Effect of the mineral-biological preparation Glauxin on the intensity of the development of the test culture of Lettuce (Lactuca sativa)

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Abstract. To ensure the safety of the drugs being developed and their guaranteed effectiveness, large-scale experiments using sufficient groups and types of test objects are required. The composition of the studied preparation, which includes the main representatives of rhizospheric microorganisms sorbed on mineral sorbent, allows us to judge its environmental safety. At the same time, the preparations offered for organic farming should have sufficient effectiveness, stimulating the growth and development of cultivated plants. The article presents the results of an experimental study and analyzes the effect of the mineral-biological drug Glauxin on the intensity of development of a test culture – Lettuce variety «Vostorg». The formed groups of experience and control, and identical growing conditions made it possible to obtain objective data, and the number of test objects in the groups (n=50) was sufficient for statistical processing of the results obtained. To obtain the most complete picture of the effect of the drug being developed, observations were carried out for 60 days, which exceeds the productive period of this culture by 15 days. To determine the most effective ways of using the drug Glauxin, two treatment schemes were applied to the tested plants: with soaking of seeds and without pre-soaking, using the studied drug only when watering and spraying. The results obtained indicate a high stimulating activity of the drug, allow us to judge its safety, because in the recommended modes of use they do not cause physiological changes and violations of the development of the test culture of lettuce. Based on the results obtained, conclusions were drawn about the most effective method of using the mineral-biological drug Glauxin, statistical data processing will allow us to draw conclusions about the economic efficiency of its use on an industrial scale.

1 Introduction

Modern intensive use of agricultural land leads to a rapid depletion of the fertile properties of soils, and the use of mineral fertilizers ultimately not only does not solve the problem of reducing the productivity of cultivated plants, but further aggravates it. First, accumulating chemicals dramatically reduce the content of soil agrobacteria – representatives of the

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microbial community of the rhizosphere, which directly affect the viability and potential of higher plants. The specific features of plants regulate the microbial composition of the soil – the substances produced by plants and the properties of the root system have a significant impact on the qualitative and quantitative composition of agrobacteria. A close symbiosis of plant-microorganisms is obvious: rhizospheric microorganisms mineralize organic residues, dissolve mineral compounds that are difficult to reach for the plant organism and convert them into easily accessible forms, enrich the soil with vitamins, amino acids, produce antibiotic substances that reduce the level of phytopathogenic microbes [1, 3, 4, 6, 8].

It has been established that with the irrational use of cultivated land, as well as in the case of man-made pollution, first of all, there is a significant decrease in the content of soil bacteria useful for plants, and an increase in the number of phytopathogens. he most common representatives of microbial communities of a healthy root zone are such microorganisms as *Azotomonas, Bacillus, Chromobacterium, Lactobacterium, Mycobacterium, Micrococcus, Mycococcus, Pseudobacterium, Pseudomonas, Promyxobacterium, Sarcina.* On the roots of different plant species, these microorganisms occur in different ratios and concentrations. A general decrease in the concentration of rhizospheric microorganisms may indicate poor soils, and will soon be replaced by phytopathogenic communities [2, 4, 5, 10].

The most promising way to solve this problem is the development and active use of preparations based on the most active forms of rhizosphere microorganisms in high concentrations in the process of cultivation of agricultural crops. In such preparations, it is necessary to include strains selected according to the principle of the highest survival rate and specific activity that are promising for introduction into degraded soils [6, 7, 9].

The mineral-biological preparation «Glauxin» is a concentrated association of bacteria of the genera Bacillus and Pseudomonas, immobilized on a natural mineral ion exchanger, designed to regulate plant growth, increase viability, plant resistance to adverse environmental conditions and diseases.

The purpose of the reserch: to determine the effectiveness of the drug Glauxin in relation to the model culture of the Lettuce variety «Vostorg».

2 Materials and methods of research

150 bushes of the Lettuce variety «Vostorg» belonging, before obtaining ready-made plants in a universal closed soil. Lettuce seeds were soaked in tap water at room temperature, pre-stood for 24 hours, without the addition of the drug Glauxin (Control, hereinafter referred to as «K»), and with the drug Glauxin (Experiment-2, hereinafter referred to as «E-2») or with the addition of 1% of the drug (Experiment-1, hereinafter referred to as «E-1»). After exposing the seeds in the soaked state for 3 hours, they were planted in a moistened soil to a depth of 0.7±0.2 cm. Further, lettuce cultivation was carried out for 60 days at 23±1 °C in artificial lighting conditions using linear phytolamps for plants with natural white glow, with a day/night light mode of 14h/10h. For the first 3 days (before the first shoots appeared), the salad containers were covered with plastic wrap. Each group included 50 plants.

The condition of the plants was assessed visually throughout the experiment. The mass and size of plants in all groups were studied selectively on the 30th, 40th and 50th days of cultivation. The weight of the green part was determined by weighing (Fig. 1), the length of the leaves was selectively measured using a ruler (Fig. 2).

Thus, during the cultivation of the test object for 60 days, the entire cycle of work was reproduced from the germination of lettuce seeds to the production of commercial plants in a closed soil (indoors).

In order to assess the prospects for further use of the drug Glauxin in crop production, statistical processing and analysis of all the results obtained during the experiment were carried out.

Fig. 1. Weighing the green mass of the test culture of the Lettuce variety «Vostorg».

Fig. 2. Determination of leaf length of the test culture of the Lettuce variety «Vostorg».

3 Research results

The appearance of plants from different groups after 30, 40, 50 and 60 days of cultivation did not differ significantly (Fig. 3), and generally corresponded to the description of the variety - the leaf is rounded, large, dark green, bubbly, the edge is wavy. However, the maximum values of the height of the green part of the shoot during the entire growing period were noted for plants from the Experiment-1 and Experiment-2 groups (Table 2).

a) b)

Fig. 3. The appearance of the aboveground part of the test culture of the Lettuce variety «Vostorg»: 1 – 30 days of cultivation, 2 – 40 days of cultivation.

After 30, 40 and 50 days, the maximum values of the average height of the visible part of the shoot and the average growth rate were still observed in plants from the Experiment-1 group (Figure 3). On the 30-40 day, the advantage compared to the control was about 9%. However, when reaching 50-60 days, the advantage of representatives of the Experience-1 group in the average height of shoots was only 6-7%, and for representatives of the Experience-2 group – 4-5%. This may be due to the release of plants to the maximum level of accumulation of green mass, characteristic of plants of this variety, which is 45 days. This is evidenced by the decrease in the average growth rate observed for each sample after 50 days of cultivation.

Upon completion of the process of growing the lettuce test culture (after 60 days), the average amount of green mass removed from one bush was calculated, and the average mass of the root system was estimated in terms of one plant (Table 1).

Table 1. The average value of the mass of leaves and roots at the end of cultivation.

Group	Weight of green mass	Weight of roots
Control	17.44±4.00	0.24±0.005
Experiment-1	19.14±4.35 (+9.7% relative to the control group)	0.28±0.004 (+16.2% relative to the control group)
Experiment-2	19.06±5.16(+9.3% relative to the control group)	0.27±0.005 (+12.4% relative to the control group)

The average mass of the green (aboveground) part of the plants was detected in the Experiment-1 and Experiment-2 groups and amounted to about 19 g per bush (Table 2, Fig. 4), which was more than 9% higher than the same indicator of the control group. The average values of the root mass of plants of the experimental groups also exceeded similar test cultures of the control group.

Table 2. The average value of lettuce leaf length after 60 days of cultivation of plants of different groups in a universal soil with and without the use of Glauxin.

Days	Group				
	Control	Experiment-1	% relative to the control group	Experiment-2	% relative to the control group
10	3.05±0.35	3.11±0.3	+2	3.04±0.36	-0.4
20	7.55±1.99	8.36±1.87	+10.7	7.83±1.64	+3.7
30	13.15±2.23	14.38±2.91	+9.4	13.84±2.3	+5.2
40	18.38±1.32	20.08±1.58	+9.2	19.14±2.15	+4
50	24.92±3.60	26.66±2.66	+7	26.10±3.17	+4.7
60	25.84±6.27	27.41±6.58	+6	26.92±7.31	+4.2

The presence of a statistically significant difference was found for the average values of the height of lettuce shoots calculated for 40 and 50 days, as well as for the average values of the mass of shoots and roots at the end of the growing process – for 60 days.

Fig. 4. Distribution of the root system in the soil.

The root system of all bushes was well developed and occupied the entire volume of the soil (Fig. 4). During the weighing of plant roots of all groups, it was revealed that the maximum average mass of the underground part of the shoot corresponded to the representatives of the Experiment-1 group (Table 1) and exceeded the value of the control group by 16.7%.

Fig. 5. Root system of plants of the control group.

Fig. 6. Root system of plants of the Experiment-1 group.

Fig. 7. Root system of plants of the Experiment-2 group.

Because of the analysis of the dynamics of the growth of shoots, the level of accumulation of green biomass (Fig. 4-7) and the root system under experimental conditions, a positive effect from the use of the drug Glauxin was noted. The effect lies in the possibility of obtaining in 60 days the biomass of lettuce is at least 9% higher than without a biological preparation. Depending on the duration of the growing period, the average rate of biomass accumulation using Glauxin was 6-11% higher compared to the control.

4 Conclusion

The results obtained allow us to conclude that when using the drug Glauxin for 40-50 days of growing lettuce, the height of shoots was 4.1-9.5% higher than in the control (without the use of the drug). At the same time, the addition to the process of using the drug of the stage of soaking seeds in a 1% solution of the drug before planting, compared with the similar process of using the drug (only watering and spraying with a solution with Glauxin), but without soaking seeds, allows you to get 2.3-5.1% higher shoots. At the same time, after 60 days of growing, the dependence of the average mass of shoots on the approach to the use of the biopreparation is no longer observed, in any case, the mass of the resulting lettuce shoots exceeds the mass of the control group by 9.3-9.7% (without the use of the drug). At the same time, it was noted that after 60 days in the case of preliminary soaking of seeds, compared with the same process of using a biological preparation (watering and spraying), the average root weight is 3.8% higher. The expediency of the stage of preliminary soaking of lettuce seeds can be accurately assessed after comparing the values of the average weight of shoots while reducing the growing period to 40-45 days, when the difference in the height of shoots with different approaches to the use of Glauxin is most significant.

The mineral-biological preparation Glauxin can be used during the cultivation of lettuce in order to shorten the period of obtaining the finished product – green biomass. The obtained results also indicate the possible use of the drug Glaucin in processes related to the optimization of reproduction, obtaining planting material and the promotion of new plant varieties.

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