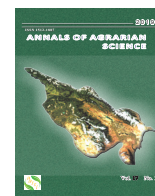




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Formation of yield and quality of vegetable crops when using a biological preparation in the conditions of dark chestnut soils of the south-east Kazakhstan

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ABSTRACT

The study of the biological product “BioEcoGum” on vegetable crops (salad, cabbage, broccoli, beans). It has been established that the varietal reaction during treatment with a biopreparation is unusual. The selective feature of vegetable crops is noted. Changes in the agrophysical properties of soil under the influence of preparations of biological origin during the cultivation of vegetables were revealed. The analysis of vegetable crops treated with a biological product in terms of yield, growth rates of plants in comparison with the control was carried out. The use of a biological product in the Almaty region of the southeast of Kazakhstan is promising in order to increase the adaptability and productivity of plants. Studies have found that having a positive effect on the growth and development of plants, improving the physiological processes in the plant organism, increasing the immunity and stress resistance of lettuce, broccoli cabbage, beans, biological product contributed to an increase in yields and product quality.

Keywords: Biological product, Lettuce, Broccoli, Beans, Plant productivity, Product quality.

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INTRODUCTION

The use of a biological product is explained by the exacerbation of a whole complex of negative phenomena in agricultural production. As a result of the use of chemical plant protection products, the most important of which are various forms

of resistance of phytophages to the main groups of widely used pesticides, and as a consequence, the continuing increase in pesticide pressure, disruption of agrobiocenotic relations and a general deterioration of the ecological situation.

The solution to the problem is possible when biological methods are included in the plant protection system, characterized by various

methods of impact on harmful populations - from the use of entomophages to the use of biological products. The cultivation of vegetables and the use of the crop for the preparation of baby and dietary food makes it necessary to use environmentally friendly preparations in protective measures. The first developments in the use of a biological product against pests of vegetable crops were carried out in 2020 on the territory of the experimental site of the UPH "Agrouniversitet". The use of biologics is already recognized in many countries around the world. Increasing yields and improved soil conditions are the best evidence for the quality of humic fertilizers. Refusal from the use of chemical (synthesis) pesticides, and the transition to new organic fertilizers will help preserve soil fertility and grow high-quality and healthy products without threatening the environment and human health. The main way to increase the productivity of agricultural crops is to apply high-quality fertilizers. Excessive use of mineral fertilizers and chemical means of protection can have a negative impact on soil fertility, the ecological state of the environment, and the quality of cultivated products. The most important role in increasing soil fertility and improving the quality of crop products belongs to fertilizers and preparations of a biogenic nature, the development and implementation of which are engaged in all over the world. Vegetables occupy the most important place in the human diet, as they are a source of vitamins, carbohydrates, organic acids, trace elements necessary to meet human physiological norms. Vegetables are the main source of vitamins, mineral salts, organic acids, aromatic and other substances, without the use of which the normal physiological activity of the human body is inconceivable. The great Russian physiologist I.P. Pavlov wrote about them: "A person can extend his life by at least a third if he eats fresh vegetables every day" [1].

Vegetable growing is an important branch of agriculture, designed to provide the population and the processing industry of the republic with full-fledged, balanced food products and high-quality raw materials all year round. According to the normative data of the Kazakh Academy of Nutrition, 120 kg of vegetables, 100 kg of potatoes and 26 kg of melons should fall on 1 inhabitant of the republic per year [2].

In the southeastern zone of Kazakhstan, with an abundance of solar heat and the availability of irrigation water, vegetable products allow you to get

a good harvest and can be highly profitable. With a high potential, the productivity of the current state of vegetable growing in Kazakhstan remains low. It is known that the main factor in increasing the productivity of vegetable crops was and remains the assortment, which is being improved both through the introduction of varieties based on soil-climatic analogues, and by breeding and introducing genotypes created by combinative selection methods on a genetic basis [3].

Today in our country the area of vegetable crops planting is about 150 thousand hectares, new territories are being developed, serious work is being done by scientific workers of the research institute. About 65% of the sown area of vegetable crops is concentrated in the southeast of the country [4].

When creating highly productive crops of vegetables, it is especially important to switch the industry to highly efficient, low-cost, energy-saving technologies that ensure the maximum use of environmental resources, affecting the good survival rate of seedlings and high yields of vegetables.

The development and implementation of such biological products in the post-Soviet space is carried out by various SRI independently or with the participation of commercial organizations. A biological product that has a complex protective and stimulating effect on plants that increase productivity and product quality, was developed by the U.U.Usmanov Kazakh Research Institute of Soil Science and Agrochemistry. Natural preparation of biological origin: increases the immunity of plants to diseases (late blight, alternaria, cercospora, white rot, etc.) and extreme environmental conditions (soil salinity, alkali-forming factors, pesticides, drought, low soil and water temperatures, frosts, etc.), limiting productivity of agrocenoses;

- promotes enhanced growth of roots and aboveground parts of plants;
- accelerates the ripening of vegetables and potatoes;
- increases the yield of vegetable crops by 15-30%;

improves the biological and nutritional value of the manufactured products, as well as extends the shelf life.

The effectiveness of bioorganic fertilizers is also manifested in cereals and legumes. The use of humic biological products based on vermicompost together with microelements and growth stimulants helps to increase the yield of winter wheat, corn and soybeans, improves soil fertility, reduces the

cost of their cultivation, and also allows you to get environmentally friendly products [5,6].

However, in the southeastern zone of Kazakhstan, which is characterized by its soil and climatic characteristics, there are practically no such works. Until recently, there were almost no recommendations in the region on a scientifically grounded system for introducing biological products into vegetable crop rotations, taking into account not only their effect, but also the aftereffect on subsequent crops in the crop rotation, and especially if we take into account the healing properties of vegetables and their effect on the general condition of the body.

Thus, the use of the domestic biological product "BioEcoGum" based on biohumus prompted to look for their own approaches to the problem and ways to solve it, taking into account the already accumulated domestic and foreign experience. The strength of scientific work is a multidimensional research approach. This is at the same time control over the reclamation of contaminated soils using a natural preparation of biological origin, the quality of cultivated vegetable products and the preservation and restoration of soil fertility. The biological product increases the defense mechanism of plants against the action of unfavorable factors, does not pose a threat to disturb the ecological balance in the biosphere, and plays an essential role in the anti-resistance strategy. The use of the biological preparation "BioEcoGum" is becoming more and more economically profitable and environmentally expedient.

MATERIALS AND METHODS

The research was carried out in the UPH "Agrouniversity" of the Almaty region. The object of the study is dark chestnut soils, vegetables (lettuce, broccoli, beans). Dark chestnut soils are formed in the foothill desert-steppe zone at an altitude of 700-800 m above sea level under ephemeroïd-fescue-wormwood vegetation (fescue, bluegrass, wormwood, sedge, sage). Mechanical composition - medium and heavy loams. Dark chestnut soils have a humus horizon on average 50 cm thick. A characteristic feature of these soils is their carbonate content. Groundwater is deep and has no effect on the soil-forming process [7,8].

The climate of the region is sharply continental with little precipitation in the spring, including the

dry month. The average air temperature in Talgar is 10°C, the average annual precipitation is 594 mm. The warmest month of the year is July (22.10°C), the coldest January is -12°C.

The research was carried out by the method of laboratory and laboratory-field experience. The planning of experiments, the establishment and conduct of experiments was carried out according to the Dospekhov method [9], the Belikov and Bondarenkov method [10] and the method of the State variety testing of agricultural crops [11].

Phenological observations were carried out according to the form adopted by the state variety testing. From the moment of sowing the seeds to the end of fruiting, the timing of the onset and passage of phenophases is marked - the phase of the appearance of single and mass shoots, the beginning of the formation of the food organ, the first and last collection. The use of natural preparations of biological origin will be carried out according to the generally accepted method of S. Litvinov [12].

Humidity - by weight method, total humus - according to I.V. Tyurin by wet combustion of humic carbon and its oxidation with dichromate; specific gravity - by pycnometric method; bulk density using Kachin borax; total porosity - by calculation method; gross forms of nitrogen, phosphorus from one sample in Gizburg and Shcheglov; determination of nitrogen according to Kjeldahl; calorimetric determination of phosphorus, potassium on a flame photometer; nitrate nitrogen according to Grandval-Lyazh, mobile phosphorus according to the method of Machigin B.A. [13]. Phenological observations of vegetable crops according to A. Druzhkin, G. Nikitenko [14,15]. Analyzes of soils and plants were carried out in certified laboratories of the U.U. Usmanov Kazakh Scientific Research Institute of Soil Science and Agrochemistry and KazNU them. I. al-Farabi (Center for Physicochemical Methods of Research and Analysis).

Vegetables were used for the experiment (lettuce, broccoli, beans). The size of the registration plots is 4–6 m² with 3-fold repetition. The experiments were carried out in vegetable crop rotations on agrotechnical backgrounds recommended for the Almaty region [16]. Fertilizing of vegetable crops will be carried out by spraying, i.e. foliar method, the drug will also be applied by the root method, watering vegetables, at the rate of 2.5 liters of solution per plant.

The regulations for the use of biological products on tomatoes are presented in Table 1.

Table 1. Regulations for the use of the drug “Bio EcoGum”

Culture	Consumption rate	Treatment method	Period and number of treatments
Salad	25 ml / 4-5 l of water	- Soaking seeds for 3 hours. - Watering the soil before sowing seeds	During the growing season of plants 1-2 times with an interval of 7-14 days.
Broccoli	35 ml / 4-5 l of water	- Soaking seeds for 3 hours. - Watering the soil before sowing seeds	The total number of treatments during the growing season of plants: 2 - 4
Beans	70 ml / 5 l of water	- Soaking seeds for 3 hours. - Watering the soil before sowing seeds	No more than two times

Liquid humic biological product “BioGumEco”, has the composition: humic substances 20%, macroelements, g / l: N - 5, P₂O₅ - 10, K₂O - 10, Ca - 7, Mg - 2, trace elements (g / l): Mn - 30, Mo - 30, Zn - 25, Se - 3 [6]. The biological product was introduced into the soil at a dose of 2.5 ml / kg of soil, before sowing, the seeds were treated with the biological product “.

RESULTS AND DISCUSSION

In the experiments, we used varieties of vegetable crops approved for use in the Almaty region - lettuce, beans, broccoli. In the south-east of Kazakhstan, as well as in Kazakhstan as a whole, the production of salad products

represents an insignificant part of the vegetable assortment. However, in recent years, interest in the culture of lettuce has increased on the part of the population and greenhouse complexes, but the need is far from being fully satisfied. The salad is distinguished by its early maturity, cold resistance and is of great dietary importance. The research was carried out on four types of lettuce: Ritzia, Poalli, Miracle of the four seasons, Large cabbage. The short growing season of this crop allows you to get several harvests even in open field conditions. Research has been carried out on the influence of the biological product “BioEcoGum” on the salad plant, both on the weight of food organs and on the yield (Table 2).

Table 2. Influence of the biological product “BioEcoGum” on the mass of food organs, yield and characteristics of lettuce seeds

Option	Variety	Mass, g		Productivity, c/ha	Seed color	Seed length, mm	Weight of 1000 seeds, g
		plants	Incl. head of cabbage				
The control	Ritzia	400	–	296,9	grayish white	3,8	1,14
	Poally	240	–	175,7	grayish white	3,7	1,18
	The miracle of the four seasons	463	254	326,5	black	3,3	1,32
	Large cabbage	502	294	352,1	grayish white	3,6	1,29
"BioEcoGum"	Ritzia	420	–	304,5	grayish white	4,4	1,21
	Poally	270	–	195,8	grayish white	4,4	1,20
	The miracle of the four seasons	483	284	350,1	black	4,2	1,25
	Large cabbage	520	300	377,0	grayish white	4,7	1,24

Our calculation of the total mass of lettuce showed significant differences in the development of the food organs of the tested varieties.

Plants of the Ritzia variety - 420 g (Figure 1), had the largest mass in leafy lettuce, the Poalli variety - 251 g.

Studies have shown that the high yield was noted in the Ritsia variety - 304.5 c/ha, the low was in the Poalli variety - 195.8 c/ha. Seeds of leafy lettuce varieties are grayish-white. The seed shape of these varieties is lanceolate.

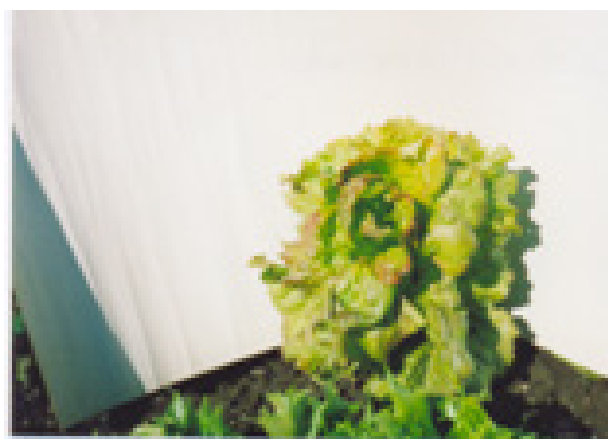


Fig. 1. Salad of the Ritzia variety

Measurement of the length of the seed showed that the longest (4.4 mm) were the seeds in the varieties Ritsia and Poalli, short (3.4 mm). The weight of 1000 seeds (1.20–1.25 g) in leaf and head varieties was within the experimental error. Head varieties differ in the weight of food organs and yield. The Large cabbage variety had a large plant mass - 520 g, the Chudo variety of the four

seasons had a smaller mass - 483 g. A high yield was obtained for the head lettuce of the Large cabbage variety - 377.0 centner /ha, the low one was for the Chudo variety of four seasons - 350.1 centner /ha. The variety Chudo of the four seasons had a black color of seeds, and the variety Large cabbage had a grayish-white color. The longest were the seeds of lettuce variety Large. The shape of the seeds of all varieties is lanceolate. In terms of economic indicators, among the headed varieties, the Krupnokochanny variety stood out. The data obtained allow us to draw the following conclusions: - the soil and climatic conditions of the Almaty region are favorable for growing lettuce. To increase productivity and economic efficiency, lettuce should be grown from leafy varieties Ritzia and Poalli, and from cabbage varieties - Large cabbage. The soil and climatic conditions of the southeast of Kazakhstan correspond to the biological characteristics of common beans, which are widely cultivated as a vegetable garden. Beans are distinguished by a high content of protein in seeds of complete amino acid composition. It is of great economic value in human nutrition. In addition, the seeds of leguminous crops contain a lot of carbohydrates (24-50%), vitamins (A, B6, B2, C). In recent years, the demand of the population of many countries, including Kazakhstan, for food products from beans has been rapidly growing: seeds in dry and canned form, freshly frozen, as well as canned beans. In terms of acreage, beans ranks 12th in the world among leguminous crops after soybeans. We carried out studies on the effect of the biological product on the yield of vegetable beans (Table 3).

Table 3. Influence of the biological product "BioEcoGum" yield and characteristics of beans seeds

Option	Variety	Productivity, c / ha	Pods per plant, pcs	Seeds in a pod, pcs	Weight of 1000 seeds, g
The control	Sachs without fiber 615	23,2	9,8	4,5	336
	Rand	30,0	11,2	4,6	394
	Laura	22,2	13,7	4,9	219
"BioEcoGum"	Sachs without fiber 615	25,0	10,5	5,8	344
	Rand	34,1	13,3	5,2	406
	Laura	25,4	15,9	5,5	242

The analysis of yield data showed that when processing with a biological product, the largest bean yield was obtained for the Rant variety - 34.1 c / ha, and the smallest was for the Saksa variety without fiber 615 - 25.0 c / ha.

Counting the number of pods on plants of the studied bean varieties made it possible to establish that the maximum number of pods was formed in the Laura variety (15.9 pcs.), The minimum was in the Saksa variety without fiber 615 - 10.5 pcs.

The Rant variety had the largest leaf surface area - 793 cm²; it was smaller in the Laura variety - 701 cm².

Counting the number of pods on plants made it possible to establish that it was the highest in the Saksa variety without fiber 615 (5.8 pcs), and the minimum in the Rant variety (5.2 pcs).

The absolute weight of seeds in plants of the studied bean varieties also differed significantly.

The highest it was in the Rant variety - 406 g, the minimum in the Laura variety (242 g).

It was found that the maximum amount of beans

was formed in the Laura variety (15.9 pieces), the minimum was in the Saksa variety without fiber 615 - 10.5 pieces. (Figure 2).



Fig. 2. Beans of the Saksa variety without fiber 615

We have conducted research on the effect of a biological product on the development and productivity of broccoli cabbage plants (Table 4).

Table 4. Influence of the biological product “BioEcoGum” on the biometrics and productivity of broccoli cabbage plants

Option	Variety	Plant height, cm	Leaf blade diameter of a large leaf, cm	The length of the petiole of a large leaf, cm	Head diameter, cm	Head branches of the first order, pcs	Plant leaf area, cm ²	Productivity, c / ha
The control	Caesar	43,2	19,7	8,5	11,6	12,2	5479	240,5
	Gnome	44,5	20,4	9,7	11,9	12,8	6576	278,3
	Christmas from Calabria	39,9	19,5	12,3	12,5	10,9	4674	248,7
	Tone	46,8	20,8	12,5	10,2	8,1	6496	252,9
"BioEcoGum"	Caesar	45,6	22,8	10,4	13,9	13,1	5537	270,8
	Gnome	46,9	21,2	11,3	12,4	12,0	6676	298,3
	Christmas from Calabria	40,9	20,1	14,1	14,0	11,1	4772	268,4
	Tone	48,9	21,6	13,3	11,2	9,8	6596	272,7

Studies of yield data showed that treatment with a biological product contributed to the formation of the highest yield in the Gnome variety - 298.3 c / ha (Figure 3), while in the control it was 278.3 c / ha. The smallest yield was noted for the variety Christmas from Calabria - 268.4 c / ha, compared to the control 248.7 c / ha.



Fig.3. *Cabbage variety Gnome*

The influence of the biological product also influenced the variety study of broccoli cabbage. It was noted that the smallest diameter of the flower head was in the Tonus cultivar - 11.2 cm, the largest in the cultivar Christmas from Calabria - 14.0 cm.

The largest leaf area was in the broccoli cabbage variety Gnome - 6676 cm², the smallest - in the variety Christmas from Calabria - 4772 cm².

The conducted studies allow us to recommend the production of methods of using the biological product "BioEcoGum" when growing vegetables, providing maximum economic and economic efficiency, taking into account environmental requirements.

CONCLUSION

As a result of a comparative study of varieties of vegetable crops carried out in the UPH "Agrouniversity", Almaty region, the following conclusions can be drawn:

The use of the biological product "BioEcoGum" has a significant effect on the onset of phenological phases and the duration of interphase periods in vegetable crops - lettuce, broccoli, beans. A high yield was obtained from the head lettuce variety Large cabbage - 377.0 c / ha, low was the variety Miracle of the four seasons - 350.1 c / ha.

The variety had a large mass of the plant Large cabbage - 520 g, the smaller mass was in the Miracle variety of the four seasons - 483 g.

It has been established that in order to increase the productivity and economic efficiency of the salad, it is necessary to grow the Ritsia and Poalli varieties, and from the cabbage - Large cabbage.

The influence of the biological product on the bean yield was the highest for the Rant variety - 34.1 c / ha, the smallest was for the Saksa variety without fiber 615 - 25.0 c / ha.

It was found that the maximum amount of beans was formed in the Laura variety (15.9 pieces), the minimum was in the Saksa variety without fiber 615 - 10.5 pieces.

The influence of the biological product on the vegetable culture of broccoli showed that the smallest diameter of the flower head was in the Tonus variety - 11.2 cm, the largest in the variety Christmas from Calabria - 14.0 cm.

The largest leaf area was in the broccoli cabbage variety Gnome - 6676 cm², the smallest - in the variety Christmas from Calabria - 4772 cm².

The greatest weight of the head of cabbage was in the plants of the Gnome variety (628 g), the highest yield was obtained here (298.3 centners / ha); The smallest yield was given by the variety Rozhdestvensky from Calabria - 268.4 kg / ha.

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