

**STUDIES REGARDING THE BIOREGULATORS
INFLUENCE OVER THE MORPHOLOGIC AND
ORNAMENTAL CHARACTERS OF
ALLIUM 'PURPLE RAIN'**

**STUDII PRIVIND INFLUENȚA SUBSTANȚELOR BIOREGULATOARE
ASUPRA CARACTERELOR MORFOLOGICE ȘI DECORATIVE LA
ALLIUM 'PURPLE RAIN'**

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Abstract. *The experiment was carried out to study the effect of the bioregulators on the Allium 'Purple Rain' ornamental onion cultivar morphologic and decorative traits. There were used two bioregulators, represented by a growth retardant, Cycocel (CCC), and a growth stimulant, gibberellic acid (GA₃), applied by foliar spraying, in three concentrations (250, 500 and 1000 ppm). The plants were studied during the vegetation season. They were evaluated regarding the main morpho-decorative characters, like leaves length, leaves number/plant, flowering stem height, inflorescence diameter, bulbs weight/plant and bulbs number/plant. The aim of this study was to indentify the product and concentration witch favors the studied characters. The most favorable influence was registered in case of the GA₃ treatment, in the 500 ppm doses for leaves length, flower stem length, inflorescence diameter and bulb yield and CCC, in 500 ppm doses for bulbs number.*

Key words: *Allium 'Purple Rain', bioregulators, morpho - decorative characters*

Rezumat. *Experimentul a fost realizat pentru a studia efectul substanțelor bioregulatoroare asupra caracterelor morfo-decorative la cultivarul de ceapă ornamentală Allium 'Purple Rain'. Substanțele bioregulatoroare utilizate au fost reprezentate de un retardant de creștere, cycocel (CCC), și un stimulator de creștere, acidul giberelic (GA₃). Acestea au fost aplicate prin pulverizare foliară, în trei concentrații (250, 500 și 1000 ppm). Plantele au fost studiate pe durata sezonului de vegetație și au fost evaluate din punct de vedere al caracterelor morfologice și ornamentale: lungimea frunzelor, numărul de frunze, înălțimea tijeii florifere, diametrul inflorescențelor, masa totală și numărul de bulbi/plantă. Scopul lucrării a urmărit identificarea celei mai favorabile substanțe bioregulatoroare și a concentrației aferente, pentru caracterele cultivarului studiat. Tratamentele cu GA₃ 500 ppm au favorizat creșterea în lungime a frunzelor și a tijeii florifere, diametrul inflorescenței și producția de bulbi, iar tratamentele cu CCC 500 ppm au favorizat numărul de bulbi/plantă.*

Cuvinte cheie: *Allium 'Purple Rain', substanțe bioregulatoroare, caractere morfo - decorative*

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INTRODUCTION

The *Allium* genus includes about 750-860 species of perennial, monocots plants. Extensively studied, *Allium* genus is one of the most diverse, including not only plant food and medicinal qualities, but also with ornamental characters (Stearn, 1992; Gregory *et al.*, 1998, cited by Harding, 2004).

The *Alliums* earned in the latest decades, an important economic trait, for the ornamental species which belong to this genus. Many studies from the ornamental plants area shows a very significant increase of the interest on the ornamental species and cultivars of this genus, not only for gardeners but also for florists, due to the colours ranges, shapes and resistance as cut flowers (Harding, 2004; Szot *et al.*, 2009).

The growth regulators substances have a wide practicability in the horticulture area and in particular for the floriculture area. The Cycocel (CCC) and the gibberellic acid (GA₃) are two much studied growth regulators in the last years, due to their effects over the vegetative growing and generative processes (Zheng *et al.*, 2012).

Many studies shown that the exogenous gibberellins, can induce the flowering for lots of long day flowering plants. But outstanding results can be obtained at the *Liliaceae* plant family (Harding, 2004).

Regarding the Cycocel growth retardant, Nidhish *et al.* (2014) shows that the leaves number of plants can be increased at the *Allium* genus (*Allium sativum*), by applying treatments with CCC, in 1000 ppm concentration.

MATERIAL AND METHOD

The experiment was conducted in the period 2014–2016, during two experimental years, in the field of Floriculture discipline, from the University of Agricultural Sciences and Veterinary Medicine of Iasi, Romania.

As biological material, was used the ornamental onion cultivar, *Allium* 'Purple Rain'. This is a cultivar obtained from *Allium* 'Purple Sensation' and *Allium afflatunense*, witch have very decorative deep purple, star shaped flowers, grouped in simple spherical umbels. Its long leaves are grown around the stem base. The stem can grow to 60-80 cm height. Every year, the plants generate new bulbs which can be separated and replanted. The flowering period occur between April and June. The *Allium* 'Purple Rain' bulbs were planted in open field, every year in the autumn, in a well drained loose garden soil. The experiment was organized in randomized blocs design, with three replications. A plot has a surface of 3 m² and it was planted with 30 bulbs. Before planting, the bulbs were disinfected with Kaptan (1%) and Topsin (0,7%) solutions and during the frosty season the plots were mulched with dried vegetal material (straw). The experimental factors were represented by two growth regulators, a growth stimulant (gibberellic acid - GA₃) and a growth retardant (cycocel CCC) in 250, 500 and 1000 ppm concentrations (tab. 1).

The treatments were made by foliar application, in the vegetative growth period, twice per season, repeated at two weeks. Thus, in 2014-2015, the first treatment was made on 24th March and the second on 7th April and in the year 2015-2016, the first treatment was made on 22nd March and the second on 5th April.

Table 1

Experimental variants

Experimental factors	Specification	Variant/Graduations
Control	Untreated	V ₁
Growth Stimulant	Gibberellic Acid - GA ₃	V ₂ - 250 ppm
		V ₃ - 500 ppm
		V ₄ - 1000 ppm
		V ₅ - 250 ppm
Growth Retardant	Cycocel - CCC	V ₆ - 500 ppm
		V ₇ - 1000 ppm

The plants were studied thru the biometric measurements and determinations, regarding the main morpho-decorative characters, like leaves length, leaves number, flower stem height, umbel diameter and new bulbs yield (number/plant and weight/plant). The experimental data was processed using analysis of variance, which established limits of probability for each planting times, compared with the control (untreated variant). The significance of the differences was assessed by taking into account the LSD test (Săulescu and Săulescu, 1967).

RESULTS AND DISCUSSIONS

Even if the ornamental *Alliums* are known to be decorating thru the inflorescences lot of them have very aesthetic foliage, regarding the colour or shape. In the last years, many studies were conducted for establish the influence of the bioregulators over the morphologic and decorative traits of the *Alliums* foliage. Maji *et al.* (2015) highlight the vegetative growing increase (plant height, leaves number, leaves length) by applying GA₃ in different concentrations.

For 'Purple Rain' cultivar, the treatment with GA₃ and CCC had different influences over the foliage. In this article, were studies characters like leaves length and number/plants.

From the results synthesis, the leaves length was increased, as compared with the control (untreated variant), in case of the GA₃ treatments. Regardless the concentration, the differences were very significant positive. But the CCC treated variant, did not registered significant differences as compared with the control (tab. 2). Regarding the leaves number, the differences were not significant, in case of the two bioregulators used. But it can be observed that the plants treated with GA₃ obtained a small increase, as compared with the control (tab. 2).

At the 'Purple Rain' cultivar, the GA₃ treatment determined the flower stem increase proportionally with the concentration, up to 500 ppm (54.23 cm and 55.03 cm), the differences being very significant positive, as compared with the control (49.57 cm). At 1000 ppm concentration, they decrease slowly (53.00 cm), with a distinct positive difference (tab. 3).

Table 2

The bioregulators influence of over the *Allium`Purple Rain`* foliage characters

Variant	Leaves length (cm)	±d (cm)	Leaves number/plant	±d (no.)
V ₁ –control	44.53	-	5.40	-
V ₂ – GA ₃ 250 ppm	50.17 ^{***}	5,63	5.57 ^{ns}	0,17
V ₃ – GA ₃ 500 ppm	52.50 ^{***}	7,97	5.93 ^{ns}	0,53
V ₄ –GA ₃ 1000 ppm	51.17 ^{***}	6,63	5.77 ^{ns}	0,37
V ₅ –CCC 250 ppm	45.00 ^{ns}	0,47	5.30 ^{ns}	-0,01
V ₆ –CCC 500 ppm	44.00 ^{ns}	-0,53	5.23 ^{ns}	-0,17
V ₇ –CCC 1000 ppm	43.80 ^{ns}	-0,73	5.17 ^{ns}	-0,23
	LSD 5%	1.29		0.74
	LSD 1%	1.81		1.03
	LSD 0.1%	2.56		1.76

Table 3

The bioregulators influence over the *Allium`Purple Rain`* flower stems and inflorescences

Variant	Flower stem length (cm)	±d (cm)	Inflorescence diameter (cm)	±d (cm)
V ₁ –control	49.57	-	23.00	-
V ₂ – GA ₃ 250 ppm	54.23 ^{***}	4,67	24.67 ^{**}	1,67
V ₃ – GA ₃ 500 ppm	55.03 ^{***}	5,47	25.67 ^{***}	2,67
V ₄ –GA ₃ 1000 ppm	53.00 ^{**}	3,43	25.50 ^{***}	2,50
V ₅ –CCC 250 ppm	50.00 ^{ns}	0,43	23.10 ^{ns}	0,10
V ₆ –CCC 500 ppm	49.80 ^{ns}	0,23	22.67 ^{ns}	-0,33
V ₇ –CCC 1000 ppm	48.63 ^{ns}	-0,93	22.33 ^{ns}	-0,67
	LSD 5%	0.74		1.16
	LSD 1%	1.03		1.63
	LSD 0.1%	1.46		2.29

The CCC treatments did not influence the stem length, the differences being statistically insignificant.

With respect at the inflorescence diameter, the increases follow the same trend as the flower stem length. The diameter increase was more favored more by the gibberellic acid, particularly in 500 and 1000 ppm concentrations, which have determined increases with 10.9-11.9% against the control, the differences being very significant. Positive effect has been noticed also at the low doses (250 ppm), but more reduced (with 7.2% above the untreated variant).

The plants treated with CCC had the tendency of reduction the inflorescence diameter, excepting the lowest dose (250 ppm), which led to increase with 0.4% toward the control (untreated variant), but the differences were statistically insignificant.

Regarding the bulb yield, Pogroszevska *et al.* (2007) discovered that the GA₃ treatment increased the new bulbs number at *Allium moly*.

The bulbs weight/plant ranged from 140.7 g (CCC 1000 ppm) up to 190.3 g (GA₃ 500 ppm). The only type of treatment which led to a significant difference was GA₃ 500 ppm (tab. 4).

The bulbs number/plant was influenced different by the treatments. The plant had positive answer for the both treatments. In case of GA₃, the most favorable result was registered at 500 ppm dose, were the plants formed 12.33 bulbs/plant, the difference being very significant positive.

Table 4

The bioregulators influence over the *Allium* 'Purple Rain' bulbs yield

Variant	Bulbs weight/plant (g)	±d (g)	Bulbs number/plant	±d (no.)
V ₁ –control	154.30	-	8.17	-
V ₂ – GA ₃ 250 ppm	166.17 ^{ns}	12,13	10.90*	2,17
V ₃ – GA ₃ 500 ppm	190.33***	36,30	12.33***	4,17
V ₄ –GA ₃ 1000 ppm	162.67 ^{ns}	8,63	9.00 ^{ns}	0,83
V ₅ –CCC 250 ppm	155.67 ^{ns}	1,63	10.73*	2,57
V ₆ –CCC 500 ppm	164.67 ^{ns}	10,63	12.83***	4,67
V ₇ –CCC 1000 ppm	140.70 ^{ns}	-13,27	8.20 ^{ns}	0,03
	LSD 5%	15.35		2.03
	LSD 1%	21.56		2.86
	LSD 0,1%	30.41		4.03

In case of CCC treatments, the highest number of bulbs were obtained at the 500 ppm dose, too (12.83 bulbs/plant) and the difference was very significant positive (tab. 4).

CONCLUSIONS

1. The bioregulators have different influences over the morphologic and decorative traits at the ornamental onion 'Purple Rain' cultivar.

2. The GA₃ treatments have positive influence regarding the leaves length, the flower stem length inflorescence diameter and bulbs yield like number and weight/plant.

3. The CCC treatments lead to favorable results only regarding the bulbs number/plant. Excepting this character, it has insignificant influences over the morpho-decorative characters of 'Purple Rain' cultivar.

4. Based on the results obtained in this study, it can be recommended for the 'Purple Rain' cultivar, the GA₃ application, in 500 ppm, for decorative traits improvement and CCC in 500 ppm doses for the bulbs number improvement.

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