Original scientific paper
10.7251/AGSY1404145D

EXAMINATION OF SEEDLINGS QUALITY OF *PELARGONIUM X HORTORUM L. H. BAIL.* TREATED WITH DIFFERENT FERTILIZERS

Margarita DAVITKOVSKA*, Gordana POPSIMONOVA, Rukie AGIC, Zvezda BOGEVSKA, Igor ILJOVSKI

Faculty of Agricultural Sciences and Food - Skopje, Republic of Macedonia
*Corresponding author: dmarge77@yahoo.com

Abstract

In order to determine the quality of the seedlings of *Pelargonium x hortorum L. H. Bail. hybrid "Ringo 2000 deep scarlet"* examinations were conducted with several crystal fertilizers, including different contains and concentration.
Easily soluble fertilizers were used in the following composition: NPK 9-10-34+M.E.; NPK 14-7-28+5CaO+M.E. and NPK 14-10-26+3MgO+M.E. The plants of the control variant were irrigated with plain water.
The following biometric parameters were examined: mass of stem, mass of root, number of branches, number of leaves and number of inflorescences.
The research period was three years, from 2010 to 2012. The obtained results were statistically processed with the method of analysis of variance and test with LSD test.
According to results of all examined biometrical parameters, it was determined that the nutrition with the crystal fertilizer NPK 9-10-34+M.E. and the crystal fertilizer NPK 14-10-26+3MgO+M.E., both with dose of 1.6 g/l solution and with dose increased to 3.2 g/l solution when the roots are in fool growth, have shown best results.
The highest stem mass for about 83% in comparison with control variant, has the plants fertilized with NPK 9-10-34+M.E. and NPK 14-10-26+3MgO+M.E.. The highest root mass for about 105% in comparison with control variant, has the plants fertilized with NPK 9-10-34+M.E. The highest number of branches (141%), number of leaves (61%) and number of inflorescence (25%), in comparison with control variant, has the plants fertilized with NPK 14-10-26+3MgO+M.E.

Keywords: *Pelargonium x hortorum L. H. Bail., seedling, fertilizer, biometric parameters*

Introduction

Species of the genus *Pelargonium* are perennial plants, with a height of 50 cm and higher. They are often grown as annual plants. Pelargonium is flower that is mass-produced and it is required on the market. It features a long blooming during the whole summer, until the appearance of autumn frost.
Pelargonium which are used for commercial purposes, are used to form the flower beds and as pot cultures. This flower species are important because it is combined very well with a variety of seasonal flowers such as begonias, ageratum, lobelia, verbena, petunias, etc. (Vujosević et al., 2009).
Pelargonium are neutral cultures and the initiation of the formation of flowers depends on the total received light energy (intensity x duration) at appropriate temperature (Langton and Runger, 1985). They are produced on substrates that are well drained and rich in nutrients. Many problems of rotting of the root are associated with the excess water, low oxygen, improper humidity and excess of accumulated soluble salts (Dole and Wilkins, 1999). According to Hammer (1991) and Bethke (1993), the optimal pH for the substrate of "zonal"

geraniums should range from 5.6 to 6.0. This is of particular significance because of the availability of the elements and the needs of the plants of certain elements.
Geraniums have a great need for magnesium and calcium. Therefore, the regime of nutrition is based on a combination of KNO_3 and Ca $(NO_3)_2$ (Dole and Wilkins, 1999). The purpose of this research is to examine the impact of different types of fertilizers on the quality of seedlings of floral species Pelargonium hortorum LH Bail and to determine the most appropriate composition and concentration of fertilizer in the seedling production of Pelargonium hortorum LH Bail.

Materials and Methods

The examinations were made in the years 2010, 2011 and 2012, in the farm "Flower-Garden" in the village Vladevci, Strumica, Republic of Macedonia. As examination material was used Pelargonium x hortorum L. H. Bail., Hybrid "Ringo 2000 deep scarlet", commercial substrate that is primarily used to produce seedlings of flowering and vegetable crops and easily soluble crystalline fertilizers with composition of: NPK 9-10-34 + M.E.; NPK 14-7-28 +5 CaO + M.E. and NPK 14-10-26 +3 MgO + M.E. The seedlings of Pelargonium x hortorum L. H. Bail. were obtained from the Dutch company Syngenta. It was produced from seed and for the research was used seedling with formed cotyledons leaves. Transplanting was made immediately after the purchase of seedlings, in the traditional way. Each plant was individually removed from the cells and transplanted in pots with diameter of 9.5 cm. The flowerpots were previously filled with a substrate with trade name Tref. Immediately after the transplanting irrigation was made with 155 ml water in each pot.
The nutrition of the seedlings of Pelargonium x hortorum LH Bail. was initiated when the first two to three true leaves appeared. The nutrition was performed once a week. Each plant from the control variant was irrigated only with 80 ml pure water. Variants are shown in Table 1.

Table 1. Variants regime using easy soluble fertilizers

Variant	Fertilizer
I	Without fertilizer ∅
II	Crystal NPK 9-10-34+M.E.
III	Crystal NPK 14-7-28+5CaO+M.E.
IV	Crystal NPK 14-10-26+3MgO+M.E.

By the first two feedings, the variants were fertilized with dose of 1.6 g / l solution. The dose of fertilizer was doubled (3.2 g / l solution) in all variants after the second fertilization, i.e. in the phase of full rooted seedlings. The double dose was based on the increased vegetative mass and consequently the increased need for nutrients. With a double dose the variants were fed six times.
Seedlings ware produced at optimum conditions necessary for the production and standard measures of care were applied: watering, ventilation, protection from diseases and pests. After 70 days from the transplantation in pots, with method of random selection, 30 plants of each variety were measured. For determining the quality of seedlings, the following biometric parameters were examined: mass of stem, mass of root, number of branches, number of leaves and number of inflorescence.
The received results were processed by variant, statistically according to the method of analysis of variance and test with LSD (Least Significant Difference) test.

Results and Discussion

The highest average value for the mass of stem (12.54 g) was obtained in the plants fertilized with crystalline fertilizer NPK 14-10-26 +3 MgO + ME. These plants also had the most homogenous mass of stem (CV 14.9%). Furthermore, the plants fertilized with crystalline

fertilizer NPK 9-10-34 + ME showed good results with an average value of the mass of the steam of 12.52 g, which is only about 0.02 g (0.2%) lower value in comparison with variant 4. Lowest average value for the mass of stem (6.85 g) was obtained in the control variant and these plants had the most heterogeneous mass (CV 25.53%). The mass of stems that were obtained by applying different crystalline fertilizers showed significant statistical difference compared with the mass of the plant stems from the control variant. Among the variants which were fertilized there was no statistically significant difference (Table 2.).

Table 2. Mass of stem (g)

Variation / fertilizer	**Arithmetic mean**	**Standard error**	**Standard deviation**	**Coefficient of variation**	**Interval of variation**	**Comparison with Var. 1**	**Comparison with Var. 2**	**Comparison with Var. 3**	**Comparison with Var. 4**
1. Without fertilizer ∅	6.85	0.18	1.75	25.53	3.7-11.7	Ø	-5.68	-3.89	-5.69
2. Crystal NPK 9-10-34+M.E.	12.52	0.27	2.61	20.82	8.2-18.1	5.68	Var. 2	1.78	-0.02
3. Crystal NPK 14-7-28+5CaO +M.E.	10.74	0.23	2.15	19.97	7.1-15.8	3.89	-1.78	Var. 3	-1.80
4. Crystal NPK 14-10-26+3MgO +M.E.	12.54	0.2	1.87	14.9	6.6-15.5	5.69	0.02	1.80	Var. 4

LSD 0.05 = 2.22
LSD 0.01 = 3.08

The average mass of root ranges from 1.06 g in the plants from the control variant to 2.17 g in the plants fertilized with crystalline fertilizer NPK 9-10-34 + M.E.. Plants fertilized with crystalline fertilizer NPK 14-10-26 +3 MgO + M.E. showed similar results with the plants of variant 2, with an average value of the root mass of 2.13 g. Plants in all variants showed homogeneity in terms of the root mass (CV <30%). According to the value of the LSD test, the mass of roots in variants 2, 3 and 4 compared to the control variant had statistically significant difference at a level of 0.01. Among the variants that were fertilized there was no statistically significant difference (Table 3.).

Table 3. Mass of roots (g)

Variation / fertilizer	**Arithmetic mean**	**Standard error**	**Standard deviation**	**Coefficient of variation**	**Interval of variation**	**Comparison with Var. 1**	**Comparison with Var. 2**	**Comparison with Var. 3**	**Comparison with Var. 4**
1. Without fertilizer ∅	1.06	0.02	0.23	21.5	0.5-1.5	Ø	-1.11	-0.89	-1.07
2. Crystal NPK 9-10-34+M.E.	2.17	0.06	0.53	24.21	1.3-3.8	1.11	Var. 2	0.22	0.04
3. Crystal NPK 14-7-28+5CaO +M.E.	1.95	0.04	0.36	18.36	1.95	0.89	-0.22	Var. 3	-0.18
4. Crystal NPK 14-10-26+3MgO +M.E.	2.13	0.04	0.35	16.43	1.4-3	1.07	-0.04	0.18	Var. 4

LSD 0.05 = 0.35
LSD 0.01 = 0.49

The number of branches was largest in the plants fertilized with crystalline fertilizer NPK 14-10-26 +3 MgO + ME. They had the highest homogeneity (21.21 %) for the number of branches. The lowest number of branches had plants of control variant, averaged 2.2 branches. These plants are most heterogeneous (CV 30.75%).
Plants that were fertilized with different crystalline fertilizers showed significant statistical difference in the number of branches compared with plants of control variant. Among the variants that were fertilized there was no statistically significant difference (Table 4.).

Table 4. Number of branches

Variation / fertilizer	**Arithmetic mean**	**Standard error**	**Standard deviation**	**Coefficient of variation**	**Interval of variation**	**Comparison with Var. 1**	**Comparison with Var. 2**	**Comparison with Var. 3**	**Comparison with Var. 4**
1. Without fertilizer ∅	2.2	0.07	0.68	30.75	1-3	Ø	-2.83	-2.31	-3.12
2. Crystal NPK 9-10-34+M.E.	5.1	0.12	1.17	23.23	3-7	2.83	Var. 2	0.52	-0.29
3. Crystal NPK 14-7-28+5CaO +M.E.	4.5	0.1	0.96	21.23	3-7	2.31	-0.52	Var. 3	-0.81
4. Crystal NPK 14-10-26+3MgO +M.E.	5.3	0.12	1.13	21.21	3-8	3.12	0.29	0.81	Var. 4

LSD 0.05 = 0.61
LSD 0.01 = 0.85

The number of leaves per plant ranged from 14 to 57. With using of the crystalline fertilizer NPK 14-10-26 +3 MgO + ME in average largest number of leaves (38 leaves) was acquired, while the lowest average number of leaves had the plants from the control variant. For this parameter, the values of all variants were homogeneous (CV <30). The number of leaves in variants 2, 3 and 4 compared to the control variant, according to the value of the LSD test, had statistically significant difference at a level of 0.01. There was statistically significant difference between variant 3 and variant 4 at the level of 0.05 and between other fertilized variants there was no statistically significant difference (Table 5.).

Table 5. Number of leaves

Variation / fertilizer	Arithmetic mean	Standard error	Standard deviation	Coefficient of variation	Interval of variation	Comparison with Var. 1	Comparison with Var. 2	Comparison with Var. 3	Comparison with Var. 4
1. Without fertilizer ∅	23.6	0.49	4.60	19.53	14-35	Ø	-12.80	-11.51	-14.40
2. Crystal NPK 9-10-34+M.E.	36.4	0.44	4.21	11.59	27-45	12.80	Var. 2	1.29	-1.60
3. Crystal NPK 14-7-28+5CaO +M.E.	35.1	0.48	4.54	12.93	26-47	11.51	-1.29	Var. 3	-2.89
4. Crystal NPK 14-10-26+3MgO +M.E.	38	0.58	5.49	14.46	28-57	14.40	1.60	2.89	Var. 4

LSD 0.05 = 2.83
LSD 0.01 = 3.93

The number of inflorescences per plant ranged from 1 to 3. The highest average number of inflorescences (2.1) was obtained in plants that were fertilized with crystalline fertilizer NPK 9-10-34 + ME and NPK 14-10-26 +3 MgO + M.E. Plants fertilized with crystalline fertilizer NPK 14-7-28 +5 CaO + ME gave approximately the same results with previous ones, with an average value of 2 inflorescences. Plants from the control variant had the lowest values, with an average value of 1.7 inflorescences. These plants were most heterogeneous regarding the parameter (CV 26.64%). The number of inflorescences in plants fertilized with crystalline fertilizers showed significant statistical difference compared with the number of inflorescences from plants of the control variant. Among the variants that were fertilized there was no statistically significant difference in terms of the number of inflorescences.

Table 6. Number of inflorescences

Variation / fertilizer	Arithmetic mean	Standard error	Standard deviation	Coefficient of variation	Interval of variation	Comparison with Var. 1	Comparison with Var. 2	Comparison with Var. 3	Comparison with Var. 4
1. Without fertilizer ∅	1.7	0.05	0.46	26.64	1-2	Ø	-0.38	-0.30	-0.43
2. Crystal NPK 9-10-34+M.E.	2.1	0.04	0.39	18.5	1-3	0.38	Var. 2	0.08	-0.06
3. Crystal NPK 14-7-28+5CaO +M.E.	2	0.03	0.28	13.93	1-3	0.30	-0.08	Var. 3	-0.13
4. Crystal NPK 14-10-26+3MgO +M.E.	2.1	0.04	0.38	17.91	1-3	0.43	0.06	0.13	Var. 4

LSD 0.05 = 0.18 LSD 0.01 = 0.25

Conclusion

The analysis of the biometric parameters, by which the quality of seedlings of Pelargonium hortorum LH Bail. was determined, showed that the best results for mass of stem, number of

branches and number of leaves were acquired by fertilized plants with crystalline fertilizer NPK 14-10-26 +3 MgO + M.E.. The best results for the mass of root showed fertilized plants with crystalline fertilizer NPK 9-10-34 + M.E. Most of numbers of inflorescences were obtained in plants fertilized with crystalline fertilizer NPK 9-10-34 + ME and NPK 14-10-26 +3 MgO + M.E.

The analysis of the parameters which determines the quality of seedlings which are fertilized with different crystalline fertilizer, showed that the quality of seedlings depends on the type of fertilizer used to produce seedlings. Quality seedlings can be obtained only by the application of appropriate fertilizers and application of appropriate technology for production of certain plant species.

References

Bethke C.L. (1993). Growing Media, pp. 3-23. In: Geraniums IV, 4th edition, White. J.W. editor. Ball Publishing, Geneva, Illinois.

Dole M. J., Wilkins H. F. (1999). Floriculture, Principles and Species, Prentice-Hall, Upper Saddle River, N.Y.

Hammer P.A. (1991). Nutrition, pp. 18-21. In: Tips on Growing Zonal Geraniums, 2nd edition, Tayama, H.K. and Roll, T.J. editors. Ohio Cooperative Extension Service, Ohio State University, Columbus, Ohio.

Langton F.A., Runger W. (1985). Pelargonium, pp. 9-21. In: Handbook of Flowering, vol. IV, Halevy, A.H., editor. CRC Press, Boca Raton, Florida.

Vujošević A., Lakić N., Beatović D. (2009). The influence of slow disintegrating fertilizers dosages on quality of pelargonium (Pelargonium hortorum) seedlings. Proceeding, Agroeconomic XXIII counselling agronomists, veterinarians and technologistVol.15, No. 1-2, Institute PKB, Serbia, 157-169.