Influence of the Mother Bulb Size on the Growth and Development of *Allium* 'Purple Rain'

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Abstract

The experiment aim was to study the influences of the mother bulb weight on the growth and development, of the plants of ornamental onion. The study was conducted during October 2015 – June 2016 and the biologic material was represented by *Allium* 'Purple Rain'. The bulbs were divided in three different weight groups: W_1 (15.1-30 g), W_2 (5.1-15 g), W_3 (< 5 g), which represented the three variants (V_1 , V_2 , respectively V_3). The bulbs were planted in the field and the plants were studied thru biometric determinations. The results were compared with the average of the experiment. The research showed that the analyzed characters (number and length of leaves, number and weight of new formed bulbs, flowers yield, diameter of the inflorescence) were decreasing from V_1 to V_3 variant. The highest number of the flowering plants (98.9 %) resulted from V_1 variant. From V_2 , bloomed only 20% of the bulbs and from V_3 the bulbs have not flourished. The first flowers were obtained from the plants resulted from the biggest bulbs (V_1), while the plants from V_2 flourished with around 3 days later and the plants from V_3 flourished with around 7 days later. The capacity to form new bulbs, expressed in bulb number or bulb weight per plant, was increased with the increasing of the mother bulb weight. The number of leaves per plant and the length of the leaves were higher for V_1 , compared the other two variants.

Keywords: *Allium*, bulb weight, plant development

INTRODUCTION

Allium is one of the biggest, various, popular and wide-spread plant gender in the world. For a long time the *Alliums* were known mostly as vegetables but in the last decades the *Allium* ornamental species became more and more popular like garden plant (Fritsch and Friesen, 2002). Their plants have a very long decorative period, from spring to late summer or even fall, offering various species and cultivars. Because of the high resistance to environmental conditions and so various color range, the interest for the *Allium* cut flowers have been increased in last period (Szot *et al.*, 2009).

In the present, from a commercial point of view, there is a great interest for the ornamental *Allium* species and cultivars, in the flower markets all over the world. From the first *Alliums*, cultivated like ornamental, it can be counted *A. giganteum*, *A. moly*, *A. sphaerocephalon* (Davies, 1992; Harding, 2004; Kamenetsky and Fritsch, 2002).

Davies (1992), talks about very few buffs of ornamental *Alliums*, that has not a good reputation for such a great and various plant gender. Thus it became very needful to carry out in the establishment of a cultivation technology, adapted to wide areas, where these plants can be grown.

In Romania there are wildly growing many *Allium* species with important ornamental qualities (*A. paniculatum* L., *A. ursinum* L., *A. saxatile* M. Bieb., *A. atrovioleaceum* Boiss), some of them are already presents in the ornamental plants catalogs of the great markets.

Regarding these valuable species, in the last years, various studies have been conducted, in Romania. Draghia *et al.* (2010) carried out researches on some species of wild flora from the north-east of Romania, including *Allium ursinum* L., in order to assess the adaptation capability and the possibility of introducing them in culture as ornamentals. Mitroi (2012), conducted a study in order to evaluate the variability of decorative morphological characters

of *Allium atrovioleaceum*, species from the Romanian wild flora. Zaharia (2014) emphasizes the possibility of cultivating *Allium paniculatum* L. species and its technological scheme.

Concerning the adaptability of some ornamental *Allium* species from the wild flora, it is very important to improve and establish the growing schemes for these plants, in the Romanian area. Regarding the growing technology, very important is the quality of the planting material. So, the aim of this study is to evaluate the importance of the bulb weight, for the plant growth and ornamental characters development, for the *Allium* 'Purple Rain' cultivar, obtained from the famous *Allium hollandicum* (Frish, 2015). The importance of the bulb size was shown by various studies. Mosleh (2008), shown that the mother bulb size of edible onions, can increase the bulbs and seeds yield and Laskowska *et al.* (2013) shown that the size of *Allium moly* bulbs increased the flowers quality and the bulbs yield.

MATERIALS AND METHODS

The experiment was conducted in the experimental field of Floriculture discipline, from University of Agricultural Sciences and Veterinary Medicine of Iași, Romania, in the period October 2015 - July 2016. The soil properties of the top 250 mm were determined just before planting. Analytical results indicated: pH 7.8, humus content 4.2%, 3% carbonates, 29.5% cation exchange capacity, 1.08 me/100g complex Na. Values of elements registered were: 0.22 total N, 246 ppm accessible P and 429 ppm accessible K. Zinc, copper, boron, mangan were 15 ppm, 5.0 ppm, 0.32 ppm and 51 ppm respectively.

The material was represented by a cultivar of ornamental onion *Allium* 'Purple Rain' whose bulbs were planted in field (outside). This is decorative thru its deep purple, star shaped flowers, grouped in simple spherical umbels. The leaves are wide, grown around the stem base. The stem can grow to about 60-80 cm height. The plants form every year new bulbs, which can be separated and replanted. This ornamental onion, blossoms between April and June (Fig. 1).

The bulbs were divided in three weight groups (Tab. 1) and before planting, they were disinfected in Kaptan (1%) and Topsin (0.7%) solutions.

The bulbs were planted in 20 October 2015 and during the frosty season the plots were

mulched with hay and straw. The experiment was organized in randomized blocks design, with three replications. A plot has a surface of 3.00 m² and it was planted with 30 bulbs. Observations and determinations were made by measurements on the main morpho-decorative characteristics of A. 'Purple Rain' cultivar (number of leaves, leaves length, inflorescence diameter, number of flowering plants, number of bulbs per plant and bulbs weight per plant). To obtain the number of bulbs per plant and bulbs weight, the bulbs were harvested, cleaned up, weighed and counted.

The experimental data was processed using analysis of variance, which established limits of probability for each weight group of bulbs, compared with the control (average of experiment for each character). The significance of the differences was assessed by taking into account the LSD test (Săulescu and Săulescu, 1967).

RESULTS AND DISCUSSION

The biometric measurements and the analysed data, shown that the number of leaves was considerably higher at the plants obtained from the W₁ bulbs group (15.1-30 g), respectively V₁, and the differences toward the control (average of the experiment) were distinctly significant positive, with a difference of 1.19 leaves more than the control (Tab. 2). The V₂ (5.1 - 15 g) registered an average value very close to the control, being not statistically insured. The plants from V₃ formed a lower number of leaves (4.42) and the difference toward the control was distinctly significant negative (Tab. 2).

The length of leaves was also different between the variants, thus from the V₁ the plants developed 55.07 cm long leaves, with 10.52 cm more than the control (the experience average), being statistically insured. From the W₂ bulbs group (V₂), the plants reached 44.11 cm long leaves, less than variant V₁ but not statistically insured because of the closeness to the control. The plants of V₃ variant were noted with the shortest leaves (34.48 cm), with a difference of 10.07 cm toward the control, registering significant differences lower than the average experience (control) (Tab. 3).

The same decrease trend from the V₁ to V₃ was observed also concerning new formed bulbs, studied individually for each plant from the three weight groups. At the V₁ variant, the new bulbs obtained from every plant have an average

Fig. 1. *Allium* 'Purple Rain' – general aspect (original photo)

Tab. 1. Experimental variants (weight groups)

Weight groups	Variants	Specification/Graduations
W_1	V_1	15.1-30 g
W_2	V_2	5.1-15 g
W_3	V_3	<5 g

weight of 135.74 g, that was a positive distinctly significant result, compared with the control. From the V_2 , every plant developed 86.97 g of new bulbs, not statistically insured but better than V_3 , where were obtained 43.60 g bulbs/plants, which ensures negative distinct significant differences (Tab. 4).

The daughter bulbs number per plant, also oscillated between the variants. The most valuable result was registered by the plants from the W_1 group (V_1 variant), 6.33 bulbs per plant, with 29.7% more than the experiment average and positive significant differences. From the other two weight groups, the results were not statistically insured, their values being close to those of the control (Tab.5).

The period of blooming, capacity blooming (total number of inflorescences/variant) and the inflorescences size (diameter) are very important characters regarding the decorative effect of *Allium*.

The *Allium* 'Purple Rain' cultivar, in the year 2016, blossomed between April 20 and May 1. Analyzing the data on earliness of flowering, it has been observed that the earliest are the plants resulted from the biggest bulbs (V_1), with around

3 days earlier than V_2 and 7 days earlier than V_3 (fig. 2).

The different mother bulb weight, between the variants, influenced also the anthesis process, like inflorescence development, in this case diameter (cm) and number of flowering plants. The flowering capacity is the most important character that can establish the quality of the ornamental plants and becomes the most important propose in the process of the cultivation technology establishment.

The number of flowering plants, calculated from the total plants per variant, was considerably different between the variants. In the first group (V_1), 29.67 of the plants (98.9%) formed flowers and the difference compared to the control was very significant positive (17.67 flowers) (Tab. 6). In the second group (V_2), only 20% of the plants formed flowers, and the result was negative distinct significant. From the third weight group, only 1.1% plants formed flowers, but it could not get to the maturity. The result in this case, was very significant negative.

The collected data shown that, the mother bulb weight influenced the inflorescence diameter, expressed in centimetres, more for the V_1 , were the

Tab. 2. The influence of the bulb weight on the number of leaves

Variants	Number of leaves/plant		d (±)	Significance of differences
	Absolute value	Relative value (%)		
V ₁	6.64	121.7	1.19	**
V ₂	5.31	97.3	-0.15	ns
V ₃	4.42	81.0	-1.04	oo
Average (control)	5.45	100.0	-	-

LSD 5% = 0.59

LSD 1% = 0.97

LSD 0,1% = 1.82

Tab. 3. The influence of the bulb weight on the leaves length

Variants	Leaves length (cm)		d (± cm)	Significance of differences
	Absolute value (cm)	Relative value (%)		
V ₁	55.07	123.6	10.52	*
V ₂	44.11	99.0	-0.45	ns
V ₃	34.48	77.4	-10.07	o
Average (control)	44.55	100.0	-	-

LSD 5% = 6.77

LSD 1% = 11.20

LSD 0,1% = 20.96

Tab. 4. The influence of the mother bulb weight on the weight of new bulbs formed/plant

Variants	Bulb weight (g)		d (± g)	Significance of differences
	Absolute value (g)	Relative value (%)		
V ₁	135.74	152.9	46.97	**
V ₂	86.97	98.0	-1.80	ns
V ₃	43.60	49.1	-45.17	oo
Average (control)	88.77	100.0	-	-

LSD 5% = 16.18

LSD 1% = 26.78

LSD 0,1% = 50.12

spherical umbels achieved, 22.73 cm in diameter, very significantly positive differences compared to the control.

The quality of the flowers depends not only on the uniformity of flowering, but also, on the development of the flowers and inflorescences. In this sense, beside of the flowers yield, the inflorescence diameter, at the maturity of flowers, was studied. This character was observed only at the flowering plants (Tab. 7).

The plants of V₂ variant have formed umbels with 18.57 cm in diameter (lower than control 11.1%) and the result was significantly negative.

Regarding the third variant (V₃), the diameter value was 0, because the flower formed in this variant did not reached the maturity and died at the bud stage (Tab. 7).

Similar influences regarding the mother bulb size on the flowering earliness, flowering plants number, inflorescence diameter and new bulbs yield were described by Laskovska *et al.* (2013), at the *Allium moly* L. cultivar.

CONCLUSIONS

The mother bulb weight of ornamental onion (*Allium* 'Purple Rain') influences the plant growth

Tab. 5. The influence of the mother bulb weight on the number of new bulbs formed/plant

Variants	Number bulbs/plant		d (±)	Significance of differences
	Absolute value	Relative value (%)		
V ₁	6.33	129.7	1.45	*
V ₂	4.55	93.3	-0.33	ns
V ₃	3.75	76.9	-1.13	ns
Average (control)	4.88	100.0	-	-

LSD 5% = 1.21
 LSD 1% = 2.01
 LSD 0,1% = 3.76

Fig. 2. Duration (number of days) from planting to flowering**Tab. 6.** The influence of the weight bulb on the inflorescences number

Variants	Inflorescences (total number)		d (±)	Significance of differences
	Absolute value	Relative value (%)		
V ₁	29.67	247.2	17.67	***
V ₂	6.00	50.0	-6.00	oo
V ₃	0.33	2.8	-11.67	ooo
Average (control)	12.0	100.0	-	-

LSD 5% = 2.93
 LSD 1% = 4.85
 LSD 0,1% = 9.08

Tab. 7. The influence of the bulb weight on the inflorescence diameter

Variants	Inflorescences diameter (cm)		d (± cm)	Significance of differences
	Absolute value	Relative value (%)		
V ₁	22.73	165.1	8.97	***
V ₂	18.57	134.9	4.80	***
V ₃	0.0	0.0	-13.77	ooo
Average (control)	13.77	100.0	-	-

LSD 5% = 0.85
 LSD 1% = 1.41
 LSD 0,1% = 2.65

and development. In case of all the analyzed characters (number and length of leaves, number and weight of new bulbs formed, flowers yield, diameter of the inflorescence) the best results were obtained at the variant V₁ from which

were used the biggest bulbs (W₁ group) and the decreasing trend of the results was from V₁ to V₃. Compared with the average of the experiment (control), at variants V₁ and V₃ were registered positive, respectively negative differences, both

in the number of leaves (distinct differences) and leaves length (significant differences). The V_2 variant registered insignificant differences. The number of flowering plants, was 29.67 for V_1 (very significant positive differences), 6.00 for V_2 (distinct significant positive differences) and 0.33 in case of V_3 (very significant negative differences); the inflorescences diameter, was 22.73 for V_1 and 18.57 for V_2 variants. Regarding the bulbs yield, in V_1 the number of bulbs/plants was 6.33, 4.55 in V_2 and 3.75 in V_3 , (differences statistically assured only in V_1). The weight of new bulbs was 135.74 g for V_1 , 86.97 g for V_2 and 43.60 g for V_3 . To obtain plants of *Allium* 'Purple Rain' with high decorative value, the results can recommend using big bulbs, weighing more than 15 g.

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