International Journal of Research Studies in Science, Engineering and Technology
Volume 6, Issue 8, 2019, PP 1-7
ISSN : 2349-476X

Scientific Substantiation Application of a Water-Saving System of Low-Intensive Irrigation When Solving problems of Mountain Agriculture in Conditions Azerbaijan

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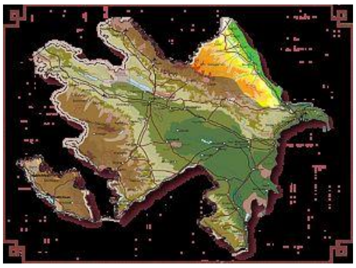
ABSTRACT

The article considers factors affecting the improvement of soil fertility, contributing to an increase in the productivity of a unit hectare of arable land and crop yields in conditions of insufficiently moist soils in the example of Mugani, in Salyan, Shirvan plain and other zones of the republic, regardless of weather conditions, by applying systems low-intensity irrigation, which allows to increase the efficiency of all intensification factors: chemicalization, complex mechanization, variety of renewal, intensive cultivation technology where I studied the assessment of the reclamation state of irrigated soils depending on the state of groundwater and the degree of salinization of soils: - 396.1 thousand hectares - "good"; - 663.7 thousand hectares - "satisfactory"; - 385.1 thousand hectares - "not satisfactory". It was determined that, due to the complexity of the physical and geographical conditions and the anthropogenic impact, 43.29% of the lands were subjected to varying degrees of erosion processes. For what purpose it was proposed that "Determination of the areas of formation of various types of erosion and its control, development and implementation of advanced irrigation technology and measures to prevent certain agricultural problems that worsen the fertility of soil resources, and adequate measures" and "Study of the current state and conservation of water and soil resources in Azerbaijan. " In addition, it is indicated that the soils in the Kura-Araks lowland zone are highly saline, where the total amount of saline land in the republic is about 600 thousand hectares, although some of them are equipped with a collector-drainage network. Moreover, for washing and recovery, an additional amount of fresh water is required, which is not available due to the lack of water balance in the republic. The author of the studies proved that on large slopes (over 80), in order to avoid a direct hit on the soil by a sprinkling stream of an undisturbed structure, he recommends the need to switch to sector sprinkling. For this it is recommended that at slopes of 6-80, sprinkling is carried out with a machine of the type ДДН with the supply of irrigation water through flexible hoses wound by sprinklers, stationary and semi-stationary systems of pulse sprinkling irrigation of self-oscillating action, etc. The angle of the sector is calculated depending on the angle of inclination of the irrigated area . Improving irrigation in the mountain zone and much more are also among the measures that contribute to the development of land for agricultural purposes.

Keywords: *soil moisture, intensification factors, arable land, low-intensity irrigation, sprinkling, slopes, groundwater*

INTRODUCTION



The main directions of economic and social development of the republic are the intensification of agricultural production. A powerful means of intensifying agricultural production in the context of its specialization is irrigation.

In areas of insufficient moisture (typical mountainous terrain), irrigation is one of the decisive factors for growing high and stable yields of agricultural crops, regardless of weather conditions. The factors directly affecting the attraction of crop yields and increasing the productivity of each hectare of arable land and agricultural land with minimal labor and resources include the use of mechanization, automation, and the expansion of the sowing area of crops and varieties of the intensive type. Irrigation increases the efficiency of all intensification factors: chemicalization, complex mechanization, variety renewal, intensive technology. It allows you to create large areas of guaranteed production of grain, feed, increase the productivity of industrial, vegetable and other types of crops. For all this, methods are being studied for the correct regulation of water consumption and plant nutrition using irrigation and fertilizers, expenditure and accumulation of nutrients in the soil, protecting it from water and wind erosion, salinization and water logging. In addition, irrigation greatly alters the nutritional conditions of plants. Nitrates, being exposed to the active root system, improve plant nutrition. It should also be noted that irrigation with excessively high standards leaches nitrates outside this zone, and then the nitrogen nutrition of plants deteriorates. In this case, irrigated fields must be observed

The Course of Research and Discussion of Materials

Irrigated soils in Azerbaijan cover 1.45 thousand hectares of area. Of these, 757.2 thousand ha or 51.8% are saline soils. The area of slightly saline soils is 387.1 thousand hectares, medium saline 185.5 thousand hectares, and very and very strongly saline 115.1 thousand hectares. Including on the area of 357.3 thousand ha of irrigated soils, slightly saline, 43.2 thousand ha of medium and strongly saline soils.

Saline soils on which crops grow are common in the areas of Mugani, in Salyan, and the Shirvan plain. Saline soils cover a significant area, highly saline soils are common in southeastern Shirvan. Of the irrigated lands suitable for agriculture, 593 thousand ha are drained. Of these, 310.4 thousand ha is open, 269.4 thousand ha is closed and 132, 0 thousand ha is drainage. However, it should be noted that the system while in operation, for a long period of time on repair and reconstruction was not paid attention in connection with which the system failed.

As a result, every year the ecological and reclamation conditions of soils worsened, groundwater increased, part of the irrigated lands, salinized, left the agricultural turnover. The danger of salinization is the high salinity of groundwater. It should be noted that groundwater at a depth of less than one meter is 68.7 thousand hectares, from 1.0 to 2.0 meters cover an area of 486.1 thousand hectares. Due to the transgression of the Caspian Sea and an increase in the level of groundwater, 47 5 out of 1.45 thousand ha of irrigated soils, where 85-90% of agricultural products can be obtained, were salinized to varying degrees.

Currently, this process is progressing, on an area of 103 thousand ha, the groundwater level has risen to the surface of soils, on the area of 167 thousand ha, the process of salinization and raising the level of groundwater is ongoing. In recent years, during the construction of reclamation-irrigation facilities, in some cases, the wrong geological, hydro geological, reclamation approach has had a negative impact on the environment.

It should be noted that in the farms located in the central and eastern parts of the Terter district, in the farms and residential areas of the western part of the Barda district, in the areas of Shamkir, Gazakh, Akstafa, Alazan - Agrichay valley, in the village of Tun-Tun, Gabelinsky district, also in the Cherur region of the Nakhichevan Autonomous Republic, part of the irrigated farms are flooded as a result of rising groundwater.

Despite the fact that a collector-drainage network with a design depth of 2.5-3.5 m was designed on the Kura-Arakskaya lowland, in recent years, studies have shown that 75-80% of the groundwater dropped by 1.0-1.5 m, and in the growing season of plants 0-1.0 m, which shows their steady state. This process affects the secondary salinization of irrigated lands. It should also be noted that the level of groundwater happens to be raised during the irrigation period.

The reason for this is that during the irrigation period there is a leak (loss) of water from the canal network and reaching the lower horizons of the soil raises the level and volume of groundwater. In areas with strong salinization, various salts are present in the composition of groundwater, so salinization develops intensively.

According to the salinity of groundwater on the land area, 489.6 thousand ha are less than 1 g/l, 506.0 thousand ha from 1.0-3.0 g/l, 449.3 thousand ha more than 3.0 g/l Groundwater mineralization plays a significant role in soil salinization. In general, the assessment of the reclamation state of irrigated soils depends on the state of groundwater and on the degree of salinization of soils:

- 396.1 thousand hectares - “good”

- 663.7 thousand hectares - "satisfactory"
- 385.1 thousand hectares - "not satisfactory".

It should be noted that the main part of the soils suitable for agriculture is located in the flat part of the republic. This part is characterized by a hot climate, low atmospheric precipitation (200-300mm / year), although evaporation is 800-1000 mm. To obtain high sustainable crop yields in this zone, irrigation and land reclamation measures are necessary.

It should also be noted that the water resources of the republic are limited. The surface water supply is 32.2 billion m3 per year, in dry years it drops to 23.2 mln.m3. Of these water volumes, the share of own water resources accounts for 10 billion m3, or 30% of the republic's water resources, the remaining 70% is generated from neighboring republics.

During maintenance and repair, this system partially collapsed and failed, which negatively affected the vegetation of agricultural crops.

It should be noted that out of 8641.5 thousand ha of land, 4514.5 thousand ha of agricultural land makes it possible to produce 85% of all products. Consequently, due to the complexity of the physical and geographical conditions and the anthropogenic impact, 43.29% of the lands underwent to one degree or erosion processes. In addition, as indicated above, the soils in the Kura-Araksinskaya lowland are highly saline. The total amount of saline land in the republic is or 600 thousand ha, although some of them are equipped with a collector-drainage network. For their washing and recovery requires an additional amount of fresh water.

It should be recognized that in addition to flat conditions in Azerbaijan, there are sloping crossed conditions that require a special approach to solving the problems of water supply for agricultural production developing in the regions of mountain farming using low-intensity irrigation systems. Since low-intensity irrigation, unlike traditional irrigation, differs in that when using this technology, humidity in the active moisture exchange layer is maintained at an optimal level (85-90% HB) without significant fluctuations between the upper (100% HB) and lower (60-70% HB) limits.

The processes taking place in the soil are not stressful, destroying its structure, and take place in conditions favorable for the formation of fertility in terms of water content and aeration.

Research Objective

Today's main task is to use low-intensity irrigation under conditions of acute shortage of water resources in the mountain and foothill zones of the republic. Therefore, it is necessary to correct the existing deficiencies in the water supply of plants, by developing a series of measures that make it possible to more fully use irrigated land due to the low-intensity water supply in accordance with the needs of crops during their growing season, eliminating soil erosion and flushing, creating conditions for environmentally friendly products and etc.

It should also be noted that according to the surface structure, the republic is divided into mountain and plain parts, which differ in relief, height, and class imatu, vegetation cover, etc. Therefore, such a geographical location of natural resources leads to a reduction in fertile land and a violation of the ecological balance.

Taking into account the increase in population on earth every year, which entails the elimination of valuable areas from agricultural circulation, it is required during the period of a market economy to solve the daunting tasks facing mankind to increase the productivity of agricultural land in order to meet the growing demand for food. To solve these problems, it is first of all necessary to expand the sown area and increase the yield of agricultural crops.

It should be noted that in comparison with other areas in the territory of the Greater Caucasus, the hydrographic network is more developed. According to water supply, the Greater Caucasus region is divided into the southern and northeastern slopes of the Main Caucasian Range and Gobustan. It should be noted that in the alpine zone of the southern slope, the average annual runoff modulus is 45 l / s km2 or 1500 mm. The runoff module decreases to 150 mm with a decrease in the height of the terrain when the rivers exit to Alazan - Avtoran valley.

Climate and geographical location affect runoff changes. On the southern slope, at an altitude of 800-900 m, there is an intensive increase in runoff; here the annual rainfall exceeds 800 mm. Moreover, with a decrease in precipitation, runoff growth slows down.

In the northeastern part of the Greater Caucasus, runoff occurs evenly. Here, an increase in runoff occurs between the Lateral and Main Caucasian ridges, in the zone that includes the upper part of the Kudialchay, Kusarchay, Karachay and

Velvelechay rivers. It should be noted that here the annual runoff values vary within 300-600 mm, where the annual runoff of the rivers flowing from the Lateral Ridge differs from the group of rivers of the Main Caucasian Ridge. That is, runoff growth also increases at an altitude of 1000-2000 m changing from 200 to 600 mm. This is due to the precipitation of large amounts of rainfall. The territory from the Lateral Ridge to the Caspian Sea to the Atachay River, the upper reaches of the Pirsag at and Sumgait rivers to the entrance to Gobystan are considered a relatively water-supplied area, where the average annual flow module is from 1 to 5 l/s km2.The rivers of this region do not provide water to the national economy. Here the lack of water is compensated by the Samur-Absheron canal, which transfers the flow of the river. Samur, Kudialchay and Velvelechay to this area. Gobystan and Absheron are considered the least water-supplied.

Here, the average annual runoff is less than 1 l/s km2, and in the coastal strip of the Caspian it is reduced to zero. Therefore, this region is not used agriculturally. The annual volume of runoff. In artificial pools, the volume of water reserves in the republic is 21.5 mlm. m3., Where a significant part of this volume is used in hydropower and irrigation.

In general, the republic uses 11-12 billion m3 of water per year, of which 67% is used in agriculture, 20-25% in industry, the remainder is used for drinking water. It should be noted that in the republic of the irrigated 3200 thousand hectares of area, 1.45 thousand hectares is irrigated by the same resources.

The indicated area is provided with an engineering-irrigation and collector-drainage network. It should also be noted that in 1970-1990, distribution irrigation systems, a collector-drainage network, pumping stations and large water facilities consisting of water basins were created in the republic. In these years, new irrigation systems were built on 875 thousand hectares of irrigated area.

As a result of such an event, the length of irrigation canals reached 73 thousand km.

However, as a result, do not rule to the region of the Greater Caucasus is 5.52 km3 or 175 m3 / s.

This amounts to an average annual runoff module of the entire territory of 2.93 l / s km2 or 92 mm, i.e. 15.3% of the water resources of the local rivers of Azerbaijan.

Along with this, in the Lesser Caucasus, the location of mountain ranges complicates the distribution of runoff. In the Lesser Caucasus, 4 districts are distinguished by water availability and runoff distribution:

- Northeastern slope;
- Northeastern slope of the southeastern part;
- in the Nakhichevan Autonomous Republic, the southwestern slope of the Zangezur ridge;

4. The southeastern slope of the southeastern part of the Lesser Caucasus and the Karabakh Plateau. It should be noted that the first 2 points include the right-bank tributaries of the Kura River with adjacent areas, and the second 2 points include the left-bank tributaries of the Araks River with areas.

It should be noted that the Lesser Caucasus differs from the Greater Caucasus in that here at an altitude of 3000 m or more, water supply reaches 900 mm or 25-28 l / s km2. It should also be noted that here the river network is distributed unevenly across the Lesser Caucasus and therefore, its development is affected by physical and geographical factors. The density of the river network varies in different high-altitude zones. The river network reaches its greatest development in the mountains at an altitude of 1000– 2500 m in the mid-mountain zone.

Above and below the hydrographic network is less developed. According to research, it was found that the right-bank tributaries of the river are the most dense river network. Hens, river basins of the Shahdag ridge to the river. Shamkhorchay, where its density ranges from 0.75 to 1.0 km / km2.

Right-bank tributaries of the river. Hens are located in the northeastern part of the Lesser Caucasus and Nagorno-Karabakh. It should be noted that such a different hydrographic position and related agricultural conditions are reflected in agricultural production.

Given the population growth, and therefore, their needs for agricultural products, the development of additional sown areas for the production of agricultural products is required.

Today's task is to develop land with an increased slope and steep slopes.

For the development and increase of sown areas in the mountainous regions of the republic, it is imperative to conduct a number of reclamation measures taking into account the natural and economic conditions of each individual region. It should be noted that in the regions, especially to agriculture, water erosion, developed in the mountainous regions of the republic, causes great damage. The main methods of erosion control are agro technical, agrochemical, forest reclamation, hydraulic engineering, and other measures. Moreover, they attach particular importance to the steepness of the slopes and the degree of soil erosion. It is advisable to saturate the crop rotation on heavily washed soils with legumes.

On steep slopes under the gardens, buffer strips are used, i.e. narrow strips of perennial grasses or shrubs, stripes located across the slope.

On slopes with a steepness of up to 40, transverse furrowing should be used. In hydraulic engineering reclamation, the following irrigation methods are used: surface irrigation, sprinkling, subsoil, drip, aerosol and other types of low-intensity irrigation.

As a result of numerous studies, it was proved that on large slopes (over 80) in order to avoid a direct hit on the soil by a sprinkling stream of an undisturbed structure, it is necessary to switch to sector sprinkling.

At slopes of 6-80, it is possible to apply sprinkling carried out with a machine of the DDN type with the supply of irrigation water through flexible hoses wound by sprinkling machines, stationary and semi-stationary systems of pulse sprinkling irrigation of self-oscillating action, etc.

The angle of the sector is calculated depending on the angle of inclination of the irrigated area. Improvement of irrigation in the mountainous zone also belongs to measures that promote land development for agricultural purposes. These methods and techniques for improving furrow irrigation on large slopes and steep slopes include:

- Planning the surface of the slopes;
- Selection of the optimal direction of irrigation furrows;
- Watering through the aisle along the furrows sealed by the tractor wheels;
- Selection of the optimal furrow length and irrigation spray costs;
- Development of a perfect on-farm irrigation network and technical means for distributing water into the furrows, providing accurate dosing and adjustment of the irrigation spray over time.

The layout and the right direction of irrigation furrows, which are mandatory techniques in the development of slopes, the volume of which depends on the thickness of the fine-grained soil layer. A characteristic feature of irrigation technology on steep slopes is the double regulation of irrigation jets over time: at the beginning of irrigation they give a small stream, then they increase by 2 times in 5-7 hours, after reaching the end of the furrow and stabilizing the discharge flow, the stream is reduced to its initial value. The increase in the irrigation stream in the middle of irrigation allows you to extend the irrigation furrow and increase the uniformity of its moisture.

Along with the above, for irrigation on steep slopes it is necessary to implement perfect on-farm irrigation network, which should provide clear control of the flow of irrigation water. At the same time, a tubular irrigation network consisting of closed distribution pipelines and irrigation pipelines with holes is most suitable for these conditions. Of which it is recommended to use a closed irrigation network for vineyards on an area of more than 1000 hectares, and a cotton semi-stationary irrigation network that has passed industrial testing on large slopes of the terrain (0.008-0.3) for cotton crops with an area of over 3000 hectares and for irrigating row crops. A closed network allows you to quickly and by the specified technology to supply water to any part of the irrigated area.

The technical essence of a closed network is the complete replacement of an open irrigation network in the earthen bed with a system of stationary irrigation pipelines with control valves. It should be noted that the new technology is achieved with the simultaneous operation of two or three or more irrigation pipelines, one of which works with the maximum flow rate, and the rest with the minimum.

In this case, the estimated diameter of irrigation pipelines allows you to strictly dose the costs of irrigation jets in the furrow. The danger of a sudden breakthrough of a large amount of water into one furrow is excluded here. The relief of the slope lands of the republic is complex. It should be noted that when assessing and choosing irrigation methods, one should use indicators that determine the requirements of agricultural production for irrigation techniques, taking into account aerobiological, soil-reclamation, organizational, economic and economic conditions.

In the development of mountain and piedmont regions, of particular interest are questions of studying the characteristics of subsidence soil during irrigation. The geomorphological and lithological-genetic conditions of these massifs predetermine the manifestation and intensive development of a number of other engineering-geological processes: irrigation erosion, disturbance of slope stability, landslide phenomena, chemical and mechanical suffusion, karst manifestation, etc.

It is known that subsidence and seismic effects, which determine the formation of seismic cracks, favor these processes. It in turn contributes to: a sharp drop in the strength of structural bonds during soil moisture.

Drawdown and associated redistribution of stresses in the soil mass; permeability anisotropy; the occurrence of tensile stresses during wetting during subsidence deformations.

With traditional methods of irrigation on the slopes in most cases, surface runoffs and linear erosion are observed, which reduces soil fertility.

Recommendations

The aim of eliminating irrigation soil erosion is the possibility of using irrigation with a sufficiently low intensity of water supply, allowing continuous irrigation in accordance with the water consumption of crops, using synchronous-sprinkling irrigation, which has found a wide area of implementation of the design (LED), characterized by a very low, average rain intensity (0.001-0.005 mm / min), quite acceptable for irrigation in the mountain and foothill regions of the republic. It is also recommended to use pressure stabilization and regulation devices as widely used equipment for mountain design options, which allow eliminating the statistical pressure in the network during the period of the pressure reduction pulse, as well as receiving and transmitting pressure reduction pulses through the network of technological pipelines. It is of great interest in that the water supply to the pulsed sprinklers is carried out according to the "bottom-up" principle. A distinctive feature of these systems is the unloading from the statistical pressure of the pressure-generating pipeline, which necessitates its implementation from a thick-walled pipeline.

It should be noted that for irrigation of areas that have small areas and a significant difference in elevation, it is also possible to use LEDs, in which a hydraulic ram is used as a pressure-generating unit. To operate the system with a hydraulic ram installation, it is required that the flow rate of the water source is several times higher than the flow rate of the system.

Findings

From all of the above, it is recommended to use the following irrigation methods in the development of mountain and foothill slopes, taking into account the correct choice of irrigation equipment and technology:

- along the furrows with a gap;
- Sprinkling with low rain intensity;
- Finely divided humidification in combination and without combination with sprinkling;
- Drip irrigation.
- Synchronous pulse sprinkling

The use of these methods of irrigation will eliminate irrigation erosion, save irrigation water by an order of magnitude and not violate the environmental protection of the environment and does not require additional capital costs for planning works and other types of agricultural activities.

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Citation: *Prof. RAE, Dr. Z.H. Aliev, "Scientific Substantiation Application of a Water-Saving System of Low-Intensive Irrigation When Solving problems of Mountain Agriculture in Conditions Azerbaijan", International Journal of Research Studies in Science, Engineering and Technology, vol. 6, no. 8, pp. 1-7. 2019.*