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Peculiarities of the technology of growing new potato varieties in the Polissia of Ukraine

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In 2018–2020, the Institute for Potato Research of NAAS of Ukraine studied the effect of different rates of application of mineral fertilizers in combination with chelated fertilizers on yield, biometric indicators of potatoes and edible properties of tubers. Chelated fertilizers were used to treat tubers during planting and foliar fertilization of new potato varieties in the Ukrainian state. The purpose of the research is to develop elements of technology for growing new varieties of potatoes for the best realization of genetic potential. Research methods – field, measurement, statistical. The early-ripening variety Slauta and the medium-ripening variety Gurman responded positively to the use of fertilizers, rates and methods of their application. The Gurman variety compared to the Slauta variety had better stem-forming capacity of the tubers. On average, for the years 2018-2020, the use of chelated fertilizers together with nitroammophoska increased the productivity of the Slauta variety to 10.2 t/ha, and the Gurman variety to 6.9 t/ha compared to the control. During 2018–2020, the percentage of the seed fraction prevailed in the crop structure. The largest number of seed tubers in the Slauta variety was provided by the sixth variant, which yielded 313.6 thousand pieces/ha with a total weight of 16.8 t/ha with a multiplication factor of 4.7. The fifth variant also stood out, in which the number of tubers was 292.4 thousand units/ha with a total weight of 14.1 t/ha with a multiplication factor of 4.4. The number of seed tubers in the Gurman variety ranged from 182.7 to 419.4 thousand pieces/ha. The mass of tubers in the sixth variant was 16.6 t/ha with a multiplication factor of 6.4. Therefore, the largest yield of seed tubers was obtained in the variants where chelated fertilizers were used and nitroammofoska was applied when planting potatoes. In the Slauta variety, the lowest percentage of tubers damaged by soil pests was found in the sixth option, where mineral fertilizers $N_{60}P_{60}K_{90}$ were applied, spreading + treatment of tubers during planting + treatment of plants during the growing season. In the Gurman variety, the lowest percentage of tubers damaged by soil pests was found in the fourth option, where the tubers were processed during planting and foliar feeding of potatoes was carried out. The Gurman variety is characterized by better indicators of suitability for processing into potato products.

Keywords: potato varieties, mineral and chelated fertilizers, treatment of tubers during planting, foliar feeding, productivity, seed fraction.

Особливості технології вирощування нових сортів картоплі на Поліссі України

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В Інституті картоплярства НААН України у 2018–2020 роках вивчався вплив різних норм застосування мінеральних добрив у поєднанні з хелатними добривами на урожайність, біометричні показники картоплі і споживні властивості бульб. Хелатні добрива застосовувалися для обробки бульб при садінні та позакореневому підживлення нових сортів картоплі на Поліссі України. Метою досліджень є розробка елементів технології вирощування нових сортів картоплі для найкращої реалізації генетичного потенціалу. Методи дослідження – польовий, вимірювальний, статистичний. Ранньостиглий сорт Слаута та середньостиглий сорт Гурман позитивно реагували на застосування добрив, норми та способи їх внесення. Сорт Гурман порівняно із сортом Слаута мав кращу стеблоутворюючу здатність бульб. У середньому за 2018–2010 роки використання хелатних добрив разом з нітроамофоскою збільшило урожайність у сорту Слаута до 10,2 т/га, а сорту Гурман до 6,9 т/га порівняно з контролем. Впродовж 2018–2020 років у структурі урожаю переважав відсоток насіннєвої фракції. Найбільшу кількість насіннєвих бульб у сорту Слаута забезпечив шостий варіант, на якому було отримано 313,6 тис.шт/га загальною масою 16,8 т/га з коефіцієнтом розмноження 4,7. Також виділився п'ятий варіант, на якому кількість бульб становила 292,4 тис.шт/га загальною масою 14,1 т/га з коефіцієнтом розмноження 4,4. Кількість насіннєвих бульб у сорту Гурман коливалася у межах від 182,7 до 419,4 тис.шт/га. Маса бульб у шостому варіанті становила 16,6 т/га з коефіцієнтом розмноження 6,4. Отже, найбільший вихід насіннєвих бульб було отримано на варіантах, де застосовувались хелатні добрива і при садінні картоплі вносилася нітроамофоска. У сорту Слаута найменший відсоток пошкоджених бульб ґрунтовими шкідниками встановлено на шостому варіанті, де вносилися мінеральні добрива $N_{60}P_{60}K_{90}$ урозкид + обробка бульб при садінні + обробіток рослин по вегетації. У сорту Гурман найменший відсоток пошкоджених бульб ґрунтовими шкідниками встановлено на четвертому варіанті, де оброблялися бульби при садінні та проводилося позакореневе підживлення картоплі. Сорт Гурман характеризується кращими показниками придатності до переробки на картоплепродукти.

Ключові слова: сорти картоплі, мінеральні і хелатні добрива, обробка бульб при садінні, позакореневе живлення, урожайність, насіннєва фракція.

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Introduction

After this terrible war, Ukraine will need to restore many cultivated areas, as well as the food base. In the Bible, the prophet Ezekiel speaks of the wonderful restoration of territories that suffered from destruction for hundreds of years. Also written:"And the earth shall yield her increase» [1]. Today, according to O. Krupa, "in the absence of a significant improvement in the standard of living, a constant increase in prices for meat, fish and dairy products, potatoes will continue to be the "second bread" for Ukrainians [2].

M. Pysarev, T. Levkivska and G. Bandurenko claim that "potatoes are a relatively cheap raw material, a traditional and favorite crop for the population of Ukraine. It is characterized by a high nutritional value due to the content of digestible carbohydrates, complete vegetable protein, a high content of amino acids, a third of which are essential, as well as a wide range of mineral substances" [3]. "For the vast majority of the population, under conditions of self-preservation, it constitutes the basis of food security" [4]. In this regard, S. Volodin notes that "in Ukraine, potatoes take third place after wheat and corn in terms of production. In 2020, about 23 million tons of potatoes were produced, 2 % of them by enterprises, and 98 % by the population" [5].

T. Artiukh, O. Bezsmertna, D. Melnyk note that based on the results of the analysis of the volume of production and the area used for potatoes during 2017-2020, it was found that the rate of increase in the volume of potato harvest exceeds the rate of growth of the area, which means an increase in the yield level. The study of the zonal specialization of potato production showed that until 2011, this crop was grown in the largest volumes in Polissia, but in the following years respecialization took place, and the main share of potato production and consumption began to fall on the regions of the Forest Steppe" [6]. "In order to reduce planting rates and increase the reproduction rate of newly created potato varieties and varieties that are in great demand among the population, the task was set to differentiate them depending on the biological characteristics of the variety and stem-forming ability" [7].

S. Melnyk, A. Pashkovskyi and L. Sulyma highlight the features of modern technologies for growing and storing potatoes, describe the system of protecting plants from pests, diseases and weeds, prove the feasibility of using advanced irrigation technologies, show the economic efficiency of growing potatoes and summarize the best experience of growing potatoes in state, leased and farm farms and the center of agricultural of "Dukat" technologies [8].

In 2019-2020, Ukrainian scientists studied the influence of potato varieties of different maturity on the productivity of tubers. Knyagina, Myroslava, Solokha, Shchedryk and Levada varieties were taken. "At the same time, the best varieties were Knyaginya with an average bush productivity of 924 g, Myroslava (762 g) and Solokha (702 g), Shchedryk (597 g) and Levada (547 g) varieties were less productive" [9]. V. Semenchuk notes that "growing potatoes in almost all regions of Ukraine contributes to the creation and introduction into production of varieties of domestic breeding, which belong to different groups of ripeness, directions of cultivation and have different potential for adaptability to the soil and climatic conditions of our country" [10].

M. Furdyha notes that "among the varieties tested in 2018, the highest yields were distinguished by early Skarbnytsia (30.3 t/ha), mid-early Fantasia (28.4 t/ha), mid-ripening varieties: Okolitsia (27.8 t /ha), Tradition (27.5 t/ha). In 2019, the mid-early varieties stood out: Aria (46.8 t/ha) and Gurman (43.5); mid-ripening: Mystery (55.4 t/ha), Okolitsia (45.5 t/ha), Tradition (43.9 t/ha), Sluch (43.2 t/ha), mid-late Red Ruta (46.1 t /ha)" [11].

S. Kolodii studiedhighly productive and adaptable to soil and climatic conditions and disease-resistant varieties of potatoes in the conditions of the mountainous terrain of the Transcarpathian region, and also tested potato varieties of domestic and foreign origin for resistance to late blight and other diseases [12]. Yu. Ilchuk, R. Ilchuk and O. Rudnyk-Ivashchenko vdetermined the influence of different feeding areas and recommended doses of mineral fertilizers on the formation of productivity of early-ripening potato varieties Kimmeria and Shchedryk. They also noted that the productivity of early-ripening potato varieties does not depend on the size of the leaf apparatus due to the accelerated passage of phenophases in the development process [13].

N. Pysarenko, V. Sydorchuk and N. Zakharchuk established that in the years of research favorable for the hydrothermal coefficient, the highest yield was observed in potato varieties of different ripeness groups: among early ripening ones – Bazaliya, Opillya and Radomysl; mid-early – Fanatka, Mezhirichka 11 and Soncedar; medium-ripened – Avangard, Rostavitsa, Volodarka and Alliance. In less favorable years, potato varieties were characterized by the highest yield: early ones – Opillya, Radomysl and Bazaliya; mid-early – Fanatka; medium-ripe - Alliance and Volodarka [14].

Potatoes are very demanding on nutrients. This need for potatoes is explained by an underdeveloped root system. The weight of the roots is only 7% of the weight of the aerial part of the plant. Given the small reserves of nutrients in the sod-podzolic soils prevailing in Polissia, obtaining high yields of tubers is impossible without the use of fertilizers. A. Pozdniev and Yu. Tkachenko indicate the influence of chemical elements on potato physiology and disease resistance during its nutrition, namely "nitrogen enhances leaf and tuber growth and maximizes starch production; phosphorus improves the growth of leaves and tubers and affects the quality and quantity of starch; potassium maximizes water consumption and dry matter production; potassium also affects the level of tuber damage; magnesium ensures strong photosynthesis and good growth; calcium minimizes the incidence of brown, necrotic spotting of the

pulp of the tubers; boron is needed for the formation of starch and stabilization of cell membranes" [15].

A. Bykin and T. Panchuk claim that "one of the important indicators that are paid attention to when growing potatoes is the content of dry matter. Potato tubers contain 15–32 % of dry matter. Its accumulation can be influenced by: nitrogen, potassium and magnesium" . The research of these scientists showed that "with the local application of phosphorus and potassium fertilizers at the rate of P80 K180 against the background of N150, the maximum level of dry matter (20.4 %) and starch (13.9 %) in potato tubers among all options was obtained" [16]. S. Liashchenko and B. Taktaiev note that "one of the new and promising areas of potato growing is the use of biological and chelated fertilizers and plant protection agents. Such drugs are effective, increasing the yield and quality of tubers and do not harm the environment. It Bitoxybacillin-BTU, Phytocide, Quantum-Diaphan, Quantum-Gold, Quantum-Aminomax" [17].

Therefore, the revelance of the topic lies in the use of chelated fertilizers for the treatment of tubers during planting and foliar feeding of new potato varieties in Polissia of Ukraine. Such technological techniques optimize physiological processes in plants, increase the yield of potatoes and improve the quality of tubers. The purpose of the research is to develop elements of technology for growing new varieties potatoes for the best realization of genetic potential. To achieve the goal, the following tasks must be solved: 1) to study the effect of different rates of mineral fertilizers, treatment of tubers at planting and foliar feeding on the yield of potatoes, 2) to evaluate the effect of different rates of mineral fertilizers and foliar feeding on field germination and biometric indicators; 3) find out suitability for processing tubers after harvesting.

The purpose of the study

The purpose of the research is to develop elements of technology for growing new varieties potatoes for the best realization of genetic potential.

To achieve the goal, the following tasks must be solved:

1) to study the effect of different rates of mineral fertilizers, treatment of tubers at planting and foliar feeding on the yield of potatoes;

2) to evaluate the effect of different rates of mineral fertilizers and foliar feeding on field germination and biometric indicators;

3) find out suitability for processing tubers after harvesting.

Materials and methods

Research was conducted in the four-field technological crop rotation of the Institute for Potato Research of NAAS of Ukraine. Turf soils are medium podzolic sandy soils with a thickness of the plow layer of 20–22 cm.

The agrochemical characteristics of the experimental plot are as follows: the pH of the salt extract is 5.7; humus content –1.93; hydrolytic acidity – 3.8 mg-eq per 100 g of soil; degree of saturation with bases - 74.7; the content of mobile forms of phosphorus and potassium is 12.4 and 11.7 mg per 100 g of soil, respectively.

The object of research is early Slauta and mid-ripe Gurman potato varieties selected by the Institute for Potato Research of NAAS of Ukraine. "Early-ripening potatoes have an important agrotechnical significance, as they can be successfully used as a steam-absorbing crop for sowing winter crops" [18].

During the research, generally accepted techniques in potato growing were used and all necessary observations and biometric analysis were carried out [19], [20]. The experiment with a total area of 0.13 ha was laid out in three repetitions. The size of the sowing area is 36 m2, the accounting area is 15 m2. The plots are four-row. Caring for potato crops is generally accepted for the Polissia zone. The predecessor of the potato is double cider steam (mustard white). Mineral fertilizers in the form of nitroammophoska were spread according to the scheme of the experiment. Tubers were treated with drugs during planting and plants during the growing season. Chelated fertilizers are represented by Quantum Siamin, Diafan 3–18–18, Quantum SRKZ, Quantum Gold, Quantum Amino Max, Quantum Bor Active, Quantum K-36.

Scheme of the experiment:

1. Control.
2. $N_{45}P_{45}K_{70}$.
3. $N_{60}P_{60}K_{90}$.
4. Treatment of tubers during planting (Quantum Siamin – 0.5 l/t, Diafan 3–18–18 – 2.0 l/t, Quantum SRKZ – 1.0 l/t) + treatment of plants during the growing season.*
5. $N_{45}P_{45}K_{70}$ (scattering) + treatment of tubers during planting + treatment of plants during the growing season.*
6. $N_{60}P_{60}K_{90}$ (scattering) + treatment of tubers during planting + treatment of plants during the growing season.*

*Treatment of plants during the growing season on the 4th, 5th, 6th options:

- plant height 15 cm: Quantum Gold – 2 l/ha, Quantum Amino Max - 0.5 l/ha.

– budding phase: Quantum Gold – 2.5 l/ha, Quantum Amino Max – 0.5 l/ha.

–flowering phase: Quantum Bor Active – 1.0 l/ha, Quantum K-36 – 2.0 l/ha.

– after flowering: Quantum Siamin – 0.5 l/ha, Quantum K- 36 – 3.0 l/ha.

Results and discussion

The results of phenological observations of potatoes are presented in table 1.

Table 1
Interphase periods of development of potato varieties in 2018–2020, days

Research options	Number of days from planting to:			
	Seedling	Buttonization	Flowering	Death
Slauta variety				
1. Control	41	54	59	80
2. $N_{45}P_{45}K_{70}$	41	54	59	80
3. $N_{60}P_{60}K_{90}$	41	54	59	80
4. Treatment of tubers during planting + treatment of plants during the growing season*	41	54	59	80
5. $N_{45}P_{45}K_{70}$ + treatment of tubers during planting + treatment of plants during the growing season*	41	54	59	80
6. $N_{60}P_{60}K_{90}$ + treatment of tubers during planting + treatment of plants during the growing season*	41	54	59	80
Gurman variety				
1. Control	41	54	59	96
2. $N_{45}P_{45}K_{70}$	41	54	59	96
3. $N_{60}P_{60}K_{90}$	41	54	59	96
4. Treatment of tubers during planting + treatment of plants during the growing season*	41	54	59	96
5. $N_{45}P_{45}K_{70}$ + treatment of tubers during planting + treatment of plants during the growing season*	41	54	59	96
6. $N_{60}P_{60}K_{90}$ + treatment of tubers during planting + treatment of plants during the growing season*	41	54	59	96

Over three years of research, the period from planting to full seedlings of potatoes in the Slauta and Gurman varieties averaged 41 days, and the period from planting to budding in the Slauta and Gurman varieties was 54 days. The period from planting to flowering in the studied varieties was 59 days, and from planting to the death of potatoes in the Slauat variety 80 days, and in the Gurman variety 96 days.

As shown in table 2, the density of plantations in the Slauta variety, with a planned 66.5 thousand units/ha, was the best in option 6 and amounted to 64.4 thousand units/ha. This is 1.7 thousand pcs/ha more compared to the control variant. In the Gurman variety, the highest indicator of plant density was noted on option 6, which was 64.4 thousand units/ha. This is 2.1 thousand units/ha more than the control. It was also established that the field similarity of the varieties was greater in the 6th variant compared to the control – by 2.5% in the Slauta variety and 3.2% in the Gurman variety.

Table 2
Field similarity and biometric indicators of potato varieties for 2018–2020

Research options	Plant density, thousand bushes/ha	Field germination, %	Stem density		Plant height, cm
			per plant, pcs	thousand pieces/ha	
Slauta variety					
1.	62.7	94.3	4.0	254.3	33.3
2.	60.0	90.2	4.4	264.9	37.3
3.	63.1	94.8	4.2	264.4	34.0
4.	64.0	96.2	3.7	233.3	33.2
5.	61.3	92.1	4.1	250.7	33.5
6.	64.4	96.8	3.9	253.7	35.0
Gurman variety					
1.	62.3	93.6	3.3	204.0	42.3
2.	62.3	93.6	3.3	205.3	43.6
3.	64.0	96.2	3.2	206.7	39.8
4.	62.3	93.6	2.4	151.1	38.4
5.	60.9	91.5	2.8	164.9	41.0
6.	64.4	96.8	3.3	212.4	43.0

The number of stems per plant in the Slauta variety was in the range of 3.7–4.4 pcs. The 4th, 6th and 5th options showed the lowest indicators – 3.7; 3.9 and 4.1 pcs, respectively. A similar trend was also noted in the Gurman variety, that is, the lowest indicators were in the 4th variant (2.4 pcs), 5th (2.8 pcs.) and 3rd variant (3.2 pcs.) in comparison with the control . Stem density in the Gurman variety ranged from 2.4 to 3.3 stems per plant. So, the best indicators of the Slout variety were on the 2nd and 3rd options, on which mineral fertilizers were applied. In the Gurman variety, the best indicators were on the 3rd and 6th options.

By the height of the plants, the studied varieties were characterized by better indicators in the variants where the tubers were treated with chelated fertilizers and different rates of mineral fertilizers were used. In the Slauta variety, the highest height was noted on the second variant – 37.3 cm and the sixth variant – 35.0 cm. In the remaining variants, the plant height was within the range of 33.2–37.3 cm. In the Gurman variety, the highest plant height was set on the second version – 43.6 cm.

As shown in table 3, treatment of tubers at planting and during vegetation with chelated fertilizers had a significant effect on yield. Therefore, the increase in the yield of tubers treated with Quantum Siamin – 0.5 l/t, Diafan 3–18–18 – 2.0 l/t, Quantum SRKZ – 1.0 l/t in combination with scattering $N_{60}P_{60}K_{90}$ in the Slauta variety on the sixth variant was 10.2 t/ha. In the fifth option, when $N_{45}P_{45}K_{70}$ was applied and the tubers of Quantum Siamin, Diafan, Quantum SRKZ were processed, the productivity increased by 8.9 t/ha. On the third option the yield increase compared to the control was 7.8 t/ha.

Table 3
Potato yields depending on the use of different rates of mineral fertilizers and foliar feeding, 2018–2020

Research options	Productivity, t/ha	+,- to control
Slauta variety		
1. Control	15.3	-
2. $N_{45}P_{45}K_{70}$	20.2	+4.9
3. $N_{60}P_{60}K_{90}$	23.1	+7.8
4. Treatment of tubers during planting + treatment of plants during the growing season*	19.4	+4.1
5. $N_{45}P_{45}K_{70}$ + treatment of tubers during planting + treatment of plants during the growing season*	24.2	+8.9
6. $N_{60}P_{60}K_{90}$ + treatment of tubers during planting + treatment of plants during the growing season*	25.5	+10.2
Gurman variety		
1. Control	13.5	-
2. $N_{45}P_{45}K_{70}$	18.4	+4.9
3. $N_{60}P_{60}K_{90}$	20.6	+7.1
4. Treatment of tubers during planting + treatment of plants during the growing season*	18.0	+4.5
5. $N_{45}P_{45}K_{70}$ + treatment of tubers during planting + treatment of plants during the growing season*	20.4	+6.9
6. $N_{60}P_{60}K_{90}$ + treatment of tubers during planting + treatment of plants during the growing season*	20.3	+6.8

In the Gurman variety, these indicators compared to the control were: in the 3rd variant, 7.1 t/ha; in the 5th option 6.9 t/ha and in the 6th option 6.8 t/ha. The highest yield of potato tubers was provided by the Slauta variety of 25.5 t/ha in the 6th variant. In the Gurman variety, the highest yield indicators were obtained on option 3 - 20.6 t/ha and option 5 – 20.4 t/ha. The highest yield was shown by the Slauta variety where different rates of mineral fertilizers were used in combination with chelated fertilizers.

The structural analysis of varieties is presented in table 4. During 2018–2020, on average, the percentage of the seed fraction prevailed in the structure of the yield of two potato varieties. In the early Slauta variety, the number of seed tubers obtained ranged from 198.4 to 313.6 thousand pieces/ha. The 6th option provided the largest number of seed tubers. It yielded 313.6 thousand pieces/ha, with a total weight of 16.8 t/ha with a multiplication factor of 4.7. Also, the 5th variant stood out, in which the number of tubers was 292.4 thousand units/ha, with a total weight of 14.1 t/ha with a multiplication factor of 4.4. The number of obtained seed tubers in the Gurman variety ranged from 182.7 to 419.4 thousand pieces/ha. The mass of tubers in the sixth variant was 16.6 t/ha with a multiplication factor of 6.4, and in the second variant – 15.6 t/ha with a multiplication factor of 4.3.

Table 4
Structural analysis of the tuber crop, 2018–2020

Research options	Yield of seed tubers per hectare				Reproduction coefficient
	the number of tubers		mass of tubers		
	thousand pieces/ha	% in the structure	t/ha	% in the structure	
Slauta variety					
1. Control	230.2	43.3	13.0	65.7	3.5
2. $N_{45}P_{45}K_{70}$	274.2	50.9	15.0	68.5	4.1
3. $N_{60}P_{60}K_{90}$	275.7	45.7	14.1	68.4	4.2
4. Treatment of tubers during planting + treatment of plants during the growing season*	198.4	37.5	9.4	55.7	3.0
5. $N_{45}P_{45}K_{70}$ + treatment of tubers during planting + treatment of plants during the growing season*	292.4	50.7	14.1	81.4	4.4
6. $N_{60}P_{60}K_{90}$ + treatment of tubers during planting + treatment of plants during the growing season*	313.6	46.5	16.8	63.8	4.7
Gurman variety					
1. Control	282.2	52.8	15.3	76.9	4.2
2. $N_{45}P45K_{70}$	284.7	57.7	15.6	77.7	4.3
3. $N_{60}P_{60}K_{90}$	264.3	50.2	14.4	68.2	4.0
4. Treatment of tubers during planting + treatment of plants during the growing season*	228.6	48.9	11.7	74.7	3,4
5. $N_{45}P_{45}K_{70}$ + treatment of tubers during planting + treatment of plants during the growing season*	182.7	39.8	9.8	63.0	2.8
6. $N_{60}P_{60}K_{90}$ + treatment of tubers during planting + treatment of plants during the growing season*	419.4	96.2	16.6	73.8	6.4

After harvesting, the tubers were analyzed for damage by soil pests. As evidenced by the data in table 5, the damage of tubers by the wireworm in the Slauta variety in the control had the highest percentage– 4.9%, and in the sixth option, the lowest – 1.6%. In the Gurman variety, the highest percentage of damage was found on the sixth option – 9.7%, and the lowest - 1.3% on the fourth option. The highest incidence of diseases in the Slauta variety was also noted in the control – 3.6%, and in the Gurman variety in the first and fourth variants, where the percentage of infestation was 11.1 and 11.2%, respectively. The lowest percentage of damage in the Slauta variety was noted on the second option, and in the Gurman variety on the sixth option.

Table 5
Damage to tubers by diseases and pests, 2018–2020

Research options	Tubers damaged,%	
	diseases	pests
Slauta variety		
1. Control	3.6	4.9
2. $N_{45}P_{45}K_{70}$	3.3	2.0
3. $N_{60}P_{60}K_{90}$	3,4	2.8
4. Treatment of tubers during planting + treatment of plants during the growing season.*	3,4	3.3
5. $N_{45}P_{45}K_{70}$ + treatment of tubers during planting + treatment of plants during the growing season.*	3.5	1.8
6. $N_{60}P_{60}K_{90}$ + treatment of tubers during planting + treatment of plants during the growing season.*	3.5	1.6
Gurman variety		
1. Control	11.2	3.5
2. $N_{45}P_{45}K_{70}$	7.1	5.9
3. $N_{60}P_{60}K_{90}$	10.9	2.4
4. Treatment of tubers during planting + treatment of plants during the growing season.*	11.1	1.3
5. $N_{45}P_{45}K_{70}$ + treatment of tubers during planting + treatment of plants during the growing season.*	6.6	1.7
6. $N_{60}P_{60}K_{90}$ + treatment of tubers during planting + treatment of plants during the growing season.*	4.2	9.7

After harvesting, tubers were sampled to determine their suitability for the production of potato products, namely chips and French fries. It has been established that the Slauta variety is not suitable for processing into chips and French fries. It had a high content of reducing sugars (0.31–0.51%) and was characterized by a low quality score of the finished product. The Gourman variety had better indicators of suitability for processing into chips after blanching (9.0 points). Before blanching, the suitability score ranged with a slight deviation from 7.0 to 8.0.

Conclusions

1. It was established on average for the years 2018-2020 that the Slauta and Gurman potato varieties responded positively to the application of different rates of nitroammofoska. But these varieties had better stem-forming ability of tubers, field germination and other biometric indicators in those variants where the tubers were processed at planting and foliar fertilization was carried out.

2. On average, for the years 2018-2020, the use of chelated fertilizers together with nitroammophoska increased the productivity of the Slauta variety to 10.2 t/ha, and the Gurman variety to 6.9 t/ha compared to the control.

3. During 2018–2020, the percentage of the seed fraction prevailed in the crop structure. The largest number of seed tubers in the Slauta variety was provided by the sixth variant, which yielded 313.6 thousand pieces/ha with a total weight of 16.8 t/ha with a multiplication factor of 4.7. The fifth variant also stood out, in which the number of tubers was 292.4 thousand units/ha with a total weight of 14.1 t/ha with a multiplication factor of 4.4. The number of seed tubers in the Gurman variety ranged from 182.7 to 419.4 thousand pieces/ha. The mass of tubers in the sixth variant was 16.6 t/ha with a multiplication factor of 6.4. Therefore, the largest yield of seed tubers was obtained in the variants where chelated fertilizers were used and nitroammofoska was applied when planting potatoes

4. In the Slauta variety, the lowest percentage of tubers damaged by soil pests was found in the sixth option, where mineral fertilizers $N_{60}P_{60}K_{90}$ were applied, spreading + treatment of tubers during planting + treatment of plants during the growing season. In the Gurman variety, the lowest percentage of tubers damaged by soil pests was found in the fourth option, where the tubers were processed during planting and foliar feeding of potatoes was carried out.

5. The Gurman variety is characterized by better indicators of suitability for processing into potato products.

Conflict of interest

The authors declare no conflict of interest.

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