AGRICULTURAL SCIENCES

POTATO PRODUCTIVITY UNDER DRIP IRRIGATION DEPENDING ON NUTRITION OPTIMIZATION IN THE SOUTH OF UKRAINE

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The purpose of the research was to determine the possibility of using reduced doses of mineral fertilizers by changing the method of application and their joint use with plant growth regulators when cultivating potatoes of the summer planting period. Three varieties were studied, such as the early-maturing variety Tiras, the medium-early variety Zabava, and the medium-maturing variety Slavyanka. Three nutrition sources were used for the study, such as without fertilizers (control), $N_{90}P_{90}K_{90}$ randomly and $N_{45}P_{45}K_{45}$ locally in the 0-12 cm soil layer. In addition to mineral fertilizers, the scheme of the experiment included variants with treatment of plants in the budding phase with growth regulators «Diazophyte», «Adaptophyte» and «Agrostimulin».

Field experiments were carried out during 2016-2018 yrs in the Educational, Scientific and Practical Center of the Mykolaiv NAU on the heavy loam residual-slightly saline Southern Chernozem. The arable soil layer contained on average 3.1% humus (by the Tyurin method), it contained 62 mg/kg of lightly hydrolyzed nitrogen, and it contained 25 mg/kg of nitrates (by Grandville–Lagou), it contained 38 mg/kg of mobile phosphorus (by Machigin), and it contained 340 mg/kg of exchangeable potassium (using a flame photometer), and the pH was of 6.9.

Weather conditions in the years of research were somewhat different, but in general they were typical for the Southern Steppe of Ukraine.

The average daily air temperature in the research area was 11.0 °C, relative humidity was 73 %, annual precipitation was 472 mm, SCC was 0.5 up to 0.7.

Potatoes are the second bread for the population of Ukraine. Its tubers are eaten all year round. This crop is one of the most productive, the yield of tubers can reach 100 t/ha or higher. In terms of gross potato production in the

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world, Ukraine ranks fourth after China, Russia and India, but the yield of tubers, unfortunately, is still low. This leads to the need to develop and improve elements of potato cultivation technology for each zone, depending on soil and climatic conditions, in order to significantly increase the yield of tubers while maintaining high quality indicators. It is impossible to achieve this without the use of fertilizers [1; 2]. Their rational use provides 40-50% yield growth or more. In addition, the use of fertilizers significantly affects the biochemical composition, nutritional value and taste of tubers, their shelf life, etc. It is known that for potatoes, it is most advisable to use organic and mineral fertilizers together, while forming favorable physical and mechanical properties, the nutritional regime of the soil, etc. Currently, due to a sharp decrease in the number of animals, the use of organic fertilizers for agricultural crops in Ukraine has significantly decreased. Mineral fertilizers in recent years have a high cost, they should be used with the greatest efficiency and payback. One of the directions of this approach may be the application of mineral fertilizers locally. It was found that with this method of application, it is possible to get a higher return from a significantly lower dose of fertilizers [3]. The effect of local fertilization on physiological processes was observed not only at the early stages of plant development, but also during the formation of spare substances, that is, this method clearly affects the level of yield and its quality indicators. The coefficient of use of nutrients by plants with local application of fertilizers in comparison with the spread method increases for nitrogen and potassium by 10 up to 15 %, and for phosphorus it increases by 5 up to 10 % [3].

One of the ways to increase the effectiveness of mineral fertilizers with reduced doses of their use is the use of growth regulators, which increase the resistance of plants to adverse weather conditions, pests and diseases. The use of modern growth regulators in the cultivation of cereals, legumes and other crops pays for the cost of increasing productivity and it is one of the most profitable methods of increasing productivity, in addition, plants use moisture much more efficiently [4; 5].

Based on this, we investigated the possibility of using reduced doses of mineral fertilizers due to the local method of their application and in addition, together with modern plant growth regulators, when cultivating three varieties of summer potatoes. For the conditions of the Southern Steppe zone of Ukraine, these issues are important, relevant and insufficiently studied.

Our research has shown that the use of mineral fertilizers contributed to a significant increase in the content of mobile nutrients in the arable soil layer in comparison with the non-maneuverable control. We determined that when the full dose of mineral fertilizer $N_{90}P_{90}K_{90}$ was applied to pre-sowing cultivation at random, as well as half of it ($N_{45}P_{45}K_{45}$) locally in the soil layer 0-12 cm,

the content of nitrates, mobile phosphorus and exchangeable potassium was almost the same, and especially during the planting of tubers. Analysis of soil samples in the phase of full maturation of tubers before harvesting determined that the content of nitrates and P_2O_5 against the background of local application of 1/2 dose of fertilizers was even slightly higher. The background of mineral nutrition, in turn, had a significant impact on the yield of tubers taken for the study of potato varieties. When cultivating a crop without mineral fertilizers, the average yield of commercial potato tubers of the early-maturing Tiras variety was 16.6 t/ha, the yield of average-early Zabava variety was 18.0 t/ha, and the average yield of medium-maturing variety Slavyanka was 19.1 t / ha. Against the background of $N_{90}P_{90}K_{90}$ application, the yields as 23.1; 25.1 and 26.8 t/ha were formed randomly, respectively, and against the background of local application of $N_{45}P_{45}K_{45}$ the yields formed 23.2; 25.2 and 26.8 t/ha, respectively. The obtained results of the experiment indicate that both the investigated backgrounds nutrition all the varieties of potato accepted for the study, form the productivity is almost the same level (Figure 1).

Treatment of potato plants with growth regulators like without fertilizers and their application, provide some trend of further increase the yield of marketable tubers 1.2–1.7 t/ha.

We found that the doses, methods of applying mineral fertilizers and plant growth regulators taken for research, in a certain way affected the quality of tubers of potato varieties.

The dry matter content in potato tubers increased both from fertilizers and from the treatment of plants with growth regulators. For example, tubers of the early – maturing Tiras variety without fertilizers contained 18.2% of them; tubers of the medium – early variety Zabava contained 18.6 %, and tubers of the medium-maturing variety Slavyanka contained 19.1 %. When $N_{90}P_{90}K_{90}$ was applied randomly, the amount of dry matter increased up to 20.7; 20.2 and 21.0%, and $N_{45}P_{45}K_{45}$ locally in the 0-12 cm soil layer the amount of dry matter increased up to 21.4; 21.3 and 21.6%, respectively. Treatment of potato plants at the beginning of budding with «Diazophyte», «Adaptophyte» and «Agrostimulin» contributed to a further increase in the content of dry substances in tubers both when cultivating the crop without mineral fertilizers, and when applying their full dose ($N_{90}P_{90}K_{90}$) separately and their half dose ($N_{45}P_{45}K_{45}$) locally. Similarly, the content of vitamin C (ascorbic acid) and starch in tubers changed. The content of nitrates in tubers did not exceed GDK.

Thus in the conditions of South of Ukraine with drip irrigation it is advisable to cultivate in the summer, planting the early maturing variety Tiras, the mid-season variety and the medium-maturing variety Slavyanka. Their yield without fertilizers and growth regulators was 16.6, 18.0 and 19.1 t/ha, respectively.

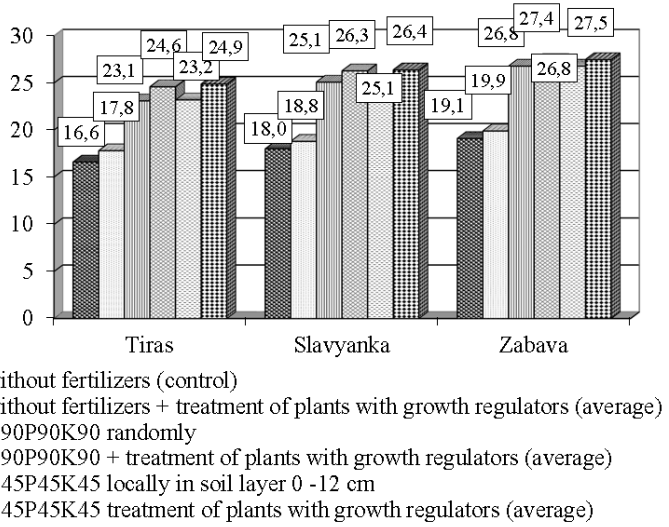

Figure 1. Yield of commercial tubers of potato varieties of summer planting depending on fertilizers and growth regulators (average for 2016-2018 yrs), t / ha

Due to mineral fertilizers, regardless of the dose and method of their application, the yield of potato tubers increases by 43 up to 45 %. The studied doses of fertilizers $N_{90}P_{90}K_{90}$ at random and $N_{45}P_{45}K_{45}$ locally in the 0-12 cm soil layer form the soil nutrient regime and crop yield at the same level. Thus, the yield of tubers of the Tiras variety was 23.1 and 23.2 t/ha, respectively, the yield of tubers of the Zabava variety was 25.6; 26.7 t / ha, and the yield of tubers of the medium-maturing variety Slavyanka was 26.8 t/ha.

It was determined that growth regulators contributed to an increase in the yield of potato tubers without the use of fertilizers by 4 up to 5%, and on a fertilized background it increased by 5 up to 8%.

Fertilizers and the use of growth regulators had a positive effect on the quality of tubers of all the studied potato varieties.

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ROLE OF NITROGEN FERTILIZERS IN MODERN AGRICULTURE OF UKRAINE

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The population not only in Ukraine, but also at a global scale is currently growing rapidly that increases the need for ensuring basic food products and encourages excessive demand for applying mineral fertilizers. To solve the food and other problems in the national agrarian sphere, it is expedient to take measures, including, but not limited to increasing investment in the agro-industrial sector and intensifying agricultural production. One of the high-priority objectives is the application of fertilizers. The proper use of mineral fertilizers in agriculture will directly affect the yield, having a positive effect. It is worth noting that even the most fertile soil is depleted over the years, if it is constantly used for growing crops, and such nutrient depletion adversely affects soil quality, boosting crop yields, therefore, creating a threat to the Ukrainian sustainable agricultural development for food security and nutrition. Agricultural enterprises are able to replenish the soil reserves by special top dressing. It will increase productivity even in small areas, improve the taste and appearance of agricultural products [1].

The issue of the expediency of applying mineral fertilizers for agrarian sphere was raised at the end of the nineteenth century, when, due to the rapidly increasing population, increase in food production based on improving agricultural productivity was urgently needed. The use of fertilizers, along with the implementation of other agro-engineering measures, such as proper land treatment and cultural operations, is one of the key factors in properly managing the development and growth of crops, and should feature prominently in obtaining high and sustained yields. The role of nitrogen fertilizers in crop production, soil science and agriculture has become increasingly important in recent years.

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