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Study Of Efficiency Of Water And Energy Resources In Growing Agricultural Crops Through Drop Irrigation. In The Example Of Amarant Crop

B.S. Shoturaev - Master, Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, National Research University.
B.R. Nasibov phd student - Tashkent Institute of Irrigation and Agricultural Mechanization Engineers

Abstract: In order to study the effectiveness of water and energy resources in the irrigation of agricultural crops from the ground up in 2021, the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers National Research University Scientific Training Center located in Ortachirchik district of Tashkent region "Use of water-saving technologies" based on the results of scientific research at the landfill. For the study, 0.12 hectares of soil was planted with amaranth in a drip irrigation area. The vegetation period of the amaranth crop lasted 5 months. During the growing season, 9 irrigations were carried out. A total of 116,334 m3 of water was used to irrigate this area. This amount is 969.45 M^3 per hectare. 116,334 m3 of water used for irrigation is 1.96 MJ per unit of energy. The energy used for agro-technical activities totaled 1979,472 megajoules. The yield of amaranth from 0.12 hectares was 310 kg. This amount is 310 kg per 1 hectare area. The yield of 310 kg of amaranth per unit of energy was 4815.24 Megajoules. Based on the results of the study, the water and energy efficiency of drip irrigation of amaranth was 2821,382 Megajoules, or 241.5%.

Keywords: drip irrigation, amaranth, energy, efficiency, water consumption.

Introduction. Consistent measures to radically reform the mechanisms of water use in the country, to ensure their rational and efficient use, to support and encourage the introduction of water-saving technologies in the economy, as well as to improve the reclamation of irrigated lands. activities are underway. The measures taken, as well as state support mechanisms, allowed to ensure the introduction of water-saving irrigation technologies on an additional 33.2 thousand hectares in 2019 alone, which will allow to use similar technologies. The cultivated lands accounted for 44% of the total area. However, the fact that the total area of water-saving irrigation technologies is only 75 thousand hectares, or 1.7% of the total irrigated area, is a measure aimed at expanding the use of water-saving technologies in agriculture and ensuring the efficiency of water use. requires further intensification of activities.

In order to further expand the mechanisms to encourage the introduction of water-saving irrigation technologies in agriculture and increase the efficiency of water use, as well as to improve the productivity of agricultural land: Mechanisms to encourage the introduction of water-saving technologies in agriculture On October 25, 2019, the President of the Republic of Uzbekistan signed Resolution PQ-4499 on expansion measures. In our country, especially in the basin of the Syrdarya River, as a result of improper and inefficient use of water resources for irrigation of agricultural crops, a large part of arable land is losing its productivity due to varying degrees of salinization and erosion. In addition, the water level of the Syrdarya River has almost reached the Aral Sea, resulting in increased environmental impact and climate change in the Aral Sea basin. These situations make it necessary to irrigate agricultural crops using water-saving technologies. In support of the large-scale work carried out in the country to save water resources and their rational use in the cultivation of agricultural crops, the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers National Research University Scientific Training Center This research was carried out at the landfill "Use of water-saving technologies". Landfill "Use of water-saving technologies" of the Scientific Training Center of the National Research University "Tashkent Institute of Irrigation and Agricultural Mechanization Engineers". Located in the Orta Chirchik district of Tashkent region, it is implemented within the framework of the European Union program "Sustainable Management of Water Resources in Rural Areas of Uzbekistan". It was built by a joint project of the United Nations Development

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Program and the Ministry of Water Resources of the Republic of Uzbekistan "Strengthening technical capacity".

Materials and methods Many scientists have worked on the conditions of drip irrigation of agricultural crops and the cultivation of amaranth, including in 2020 Shahodat Saidganieva conducted scientific experiments on the technology of cultivation of medicinal amaranth in the Andijan region. In addition, Khoshimjanova Nazokat studied the biological and nutritional value of amaranth. Many scientists point out that the most important features of the amaranth plant are its resistance to salt, drought, simplicity and convenience of agricultural techniques, adaptability to any soil and climatic conditions, low seed consumption, intensive development, resistance to pests and diseases. One of the most important features of amaranth is its very high seed yield and multiplication factor (2000-5000). No cultural crop has such a coefficient. If the ideal protein is considered to be 100%, this amount is 75% in amaranth, 68% in soybeans, 45% in peas, 44% in corn and 57% in wheat.

In this study, 20 50 m long drip hoses were laid in the experimental field at a depth of 30 cm at a distance of 1.2 m. Amaranth was planted at a distance of 15 cm on both sides of the line where the drip hoses were located. A total of 1.8 kg of amaranth seeds were planted in 1.2 ha of soil from the soil to the drip irrigation area for the experiment. A total of MTZ 80 tractors worked for 3 hours and a total of 4 people worked for 80 hours. The vegetation period lasted 145 days, during which soil moisture, groundwater level and irrigation water volume were regularly monitored. No mineral or organic fertilizers were used during the growing season. Observation wells have been installed at the beginning and end of the experimental field to monitor groundwater. The groundwater level fluctuated between 3.2 and 4.5 m during the entire growing season and did not rise above 3.2 m, so it was estimated that the groundwater had no effect on crops.

1- table

Groundwater level monitoring table

Date of observation	Groundwater level (m)	
	Observation well 1	Observation well 2
12.05.2021	4.5	4.45
27.05.2021	4.2	4.33
8.06.2021	3.95	4.1
22.06.2021	3.55	3.68
15.07.2021	3.25	3.2
1.08.2021	3.4	3.3
24.08.2021	3.75	3.5

During the growing season, soil moisture was regularly monitored. Irrigation was organized based on the results of moisture. Moisture was taken twice from the same soil layer to a depth of 225 cm. Moisture was removed from the soil 15 times during the general growing season.

Results and their discussion. Before planting amaranth, the land was plowed and leveled. Agricultural machinery was used for this purpose. The MTZ 80 tractor took 3 hours to plow and level. We calculate the energy consumed by the MTZ 80 tractor, which requires determining the total power of the MTZ 80 tractor. The total power of the MTZ 80 tractor is calculated as follows.

Based on these figures, the power of the MTZ 80 tractor is equal to 80 horsepower, and one horsepower is equal to 735.5 w.

$$N_{tractor}$$= 80C735,5 w = 58,84 kw

The total power of the MTZ 80 tractor is 58.84 kW, and the work done knowingly can be calculated using the following formula. That is, it can be determined by multiplying the total power of the tractor by the operating time.

$$A_{tractor} = N_{tractor} \times T_{working\ time}$$

Ushbu formulaga bizda mavjud bo'gan qiymatlarni qo'ygan holda hisoblash ishlarini olib boramiz.

$$A_{tractor}$$= 58840 w × 10800 s = 635472000j = 635,472 Mj

The total energy consumption of the MTZ 80 tractor was 635,472 Mj.

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All activities from sowing to harvesting were done by hand. A total of 4 people worked for 16 hours to complete this work. We calculate the total energy expended by human labor in cultivating the crop. To do this, we determine how much energy 1 person spends on fieldwork in 1 hour. A person consumes an average of 300 calories per hour of agricultural work. Based on this, we determine how much energy 4 people expended in 16 hours. To do this, we determine how much energy 1 person consumes in 16 hours and multiply by 4.

300 kkal × 16 = 4800 kkal × 4 =19200 kkal

Convert this value from kcal to joules using the following equation 1 cal = 4.1868 j.

A_{man} = 19200 kkal = 19 200 000 kal × 4,1868 =80,4 Mj

This means that 80.4 Mj of human energy was consumed during the cultivation of the total crop.

During the growing season, a K100-50-200 pump was used to irrigate the crop at the required pressure. We calculate the energy consumed by this K100-50-200 brand pump during the entire growing season. The K100-50-200 pump was used for 33 hours during the growing season. The capacity of the K100-65-200 cantilever pump is 13 kw. Based on these parameters, the total energy consumption of the pump K100-65-200 was calculated.

A_{nasos}= N_{nasos}× $T_{ish\ vaqti}$ = 13000 w × 27 × 3600 s =1263,6 Mj

The total energy consumption of the pump supplying water to the drip pipes for irrigation was 1263.6 Mj.

We calculate the total amount of energy used to grow amaranth by drip irrigation.

A_{umumiy}= $A_{traktor}$+ A_{inson}+ A_{nasos} + $A_{urug'}$ + A_{suv} = 635,472Mj + 80,4 Mj + 1263,6 Mj +12,426 Mj + 1,96 Mj =1993,858 Mj

0.12 ha The total energy used to grow the amaranth crop by drip irrigation from the soil was 1979,472 Mj. Amaranth planted on 0.12 ha of arable land was irrigated using drip irrigation technology using a total of 116,334 m³ of water or 1.96 Mj of energy. If we calculate this value for 1 hectare, the volume of water is 969.45 m³ or 16.33 Mj of energy. When irrigating amaranth without the use of surface water-saving technologies, its irrigation rate is 1700-1800 m³ / ha.

A total of 310 kg of crop was harvested from the experimental field. To convert this amount to energy, we determine the energy content of 1 kg of amaranth. 100 g of amaranth seeds contain 371 kcal of energy. Therefore, 1 kg of amaranth contains 3710 kcal of energy.

1kal. = 4.1868 joul

Using this equation, we can determine how many joules of energy are in 1 kg of amaranth.

3710 kkal= 3710 000 kal. = 3710000 × 4.1868 = 15533028 joul

According to the calculation, 1 kg of amaranth contains 15533028 j of energy, so we calculate the amount of energy in the total yield.

310 kg × 15533028 = 4815238680 j =4815,24 Mj

The amount of energy obtained from the amaranth plant planted on 0.12 ha for scientific research was 4815.24 Mj.

From this amount of energy, we subtract the amount of energy expended before growing and harvesting the crop and determine the energy efficiency.

4815,24 Mj - 1979,472 Mj = 2835,768 Mj

From this value, we also subtract the amount of amaranth seeds sown in the field for the experiment and the value of the volume of water supplied for irrigation per unit of energy. A total of 0.8 kg of amaranth seeds were planted for the experiment, which we converted into energy units.

0,8 kg × 15533028 = 12426422,4 j =12,426 Mj

2835,768 Mj - 12,426 Mj – 1,96 Mj = 2821,382 Mj

Cultivation of amaranth by drip irrigation produced 2,821,382 Mj of energy from 0.12 ha of land. This is (4815.24 Mj / 1993,858 Mj) × 100% = 241.5% efficiency.

Conclusion

The need for agricultural machinery is reduced by drip irrigation of agricultural crops. In general, agro-technical measures are almost unnecessary when using this method for irrigation. By irrigating the amaranth crop underground, it is possible to use 7 times less water than cotton and 4 times less water than irrigated

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land without economical technology. If we consider that the main crops grown in our country are cotton and wheat, it is possible to save up to 82% of water resources if they are completely replaced by crops such as amaranth. If we take into account that 20% of the water resources consumed in the country today are in the territory of the Republic and 54% of our soils are saline, we can conclude that the need for crops such as amaranth is very high. If cotton and wheat are replaced by similar crops throughout the country, 70-80% of the water we consume will be formed in our country. In addition, drip irrigation reduces the impact of harmful substances into the atmosphere due to the low use of agricultural machinery in the field. In this way, water erosion was eliminated because the water was not discharged into the sewer. Air saturation is improved in the active layer of the soil. A number of other agro-technical measures, such as control of soil diseases and pests, preparation of land for planting, enrichment of land with organic fertilizers, tillage, opening of fields for irrigation, application of mineral fertilizers, weed control no action was required.

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