THE EFFECT OF MINERAL FERTILIZERS ON THE ACCUMULATION OF MINOR ELEMENTS IN "RAVNAQ-1" COTTON VARIETY

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Abstract. The article presents data on the effect of various mineral fertilizer rates on the leaves, stems, panicles, fibers and root organs of the "Ravnak-1" cotton variety, and on the fact that when using the NPK complex, the amount of nutrients is significantly higher than in the control variant. It is noted that the highest indicators of productivity and accumulation of nutrients were observed in the variants $N_{225} P_{191} K_{146}$ and $N_{250} P_{213} K_{163}$, and that the balanced use of mineral fertilizers is of great importance in ensuring the formation of high and high-quality yields in the "Ravnak-1" cotton variety .

Key words: cotton variety "Ravnaq-1", mineral fertilizer rate, nitrogen, phosphorus, potassium, nutrients, cotton organs .

Introduction. Among agricultural crops, cotton (Gossypium hirsutum L.) is one of the main technical crops of strategic importance in the economy of Uzbekistan. Cotton is grown on an average of about 900 thousand hectares in the country annually, yielding about 3-3.8 million tons of raw cotton. In recent years, as a result of improving agricultural technologies, introducing new high-yielding varieties, and effective use of mineral fertilizers, the productivity of the cotton sector has been increasing significantly. For example, in 2023, it was noted that 3.8 million tons of raw cotton were harvested in the country [1, 2] .

Mineral fertilizers are an important agrotechnical factor in ensuring a high and stable yield of cotton. According to the results of scientific research , elements of nitrogen, phosphorus and potassium are of decisive importance in the development of plant growth and the formation of elements of the crop . Mineral trace elements are absorbed by the plant through biochemical processes in the soil and accumulate in leaves, stems, flowers and pods. Therefore, determining the rate of mineral fertilizers and application periods on a scientific basis is important in optimizing the physiological processes of cotton and increasing productivity [3] .

One of the new varieties developed in recent years, the "Ravnak-1" cotton variety, is distinguished by its high yield and fiber quality. According to scientific sources, this variety is capable of yielding an average of 4.0-5.0 t /ha of raw cotton under farm conditions, which is higher than the yield of most varieties grown in the country (1.5-2.5 t/ha) [4].

In this regard, it is important to study the characteristics of the accumulation of nutrients in plant organs as a result of the application of mineral fertilizers in various rates and ratios in the "Ravnak-1" cotton variety, and to scientifically analyze their impact on growth and development processes. Such studies will serve to develop scientifically based recommendations for the effective use of mineral fertilizers, maintaining soil fertility, and ensuring high and stable cotton yields.

It is known that the main nutrients such as nitrogen, phosphorus and potassium are of decisive importance in the development of cotton plants . Nitrogen participates in the synthesis of proteins and enzymes in plants and enhances vegetative growth. Phosphorus participates in energy metabolism and contributes to the good development of the root system. Potassium plays an important role in water metabolism, photosynthesis processes and the formation of fiber quality. Therefore, it is of great scientific and practical importance to study the degree to which nutrients accumulate in plant organs when mineral fertilizers are applied in different doses .

Based on this, the aim of the research is to determine the effect of different mineral fertilizer rates on the amount of nitrogen, phosphorus and potassium in the plant organs in "Ravnaq-1" cotton variety.

The studies were conducted in field conditions using different rates of mineral fertilizers. The experiment was organized in 10 variants and 3 replicates. In the field experiment, mineral fertilizers were applied in a complex manner during the sowing and tillering phases, that is, nitrogen, phosphorus and potassium mineral fertilizers were applied simultaneously. At the same time, nitrogen fertilizers were additionally applied in the 3-4 true leaf and flowering phases of cotton (Table 1).

Such complex fertilizing system ensures efficient absorption of microelements by the plant and has a positive effect on the growth of the cotton plant and the formation of the elements of the crop.

The system of simultaneous application of mineral fertilizers is one of the relatively new agrotechnological methods in the soil-climatic conditions of the republic. However, in world practice, balanced and complex application of nutrients is widely used as an effective method for increasing crop yields. For example, according to the results of field experiments conducted in China, with the complex application of nitrogen, phosphorus and potassium mineral fertilizers, cotton yield reached 4580 kg/ha, which is 5.9 - 11.1 percent higher than with NP, NK or PK options [5].

Also, long-term studies conducted in India and Pakistan have shown that the use of balanced NPK fertilizers increases cotton yield by 25-40 percent compared to the use of nitrogen fertilizers alone The main factors are increased number of bolls, improved fiber formation, and efficient distribution of nutrients throughout the plant organs.

As can be seen from the scientific data presented above, the complex application of mineral fertilizers has a positive effect on the accumulation of trace elements in cotton, the formation of plant biomass and the increase in productivity.

Therefore, in this study, the effect of the system of simultaneous application of mineral fertilizers in the phases of planting and pruning on the accumulation of trace elements in the cotton variety "Ravnaq-1" was studied.

Table 1.

Experimental scheme

B	Annual rate of mineral fertilizers, kg/ha in pure form	Annual distribution of mineral fertilizers, kg/ha									
		under the plow		along with planting			3-4 real leaf	combing			flowering
		P-60%	K-50%	N-25%	P-20%	K-25%	N-20%	N-25%	P-20%	K-25%	N-30%
1.	Control without fertilizer ($N_0P_0K_0$)										
2.	$N_{200}P_{170}K_{130}$	102	65	50	34	33	40	50	34	33	60
3.	$N_{200}P_{140}K_{100}$	84	50	50	28	25	40	50	28	25	60
4.	$N_{200}P_{110}K_{70}$	66	35	50	22	18	40	50	22	18	60
5.	$N_{225}P_{191}C_{146}$	115	73	56	38	37	45	56	38	37	68
6.	$N_{225}P_{158}C_{113}$	95	56	56	32	28	45	56	32	28	68
7.	$N_{225}P_{124}C_{79}$	74	39	56	25	20	45	56	25	20	68
8.	$N_{250}P_{213}K_{163}$	128	81	63	43	41	50	63	43	41	75
9.	$N_{250}P_{175}K_{125}$	105	63	63	35	31	50	63	35	31	75

10.	N_{250} P_{138} C_{188}	83	44	63	28	22	50	63	28	22	75

It was found that when mineral fertilizers were applied to the "Ravnak-1" cotton variety, the accumulation of nutrients in the cotton organs increased significantly compared to the control variant. In the control (without fertilizers) variant, nitrogen in the leaves was 1.31%, phosphorus 0.39% and potassium 1.11 % , while in the variants where mineral fertilizers were applied, these indicators were significantly higher. For example, in variant 8 ($N_{250}P_{213}K_{163}$), the amount of nitrogen in the leaves reached 2.63%, phosphorus 0.85% and potassium 2.41%. This indicates that it is almost 2.0 times higher in nitrogen, 2.2 times higher in phosphorus and 2.1 times higher in potassium than in the control variant. This situation showed that as a result of the use of mineral fertilizers, the photosynthetic apparatus of cotton was activated and trace elements were rapidly accumulated in the leaves (Table 2) .

Table 2

Amount of main nutrient elements in cotton parts

Regionalized "Ravnaq-1" cotton variety				
Options	Cotton parts	N	P2O5	K_2O
Option 1 is control without fertilizer	Leaf	1.31	0.39	1.11
	Stem	0.68	0.27	1.36
	Sled	0.81	0.22	2.15
	Fiber+seed	2.28	0.87	1.84
	Root	0.52	0.34	0.62
Option 2 N_{200} $P_{170}K_{130}$	Leaf	2.36	0.71	1.33
	Stem	0.82	0.34	1.54
	Sled	1.14	0.33	2.45
	Fiber+seed	2.31	1.18	2.14
	Root	0.69	0.52	0.82

Option 3 N_{200} $P_{140}K_{100}$	Leaf	2.24	0.58	1.32
	Stem	1.14	0.34	1.65
	Sled	1.25	0.32	2.10
	Fiber+seed	2.25	1.24	2.36
	Root	0.72	0.64	0.84
Option 4 N_{200} $P_{110}K_{70}$	Leaf	2.18	0.68	1.32
	Stem	0.84	0.31	1.57
	Sled	1.32	0.35	2.41
	Fiber+seed	2.44	1.24	2.34
	Root	0.71	0.63	0.66
Option 5 N_{225} $P_{191}K_{146}$	Leaf	2.24	0.78	1.24
	Stem	0.82	0.41	1.69
	Sled	1.24	0.38	2.36
	Fiber+seed	2.46	1.09	2.58
	Root	0.83	0.66	0.75
Option 6 N_{225} $P_{158}K_{113}$	Leaf	2.42	0.69	1.28
	Stem	0.69	0.28	1.55
	Sled	1.25	0.32	2.41
	Fiber+seed	2.33	1.21	2.39
	Root	0.74	0.67	0.77
Option 7 N_{200} $P_{124}K_{79}$	Leaf	2.33	0.66	1.21
	Stem	0.69	0.24	1.38
	Sled	1.05	0.21	2.14
	Fiber+seed	2.17	1.08	2.14
	Root	0.59	0.62	0.83
Option 8 N_{250} $P_{213}K_{163}$	Leaf	2.63	0.85	2.41
	Stem	1.15	0.42	2.04

	Sled	1.28	0.47	2.48
	Fiber+seed	2.46	1.29	2.01
	Root	0.82	0.76	0.97
Option 9 N_{250} P_{175} K_{125}	Leaf	2.54	0.78	2.05
	Stem	1.05	0.29	1.87
	Sled	1.17	0.31	2.35
	Fiber+seed	2.42	1.24	2.29
	Root	0.84	0.78	0.79
Option 10 N_{250} P_{138} K_{88}	Leaf	2.32	0.74	1.62
	Stem	1.12	0.32	1.48
	Sled	1.08	0.29	2.14
	Fiber+seed	2.17	1.15	2.19
	Root	0.77	0.65	1.14

Nutrients in the stem of cotton was also observed to increase under the influence of mineral fertilizers. In the control variant, the stem contained 0.68% nitrogen, 0.27% phosphorus, and 1.36% potassium, while in the variants where mineral fertilizers were applied, these indicators were recorded in the range of 0.69 - 1.15% nitrogen, 0.24 - 0.42% phosphorus, and 1.38 - 2.04% potassium . In particular, in the variants where high fertilizer rates were applied, the amount of potassium in the stem was high. This is explained by the important role of potassium in regulating water metabolism in the plant and in the processes of transporting photosynthesis products throughout the plant organs.

The results of the experiment showed that the accumulation of nutrient elements increased under the influence of mineral fertilizers. Nitrogen was 0.81%, phosphorus 0.22% and potassium 2.1% in the control option, while nitrogen was 1.05-1.32 % , phosphorus 0.21-0.47% and potassium 2.10-2.48 % in the options where mineral fertilizers were used . This situation shows that more accumulation

of trace elements in the generative organs of cotton serves to improve boll formation and fiber yield.

The amount of nutrients in the fiber and seed, which are the main economically important parts of cotton, also increased under the influence of mineral fertilizers . In the control variant, the fiber and seed contained 2.28% nitrogen, 0.87% phosphorus, and 1.84% potassium, while in the variants where mineral fertilizers were applied, these indicators ranged from 2.17 to 2.46% nitrogen, 1.08 to 1.29% phosphorus, and 2.01 to 2.58% potassium . The highest indicators were observed in variant 5 ($N_{225} P_{191} K_{146}$) and variant 8 ($N_{250} P_{213} K_{163}$). This confirms that mineral fertilizers enhance the accumulation of nutrients in the generative organs of cotton and have a positive effect on the formation of fiber and seed.

It was observed that the accumulation of nutrients in the root part also increased to a certain extent under the influence of mineral fertilizers. In the control option, nitrogen in the root was 0.52%, phosphorus 0.34% and potassium 0.62%, while in the options where mineral fertilizers were applied, these indicators were 0.59 - 0.84%, 0.52 - 0.78% and 0.66 - 1.14 % , respectively . This indicates that under the influence of mineral fertilizers, the active development of the root system and the ability to absorb trace elements have increased.

In general, the results of the experiment showed that the application of mineral fertilizers at different rates had a significant effect on the accumulation of nutrients in the cotton organs of the "Ravnak-1" cotton variety . In particular , when mineral fertilizers were applied at the rates of $N_{225} P_{191} K_{146}$ and $N_{250} P_{213} K_{163}$, a high content of nutrients was observed in the leaves, stems, panicles, fiber-seed and root organs . This showed that the balanced application of mineral fertilizers activates the physiological processes of cotton, is of great importance for the formation of crop elements and obtaining high yields.

To sum up, the results of the conducted field experiment showed that the use of mineral fertilizers in the cotton variety "Ravnaq-1" has a significant effect on the

accumulation of trace elements in plant organs. Compared to the control option, in all options where mineral fertilizers were used, an increase in the amount of nitrogen, phosphorus and potassium was observed in the leaves, stems, pods, fiber-seed and root organs. This confirms that mineral fertilizers activate the plant's physiological processes and increase the assimilation of trace elements .

In the variants where mineral fertilizers were applied ($N_{250} P_{213} K_{163}$ and $N_{225} P_{191} K_{146}$) high levels of nitrogen, phosphorus, and potassium were found in leaves, generative organs, and fiber-seed composition.mineral This indicates that the complex application of mineral fertilizers has a positive effect on the growth and development of cotton and the formation of yield elements.

At the same time, it was found that the complex application of mineral fertilizers during the planting and combing phases and the additional application of nitrogen fertilizers during the vegetation period ensure the effective absorption of nutrients by cotton. As a result , a balanced distribution of nutrients in plant organs is ensured, creating favorable conditions for the formation of high-quality cotton yields.

In general, it was found that in the cultivation of "Ravnaq-1" cotton variety, the use of mineral fertilizers in scientifically based standards and in a complex manner increases the accumulation of trace elements in the cotton organs and increases the biological productivity of cotton.

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