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IRRIGATION PROCEDURE AND THE EFFECT OF MINERAL FERTILIZER NORMS ON AUTUMN RYE GRAIN YIELD

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ABSTRACT

In the conditions of light gray soils of Andijan region studied the norms of mineral fertilizers and the requirements for irrigation procedures in the cultivation of high-quality grain from autumn rye. The obtained data show that pre-irrigation soil moisture is irrigated at 70–70–60% relative to the ChDNS, and mineral fertilizers are applied. N150P75K120 and N200P100K160 When applying the norms of kg / ha, in addition to the control option 6.7–10.5 ts / ha, pre-irrigation soil moisture is irrigated at 70–80–70% relative to the ChDNS, mineral fertilizers N150P75K120 ва N200P100K160 When applying the norms of kg / ha, an additional grain yield of 8.0–12.2 ts / ha was obtained compared to the control variant

1. Introduction

Today, in order to meet the needs of the world's population in grain food products, great attention is paid to the expansion of the range and cultivation of cereals.

As a clear proof of our opinion, we can say that the United Nations (UN), the Food and Agriculture Organization (FAO) in its October 2019 report noted that the production of wheat in the world is growing from year to year. According to the data, the gross grain yield of wheat in 2016 was 729 million tons, in 2017 - 749 million tons, in 2018 - 760.4 million tons, and in 2018 the gross grain yield of total grain crops was 2658.1 million tons. tons, of which 28.6% was wheat grain, and in 2019 it was 2720.0 million tons, of which 28.9% was wheat grain, and grain production increased by 65.3 million tons or 2.5% compared to 2018.

After gaining independence, many consistent measures have been taken to meet the demand of the population for food products, especially grain products. Decisions, decrees and orders adopted by the President, the Cabinet of Ministers and relevant ministries are being widely applied to the conditions of production. In other words, cotton fields are being sharply reduced, and great attention is being paid to the development of the grain sector. In particular, in cooperation with countries that have made great strides in the field of grain, new varieties adapted to the soil and climate of the Republic were brought and acclimatized, and high-yield agro-technologies were developed. Today, as a result, the Republic is achieving high results in grain production.

It should be noted that the country is working hard to develop grain in agriculture, increase the variety, develop resource-saving agro-technical measures using innovative technologies in grain production. As an example, the decisions and decrees on the cultivation of winter rye, autumn oats and winter millet in the grain sector of agriculture serve as a basis for the development of not only grain but also livestock in the country.

In world agriculture, rye is one of the most valuable cereals and a valuable raw material for the food, bread and alcohol industries. At the same time, it is described as one of the main crops in providing livestock with high-calorie fodder and increasing soil fertility in agriculture and protecting it from wind and water erosion.

Rye grain can be used in the preparation of alcoholic beverages such as whiskey and beer and as feed for livestock, as well as in the preparation of nutritious bread rye flour. Rye is widely grown as a winter cover crop to prevent soil erosion, and mature leaves are commonly used as bedding for animals (https://plantvillage.psu.edu/ topics / rye / infos).

In many regions of the world, especially for the population of the northern region, rye grain is a staple food. Rye bread is not inferior to wheat bread in terms of calories and quality, although rye bread is richer in lysine (essential amino acids) than wheat bread, but slightly lower in digestibility than wheat bread. Also, rye grain and green mass are used as staple feed for livestock.

Autumn rye is one of the most important grain crops in terms of importance, grain and straw are used in the food industry, animal husbandry. The seeds contain 9-10% protein, 53-64% starch, 1.5-1.8% oil and other substances, depending on soil climatic conditions. In addition to bread and bakery products, grain is used as a raw material in the production of alcohol and starch. There are 116 nutritional units per 100 kg of rye grain (D.Yormatova, N.Shamuratov (2008)).

From the data presented, it is clear that rye grain is a valuable crop for all sectors of agriculture and the national economy.

Many scientists: D.Yormatova, N.Shamuratov, R.O.Oripov, N.Kh.Khalilov, O.F. Studied by Mirzaev, TSKhudoyberdiev, A.Hamzaev, V.Ismoilov, B.Mavlonov, H.N.Atabaeva, J.B.Khudaykulov. However, research on the effect of mineral fertilizer rates and irrigation regimes on the growth, development and grain yield of winter rye in the conditions of light gray soils of Andijan region has not been studied scientifically.

2. Procedure and methodology of research

The research was conducted in 2016-2019 in the light gray soils of the Andijan Research and Experimental Station of the Research Institute of Cotton Breeding, Seed Production and Agrotechnology (PSUEAITI). The effect on productivity was studied.

The experiment was placed in one tier with 6 variants of 4 variants. In the experimental field, the width of the field is 70 cm and the length is 100 m. The area of each spring is 560 m^2, the area to be considered is 280 m^2. The total area of the experiments was 1.4 ha. The experiment was carried out for 3 years in a 1: 1 (cotton: grain) short rotation rotation system. In the experiment, the variety of autumn rye "Vakhshskaya-116" included in the State Reserve was planted.

Three types of mineral fertilizers in the experiment ($N_{100}P_{50}K_{80}$ kg / ha; $N_{150}P_{75}K_{120}$ кг/га; $N_{200}P_{100}K_{160}$ kg / ha) norms and two types (relative to ChDNS 70–70–60% and 70–80–70%) irrigation procedures are defined.

1–Table

Experimental system

№	Irrigation regime in relation to ChDNS, %	Annual norm of mineral fertilizers, kg / ha
1	70–70–60	NPK: 100–50–80
2		NPK: 150–75–120
3		NPK: 200–100–160
4	70–80–70	NPK: 100–50–80
5		NPK: 150–75–120
6		NPK: 200–100–160

When feeding autumn rye, ammonium nitrate (N-34%) from nitrogen fertilizers, superphos from phosphorus fertilizers (P_2O_5–12–14%), potassium chloride salt from potassium fertilizers (K_2O–50%) used. In the experimental autumn rye, 70% of the annual norm of phosphorus fertilizers and 100% of potassium fertilizers were applied in autumn, under plowing, the remaining 30% of phosphorus fertilizers were applied in the 1st feeding with nitrogen fertilizers, and the 2nd feeding was carried out with nitrogen fertilizers in the fallow period.

3. Research results

The bulk density of the soil is one of the important characteristics that determine its softness or density. The volumetric mass of soil is the ratio of the mass in grams of one cubic centimeter of dry soil (with air) in the natural state to the weight of water obtained at 4 ^{0}S of the same volume, and g / cm^3 represented by The volume weight of the soil for good growth and development of agricultural crops is 1.30 g / cm ^{3} is the most acceptable.
The soil volume weight of the experimental field, at the beginning and end of the growing season, is 500 g / cm ^{3} using cylinders equal to, every 10 cm of soil. 50 cm from the layer. depth samples were taken and determined.
According to the results obtained at the beginning of the experiment (2016), samples were taken from five points of the field in the envelope method from the driving (0–30 cm) and bottom (30–50 cm) layers of soil and analyzed, 0–30 cm. the bulk density of the soil in the layer averaged 1.32 g / cm^3, 30–50 cm. in **the layer 1.43 g / cm ^{3} found to be.**
2– Table
At the beginning of the application period of the experimental field, the volume weight of the soil, g / cm ^{3}

Points	At the beginning of the validity period					
	2016		2017		2018	
	Soil layers, cm					
	0–30	30–50	0–30	30–50	0–30	30–50
1	1,31	1,42	1,30	1,42	1,33	1,43
2	1,32	1,42	1,31	1,41	1,31	1,42
3	1,31	1,43	1,33	1,44	1,32	1,44
4	1,33	1,45	1,32	1,42	1,33	1,45
5	1,32	1,44	1,31	1,43	1,31	1,42
Average	**1,32**	**1,43**	**1,31**	**1,42**	**1,32**	**1,43**

Towards the end of the growing season (2017), when the volume weight of the soil was analyzed in the cross section of the options, it was found that there were differences between the options depending on the factors used.
According to the data obtained, mineral fertilizers were applied when the soil moisture before irrigation was 70–70–60% relative to the ChDNS $N_{100}P_{50}K_{80}$ 0–30 cm of soil in the 1st control variant used in the norms of kg / ha. The

volume weight in the layer averages 1.40 g / cm ^{3} , 30–50 cm of soil. and in the strata showed an average of 1.50 g / cm^3. $N_{150}P_{75}K_{120}$ ва $N_{200}P_{100}K_{160}$ kg / ha In 2–3 variants, the average volume weight of the soil was 1.38 g / cm^3 in the 0–30 cm layer, and 1.48–1.47 g / cm^3 in the 30–50 cm layer.

3–Table

Influence of mineral fertilizer norms and irrigation regimes on soil volume weight, g / cm ^{3}

№	Irrigation regime is relative to ChDNS, %	Annual norm of mineral fertilizers, kg / ha	At the end of the validity period					
			2017		2018		2019	
			Soil layers, cm					
			0–30	30–50	0–30	30–50	0–30	30–50
1	70–70–60	NPK: 100–50–80	1,40	1,50	1,40	1,50	1,39	1,52
2		NPK: 150–75–120	1,38	1,48	1,38	1,48	1,37	1,49
3		NPK: 200–100–160	1,38	1,47	1,37	1,48	1,37	1,49
4	70–80–70	NPK: 100–50–80	1,43	1,52	1,43	1,53	1,42	1,55
5		NPK: 150–75–120	1,40	1,50	1,41	1,51	1,40	1,52
6		NPK: 200–100–160	1,40	1,49	1,40	1,50	1,39	1,51

Mineral fertilizers are applied when the soil moisture before irrigation is 70–80–70% relative to the ChDNS. $N_{100}P_{50}K_{80}$ When determining the soil volume weight of the 4th control variant used in the norms of kg / ha, the soil is 0–30 cm. The volume weight in the layer averaged 1.43 g / cm ^{3}, 30–50 cm. in the stratum, the average was 1.52 g / cm^3. $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ kg / ha In 5–6 variants, this value is 1.40 g / cm in the 0–30 cm^3 layer of soil, in the 30–50 cm layer of the soil, the average was 1.50–1.49 g / cm^3.

The data show that in the experiment it was observed that the increase in the number of irrigations between irrigation regimes had a negative effect on the volume weight of the soil, while the increase in mineral fertilizer norms had a positive effect on the volume weight of the soil.

Another agrophysical property of soil is water permeability. The water permeability of the soil itself is called the water permeability and its amount is measured by the amount of water that passes through the soil over a period of time (mm. H or m^3 / ha).

Based on this, we analyzed the water permeability of the soil in the envelope method from five points of the experimental field area at the beginning of the 2016 application period.

Accordingly, it was found that the soil of the experimental field absorbed an average of 810 m^3 / ha of water for 6 hours. Towards the end of the application period (2017), the effect of the applied factors on the water permeability of the soil was determined in the section of options.

According to the data obtained, pre-irrigation soil moisture is irrigated in the order of 70–70–60% relative to the ChDNS, and mineral fertilizers are applied. $N_{100}P_{50}K_{80}$ kg / ha The control applied in the 1st variant showed that the water permeability of the soil was 724 m^3 / ha in accordance with the weight of the soil volume. $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ In 2–3 variants using the norms of kg / ha, this figure was 734–741 m^3 / ha, respectively, and it was found that more water was broken into the soil by 10–17 m^3 / ha than in the control variant.

4–Table

Soil water permeability at the beginning of the experimental field application period, m^3 / ha

Points	**At the beginning of the validity period (for 6 hours)**		
	2016	**2017**	**2018**
1	817	832	822
2	802	815	804
3	827	824	828
4	795	830	814
5	809	811	826
Average	**810**	**822**	**819**

5–Table

Influence of mineral fertilizer norms and irrigation procedures on soil water permeability, m^3 / ha

№	**Irrigation regime is relative to ChDNS, %**	**Annual norm of mineral fertilizers, kg / ha**	**At the end of the validity period (for 6 hours)**		
			2017	**2018**	**2019**
1	70–70–60	NPK: 100–50–80	724	742	740
2		NPK: 150–75–120	734	751	753

3		NPK: 200–100–160	741	758	758
4	70–80–70	NPK: 100–50–80	702	724	722
5		NPK: 150–75–120	718	738	740
6		NPK: 200–100–160	725	750	748

The second pattern of irrigation, pre-irrigation soil moisture in the order of 70–80–70% relative to the ChDNS, the same patterns were observed in the variants, and the application of mineral fertilizers. $N_{100}P_{50}K_{80}$ kg / ha norms applied control Soil water permeability in option 4 702 m^3/ha mineral fertilizers, irrigated in this irrigation order, if reflected $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ It was found that the water permeability of the soil was 718–725 m^3 / ha, respectively, in 5–6 variants using the norms of kg / ha, and 16–23 m^3 / ha more water was applied to the soil than in the control variant.

The data obtained show that the increase in the number of irrigations affects not only the volume weight of the soil, but also the water permeability of the soil.

The results of our studies in 2017–2018 and 2018–2019 also provided data in accordance with the above laws, which, depending on the irrigation regime and the number of irrigations, affected the volume weight and water permeability of the soil.

The data obtained show that, while maintaining the same regularity in both irrigation regimes, the application of mineral fertilizers at high rates had a positive effect on the volume weight and water permeability of the soil from the agrophysical properties.

For the germination of autumn rye seeds absorb 50–70% of its dry mass of water. Seeds germinate 5–8 days after sowing when the total effective temperature for germination is 50 ^{0}C (R.O.Oripov, N.Kh.Khalilov 2007).

According to the data obtained on the germination and seedling thickness of autumn rye seedlings during 2016–2019, the effect of the mineral fertilizer standards applied was significant among the options.

In particular, when analyzing the data obtained during the growing season 2016-2017, mineral fertilizers were applied when the pre-irrigation soil moisture was 70–70–60% relative to the ChDNS. $N_{100}P_{50}K_{80}$ kg / ha control In option 1, the number of seedlings germinated per 1 m^2 was 384.6, mineral fertilizers $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ In 2–3 variants used at the rate of kg / ha, this figure was 400.2–407.7 seedlings, and 15.6–23.1 seedlings sprouted more than in the control variant.

The same pattern was observed in the second irrigation regime (pre-irrigation soil moisture relative to ChDNS 70–80–70%). $N_{100}P_{50}K_{80}$ The norm of mineral fertilizers is 407.4 seedlings per 1 m^2 in the control (4 options). $N_{150}P_{75}K_{120}$ ва

$N_{200}P_{100}K_{160}$ The number of seedlings germinated in 5–6 variants used in increments of kg / ha was 430.6–438.9, and it was found that 23.2–31.5 seedlings germinated more than in the control variant.

With the wintering of autumn rye, the period of time until the end of the application period is the viability of the plant. Survival varies depending on several factors: soil-climatic conditions, level of nutrition, planting times and standards, irrigation, biological characteristics of the variety.

Autumn rye requires an effective temperature sum of 67 ^{0}S from germination to accumulation. At a temperature of 10–12 ^{0}C, accumulation continues rapidly, stopping at 4–5 ^{0}C. Among winter grain crops, autumn rye is the most winter-hardy and can withstand temperatures down to -25-30 ° C. The plant survives even when the temperature at the accumulation node is -18 –20 ^{0}C (R.O.Oripov, N.Kh.Khalilov 2007).

Data from experiments conducted during the growing season 2016–2017 also to some extent confirmed the above ideas.

In particular, pre-irrigation soil moisture relative to ChDNS

Irrigated at 70–70–60%, mineral fertilizers $N_{100}P_{50}K_{80}$ Control in kg / ha In variant 1, the death rate of seedlings during the winter period averaged 6.4% per 1 m^2, and the number of seedlings that survived the winter was 360.0. $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ In 2–3 variants with the application of kg / ha, the average mortality rate was 5.8–5.4% per 1 m^2, with 377.0–385.7 seedlings per winter, compared to the control variant. There was a decrease of 0.6–1.0 percent.

In the second irrigation regime (pre-irrigation soil moisture relative to ChDNS 70–80–70%) the same patterns were observed. $N_{100}P_{50}K_{80}$ Control in kg / ha In variant 4, the death rate of seedlings during the winter period averaged 6.0% per 1 m^2, and the number of seedlings that survived the winter was 383.0. $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ In 5–6 variants using the norms of kg / ha, this figure averaged 5.5–5.0% per 1 m^2, and the number of seedlings emerged from the winter was 406.9–417.0, compared to the control variant. The mortality rate was found to be 0.5–1.0% lower.

However, when studying the actual seedling thickness at the end of the application period, it was observed that during the period from the accumulation phase to the end of the ripening period, the seedlings died under the influence of various agro-technical and other factors.

In particular, pre-irrigation soil moisture relative to ChDNS

Irrigated at 70–70–60%, mineral fertilizers $N_{100}P_{50}K_{80}$ In variant 1, where the norm of kg / ha was applied, by the end of the validity period, the actual seedling thickness was 339.1 m^2 / piece, the number of dead seedlings was 5.8%, and the norm of mineral fertilizers was increased, $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ By the end of the validity period in 2-3 variants used in the amount of kg / ha, the actual seedling thickness was 360.0–369.5 m^2 / piece, and the number of dead seedlings was 4.5–4.2%, compared to the control variant. 1.3–1.6 percent less.

The second pattern is reflected in the above patterns, when the pre-irrigation soil moisture is 70–80–70% relative to the ChDNS, and mineral fertilizers are applied. $N_{100}P_{50}K_{80}$ In the 4th control variant, where the norms of kg / ha were applied, the actual seedling thickness was 362.3 m^2 / grain by the end of the validity period, and the number of dead seedlings was 5.4%. $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ In the 5-6 variants used in the amount of kg / ha, the actual seedling thickness was 391.5–402.8 by the end of the validity period, and the number of dead seedlings was 3.8–3.4%, compared to the control variant of 1.6–2.0. percent less was reported.

Studies conducted in 2017–2018 and 2018–2019 also obtained data in accordance with the above-mentioned laws, and it was observed that the increase in mineral fertilizer rates and the number of irrigations resulted in an increase in seedling germination and a decrease in seedling mortality.

6–Table

Influence of mineral fertilizer norms and irrigation regimes on germination and seedling thickness of rye seedlings, 2016–2017.

№	Irrigation regime is relative to ChDNS, %	Annual norm of mineral fertilizers, kg / ha	Number of sprouted seedlings, m² / pcs	The number of seedlings killed in the winter, %	Number of seedlings out of winter, m² / pcs	Accumulation - the number of plants killed before ripening,%	Number of seedlings at the end of the growing season, m² / pcs
1	70–70–60	NPK: 100–50–80	384,6	6,4	360,0	5,8	339,1
2		NPK: 150–75–120	400,2	5,8	377,0	4,5	360,0
3		NPK: 200–100–160	407,7	5,4	385,7	4,2	369,5
4	70–80–70	NPK: 100–50–80	407,4	6,0	383,0	5,4	362,3
5		NPK: 150–75–120	430,6	5,5	406,9	3,8	391,5
6		NPK: 200–100–160	438,9	5,0	417,0	3,4	402,8

Accumulation of autumn rye is one of the main indicators like other autumn grain crops. The accumulation of autumn rye begins with the formation of the third and fourth leaves in the fall. Autumn rye is mainly harvested in the fall, and in some cases (when planted late) may continue to be harvested in the spring. Accumulation and germination are faster than in autumn rye, but germination and flowering are prolonged.

Accumulation in autumn rye lasts 35–40 days. During this period, autumn rye undergoes a stage of germination, which lasts 20–70 days at 0–2 ^{0}C. When the air temperature is 10 ^{0}C, the duration of the evaporation stage increases.
The total number of stems in a plant is called the total stem. Stems that form spikes and receive full grain are called productive stems or productive accumulations.
The results of the experiment show that in the growth and development of autumn rye, the effect of irrigation regimens and mineral fertilizers was significant.
In particular, according to the experiments conducted during the growing season 2016–2017, when the soil moisture before irrigation was 70–70–60% relative to the ChDNS, mineral fertilizers were applied. $N_{100}P_{50}K_{80}$ Control in the norm of kg / ha In the 1st variant, the height of autumn rye is 72.5 cm at the end of the validity period (1.06), the total number of stems is 518.8 m^2 / grain, and the number of productive stems is 419.2 m^2 / grain. The share of relatively productive stalks was 80.8%. $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ In 2–3 variants, where the norms of kg / ha were applied, the height of the plant reached the end of the period of validity, respectively, 86.2–92.7 cm. The total number of stems was 601.2–646.6 m^2 / grain, and the number of productive stems was 506.2–552.2 m^2 / grain. The height of the plant compared to the control variant is 13.7–20.2 cm, the total number of stems is 82.4–127.8 m^2 / piece, and the number of productive stems is 87.0–133.0 m^2 / piece, the share of productive stems relative to the total stem It was found that the highest results were obtained by 3.4–4.6%.

7–Table

Influence of mineral fertilizer norms and irrigation regimes on autumn rye plant height, total and number of productive stems, 2016–2017.

№	**Irrigation regime is relative to ChDNS, %**	**Annual norm of mineral fertilizers, kg / ha**	**Plant height, cm**	**Total number of stems, m^2 / pcs**	**Hence the number of productive stems, m^2 / pcs**
			1.06		
1	70–70–60	NPK: 100–50–80	72,5	518,8	419,2
2		NPK: 150–75–120	86,2	601,2	506,2
3		NPK: 200–100–160	92,7	646,6	552,2
4	70–80–70	NPK: 100–50–80	73,8	565,2	461,2
5		NPK: 150–75–120	91,5	673,3	575,0
6		NPK: 200–100–160	100,2	733,1	639,2

The same rules were observed in the second irrigation regime, when the pre-irrigation soil moisture was irrigated at 70–80–70% relative to the ChDNS, and mineral fertilizers were applied. $N_{100}P_{50}K_{80}$ By the end of the validity period in control 4, the plant height was 73.8 cm. The total number of stems was 565.2 m^2 / grain, of which the number of productive stems was 461.2 m^2 / grain, and the share of productive stems in the total number of stems was 81.6%. $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ By the end of the growing season, the plant height averaged 91.5–100.2 cm, the total number of stems was 673.3–733.1 m^2 / piece, and the number of productive stems was 575.0–639. 0 m^2 / piece, the share of productive stems in relation to the total stem is 85.4–87.2%, compared to the control variant, the plant height is 17.7–26.4 cm, the total number of stems is 108.1–167.9 m^2 / piece. The number of productive stems was 113.8–178.1 m^2 / piece, respectively, and the share of productive stems was 3.8–5.6% higher than the total number of stems.

2017–2018 and 2018–2019 In our research, it was found that the above laws were observed, and the effect of mineral fertilizer standards and irrigation regimes on the height of autumn rye stalks and the number of total and productive stems was significant.

The spike length of the autumn rye plant, the number of grains in the spike, the weight of the grain in one spike, and the weight of 1000 grains are important indicators of rye yield.

In our experiment conducted in 2016–2019, it was observed that the effect of mineral fertilizer norms and irrigation regimes on the yield elements of autumn rye was unique.

In particular, based on the results of experiments conducted during the growing season 2016–2017, mineral fertilizers were applied when the soil moisture before irrigation was 70–70–60% relative to the ChDNS $N_{100}P_{50}K_{80}$ In variant 1 (control) used in the norm of kg / ha, the average grain length was 11.3 cm, the number of grains per grain was 39.3, the weight of grain per grain was 0.829 g and the weight of 1000 grains was 21.1 g. In this irrigation regime, the norms of mineral fertilizers are increased, $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ In the 2–3 variants used in the amount of kg / ha, the average spike length was 12.5–13.0 cm, respectively. The number of grains per grain is 40.1–41.6, the weight of grain per grain is 0.874–0.924 g. and 1000 grains weighing 21.8–22.2 g. The length of one spike is 1.2–1.7 cm compared to the control variant. ha, the number of grains per grain is 0.8–2.3 grains, the weight of one grain is 0.045–0.095 g. and 1000 grains weighing 0.7–1.1 g. It was noted that

8-Table

Impact of mineral fertilizer norms and irrigation regimes on biometric indicators of autumn rye, 2016–2017.

№	Irrigation regime is relative to ChDNS, %	Annual norm of mineral fertilizers, kg / ha	Spike length, cm	Number of grains per spike, pcs	Grain weight per spike, g	Weight of 1000 grains, g
1	70–70–60	NPK: 100–50–80	11,3	39,3	0,829	21,1
2		NPK: 150–75–120	12,5	40,1	0,874	21,8

3		NPK: 200–100–160	13,0	41,6	0,924	22,2
4	70–80–70	NPK: 100–50–80	11,8	39,5	0,837	21,2
5		NPK: 150–75–120	13,2	40,5	0,891	22,0
6		NPK: 200–100–160	13,8	42,0	0,945	22,5

The second pattern of irrigation, when the pre-irrigation soil moisture is 70–80–70% relative to the ChDNS, the same pattern is observed in the irrigated variants. $N_{100}P_{50}K_{80}$ kg / ha In the 4th variant, the average length of one spike is 11.8 cm, the number of grains per spike is 39.5, and the weight of one spike is 0.837 g. and 21.2 g of grain weight per 1000 grains. mineral fertilizers, irrigated in this irrigation order, if equal to
$N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ In 5–6 variants used in the norms of kg / ha, the length of one spike is 13.2–13.8 cm. The number of grains in one grain is 40.5–42.0, the weight of one grain is 0.891–0.945 g. and 1000 grains weighing 22.0–22.5 g. These indicators are mineral fertilizers $N_{100}P_{50}K_{80}$ kg / ha The standard control is 1.4–2.0 cm in length of one spike compared to option 4. ha, the number of grains in one spike is 1.0–2.5, the weight of one spike is 0.054–0.108 g. and 1000 grains weighing 0.8–1.3 g. was found to be high.
From the data obtained, it can be seen that the norms of mineral fertilizers in both irrigation regimes $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ The increase in kg / ha was observed to have a significant effect on the length of the grain, the number of grains per grain, the weight of the grain per grain, and the weight of 1000 grains.
The effect of autumn rye on the norms of mineral fertilizers and irrigation regimes applied to the navigation "Vakhshskaya-116" on the indicators of productivity was studied in terms of options.
According to the results of the experimental options, mineral fertilizers were applied when the soil moisture before irrigation was 70–70–60% relative to the ChDNS. $N_{100}P_{50}K_{80}$ kg / ha In the 1st variant, the grain yield averaged 36.0 ts / ha in three years $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ kg / ha (2–3 options) yielded an average of 42.7–46.5 ts / ha of grain in three years, and an additional 6.7–10.5 ts / ha of grain compared to the control option. .
The second irrigation regime was carried out when the soil moisture before irrigation was 70–80–70% relative to the ChDNS $N_{100}P_{50}K_{80}$ In the control variant 4, where the norm of kg / ha was applied, the average grain yield was 39.7 ts / ha in three years, and mineral fertilizers were applied in the same irrigation regime $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ In 5–6 variants using the norms of kg / ha, the grain yield in three years was 47.7–51.9 ts / ha, respectively, and 8.0–12.2 ts / ha more than in the control variant. The data show that the effect of mineral fertilizer standards and irrigation regimes on the grain yield of autumn rye was significant.

9–Table

Influence of mineral fertilizer norms and irrigation regimes on grain and straw yields

№	Irrigation regime in relation to ChDNS,%	Annual norm of mineral fertilizers, kg / ha	Grain yield, ts / ha	Straw yield, ts / ha
			Average in three years	Average in three years
1	70–70–60	NPK: 100–50–80	31,6	38,5
2		NPK:150–75–120	44,2	54,9
3		NPK:200–100–160	53,4	68,2
4	70–80–70	NPK: 100–50–80	33,1	41,1
5		NPK:150–75–120	45,8	58,7
6		NPK:200–100–160	55,2	72,8

4. Conclusion.

In the conditions of light gray soils of Andijan region, the norms of mineral fertilizers and the requirements for irrigation procedures for obtaining high-quality grain from autumn rye were studied:
mineral fertilizers ($N_{150}P_{75}K_{120}$ ва $N_{200}P_{100}K_{160}$ kg / ha) The increase in the norms has a positive effect on the germination of seedlings, the pre-irrigation soil moisture in relation to the control options is 70–70–60% in the order of irrigation from 15.6 m^2 / unit to 23.1 m^2 / unit, pre-irrigation soil moisture is 70–80– in relation to the CHDNS. In the case of 70% irrigation, it was found that 23.2–31.5 seedlings sprouted a lot.
mineral fertilizers during the growing season $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ kg / ha, pre-irrigation soil moisture is 70-70–60% of the ChDNS, the plant height is 13.7–20.2 cm compared to the control option, the total number of stems is 82.4–127.8 m2 / ha, the number of productive stems is 87.0–133.0 m2 / piece, the share of productive stems in relation to the total stem is 3.4–4.6%, pre-irrigation soil moisture is 70–80–70% in relation to ChDNS, and in the irrigation mode the height of the plant compared to the control option 17.7–26.4 cm, the total number of stems is 108.1–167.9 m^2 / piece, the number of productive stems is 113.8–178.1 m^2 / piece, respectively, and the share of productive stems in relation to the total stem is 3, High results were observed in 8–5.6%.
Irrigation is carried out when the soil moisture before irrigation is 70–70–60% relative to the ChDNS $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ When applying the norms of kg / ha, in addition to the control option 6.7–10.5 ts / ha, pre-irrigation soil

moisture is irrigated at 70–80–70% relative to the ChDNS, mineral fertilizers $N_{150}P_{75}K_{120}$ and $N_{200}P_{100}K_{160}$ When applying the norms of kg / ha, an additional grain yield of 8.0–12.2 ts / ha was obtained compared to the control variant.

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