
THE EFFECT OF IRRIGATION EROSION ON THE AGROCHEMICAL CHARACTERISTICS OF MOUNTAIN-BROWN SOILS, AND THE PRODUCTIVITY OF CEREALS - LEGUMES

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Abstract

Considering all these factors, it is crucial to enhance soil fertility affected by erosion and to prevent the displacement of fodder crops from perennial herbs. The cultivation of these plants in mountainous regions safeguards the slopes from severe erosion and supplies animals with robust fodder. The research results demonstrate that restoring fertility and ecological balance in eroded lands, along with the execution of soil-agro-technical measures to enhance productivity, is of significant importance. By implementing these measures, we enhance the water and physical properties of the affected land, thereby preventing surface water runoff. Furthermore, the study's findings are substantiated by the observation that, for specific reasons, erosion and erosion hazards are predominantly mitigated by the cultivation of perennial herbs. Perennial herbs, especially, absorb nitrogen from legumes, enhance soil organic matter, expedite the development of water-resistant granular structure, and improve its hydrophysical properties, thereby facilitating the swift digestion of foodstuffs.

Keywords: ecosystem, erosion, slopes, cross country, soil characteristics, mountain gray-brown soils, degraded, etc.

INTRODUCTION

The conservation and efficient utilization of natural resources and the environment in the Republic of Azerbaijan constitute a significant aspect of the State's socio-economic policy. Numerous national programs implemented in this domain encompass a broad spectrum of land addressing the urgent resolution of disputes. To preserve the country's diverse flora and fauna, initiatives such as the establishment and expansion of national parks and forests, remediation of contaminated soils and water bodies, and modernization of hydrometeorological services are being implemented to tackle significant environmental issues. Destruction of the ecological environment within the Republic, depletion of forests, meadows, and arable land, eradication in certain areas, disruption of biological diversity among various flora and fauna, etc., underscores the growing significance of comprehensive ecosystem assessment. The soil cover has developed as a crucial element of the biosphere due to the effects of abiotic, biotic, and anthropogenic factors shaping the Earth as a natural entity.

Soil ecosystems and their erosion are the primary factors that underpin biological activity, cultivated plant productivity, and the environmental assessment of products derived from soil and its formative elements in these interactions.

The degradation of soil and its ecological assessment represent a novel domain within soil science, elucidating the ecological characteristics of soil processes, their underlying causes, dynamics, and scientific validity. The land impacted by natural and anthropogenic factors, along with all natural regions of the Republic, encompasses extensive areas in the Shamakhi region, situated on the southeastern slopes of the Greater Caucasus. The district encompasses a total area of 215,875.0 hectares, comprising 127.5 thousand hectares (58.7%) of various degraded soils, 55.8 thousand hectares (25.7%) of severely eroded land, and 28.3 thousand hectares (13.0%) affected by erosion. The topography of the Shamakhi region is intricate, and erosion is prevalent due to anthropogenic influences. The occurrence of erosion is significantly influenced by abrupt changes in relief, slope morphology, precipitation volume, intensity and duration, human economic activities, and various other factors.

The lack of understanding regarding the soil on the plowed slopes has led to their complete degradation. The agricultural zone of the Shamakhi region primarily consists of lowland, midland, mountainous, and hilly plains. The erosion process in the mountainous agricultural region has intensified, damaging extensive areas. The prolonged cultivation of the same plant species, particularly grain crops, on sloped areas, combined with the implementation of herbaceous crop rotations and the absence of organic fertilizers, has exacerbated erosion. Species and types of erosion are present in the Shamakhi region. In the Shamakhi region, extensive areas are dominated by mountain gray-brown soils, primarily utilized for grain cultivation.

Mountain gray-brown soils exist at altitudes of 500-600 meters above sea level. In soil subjected to significant human-induced stress, erosion has deteriorated the agrochemical composition and agrophysiological properties. The gray-brown soils of the mountains serve as a transitional zone between the forest steppe and plain regions, exhibiting significant differences from the soils found within those areas.

Several scholars have offered comprehensive insights into the prevalence, genetic characteristics, distribution, and applications of gray-brown soils in Azerbaijan [1,2,3,4].

The subject and approach of the study

The study was conducted in the village of Melham, located in the Shamakhi region. The research was executed on this program.

1. Supervision; 2. The poem; 3. Clover.

The impact of perennial herbs (kasha, yonca) on the dynamics of volatile nutrients in eroded mountainous brown soils of the Ismayilli region, southeast of the Greater Caucasus, has been investigated. The research was extensively applied in soil sciences, following Alekberov's methodology [2].

It is important to acknowledge the cultivation of both pure and mixed perennial herbs (khash and clover) in the mountainous areas of our Republic, particularly for the restoration of eroded soils on the southeastern slopes of the Greater Caucasus (Shamakhi region).

Perennial herbs have developed substantial root mass in eroded soil, enhancing its structure and fertility.

The research object was examined in the Chemical Analyzes Laboratory, utilizing soil samples collected from the site.

Humus; Total nitrogen - IV Thurin; Mutagenic phosphorus - B.P. Method of mathematics; Absorbed ammonia - R. R. Konev; Ammonia - Nesler reagent soluble in water; Nitrate nitrogen - Granand lavage; Acquired causes (Ca, Md) - D.V. Ivanov method.

Material Analysis and Discussion

Our research indicates that the brown-brown soils, which are intensively utilized in agriculture in the region's middle and low mountainous areas, exhibit greater erosion. The research was conducted in gray-brown soils, examining the impact of erosion on nutrient levels. The degradation of soil fertility due to erosion can be attributed to the morphological characteristics of soil cuts and the outcomes of analyses conducted in the natural environment.

Research Progress

Some soil-agrochemical characteristics of these soils have been studied to determine the effects of the erosion process on the fertility of the studied soils. The analysis of the research materials suggests that the erosion process has resulted in anthropogenic factors and as a result of hydrotermic conditions, changes in nutrients in these soils and deterioration of some signs. The mechanical composition of mountain gray-brown soils is heavy-gill and clay, profile carbonate. The majority of the clay and white clays on the lower layers of the middle layer of the soil profile and moderately eroded in the erosion are related to the illudial layer of these soils. [3,4]

It has been established that the amount of physical clay on the upper layers of the gray-brown soils (0-13, 13-31 cm) not exposed to erosion is 54,48-59,60%, humus 3,13-3,34%, total nitrogen 0,13 -0,16%, absorbed ammonia 64,35-76,70 mg /kg, water-soluble ammonia 15,21-17,70 mg/kg, nitrates 4,39-5,90 mg/kg total phosphorus 0,20 (Ca + Md) 34,% of total potassium 3,07-3,11%, exchanged potassium 344,19-359,49 mg/ kg, carbonate 7,27-10,39% Varies between 41-39,08 mq.ekv (100 g of land).

Humus is 1.46-1.87%, total nitrogen 0.10-0.07%, absorbed ammonia 33.90-57.00 mg/kg, water-soluble soil, in moderately degraded soil compared to non-eroded gray-brown soils ammonia 9,32 -11,40 mg/kg, nitrates 2,82 -3,42 mg / kg, general phosphorus 0,11 -0,14%, total potassium 2,16 -2,90% (Table 1) .

Since the erosion process has absorbed the organic layer rich in organic matter, its physical properties have not been significantly degraded in erosion type 1.23-1.20 g / cm, special 2.69-2.67 g / cm³, pores 54.28 -55,06%, while moderate erosion was reduced by 1.29 to 1.24 g/cm, with a specific weight of 2.72 -2.68 g/cm³ and pallor 52.57 to -53.74% (Table 2).

It was determined that humus 116,91 t/hex,%, total nitrogen 7,12 t/hex, absorbed ammonia 398,77 kg/hectare, water-soluble ammonia 92-50 cm layer of gray-brown soils not eroded , 03 kg/hectare, nitrates 29.17 kg/hectare, total nitrogen forms 519.97 kg/hectare,total phosphorus 10.95 t/hex, mesophore phosphorus 114.11 kg/hectare, total potassium 187.03 t/hectare, potassium exchange was 2106.70 kg/hectare.

Humus reserves in the 0-50 cm layer of moderate erosion compared to the erosion type of these lands are 71,88 hectares, total nitrogen 3,47 t/hectare, absorbed ammonia 175,68 kg/hex, water soluble ammonia 33,02 kg/hectare, total potassium - 38.53 t/hectare, potassium potassium - 943.47 kg/hectare.

The average humus content of these soils is 1.46-1.87%, humus reserves of 0-50 cm, 71.88 t/hectare, the total nitrogen content of 0.10-0.07%, reserve 3, 47 t/hectare less.

Table 1

Agrochemical indicators of mountain gray-brown soils (in absolute dry land)

Cut off Number	Genetic layers	Depth, in sm	Humus, in%	Total nitrogen, in%	Nitrogen for msmg / kg			Phosphorus		Potassium		Ca CO ₃ by CO ₂ %--with
					It's absorbed ammonia	Soluble in water ammonia	Nitrates	ommon P ₂ O ₅ mg/kg	Flexible P ₂ O ₅ mg/kg	common%-with	Exchangedim g / kg	
No erosion												
1	A ₁	0-13	3,34	0,160	76,70	17,70	5,90	0,23	22,51	3,11	359,49	7,27
	A ₂	13-31	3,13	0,131	64,35	15,21	4,39	0,20	20,44	3,07	344,19	10,39
	B	31-50	1,13	0,073	58,00	13,05	4,35	0,12	14,32	2,92	217,98	18,55
	BC	50-72	0,85	0,044	46,40	11,60	2,90	0,08	10,37	2,97	202,21	19,85
	C	72-95	0,59	0,029	34,50	10,06	1,44	0,05	6,25	2,95	114,62	14,71
Medium degree of erosion												
2	A ₂	0-10	1,87	0,101	57,00	11,40	3,42	0,14	13,23	2,90	253,33	13,35
	B	10-29	1,46	0,073	33,90	9,32	2,82	0,11	12,49	2,16	176,37	19,72
	BC	29-55	0,75	0,029	27,75	8,32	1,39	0,05	4,16	2,50	72,87	20,48

Table 2

Some physical properties of mountain gray-brown soils

Number of sliced cuts	Degree of erosion	Genetic layer	Depth, in cm	Volume mass, g/cm ³	Specific weight, q/cm ³	Porosity, in%
1	No erosion	A ₁	0-13	1,20	2,67	55,06
		A ₂	13-31	1,23	2,69	54,28
		B	31-50	1,28	2,71	52,77
		BC	50-72	1,28	2,71	52,77
		C	72-95	1,33	2,69	49,44
2	Medium degree of erosion	A ₂	0-10	1,24	2,68	53,74
		B	10-29	1,29	2,72	52,57
		BC	29-55	1,34	2,70	50,37

As a result of studies conducted in mountain gray-brown soils in Shamakhi region, erosion has weakened its fertility and led to its agrochemical properties, physical properties and mechanical composition considerably.

The change in food in these lands, which are intensively used in agriculture, makes it clearer in the moderately eroded soils compared to non-eroded soils.

In the Gobustan region, which is 600-800 m above sea level, we find that the water-physical properties of these weakly and moderately degraded gray-brown soils are analyzed in genetically engineered samples. [2,4,5]

As can be seen from the table, the porosity at the top layer of the weakly wounded profile is -52%, whereas the overall porosity at the top layer of the moderately wetted profile was 50%. The special output was 2.53-2.97q / cm³ on the upper floors.

The thickness of the sliced sections is determined as follows (see Table 3)

It was found that 9.8% of the mildly washed (cut 1) soil moisture content was 9.8%, moderately washed (cut 2) and 9.30% in the upper A-layer.

In the next layer, the natural moisture has increased.

The hygroscopic moisture content was 3.04% B and C 4.37 and 4.54% in the alluvial layer of the deteriorated soil.

Humusopic moisture in the soil profile subject to moderate erosion has been as follows. The upper layer was 3.02%, and B C was 4.68 and 4.93.

Table 3

Fertility Indicators in Eroded Mountain-Brown Degraded Soils of Gobustan Region

Curvature of the cut or fragility	Number of sliced cuts	Genetic layer	Depth, sm	Humus %-with	Total nitrogen %-with	Absorbed grounds 100 land. m ² / equ				
						Ca	M _э	Total	Ca %-with	M _э %-with
North-East inclination 10°	1 Poorly washed	A ₀	0-9	grass floor						
		A	9-22	4,8	0,308	30,0	4,0	34,0	88,0	12,0
		B	22-34	4,0	0,224	25,5	5,0	30,5	84,0	16,0
		C	34-47	1,4	0,084	17,5	3,0	20,5	85,0	15,0
North-East inclination 12°	2 Middle washed	A	0-15	4,0	0,252	29,0	4,5	33,5	86,0	14,0

The erosion process on the southern slope of the Greater Caucasus, including the Gobustan, Shamakhi, Ismayilli and Aghsu regions, has widespread and has sharply deteriorated soil fertility. Here, the development of the erosion process, covering large areas, caused the complexity of the relief, the sharp change and the abundance of anthropogenic factors.

The study also found that, in the eroded soils, the amount of nutrients in the slopes was considerably reduced.

Therefore, the normal development of agricultural crops cultivated in those lands is disrupted, resulting in low quality products. Various agro-technical measures have been effectively utilized to bring such lands into good condition and to improve their lost fertility.

As a visual manifestation of this, it is possible to satisfy the biometric measurements and phenological observations on the plant with the experimental variant, as a result of the prediction of the research we have undertaken under the sowing plant in the Shamakhi region of the region. [3,4]



Note: Piping phase 06.07. 2020

Figure 1. The phenological observation fragment in the field of practice.

Table 4

Phenology observations on biological plants and biometric measurements

Practice scheme	1st repetition	2nd recurrence	3rd repetition
Nofertile	27	28	33
N ₃₀ P ₃₀ K ₃₀	35	49	47
N ₄₅ P ₆₀ K ₆₀	48	55	49
N ₆₀ P ₆₀ K ₆₀	49	57	54
N ₆₀ P ₉₀ K ₆₀	55	60	69

Note: The height of the plant (in cm); Piping phase 26.04. 2019

Growing of leguminous herbs in these lands for 2-3 years in improvement and enhancement of fertility of degraded soils is considered as one of the effective agro-technical measures.

The perennial herbs, primarily in the soil and clover, increase soil fertility by maintaining a large amount of organic matter, while enriching soil with nitrogen [2,7,8]. As is known, plants are easier to absorb ammonia and nitrates than nitrogen.

These forms of nitrogen are more volatile. As the ammonia nitrogen is absorbed by the soil, it is hardly washed out by surface water flow and its loss is accompanied by soil.

Because nitrate nitrogen is not absorbed by the soil, it is easier to wash with surface water. Hence, ammonia and nitrates, which are soluble in water, are more environmentally friendly and are washed out of the soil by ordinary surface water. Therefore, in the eroded soils, plants suffer from nitrogen deficiency and develop very poorly [5].

The cultivation of perennial herbs in the degraded soils and providing them with mineral fertilizers is crucial. Since the early stages of perennial herbs have been reducing their underground and surface organisms intensively from the mineral fertilizers, using intravenous nutrients [3,9,11]

Research Movements

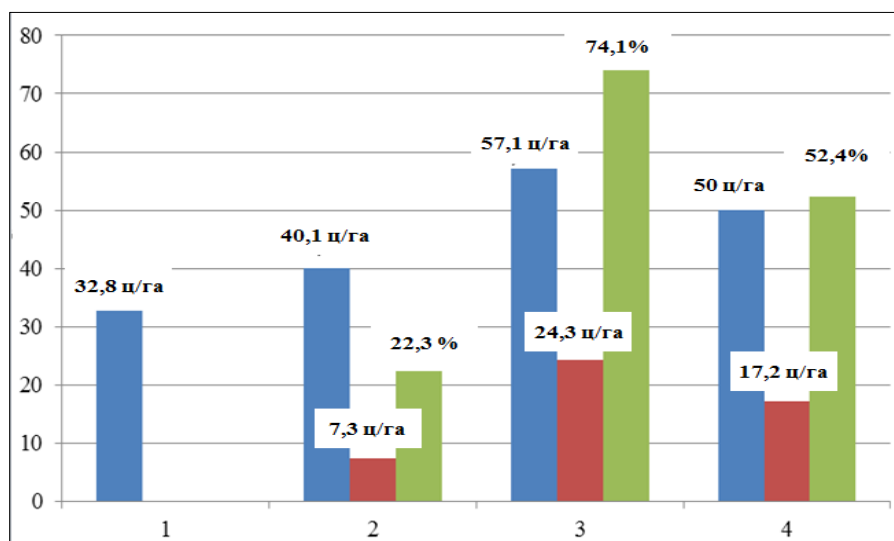
It should be recognized that during traditional soil cultivation, on average, over the years of research, the collection of winter wheat without fertilizing amounted to 32.8 c/ha (Fig. 2).

In the version of manure 10 t/ha + N45P60K60, the grain yield is 40.1 c/ha, the increase is 7.3 c/ha or 22.3%.

The largest grain yield was obtained in the version of manure 10 t/ha + N60P90K60 57.1 c/ha, an increase of 24.3 c/ha or 74.1%.

With a further increase in the doses of mineral fertilizers against the background of manure (N60P60K60), grain harvest increased slightly - 50.0 c/ha, the increase was 17.2 c/ha (52.4%) of grain.

Mathematical processing of the obtained data showed their reliability: $P=1.38-2.47\%$; $E = 0.58-1.16$ c/ha



$$E = 0.58-1.16 \text{ ц / ha}$$

$$P = 1.38-2.47\%$$

Figure 2. The influence of traditional processing and fertilizer rates on the yield of winter wheat (for 3 years)

With minimal soil treatment, on average, for the years of research, the collection of winter wheat grain in an unsophisticated version amounted to 30.6 c/ ha

Results

As a result, a lot of organic matter is accumulated in eroded soils and the activity of microorganisms rises. Organic remnants of microorganisms significantly improve soil fertility and make them useful by increasing the amount of volatile food in the soil.

From the observations on the dynamics of the conservative forms of food in the degraded brown soils in the erosion, it is clear that the amount of poisonous nutrients was high in the early stages of fur and chimpanzee and gradually towards the end of the vegetation, during the harvesting period.

Conclusion

Thus, on the basis of the studies carried out, it can be concluded that in order to obtain a high and qualitative harvest of winter wheat grain and restore fertility of soils on gray-brown, long-irrigated soils to this zone, it is recommended that traditional farms (loosening 20-22 cm) and minimal tillage, also the use of fertilizers annually in the norm of manure is 10t/ha + N60P90K60 kg/ha. As a result, both cultivation of soil treatments and the rate of fertilizers are recommended, in addition, after 3 years the minimum treatment should be replaced by a traditional one.

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