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THE MASS ACCUMULATION OF POTATO POTATOES DEPENDS ON EXTRA-ROOT NUTRITION OF PLANTS WITH MICROFERTILIZERS IN THE CONDITIONS OF THE WESTERN FOREST-STEPPE OF UKRAINE

Abstract

Goal. *To determine the effect of foliar fertilizing with microfertilizers on the mass accumulation of potato tubers in the conditions of the Western Forest-Steppe of Ukraine.*

Methods. *Analysis, synthesis, generalization, laboratory and field experiment.*

The results. *It is established that the highest indices were obtained from the use of micronutrient Reakom – a variety of Dar and Crystaloneone special – a variety of Alladin. Thus, in the Aladin variety from the introduction of microfiber Crystaloneone special with a norm of 2,50 kg/ha, the average weight of tubers in the bushes in the budding phase was obtained – 318 g, in the phase of drying of the peduncle – 624 g, the Dar variety – the most effective rate of application among the studied variants the established norm of Reakom – 4,50 kg/ha, while the average weight of tubers in the budding phase was 309 g, the beginning of the drying of the peduncle – 683 g, respectively. The most effective rate for introducing potato plants is the following: Reakom – 4,50 kg/ha, Crystalonelone special – 2,50 kg/ha, and Rozasol – 3,00 kg/ha in the budding phase and the beginning of the disappearance of the peduncle.*

Conclusions. *Indigenous fertilization with microfertilizers (Reakom, Crystalone special and Rozasol), influenced growth processes. At the same time, they were more intense compared with the control (without plant treatment) and maintained until the drying of the peduncle. All this contributed to the growth of the tubers weight and increased the yield and quality of products.*

Key words: *potato, variety, soil, microfertilizers, nutrients, harvest.*

Introduction. Potato is a valuable food, technical and fodder crop. It contains a large amount of useful nutrients and, unlike other vegetables, it is available for cultivation in all soil and climatic zones of our country. Potatoes are one

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of the leading crops that, due to their great potential, are able to provide high and steady yields [2; 11]. In terms of potato consumption per capita, Ukraine ranks third in the world – 139 kg/year, while the average resident of the United States consumes only 54 kg of potatoes annually. Despite the high consumption, the yield of potatoes in the country is quite low and amounts to 14–16 t/ha [7].

The experience of advanced countries of the world and domestic potato producers shows that high-yielding potato growing is based on modern achievements of scientific and technical progress, thanks to which the yield of potatoes can be increased several times [5; 8]. Therefore, the study of the regularities of the formation of high and stable potato yields due to the introduction of new highly effective microfertilizers is quite relevant.

Analysis of recent research and publications. One of the ways to optimize the mineral nutrition of potatoes is the use of not only macro-, but also micro-fertilizers in the fertilization system. It should also be taken into account that new high-yielding varieties have an intensive metabolism, which requires a sufficient supply of all nutrients, including trace elements. When growing potatoes using intensive technologies, the need for trace elements increases. In addition, the need to apply microfertilizers is due to the fact that the use of organic fertilizers, which were the main source of microelements entering the soil, has recently decreased [10; 13].

The use of microfertilizers during foliar feeding of plants, in which trace elements are absorbed by plants directly through the leaves, is of particular importance in obtaining a high yield of commercial potato products with high quality indicators. The use of this method makes it possible to reduce the consumption of fertilizers, as well as to process plants in different periods of their growth and development [9; 12].

A.A. Sydorchuk, P.F. Kalitskyi note that the best method of applying trace elements, from a scientific and practical point of view, is foliar, because it is quickly and qualitatively included, and regulates the processes of nutrition during the growing season of plants. Replenishment with trace elements should be carried out in combination with the main elements (N, P, K), because all nutrients are closely related to each other in single biochemical processes and the role of each of them is very important [15].

According to V.V. Alyokhin, the lack of nutrients leads to the collection of a low level of harvest, weakening of plants, dying of roots and deterioration of the quality of the obtained products. The lack of trace elements in the soil does not lead to the death of plants, but it causes a decrease in the speed and coherence of the processes responsible for the development of the organism. Ultimately, plants do not realize their genetic potential and give a low, not always high-quality harvest [1].

A number of authors believe that much attention is paid to the use of microfertilizers to enhance tuber formation, the flow of photosynthesis products from the vegetative mass to the tubers, and to increase the stability of plants during the growing season and tubers during storage. Different sensitivity of plants to microfertilizers was noted. Their use is most effective in optimal conditions for the processes they regulate [14; 4].

R.V. Ilchuk, Yu.R. Ilchuk claim that the introduction of microfertilizers into the technology of potato production requires the study of their effect on plants depending on the levels and terms of application. Thus, the supply of nutrients through the leaves has its own specificity, determined by the anatomo-morphological features of the leaf structure, as well as some physical factors: the wettability of the leaf surface with a solution, the degree of dispersion, the rate of evaporation, etc. [6].

The issue of levels and periods of foliar nutrition of plants, in particular with the preparations “Reakom”, “Crystalone special”, “Rozasol” is practically not studied in the conditions of the forest-steppe of western Ukraine, and especially for such a crop as potatoes.

The **purpose of the research** was to determine the effect of foliar fertilizationmicrofertilizers for accumulation of mass of potato tubers in the conditions of the Western Forest-Steppe of Ukraine.

Research material and methodology. The research was conducted at the research field of the Educational and Production Center “Podillya” of the Higher Educational Institution “Podillia State University” during 2020–2022.

The soil of the experimental field is a typical leached chernozem, with little humus, medium loam on loess loams. Humus content (according to Tyurin) in the 0–3 cm soil layer is 3,6–4,2%. The content of easily hydrolyzable nitrogen compounds (according to Kornfield) is 98–139 mg/kg (high), mobile phosphorus (according to Chirikov) 143–185 mg/kg (high) and exchangeable potassium (according to Chirikov) – 153–185 mg/kg of soil (high). The amount of absorbed bases varies between 158–209 mg eq./kg. Hydrolytic acidity is 17–22 mg equiv./kg, the degree of saturation with bases is 90%.

Evaluation of the effectiveness of using microfertilizers for foliar feeding of potato plants on the yield and quality of tubers (2020–2022). Foliar feeding of plants was carried out in the phase of budding – flowering (intensive growth). Microfertilizers “Reakom”, “Crystalone special”, “Rozasol” were used for the research.

“Reakom” – boron content 10 g/l + microfertilizers (in chelated form OEDF acid + citric acid; Mo – 5,6; Mn – 5,0; Cu – 4,5; Zn – 4,0; Co – 1,7 u/k; pH – 8.0; density – 1,136 g/cm3. “Crystalone special” – N18P18K18 + microfertilizers (in the chelated form of EDTA, DTRA) B – 0,025%; Cu – 0,01%; Mn – 0,04%; Mo – 0,004; Zn – 0,0025%. “Rozasol” – N18P18K18 + microfertilizers (in the chelated form of EDTA) B – 125 mg/kg; Mn – 400; Cu – 94; Fe — 325; Zn – 287 mg/kg.

In the experiment, medium-late varieties Alladin and Dar were used, which are entered in the State Register of Plant Varieties of Ukraine and have not been studied in the soil and climatic conditions of the zone.

Foenological observations, biometric and physiological-biochemical studies were carried out according to the methods of G.L. Bondarenko, K.I. Yakovenko [3].

Research results. According to experimental studies, foliar fertilization had a significant effect on the average mass of potato tubers of the Alladin and Dar varieties in the budding phase and the beginning of the drying of the peduncle (table 1).

Table 1. The effect of foliar feeding of plants with microfertilizers on the accumulation of mass of tubers per bush, g (average for 2020–2022)

Name of microfertilizer (factor A)	Microfertilizer application rate, kg/ha (factor B)	Variety (factor C)			
		Alladin		Dar	
		budding	beginning of the drying of the peduncle	budding	beginning of the drying of the peduncle
Reakom	without plant treatment (k)*	274	461	277	496
	4,00	285	493	279	504
	4,50	295	535	309	683
	5,00	289	511	296	568
	5,50	279	508	284	537
Crystalone special	without plant treatment (k)*	281	465	273	494
	1,50	294	536	281	516
	2,00	296	512	288	509
	2,50	318	624	294	523
	3,00	299	534	284	507
Rozasol	without plant treatment (k)*	275	460	272	490
	2,00	278	463	276	494
	2,50	284	486	278	501
	3,00	294	516	280	508
	3,50	278	493	273	498
Nir05 A – 1,17; Nir05 V – 2,03; Nir05 C – 1,62					

*Note: *(k) – control*

From the use of Reakom and Crystalone special in foliar feeding, the indicators had the greatest significance in the years of research. The lowest value of this indicator was noted on the control option without treating plants with microfertilizers.

The highest indicators were obtained from the use of Reakom microfertilizer – Dar variety and Crystalone special – Alladin variety. Thus, in the Alladin variety, from the application of Crystalone special microfertilizer at a rate of 2,50 kg/ha, the average mass of tubers in the bush in the budding phase was 318 g, in the phase of the beginning of drying of the peduncle – 624 g, in the Dar variety, the most effective rate of application among the studied options the established rate of Reakom is 4,50 kg/ha, while the average mass of tubers in the budding phase was 309 g, the beginning of top drying of the peduncle 683 g, respectively.

So, as evidenced by the research results, the average mass of potato tubers, starting from the budding phase until the beginning of the drying of the peduncle, increases with the use of foliar feeding of plants. The use of microfertilizers Reakom, Crystalone special and Rozasol on all the studied variants gives an increase in the mass of tubers compared to the control variant. The most effective application rates for foliar feeding of potato plants are: Reakom – 4,50 kg/ha, Crystalone special – 2,50 kg/ha and Rozasol – 3,00 kg/ha in the budding phase (intensive growth).

Important in evaluating the effectiveness of microfertilizer application in foliar feeding is the accumulation of raw mass of tubers at different application rates, starting from the budding phase until the beginning of the drying of the peduncle. Research has established that from the treatment of plants with microfertilizers, in the budding phase, a tendency to increase the mass index was observed, compared to the option without fertilizing (figs. 1, 2).

Analyzing the indicators of the accumulation of raw mass of potato tubers, the highest level of plant productivity was observed in both studied varieties Alladin and Dar on variants with Reakom and Crystalone special feeding.

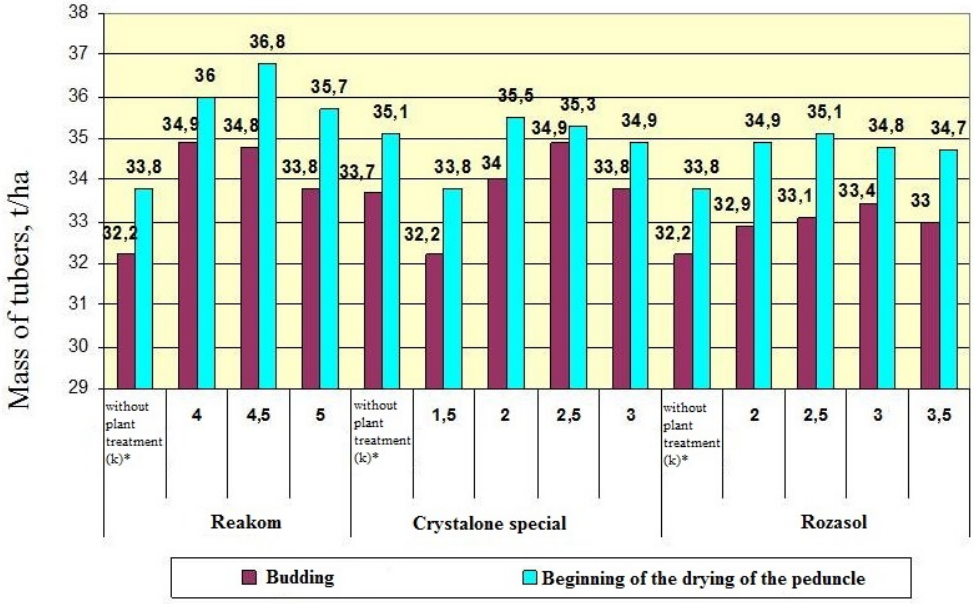

Fig. 1. The effect of foliar feeding with microfertilizers on the accumulation of the mass of potato tubers of the Alladin variety (average for 2020–2022), t/ha

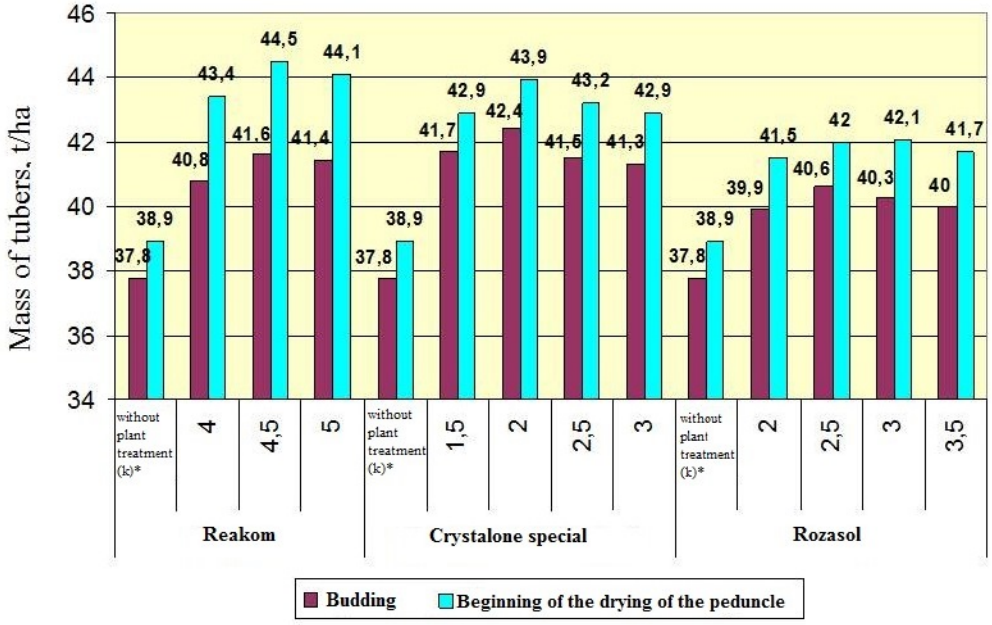

Fig. 2. The effect of foliar fertilization with trace elements on the accumulation of the mass of potato tubers of the Dar variety (average for 2020–2022), t/ha

Foliar fertilizing with Reakom at the application rate of 4,50 kg/ha significantly increased the analyzed indicator relative to the control, for the period of budding, it amounted to 34,8 t/ha in the Alladin variety, and 41,6 t/ha in the Dar variety. Fertilizing with Rozasol microfertilizers at an application rate of 3,00 kg/ha increased the mass accumulation of root crops during the budding period by 1,2 t/ha of the Alladin variety, and by 2,5 t/ha of the Dar variety.

During the period of top drying, the mass of potato tubers of the Alladin variety in variants with foliar feeding by Reakom was 35,7–36,8 t/ha, Crystalone special – 33,8–35,5 t/ha, and Rozasol – 34,7–35,1 t/ha, in the Dar variety – 40,8–44,5 t/ha, 42,9–43,9 t/ha and 39,9–42,1 t/ha, respectively.

Variants with foliar feeding by Reakom stand out with the highest indicators in the Alladin and Dar varieties.

According to the dispersion analysis, starting from the budding phase, the variety (factor C) had the greatest influence on the studied indicator (fig. 3).

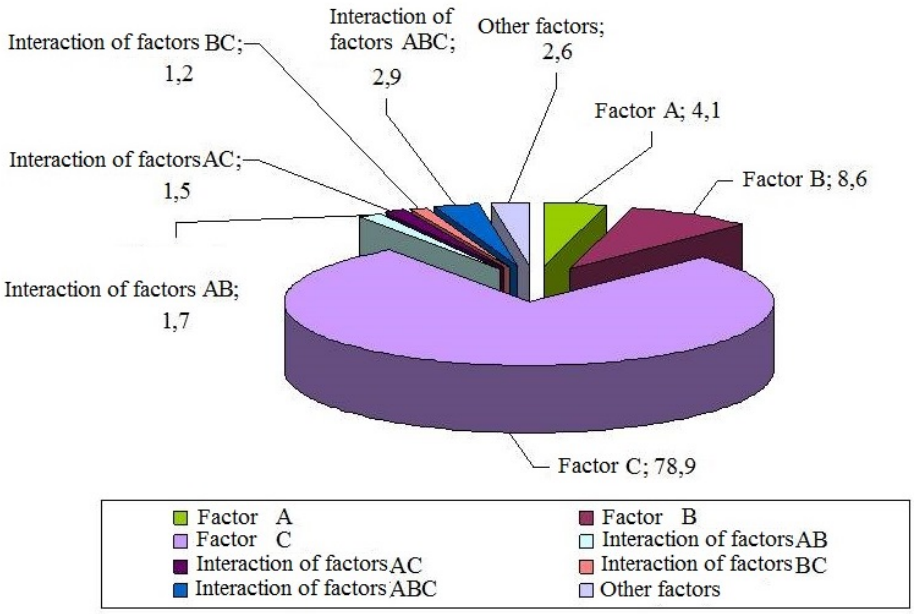

Fig. 3. The share of the effect of foliar feeding of plants with microfertilizers on the dynamics of the accumulation of tuber mass during the period of the beginning of the drying of the peduncle (average for 2020–2022), t/ha

The share of the influence of the factors of foliar application of microfertilizer on the accumulation of tuber mass during the period of the beginning of the drying of the peduncle depended on the type of microfertilizer (factor A) – 4,1%, the rate of their application (factor B) – 8,6%, variety (factor C) – 78,9%. The share of influence of other unaccounted factors is 2,6%.

It should also be noted that foliar fertilizing with microfertilizers (Reakom, Crystalone special and Rozasol) affected the growth processes. At the same time, they took place more intensively in comparison with the control option (without plant treatment) and were maintained until the tops began to dry. All this contributed to the increase in the mass of tubers and increased the yield and quality of products.

Conclusions. Research has established that the mass accumulation of potato tubers in Alladin and Dar varieties, starting from the budding phase, occurs more intensively under the influence of foliar feeding with microfertilizers, especially Reakom and Crystalone special, and during the period of the beginning of drying of the tops, a greater increase in the mass of tubers was obtained in comparison with the control variant.

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НАГРОМАДЖЕННЯ МАСИ БУЛЬБ КАРТОПЛІ ЗАЛЕЖНО ВІД ПОЗАКОРЕНЕВОГО ПІДЖИВЛЕННЯ РОСЛИН МІКРОДОБРИВАМИ В УМОВАХ ЗАХІДНОГО ЛІСОСТЕПУ УКРАЇНИ

Анотація

Досліджено вплив мікродобрив на нагромадження маси бульб картоплі в умовах Західного Лісостепу України. Встановлено, що найвищі показники одержано від застосування мікродобрива Реаком у сорту Дар та Кристалону особливого в сорту Алладін. Так, у сорту Алладін від внесення мікродобрива Кристалону особливого з нормою 2,50 кг/га отримали середню масу бульб у кущі у фазу бутонізації 318 г, у фазі початку всихання бадилля – 624 г. У сорту Дар найбільш ефективною нормою внесення серед досліджуваних варіантів встановлена норма Реакому – 4,50 кг/га, при цьому середня маса бульб у фазу бутонізації становила 309 г, у фазу початку всихання бадилля – 683 г. Найбільш ефективною нормою внесення в разі позакореневого підживлення рослин картоплі у фазу бутонізації та початку відмирання бадилля встановлено: Реаком – 4,50 кг/га, Кристалон особливий – 2,50 кг/га, Розасоль – 3,00 кг/га.

Позакореневе підживлення мікродобривами (Реаком, Кристалом особливий і Розасоль) вплинуло на ростові процеси. При цьому вони проходили більш інтенсивно порівняно з контрольним варіантом (без обробки рослин) та підтримувалися до початку всихання бадилля. Усе це сприяло зростанню маси бульб і підвищувало врожайність та якість продукції.

Ключові слова: *картопля, сорт, ґрунт, мікродобрива, елементи живлення, урожай.*

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