 0.4% daminozide solution to plants grown under natural day length led to a statistically significant difference at p =1% compared to the control and variants treated with 0.2% daminozide solution for plant height in first trial year only. Higher significance for the effect of the growth retardant upon plant height was recorded in plants grown under short day. In first trial year, plants treated with 0.4% daminozide solution were lower compared to the control and treatments with 0.2% solution. Only between the variant treated with 0.4% daminozide solution with fertilization and the variant treated with 0.2% daminozide solution without fertilization the difference of 1.12 cm was statistically insignificant.

In second trial year, the results for growth were similar to those from the preceding year; variants treated with a higher growth retardant concentration were lower than the other variants. The difference of 1.08 cm between the variant treated with 0.4% solution with fertilization and variants treated with 0.2% daminozide solution with fertilization was statistically insignificant. The average number of buds in plants grown under natural day length in the first two trial years was significantly larger when growth retardants were applied, at p=1%. In first trial year, both daminozide concentrations rendered at p=1% more buds compared to the control, more buds being recorded in 0,4% daminozide solution than in 0,2 daminozide solution at p= 1% (Figure 1). In second trial year, daminozide treated variants also achieved significantly more buds compared to the control at p=1%, but there was no significant difference in the number of buds between variants treated with 0.2% daminozide solution without fertilization and the variant without daminozide with fertilization. The variant with the higher daminozide concentration and with fertilization having more buds at p=1% stood out from the other variants (Figure 2). A significant difference in the number of buds was recorded in the first two trial years for plants grown under short day conditions. Like in the natural day conditions, the largest number of buds at p=1% was obtained with 0.4% daminozide concentration and with fertilization.

Fertilization

In the first two trial years, fertilized plants grown under natural day length produced significantly more buds at p=1%, in first trial year by 16.5%, and in second trial year by 38.4%, whereas no difference was recorded between fertilized and unfertilized plants in last trial year. Plants grown in short day conditions also showed a positive response to fertilization in the first two years at p=1%; in first trial year there were 27.3% more buds, and in second trial year even 58.7% more than in the unfertilized variant. Effect of fertilization on the number of inflorescence heads was recorded only under short day conditions in second trial year, when application of liquid mineral fertilizer resulted in 26.1% more inflorescence heads compared to the control at p=5%.

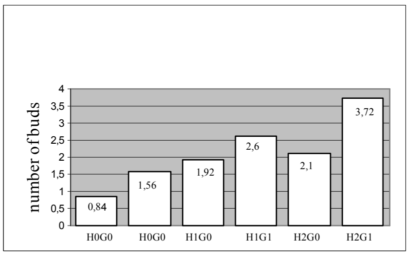


Daminozide

LSD p=5% =0,25

LSD p=1% =0,39

Figure 1. Number of buds under natural day conditions in the first trial year



Daminozide

LSD p=5% =0,42

LSD p=1% =0,58

Figure 2. Number of buds under natural day conditions in the second trial year

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Legend:

H0G0 combination without daminozide and without fertilizer
H0G1 combination without daminozide and with 1.5% fertilizer solution
H1G0 combination with 0.2% daminozide solution and without fertilizer
H1G1 combination with 0.2% daminozide solution and with 1.5% fertilizer solution
H2G0 combination with 0.4% daminozide solution and without fertilizer
H2G1 combination with 0.4% daminozide solution and with 1.5% fertilizer solution

Conclusions

Environmental factors require a balanced state to provide plants optimum conditions. In an *Aster novae-angliae* L study growth and development manifestation was evaluated. Plant diameter was significantly larger in the first two years in the natural day length conditions. Number of buds were also larger in plants grown under natural day length than in plants grown under short day conditions. Application of daminozide resulted in an increased number of buds and was also efficient in reducing the internode length. The effect of daminozide treatment was stronger when the plants were grown under short day conditions. Application of liquid mineral fertilizer resulted in a larger number of buds per plant, especially when the plants were grown under natural day length.

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