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THE CONTENT OF NUTRITION ELEMENTS AND THEIR BALANCE IN IRRIGATED SOILS WITH DIFFERENT LEVEL OF FERTILITY

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Abstract:
The article discusses the reasons for changing the agrochemical properties of irrigated typical seozem of pilot plots with low, medium and high fertility, and also provides a comparative description of the content of the main nutrients - nitrogen, phosphorus and potassium in the organs of cultivated cotton, their removal during the growing season and a balance is given.

Keywords: Irrigated, typical, seozem, fertility, nutrients, cotton, removal, balance, humus.

INTRODUCTION: In recent years, all over the world, including in Uzbekistan, there has been a tendency to reduce the content of humus and nutrients in soils as a result of intensive use of land resources. In soils, such negative phenomena as a decrease in soil resistance under the influence of anthropogenic impact, erosion processes progressing in them, deterioration in the physicochemical and agrochemical properties of soils, violation of the agronomic value of their state of aggregation, which indicates the occurrence of degradation processes in soils, are manifested in soils.

In this regard, increasing the level of soil fertility, enriching them with humus, nutrients, creating an optimal balance for the growth and development of crops in them, increasing their productivity through the use of modern agrotechnological measures for the use of fertilizers in intensive farming, crop rotation and crop rotation, as well as their widespread introduction into agricultural production is relevant [1].

In countries where the system of application of mineral fertilizers based on the latest technologies is developed, modern technologies are being developed for the timing and methods of introducing macro- and microelements into soils together with local fertilizers, which are characterized by very high efficiency. The Food and Agriculture Organization of the FAO (UN) presented to the public the results of studies on the needs of crops in mineral fertilizers cultivated in various soil conditions 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 [1].

At present, the application of mineral fertilizers for various crops is carried out taking into account the soil and climatic conditions of each region.

Due to the great need of plants for nitrogen, phosphorus and potash fertilizers, their world production is high, but they do not replace each other, but only complement.

It is known that nitrogen improves the growth and development of plants, participates in the formation of the crop and its quality, and serves as the main element of protein and nitrogenous substances.

Nitrate and ammonia nitrogen enter the soil with fertilizers and are formed as a result of the decomposition of organic matter in the soil by microorganisms during complex biochemical processes. Under natural conditions, the amount of nitrates and ammonia depends primarily on the content of mobilized substances in the soil, humus and the activity of microbiological processes. In the irrigated soils of Central Asia, in the summer, ammonia nitrogen passes into the nitrate form already a few days after application.

Phosphorus is known to play an important role in plant metabolism. The low coefficient of phosphorus utilization by plants from fertilizers, especially mineral fertilizers, is due to the rather rapid transition of phosphate ions to an insoluble state in the soil.

The need of plants for potassium nutrition cannot always be satisfied at the expense of the soil. This is explained by the weak mobility of potassium compounds in soils, which are mainly represented by sparingly soluble alum inosilicates. In plant organisms, potassium activates more than 60 enzymes [2]. Therefore, nitrogen, phosphorus and potash fertilizers are produced worldwide in large quantities compared to other mineral fertilizers.

In order to increase soil fertility and create a permanent positive balance of nutrients (the law of return of nutrients), it is necessary to control the condition of soils 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. Studies were carried out on one type of soil - old-irrigated typical gray soils located on the Achamaili massif of the Buka district of the Tashkent region. In the aisles of this farm, soils were assessed from 51 to 80 points, of which soils were selected that differ in terms of fertility: low, medium, and highly fertile soils.

In order to study the agrochemical and other properties of irrigated soils common in the pilot plots, main and auxiliary sections were laid on each of them, from the genetic horizons of which soil samples were taken. In addition, at the end of the cotton growing season, plant samples were taken to study their chemical composition.

Field and laboratory studies were carried out according to common generally accepted guidelines: "Methodology of field and vegetation experiments with cotton under irrigation conditions" [3], "Methods of agrochemical analyzes of soils and plants" [4], "Methods of agrochemical, agrophysical and microbiological studies in irrigated cotton areas" [5], "Guidelines for the chemical analysis of soils" [6], "Agrochemical methods of soil research" [7], "Guidelines for conducting chemical and agrophysical analyzes of soils during land monitoring" [8], "Recommendations on the use of mineral and local fertilizers in cotton growing" [9], "Technology for obtaining high yields in cotton growing" [10].

RESEARCH RESULTS. We have studied the geomorphological, soil and climatic conditions of the studied soils, the annual norms of mineral, organic or non-traditional types of fertilizers, the norms and terms of their introduction during the growing season of cultivated crops.

On the territory of the Achamaili massif, old-irrigated typical serozems, sierozem-meadow, meadow and marsh-meadow soils are widespread. Pilot plots on old-irrigated typical sierozem soils were selected for our research.

The genetic horizons of highly and medium fertile soils are mainly medium loamy in terms of mechanical composition; low-fertile soils of the pilot area are characterized by medium and heavy loamy texture. Due to salinization and leaching, these soils are estimated at 41-50 points. Medium-fertile soils are also saline, but are not washed out and are estimated at 61-70 points. Highly fertile soils of the pilot plots, medium loamy in texture, due to differences in the degree of salinity, leaching and other indicators, were estimated at 71-80 points.

Despite the fact that old-irrigated typical serozems differ little from each other in terms of mechanical composition, as a result of long-term anthropogenic pressure on soils, the use of various agro technical and agro-ameliorative measures, they have undergone various changes and currently differ in terms of fertility.

The research results showed that in the arable horizon of highly fertile irrigated typical gray soils, the humus content is 1.264% and it decreases along the soil profile to 0.165%. The arable horizon of medium fertile soils contains less humus - about 1.142% and decreases to 0.452% to the parent rock. Low-fertile irrigated typical gray soils contain less humus than the previous ones and their amount varies along the soil profile within 0.475-0.967%.

The content of gross nitrogen in the upper horizons of the studied soils is 0.084% and decreases along the soil profile to 0.027% (Table 1).

The ratio of carbon to nitrogen in the upper soil horizons ranges from 7.9-8.8. According to Kh.T.Riskieva [11], in typical serozems, the ratio of carbon to nitrogen ranges from 7 to 9, however, a low ratio of carbon to nitrogen indicates a weak activity of biological processes occurring in soils.

It is noted that in irrigated typical gray soils, medium loamy in texture, the ratio of carbon to nitrogen decreases from the upper horizons down the soil profile. However, as the mechanical composition of the studied soils becomes heavier, the ratio of carbon to nitrogen in the soil profile fluctuates within 7.1–9.8, which indicates that this ratio depends on the mechanical composition of the soils.

The content of gross phosphorus in the arable horizon of highly fertile soils is 0.187-0.214%, in medium-fertile soils - 0.173-0.193%, in low-fertile soils the amount of gross phosphorus ranges 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 arable horizons of the studied old-irrigated typical gray soils, the amount of gross potassium varies between 0.82-1.12% and decreases in the underlying horizons to 0.34-0.62%. The dependence of the content of total potassium on the mechanical composition of soils was not noted. However, highly fertile soils differ from low-fertile soils of the pilot plots in terms of the content of gross potassium.

Table 1
Agrochemical indicators and mechanical composition old-irrigated typical gray soils

Incisions, №	Horizon depth, sm	Humus, %	Total nitrogen, %	C:N	Nutrients					Mechanical composition	
					total, %		movable, mg/kg			physical clay, %	mechanical composition
					phosphorus	potassium	N-NO_3	P_2O_5	K_2O		
Highly fertile pilot plot											
1 B-A-AO	0-30	1,257	0,084	8,7	0,187	1,11	25,6	25,7	214	41,8	medium loam
	30-49	1,005	0,071	8,2	0,174	1,08	19,4	22,1	198	39,3	medium loam
	49-82	0,911	0,068	7,8	0,158	0,94	14,1	16,4	167	35,5	medium loam
	82-117	0,698	0,059	6,8	0,124	0,84	9,7	11,9	154	38,7	medium loam
	117-156	0,354	0,038	5,4	0,101	0,74	6,4	6,7	132	41,0	medium loam
	156-210	0,165	0,027	3,5	0,098	0,62	4,9	4,5	92	41,0	medium loam

4 B-A-AO	0-28	1,217	0,082	8,6	0,197	1,07	22,4	19,4	187	39,4	medium loam
	28-50	1,023	0,072	8,2	0,178	0,91	18,4	10,6	156	33,7	medium loam
	50-91	0,782	0,065	7,0	0,164	0,67	9,4	7,8	135	39,4	medium loam
	91-125	0,504	0,044	6,6	0,146	0,53	6,2	6,2	102	40,1	medium loam
	125-160	0,345	0,037	5,4	0,137	0,44	5,9	3,9	78	39,4	medium loam
5 B-A-AO	0-32	1,264	0,084	8,7	0,214	1,11	19,7	29,7	234	42,7	medium loam
	32-51	1,114	0,075	8,6	0,181	0,98	14,6	20,1	189	36,4	medium loam
	51-92	0,892	0,067	7,7	0,170	0,74	9,4	14,2	156	35,9	medium loam
	92-129	0,647	0,053	7,1	0,159	0,62	6,8	9,4	124	41,5	medium loam
	129-170	0,425	0,036	6,8	0,135	0,46	4,5	6,4	77	40,9	medium loam
Medium fertile pilot plot											
6 B-A-NP	0-28	1,142	0,078	8,5	0,185	1,07	22,4	22,9	198	39,5	medium loam
	28-50	0,897	0,065	8,0	0,180	0,98	18,4	17,4	174	40,2	medium loam
	50-83	0,745	0,056	7,7	0,164	0,79	14,2	15,7	168	37,9	medium loam
	83-125	0,681	0,052	7,6	0,148	0,62	9,5	10,6	152	37,6	medium loam
	125-184	0,561	0,048	6,8	0,132	0,56	5,7	6,1	124	41,1	medium loam
	184-230	0,452	0,042	6,2	0,114	0,50	4,2	5,9	112	32,8	medium loam
8 B-A-NP	0-30	1,082	0,071	8,8	0,193	0,93	19,4	19,7	184	42,1	medium loam
	30-52	0,901	0,060	8,7	0,180	0,84	16,7	16,5	171	37,9	medium loam
	52-87	0,716	0,052	8,0	0,164	0,74	14,2	12,4	169	39,4	medium loam
	87-135	0,621	0,048	7,5	0,146	0,63	9,7	8,4	153	42,5	medium loam
	135-174	0,519	0,041	7,3	0,135	0,54	6,7	6,3	119	41,4	medium loam
10 B-A-NP	0-31	0,987	0,068	8,4	0,175	1,12	26,4	23,1	219	33,9	medium loam
	31-50	0,859	0,054	9,2	0,167	0,93	19,5	22,4	197	38,4	medium loam
	50-88	0,672	0,042	9,3	0,165	0,84	9,2	9,5	156	35,2	medium loam
	88-107	0,587	0,041	8,3	0,123	0,74	7,0	5,2	123	35,7	medium loam
	107-165	0,469	0,029	9,4	0,104	0,56	5,3	3,9	91	33,5	medium loam
Low-fertile pilot plot											
11 B-A-KF	0-30	0,967	0,069	8,1	0,184	0,84	15,4	12,4	156	43,2	medium loam
	30-51	0,841	0,062	7,9	0,172	0,74	12,4	9,8	140	47,6	heavy loam
	51-87	0,726	0,045	9,3	0,165	0,63	9,4	6,4	132	46,1	heavy loam
	87-109	0,632	0,043	8,5	0,147	0,58	6,3	4,5	124	45,4	heavy loam
	109-168	0,529	0,041	7,5	0,136	0,42	5,2	4,1	94	47,1	heavy loam
	168-210	0,475	0,039	7,1	0,097	0,34	4,2	3,2	82	47,8	heavy loam
14 B-A-KF	0-30	0,854	0,063	7,8	0,176	0,96	19,4	10,4	124	33,5	medium loam
	30-51	0,802	0,051	9,1	0,163	0,78	12,4	8,3	113	33,8	medium loam
	51-86	0,743	0,049	8,8	0,157	0,65	9,4	4,6	92	47,2	heavy loam
	86-110	0,659	0,039	9,8	0,134	0,54	5,3	3,5	82	47,9	heavy loam
	110-170	0,519	0,032	9,4	0,121	0,36	3,1	3,2	74	46,8	heavy loam
15 B-A-KF	0-28	0,905	0,066	7,9	0,180	0,82	16,4	11,5	136	36,5	medium loam
	28-50	0,856	0,052	9,5	0,169	0,74	13,9	8,3	124	46,8	heavy loam
	50-89	0,746	0,045	9,6	0,147	0,62	6,8	5,3	93	47,2	heavy loam
	89-115	0,624	0,041	8,8	0,126	0,42	4,2	4,2	82	47,8	heavy loam
	115-177	0,513	0,031	9,6	0,107	0,36	3,6	3,5	71	47,5	heavy loam

Highly fertile and medium fertile soils in the plow horizon contain very low and low amounts of the nitrate form of nitrogen, respectively, 19.4-26.4 mg/kg (very little <20 mg/kg, little 20-30 mg/kg). Typical gray soils 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.

Medium and low-fertile soils are very low (0-15 mg/kg) and low (16-30 mg/kg) provided with mobile phosphorus: the arable horizon contains 10.4-12.4 mg/kg and its amount decreases in lower horizons up to 3.2-3.5 mg/kg.

Irrigated typical gray soils of the pilot plots are very low (0-100 mg/kg), low- (101-200 mg/kg) and moderately supplied with exchangeable potassium (201-300 mg/kg) and its amount decreases down the soil profile.

The study of the content of nitrogen, phosphorus and potassium in the organs of cotton at the end of its growing season showed that the assimilation of nitrogen occurs according to the following killing scheme:

aw leaves → stems valves and roots; phosphorus is absorbed by the cotton organs in the following sequence:

raw → leaves → roots → stems and valves; The largest amount of potassium is found in the leaves of cotton, then in the valves, stems, roots and raw cotton. According to the data obtained on the content of nitrogen, phosphorus and potassium in the organs of cotton, their removal also occurs. The results of these studies are presented in Table 2.

Table 2
The content of nitrogen, phosphorus and potassium in the organs of cotton grown on old-irrigated typical gray soils of pilot plots and their removal

Cotton						
Content in organs, %				takeaway, kg/ha		
Organs	N	P	K	N	P	K
Highly fertile pilot plot						
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
The roots	0,8	0,6	1,5	6,1	4,6	11,5
Total:				**148,2**	**73,6**	**142,4**
Medium fertile pilot plot						
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
The roots	0,7	0,5	1,4	4,8	3,4	9,5
Total:				**116,7**	**60,3**	**124,5**
Low-fertile pilot plot						
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
The roots	0,8	0,6	1,5	4,8	3,6	8,9
Total:				**102,9**	**58,2**	**120,4**

Based on the data obtained on the content of nutrients in the organs of cotton, their intake with mineral, organic fertilizers and in a natural way, the removal of nutrients with the harvest and other organs, an economic balance was compiled, which is shown in Table 3.

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 in a natural way, 103.0 kg of nitrogen, 36.5 kg of phosphorus and 79.2 kg of potassium are introduced per 1 hectare.

Table 3
The removal of nutrients by cotton and their balance
Bukinsky district, Tashkent region)

Highly fertile pilot plot				
Cotton				
Take in to soils				
Income and expenditure balance items		N	P	K
With mineral and local fertilizers applied to the soil	with mineral fertilizers	80,0	9,2	28,0
	with local fertilizers	5,6	1,8	8,8
With parts of wheat	with leafed	37,4	11,9	27,2
	with roots	6,1	4,6	11,5
In a natural phenomenon	in the 0-30 cm layer of soil	38,0	17,0	31,0
	with sowed 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**
Outgoing proportion from soil				
With the harvest of raw cotton		72,7	45,9	53,6
With guzapay		32,0	11,2	57,8
Total:		**104,7**	**57,1**	**111,4**
BALANCE:		**+78,3**	**-11,4**	**-4,2**
Medium fertile pilot plot				
Income and expenditure balance items		N	P	K

With mineral and local fertilizers applied to the soil	with mineral fertilizers	70,0	7,0	21,0
	with local fertilizers	2,4	0,8	3,8
With parts of wheat	with leafed	29,1	9,2	23,0
	with roots	4,8	3,4	9,5
In a natural phenomenon	in the 0-30 cm layer of soil	24,0	10,0	21,0
	with sowed 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**
Outgoing proportion from soil				
With the harvest of raw cotton		60,7	39,3	46,4
With guzapay		22,2	8,4	52,8
Total:		**82,9**	**47,7**	**99,2**
BALANCE:		**+63,3**	**-16,1**	**-20,2**
Low-fertile pilot plot				
Income and expenditure balance items		N	P	K
With mineral and local fertilizers applied to the soil	with mineral fertilizers	60,0	4,6	14,0
	with local fertilizers	1,6	0,5	2,5
With parts of wheat	with leafed	26,0	7,2	20,2
	with roots	4,8	3,6	8,9
In a natural phenomenon	in the 0-30 cm layer of soil	22,0	8,0	18,0
	with sowed seeds	0,8	0,5	0,7
	with irrigation water	12,1	0,7	-
	with precipitation	3,0	-	-
Total:		**Total:**	**25,1**	**64,3**
Outgoing proportion from soil				
With the harvest of raw cotton		51,7	38,8	45,2
With guzapay		20,4	8,7	52,6
Total:		**72,1**	**47,5**	**97,8**
BALANCE:		**+58,2**	**-22,4**	**-33,5**

Taking into account the removal of nutrients with the harvest of raw cotton, stems, wings, it was found that a positive balance is created in soils for nitrogen (+78.3 kg/ha), negative - for phosphorus (-11.4 kg/ha) and potassium (4.2 kg/ha) (Table 3).

When cultivating cotton on medium-fertile soils of pilot plots, with mineral fertilizers for the growing season per hectare in measurements of 70.0 kg of nitrogen, 7.0 kg of phosphorus and 21.0 kg of potassium. With leaf litter, guzapay residues 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 in these soils a positive balance is created for nitrogen (+63.3 kg/ha), negative - for phosphorus (-16.1 kg/ha) and potassium (-20.2 kg/ha).

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

CONCLUSIONS.

The obtained data on the influence of the degree of fertility of irrigated typical gray soils on the nutritional regime of these soils show that when cotton is cultivated on highly fertile soils, a positive nitrogen balance is created, which can lead to soil contamination with this element. he high removal of phosphorus and potassium from the soil by plants contributes to the transition of soils from the group of low-supplied soils to the group of very low-supplied phosphorus and potassium, which leads to a violation of the ratio between nutrients and changes in the properties and characteristics of soils.

It should be noted that the reasons for the degradation of agricultural land, which are the "golden fund", can be attributed to a number of reasons: non-observance of crop rotations and alternation of crops, violation of the norms and ratios of applied mineral fertilizers, which leads to the transition of soils from one supply 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 it is necessary to develop modern agricultural technology using improved equipment (aggregates) adapted for the automatic application of mineral fertilizers, taking into account the degree of provision of each hectare of land with basic nutrients, and only then can the optimal ratio be maintained between them and obtain high, high-quality agricultural yields. crops grown on these soils.

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