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Original Research Article

Cotton Plant of Mughan – Salyan Economic District Ancient Watered Tund Used Underneath Effect of Erosion Process on Agrochemical Indicators and Structure-Aggregate Composition of Gray-Grass Soils

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Abstract

The changes happening in the structural-aggregate composition and agrochemical indications of soil on separate genetic layers of the dark gray-meadow soils profile have been determined on the basis of the field-soil and cameral-laboratory materials performed in the experimental area of the zone of state Sort-Test Station in the part of the Salyan district in the structure of Mughan-Salyan economic region. The agrochemical indications and structural-aggregate composition in the experimental area were studied as a result of the analysis of the soil samples taken from genetic layers of the section with structural-aggregate composition and agrochemical indices in the experimental area.

An amount of the dry and wet atructural-aggregate particles larger than 0.25 mm, and also humus, nitrogen phosphorus which are basic-fertility indices on genetic layers of Dark-grey-meadow soils was investigated. A result of the laboratory analyzes rendered that the humus quantity on the upper layer of the section was 3.6% and it gradually decreases towards the lower layers. It is 1.8%.

An amount of total nitrogen gradually decreases towards lower layers and changes by 0.113-0.225%. The highest index (0.225%) is at the first layer, the lowest indication (0.113%) is in the last layer. A sum of dry structural particles more than 0.25 mm is 97.9-98.75%, but a sum of the wet structural particles changes by 75.00-81.68%. A sum of the dry structural oarticles more than 0.25 mm doesn`t differ in the separate genetic layers of profile, the lowest index (97.49%) was observed at the first layer, the highest index (98.75%) at the second layer, but in the wet structural particles the lowest index is (75.00%) at the last layer, the highest index (81.18) is at the first layer.

Keywords: soil, section, dark-grey-meadow, humus, nitrogen, structure.

Introduction

The current 1,451 million ha of irrigated land under cultivation in Azerbaijan has been subject to irrigation erosion to one degree or another, due to traditional surface irrigation, and it is a real fact that it is forced to lose its productivity. So that, the fact that the territory of Salyan region, which is our research object, has a flat relief, that the soil and climate conditions are very favorable for the development of cotton cultivation, and that the Kura River, which is the source of irrigation, crosses the territory, is one of the regions of Azerbaijan where irrigation agriculture has been developed since ancient times.caused it to become one. This historical tradition is continued at the present time. Irrigation works in this region were carried out spontaneously from the past, irrigation norms and methods were not properly followed, progressive irrigation methods were not applied. Therefore, pomegranate particles washed from the fertile upper snows of the beginning and middle parts of the irrigated lands are deposited in the lower parts of the fields. The cause of this process is irrigation erosion. Taking this into account, we considered it appropriate to study irrigation erosion under the cotton plant in Salyan region in 2019-2022.

RESEARCH OBJECT AND METHODOLOGY

The research object is an experimental area located at the base of the Salyan State Sort-Testing Station in the territory of the Kura Garagashli Village Municipality of the Salyan region.

While determining the degree of soil erosion in the research facility, K.A. The comparative geographical methodology proposed by Alekbarov [8] was used.

Modern methods were used in the laboratory analysis of soil samples taken from the genetic layers of the planted cuttings: the amount of humus and total nitrogen - I.V. By Tyurin's method, activated phosphorus (P2O5) – by Machig's method, absorbed and – D.V. By Ivanov's method, carbonation (CO2) in a calcimeter device - by Scheibler's method, soil acidity-potentiometric method, structure-aggregate composition - N.I. Determined according to Savinov.

ANALYSIS AND DISCUSSION

The Salyan region, which is the object of the study, is located in the territory of the Mugan-Salyan economic region, and its administrative territory is formed by the east and north of the Mugan plain, the north of the Salyan plain and the western part of the South-Eastern Shirvan plain. The area is located 20-28 m below the ocean level. In the western part of the territory, the absolute height is minus 20 m, gradually decreases towards the east and reaches minus 28 m on the coast of the Caspian Sea

The relief of the area was formed due to the alluvial-proluvial sediments brought by the Kura and Araz rivers on the ancient terraces of the Caspian Sea.

General background of the area it is dominated by sloping meso- and micro-valleys with weakly noticeable relief.

In the central, western and southern parts of the territory, the relief consists of alluvial-lacustrine depressions of the Halocene age, and in the Kuryan lowland part, it consists of terraced alluvial plains of the IV period.

In irrigated lowland areas, climatic parameters - the amount of precipitation and possible surface evaporation - play an important role in the application of irrigation. Salyan region, where irrigation is applied, is one of the hottest and driest regions of Azerbaijan. G.A. Hajiyev and V.A. Rahimov [9] distinguished the climate type of temperate-hot semi-desert and dry steppes with dry summer in the territory of Salyan region.

There are 2 meteorological stations in the region. The climate indicators of these meteorological stations differ from each other.

Meteorological stations of Salyan and Karachala are located in the west of the region. The eastern part of the territory is drier than the western part.

In the western part of the territory (Salyan), the amount of multi-year average annual precipitation is 283 mm, it varies between 7-38 mm in individual months.

Most of the precipitation falls in winter (85 mm), spring (81 mm) and autumn (91 mm). The total amount of precipitation in these three seasons is 257 mm, which is 90.81% of the annual precipitation.

Summer is very dry. The amount of precipitation in summer is 26 mm (9.19% of annual precipitation). The least precipitation occurs in July (7 mm) and August (8 mm), and the most precipitation occurs in October (37 mm) and November (38 mm). The annual possible evaporation in the area is 962 mm. The most evaporation is observed in the summer months (June – 144 mm, July – 172 mm, August – 153 mm) and is 469 mm. This is 48.75% of the annual possible evaporation. In general, the amount of summer precipitation (26 mm) is 443 mm or 17.04 times less than possible evaporation (469 mm).

Compared to precipitation (81 mm in spring and 91 mm in autumn), surface evaporation is high in spring and autumn, 201 mm in spring and 211 mm in autumn, which is 120 mm more than precipitation in both spring and autumn.

In the eastern part of the territory (Karachala), the amount of annual precipitation is 261 mm, and possible evaporation is 974 mm.

Here, the main part of precipitation falls in winter (79 mm), spring (74 mm) and autumn (79 mm), making up 232 mm or 88.89% of the annual precipitation. Summer is dry. 30 mm or 11.11% of the annual precipitation falls in summer. The highest evaporation is observed in the summer months (June-145 mm, July-175 mm, August-162 mm) and is 482 mm or 49.49% of the annual possible evaporation.

Surface evaporation is 452 mm or 16.07 times more than the amount of summer precipitation (30 mm).

Compared to precipitation in spring and autumn (74 mm in spring and 79 mm in autumn), surface evaporation is high and amounts to 212 mm in spring, 204 mm in autumn and 204 mm, which is 138 mm more than precipitation in spring and 125 mm in autumn.

Only in winter, the amount of precipitation (79 mm) was slightly higher than surface evaporation (76 mm). In winter, precipitation (30 mm) exceeded evaporation (23 mm) only in January. Surface evaporation is more than precipitation in December and February (25 mm in December and 24 mm in February), 27 mm in December and 26 mm in February.

That is, in the eastern part of the Salyan region, the climate is drier due to the high surface evaporation from the precipitation that falls in 11 months of the year (from February to December), so artificial irrigation is needed.

Soil and soil-erosion studies were conducted by researchers [1,2,3,4,5,6,7,10,11] in the territory of Mugan-Salyan economic district, which includes Salyan district, which is the object of research.

Soil erosion studies in the area were conducted for the first time by Z.H.Aliyev[1]. E.A.Gurbanov [11] in the Mughan plain. In 1981-1983, he studied the characteristics of irrigation erosion in the irrigated gray-grass, grass-gray and gray-brown soils used under cotton and grain crops in Bilasuvar and Saatli districts in the foothills of the Mughan plain, and its effects on the water-physical properties of the soil and plants. Studied the effect on productivity as well as soil leaching has drawn up maps of the area's surface inclination, resistance to erosion, potential danger of irrigation erosion, irrigation techniques against erosion on a scale of 1:100,000, and prepared soil-protecting irrigation techniques taking into account possible leaching. E.A. Gurbanov chose 4 experimental plots (I, II, III under cotton, IV under winter buckwheat) in the territory of the collective farm named after Kirov of Bilasuvar region, 2 experimental plots (V field under cotton, VI under winter wheat) in the territory of the collective farm named after the XXI Party Congress of Saatli region.

Experimental fields were irrigated by furrow (cotton) and strip (wheat) methods.

Irrigation erosion was studied taking into account surface slope, furrow length and irrigation rate.The latest results of the scientific-research works conducted by us in the direction of studying the long-term irrigation erosion in the irrigated lands of different regions of Azerbaijan show that the water in the irrigated areas

If the norms and rules of RMA are not properly followed, the fertile top layer of the beginning and middle parts of the field is gradually washed away and deposited in the lower part of the field. In order to prove that irrigation erosion has occurred in the research object, on september 22, 2021, 1 complete cutting was placed at the end of both the experimental area and the general area of the State Sort-Testing Station, for agrochemical and agrophysical analyzes from separate genetic layers of the cutting. soil samples were taken, relevant analyzes were carried out in the analytical laboratory.

In this article, we will investigate the agrochemical parameters and structural-aggregate composition of the ancient irrigated dark gray-meadow soils that have not been eroded in the research object. In the next research years (2019-2022), additional sections will be placed in the research facility to determine the degree of erosion of the gray-grass soils in the territory of the State Sort-Test Area, and the erosion process of the gray-grass soils will be determined. the effect on both agrochemical and agrophysical indicators will be investigated.

As the amount of humus and basic nutrients (N, P, K) in the soil is high, its fertility is also high, it can seriously resist the destructive effects of rain and irrigation water, surface washing does not occur, high yield from both cultivated and wild plants. is taken.The summary of the chemical analysis of the soil samples taken from the genetic layers of the cutting and the mathematical calculations of the analysis results is given in table No. 1. We give an analysis of that table below.

The amount of humus in the upper layer of dark gray-meadow soils, which has been irrigated since ancient times, is 3.6%, and in the profile of the section, it varies between 1.8-3.6%. The indicators of humus in separate genetic layers of the profile do not differ sharply from each other. So, the difference between the indicators of the first (0-21) layer and the second (21-40 cm) layer is 0.9%, between the second (21-40cm) and the third (40-61cm) is 0.4%, the third (40-61cm) and the fourth (61-78cm) is 0.5%.

The reason for the slight difference between the indicators of the genetic layers is due to the ancient irrigation of these lands. The humus in the upper layer migrates to the lower layers together with water as a solution in rain, snow, and irrigation water that soaks into the soil and settles there. Gradually, the amount of humus in the lower layers increases.

According to the amount of humus, the amount of total nitrogen fluctuates between 0.225% and 0.113-0.225%, respectively.

The amount of phosphorus varies between 18.90-23.33 mg/kg in the 0-61 cm layer of the cut. The amount of phosphorus also decreases gradually from the upper layer to the lower layers. The amount of phosphorus was the highest (23.33 mg/kg) in the first layer (0-21 cm), and the least (18.90 mg/kg) was observed in the third layer (40-61 cm).

Soil acidity (pH) varies from 7.83 to 8.09 in the cutting profile. The lowest (7.83) indicator is observed in the first layer (0-21cm), and the highest indicator (8.09) is observed in the last layer (61-78cm).

The acidity (pH) indicator does not change sharply for individual genetic layers, it gradually increases slightly from the upper layer to the lower layers.

The soil is a weak alkaline soil.

Uneroded, anciently irrigated dark gray-meadow soils are carbonate soils. The amount of carbonates in the profile of the cut varies from 9.87 to 12.44%.

The total amount of absorbed bases (and) in the old, irrigated dark gray-meadow soils that have not undergone erosion is 26.5-33.00 mg eq. in the profile of the cut. Varies between Among the absorbed bases, calcium cation prevailed and was 15.5-20.5 mg equiv. varying between 58.49-62.12% of the absorbed bases.

Magnesium cation is much less than calcium cation and makes up 37.88-41.51% of the total absorbed bases.

The structure is one of the most important agrophysical indicators of the soil and plays an important role in preventing irrigation erosion in irrigated areas.

Well-structured soils are highly resistant to water erosion and prevent soil erosion.

According to its structure, dark gray-meadow soils, which have not been eroded and irrigated since ancient times, occupy an average position among the soil types common in Azerbaijan and have a ball-like structure.

In 2021, table No. 2 was compiled as a summary of mathematical calculations of the results of dry and wet structure-aggregate analyzes of soil samples taken from the genetic layers of 1 complete section placed in the experimental field. Below we give an analysis of the table.

The analysis results of cut No. 1 show that the total of dry structural particles larger than 0.25 mm in the profile of the cut is 97.49-98.75% for individual genetic layers, and the total of waterproof wet structural particles is 75.00-81,

It varies between 68%. The highest indicator (98.75%) of dry structure particles was observed in the second layer (21-40cm), and the lowest indicator (97.49%) was observed in the first layer (0-21cm).

The highest index of waterproof structural particles larger than 0.25 mm (81.68%) is in the first layer (0-21cm), and the lowest index (75.00%) is in the last-fourth layer (61-78cm).

Dry structure the total number of particles (larger than 0.25 mm) is less in the top layer than in the bottom three layers, and in the bottom three layers there is no sharp difference in indicators, almost the same, very slight.

Thus, in the second layer (21-40 cm) it reaches the highest indicator (98.75%), the indicator of the third layer (40-61 cm) (98.69%) is much lower than the second layer (0.06%), the indicator of the fourth layer (61-78 cm) (98.42%) is slightly less than the indicators of both the second and third layer (0.33% less than the indicator of the second layer, 0.27% less than the indicators of the third layer).

On the contrary, the amount of water-resistant structural particles (larger than 0.25 mm) gradually decreases from the top layer to the bottom layers.

The total amount of dry structural particles in the first layer (0-21 cm) is 1.26% less than the second layer (21-40 cm), 1.20% less than the third layer (40-61 cm), and 0.93% less than the fourth layer (61-78 cm) in this case, the total number of wet structural parts in the first layer was 2.77% more than the second one, 5.67% more than the third one, and 6.68% more than the fourth one.

Table 1.Agrochemical parameters of non-eroded, anciently irrigated dark-grey-meadow soils

Serial number of the cut	Depth, in cm	Humus, in %	Total nitrogen, in %	Phosphorus, in mg/kg	pH	CO2, in %	CaCO3 in % of CO2	Absorbed base.100g of soil. main.total with mgekv		Absorbed main.total mgekv-le	Absorbed main.from total. %-with	
								$Ca^{\cdot\cdot}$	$Mg^{\cdot\cdot}$		$Ca^{\cdot\cdot}$	$Mg^{\cdot\cdot}$
1	0-21	3,6	0,225	23,33	7,83	4,34	9,87	18,0	11,5	29,5	61,02	38,98
	21-40	2,7	0,169	21,10	7,97	4,34	9,87	15,5	11,0	26,5	58,49	41,51
	40-61	2,3	0,144	18,90	8,04	4,53	10,30	20,0	12,5	32,5	61,54	38,46
	61-78	1,8	0,113	təy.olmay.	8,09	5,47	12,44	20,5	12,5	33,00	62,12	37,88

Table_2: Dry (in velocity) and wet (in denominator) of non-eroding, historically irrigated dark gray-grass soils structure-aggregate composition

Serial number of the cut	Depth, in cm	Size of particles in mm, amount in %								
		>7	7-5	5-3	3-1	1-0,5	0,5-0,25	<0,25	>1,0	>0.25
1	0-21	73,31 / 8,52	6,44 / 11,56	5,73 / 20,88	3,94 / 17,68	5,36 / 9,56	2,71 / 13,48	2,51 / 18,32	89,42 / 58,64	97,49 / 81,68
	21-40	63,44 / 10,88	10,73 / 9,40	11,43 / 13,35	6,02 / 15,00	5,47 / 14,28	1,66 / 16,00	1,25 / 21,09	91,62 / 48,63	98,75 / 78,91
	40-61	72,93 / 11,41	9,17 / 9,00	8,08 / 14,24	4,38 / 13,00	3,33 / 11,52	0,80 / 16,84	1,31 / 23,99	94,56 / 47,65	98,69 / 76,01
	61-78	74,52 / 8,64	6,29 / 11,32	6,62 / 8,00	5,36 / 16,16	3,94 / 15,60	1,69 / 15,28	1,58 / 25,00	92,79 / 42,12	98,42 / 75,00

The amount of dry structural particles larger than one mm varies from 89.42 to 94.56% of the profile length, and from 42.12 to 58.64% with wet structural particles. The highest index of dry structural particles (94.56%) is in the third layer (40-61cm), the lowest (89.42%) in the first layer (0-21cm), and the highest in wet structural particles (58.64%)) was observed in the first layer, the least (42.12%) in the last layer (61-78cm).

Among the dry structural particles, particles larger than 7 mm prevail and vary between 63.44-74.52% in the profile. Among wet structural particles, 3-1 mm size particles are dominant and fluctuate between 13.00-17.68%. Among wet structural particles, the second place is occupied by particles with a size of 0.5-0.25 mm and the length of the profile increases by 13.48-16.84%.

SI according to the sum of dry and wet structural particles larger than 0.25 mm. Dolgov and P.I. According to the scale of Bakhtin [12], the ancient irrigated dark gray-meadow soils distributed in the experimental area have excellent structure.

Conclusion

As a result of the field-field and camera-laboratory scientific-research work conducted in the territory of the State Sort-Test Station of Salyan region, which is the object of research, we have come to the following conclusions:

1. Due to the fact that the gray-grass lands spread in the territory of Mugan-Salyan economic region were not used efficiently, they were subjected to the erosion process.
2. The results of the laboratory analysis of soil samples taken from the genetic layers of the cuttings placed in the remaining part of the territory of the State Sort-Testing Station showed that dark gray-grass soils, which have been irrigated since ancient times, are spread in the remaining part of the territory.
3. As a result of improper compliance with irrigation norms and rules, the soil particles of pomegranate washed from the beginning and middle parts of the field become more fertile than the beginning and middle part as a result of sedimentation in the remaining part due to the development of irrigation erosion.
4. The results of dry and wet sieving of soil samples taken from the genetic layers of the ancient irrigated dark gray-meadow soils spread in the remaining part of the site show that it has an excellent structure in terms of the sum of dry and wet structural particles larger than 0.25 mm.

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