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The Effect of the Rate of Mineral Fertilizers Used in Winter Wheat on Grain Yield and Its Quality Indicators

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Abstarct: The article provides information on the influence of mineral fertilizer rates used in winter wheat on the grain yield and its quality indicators in the conditions of alluvial soils of the Republic of Karakalpakstan.

Key words: mineral fertilizer, agriculture, production

Today, meeting the needs of the world's population for grain and grain products is one of the most urgent tasks.

The level of lifestyle of the population and the level of providing the population with grains and grain products are indicators that show the economic potential of each country. The main purpose of planting grain crops is the production of bread products

Based on the above, special attention was paid to this type of crops in the republic from the first period of independence. And due to the reforms, the composition of agricultural arable land has undergone major changes.

The areas of cotton and fodder crops were reduced, and the areas of grain crops were increased. Grain farming has become the leading branch of the republic's agriculture.

If in 1992 the total area of grain crops in the republic was 874,800 hectares, by 2023 this figure will be 1.4 million hectares. The total yield of grain crops increased from 1.2 million tons to 8.1 million tons.

The average yield on irrigated lands increased from 11.7 quintals to 70.5 quintals.

At present, special attention is being paid to the development and implementation of crop cultivation technologies that save water and energy, increase soil fertility, and ensure high and quality yields from grain crops.

As a result, the population of the Republic not only achieved grain independence, but also received the highest yield per hectare among the republics of the former Union and exported grain to foreign countries.

Today, although high productivity has been achieved in the field of grain cultivation, a lot of research is still needed to improve the technological quality of the grown grain and to provide the population with high-quality flour products.

Because the chemical composition of wheat grain changes depending on the characteristics of the variety, the method of cultivation and the agrotechnical measures used in them.

Protein is an important indicator in its chemical composition, and it is abundant in durum wheat. As the fields move from north to south, from west to east, the amount of protein in the grain also increases.

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Grain grown in Uzbekistan, especially in dry lands, contains a lot of protein. Also, if nitrogen fertilizers increase protein, excess moisture causes its decrease.

Proteins in grain are divided into 4 groups depending on their solubility: water-soluble albumin, salt-soluble globulin, alkali-soluble glutenin, and alcohol-soluble gliadin.

Not all proteins are of equal value. Gliadin and glutenin, which are part of gluten, are more important in the grain used for food. The quality, size, porosity of the bread depends on the quantity and ratio of these proteins. A 1:1 ratio of gliadin to glutenin is best [1] .

Proteins that are insoluble in water are called gluten. Gluten is the substance that remains after the washing of starch and other compounds from the dough.

Also, bread and tasty qualities of flour depend on the amount and quality of gluten, the amount of crude gluten in wheat is in the range of 16-50%, in rye 3.1-9.5%, in barley 2-19% [1, 2, 3, 4, 5].

Based on these goals, scientific studies were conducted on the effect of mineral fertilizer rates on grain yield and its quality indicators in winter wheat in the conditions of meadow-alluvial soils of the Republic of Karakalpakstan (Table 1).

The soil of the experimental field is poorly supplied with nutrients, and in the plowed (0-30 cm) layer, humus is 0.517%, total nitrogen is 0.047, total phosphorus and potassium are proportionally 0.047 and 0.042%, while N-NN4-10.7; N-NO3-7,1; R2O5 -25 and K2O -120 mg/kg.

Urea (46% N), suprefos (N-10%, R2O5-22-23%) and potassium chloride (60% K2O) fertilizers were used in the experiment.

Experiments, phenological observations, soil and plant sampling were carried out based on the manuals "Методика полевых опытов" (Dospehov, 1985), "Методика Государственного сорта испытания сельскохозяйственных культур" (1964), "Дала тажрибаларини ўтказиш услублари" (2007).

Table 1

Effectiveness of mineral fertilizer rates in winter wheat

№	Mineral fertilizer rate, kg/ha			Periods of application, kg/ha					
	N	P	K	before the plough			pile up	tube	Spike
				N	P	K	N	N	N
1	0	0	0	0	0	0	0	0	0
2	120	80	60	20	80	60	40	40	20
3	180	120	90	30	120	90	60	60	30
4	240	160	120	40	160	120	80	80	40

Amounts of humus, general and mobile types of NPK in soil samples were carried out according to the methods " Методы агрохимических, агрофизических и микробиологических исследований в поливных хлопковых районах" (1963) and "Методы агрохимических анализов почв и растений Средней Азии" (1977).

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In the studies, the grain yield was very low (8.2 t/ha) in the variant without fertilizer (N0P0K0) (Table 2). This can be explained by the low fertility and salinity of the field soil.

When the rate of mineral fertilizers was N120P80K60 kg per hectare, the grain yield increased to 33.5 t/ha and an additional grain yield of 25.3 t/ha was obtained compared to the control option without fertilizer.

When mineral fertilizers were used at the rate of N180P120K90 kg/ha, it was found that the grain yield of winter wheat increased further, and compared to the control (N0P0K0) and N120P80K60 kg/ha, the additional grain yield obtained was 44.5 and 19.2 ts/ha, respectively, and it was statistically confirmed [6].

Table 2

Effect of mineral fertilizer rates on wheat grain yield (2015)

№	Mineral fertilizer rate, kg/ha	Grain yield, ts/ha	SL	SE	CV
1	$N_0P_0K_0$	8,2c	1,89	1,09	2,96
2	$N_{120}P_{80}K_{60}$	33,5b	1,90	1,10	5,67
3	$N_{180}P_{120}K_{90}$	52,7a	2,28	1,29	4,23
4	$N_{240}P_{160}K_{120}$	50,4a	2,27	1,31	4,51

Note: SL - standard limitation; SE – standard error; CV – coefficient of variation; Differences between indicators with the same letter in a column were not statistically significant (LSD Alpha 0.05).

When mineral fertilizers were applied at an increased rate (N240P160K120 kg/ha), the grain yield was 50.4 t/ha and was equal to the option using N180P120K90 kg/ha.

After harvesting, grain quality indicators were analyzed. In particular, in the non-fertilizer version of the experiment, grain moisture was 7.9%, natural weight was 641 g/l, gloss was 67%, protein was 10.4%, and gluten content was 23.8%, while in the 3 versions, the rate of mineral fertilizer was N180P120K90 kg/ these indicators were characterized as higher than other variants (grain moisture 10.6%, bulk weight 775 g/l, gloss 78%, protein 13.6% and gluten 29.7%).

Table 3

Effect of mineral fertilizers on quality parameters of winter wheat grain, 2015.

№	Mineral fertilizer rate, kg/ha	Moisture, %	Natural weight, g/l	Luster,%	Protein, %	Gluten, %
1	$N_0P_0K_0$	7,9c	641c	67b	10,4c	23,8c
2	$N_{120}P_{80}K_{60}$	9,5b	713b	72b	11,9b	27,1b
3	$N_{180}P_{120}K_{90}$	10,6a	775a	78a	13,6a	29,7a
4	$N_{240}P_{160}K_{120}$	10,7a	773a	76a	13,5a	29,4a

Note: Differences between indicators with the same letter in a column were not statistically significant (LSD Alpha 0.05).

In the 4 options where the highest rate of mineral fertilizers N240P160K120 kg/ha was used, the quality indicators of winter wheat grain were 0.1-0.2 percent less than the option where mineral fertilizers N180P120K90 kg/ha were used, but the difference between these data was not confirmed from a statistical point of view [6].

So, mineral fertilizers used in winter wheat in the rate of N180P120K90 kg/ha in conditions of meadow alluvial soils of the Republic of Karakalpakstan show a positive effect not only on high grain yield, but also on its quality indicators.

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