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NUTRIENT CONTENT AND THEIR BALANCE IN IRRIGATED SOILS WITH DIFFERENT LEVELS OF FERTILITY**KUZIEV J.M.***Institute of Soil Science and Agrochemical Research,**Tashkent, Uzbekistan**E-mail: mmjahongir81@ g mail.com*

Annotation: The article discusses the reasons for changes in the agrochemical properties of irrigated typical sierozems in pilot plots with low, medium and high fertility, and also provides a comparative description of the content of the main nutritional elements - nitrogen, phosphorus and potassium in the organs of cultivated cotton, their removal during the growing season and a balance.

It has been established that when cultivating cotton on the studied soils, a positive nitrogen balance is created. High removal of phosphorus and potassium from the soil by plants contributes to the transition of the studied soils from the group of low-provided to the group of very low-provided with phosphorus and potassium, which leads to a violation of the ratio between the nutritional elements and a change in the properties and characteristics of these soils.

Key words: irrigated typical sierozems, fertility, nutrients, cotton, removal, balance.

Abstract

The article discusses the reasons for changes in the agrochemical properties of irrigated typical gray soils in pilot plots with low, medium and high fertility, and also provides a comparative description of the content of basic nutrients - nitrogen, phosphorus and potassium in the organs of cultivated cotton, their removal during the growing season and a balance.

It has been established that when cultivating cotton on the studied soils, a positive nitrogen balance is created. The high removal of phosphorus and potassium from the soil by plants contributes to the transition of the studied soils from the group of low-supply to the group of very low-supply of phosphorus and potassium, which leads to a violation of the relationships between nutrients and a change in the properties and characteristics of these soils.

Key words: irrigated typical serozem soils, fertility, nutrients, cotton, removal, balance.

In recent years, a tendency towards a decrease in the content of humus and nutrients has been noted throughout the world, including Uzbekistan, as a result of intensive use of land resources. The main reason for this is the increased removal of nutrients with the harvest and some plant organs, which is not replenished due to the imbalance of nutrients in soils, where negative processes such as a decrease in soil resistance under the influence of anthropogenic impact, progressive erosion processes in them, deterioration of the physicochemical, agrochemical and other properties of soils, violation of the agronomic value of their aggregate state, which leads to a decrease in soil fertility, are manifested.

Increasing soil fertility, enriching it with humus and nutrients, creating an optimal balance for the growth and development of agricultural crops, increasing their yields through the use of modern agro-technological measures for the application of fertilizers in intensive farming, crop

rotation and crop rotation, as well as their widespread introduction into agricultural production, is very important [1].

In countries where the system of application of mineral fertilizers based on the latest technologies and equipment is developed, more modern technologies are being developed for the timing and methods of introducing macro- and microelements into the soil together with local fertilizers, which are characterized by very high efficiency.

The Food and Agriculture Organization of the United Nations (FAO) presented to the public the results of research on the needs of agricultural crops for mineral fertilizers, cultivated in more than 40 countries of the world. The main yield of cultivated crops - up to 50-60%, is achieved through the use of mineral fertilizers [2].

In this regard, at the present time it is timely to use highly efficient resource-saving technologies designed to obtain the yield of cultivated agricultural crops close to its biological potential, with high quality products with minimal environmental resources, which is the essence of precision farming. These agro-technological operations are carried out with maximum consideration of the variability of the soil cover, the condition of crops, the degree of their damage by pests, as well as the definition and study of the spatial, temporal heterogeneity of agrochemical, agrophysical and other properties of soils during the cultivation of agricultural crops.

Within the framework of "precision farming", it becomes possible to develop a system of probabilistic statistical models for each field separately, which allows for their spatial heterogeneity to be taken into account to the maximum extent. [3].

In this regard, in order to increase the fertility of irrigated soils of the republic, the most productive sector of agricultural production, where the main agricultural crops (cotton, winter wheat and others) are grown, it is necessary to create a positive balance of the main nutrients, regularly monitor their nutritional regime and, on this basis, introduce effective, resource-saving agricultural technologies into agricultural production, the most important of which is the use of the "precision farming" system.

The system of "precision farming" is currently one of the promising methods of information agro-technologies in agricultural production, allowing to obtain quantitative and qualitative indicators in the form of electronic maps and cartograms on the screen (computer monitor) and, on their basis, to identify changes in the quantitative state of nutrients in space and time, which makes it possible to form a geographic information system (GIS) and rationally apply mineral fertilizers on each individual soil contour [3].

The aim of the study is to create and implement an automated geophase smart system for applying mineral fertilizers to cotton, taking into account the availability of nutrients to form high and high-quality yields.

To increase soil fertility and create a constant positive balance of nutrients (the law of nutrient return), it is necessary to monitor the condition of the soil and, based on the findings and recommendations, introduce effective fertilizer application systems into production, taking into account various soil and climatic conditions.

Objects and methods of research. Research was conducted on old-irrigated typical sierozems of pilot plots located in the Achamaili massif of the Bukinsky district of the Tashkent region, differing in fertility levels: low-, medium- and high-fertility soils.

In order to study the agrochemical and other properties of irrigated soils common in the pilot areas, main and auxiliary sections were laid in each of them, from the genetic horizons of which soil samples were selected.

At the end of the cotton growing season, plant samples were taken to study their chemical composition.

Field and laboratory studies were conducted according to the unified generally accepted guidelines: "Methodology of field and vegetation experiments with cotton under irrigated conditions" [4], "Methods of agrochemical, agrophysical and microbiological research in irrigated cotton regions" [5], "Guide to chemical analysis of soils" [6], as well as according to the recommendations of the Uzbek Research Institute: "Recommendations for the use of mineral and local fertilizers in cotton growing" [7], "Methodology for conducting field experiments" [8].

Research results. We studied the geomorphological, soil and climatic conditions of the studied soils, annual rates and timing of application of mineral, organic or non-traditional types of fertilizers during the growing season of cultivated agricultural crops.

The territory of the massif is widely spread by old-irrigated typical sierozems, sierozem-meadow, meadow and bog-meadow soils. For our research, pilot plots on irrigated typical sierozems were selected.

Genetic horizons of highly and moderately fertile soils are mainly medium loamy in mechanical composition; low-fertility soils of the pilot plot are characterized by medium and heavy loamy mechanical composition. Due to salinization and leaching, these soils are estimated at 41-50 points. Moderately fertile soils are also saline, but are not washed away and are estimated at 61-70 points. Highly fertile soils of the pilot plots, medium loamy in mechanical composition, due to differences in the degree of salinization, leaching and other indicators, are estimated at 71-80 points.

Despite the fact that the studied irrigated typical sierozems differ little from each other in mechanical composition and, as a result of long-term anthropogenic pressure on the soils, the use of various agrotechnical and agro-improvement measures, they have undergone various changes and currently differ in fertility levels [9]. The research results showed that in the arable horizon of highly fertile irrigated typical sierozems, the humus content is 1.264% and it decreases along the soil profile to 0.165%. The arable horizon of medium-fertility soils contains less humus - about 1.142% and in the parent rock its amount decreases to 0.452%. Low-fertility irrigated typical sierozems contain less humus than the previous ones and its amount in the upper soil horizon is 0.976% and decreases to 0.475% in the rock.

The content of total nitrogen in the upper horizons of the studied soils is 0.084% and decreases in the parent rock to 0.027%.

The ratio of carbon to nitrogen in soils fluctuates within the range of | 3.5-9.8. According to data from Kh. T. Riskieva [10], in typical sierozems the ratio of carbon to nitrogen fluctuates from 7 to 9, however a low ratio of carbon to nitrogen indicates weak activity of biological processes occurring in the soils.

It is noted that in irrigated typical sierozems, medium loamy in mechanical composition, the ratio of carbon to nitrogen decreases from the upper horizons down the soil profile. However, with the heavier mechanical composition of the studied soils, the ratio of carbon to nitrogen in

the soil profile fluctuates within 7.1-9.8, which indicates the dependence of this ratio on the mechanical composition of the soils.

The content of total phosphorus in the arable horizon of highly fertile soils is 0.187-0.214%, in medium-fertility soils it decreases to 0.173-0.193%, in low-fertility soils the amount of total phosphorus fluctuates from 0.176% to 0.184%. In the underlying horizons its content is, respectively, 0.098-0.137%; 0.104-0.135%; 0.097-0.121%.

In the upper horizons of irrigated typical sierozems, the amount of total potassium fluctuates within 0.82-1.12% and decreases in the underlying horizons to 0.34-0.62%. No dependence in the content of total potassium on the mechanical composition of soils was noted. However, highly fertile soils differ from low-fertility soils of pilot plots in the content of total potassium.

Highly fertile and medium fertile soils in the arable horizon contain very low and low amounts of nitrate form of nitrogen, respectively, 19.4-26.4 mg/kg (very little <20 mg/kg, little 20-30 mg/kg). Typical sierozems with low fertility are very poorly supplied with nitrate nitrogen: in all irrigated soils of the pilot plots, its amount decreases down the soil profile.

Highly studied - medium- and low-fertility soils have very low (0-15 mg/kg) and low (16-30 mg/kg) supply of mobile phosphorus: the arable horizon contains 10.4-12.4 mg/kg and its amount decreases in the lower horizons to 3.2-3.5 mg/kg.

The soils of the pilot plots also have very low (0-100 mg/kg), low (101-200 mg/kg) and medium (201-300 mg/kg) levels of exchangeable potassium, and its amount decreases down the soil profile.

Table 1 presents data on the content of nitrogen, phosphorus and potassium in the organs of cotton grown on soils with different levels of fertility and their removal. It was found that the greatest amount of nitrogen is contained in cotton leaves and raw cotton, which depends on the degree of fertility of the soils where cotton is grown: on highly fertile, medium-fertile and low-fertility soils, the nitrogen content in leaves is, respectively, 2.2%; 1.9%; 1.8%, and in the composition of raw cotton - respectively, 1.9%; 1.7%; 1.7%. In other organs of cotton, the amount of nitrogen is significantly less. (table 1).

The highest amount of phosphorus is found in raw cotton - within 1.1%-1.2%, and does not depend on the level of soil fertility when cultivating cotton. The stems, valves, roots of cotton contain less phosphorus and differ from the level of soil fertility: the lower the fertility, the less phosphorus they contain (table 1).

Table 1

The content of nitrogen, phosphorus and potassium in the organs of cotton grown on irrigated typical sierozems of pilot plots and their removal.

Cotton						
Content in organs, %				Removal, kg/ha		
Organs	N	P	K	N	P	K

Highly fertile soils of the pilot site						
Leaves	2,2	0.7	1.6	37.4	11.9	27.2
Stems	0.9	0.3	1.5	18.4	6.1	30.6
Sashes	0.8	0.3	1.6	13.6	5.1	27.2
Raw cotton	1.9	1,2	1,2	72.7	45.9	45.9
Roots	0.8	0.6	1.5	6.1	4.6	11.5
Total:				148.2	73.6	142.4
Medium fertile soils of the pilot site						
Leaves	1.9	0.6	1.5	29.1	9.2	23.0
Stems	0.7	0.2	1.6	12.5	3.6	28.6
Sashes	0.6	0.3	1.5	9.7	4.8	24.2
Raw cotton	1.7	1,1	1,1	60.7	39.3	39.3
Roots	0.7	0.5	1.4	4.8	3.4	9.5
Total:				116.7	60.3	124.5
Low-fertility soils of the pilot site						
Leaves	1.8	0.5	1.4	26.0	7.2	20.2
Stems	0.6	0.3	1.5	11.2	5.6	28.1
Sashes	0.6	0.2	1.6	9.2	3.1	24.5
Raw cotton	1.6	1,2	1,2	51.7	38.8	38.8
Roots	0.8	0.6	1.5	4.8	3.6	8.9
Total:				102.9	58.2	120.4

The leaves, stems, valves and roots of cotton contain a relatively high amount of potassium - within 1.5-1.6%, and in raw cotton less potassium was found compared to other organs - 1.1-1.2%.

Nitrogen removal, phosphorus and potassium by cotton organs and the entire plant as a whole depends on the fertility level of irrigated typical sierozems (Table 1). It has been established that the removal of nitrogen, phosphorus and potassium by cotton grown on highly fertile soils is, respectively, 148.2; 73.6; 142.4 kg/ha. On medium-fertile soils, cotton tolerates nitrogen, phosphorus and potassium per 1 hectare, respectively, 116.7; 60.3; 124.5 kg. The lowest removal of nitrogen, phosphorus and potassium by cotton is noted on low-fertility soils and its amount is, respectively, 102.9; 58.2; 120.4 kg/ha.

Based on the data obtained on the content of nutrients in cotton organs, their intake with mineral, organic fertilizers and natural means, the removal of nutrients with the harvest and other organs, an economic balance was compiled, which is given in Table 2.

When cultivating cotton on highly fertile soils of pilot plots, 80.0 kg/ha of nitrogen, 9.2 kg/ha of phosphorus and 28.0 kg/ha of potassium enter the soil with mineral fertilizers during the growing season. Due to leaf fall and naturally, 103.0 kg of nitrogen, 36.5 kg of phosphorus and 79.2 kg of potassium are introduced per hectare.

Taking into account the removal of nutrients with the raw cotton crop, stems, and valves, it was established that a positive balance is created in the soil for nitrogen (+78.3 kg/ha), and a negative balance for phosphorus (-11.4 kg/ha) and potassium (-4.2 kg/ha).

When cultivating cotton on medium-fertile soils of pilot plots, 70.0 kg of nitrogen, 7.0 kg of phosphorus and 21.0 kg of potassium are applied per hectare with mineral fertilizers during the growing season. With fallen leaves, remains of guzapaya and naturally, 76.2 kg/ha of nitrogen, 24.7 kg/ha of phosphorus and 58.0 kg/ha of potassium enter the soil.

Calculations of the balance of nutrients show that these soils have a positive balance of nitrogen (+63.3 kg/ha), and a negative balance of phosphorus (-16.1 kg/ha) and potassium (-20.2 kg/ha).

On low-fertility soils of pilot plots, when cultivating cotton, a positive balance was established for nitrogen (+58.2 kg/ha), and a negative balance for phosphorus (-22.4 kg/ha) and potassium (-33.5 kg/ha).

Table 2

The supply of nutrients with mineral and local fertilizers, cotton organs, naturally, the removal of nutrients by cotton and their balance

(Bukinsk district, Tashkent region)

Highly fertile soils of the pilot site				
Cotton				
Entry into soils				
Expense and income items		N	P	K
Entering the soil with mineral and local fertilizers	with mineral fertilizers	80.0	9.2	28.0
	with local fertilizers	5.6	1.8	8.8
With cotton organs	with leaves	37.4	11.9	27.2
	with roots	6.1	4.6	11.5
The natural way	content in 0-30 cm soil layer	38.0	17.0	31.0
	with seeds	0.8	0.5	0.7
	with irrigation water	12.1	0.7	-

	with precipitation	3.0	-	-
Total:		183.0	45.7	107.2
Removal from the soil				
With the harvest of raw cotton)		72.7	45.9	53.6
With guzapaya		32.0	11.2	57.8
Total:		104.7	57.1	111.4
DIFFERENCE:		+78.3	-11.4	-4.2
Medium fertile soils of the pilot site				
Expense and income items		N	P	K
Entering the soil with mineral and local fertilizers	with mineral fertilizers	70.0	7.0	21.0
	with local fertilizers	2.4	0.8	3.8
With cotton organs	with leaves	29.1	9.2	23.0
	with roots	4.8	3.4	9.5
The natural way	content in 0-30 cm soil layer	24.0	10.0	21.0
	with seeds	0.8	0.5	0.7
	with irrigation water	12.1	0.7	-
	with precipitation	3.0	-	-
Total:		146.2	31.6	79.0
Removal from the soil				
With the harvest of raw cotton		60.7	39.3	46.4
With guzapaya		22.2	8.4	52.8
Total:		82.9	47.7	99.2
DIFFERENCE:		+63.3	-16.1	-20.2
Low-fertility soils of the pilot site				
Expense and income items		N	P	K
Entering the soil with mineral and local fertilizers	with mineral fertilizers	60.0	4.6	14.0
	with local fertilizers	1.6	0.5	2.5
With cotton organs	with leaves	26.0	7.2	20.2

	with roots	4.8	3.6	8.9
The natural way	content in 0-30 cm soil layer	22.0	8.0	18.0
	with seeds	0.8	0.5	0.7
	with irrigation water	12.1	0.7	-
	with precipitation	3.0	-	-
Total:		130.3	25.1	64.3
Removal from the soil				
With the harvest of raw cotton		51.7	38.8	45.2
With guzapaya		20.4	8.7	52.6
Total:		72.1	47.5	97.8
DIFFERENCE:		+58.2	-22.4	-33.5

Conclusions: The obtained data on the influence of the degree of fertility of irrigated typical sierozems on the nutrient regime of these soils show that when cultivating cotton on highly fertile soils, a positive nitrogen balance is created, which can lead to soil pollution with this element.

High removal of phosphorus and potassium from the soil by plants contributes to the transition of soils from the group of low-provided to the group of very low-provided soils with phosphorus and potassium, which leads to a disruption of the relationship between nutritional elements and a change in the properties and characteristics of the soil.

It should be noted that the reasons for the degradation of agricultural lands, which are the "golden fund", can be attributed to a number of reasons: failure to observe crop rotation and crop rotation, violation of the norms and ratios of applied mineral fertilizers, which leads to the transition of soils from one provision group to another. In addition, the removal of nutrients with the yields of cultivated crops and their organs contributes to a decrease in soil fertility.

Thus, we believe that on the basis of "precision farming" it is necessary to develop and more widely implement modern agricultural technology using improved equipment adapted for the automatic application of mineral fertilizers taking into account the degree of provision of each hectare of land with the main nutrients, and only then can we maintain an optimal ratio between them and obtain high, high-quality yields of agricultural crops grown on these soils.

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