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The Impact of the Introduction of Norms of Fertilizers and Irrigation on the Change in the Nutritional Regime of the Soil in Mixed Crops of Barley and Alfalfa

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ABSTRACT

The article quotes questions of the influence of fertilizer rates and the number of irrigations on the change in the nutrient regime of the soil when growing mixed crops of barley and alfalfa in the conditions of the Karabakh zone of Azerbaijan. In this regard, one of the main issues considered was the development on a scientific and practical basis of the nature of changes in the nutrient regime of the soil and the effect of optimal fertilizer rates and the number of irrigations on crop yields in mixed crops in long-irrigated gray meadow soils.

To study the effect of irrigation and fertilizer rates in mixed crops on changes in the nutrient regime of the soil, soil samples were taken from two soil layers (0-30 and 30-60 cm) after cutting. In the soil samples taken, compounds of nitrogen, phosphorus and potassium that are readily absorbed by plants were analyzed. Analysis of soil samples shows that the application of mineral and organic fertilizers against the background of different amounts of irrigation fundamentally affects the effective fertility of the soil.

Against the background of 4-fold vegetative irrigation (3800 m3 / ha) in the control variant without fertilizers in the 1st mowing, analysis of soil samples makes it known that in the variant without fertilizer in the first crop the amount of absorbed ammonium was 5.2-6.6 mg / kg, nitrates 3.3-4.9 mg / kg, mobile phosphorus 7.2-12.7 mg / kg, and exchangeable potassium 217.5-254.7 mg / kg, and in the variant with the norm N45P120K90 in the soil layer of 0-30 cm after the first mowing, the amount of absorbed ammonium was 6.2-8.3 mg / kg, nitrate nitrogen 4.5-5.4 mg / kg, mobile phosphorus 9.4-13.2 mg / kg, and exchangeable potassium 256-263 mg / kg. As a result of the analysis, it becomes clear that the introduction of irrigation and fertilizer rates increases the number of digestible nutrients. And this in turn has the necessary effect on the yield of alfalfa in mixed crops with barley, as a result, the effective fertility of the soil is maintained.

1. INTRODUCTION

On mixed senosy, the digestibility of nutrients and water is improved. Legumes with taproot, assimilating water and mineral substances from the deep layers of the soil, enrich the upper layers of the soil. Mixed crops with different biological features and rich in nitrogen, phosphorus, potassium, calcium and magnesium are of particular importance. Thus, the difficultly digestible bivalent calcium and magnesium compounds, which are very important for grain crops, are absorbed by the roots of legumes and, passing into mobile forms, create a reserve (reserve) for the grain crops. And grain, converting the elements of phosphorus and potassium contained in the soil into mobile forms, enrich legumes with these components. The enrichment of soil with nitrogen by leguminous crops is known and the application in the experience of these plants is important. The above are the cause of increasing the yield of mixed crops and prove the advantage of mixed crops over crops of the same crop.

The total stock in soil nutrient matter describes its potential fertility. Effective soil fertility is determined by the amount of nutrients contained in the soil that can be absorbed by plants. One of the main factors for increasing the effective and potential fertility of the soil is the use of organic and mineral fertilizers. Fertilization in the desired rate and proper agricultural technology may improve the agrochemical characteristics of the soil. And this is due to the creation of favorable nutritional conditions for plants.

V. G. Mineev, in studying the soil potassium regime, took the amount of exchangeable potassium as a basis. If potash fertilizers are not introduced, then the compounds of this element in the soil decrease, the productivity of plants decreases sharply. Especially one-sided application of nitrogen and phosphate fertilizers again increases the need of plants for this element [5].

The systematic use of phosphate fertilizers increases the stock of total phosphorus, as well as the content of mobile phosphorus in it. This increase is mainly observed in the topsoil. But it should be noted that in light soils it can leach into the subsoil layers.

The systematic use of nitrogen and phosphate fertilizers increases the plant's need for potassium. As a result of the experiments, it was found that the use of potash fertilizers significantly reduced potassium deficiency in the soil, as a result, the yield of agricultural plants and its quality increased significantly [6].

Studies show that the following factors affect the movement of phosphorus in soil: soil characteristics, mainly its particle size distribution, the number and composition of colloids, the chemical composition of the soil, the soil solution environment, the amount of organic compounds, water regime, climatic conditions, precipitation, humidity, temperature, plant cover, forms of phosphate fertilizers, soil phosphates, etc. [four].

In connection with the use of organic and mineral fertilizers, researchers have long been interested in the study of their effect on the nutrient regime of the soil. Such work as F.V.Turchin (1964), D.A.Korenkov (1965), RKGuseinov (1965), V.G. Mineev (1973), Z.R. Movsumov (1978) engaged in this work at different times. , M.I. Jafarov (1982), F. Kh. Akhundov (1989), P. B. Zamanov (1995), E. R. Allahverdiyev (2002), R. K. Mamedov (2011) and others [1].

The main source of plant nutrition is the mineral elements of the soil and nitrogen. The richness of soil minerals is determined by the specific feature of the rocks and the activity of microorganisms.

One of the factors on which soil fertility depends, and because of this, the whole complex of mineral nutritional conditions of plants is the soil microflora.

The decomposition products of organic residues not only enrich the soil with assimilable nitrogen and phosphorus compounds and increase the supply of CO2 in the lower atmosphere. They also have various stimulating effects. The processes of mineralization of organic residues also significantly affect the state of other important elements (sulfur, phosphorus, etc.) [2].

The decomposition of organic residues also affects the balance of phosphoric acid compounds in the soil. J. Liebig proved the indispensable and uninterrupted application of fertilizers as the main means of soil fertility management.

In the field by means of fertilizers it is quite possible directional placement in the formation of the root system. Thus, according to AB Sokolov, nitrogen fertilizer enhances the development of the roots in the layers of the soil, where its compounds are directly located. And in the layers where the soil is fertilized with phosphorus, the roots grow at the lowest intensity. They, bypassing this layer without branching, develop most intensively in the lower layers.

Knowing these features, it is possible to regulate the placement of the main mass of roots in the soil. For example, in arid zones, the application of phosphates to the upper layers of the soil can help the development of roots on moisture-rich deep soil horizons. And the development of the roots can be enhanced by the introduction of nitrogen fertilizers on these soil layers.

Researches of the Kazan School of Physiologists show that additional mineral fertilizer can be a significant factor affecting the water regime of plants. The nature of this influence depends on the type and time of additional fertilizer. Nitrogen fertilizers applied as an additional fertilizer, if the amount of bound and colloidal water is reduced, then phosphate and potash fertilizers, on the contrary, increase these indicators. When fertilized with nitrogen fertilizers, these fertilizers also have a positive effect.

In 2010, according to the plan, the ways of growing mixed crops of barley and alfalfa in the conditions of the Karabakh zone, as well as the effect of fertilizer rates and the number of irrigations on the change in the soil of the nutritional regime, were studied in research work. In this regard, it was considered one of the important issues to develop on a scientific and practical basis the optimal rates of fertilizers and the number of irrigations and their effect on the change in soil and plants of nutrient regimes in mixed crops, under conditions irrigated from antiquity on serum soils.

Water plays a crucial role in plant life. If even some primitive plants can definitely live without air and light, then there is no water without water. Ox is an integral part of living plasma of plants. Water inside the plant moves with different substances. As a result of evaporation, plants lose water and it retains increasing water tension, normalizes temperature, and protects the soil from excessive heating. Plant organs usually store 50-90% of water, and sometimes more. The value of water that is not part of plants is also great. Precipitation, soaking into the soil and assimilated by the roots of plants from the deep layers, is used by plants. It also influences the change in the nutritional regime of the soil, creates the conditions for providing plants with water [7].

During the study, a significant effect of fertilizer introduction was observed against the background of a different number of irrigations under mixed crops of barley and alfalfa on the nutritional regime of the soil and a significant increase in the number of nutrient elements readily absorbed by plants. And this, in turn, proves a large increase in the effective fertility of the soil as a result of the use of fertilizers and irrigation.

There is a close connection between mineral nutrition and water exchange, as well as the possibility of active influence through a properly adjusted fertilizer system on water exchange. It is important to increase the effectiveness of nutrients introduced into the soil. Therefore, the urgent issue is the application of fertilizers in the soil to certain places by a local method [8].

Soil fertility, the provision of plants with water, oxygen and carbon dioxide, the amount of anaerobic decomposition products in the soil of organic compounds strongly influence the size of the root system.

To obtain a normal yield, it is necessary to apply these three nutrients (macro-fertilizers) to the soil in the form of fertilizers.

As a result of analyzes, the effect of irrigation and fertilizer rates on cuttings on the amount of nutrients in the aerial part of alfalfa has been studied.

In the republic, for the first time, we study the effect of irrigation and fertilizer rates on changes in the nutrient regime of the soil in various cuttings in mixed barley and alfalfa crops. For this, after cutting, soil samples were taken from two depths (0-30 v ə 30-60 sm). In the soil samples taken, compounds of easily digestible nitrogen, phosphorus and potassium were analyzed. Analysis of soil samples show that the use of mineral and organic fertilizers against the background of various vegetative irrigations has fundamentally affected the effective fertility of the soil. The test results were as shown in the table.

As can be seen from the table, after harvesting barley on the background of 4-fold vegetative irrigation (3800 m3 / ha) by analyzing soil samples, it becomes known that in the variant without fertilizer in the first crop, the amount of absorbed ammonium was 5.2-6.6 mg / kg, nitrates 3.3-4.9 mg / kg, rolling phosphorus 7.2-12.7 mg / kg, and exchangeable potassium 217.5-254.7 mg / kg. When applying fertilizers in various doses, these indicators continue to increase. So, when fertilizers were applied in the standard N30P90K60, the amount of absorbed ammonium was 5.7–8.0 mg / kg, nitrate nitrogen, 3.6–5.4 mg / kg, mobile phosphorus, 8.4–16.4 mg / kg, potassium 224.2-270.2 mg / kg, in the variant with the norm N45P120K90 in the soil layer 0-30 cm after the first cut, the amount of absorbed ammonium

was 6.2-8.3 mg / kg, nitrate nitrogen 4.5-5, 4 mg / kg, mobile phosphorus 9.4-13.2 mg / kg, and exchangeable potassium 256-263 mg / kg.

In the variant with the introduction of 10 tons of manure in the soil layer of 0-30 cm in the first cut, the amount of absorbed ammonium was 5.5-7.9 mg / kg, nitrate nitrogen 3.6-5.1 mg / kg, mobile phosphorus 8.1 -14.5 mg / kg, and exchangeable potassium 223.1-261.9 mg / kg. As a result of research in II, III, IV mowing, an increase in the amount of nutrients was observed.

As a result, the combined use of organic and mineral fertilizers in the normal 10 t / ha + N15P65K30 indicators changed and the amount of absorbed ammonium was 6.0-8.1 mg / kg, nitrate nitrogen 3.8-5.5 mg / kg, mobile phosphorus 8 , 5-16.2 mg / kg, and exchangeable potassium 225.4-271.5 mg / kg. Against this background, analysis of soil samples taken from under alfalfa makes it known that in the 2nd crop in the control variant without fertilizing, the amount of absorbed ammonium was 4.9-6.1 mg / kg, nitrate nitrogen 3.0-4, 6 mg / kg, mobile phosphorus 7.0-12.3 mg / kg, and exchangeable potassium 201.5-240.3 mg / kg.

When mineral fertilizers were applied in the norm of N30P90K60, these indicators were respectively 5.4-7.6: 3.3-4.8: 7.7-13.8: 203.8-250.6 mg / kg, and in the variant with the norm N45P120K90 in the second cut, they were respectively 5.2-7.4; 3.1-4.5; 7.4-12.3 and 208.0-247.1 mg / kg, and when using organic fertilizers, these indicators have changed a lot. So, in the variant with application of manure at a rate of 10 t / ha in the first cut at a soil depth of 0-30 cm, the amount of absorbed ammonium was 5.0-7.2 mg / kg, nitrate nitrogen 3.3-4.5 mg / kg , mobile phosphorus, 7.4-13.1 mg / kg, and exchangeable potassium, 202.4-247.6 mg / kg, and the variant at a rate of 10 t / ha of manure + N10P65K30, these indicators made up respectively 5.8-7.7 ; 3.5-4.9; 7.8-14.5 and 204.1-251.7 mg / kg.

The effect of irrigation and fertilizer rates in mixed crops of barley and alfalfa on changes in the nutritional regime of the soil

Table

	Options	Depth, cm	Date of taking soil samples															
			First mowing (07.02.09)				Second mowing (30.07.09)				Third mowing (29.08.09))				Forht mowing (24.09.09))			
			N/NH_3	N/NO_3	P_2O_5	K_2O	N/NH_3	N/NO_3	P_2O_5	K_2O	N/NH_3	N/NO_3	P_2O_5	K_2O	N/NH_3	N/NO_3	P_2O_5	K_2O
			3 time watering, 3800 m3/ha															
I	Control, no fertilizer	0-30	6,6	4,9	12,7	254,7	6,1	4,6	12,3	240,3	5,8	3,9	10,1	218,2	5,3	3,2	9,4	208,3
		30-60	5,2	3,2	7,2	217,5	4,9	3,0	7,0	201,5	4,6	2,9	6,3	179,0	4,2	2,3	5,6	179,0
II	$N_{30}P_{90}K_{60}$	0-30	8,0	5,4	16,4	270,2	7,6	4,8	13,8	250,6	6,8	4,3	10,5	228,2	6,2	4,1	9,7	215,5
		30-60	5,7	3,6	8,4	224,2	5,4	3,3	7,7	203,8	5,1	3,3	6,3	184,5	4,7	3,1	5,8	174,2
III	$N_{45}P_{120}K_{90}$	0-30	8,3	5,4	13,2	263	7,4	4,5	12,3	247,1	6,9	4,1	11,5	228,6	6,9	4,1	10,4	219,6
		30-60	6,2	4,5	9,4	256	5,2	3,1	7,4	208,3	5,1	2,9	7,4	190,4	4,9	2,7	7,3	188,4
IV	manure 10 t/hec	0-30	7,9	5,1	14,5	261,9	7,2	4,5	13,1	247,6	6,4	4,1	10,8	227,1	6,0	3,7	9,9	277,6
		30-60	5,5	3,6	8,1	223,1	5,0	3,3	7,4	202,4	4,8	3,0	6,6	184,2	4,5	2,7	6,2	174,3

V	manure 10 t/hec + $N_{15}P_{65}K_{30}$	0-30	8,1	5,5	16,2	271,5	7,7	4,9	14,5	251,7	7,3	4,4	11,9	237,1	6,8	4,1	10,2	228,2
		30-60	6,0	3,8	8,5	225,4	5,8	3,5	7,8	204,1	5,2	3,5	7,2	194,3	5,2	3,5	7,2	185,2
		4 time watering, 4800m^3/ha																
I	Control, no fertilizer	0-30	6,9	5,1	13,5	260,1	6,4	4,8	12,7	244,4	6,1	4,2	11,4	225,6	5,8	4,0	10,6	222,5
		30-60	5,5	3,6	7,8	219,4	5,2	3,1	7,1	201,5	4,5	3,0	6,9	184,2	4,3	2,9	6,4	181,4
I	$N_{30}P_{90}K_{60}$	0-30	8,8	6,1	17,4	277,5	8,0	5,1	13,9	253,6	7,6	4,7	12,2	238,1	7,2	4,5	11,8	235,4
		30-60	6,6	4,4	9,2	236,9	5,6	3,7	8,2	206,7	5,1	3,5	7,7	195,8	5,0	3,2	7,3	190,6
II	$N_{45}P_{120}K_{90}$	0-30	9,2	6,3	17,8	279,3	8,7	5,7	15,2	252,8	8,1	5,0	12,8	244,4	7,9	4,8	11,0	237,4
		30-60	6,7	4,6	9,9	258,1	6,0	4,1	8,7	207,2	5,8	3,8	8,1	200,3	5,4	3,6	7,7	198,5
V	manure 10 t/hec	0-30	8,2	5,5	15,2	268,3	7,9	5,0	13,5	250,2	7,2	4,6	11,4	234,5	6,8	4,2	10,3	228,4
		30-60	6,1	4,0	8,4	224,2	5,2	3,7	7,9	203,4	5,0	3,1	7,2	181,2	4,8	2,9	6,8	178,3
	manure 10 t/hec + $N_{15}P_{65}K_{30}$	0-30	8,5	5,9	17,1	273,9	8,1	5,2	15,1	253,6	7,8	4,4	12,4	239,2	7,3	4,3	11,4	232,3
		30-60	6,3	4,1	9,1	229,6	5,8	3,6	8,3	206,4	5,2	3,3	7,7	200,1	5,0	3,1	7,1	192,1

From analyzes of soil samples taken from under the plants at the 3rd mowing of alfalfa, it becomes clear that the amount of absorbed ammonia decreases to 4.6-5.8 mg / kg, nitrates 2.9-3.9 mg / kg, mobile phosphorus 6.3-10.1 mg / kg, and exchangeable potassium 179.0-218.2 mg / kg. When mineral fertilizers were applied in the norm of N30P90K60, these indicators were 5.1-6.8, respectively: 3.3-4.3: 6.3-10.5 and 184.5-228.2 mg / kg. In the variant with the application of fertilizers in the norm N45P120K90 in the 3rd cut, the amount of absorbed ammonium was 5.1-6.9 mg / kg, nitrate nitrogen 2.9-4.1 mg / kg, mobile phosphorus 7.4-11.5 mg / kg, and exchangeable potassium 190.4-228.6 mg / kg, and in the variant with the use of manure at a rate of 10 t / ha, the amount of absorbed ammonium was 4.8-6.4 mg / kg, nitrate nitrogen 3.0 -4.1 mg / kg, mobile phosphorus 6.6-10.8 mg / kg, and exchangeable potassium 184.2-227.1 mg / kg, and when applying manure at a rate of 10 t / ha + N15P65K30, these figures were respectively 5.2-6.8: 3.5-4.4: 7.2-11.9 and 194.3-237.1 mg / kg.

From analyzes of soil samples taken from under the plants at alfalfa mowing, it becomes clear that nutrients change significantly in the soil as a result of using mineral and organic fertilizers.

When the number of irrigations reached 5 during the growing season (4800 m3 / ha) as a result of the use of mineral and organic fertilizers, the indicators of effective fertility increased even more. Thus, analyzes of soil samples taken from under alfalfa after harvesting barley against 5 irrigations (4,800 m3 / ha) make it clear that in the control variant without fertilizers in the 1st crop the amount of absorbed ammonium was 5.5-6.9 mg / kg, nitrate nitrogen 3.6–5.1 mg / kg, mobile phosphorus 7.8–13.5 mg / kg, and exchangeable potassium 219.4–260.1 mg / kg. When fertilizers are applied in various rates, these indicators continue to increase. So, when fertilizer is applied in the norm N30P90K60, the amount of absorbed ammonium was 6.6-8.8 mg / kg, nitrate nitrogen 4.4-6.1 mg / kg, mobile phosphorus 9.2-17.4 mg / kg, and exchangeable potassium 236.9-277.5 mg / kg, and in the variant with the use of fertilizers in the norm of N45P120K90 in the 1st cut at a depth of 0-30 cm, the amount of absorbed ammonium was 6.1-8.2 mg / kg, nitrate nitrogen 4.0-5.5 mg / kg, mobile phosphorus 8.4-15.2 mg / kg, and exchangeable potassium 224.2-268.3 mg / kg. The combined application of organic and mineral fertilizers in the norm of 10 tons of manure / ha + N10P65K30 the amount of absorbed ammonium was 6.3-8.5 mg / kg, nitrate nitrogen 4.1-5.9 mg / kg, mobile phosphorus 9.1-17 , 1 mg / kg, and exchangeable potassium 229.6-273.9 mg / kg.

From analyzes of soil samples taken from under alfalfa against this background of irrigation, it becomes clear that in the 2nd crop in the control variant without fertilizers the amount of absorbed ammonium

was 5.2-6.4 mg / kg, nitrate nitrogen 3.1-4, 8 mg / kg, mobile phosphorus 7.1–12.7 mg / kg, and exchangeable potassium, 201.5–244.4 mg / kg. When using mineral and organic fertilizers, these indicators have changed a lot. So, when using mineral fertilizers in the norm N30P90K60, these figures were respectively 5.6-8.0; 3.7-5.1: 8.2-13.9 and 206.7-253.6 mg / kg, and in the standard N45P120K90 - 6.0-8.7: 4.1-5.7: 8, 7-15.2 and 207.2-252.8 mg / kg.

When applying organic fertilizer in the form of manure at a rate of 10 t / ha in the 1st cut at a depth of the soil layer of 0-30 cm, the above indicators were 5.2-7.9; 3.7-5.0; 7.9-13.5 and 203.4-250.2 mg / kg, and at a manure rate of 10 t / ha + N10P65K30 - 5.8-8.1: 3.6-5.2: 8.3 -15.1 and 206.4-253.6 mg / kg.

From the analyzes of soil samples taken from under the alfalfa at the 3rd mowing of alfalfa it becomes clear that in the control variant without fertilizers the above indicators were 4.5-6.1; 3.0-4.2; 6.9-11.4 and 184.2-225.6 mg / kg. When mineral fertilizers were applied in the norm of N30P90K60, these indicators were 5.1-7.6: 3.5-4.7: 7.7-12.2 and 195.8-238.1 mg / kg, and at the rate of N45P120K90 in 3rd cut - respectively 5.8-8.1; 3.8-5.0; 8.1-12.8 and 200.3-244.4 mg / kg. When applying manure at a rate of 10 t / ha + P35, the amount of absorbed ammonium was 5.0–7.2 mg / kg, nitrate nitrogen 3.1–4.6 mg / kg, mobile phosphorus 7.2–11.4 mg / kg, and exchangeable potassium 181.2-234.5 mg / kg, and when applying manure in the normal 10 t / ha + N10P65K30 - respectively 5.2-7.8: 3.3-4.4: 7.7- 12.4 and 200.1-239.2 mg / kg.

Nutrients, participating in biochemical processes, occurring with different intensities and in different directions in the period of plant development, fundamentally apply to plant organisms. Plants always feel a lack of such nutrient elements as nitrogen, phosphorus and potassium from the soil. Efficient use of nutrients by plants depends largely on the creation of an optimal water regime. For this, the amount of nitrogen, phosphorus and potassium in the soil layer was determined by cuttings to characterize the nutrient requirements of alfalfa against the background of different amounts of irrigation. As a result of the analysis, it becomes clear that the introduction of irrigation and fertilizer rates in the soil increases the number of digestible nutrients. And this, in turn, has the necessary effect on the yield and quality of alfalfa in its mixed sowing with barley.

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