The effectiveness of the use of Aminozol and Lebozol on the yield of winter garlic

Marina Dyikanova*, *Michael* Vorobyev, *Vera* Terekhova, *Maria* Bocharova, and *Varvara* Bogdanova

Russian State Agrarian University - Moscow Agricultural Academy named after K.A. Timiryazev, 49, st. Timiryazevskaya, Moscow, 127434, Russia

Abstract. This article discusses the results of an experiment to grow hardneck garlic in the Moscow region. The study used Russian hardneck garlic varieties of Odintsovsky Jubilee and Streletz and found that they had high flavor qualities and were recommended for cultivation in the non-black soil zone of Russia. The experiments were conducted in 2021-2022 at the «Horticulture and vegetable growing» of Gardening and Horticulture named after V.I. Edelstein. The results showed that the double application of organic fertilizer of Aminozol and Lebozol-Full Care during the vegetative period led to an increase in yield for all tested varieties. On the Odintsovsky Jubilee variety, the organic fertilizer Aminozol had a positive effect on increasing the average mass of bulbs by 26.9% compared to the control and 13% compared to the treatment with Lebozol-Full Care. The study also noted an increase in the average mass of bulbs due to the mass of each clove. The variety Streltets when treated with Aminozol and Lebozol-Full Care fertilizers increased the mass of the bulb by 17.7% and 10.9% compared to the control. Research has established a positive effect of organic Aminozol Lebozol - Full Care fertilizers on the productivity and yield of winter garlic.

1 Introduction

Every year, Russia imports 51 to 59 thousand tons of garlic, with the exception of 2020 (during the peak of the coronavirus pandemic), when imports exceeded 70 thousand tons. Afterwards, the Figure decreased to the average values of 2018-2019. China is the main supplier of garlic to Russia, and in recent years, imports from Iran have increased significantly. On average, Russia's self-sufficiency in garlic in the period from 2017 to 2022 was 19.1%, with the highest level recorded in 2019 at 25.6%. Retail prices in Russia in the first period of 2022 reached an average of 374.3 rubles per kg, which is the highest value in the last 5 years with an increase of 42.6%. However, in October, the price dropped by 30-40%. To reduce the dependence on garlic imports from other countries, it is necessary to develop seed farming, increase areas, and use agricultural practices that contribute to increasing yields, while at the same time, in recent years there has been increased attention to environmentally safe products, which are in high demand [1,2].

* Corresponding author: dyikanova@rgau-msha.ru

Garlic is one of the demanding vegetable crops in terms of soil fertility and groundwater level. Organic and complex fertilizers can provide garlic plants with nutritious elements in the first period of vegetation and increase the plants' resistance to stress factors. In our research, we used Aminozol and Lebozol-Full Care fertilizer, released by the Leyminer company in 1985, as organic fertilizers. Currently, these fertilizers are in high demand in Europe in all areas of agriculture. Aminozol is an organic fertilizer for foliar feeding, containing mineral substances (sodium, magnesium, calcium, etc.), microelements (iron, manganese, copper), and raw materials that are ideal for plant feeding. The fertilizer is a water-soluble and environmentally friendly substance. It is harmless to humans, animals, and plants and can be used all year round, in any phase of plant growth and development, at any temperature, but the effect is only increased in warm weather, with no burns occurring.

Using fertilizers at an early stage stimulates plant growth processes and improves the initial conditions for the development of the root system and above-ground part. Lebezol - Complete Care is recommended for non-root feeding of plants in order to overcome periods with poor growth and development conditions. It stimulates intensive growth and development of plants, contains nutritional substances (nitrogen, water-soluble potassium, magnesium oxide, manganese, zinc, copper, boron, etc.), and is recommended for use on onion crops. Currently, in vegetable production, including garlic production, intensive cultivation technologies are used that allow for high yields. In Russia, biological and microbiological fertilizers are allowed to be used, some even in conjunction with chemical preparations. Working in this direction will help reduce the use of chemical compounds. A systemic approach and the use of organic fertilizers are currently relevant and should be used as components of modern vegetable production technology [3,4,5].

The purpose of the work was to study the Aminozol organic fertilizer and the Lebozol-Full Care fertilizer on the productivity and yield of winter garlic. To obtain production of winter garlic in the non-black soil zone, it is necessary to carefully approach the selection of variety, the time of cultivation, and the quality of planting material. We studied the varieties of winter garlic Odintsovsky Jubilee and Strelets. The variety of winter garlic Odintsovsky Jubilee is allowed for use in all regions of Russia, included in the registry of breeding achievements in 2008. The originator of the variety is Federal Scientific Center for Vegetable Growing. The variety is medium-ripening, scape, the bulb is round-flat, weighs 67 g, the number of cloves is 5-6, the color of dry scales is white, the color of the skin is purple, the flesh is white, the taste is spicy. Can be stored for 6 months.

The Streletz garlic variety (Early Russian Garlic Streletz) is allowed for use in all regions of Russia, and was included in the register of breeding achievements in 2015. The originator of the variety is the Federal State Budgetary Institution "Federal Scientific Center of Vegetable Growing". The variety is medium-maturing, bulbous, round-flat bulbs with a mass of 65g, 5-7 cloves, dry scales purple-violet, brown skin and white flesh, spicy taste and winter-hardy [6,7].

2 Materials and methods

The work was conducted on the collection plot of the territory of the «Horticulture and vegetable growing» of Gardening and Vegetable Growing named after V.I. Edelstein, RGAU-MSA named after K.A. Timiryazev. The soil of the experimental plot is loamy-sandy with a humus content of 2.6%, pH of 5.8, and a depth of 20-23 cm. The nitrogen content is 9.3 mg/100 g, phosphorus is 15.0 mg, potassium is 8.3 mg. The experiment was conducted three times, with a plot size of 39 square meters and a planting scheme of 60X6, with a plant density of 278,000 plants per hectare. For planting, large (variety Strelets) and medium (variety Odintsovsky Jubilee) fraction seed cloves were used. Before planting, the seed cloves were soaked in the Maxim preparation to accelerate rooting and reduce susceptibility to

diseases during the winter period. Planting was carried out in the first ten days of October, as recommended for the conditions of the Moscow region. The planting date should be selected according to the climatic conditions of the zone. Optimal conditions for garlic in the winter period are also related to the thickness of the root system: the thicker it is, the less loss from freezing [8,9,10,11].

According to Alekseyeva M.V., it is noted that before the plant goes into winter, the cloves should have 12-18 roots with a length of 5-10 cm. For a well-developed root system with a length of 10-15 cm, 35-50 days are required [12]. The agrotechnics for growing winter garlic consisted of pre-plant soil treatment, clove preparation, planting, care and harvesting. Observations during the vegetative period were carried out in accordance with experimental methods, with the determination of phenological development phases, biometric observations, harvesting, and analysis of yield structure. Non-root treatment with Aminozol and Lebozol-Full Care was carried out twice during the vegetative period. The first treatment was carried out in the phase of two true leaves (May 10th), the second treatment from June 10^{th}-20^{th}, at the recommended concentration of the solution by the manufacturer of the products. Data processing was carried out using Excel 2010 software. The text and tables present the average arithmetic values of parameters and their 95% confidence intervals [13,14].

Experience options: 1) Odintsovsky anniversary (control); 2) Odintsovsky anniversary (double processing with organic fertilizer Aminozol); 3) Odintsovsky anniversary (double processing with fertilizer Lebozol - Full care); 4) Strelets (control); 5) Strelets (double processing with organic fertilizer Aminozol), 6) Strelets (double processing with fertilizer Lebozol - Full care).

3 Results of experiment

In the conditions of the Moscow region, the development of garlic plants and the formation of the harvest depend on the variety, the duration of the winter period, the height of the snow cover, the meteorological conditions during the vegetation period, the preliminary preparation and the size of the planting material, as well as optimal moisture and nutrient levels in the soil (Figure 1).

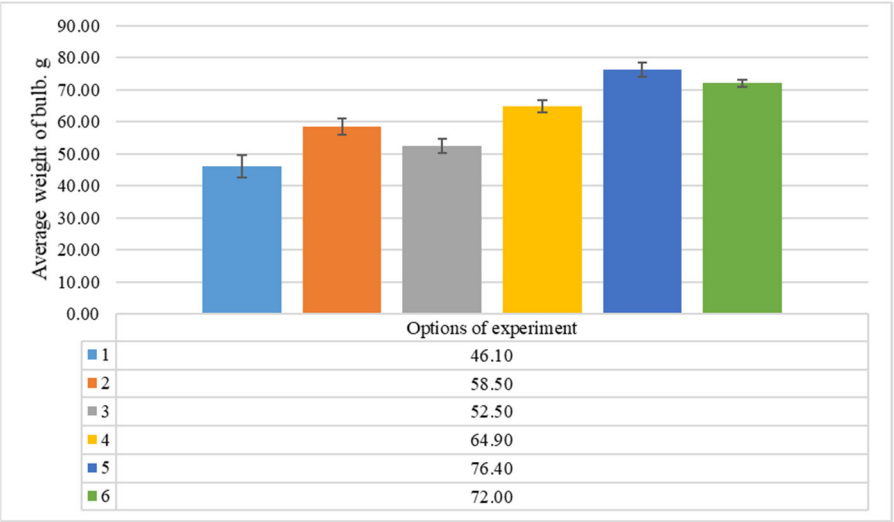

Fig. 1. The effect of non-root top dressing with Aminozol organic fertilizer and Lebozol-Full care fertilizer on the productivity of winter garlic, on average for 2021...2022.

During the research years, the weather conditions were within the climatic norm for the region during the winter period, but there were differences in temperature and moisture supply during the summer vegetation period. Garlic belongs to moisture-loving and cold-resistant plants, but in 2021 and 2022, June and July were less favorable for plants, characterized by a lack of moisture and high temperatures during the vegetation period (28°C...33°C). However, high temperatures in June and July did not affect the formation of the harvest, the maximum result of which was recorded in 2021 due to the early appearance of shoots and prolonged vegetation period compared to 2022. The shoots had differences of 5 days, in all variants the shooting phase was marked in 2021 (April 25) and in 2022 (April 30). The harvest was carried out at the same time on August 1 with 80% drying of the leaves.

The use of organic Aminozol fertilizer on the Odintsovsky Jubilee variety led to an increase in the average weight of the bulb by 26.9% compared to the control variant and by 13% compared to the variant treated with Lebozol-full care. The study results showed an increase in the average weight of the bulb due to the weight of one tooth. The Sagittarius variety, when treated with Aminozol and Lebozol-full care, gave an increase in the weight of the bulb by 17.7 and 10.9% compared to the control. No significant influence of the Aminozol and Lebozol-full care fertilizers on the number of cloves of autumn garlic for the varieties Odintsovsky Jubilee and Sagittarius was detected. Increasing yields through the use of promising high-yielding varieties that are resistant to various unfavorable factors is one of the most important tasks of vegetable growing. Aminozol and Lebozol-Full Care fertilizers have a wide range of effects, which increases the overall yield of winter garlic by an average of 18% across all experimental variants. No significant differences in the increase in the number of cloves or the length of the vegetative period were observed.

Table 1. Influence of non-root feedings of Aminozol organic fertilizer and Lebozol-Full Care on the yield of winter garlic, on average for 2021...2022.

Option		Yield, t/ha, by years		Yield t / ha, on average 21 ... 22 years	± % to control
		2021	2022		
1	Odintsovsky Jubilee (control)	15.3	10.3	12.8±0.2	-
2	Odintsovsky Jubilee + Aminozol	18.7	13.7	16.2±0.4	+26.6
3	Odintsovsky Jubilee + Lebozol - Full Care	16.6	12.4	14.5±1.1	+13.3
	LSD_{05}	1.6	1.1	-	-
4	Sagittarius (control)	19.3	16.7	18.0±0.4	-
5	Sagittarius + Aminozol	23.5	18.9	21.2±1.4	+17.8
6	Sagittarius + Lebozol - Full Care	21.5	18.3	19.9±0.5	+10.6
LSD_{05}		2.1	1.5	-	-

It has been established that a double foliar treatment of garlic plants with the Aminozol organic fertilizer during the first period of vegetation leads to an increase in yield for the variety of Odintsovskij Jubilejnyj by 26.6% and for the variety Strelets by 17.8% compared to control variants. The double foliar treatment with the Lebozol-Polnyj Uhod fertilizer had a lesser effect on increasing yield, resulting in a +13.3% increase for the variety of Odintsovskij Jubilejnyj and +10.6% for the variety Strelets compared to control variants.

References

1. A. V. Meshkov, V. I. Terekhova, A. V. Konstantinovich*, Practicum in vegetable growing Second edition,* stereotype (Publishing house Lan, St. Petersburg, 2022)
2. V. A. Kokoreva, N. A. Yureva, *Onion and garlic on a smallholding*, (Kolos, Moscow, 1993)
3. V. A. Kokoreva, I. V. Titova, *Onion, garlic and ornamental onions* (Niola – Press, Moscow, 2007)
4. V. Karic, H. Abrahamse, A. Jaiswal et al., Natural Oral Care in Dental Therapy (2020)
5. C. Wu, M. Wang, Y. Dong et al., Scientia Horticulturae **194** (2015)
6. A. Polyakov, T. Alekseeva, A. Soldatenko, IOP Conference Series: Earth and Environmental Science **395** 012088 (2019)
7. C. Fabeiro Cortes, F. Martn De Santa Olalla, R. Lopez Urrea, Agricultural Water Management **59(2)** (2003)
8. V. F. Belik, *Methodology of physiological research in vegetable and bulb growing* (Moscow, 1970)
9. B. A. Dospetkhov, *Methodology of field experiment* (Moscow, 1985)
10. S. S. Litvinov, *Methodology of field experiments in vegetable growing* (Moscow, 2011)
11. O. N. Ivashova, I. N. Gasparyan, A. G. Levshin, M. E. Dyikanova, N. F. Deniskina and Sh. V. Gasparyan, *Cultivation of two crops of potatoes of early varieties in the conditions of the Moscow region: monograph*, Russian State Agrarian University - Moscow Timiryazev Agricultural Academy. (RGAU-MSHA Publishing House, Moscow, 2021)
12. M. V. Alekseeva, *Garlic* (Rosselkhozizdat, Moscow, 1979)
13. A. G. Levshin, I. N. Gasparyan, M. E. Dyikanova, A. A. Kalilets, R. V. Korshunov, F. V. Lobuntsov, V. G. Suddenko, *The use of glauconite sand in the cultivation of environmentally friendly early potatoes: practical recommendations* (MESH, Moscow, 2019)
14. T. M. Seredin, V. V. Shumilina, M. E. Dyikanova *Growing winter garlic from aerial bulbs (bulbils) and their use in breeding* (Izvestiya FNCO, 2021), pp. 64-69