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Effect of Growth Retardants and Biostimulators on Annual Potplants

Summary

To reach the habits for market purpose we used alternative biostimulators and retardants such as Regalis, Toprex, Caramba, CCC and Cultar. These are mainly fungicides but contain dwarf-growth influencing components. The species used for the experiment were Coreopsis grandiflora, Godetia grandifolra, Scabiosa atropurpurea, Matthiola incana and Schizanthus wisentonensis. The trial interval was 2010 April to 2011 July. The treatments were started when the plants were in 2-3 true leaf stage. From that time the treatments were repeated in 14-18 days cycle with the substances. We tried to increase the habit, the intensity of blooming and durability with conditioning substances. The results were followed-up by biochemical and histological methods too.

Summarizing, all chemicals had effect on the tested species. Regalis and Cultar showed the most effective achievement. With these substances treated plants have more, shorter joints, more and robust leafs, and more compact habit comparing to the control plants. Regarding blooming the treated plants started to bloom 10-14 days later, and 15 % of the treated Scabiosa atropurpurea pots haven't started blooming during the vegetation interval time. Matthiola incana showed very good results, it was a successful trial plant.

1. Introduction, literary overview

The demand for ornamentals is changing year by year worldwide. More species and hybrids appear on the market, the demand is increasing on the previously unknown variants of new or existing plants. In order to fulfill the widely growing supply and demand in the agriculture and commerce of ornamentals we may find a solution to grow the possible new species as potplants. The auxins, gibberellins, citokinins and other, synthetic dwarf-growth effecting materials (mainly retardants) are a must in quality cultivation of ornamentals despite of their limitation after joining to EU – in contempt of technical pressure. It is important to study the reasonable and practical usage of these retardants and newcoming alternative bioregulators.

The function of natural biostimulators is growing in the cultivation of horticultural crops (annuals and perennials). The international researches have been started earlier in this field however the results can be adopted to domestic conditions after thorough tests. The experiments testing the effects of biostimulators to ornamentals started only a few years ago.

Most of these kind of experiments were made in Germany and England with arboreals and herbaceous plants.

Reiners (2007) tested the daminosid based Alar-85 – which is a general grow-effecting material in horticulture – on potted ornamentals. The result is that the treated plants had better habits compared to the plants in the controlgroup.

Schmidt et al. (1996) examined the scaling of leaves of ornamentals such as Fuchsia, Torenia, Solidago, and Hibiscus. They used Alar-85, Cycocel and Cultar with different concentrations for the experiments. By the histological experiments they found that the palisad parenchima of the treated plants became thicker than the control group had, and there were less clorophyls in the leaves of the treated plants by Cultar than the untreated plants.

The tests explored that the metconazol based Caramba – fungicid agent used against diseases of cereals and colza – and flurprimidol based Topflor specially suggested for grow-control have the similar mechanism of effects.

Tilly-Mándy and her group (2011) made experiments on the type 'Robert's Lemon' of Pelargonium using Bistep agent. They established a series of concentrates and examined the clorophyl contents of leaves and the length, volume and diameter of roots. They came to the result that the most effective concentrate was the highest (0,2%).

The dwarf-groth effecting retardants have effect to the production of gibberellin-hormones of plants as they cancelling the effect of hormones and breaking the apical dominance (Schmidt 2002).

Due to the results mentioned above the longitudinal growth of plants is slowing or stop and the joints start evolving more intensely.

Ikeda and his group (2001) tested the effect of gibberellins to rice. The result is that the more gibberelin content a plant has the more side directional joints it will have than the untreated wild plants have.

Hirano and his group (2010) described the mechanism of gibberelin genetically on Oryza sativa.

Wojciechowski and his group (2009) made experiments on barley. The tests were to get dwarf-growth in case of the root growing. They involved ' Mercia' and 'Maris Midgeon' species into the experiments..

They examined the dwarf growing effecting alleles and prtially dwarf growing effecting alleles too. The scope of experiment was to identify which circumstances are the best for the growing plants They question was which is the ideal cirumstance to plantsin terms of : outside bed, medium in gel state or in liquid. In case of partially dwarf-groth effecting species the length and volume of roots had neo significant deviation compared to control group however the roots of plant treated by dwarf-groth effecting alleles became bigger proportinally. It means that the allele has significant effect to roots of the plants too.

2. Materials and methods

Our experiments were made both in the planting yard and greenhouses of the VM ASZK Matra Technical College (located in Matrafured) and at Faculty of Horticultural Science of the Corvinus University of Budapest.

The experiments were made on annuals such as *Godetia grandiflora, Scabiosa atropurpurea, Coreopsis grandiflora*, *Matthiola incana and Schizanthus wisentonensis*. These taxons are not prevalent as potplants as their height is 50-80 cm, have few or no joints, but their leaves are decorative, have great and coloured blossoms and long blooming interval.

The experiments have been made in two breeding seasons, from April to August in 2010 and from April to July in 2011.

The cultures are started from planting seeds and they are potted after reaching 2-3 true leaf stage into outdoor beds from the greenhouse with their containers. The transplants were in the age of three weeks at that time. The beds were covered by raschel-nets due to the intense sunbeams. The tested group stayed in these beds until the end of the breeding season. The substances had to be treated with nutrient solution once as it was necessary due to the noticeable lack of nitrogen.

The involved taxons were Godetia grandiflora, Matthiola incana, Scabiosa atropurpurea, Coreopsis grandiflora in 2010. In 2011 we involved Matthiola Incana which showed good results in the previous day, Schizanthus wisentonensis and Scabiosa atropurpurea were the tested species.

The substances were grouped by taxons into groups with 20-25 pieces each, so we had 6 test groups. Each group were treated with different retardants, and we had one control group.

CCC, Caramba, Cultar and Toprex were used with 0,1%, and Regalis were used with 0,25% concentration. These are the concentrations suggested by the manufacturers. The consumption was 300 ml/m^2 from the retardants

The first treatment was done 2 days after pricking, and we continued to 100% blooming in 10-14 days periods.

We found burning marks on plants treated with Caramba after the first treatment. We assumed that this issue happened due to high concentration, so we took another group into the tests. This group was treated with 0,05% concentrated Caramba in 2010.

The scopes of observations and measurements on the tested annual ornaments were the following:

- tracing the fenological status of plants (sprouting, joints, starting and ending date of blooming),
- determine the growth rate, comparison with the growth rate of control plants (height and coverage measurement),
- morphological traits of plants (such as plant height, leaf area index, number of branches, bush diameter, flower size, flower number, flower color, color intensity)

3.Results and conclusions

Based on the results of the experiment all agents inhibited the growth of test plants, the dwarf-growth rate was species-specific.

3.1.The results of year 2010

Matthiola incana showed the best results achieved by the treatment (Figure 1), this is the plant most sensitively responded to the tested substances. The results demonstrated that the retardants resulted an average height of 10 cm in case of Matthiola incana taxon , while the other taxons reached height of 30-50 cm. It can be said that all retardant significantly reduced the plant height, these measures lead to a compact, bushy habit formed. Regal was the most powerful dwarf-growth effecting solution, but even the least efficient CCC resulted 50% effect.

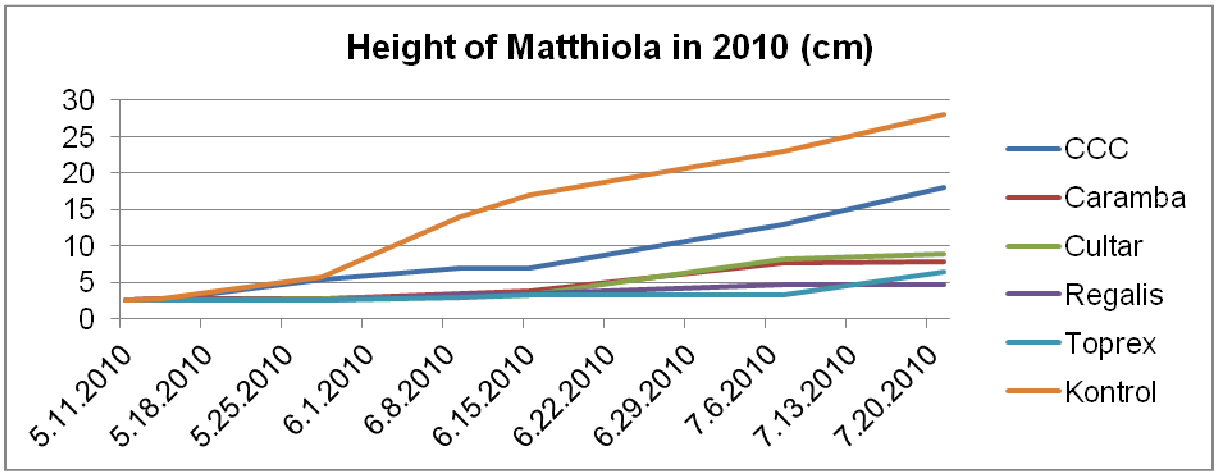

Figure 1: Height of Matthiola incana in 2010

All of the retardants had effect on the tested plants. The most effective retardants were Regalis and Cultar. As a reaction the habit of the plants became more bushy, the mass of leaves increased, and the plants became more compact. The retardants are taxon specifics. From blooming interval side the treated plants started to bloom 10-14 days later, and 15% of the treated *Scabiosa atropurpurea* haven't started to bloom during the breeding season.

3.1.1. Results regarding vegetative parts

The Matthiola incana closed the year with very good results, the height of the Control group sharply separated from the treated groups as you can see it well on the Figure 1. Unfortunately Toprex caused so low height that would be not marketable being not showy.

The diameter of plants reached and in some cases exceeded the diameter of plants in control group.

3.1.2.Results regarding blooming

The blooming started one and half month later (30th of July) in case of Matthiola incana tretaed with Toprex and Regalis compared to control group (15th of June), however the blooming lasted for approx the same period (10th Aug in case of treated plants, 13th of Jul at control group) proportionally from the beginning of blooming. In case of plants treated with 0,05% concentrated Caramba the blooming has not even started.

The other treated groups didn't show so high differences, there was max 1 week delay in case of Toprex.

Table 1: The effects of retardants on the test pots 30/06/2011

Matthiola i. **2010.06.30**	**Control**	**CCC**	**Caramba (0,05%)**	**Caramba (0,1%)**	**Cultar**	**Regalis**	**Toprex**
Blooming(%)	100	6	0	20	10%	0	10
# of flowers	5	3	0	1	0,5	0	0,5
Scabiosa a. **2010.06.30**	**Control**	**CCC**	**Caramba (0,05%)**	**Caramba (0,1%)**	**Cultar**	**Regalis**	**Toprex**
Blooming(%)	100	0	0	0	0	100	0
# of flowers	2	0	0	0	0	2	0
Godetia g. **2010.06.30**	**Control**	**CCC**	**Caramba (0,05%)**	**Caramba (0,1%)**	**Cultar**	**Regalis**	**Toprex**
Blooming(%)	100	0	200	100	100	100	0
# of flowers	1	0	2	1	1	1	0
Coreopsis g. **2010.06.30**	**Control**	**CCC**	**Caramba (0,05%)**	**Caramba (0,1%)**	**Cultar**	**Regalis**	**Toprex**
Blooming(%)	100	0	0	0	100	0	100
# of flowers	1	0	0	0	1	0	1

3.2. The results of year 2011

The tested taxons were Matthiola incana, Schizanthus wisentonensis and Scabiosa atropurpurea in this year. Coreopsis grandiflora and Godetia grandiflora were removed from the tested taxons from previous year as they produced insufficient results.

The results made in 2011 were very similar to the results of year 2010. The results showed that Matthiola incana was the most sensitive during the experiments regarding height, number of leaves and plant diameter. Matthiola reached the less height and the highest leaf volume in case of all retardants.

3.2.1.Number of flowers

In case of Matthiola incana we got interesting results experimenting with the retardants (Table 2). The blooming starts the earliest applying CCC and Caramba. Caramba performs outstandingly compared to others, producing 1250% higher flower volume compared to the control group. The plants treated with CCC started blooming earlier however their blooming interval finished much earlier (second decade of June) compared to other groups. Unfortunately this is quite a setting-back factor considering market purposes. Groups treated with Regalis started blooming only in the end of June and haven't produced high volume of flowers compared to control group (75%) however that effect is compensated by the habit of plants, their compact stature and high leaf volume.

Table 2: The effects of blooming by Matthiola incana /2011/

2011.05.31	**Control**	**Caram**	**CCC**	**Cultar**	**Regalis**	**Toprex**
Blooming %	100%	16%	33%	66%	0%	0%
# of flowers	6	1	2	4	0	0
2011.06.14	**Control**	**Caram**	**CCC**	**Cultar**	**Regalis**	**Toprex**
Blooming %	100%	350%	200%	200%	0%	420%
# of flowers	4	14	8	8	0	17
2011.06.30	**Control**	**Caram**	**CCC**	**Cultar**	**Regalis**	**Toprex**
Blooming %	100%	1250%	150%	250%	75%	150%
# of flowers	2	25	3	5	3	30

Toprex and Cultar performed well during the experiments too. Toprex was producing 420% higher flower volume compared to control group but the blooming interval was short. Cultar was producing 200% higher flower volume and generated more flowers even after the fading started in the other groups. The groups of Toprex and Caramba were blooming the longest (end of June – beginning of July).

CCC, Cultar and Regalis resulted in a high degree of earliness compared to other groups in case of Schizathus wisentonensis.

3.2.2. Results of vegetative performance:

We can state that Matthiola performed well at all retardants, the height stayed below 20 cm. We should also mention that even the plants in the control group were not so high with an average 40-50 cm. The habit of tested plants became bushy, and they had earlier blooming compared to the control group.

Scabiosa atropurpurea haven't shown good results in terms of height, diameter and number of leaves. The results are not clear as there were too high deviations within the treated group. The treated plants faded away in the first half of June already therefore we had to discard them from the experiments. From cultivation point of view this is an unfavorable property, so this taxon is not suggested to further tests.

Figure 2: The effect of Toprex compare to control plant by Matthiola incana

Figure 3: The effect of Caramba compare to control plant by Matthiola incana

Figure 4: The effect of Toprex compare to control plant by Matthiola incana

Regarding number of leaves Toprex was inefficient however we have to mention that lower height is coupled with less leaves. CCC was inefficient too not only in 2010 but also in 2011.

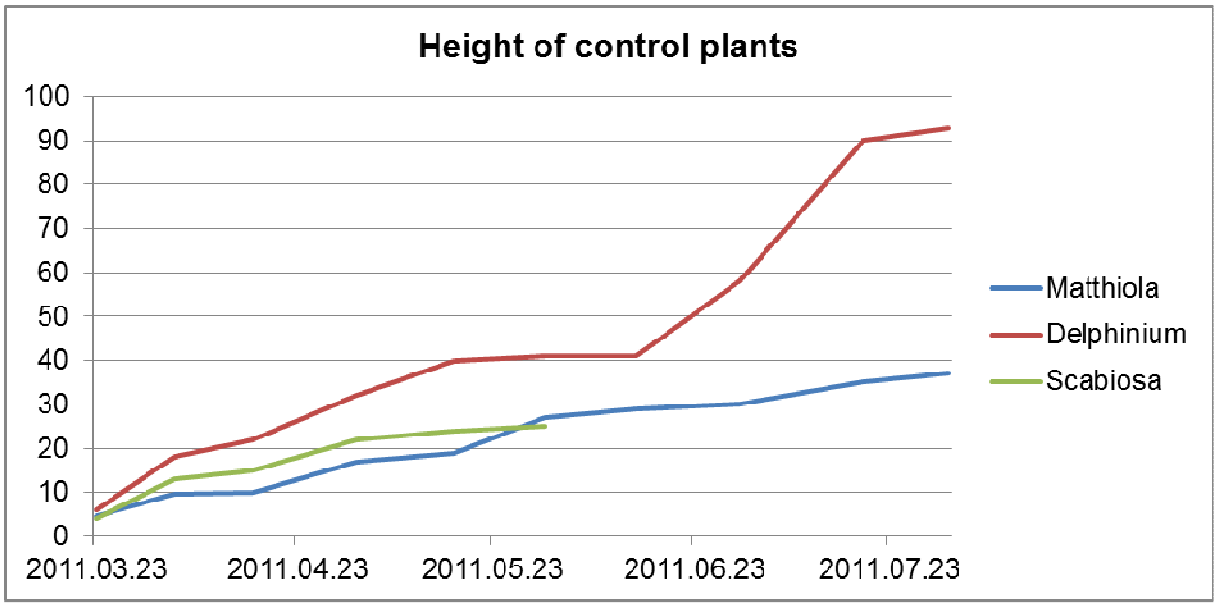

Figure 5: Height of control plants

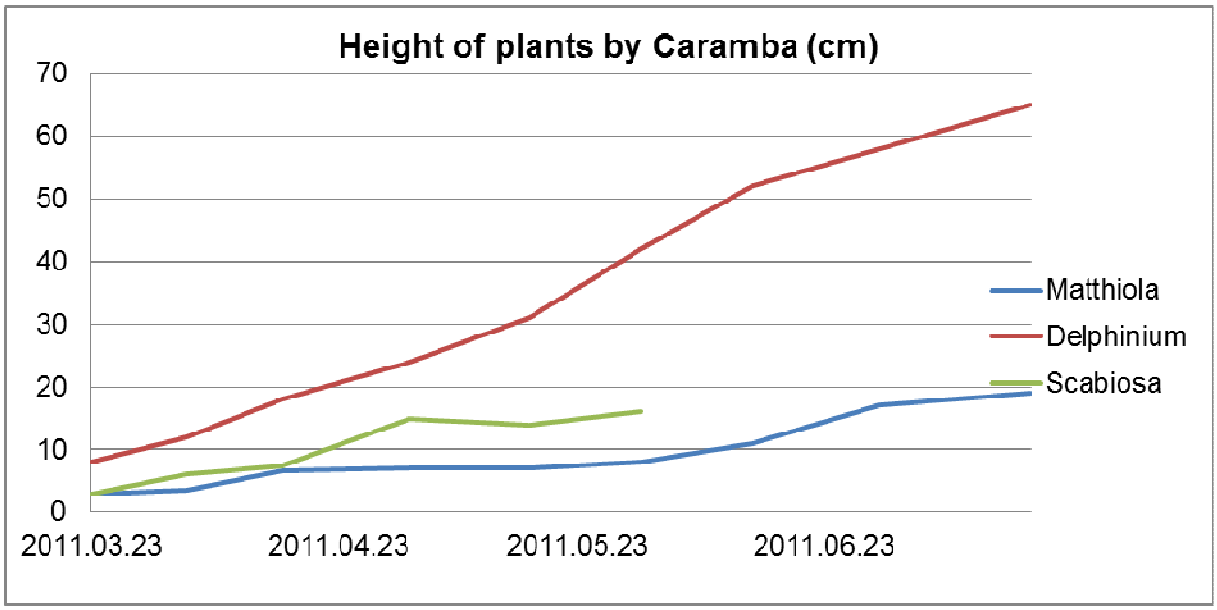

Figure 6: Height of plants by Caramba

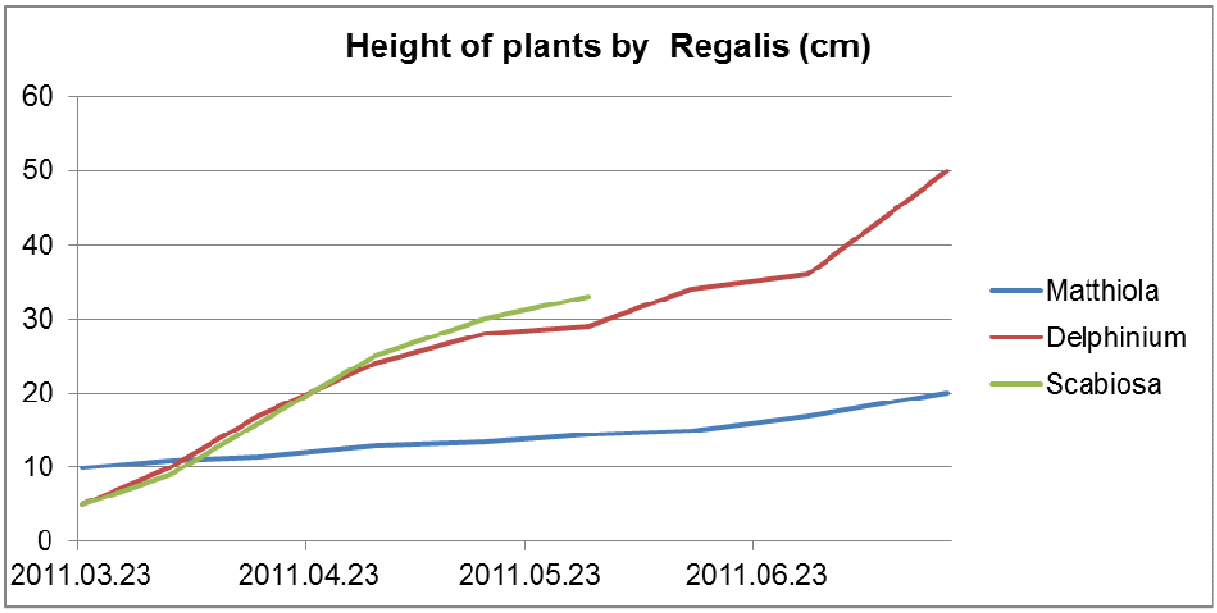

Figure 7: Height of plants by Regalis

4. Summary

During our experiment the effect of CCC, Caramba, Cultar, Regalis and Toprex bioregulators were examined on some annual ornamental species. These are fungicides with retardant side effect. The species used for the experiment were *Coreopsis grandiflora, Godetia grandifolra*, *Scabiosa atropurpurea* and *Matthiola incana.* The aim of this work was to produce marketable, bushy habitat annual plants as flowering potplants with the use of retardants. The experiment was carried out from April to September 2010, plants were treated beweekly.

We found that all the treatments had effect on the plants but the result depended on the species. In the case of *Coreopsis grandiflora* the best dwarfing effect was obtained with Regalis 0,25 % and Caramba at 0,05 % concentration, the maximum shorten rate was 50 %. Int he case of the other examined species intensive retardant effect was observed with the spray of Cultar, Toprex or Caramba. Best results were obtained by the treatment of *Matthiola incana*, all the chemicals resulted compact, bushy, decorative plant habitat.

Regalis and Caramba were the most effective retardants considering the results. The best taxon of the experiment was Matthiola incana. The other taxons were gained good results too however these were not so outstanding than in case of Matthiola incana.

The blooming intervals were shortened in most cases however not to the extent to influence them greatly to be marketable. The number of flowers are increased as well as bushy habit. We observed deformed leaves in most cases.

We can state that the experiment and the used retardants are suitable for further experiments.

These experiments will be continued in the following years involving the the tests to identify vernalization periods of perennials. We continue the experiments with biostimulators too.

In case our experiments would be succesfull and these plants would be cultivated with minimal energy inputs that would open new possibilities in the cultivation of ornamentals for future generations.

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