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INFLUENCE OF FERTILIZER SYSTEMS ON BIOMETRIC INDICATORS AND POTATO YIELD

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The article presents the results of experimental studies of the influence of different fertilization systems, including mineral, organic-mineral and organic fertilizers, on the development of the vegetative mass of potato plants and the yield accumulation of varieties of different maturity groups concerning the soil and climatic conditions of the Western Forest-Steppe. It was established that the highest yield indicators on the 80th day after planting were obtained on variants with the introduction of biohumus fertilizer (4.0 t/ha) of the Legend variety, where the weight of the tubers was 0.526 kg and, accordingly, the yield was 28.9 t/ha. In the Slauta variety by introducing dry granulated chicken manure (0.5 t/ha), tuber weight was 0.543 kg and yield – 29.8 t/ha. In all other variants of the experiment for the varieties Legend and Slauta, there was a decrease in yield indicators compared to the 60th day, which, in our opinion, is caused by weather conditions, namely a large amount of precipitation, which caused rotting of potato tubers.
Keywords: potatoes, fertilizers, vegetative mass, assimilation surface, productivity.

Introduction

The potato growing industry is constantly at the centre of attention not only of scientists but also of producers and requires constant improvement in the application of new varieties and improved elements of the technological process (Shuvar I. A. et al., 2021).

Some domestic scientists (Burbela M., 1995; Tarariko O. H. et al., 1999) do not share the requirements of ecologically safe agriculture in terms of a complete refusal to use mineral fertilizers of synthetic origin because there is a problem with ensuring the return of nutrients that are alienated by the crop. Opposingly – mineral fertilizers, pesticides and other chemical or biological means of improving soil fertility, and hence increasing the yield of crops, are not recommended also because, with the incorrect use of both types of fertilizers, the influence of one and the other can only increase the soil deterioration.

In recent years, Ukrainian and foreign scientists have developed and implemented various biotechnologies for the processing of organic waste from poultry farms and livestock farms, secondary products of crop production, as well as additional components – peat, sapropel, sludge, sludge from sewage treatment plants, waste from the processing of tanneries and production plants of sugar and alcohol industry, meat processing plants and organic waste of other origins into high-quality organic fertilizers, are gaining wide scale. These fertilizers can be obtained by introducing the method of vermiculture into production, accelerated biological fermentation in fermenters or open sites, and other methods. They have the general name – high-quality and highly effective micro biotransformed organic fertilizers. They successfully undergo research in field experiments and implementation in the production of agricultural products. Research has established their positive impact on the agrophysical and microbiological properties of the soil, increasing the productivity of crops and quality indicators (Bykin A. V. et al., 1999; Khabovskyi A. M., Plekhtii D. P., 2000; Hnydiuk V. S. et al., 2010).

Vermiculture and vermicomposting represent the safest, from the point of view of environmental friendliness, biotechnology for the processing and disposing of organic or organic-containing production waste. Widespread promotion and implementation among owners of small households of the technology of processing organic waste with the help of red rainworms and other populations of worms is gaining momentum. This will make it possible for the benefit of the population and the environment to accelerate the transformation of waste from summer cottages and homesteads to organic waste from households, based on which they will be able to grow high-quality products without harm to health and without the use of mineral fertilizers and pesticides (Edwards C., 2018).

The staff of the "Bioconversion" association initiated the theoretical and practical implementation of industrial vermiculture in Ukraine, and with their support, vermiculture was established in all regions of our country.

In cooperation with scientific institutions, scientists of the association have developed technologies for processing organic waste and producing high-quality biohumus from almost all types of organic waste. The main direction of the work was the creation of humic preparations and the use of worm biomass in the processing of livestock, poultry and animal husbandry waste (Melnyk I. P. et al., 2015).

Researches have carried out several studies on the impact of organic fertilizers on the yield and quality of crops the results of which have established the high efficiency of using organic fertilizer humus. Scientists have established that biohumus fertilizer, applied at a dose of 3.0-9.0 t/ha, increased agricultural crop yield by 15-40 %, significantly improving economically valuable indicators of the production. Industrial biotechnological processing with the help of vermiculture, in their opinion, turns into a new branch of production that will be able to solve the problems of protein deficiency of animal origin while simultaneously improving soil fertility (Bykin A. V. et al. 1999; Povkhan M. F., 1990; Melnyk I. P., 2010).

Using biohumus fertilizer of organic origin for fertilizing fields significantly reduces the costs of cattle manure transportation. Depending on the culture being grown, applying 20.0-40.0 t/ha of manure is recommended, but only 3.0-8.0 t/ha of biohumus for many crops. It is possible to achieve the same effect. According to research, applying biohumus on degraded soils contributes to creating better conditions for developing the vegetative mass of plants, which are close to natural ones (Melnyk I. P., 2010).

Research by several scientists has established that new organic fertilizers can significantly increase the yield in rural areas and significantly improve the quality parameters of the agricultural products grown. Studying the effect of biohumus organic fertilizers on corn, it was established that the application of fertilizer at a dose of 5.0-6.0 t/ha had a positive effect on the growth and development of plants, improved their biometric indicators and increased the yield of the crop by 32.0-46.0 % (Melnyk I.P. et al., 2015).

According to research data on the use of organic fertilizer biohumus in greenhouse farming, an increase in the yield of vegetables by 27.0-45.0 %, an improvement in the quality indicators of products by 15.0-30.0 %, and a decrease in the content of nitrates in vegetable products were noted.

Field studies to determine the effect of different doses of biohumus (3.0, 6.0 and 9.0 t/ha) applied by the pre-sowing cultivation for the cultivation of table beets, carrots, and cabbage showed that the optimal dose of organic fertilizer biohumus for table beets is 6.0 t/ha, for carrots – 3.0 t/ha. The increase in the yield of root crops compared to the control was 51.9 % and 43.4 %. The most effective biohumus organic fertilizer dose for white cabbage is 6.0 t/ha with a maximum yield increase of 38.0 % (Kolisnyk N. M. et al., 2016).

The pre-sowing application of organic fertilizer biohumus in the conditions of Moldova showed a positive effect in the experiments of V. Karageorghii with the culture of sweet pepper, where the optimal dose of 6.0 t/ha ensured a yield increase of almost 70.0 % (Kolisnyk N. M. et al., 2016).

A study on the effectiveness of the use of organic fertilizer biohumus for such crops as winter wheat, soybeans, corn for grain, tomatoes, carrots, potatoes, cabbage and cucumbers, conducted by A. Shoniy, showed that the yield of the listed crops increased on average by 27.0-65.0 % compared to the control versions of the experiment.

Local application of organic fertilizer biohumus under early cabbage and sweet pepper was efficient and showed the most appropriate dose application of 100 g per pit, which contributed to increasing the yield of pepper by 72.5 % and early cabbage – by 41.6 %.

Several authors state the essential role of organic fertilizer biohumus in soil protection and biological agriculture. Studies on the effectiveness of the use of this fertilizer for agricultural use have shown the effect of improving the quality and fertility of grey forest soils and have shown that the application of 5.0-8.0 t/ha of fertilizer is equal to the application of 25.0-35.0 t/ha of organic fertilizers (Tsentylo L. V. et al., 2016). Introduction of organic fertilizer biohumus, made by the method of vermiculture from sunflower husks, provided a high effect in compliance with the cultivation technology and showed an increase in the yield of tomatoes by 7.7 t/ha when applying a dose of 6.0 t/ha.

Biohumus is rich in bacterial flora. The large amount of biologically active substances contained in biohumus as well as the primary nutrients (NPK), without taking into account the total microelements, shows that 1 ton of biohumus is equivalent to 30.0-40.0 t of organic fertilizers in the form of manure (Shuvar I. A., Snitynskyi V. V., Balkovskyi V. V., 2011). Studies conducted in Ukraine and the USA show the high efficiency of humus. Crops such as sugar beets and potatoes increased yield to 20.0-30.0 %, and vegetables of the borscht set – up to 30.0-50.0 %.

Thus, according to the data of the mentioned scientific research, the promotion of modern technology is necessary since it is the basis for soil and plant health, increases productivity and quality of products, improves the environment and rises the level of agricultural industry.

Studies conducted in the USA have shown the high efficiency of Fermway fertilizer. The economic effect in terms of costs and increase in fertility – up to 25.0 % by applying two tons of fertilizers (equivalent to applying 13.0 tons of organic matter). The use of a dose of 3.0-5.0 t/ha for crops, depending on the properties of the soil and the cultivated crop, gave significant results during the research.

Using Fermway fertilizer made it possible to successfully fight against soil pests, particularly nematodes, which made it possible to obtain a significant economic effect. For example, in Colorado (USA), on one of the farms, the cost of fertilizer savings amounted to 40 USD per 1 hectare of planting area.

The advantages of the technology are the following factors: the relatively short duration of the processes themselves; independence from weather and climate conditions; the ability to control the process of preparation of the substrate itself, parameters and regimes of composting and fermentation; the possibility of obtaining a finished product (fertilizer) with given physical and mechanical properties (Hnydiuk V. S. et al., 2010).

Based on the developed technology, scientists of the "Bioconversion" association at the "Lviv Regional Fish Farm" LLP built a complex for producing bioactive organic fertilizer with a productivity of 10,000 tons annually. The technology of organic fertilizers production, based on the method of biological fermentation, has been introduced in such farms as

PE "DVK Bioz-Volyn" of the Volyn region and LLC "Bioz Khorost" of the Khmelnytsky region (Kolisnyk N. M. et al., 2016).

However, this technology did not make it possible to carry out high-quality and timely aeration and moistening of composts with the mechanisms available in the enterprise, and the obtained biocompost had a high cost. Considering soil, climatic and economic conditions, implementing biological fermentation technology in open areas requires specific improvement and development of more optimal elements of the technological production process. Therefore, from 2013 to 2018, at agricultural company "Kolos" LLC several experimental and industrial studies have been conducted in village Pustovarivka of Skvyrsky district, Kyiv region. In producing organic fertilizers with the help of composting, an element of accelerated fermentation under aerobic conditions with microbial preparations is introduced for each separate phase of composting. Several composting schemes were developed in aerobic conditions using biological preparations to obtain full-fledged fertilizers that meet the requirements of the quality parameters of organic fertilizers for their further use in traditional and organic agriculture.

In this farm, 15,000-20,000 tons of such fertilizers are applied to the fields annually, and a high yield of crops is obtained with a reduction in the costs of purchasing mineral fertilizers and plant protection products (Sendetskyi V. M. et al., 2009).

Research on sod-podzolic, heavy loamy soils to study the effectiveness of using bioprofarm organic fertilizers for its application under winter wheat, was conducted. It was found that doses from 3.0 to 10.0 t/ha increased yield by 1.78-2.84 t/ha, and the highest – 2.84 t/ha compared to the control was on the option for applying 10.0 t/ha of bioprocessed fertilizer.

Applying this organic fertilizer at a dose of 6.0 t/ha made it possible to obtain an increase in yield of 2.53 t/ha compared to the control option and 0.75 t/ha more than in the option with 30 t/ha of cattle manure. An increase in the nutrient regime of the soil, its enrichment with organic substances and improvement of physical and agrochemical properties were also noted. The application of bioprocessed fertilizer increased the content of protein and gluten in the obtained grain, and the best indicators were obtained with the application of fertilizers at a dose of 10.0 t/ha. On average, over 3 years of research, the content of protein and gluten was, respectively, by 1.17 and 3.77 % higher than in control and by 0.8 and 2.74 % higher in the variant with the application of 30 t/ha of manure (Hnydiuk V. S. et al., 2010).

The introduction of bioproferm organic fertilizer in enterprises is reasonably practical in ensuring an increase in the yield of crops and improving soil fertility. Thus, during the 2010 harvest, "Bioz Khorost" LLP of the Khmelnytskyi region used bioproferm organic fertilizer for pre-sowing cultivation at 10.0 t/ha on 40 ha. Despite the unfavourable weather conditions of the research year (significant drought with an excess of the average monthly temperature conditions by 1.5-2.0 times), 6.12 tons of winter wheat were harvested from each hectare, and the yield increase was 2.28 tons/ha. Which made it possible to obtain an additional profit of 3,648 hryvnias from one hectare of land (Shuvar I. A. et al., 2015).

Bioactive organic fertilizer is a nutrient element in technology, used in agricultural enterprises of FG "VIBO", FG "LIM", Kamianko-Busky district, TzOV "Svirzh", PP "Deviatyr" and POP "Viktoria" of Lviv district, FG "Mech" and FG "Sermishagro" of Zolochiv district, FG "Revera" and FG "Mriya" of Stryi district, FG "Elegant", Novoiavorivskyi district, FG "Buchok" of Sambir district, PE "Zakhidnyi Buh" of Chervonograd districts of Lviv region for growing winter cereals, corn, sugar beets, vegetables and other crops. Yield and economically valuable indicators were high, and use was economically justified (Sendetskyi V. M. et al., 2010).

The study of the effect of organic fertilizer from bioproferms on the accumulation of agricultural crop yields and the quality of products on the sod-medium podzolic sandy soils typical for Western Polissia, conducted in 2010-2011 by scientists of the Volyn SARS of the Institute of Agriculture of the Carpathian Region of the National Academy of Sciences. The results of the phytopathological evaluation showed that the lowest degree of damage to potato plants by late blight was detected in the option of applying bioproferm at a dose of 10.0 t/ha (continuous application) and 5.0 t/ha (local application directly under the plant). It has been established that due to several microelements in its composition, the potato plants resistance increases, and therefore, the degree of damage by the disease is much lower compared to the application of other fertilizers. The highest increase in the yield of potatoes was established on the option of applying fertilizer at a dose of 10.0 t/ha, which amounted to 16.6 t/ha, and with the local application of bioproferm at a dose of 5.0 t/ha, the increase was 12.3 t/ha of the obtained product.

Therefore, on the soils of the light granulometric composition of the Western Polissia zone, the introduction of bioproferm increases the resistance of plants to the development of diseases with the increased formation of potato yields of high-quality indicators (Hnydiuk V. S. et al., 2015).

In 2012–2013, scientists of the Institute of Climate-oriented Agriculture conducted a study of the effect of organic fertilizer from bioprofarms on the productivity and quality of tomatoes and changes in the fertility indicators of dark chestnut soils under irrigation conditions. According to the research results, on the version with the introduction of bioproferm at a dose of 5.0 t/ha, a later onset of the phases of flowering and fruit formation was noted (by 3-4 days). In this variant, the plants developed a more powerful vegetative mass with a 6-10 cm height of the main stem and a more significant number of lateral shoots (by 18-23%) compared to the control variant. At the same time, it should be noted that the beginning phase of fruit ripening occurred at the same time as all in options of the conducted study. The application of bioproferm contributed to a better fruit setting for tomato plants. Thus, after applying 2.5 t/ha of fertilizer, there were an average of 69 fruits on one plant, and after applying 5.0 t/ha – 91 fruits on one plant, which exceeded the control variant by 13.5 and 49.0 %, respectively (Kolisnyk N. M. et al., 2015).

Materials and methods

The Western Forest-Steppe is favourable for growing potatoes according to natural and climatic conditions. However, even within the same region, such meteorological conditions are created that determine the difference in yield by year because its formation is significantly influenced by the total amount of precipitation and its uniform (statistical average) distribution during the growing season of plants.

Field research was conducted in the fields of the Institute of Agriculture of the Carpathian Region of the National Academy of Sciences in the crop rotation of the Crop Selection Department according to generally accepted methods in potato growing (Sygareva D. D., 1986; Kutsenko V. S. et al., 2002; Trybel S. O. et al., 2013; Bondarchuk A. A. et al., 2019), experimental data were processed using the Microsoft Excel program (Ehrmantraut E. R. et al., 2018).

The soils under the experiments were grey forest surface-glazed coarse silt-light loam on loess-like sediments. They are not homogeneous in terms of the profile of their mechanical composition, and their hydration regime largely depends on this. The upper horizons' humidity should be higher than the lower ones. For this reason, soils in rainy seasons or years with a large amount of precipitation are subject to excessive moistening and glaciation. In dry years, they are sufficiently supplied with productive moisture. In addition, groundwater, the depth of which ranges from 1.5 to 1.8 m, greatly influences glaciation.

Based on the agrochemical analyses conducted, it was established that the soils under the experiments are poor in humus by 1.58-1.67%, have an acidic reaction of the soil solution (pH 4.80-5.17), the sum of absorbed bases is 6.20-7.22, hydrolytic acidity – 2.87-3.29 mg equiv per 100 g of soil.

The Western Forest-Steppe belongs to the zone of sufficient moisture, where 350-390 mm of precipitation falls during the growing season, enough to obtain a high yield of potatoes. However, in some years, it happens that during the period of greatest need of plants for water supply, precipitation does not fall, or vice versa – it falls at a time when potato plants need less moisture. That is, there is no uniform moisture distribution during the growing season of potatoes.

Results and discussion

One of the indicators of the full development of potato plants and the increase in their productivity is the growth of plants' vegetative mass (leaves and stems). With the optimal passage of these processes, the daily growth rate of potato tubers is maximal. The number of stems significantly influences the formation of the final yield of potatoes in the formed bush, where each stem, in the process of growth and development, becomes an independent plant with its root system and forms tubers. Research data indicate that such factors as the dose of fertilizers and their composition variety affected potato plants' stem density (Tables 1, 2).

Table 1. Biometric indicators of the Legend variety on the 60th day after planting, 2023-2024

№	Research options	Vegetative mass:			assimilation surface, thousand m²/ha
		stem, pcs	stem weight, g	stem height, cm	
1	No fertilizers (control)	4,0	374,0	72,0	31,9
2	Manure, 40 t/ha + $N_{90}P_{90}K_{120}$	4,6	287,0	94,0	55,0
3	Recommended fertilizer dose $N_{90}P_{90}K_{120}$	5,3	370,0	84,0	45,0
4	Manure, 40 t/ha	5,6	430,0	87,0	43,8
5	Granulated chicken manure, 0,5 t/ha	5,6	430,0	87,0	43,8
6	Biohumus, 4.0 t/ha (local)	11,0	724,0	100,0	45,5
7	Bioactive, 8.0 t/ha (local)	4,7	240,0	77,0	39,0

So, we can see that on the options without fertilizers (control) and with the introduction of the recommended dose of fertilizers $N_{90}P_{90}K_{120}$, the average number of stems in the years of research under dynamic digging on the 60th day after planting was 4.0 and 4.3, respectively, of the cultivated varieties – 4.6 pcs. Therefore, on average, the most significant number of stems in a bush, concerning the Legend variety, was due to the application of biohumus (4.0 t/ha) - 11.0 pieces, and in the Slauta variety, when applying manure (40.0 t/ha) was, respectively, 6.0 pcs.

Table 2. Biometric indicators of the Slauta variety on the 60th day after planting, 2023-2024

№	Research options	Vegetative mass:			assimilation surface, thousand m^2/ha
		stem, pcs	stem weight, g	stem height, cm	
1	No fertilizers (control)	4,0	120,0	47,0	30,3
2	Manure, 40 t/ha + $N_{90}P_{90}K_{120}$	4,3	310,0	68,0	51,0
3	Recommended fertilizer dose $N_{90}P_{90}K_{120}$	4,3	153,0	45,0	35,0
4	Manure, 40 t/ha	6,0	303,0	70,0	46,2
5	Granulated chicken manure, 0,5 t/ha	4,7	377,0	74,0	53,9
6	Biohumus, 4.0 t/ha (local)	4,7	294,0	76,0	45,5
7	Bioactive, 8.0 t/ha (local)	3,7	271,0	68,0	41,0

According to the study results, the average potato leaf surface area indicators in the variant without fertilizers (control) were 31.9 thousand m^2/ha in the Legend variety and 30.3 thousand m^2/ha in the Slauta variety, respectively. With the recommended dose of $N_{90}P_{90}K_{120}$ fertilizers, the leaf surface area of these varieties was, respectively, 55.0 and 51.0 thousand m^2/ha.

The highest indicator of the leaf surface area of potato plants was noted on the variant with the introduction of granulated chicken manure, which was 53.9 thousand m^2/ha for the Slauta variety, and for the medium-ripening Legend variety, the highest indicator of the leaf surface area was noted with the introduction of manure 40 t/ha ha + the recommended dose of fertilizers $N_{90}P_{90}K_{120}$, and amounted to 55.0 thousand m^2/ha, respectively.

As a result of the research, it was established that in the version without fertilizers (control) in the Legend variety, with an average weight of tubers per bush of 0.334 kg, the yield was 18.4 t/ha, and in the Slauta variety, the average weight of tubers was 0.387 kg and, accordingly, the yield was 21.2 t/ha.

On the variant with manure application of 40.0 t/ha and the recommended dose of $N_{90}P_{90}K_{120}$ fertilizers, the weight of the tubers was 0.423 kg in the Legend variety, in the Slauta variety it was 0.543 kg, respectively. The yield was 23.2 and 29.8 t/ha accordingly (Table 3, 4).

Table 3. Dynamic digging of the Legend variety on the 60th day after planting, 2023-2024

№	Research options	Potatoes:								yield, t/ha
		large		medium		small		total		
		pcs	g	pcs	g	pcs	g	pcs	g	
1	No fertilizers (control)	0,6	64	4,7	257	1,0	13,3	6,3	334	18,4
2	Manure, 40 t/ha + $N_{90}P_{90}K_{120}$	1,0	110	5,7	303	1,7	17	8,4	423	23,2
3	Recommended fertilizer dose $N_{90}P_{90}K_{120}$	0,3	37	4,7	194	4,7	64	9,7	294	16,2
4	Manure, 40 t/ha	1,3	133	5,0	240	3,7	57	10,0	430	23,2
5	Granulated chicken manure, 0,5 t/ha	1,3	135	5,0	242	3,8	59	10,0	440	23,6
6	Biohumus, 4.0 t/ha (local)	1,3	134	6,4	310	5,0	84	12,7	526	28,9
7	Bioactive, 8.0 t/ha (local)	0,6	67	3,7	180	1.4	30	5,7	277	15,7

The highest yield indicators were on the 60th day after planting variants with the introduction of biohumus (4.0 t/ha) in the Legend variety, where the weight of the tubers was 0.526 kg, and the yield was 28.9 t/ha. In the Slauta variety by the granulated chicken manure application, tuber weight was 0.543 kg and at yield of 29.8 t/ha.

When growing potatoes, the application of agrotechnological measures should be optimal and timely, which significantly impacts the quality indicators of the obtained harvest and the final yield of potatoes. An essential factor for obtaining a high yield of potatoes, first of all, is the level of plant nutrition, that is, the dose of fertilizers that will ensure a significant accumulation of the harvest concerning the varieties of different maturity groups that are planned to be grown.

Table 4. Dynamic digging of the Slauta variety on the 60th day after planting, 2023-2024

№	Research options	Potatoes:								yield, t/ha
		large		medium		small		total		
		pcs	g	pcs	g	pcs	g	pcs	g	
1	No fertilizers (control)	1,3	120	4,3	203	4,7	64	10,3	387	21,2
2	Manure, 40 t/ha + $N_{90}P_{90}K_{120}$	4,0	363	3,7	147	2,7	34	9,0	543	29,8
3	Recommended fertilizer dose $N_{90}P_{90}K_{120}$	0,3	27	2,7	140	1,7	30	4,7	197	10,8
4	Manure, 40 t/ha	2,0	160	6,7	267	6,0	50	14,7	477	26,2
5	Granulated chicken manure, 0,5 t/ha	3,0	327	4,0	170	5,0	40	12,0	543	29,8
6	Biohumus, 4.0 t/ha (local)	2,0	233	3,0	130	2,3	27	7,7	390	21,4
7	Bioactive, 8.0 t/ha (local)	1,4	114	4,7	240	2,7	33	8,7	387	21,2

By carrying out dynamic digging on the 80th day, it was established that the highest yield rate, both in the Legend variety and in the Slauta variety, was noted with the introduction of bioactive fertilizer (8.0 t/ha (local)) and manure (40 t/ha). Respective to the varieties, the weight of tubers was 0.547 kg and 0.690 kg, while the yield was 28.8 and 38.0 t/ha (tables 5, 6, 7, 8).

Table 5. Biometric indicators of the Legend variety on the 80th day after planting, 2023-2024.

№	Research options	Vegetative mass:			assimilation surface, thousand m^2/ha
		stem, pcs	stem weight, g	stem height, cm	
1	No fertilizers (control)	4,0	117,0	93,0	30,3
2	Manure, 40 t/ha + $N_{90}P_{90}K_{120}$	4,6	320,0	87,0	51,0
3	Recommended fertilizer dose $N_{90}P_{90}K_{120}$	5,3	125,0	55,0	35,0
4	Manure, 40 t/ha	5,6	240,0	80,0	46,2
5	Granulated chicken manure, 0,5 t/ha	5,6	77,0	63,0	53,9
6	Biohumus, 4.0 t/ha (local)	11,0	160,0	73,0	45,5
7	Bioactive, 8.0 t/ha (local)	4,7	333,0	95,0	41,0

Table 6. Dynamic digging of the Legend variety on the 80th day after planting, 2023-2024.

№	Research options	Potatoes:								yield, t/ha
		large		medium		small		total		
		pcs	g	pcs	g	pcs	g	pcs	g	
1	No fertilizers (control)	0,7	70	1,0	60	2,3	60	3,7	143	7,7
2	Manure, 40 t/ha + $N_{90}P_{90}K_{120}$	0,7	57	7,0	334	0,7	34	8,3	423	23,2
3	Recommended fertilizer dose $N_{90}P_{90}K_{120}$	1,0	140	3,0	157	1,3	37	4,7	334	18,4
4	Manure, 40 t/ha	2,7	280	2,0	110	1,7	17	6,3	406	22,3
5	Granulated chicken manure, 0,5 t/ha	1,0	147	1,7	93	6,0	63	9,3	283	15,7
6	Biohumus, 4.0 t/ha (local)	3,3	473	3,0	167	2,3	40	8,7	523	28,8
7	Bioactive, 8.0 t/ha (local)	3,3	437	1,7	90	2,3	24	7,3	547	30,1

Table 7. Biometric indicators of the Slauta variety on the 80th day after planting, 2023-2024.

№	Research options	Vegetative mass:			assimilation surface, thousand m^2/ha
		stem, pcs	stem weight, g	stem height, cm	
1	No fertilizers (control)	4,0	70,0	55,0	30,3
2	Manure, 40 t/ha + $N_{90}P_{90}K_{120}$	4,3	393,0	95,0	51,0
3	Recommended fertilizer dose $N_{90}P_{90}K_{120}$	4,3	123,0	53,0	35,0
4	Manure, 40 t/ha	6,0	290,0	87,0	46,2
5	Granulated chicken manure, 0,5 t/ha	4,7	217,0	63,0	53,9
6	Biohumus, 4.0 t/ha (local)	4,7	163,0	70,0	45,5
7	Bioactive, 8.0 t/ha (local)	3,7	167,0	77,0	41,0

Table 8. Dynamic undermining of the Slauta variety on the 80th day after planting, 2023-2024.

№	Research options	Potatoes:								yield, t/ha
		large		medium		small		total		
		pcs	g	pcs	g	pcs	g	pcs	g	
1	No fertilizers (control)	2,0	247	2,0	93	1,3	10	5,3	350	19,3
2	Manure, 40 t/ha + $N_{90}P_{90}K_{120}$	2,3	173	4,3	273	9,7	130	16,3	577	31,7
3	Recommended fertilizer dose $N_{90}P_{90}K_{120}$	2,0	177	2,0	83	7,0	90	11,0	350	19,2
4	Manure, 40 t/ha	1,0	170	7,3	390	8,0	130	16,3	690	38,0
5	Granulated chicken manure, 0,5 t/ha	3,3	400	2,7	133	1,3	27	7,3	560	30,8
6	Biohumus, 4.0 t/ha (local)	1,7	177	3,3	163	3,7	27	8,7	367	20,2
7	Bioactive, 8.0 t/ha (local)	0,7	67	2,0	103	0,7	5	3,3	175	9,6

In all other variants of the experiment for the varieties Legend and Slauta, there is a decrease in yield indicators compared to the 60th day of digging and determining the accumulation of yield, which, in our opinion, is caused by weather conditions, namely a large amount of precipitation, which caused rotting of potato tubers.

Conclusions

The highest yield indicators on the 80th day after planting were obtained on variants with biohumus fertilizer (4.0 t/ha) of the Legend variety, where the weight of the tubers was 0.526 kg; accordingly, the yield was 28.9 t/ha. In the Slauta variety, by the granulated chicken manure application this indicator was 0.5 t/ha with a tuber weight of 0.543 kg and a yield of 29.8 t/ha.

The obtained data indicate that using mineral fertilizers in combination with organic fertilizers of different compositions and origins allows the obtaining of high yields of potatoes by growing varieties of different maturity groups in the soil and climatic conditions of the Western Forest-Steppe**.**

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ВПЛИВ СИСТЕМ УДОБРЕННЯ НА БІОМЕТРИЧНІ ПОКАЗНИКИ ТА УРОЖАЙНІСТЬ КАРТОПЛІ

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У статті наведено результати експериментальних досліджень впливу різних систем удобрення, зокрема мінеральних, органо-мінеральних та органічних, на розвиток вегетативної маси рослин картоплі та накопичення врожаю у сортів різних груп стиглості в ґрунтах та кліматичних умовах Західного Лісостепу. Встановлено, що найвищі показники врожайності на 80-й день після садіння були отримані на варіантах із внесенням біогумусу (4,0 т/га) сорту Легенда, де маса бульб становила 0,526 кг і, відповідно, урожайність становила 28,9 т/га. У сорту Слаута за внесення сухого гранульованого курячого посліду (0,5 т/га) маса бульб становила 0,543 кг, а урожайність – 29,8 т/га. В усіх інших варіантах досліду для сортів Легенда та Слаута спостерігалося зниження показників урожайності порівняно з 60-ю добою, що, на нашу думку, зумовлено погодними умовами, а саме – великою кількістю опадів, що спричинило загнивання бульб картоплі.

Ключові слова: картопля, добрива, вегетативна маса, асиміляційна поверхня, урожайність.

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