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EFFECT OF PRECIPITATION ON THE PROCESS OF EROSION IN LANKARAN NATURAL AREA

*©**Akbarova U.**, ORCID 0000-0002-8930-3723, Ph.D., Lankaran State University, Lankaran, Azerbaijan, ulkarcoqrafiya@mail.ru*

ВЛИЯНИЕ АТМОСФЕРНЫХ ОСАДКОВ НА ПРОЦЕСС ЭРОЗИИ В ЛЕНКОРАНСКОЙ ПРИРОДНОЙ ОБЛАСТИ

*©**Акперова У. З.**, ORCID 0000-0002-8930-3723, канд. с.-х. наук, Ленкоранский государственный университет, г. Ленкорань, Азербайджан, ulkarcoqrafiya@mail.ru*

Abstract. An intensive development of some agricultural areas and positive economic consequences were a reason for deterioration of the ecological state in the last 20-30 years. It should be noted that change of the ecological state, increase of the anthropogenic effect on the environment and global climate changes make necessary to protect the soils and from this point of view there is a great need to study the climatic factors in the formation of the erosion process. According to the comparative analysis it should be noted that an amount of the precipitation decreased 281,4 mm, but the average annual temperature increased 0,8-1,2°C in comparison with the average index of 1977. Though an amount of the rainfall decreases, the erosion process intensity and areal are rising in the region year after year. Its main reason is intensive shower precipitations in the autumn after dry summer, deforestation, the man's incorrect farming activity. According to the conducted research in the pseudopodzole yellow soils it can be noted that the erosion process deteriorated physical characters of the soils. So, a bulk weight increased 0,12 g/cm^3, special weight 0,15 g/cm^3, but the porosity decreased 1,65% in the averagely eroded soils in comparison with the non-eroded soils. It is necessary to conduct zonal complex fight measures against erosion in order to achieve an intensive development of agriculture and to restore fertility, and in order to prevent from erosion process, to protect destruction of soil cover. It is necessary to pay attention to soil-climate condition, the factors that lead to the development of erosion, degree of soil erosion, farming direction while these measures are worked out and realized. All the measures against erosion protect the soil cover from leaching, destruction and it must be directed to improve fertility.

Аннотация. В последние 20–30 лет интенсивное развитие некоторых областей сельского хозяйства наряду с положительными экономическими результатами послужило еще и экологической порче положения земли на этом фоне. Надо отметить, что в ходе изменения экономического положения, увеличение антропогенного влияния на окружающую среду и возникновение глобального климатического изменения приводит к необходимости защиты земель. И именно с этой точки зрения в формировании процесса эрозии появляется необходимость исследования климатических факторов. На формирование эрозии и процесс его развития влияют в основном факторы и элементы климата. На основе проведенных анализов можно отметить, что на объекте исследования количество осадков по сравнению с 1977 годом в среднем уменьшилось на 281,4 мм, а средняя годовая температура повысилась на 0,8–1,2° С. Несмотря на уменьшение количества осадков, с каждым годом увеличивается интенсивность процесса эрозии и ареал эрозии в регионе. В желтых псевдоподзолированных землях на основе исследований можно отметить, что в процессе эрозии ухудшаются

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физические особенности земли. Чтобы предотвратить эрозию, защитить землю от промывания, восстановить плодородность земли и добиться интенсивного развития сельского хозяйства надо вести зонально-комплексные мероприятия против эрозии. При разработке и подготовке этих мероприятий и воплощении их в жизнь надо обязательно учитывать земельно-климатические условия, факторы, способствующие развитию эрозии, степень эрозии земли, направление хозяйства. Все мероприятия против эрозии должны воплотиться в жизнь без промывания покрова земли, защищая землю от деструкции. Все это должно быть направлено на улучшение плодородия земли.

Keywords: Lankaran natural area, precipitation, water erosion, measures against erosion, surface flow, tea plantation.

Ключевые слова: Ленкоранская природная область, осадки, водная эрозия, мероприятия против эрозии, поверхностное течение, чайная плантация.

A climate condition of the Lankaran province is stipulated with some special aspects of the zone. Directly bordering of the eastern and south-eastern end with the Caspian Sea and strongly descending of the mountainous zones along the shore in the south created a good condition for condensation of the water evaporation over the Caspian Sea. On the other hand, a dry strong continental climate of the Iran mountainous plateau affected the zone climate between the Talish and Peshtasar chains and it causes aridity. As a result, an anomalous distribution of the precipitations in the south of the region, i.e. it increased to the height of 500-700 m in the area and decreased in the later heights.

So, an amount of the average annual rainfall reaches 600 m in the north of the Lankaran natural area, it increases to 1400 mm as it goes to the south, and it reaches 1900 mm in the lower part of the valley and foothills. The most precipitation was observed in September and October months, but the least rainfall was observed in July (Figure 1) [1].

Material and methodology

Soaking of water into the soil becomes difficult; as a result, a good condition is created for formation of some kinds of the water erosion as a result of increase of rainfall amount (especially, sower type) and intensity on other hand increase of anthropogenic pressure in the autumn after arid summer months.

A main reason and riskiness of the water erosion is a rain drop erosion. The rain drop affects the zones without plant cover at a speed of 32 km an hour and it can splash the soil particles 100-150 cm around and 60 cm high. Consequently, approximately 257 tons of soil particles splashes and changes a place in one hectare of the area. The soil structure is disturbed, the porosity reduces, so soaking of water and air into soil is deteriorated as a result of the rain drop effect. An influence of the rain drops on soil changes in connection with the magnitude of the diameter and intensity of the drops. K. K. Bityukov showed that [2, 3] the drop diameter is 1,40 mm in the rains with 1 mm/min. of intensity, while a diameter of each drop with an average intensity is 0,03 mm/minute.

The slope inclination, water leakage ability, granulometric, structural, aggregate structure of the soil affect the rain drop erosion, too.

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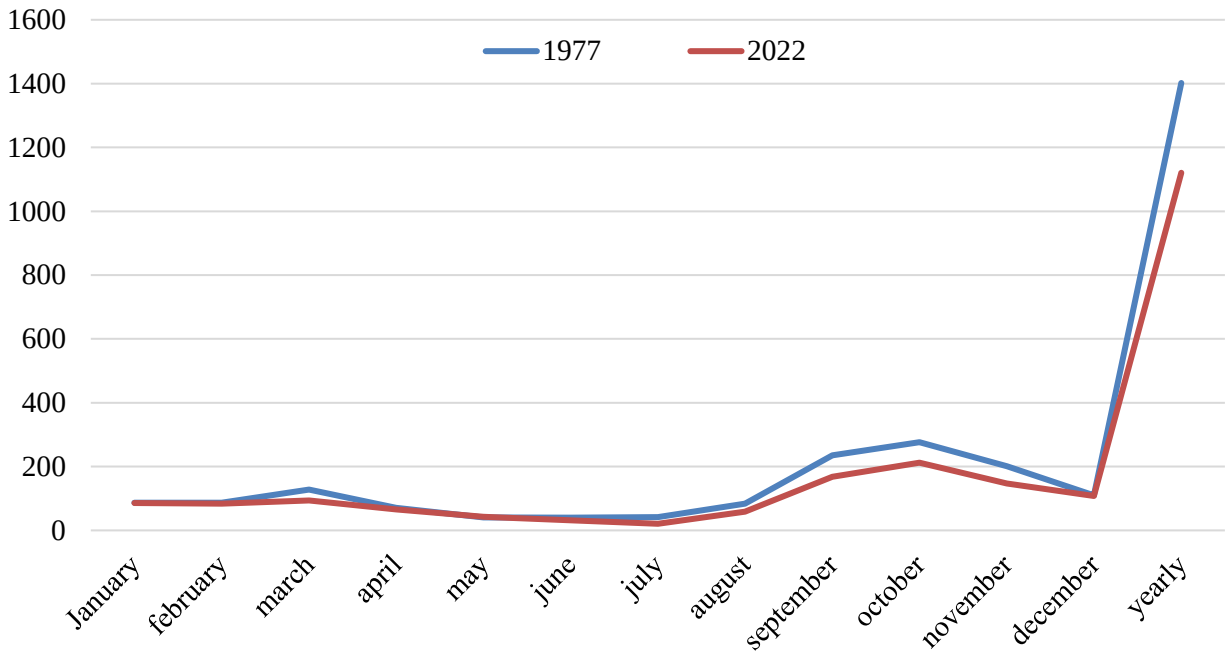

Figure 1. Comparative character of the rainfall amount in the Lankaran natural area, mm

Kh. M. Mustafayev [4] determined that 500-520 tons of soil is leached from every hectare as a result of the shower rain with 1-1.2 mm/min. intensity in the areas with sparse plant cover at a slope of 15-18°.

The soil surface covered with plant is important for prevention from the rain drop erosion. The plant cover prevents direct penetration of rain drop into the soil, gradually soaks the water into the soil and the soils are maximally protected from such effects, at the same time the moisture loss is prevented. It is important to determine the rainfall amount and intensity on seasons, to provide the soil with plant cover, to study physical-chemical characters of the soil, durability against erosion.

The rain waters don't completely soak into the soil and create the surface flow, this is resulted in formation of the surface erosion that is a reason for inoculation of the upper fertile layer and the light — colored lower layer is exposed. An effect of the surface erosion is mostly observed in the arable soil plots that are not properly used. Consequently, the soils lose their fertility, and the productivity reduces. This process continues year after year and leads to soil failure [4].

The surface erosion process is characteristic for the foothill and valley parts of the south-eastern part of the Lankaran natural area.

The most atmospheric precipitations and sometimes their high intensity, however conduction of all the cultivation work along the slope direction caused widespread and intensive of the surface erosion.

Results

In the studied area, the amount of soil washed away during the rainfall of 30.2 mm that fell on September 18, 2023, in the area of the tea longitudinal direction of the slope in the village of Khanbulan was recorded. The observation showed that 43.2 m^3/h of soil was washed away due to the impact of rainfall with an intensity of 2.0 in the tea plantation in 1975. As a result, firstly the water-physical characters of the soil (humidity, water-absorption ability, bulky mass, porosity etc.) have been deteriorated.

The bulky mass of soil was 1.40 g/cm^3, total porosity — 47.96%, natural moisture — 22.80%,

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water-absorption ability — 60-80 mm/hour on the upper part of the soil that moderately eroded (Table). The soil fertility was deteriorated in the zone, some plots are covered with rocky crumbs with different diameter. The heavy and average loamy granulometric structure of the soil was replaced by light loamy granulometric structure.

The other observation was performed in order to investigate an influence of the zone inclination on development of the surface erosion process (Khanbulan village). The consequences of the measurement works indicated that 43.8 m^3/h of soil cover was subjected to surface erosion in the area with inclination 60, while the average amount of soil washed from one hectare of the soil in the tea cultivation area with inclination 30 was 14.6 m^3/h.

Table

WATER-PHYSICAL CHARACTERS OF THE PSEUDOPODZOLIC YELLOW SOILS

Number of plots of land	*Inpatient practice area*	*Genetic layers and depth, in cm*	*Volume weight, g/cm³*	*Special weight, g/cm³*	*Porosity, %*	*Water capacity, %*	*Natural moisture, %*	*The amount of water, mm/hour*
		Non eroded						
1	Tea plantation (1975)	АУvg 0-15	1,28	2,54	49,61	34,80	27,50	150-160
		АУELg 15-30	1,32	2,58	48,84	33,40	31,40	
		BTg 30-50	1,35	2,62	48,47	32,50	36,20	
		B/Cg 50-70	1,38	2,66	48,12	28,80	38,80	
		Cg 70-100	1,41	2,71	47,97	30,00	42,40	
		Moderately eroded						
2	Tea plantation (1975)	АУvg 0-10	1,40	2,69	47,96	30,20	22,80	60-80
		АУELg 10-20	1,43	2,73	47,62	29,80	27,40	
		BTg 20-40	1,45	2,75	47,27	27,40	26,30	
		B/Cg 40-70	1,48	2,78	46,76	25,20	30,40	

The length, exposition of the slope plays a main role in formation and development of the surface erosion process in the zone.

The observations performed in the tea plantations indicated that 150 m below the beginning part, an amount of washed soil increased by 50.0 m^3/h, while the soil washing from the flattened-peneplained area at the beginning of the slope area. However, the washed-out soils are mostly found in the southern and eastern parts of the slope, and less often in the northern and western slopes. That's why the soils developed in such areas are thick and they were able to preserve their genetic layers. A result of the experiments performed in the tea plantation along the slope in the field with 5-60 inclined rows in the pseudopodzolic yellow soil area in the territory of the Khanbulan village municipality in 2023 in order to prevent washing the soil surface and to regulate the surface water flow in the in the tea plantations showed that an average annual quantity of the washing soil under the control variant was 37.5 m^3/h, but an average yearly amount of the soil washed from the variant made in the form of temporary water retaining strips retaining between the rows 6.20 m^3/h, soil washing wasn't observed in the variant where temporary soil logs were made between the rows.

The negative results of the surface erosion don't end only with the reduction of soil fertility in

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the area where it occurs. In the inclined zones the unstructured materials transported from top to bottom cover the fertile soils below, reduce their agronomic importance, and it leads to silt collection in drainage canals, rivers, water storages, decrease of their economic rationality, spending additional funds.

The surface flow occurs in the soils with 1-2 slopes and weak permeability when the soils aren't protected. Some researchers consider that the surface erosion is more danger than the linear erosion. As the surface erosion gradually happens, it is difficult to define it at the time of its first occurrence, until the upper fertile layer is washed away, and the lower light-colored layer comes to the surface and is separated from the surrounding areas. We can say that it is urgent and important to fight surface erosion. When the surface erosion wasn't determined, it isn't fought against, it creates the basis for the formation of more dangerous forms (linear erosion, landslide etc.) of erosion.

The temperature along with the rainfall affects creation of the erosion process. It can be noted according to the research that at present an average daily temperature increased to 0.8-1.2°C compared to 1977. Its main reason is deforestation (Figure 2).

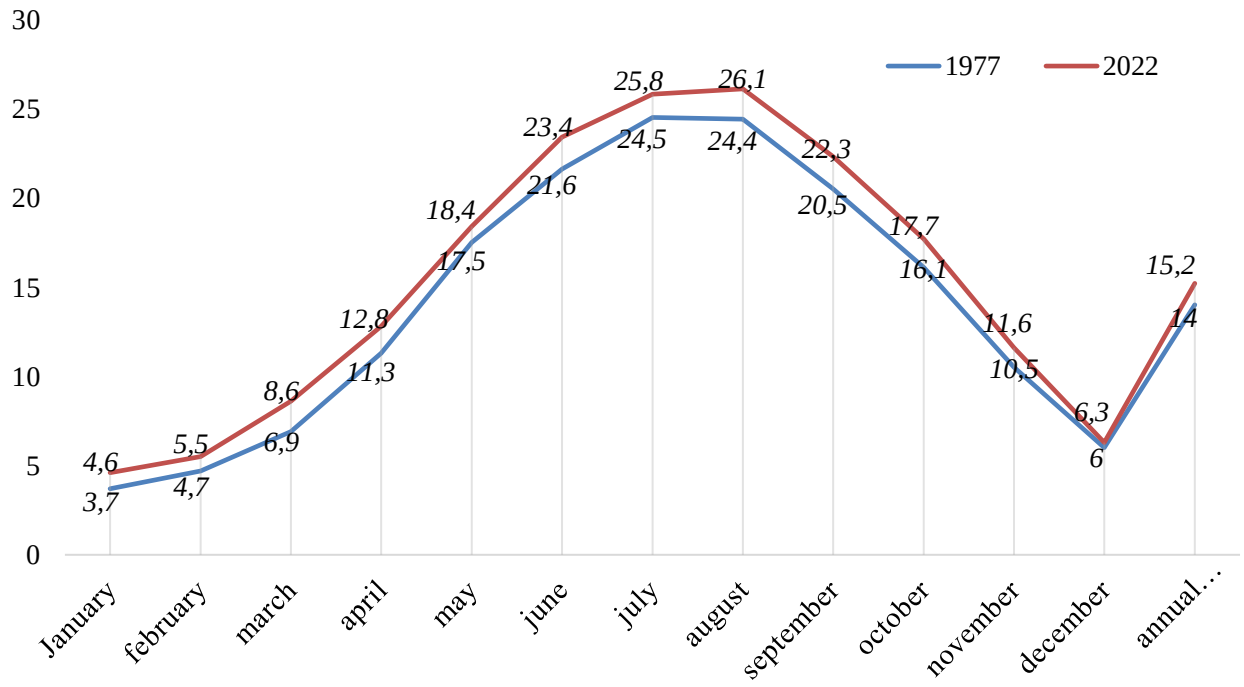

Figure 2. Comparative characteristics of the average monthly and annual indicators, °C

Though a climate condition of the natural province of Lankaran resemble a number of areas of natural habitat in the Mediterranean basin, it differs from them for the soil condition and some climate characters. The same differences are reflected with their ecological features and some characters in the present concrete circumstances.

It is important for the modern farmer chiefs to know that which quantities of the annual rainfalls in the concrete values of the temperature sums can meet the plant's needs. The dry spring season is rarely encountered in the Lankaran natural area. A role of the rain waters is great in soilformation process, irrigation of agricultural plants, rivers nourishment.

80-100% of the annual surface flow of the Lankaran natural area is precipitation. Such nourishment of the river basins is mainly at the expense of strong shower and continuous rainfalls.

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Rapid transition to the economy of the country in the new market economic system was a reason for definite changes in an ecological state of the environment.

Greatness of the anthropogenic effects on a unit area, placement of the agricultural fields that don't match the ecological production capacity of the zone, unsystematic deforestation, desertification, erosion etc. caused a great climate change in the province zone. As a result of the shown ecological problems in our Republic, including repetition of the ecological risk, damages and destructions strongly increased. Especially, erosion-landslides create an important problem in conduction of buildings and road restoration-construction works in the arable soils. For example, we can show erosion-landslide occasions in Lankaran, Astara and Lerik.

Complexity of the geo-morphological condition affects the climate indications. Torrential nature of the rains creates conditions for the formation of surface water flow, this washes a fertile layer of the soil, deteriorates its water-physical characters and as a result the arable soils it leaves the agricultural rotation and they become useless soils. Here all the kinds and forms of the erosion widespread, therefore the landscapes were disturbed, the soil profile was shortened, morphogenetic, agrochemical-agro-physical indications changed, their ecological fertility potential was greatly weakened.

So, a climate factor, especially the rainfall and temperature elements stimulate formation of the erosion process and expansion, reduction of the soil fertility in the research soils. As a result of the erosion process the soil formed over many years is washed away, its fertility reduces, the areas are shattered by gorge networks, the valuable soil areas gradually become useless, humus quantity decreases and its ingredient changes, microbiological processes weaken in the soil. It is necessary to conduct regular fight measures against soil erosion because this process gradually develops. In solving the problem of erosion, first of all, it is necessary to identify and eliminate the factors that cause its occurrence. Firstly, the reasons of erosion formation should be determined in the area under consideration, the available situation must be properly evaluated according to the soil-erosion maps. The soil-erosion maps give a chance to evaluate relief, soil and erosion process, too.

It is necessary to conduct zonal complex fight measures against erosion to achieve intensive development of agriculture and to restore fertility, to protect the soil surface, to prevent erosion process. The soil-climate condition, the factors that cause erosion development, eroding degree of soil, the farming direction should be taken into consideration while these measures are worked out and realized. Soil fertility should be directed to improvement by protecting the soil cover from leaching, destruction.

Agro-technical, forest-amelioration and hydro-technical measures belong to the complex fight measures against erosion. It is necessary to achieve increase of resistance against water assimilation ability and washing by application of soil cultivation under agro-technical measures.

Using of soil-protective characters of the annual and perennial grasses, application of the cultivation rules of soils against erosion, artificial storage of snow in the field, regulation of snow melting, agrochemical means of increase of the eroded soil fertility.

Inclination of the slopes, durability of the soil cover against erosion, depth of the local erosion base and the plants which will be planted are taken into consideration and a problem of the areas organization is a basis of the fight system against erosion.

The plant cover is considered the most important means against erosion. The plant roots bind the soil particles tightly together and they prevent the soil particles from leaching. The surface cover of the plants takes the slash of the raindrops and prevents the structural destruction.

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The forest-amelioration measures are considered as forest strips along the slope, in other words, the creation of forest plantations of various purposes (windbreaker, field protector, gorge hardener, water protector and so on). A role of the forests as a water regulator, soil protector is great. On average 100 hectares of mountain forest turns 80300 m^3 of rainwater into groundwater and prevents soil erosion [5].

A canopy, a trunk, a root system of the trees and bushes and the forest litter on the soil surface regulate the water regime on the slopes. These elements of the forest greatly affect the soil-formation process. It was determined that the erosion process and the soil leaching weren't observed in the forest though 3,1 tons of soil was washed from one hectare in the plowed area [3]. It is necessary to pay attention to afforestation in order to protect the soil cover from erosion on the slopes and to regulate the water regime of the rivers. One of the important problems is to prepare the soil correctly for sowing, to select corresponding tree and bush species according to the soil-climate condition taking into account a local situation during the afforestation in the eroded zones.

The hydro-technical measures are fulfilled as a result of joint application. The hydro-technical measures are applied while there are no other measures for prevention of erosion processes. Building of the hydro-technical devices which prevent and regulate the slope flows and construction of the dams, trenching, etc. are belonged here.

The plant cover is considered the most important means against erosion. The plant roots bind the one of the basic factors that are a reason for erosion formation and strong continuation of erosion process is the man's incorrect activity. The erosion process accelerates as a result of irrational anthropogenic effect. A reason of this is absence of the scientifically based measures, therefore the soil resources good for agriculture reduce from year to year.

Erosion is considered an accident in the world. The desired result isn't obtained though different measures are fulfilled for its prevention. But prevention of erosion beforehand is easier in comparison with the fight and elimination of the consequences.

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