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

АНАЛИЗ ДИНАМИКИ УРОЖАЙНОСТИ, ПОСЕВНЫХ ПЛОЩАДЕЙ И ВАЛОВЫХ СБОРОВ КУКУРУЗЫ В РФ И ПЕРСПЕКТИВЫ РАСШИРЕНИЯ ЕЕ ПОСЕВОВ В АСТРАХАНСКОЙ ОБЛАСТИ

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В статье приведен анализ изменения урожайности, посевных площадей и валовых сборов кукурузы, выращиваемой на зерно в целом по РФ и определены перспективы расширения посевов изучаемой культуры в засушливых условиях Астраханской области. Изучена динамика изменения площади посевов кукурузы на зерно в РФ в зависимости от года исследований, выявлено, что связь между признаками слабая и обратная. Исследована динамика изменения урожайности кукурузы на зерно в РФ в течение рассматриваемого периода с 2015 по 2024 гг., которая зафиксировала, что связь между признаками высокая и прямая. Изучена динамика изменения валовых сборов кукурузы на зерно в РФ в зависимости от года исследований, показавшая, что связь между признаками заметна и прямая. Проведенный анализ позволил определить тенденции изменения посевных площадей, урожайности и валовых сборов кукурузы на зерно в РФ в течение последних 10 лет. Доказано, что увеличение валовых сборов изучаемой культуры происходило не за счет роста посевных площадей, а за счет увеличения урожайности, т.е. интенсивным путем. Перспективы увеличения посевов кукурузы в Астраханской области связаны с расширением направлений ее использования. В настоящее время изучаемую культуру в регионе выращивают в основном на кормовые цели. Производство кукурузы на пищевые цели и в качестве сидератов позволит значительно увеличить ее посевные площади в Астраханской области

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

ANALYSIS OF THE DYNAMICS OF CROP YIELD, SOWING AREAS AND GROSS CORN PRODUCTS IN THE RUSSIAN FEDERATION AND PROSPECTS FOR EXPANSION OF ITS SOWINGS IN THE ASTRAKHAN REGION

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The article presents an analysis of changes in the yield, sown areas and gross harvests of corn grown for grain in the Russian Federation as a whole and determines the prospects for expanding the sowing of the studied crop in the arid conditions of the Astrakhan region. The dynamics of changes in the area of sown corn for grain in the Russian Federation depending on the year of research was studied, it was found that the relationship between the characteristics is weak and inverse. The dynamics of changes in the yield of corn for grain in the Russian Federation during the period under review from 2015 to 2024 was studied, which recorded that the relationship between the characteristics is high and direct. The dynamics of changes in the gross harvest of corn for grain in the Russian Federation was studied depending on the year of research, which showed that the relationship between the characteristics is noticeable and direct. The conducted analysis allowed to determine the trends of changes in the sowing areas, yields and gross harvests of corn for grain in the Russian Federation over the past 10 years. It was proven that the increase in gross harvests of the studied crop occurred not due to the growth of sowing areas, but due to an increase in yields, i.e., in an intensive way. Prospects for increasing corn crops in the Astrakhan Region are associated with expanding the areas of its use. Currently, the studied crop is grown in the region mainly for feed purposes. The production of corn for food purposes and as green manure will significantly increase its sown areas in the Astrakhan Region

Ключевые слова: РЕГРЕССИОННЫЙ АНАЛИЗ, УРОЖАЙНОСТЬ, ПОСЕВНЫЕ ПЛОЩАДИ, ВАЛОВЫЕ СБОРЫ, КУКУРУЗА

Keywords: REGRESSION ANALYSIS, PRODUCTIVITY, SOWING AREA, GROSS CROP PRODUCTION, CORN

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CONTENT.

1. INTRODUCTION. Corn is a row crop [8]. In the south of Russia, it occupies significant areas in the structure of sown areas in the Volgograd, Rostov regions, Krasnodar and Stavropol territories [2, 6, 7, 9], and is a promising crop for North Ossetia [3]. The widespread use of corn is associated with its versatility and high adaptability to various soil and climatic growing conditions. The studied crop is distinguished by good productivity due to the high level of implementation of the genetic potential of productivity, which makes it necessary to cultivate it using intensive technologies [1]. Use as feed for farm animals, as well as in medicine and the food industry contributes to the expansion of corn crops in the south of Russia. The studied crop is grown both for grain and silage. At the same time, in recent years, soil fertility degradation processes have been observed in the Southern Federal District and trends toward a negative humus balance have emerged [10]. In this regard, the role of corn as a green manure crop increases, which enriches the soil with nutrients due to its well-developed root system and above-ground mass, protects the soil from weeds, forming a weed cushion, attracts and retains beneficial microorganisms in the soil, and improves the water-holding capacity of arable land [4, 5].

2. METHOD. The research included an analysis of the dynamics of yield, sown areas and gross harvests of corn grown for grain in the Russian Federation as a whole and identified prospects for expanding corn crops in the arid conditions of the Astrakhan Region.

Mathematical processing of the results was carried out using the regression analysis method on a PC using the application software packages for statistical

processing “Statgrafics” and “Statistica”.Corn was grown using agricultural technology recommended for the Astrakhan region.

3. RESULTS.

Currently, corn is grown in Russia as a forage crop, as well as for food purposes. Over the past 10 years, from 2015 to 2024, the area under this crop has tended to both increase and decrease.

To determine the equation of paired linear regression and further forecasting of the sowing areas for grain corn, we will use the OLS method (the method of least squares), which gives the best estimates of the parameters of the regression equation. To calculate the regression parameters, we constructed a calculation table (table 1).

The regression equation was: y = -12.5 x + 2832.9. The linear pair correlation coefficient was determined using the regression coefficient b:

$$r_{x,y} = b \cdot \frac{S(x)}{S(y)} = -12.515 \cdot \frac{2.872}{171.806} = -0.209$$

The dynamics of changes in the area of corn crops for grain in the Russian Federation were studied depending on the year of research. During the period under review from 2015 to 2024, the area of crops decreased by 12.5 thousand hectares on average per year. The linear correlation coefficient was equal to -0.209, therefore, the relationship between the characteristics is weak and inverse.

To determine the equation of paired linear regression and further forecast the yield of corn grown for grain, a calculation table was constructed (Table 2).

The regression equation was: y = 1.6085 x + 46.2333

The linear pair correlation coefficient was determined using the regression coefficient b:

$$r_{x,y} = b \cdot \frac{S(x)}{S(y)} = 1.608 \cdot \frac{2.872}{6.435} = 0.718$$

Table 1 – Calculation table for determining regression parameters (dynamics of changes in the area under grain corn in the period from 2015 to 2024 in the Russian Federation)

x	y	x2	y2	x*y
1	2762	1	7628644	2762
2	2887	4	8334769	5774
3	3019	9	9114361	9057
4	2452	16	6012304	9808
5	2593	25	6723649	12965
6	2855	36	8151025	17130
7	2954	49	8726116	20678
8	2852	64	8133904	22816
9	2667	81	7112889	24003
10	2600	100	6760000	26000
55	27641	385	76697661	150993

The dynamics of changes in the yield of grain corn in the Russian Federation were studied depending on the year of research. During the period under review from 2015 to 2024, on average, the yield increased by 1.6 t/ha per year. The linear correlation coefficient was equal to 0.718, therefore, the relationship between the traits is high and direct.

Table 2 – Calculation table for determining regression parameters (dynamics of changes in grain corn yield in the period from 2015 to 2024 in the Russian Federation)

x	y	x2	y2	x*y
1	49.3	1	2430.49	49.3
2	55.1	4	3036.01	110.2
3	49	9	2401	147
4	48.1	16	2313.61	192.4
5	57	25	3249	285
6	50	36	2500	300
7	52.5	49	2756.25	367.5
8	59	64	3481	472
9	69.3	81	4802.49	623.7
10	61.5	100	3782.25	615
55	550.8	385	30752.1	3162.1

To determine the equation of paired linear regression and further forecast the gross harvest of corn grown for grain, a calculation table was constructed (Table 3).

The regression equation was: y = 358.1879 x + 12515.6667 The linear pair correlation coefficient was determined using the regression coefficient b:

$$r_{x,y} = b \cdot \frac{S(x)}{S(y)} = 358.188 \cdot \frac{2.872}{1517.297} = 0.678$$

The dynamics of changes in gross grain corn yields in the Russian Federation were studied depending on the year of research.

Table 3 – Calculation table for determining regression parameters (dynamics of changes in gross grain corn harvests in the period from 2015 to 2024 in the Russian Federation)

x	y	x2	y2	x*y
1	13138	1	172607044	13138
2	15282	4	233539524	30564
3	13208	9	174451264	39624
4	11419	16	130393561	45676
5	14282	25	203975524	71410
6	13879	36	192626641	83274
7	15238	49	232196644	106666
8	15787	64	249229369	126296
9	16624	81	276357376	149616
10	16000	100	256000000	160000
55	144857	385	2121376947	826264

During the period under review from 2015 to 2024, on average, gross yields of the studied crop increased by 358.2 thousand tons/ha per year. The linear correlation coefficient was equal to 0.678, therefore, the relationship between the characteristics is noticeable and direct.

The conducted analysis allowed us to determine the trends in the change of sown areas, yields and gross harvests of corn for grain in the Russian Federation over the past 10 years. It should be noted that the increase in gross harvests of the studied crop occurred not due to the growth of sown areas, but due to an increase in yields, i.e., in an intensive way.

In 2024, the area under grain corn in the Astrakhan region was 3,171 hectares, of which 830 hectares were in the Volodarsky district; 828 hectares in the Yenotaevsky district; 1,420 hectares in the Kamyzyaksky district and 93 hectares in the Krasnoyarsk district. The distribution of grain corn areas by farms in the Astrakhan region in 2024 is shown in Table 4.

Table 4 – Production of grain corn in 2024 in farms of the Astrakhan region

No., p/p	District	Farm	Cultivated area, ha
1	Kamyzyaksky	JSC Kommunar	1170
2	Kamyzyaksky	JSC Chaganskoe	250
3	Voldarsky	State farm "Delta"	800
4	Voldarsky	Volodarskoe	30
	Enotaevsky	Prishibinskoe	517
6	Enotaevsky	Named after Kirov	200
7	Enotaevsky	Volzhskoe	111
8	Krasnoyarsk	OOO "Kartubinskoe"	93
9	TOTAL		3171

The average yield of grain corn in 2024 in the Astrakhan region was 10 t/ha.

4.CONCLUSIONS, LIMITATIONS AND PROSPECTS

Currently, corn in the Russian Federation is one of the most popular row crops, which is associated with its multifaceted use for feed, food purposes and as a green manure crop. In modern conditions, according to regression analysis data, the development of the industry in the Russian Federation is carried out in an intensive way, due to the growth of corn yields with a decrease in the area of crops.

In the Astrakhan region, the sown areas of the studied crop are not significant and do not exceed 3.5 thousand hectares or 3.5% of the total sown area occupied by all groups of crops. The main direction of using the grown products is for feed purposes. At the same time, the prospects for increasing the sown areas occupied by corn in the Astrakhan region directly depend on its further use.

Growing varieties and hybrids of the studied crop for food purposes, as well as green manure, will significantly increase the area of corn crops in the region.

BIBLIOGRAPHICAL LIST

1.Verbickaya, N.M. Intensification of grain corn cultivation / N.M. Verbickaya. – M.: Kolos, 1988. – 45 p.

2.Dikanev, G.P. Adaptive technology of cultivation of corn for grain on non-irrigated soils of the Lower Volga region /G.P. Dikanev, D.V. Efanov // Corn and sorghum. - 2007. - No. 1. - P. 8-12.

3.Doeva, A.T. Sweet corn in North Ossetia / A.T. Doeva, A.Yu. Khadikov, L.A. Dzugaeva // Innovative technologies in plant growing and ecology: collection of the International scientific and practical conference dedicated to the 80th anniversary of the birth of the scientist-microbiologist-agroecologist, honored worker of higher education of Russia, honored scientist of North Ossetia, doctor of agricultural sciences, professor Alexander Timofeevich Farniev. - 2017. - P. 75-76.

4. Drediger, V.K. The influence of plant residues on moisture accumulation and Soil density in the first rotation of field crop rotation on ordinary chernozem / V.K. Dridiger, M.P. Zhukova, R.S. Stukalov, R.G. Gadzhiumarov // Evolution and degradation of soil cover: collection of scientific articles based on the materials of the V International Scientific Conference. - 2017. - P. 251-256.

5. Drincha, V.M. Increasing soil fertility without fertilizers / V.M. Drincha // Agromarket.-2004.-№2.-P. 22-23.

6.Efremova, E.N. Development of corn depending on sowing dates / N.Yu. Petrov, E.N. Efremova // Bulletin of the Orenburg State Agrarian University. 2012. - V. 3. - No. 35-1. - P. 63-65.

7.Efremova, E.N. Intensive resource-saving farming system in the Russian Federation / E.N. Efremova, A.V. Efremov // Scientific and production support for innovation processes in irrigated agriculture of the Northern Caspian region: collection of interregional scientific and practical conference. - Solenoe Zaimishche, 2013. - P. 88-90. 116.

8. Efremova, E.N. The influence of agrotechnical practices on the development of row crop rotations / V.P. Zvolinsky, N.Yu. Petrov, E.N. Efremova, E.A. Zenina - Volgograd, 2014. – 168 p.

9. Ionova L. P., Current state and development trends of the crop production sector in the agro-industrial complex of the Astrakhan region: monograph / L. P. Ionova. - Astrakhan - 2023. - 418 p.

10. Pleskachev Yu. N., Kostin M. V. Land degradation in the Lower Volga region. Field research. - 2020.- No. 7. -P. 124-133.