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4.1.1. Общее земледелие и растениеводство (биологические науки, сельскохозяйственные науки)

ЭКОНОМИЧЕСКАЯ ЭФФЕКТИВНОСТЬ ОСНОВНОЙ ОБРАБОТКИ ПОЧВЫ И МИНЕРАЛЬНЫХ УДОБРЕНИЙ В ТЕХНОЛОГИИ ВОЗДЕЛЫВАНИЯ КУКУРУЗЫ

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В статье представлены результаты анализа экономической эффективности основной обработки почвы и минеральных удобрений в технологии возделывания гибрида кукурузы Краснодарский 377 АМВ на чернозёме выщелоченном Западного Предкавказья. Выявлено, что лучшие показатели урожайности отмечены на вариантах со вспашкой на фоне как рекомендуемой ($N_{60}P_{60}K_{60}$), так и интенсивной ($N_{120}P_{120}K_{120}$) норм минерального удобрения, где отмечен их рост по сравнению с контролем на 1,31 и 1,97 т/га или на 25,5 и 38,4 %. Оставление почвы без обработки при выращивании кукурузы по системе no-till не проводило к росту данного показателя, даже и на фоне применения минеральных удобрений. Здесь отмечена наименьшая фактическая урожайность – 4,16–4,46 т/га, что меньше контроля на 0,67–0,97 т/га (или на 13,1–18,9 %). Лучшие показатели по стоимости валовой продукции получены на варианте со вспашкой на фоне интенсивной нормы минерального удобрения ($N_{120}P_{120}K_{120}$), где отмечен рост данных показателей по сравнению с контролем на 20,3 тыс.руб./га или на 38,4 %. Максимальный чистый доход получен на варианте с со вспашкой и с внесением интенсивной нормы удобрения ($N_{120}P_{120}K_{120}$) – 21600 руб./га против 12900 руб./га на контроле. Минимальная себестоимость продукции, которая составила 6817 руб./т (против 7482 руб./т на контроле), а также максимальная рентабельности в 46,7 % (против 33,6 % на контроле) получены на варианте с внесением рекомендуемой нормы ($N_{60}P_{60}K_{60}$) минеральных удобрений под вспашку

Ключевые слова: КУКУРУЗА, ГИБРИД, КРАСНОДАРСКИЙ 377 АМВ, СТРУКТУРА УРОЖАЯ, УРОЖАЙНОСТЬ

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4.1.1. General agriculture and crop production (biological sciences, agricultural sciences)

ECONOMIC EFFICIENCY OF BASIC SOIL TILLAGE AND MINERAL FERTILIZERS IN CORN CULTIVATION TECHNOLOGY

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The article presents the results of an analysis of the economic efficiency of basic soil treatment and mineral fertilizers in the technology of cultivating the Krasnodar 377 AMB corn hybrid on leached chernozem of the Western Ciscaucasia. It was revealed that the best yield indicators were noted in variants with plowing against the background of both recommended (N60P60K60) and intensive (N120P120K120) norms of mineral fertilizer, where their increase was noted compared to the control by 1.31 and 1.97 t/ha or by 25.5 and 38.4%. Leaving the soil uncultivated when growing corn using the no-till system did not lead to an increase in this indicator, even against the background of the use of mineral fertilizers. The lowest actual yield was noted here - 4.16–4.46 t/ha, which is 0.67–0.97 t/ha (or 13.1–18.9%) less than the control. The best indicators for the cost of gross production were obtained in the variant with plowing against the backdrop of an intensive rate of mineral fertilizer (N120P120K120), where an increase in these indicators was noted compared to the control by 20.3 thousand rubles/ha or by 38.4%. The maximum net income was obtained in the option with plowing and the application of an intensive fertilizer rate (N120P120K120) - 21,600 rubles/ha versus 12,900 rubles/ha in the control. The minimum cost of production, which amounted to 6817 rubles/t (versus 7482 rubles/t in the control), as well as the maximum profitability of 46.7% (versus 33.6% in the control) were obtained using the option with the introduction of the recommended rate (N60P60K60) mineral fertilizers for plowing

Keywords: CORN, HYBRID, KRASNODAR 377 AMB, CROP STRUCTURE, YIELD

Introduction

Agriculture is one of the ways to maintain the independence of the state. A country that has the most advanced weapons, but is unable to feed itself, will depend on other countries. Agricultural production is the most important condition for political stability. Corn is a strategic crop of the 21st century. It has high yield potential and is widely used in production. Almost all of its parts are used in various industries that cannot do without corn grain, and the leaves and stems are used by pulp and paper mills. Corn grain accounts for the third level of consumption, after wheat and rice [2].

The importance of the technology of simultaneous cultivation with organic and mineral fertilizers in obtaining high-quality products from corn is very great. Correct use of fertilizers through appropriate processing allows you to obtain stable and high yields even on the weakest soils [4].

Every element of technology carries specific tasks aimed at solving the main problems associated with growing corn. The annual application of N60P60K60 had a strong and sustainable effect over the years [3].

The climatic zones of the region should be taken into account. Both on rainfed and irrigated soils, the most productive hybrids in terms of grain yield are FAO 250–300 [9].

The selection of the correct method of tillage, in turn, depends on the agricultural landscape, the zone where the crop will grow (zones of insufficient, sufficient and unstable moisture), its resource intensity and energy consumption. Also, the intensity of treatment will depend on the condition of the soil [1, 5-8, 10, 11].

The purpose of the study is to analyze the economic efficiency of the main soil cultivation of leached chernozem and mineral fertilizers in the technology of cultivating the hybrid corn Krasnodar 377 AMV in Western Ciscaucasia.

Material and object of research

The Krasnodar Territory is considered to be the most unique region in the Russian Federation. This lies in its geographical location and the wide variety of landscapes, soil and climatic conditions and the occurrence of surface and groundwater, as well as the great diversity of flora and fauna. Kuban has long been famous to this day for the richness and fertility of its chernozem soils, on which more than 100 types of various agricultural crops are cultivated. The territory of the Kuban educational farm (the place where the experiments were conducted) is included in the Kuban delta region, represented by the Pre-Kuban Plain, and also belongs to the forest-steppe and steppe zone of the Cis-Caucasian forest-steppe province. The land plot is located on the right bank of the river. Kuban, on the first terrace above the floodplain.

The soil cover is represented mainly by chernozems (64.6%), including the leached chernozem subtype. The average thickness of the humus horizon is 147 cm. The relief of the field is flat. The mechanical composition is light clayey. The reaction of the aquatic environment is 6.5–8.2. The soil-forming material is loess-like heavy loam. Leached chernozem is characterized by a heavy mechanical composition, good structure, granular and fine-grained fractions. The ratio of capillary to non-capillary duty cycle is 3:1.

Field experiments were carried out on a corn hybrid Krasnodarsky 377 AMV(simple modified odontoidmid-season hybrid of grain and fodder directions, FAO 370).

Research methods

Experiment scheme.

Factor Ā– basic tillage methods: plowing at 25–27 cm, chiseling at 25–27 cm, disc hulling at 10–12 cm and zero tillage with direct sowing of the crop.

Factor B – fertilization background: 1. Without fertilizers. 2. recommended rate of mineral fertilizers (N80P80K80) 2). 3. Intensive rate of mineral fertilizers (N120P120K120).

Methods and agricultural technology are generally accepted.

Results and discussion

Therefore, the best motivation for producing high-yield products is high profits. In our experiment, we touched upon the economic side of the issue of growing corn and carried out an economic assessment of the results obtained during the experiment.

Making a profit must correspond to the real situation of the economy, namely its energy, economic and labor equipment. An uncontrolled increase in the gross volume of production does not lead to real profit, since it is necessary to take into account all criteria of economic efficiency, including the costs of growing crops, maintaining equipment, paying workers and maintaining the resulting crop. Therefore, simply getting a high yield is not enough to get a high income from this crop. It is also important for the agricultural producer not only to obtain a large volume of products, but also to satisfy the needs of the population, thanks to which the same profit will be received. It is the ability to meet the needs of the majority of the population, who are potential buyers, that determines the success of production and the enterprise as a whole.

In accordance with these criteria, we assessed production efficiency from an economic point of view.

The cost of gross output is determined by the size of the harvest and the cost of a unit of production on the market. The grain sales price was used in the calculation in accordance with the sales prices of corn grain in 2023. Production costs for obtaining final crop products consist of costs at all stages of production: from the purchase of seeds to the payment of wages to employees after harvesting the crop. Prices for applied fertilizers and materials for

equipment maintenance correspond to real-time market prices.

The level of profitability is the final stage in assessing the economic efficiency of production. It is this that determines the need to use one or another cultivation technology that will bring the greatest income to the enterprise.

Calculation of the level of profitability is carried out by dividing the net income of the enterprise by production costs, and is expressed as a percentage. It is the level of profitability of production that determines the feasibility of using crop cultivation technology, even if a high yield was obtained, but significant funds were spent on its cultivation. This ultimately leads to the fact that this technology is unprofitable for the enterprise and it is worth sacrificing productivity, but at the same time getting the same profit at lower production costs. Economic assessment is a complex multifactorial process, during which it is necessary to pursue not only personal goals in obtaining benefits, but also to be objective when assessing the capabilities of the farm.

Net income is the main goal of every farmer when cultivating crop products. Net profit shows the real capabilities of the farm, its success and ability to obtain a large volume of high-quality products. Net profit is determined by the difference between the cost of gross output and the cost of obtaining it.

Economic calculation of the results of studies of the influence of soil cultivation method and the use of mineral fertilizers on the growth and development of maize plants of the Krasnodar hybrid 377AMV is presented in Table 1.

The highest actual grain yield was obtained in the variant with plowing to a depth of 25–27 cm using an intensive fertilizer rate (N120P120K120) – 7.10 t/ha, which is higher than the control by 1.97 t/ha (or 38.4%). It was slightly lower in the variant with the use of fertilizers at the recommended rate (N60P60K60) - 6.44 t/ha, which is higher than the control by 1.31/ha (or 25.5%).

Leaving the soil uncultivated when growing corn using the no-till system did not lead to an increase in this indicator, even against the background of the use of mineral fertilizers. The lowest actual yield was noted here - 4.16–4.46 t/ha, which is 0.67–0.97 t/ha (or 13.1–18.9%) less than the control.

In the variant with the highest yield (plowing at 25–27 cm) using fertilizers at an intensive rate (N120P120K120) the highest value of gross production was obtained: 71,000 rubles/ha.

Table 1 - Economic indicators of cultivationcorn for grain hybrid Krasnodar 377 AMV

Indicator	Option					
	plowing			no-till		
	b/ud (k)	$N_{60}P_{60}K_{60}$	$N_{120}P_{120}K_{120}$	used	$N_{60}P_{60}K_{60}$	$N_{120}P_{120}K_{120}$
Productivity, c/ha	5.13	6.44	7.10	4.16	4.39	4.46
Yield increase, c/ha	-	+13.1	+19.7	-0.97	-0.74	-0.67
Selling price, rub./t	10,000	10,000	10,000	10,000	10,000	10,000
Cost of gross production, rub./ha	51 300	64 400	71,000	41 600	43 900	44 600
Production costs, rub./ha	38 400	43 900	49 400	33 940	39 440	43 940
Cost, rub./ts	7 485	6,817	6,958	8 159	8,984	10,076
Net income, rub./ha	12 900	20 500	21 600	7 660	4460	660
Profitability, %	33.6	46.7	43.7	22.6	11.3	1.5

In the variant with the highest yield (plowing at 25–27 cm) using fertilizers at an intensive rate (N120P120K120) the highest value of gross production was obtained: 71,000 rubles/ha. This option had the highest production costs - 49,400 rubles / ha, as well as net income, which amounted to 21,600 rubles / ha.

The minimum cost of production, which amounted to 6817 rubles/t (versus 7482 rubles/t in the control), as well as the maximum profitability of

46.7% (versus 33.6% in the control) were obtained using the option with the introduction of the recommended rate (N60P60K60) mineral fertilizers for plowing.

Leaving the soil uncultivated when growing corn using the no-till system led to a sharp decline in all economic indicators, especially against the backdrop of the use of mineral fertilizers. Here, according to experience, the lowest cost of gross production was noted - 41,600–44,600 rubles/ha, which is less than control by 6,700–9,700 rubles/ha (or 13.1–18.9%), net income – 660–7,660 rubles/ha ha, which is less than control by 8540–12240 rubles/ha (or 40.6–94.9%) and profitability – 1.5–22.6%, which is less than control by 11.0–32.1%, at the maximum production cost - 8159–10076 rubles/t, which is higher than the control by 674–2591 rubles/t (or 9.0–34.6%).

Conclusions

Thus, the best yield indicators were noted in variants with plowing against the background of both recommended (N60P60K60) and intensive (N120P120K120) norms of mineral fertilizer, where their increase was noted compared to the control by 1.31 and 1.97 t/ha or by 25.5 and 38.4%. Leaving the soil uncultivated when growing corn using the no-till system did not lead to an increase in this indicator, even against the background of the use of mineral fertilizers. The lowest actual yield was noted here - 4.16–4.46 t/ha, which is 0.67–0.97 t/ha (or 13.1–18.9%) less than the control.The best indicators for the cost of gross production were obtained in the variant with plowing against the backdrop of an intensive rate of mineral fertilizer (N120P120K120), where an increase in these indicators was noted compared to the control by 20.3 thousand rubles/ha or by 38.4%. The maximum net income was obtained in the option with plowing and the application of an intensive fertilizer rate (N120P120K120) - 21,600 rubles/ha versus 12,900 rubles/ha in the control. The minimum cost of production, which amounted to 6817 rubles/t (versus 7482 rubles/t in the

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Bibliography

1. Archipenko, A. A. The role of mineral fertilizers and basic tillage for winter wheat crops in the formation of its productivity / A. A. Archipenko, R. V. Kravchenko // Polythematic network electronic scientific journal of the Kuban State Agrarian University, 2021. – No. 171. – pp. 335-347. – DOI 10.21515/1990-4665-171-023. – EDN QZEXHZ.

2. Bagrintseva, V. N. Weediness and yield of corn under different soil tillage / V. N. Bagrintseva, T. I. Borshch, I. A. Shmalko, R. V. Kravchenko // Protection and quarantine of plants, 2006. – No. 2. – P. 29 – 30.

3. Gabaraev, D. B. The role of biological fertilizers in the formation of the productivity of corn hybrids / D. B. Gabaraev, R. V. Kravchenko / Polythematic network electronic scientific journal of the Kuban State Agrarian University, 2023. - No. 187. – P.40-54. – DOI 10.21515/1990-4665-187-009. – EDN VPZGYW.

3. Kravchenko, R.V. Realization of the productive potential of corn hybrids depending on sowing time / R.V. Kravchenko // Agrarian Science, 2009. – No. 2. – P. 27 – 28.

4. Kravchenko, R.V. Adaptability and stability of the manifestation of yield properties of corn hybrids against the background of anthropogenic factors / R.V. Kravchenko // Polythematic network electronic scientific journal of the Kuban State Agrarian University. – Krasnodar: KubGAU, 2012. – No. 77. P. 770-784.

5. Kravchenko, R.V. The influence of basic tillage on the agrobiological parameters of sunflower hybrid Vulcan in the conditions of the Central zone of the Krasnodar Territory / R.V. Kravchenko, A.S. Tolstykh // Proceedings of KubSAU. - Krasnodar: KubSAU, 2019. - No. 78. – P.86-90. – DOI 10.21515/1999-1703-78-86-90. – EDN ADVYFZ.

6. Kravchenko, R. V. The influence of the main tillage on the agrophysical properties of the soil in the technology of cultivation of sugar beets / R. V. Kravchenko, A. V. Zagorulko, O. S. Kalinin // Proceedings of KubSAU, 2019. - No. 81. – P.97-102. – DOI 10.21515/1999-1703-81-97-102. – EDN KGYQZK.

7. Kravchenko, R. V. The influence of the main tillage on the agrophysical properties of soil in sunflower crops / R. V. Kravchenko, A. S. Tolstykh // Polythematic network electronic scientific journal of the Kuban State Agrarian University, 2019. – No. 150. – C .182-194. – pp. 182-194. – DOI 10.21515/1990-4665-150-019. – EDN DJFYIQ.

8. Kalinin, O. S. The influence of soil cultivation and mineral fertilizers on the agrophysical properties of soil under sugar beet crops / O. S. Kalinin, R. V. Kravchenko // Polythematic network electronic scientific journal of the Kuban State Agrarian University, 2021. – No. 173. – pp. 61-75. – DOI 10.21515/1990-4665-173-006. – EDN STEEJO.

9. Filipenko, N. N. Efficiency of new herbicides on corn crops in the Western Ciscaucasia / N. N. Filipenko, R. V. Kravchenko, S. I. Luchinsky / News of the Timiryazev Agricultural Academy, 2023. - No. 1. – C .68-78. – DOI: 10.26897/0021-342X-2024-1-68-78. – EDN: EEUFOB

10. Shuvalov, A. A. Dependence of agrochemical and agrophysical indicators of soil on its main processing in the technology of cultivating sugar beets / A. A. Shuvalov, R. V. Kravchenko // Polythematic network electronic scientific journal of the Kuban State Agrarian University, 2020. – No. 162. – pp. 219-228. – DOI: 10.21515/1990-4665-162-015. – EDN LZGTRR.

11. Shuvalov, A. A. Dependence of the soil water regime on its main treatment in the technology of cultivating sugar beets / A. A. Shuvalov, R. V. Kravchenko // Polythematic network electronic scientific journal of the Kuban State Agrarian University, 2020. – No. 163 . – pp. 265-274. – DOI 10.21515/1990-4665-163-022. – EDN XPUQZM.