ISSN NO: 2770-0003
Date of Publication: 10-02-2024

Efficiency of the Sprinkling Irrigation Method for Irrigation Of Soybean And Cauliflower

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Abstract: In order to reduce the population's need for food and rational use of water resources in the conditions of typical irrigated gray soils Tashkent region, the sprinkling irrigation method was used for soybean crops "Nafis" and cauliflower "Raskot", while taking into account the volumetric mass of the soil, soil porosity, soil permeability. This is explained by the fact that the timing of irrigation, given to crops, irrigation rates, seasonal irrigation rates, the impact on growth, the development and productivity of plants are described.

Keywords: soybean and cauliflower species, sprinkling irrigation method, soil bulk density, soil porosity, soil water permeability, field capacity limit, irrigation rates, irrigation timing, irrigation rate, soybeans yield.

Introduction: Today, due to the increase in the world population, the demand for food is increasing day by day. In the world, soybean is grown as a main and repeated crop on 122.1 million hectares. It ranks fourth after wheat, rice and corn in terms of cultivated areas, and the annual gross grain yield is 220.6 million tons. The USA, Argentina and Brazil, where the goods are exported to other countries. China, Korea and other Asian countries are the main importing countries. According to FAO data, in 2021, 1.66 million tons of soybeans were grown." This figure is increasing by 2.2% every year and will reach 371.3 million by 2030. tons of harvest is planned, [1, 2, 3, 4].

According to the estimates of the World Water Institute, by 2025 there will be approximately 3.5 billion populations may face the problem of water shortage in the world. In particular, this indicator reaches 1.2-1.8 million per person. By 2080, despite the increase in the efficiency of crop irrigation, the demand for fresh water is predicted to increase by 25% due to changes in global climate, weather, precipitations and vegetation period, [5,6,7].

Currently, 17 countries in the world are considered to be "extremely" water-scarce. According to this indicator, Uzbekistan ranks 25th among 164 countries (level 2 on a five-point scale), that is, it is among the countries with a "high" level of water shortage.

Due to the fact that the population of Uzbekistan will reach 40 million people by 2030, 7-8 km of available water resources will be reduced. In such conditions, the level of water scarcity can increase from 13-14% to 44-46%, which negatively affects the development of agriculture [8,9,10].

The purpose of the study, the development of a method of sprinkler irrigation for soybean and cauliflower species in the conditions of the meadow gray soils of the Tashkent region.

As an object of research, the old irrigated gray meadow soils of the Tashkent region, sprinkler irrigation method, soybean and cauliflower species, plant were taken.

The subject of research is sprinkler irrigation method, number of irrigations, seasonal irrigation rate, soybean and cauliflower species growth and development, grain yield.

Materials and methods experimental studies, conducting laboratory and field experiments, phenological observation and biometric measurements were carried out on the basis of soybean and cauliflower harvest data were analyzed according to the method of dispersion analysis from the source "Методика полевого опита" by B.A.Dospehov and mathematical-statistical analysis using a computer program [8, 9, 10].

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Results and discussion. Tashkent region borders with the states of Kyrgyzstan, Kazakhstan and Tajikistan, as well as Namangan to the east and Syrdarya to the south-west. Chotkal, Kurama, Piskom and Ugom ridge mountains form the north-eastern and eastern part of the region. A large part of its territory consists of a mountainous plain sloping down to the Syrdarya River to the south and south-west. The climatic conditions of the Tashkent region are sharply continental and dry, characteristic of the whole of Uzbekistan. The winter is wet, relatively mild, the summer is hot, dry. The temperature of the winter months in the plains and hilly regions is unstable and varies according to them. The coldest month in the region is January, when the air temperature ranges from 11C to 28C. Snow-covered days are 31-33 days. The hottest month of the region is July, when the air temperature exceeded 430C. Summer temperatures are dry and hot, sometimes bringing a "Nexus" wind. The air temperature during Nexus is 6-8 C higher than the temperature of normal days, and the air humidity is extremely dry. Under the influence of such air temperature, many agricultural crops are damaged, they stop growing and developing. In August, September, very strong wind blows in Bekobad area, that is, between Fergana valley and Mirzachol due to air exchange. The speed of this wind reaches from 10-30 m/sec to 40 m/sec. It also has a strong negative impact on the growth and development of agricultural crops.

The main part of atmospheric precipitation occurs in the form of snow in the mountain region, and in the form of rain in the hilly and plain regions. Most of the precipitation falls in the winter and spring months, and a small amount falls in the autumn months. The amount of precipitation in the region is also different. During a year, there will be 261 - 316 mm of atmospheric precipitation in the plain part, 366 - 435 mm in the foothills, and 700 - 895 mm in the mountain regions. In the summer months, there is almost no rain. In general, by analyzing the climatic conditions of the Tashkent region, it is possible to conclude that this region is suitable for the cultivation of any type of agricultural crops, which allows to obtain abundant and high-quality harvests.

In 2021 and 2022, when the average amount of air temperature, precipitation, and wind speed was observed, the highest air temperature was observed from April to September, and the average wind speed was 1.3 to 1.7 m/s.

On April 11, 2022, super-elite seeds of the "Nafis" soybean variety were planted. Soybean cultivars were treated 3 times against insects, 6 times between rows were treated, 5 times were treated by hand against weeds, 5 times were irrigated by tilting soybeans and 13 times were sprinkled with rain.

According to the results of the laboratory analyzes conducted to determine the mechanical composition of the soil of the experimental area, it was found that the arable layer consists of medium, lower layers of light sand, located in loess deposits, prone to waterlogging, irrigated meadow gray soils with low productivity.

In the soil samples taken for the agrochemical analysis of the soil, the amount of humus in the 0-30 cm plowed layer was 0.822%, and in the 30-50 cm sub-plot layer was 0.810%, and the amount of nitrogen and phosphorus elements from the main nutrients was proportionally 0.089-0.077 in these layers. % and 0.094–0.088%, it was found that the mobile form of nutrients in the soil was NO_3 9.89–8.7 mg/kg, P_2O_5 18.7–16.9 and K_2O 158–146 mg/kg.

According to the results of agro physical observation of the soil studied in the general substrate at the beginning of the application period of the soybean, the volume mass in the 0-30 sm layer of the experimental field increased by 1.28 gm/cm^3, at 0-50 cm by 1.31 gm/sm^3, at 0-70 sm by 1.34 gm/sm^3 and 1.37 gm/sm^3 at 0–100 sm, the average porosity of the experimental area decreased from top to bottom, i.e. 52.9% at 0–30 sm, 51.5 at 0–50 sm %, 50.4% in 0-70 sm and 49.3% in 0-100 cm.

At the end of the plant life in the experimental field, the least amount of soil volume change between the options was as follows, i.e., 1.36 g/cm3 at 0–30 cm and 1.42 g/cm3 at 0–50 cm in the control option. /cm3 was 1.44 g/cm3 at 0–70 cm and 1.45 g/cm3 at 0–100 cm. A significant change in the volume mass of the soil was observed in the option of sprinkler irrigation of the soybean variety and was 1.39, respectively; 1.41; 1.43 and 1.44 g/cm3 were observed in the experimental results.

At the beginning of the vegetation of the soybean, the water permeability of the soil for 6 hours was 882 m^3 per hectare, 88.2 mm or 0.24 mm/min. a decrease in water absorption capacity of the soil was observed.

At the beginning of the vegetation of soybean cultivation, the field moisture content of the soil in the experimental field was 21.5% in the layer of 0-30 sm above the plow, 21.6% in the layer of 0-50 sm, 21.8%

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in the layer of 0-70 sm, 21.8% in the layer of 0-100 sm and it was observed that it was 22.2 percent on average in the stratum, and during the growing season each irrigation of soybeans and cauliflower was carried out in accordance with the field moisture capacity of the soil.

In the research carried out in 2022, soybean was irrigated 5 times in a 1-2-2 system, 590 m^3/ha once in the pre-flowering phase, 600, 650 m^3/ha twice in the flowering-harvest phase, and 650, 640 twice in the ripening phase, the duration of irrigation is 15-17 hours, 24-37 days between irrigations, and the seasonal irrigation rate is 3130 m^3/ha, in the 3-5-5 system, 3 times 320, 320, 320 m^3/ha, in the flowering-harvest phase 5 times at the rate of 240, 240, 240, 240, 240 m^3/ha, and in the ripening phase 5 times at the rate of 240, 240, 240, 240, 240 m^3/ha, watering it was observed that the duration was 2.0-2.5 hours, 6-12 days between irrigations, and the seasonal irrigation rate was 2880 m^3/ha. It was found that 250 m^3/ha of water was used less in the rain-irrigated version than in the case of rain-fed soybeans. In the case of irrigation of "Nafis" variety of soybean in the conditions of grassy gray soils, it was possible to obtain an additional grain yield of up to 4.2 t/ha in comparison with the controlled irrigation option.

According to the analysis of the data obtained from the two-year experiments, it was found that the applied agrotechnical measures and the rain irrigation of soybeans have a good efficiency in the cultivation of soybeans with the observance of the irrigation procedure, i.e., the soil moisture before irrigation of the "Nafis" soybean variety is when irrigated with an irrigation rejime 70-75-75 %. In the 1st option, which was irrigated in percentage order, the seasonal irrigation rate was 3130 m^3/ha, the general irrigation rate was 3680 m^3/ha, the grain yield was 2,34 ton/ha, and the water consumption rate for 1 ts of crop was 157.3 m^3. In addition, in the 2nd option of rain-irrigated soybean, the seasonal irrigation rate is 2880 m^3/ha, the total irrigation rate is 3430 m^3/ha, the grain yield is 2.76 ton/ha, and the water consumption rate for 1 t crop is 124.3 m^3, or the seasonal irrigation rate is 250 compared to the control m^3/ha, the total irrigation rate was 50 m^3/ha, the grain yield was 4.2 ton/ha, and the rate of water used for 1 tons of crop was less than 33.0 m^3, (Table-1).

Table-1.

Impact of soybean irrigation methods on yield and water consumption per crop unit, 2022 data

Opt	When irrigated with an irrigation rejime, %	Irrigation method	Irrigated layers, sm	Seasonal irrigation rate, m^3/ha	Overall irrigation rate, m^3/ha	Produc-tivity, t/ha	Water consumption for 1 ton crop, m^3
1	70-75-75	Surface irrigation	50-50-70	3130	3680	2,34	157,3
2		Sprinkler irrigation	30-40-40	2880	3430	2,76	124,3

The amount of protein was 35.4%, and the amount of oil was 18.7% in variant 1, which was irrigated in the order of when irrigated with an irrigation rejime 70-75-75 %, and the amount of oil was 18.7 %. it was observed that the amount made 35.7 percent, and the amount of oil 18.3 percent.

Also, based on the results of the conducted research, firstly, using a Pentium IV computer, "Prediction of the yield of agricultural crops depending on the irrigation procedures" using a Pentium IV computer, and secondly, on "Determining the yield of the main crop depending on the irrigation procedures of soybeans" EHM programs have been created and on the basis of two programs, a mathematical model of the effect on yield depending on the main and repeated soybean irrigation procedures was developed, and through this model, it was possible to determine the effect of soybean grain yield by managing irrigation in soybean care, and based on this program, it is being used in the educational processes of higher education.

Cauliflower variety "Raskot" was irrigated 5 times in the 1-2-2 system at 70-75-75% relative to limited field moisture capacity in the 1st planting period, with 590 m^3/ha once in the pre-flowering phase, 600 m^3/ha twice in the flowering-harvest phase. , at the rate of 650 m^3/ha, and in the ripening phase, it is irrigated twice at the rate of 650, 640 m^3/ha, the duration of irrigation is 15-17 hours, the interval between waterings is 24-37 days, and the seasonal irrigation rate is 3130 m^3/ha, then watering cauliflower with rain before soil moisture was irrigated 11 times in the 2-4-5 system at 70-75-75% according to limited field moisture capacity, 2 times

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230, 230 m^3/ha in the pre-flowering phase, 4 times 220, 220, 220 and 220 m^3/ha in the flowering-harvest phase in the norm, and in the ripening phase, it was irrigated 5 times at the rate of 220, 220, 220, 220 and 220 m^3/ha, the duration of irrigation was 2.0-2.2 hours, 8-10 days between waterings, and the seasonal irrigation rate was 2440 m^3/ha observed.

Cauliflower variety "Raskot" was irrigated 5 times in the 1-3-1 system at 70-75-75% relative to limited field moisture capacity in the 2nd planting period, with 520 m^3/ha 1 time in the pre-flowering phase, 540 m^3/ha 3 times in the flowering-harvest phase. , at the rate of 550, 550 m^3/ha, and in the ripening phase, it is irrigated once at the rate of 540 m^3/ha, the duration of irrigation is 15-17 hours, the interval between waterings is 24-37 days, and the seasonal irrigation rate is 2520 m^3/ha, then watering cauliflower with rain before soil moisture was irrigated 10 times in the 1-5-4 system at 70-75-75% relative to limited field moisture capacity, 220 m^3/ha once in the pre-flowering phase, 200, 210, 210, 210 and 210 m^3/ha 5 times in the flowering-harvest phase in the norms, and in the ripening phase, it was irrigated 4 times at the rate of 200, 200, 200 and 200 m^3/ha, the irrigation duration was 2.0-2.2 hours, 8-10 days between waterings, and the seasonal irrigation rate was 2060 m^3/ha.

It was found that 460-690 m^3/ha of water was used less in the option of raining cauliflower than when it was irrigated in both periods, (Fig.-1).

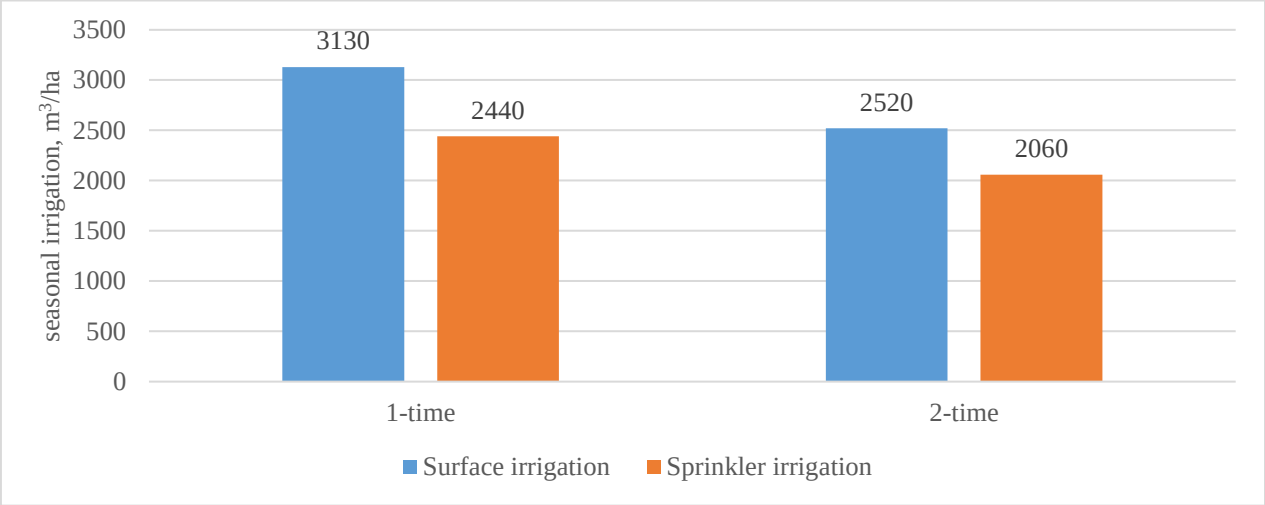

Figure 1. Effect of irrigation method on cauliflower planting time

According to the results of the experimental research, it was found that in the conditions of the meadow gray soil of the Tashkent region, the "Raskot" variety of cauliflower was irrigated 5 times in the 1-2-2 system before irrigation, and the soil moisture before irrigation was 70-75-75% in the 1-2-2 system. 590 m^3/ha, in the flowering-harvest phase, it was irrigated 2 times at the rate of 600, 650 m^3/ha, and in the ripening phase, 2 times at the rate of 650, 640 m^3/ha, the duration of irrigation was 15-17 hours, 24-37 days between irrigations, seasonal irrigation was 3130 m^3/ha, before irrigating cauliflower with sprinklers, the soil moisture was 70-75-75% compared to limited field moisture capacity (LFMC), irrigated 11 times in the 2-4-5 system, 2 times in the pre-flowering phase, 230, 230 m^3/ha, flowering-harvest collection irrigated 4 times at the rate of 220, 220, 220 and 220 m^3/ha in the ripening phase, and 5 times at the rate of 220, 220, 220, 220 and 220 m^3/ha in the ripening phase. It is recommended to water 10 days, the seasonal irrigation rate is 2440 m^3/ha.

Conclusion. According to the results of the experimental research, it was found out that it is recommended to irrigate the "Nafis" sort of soybean during the growing season of the gray grassy soils in the 3-5-5 system, each irrigation rate is 220- 230 m^3/ha, seasonal irrigation rate is 2880 m^3/ha. The "Raskot" cauliflower irrigated 11 times in the 2-4-5 system, 2 times in the pre-flowering phase, 230, 230 m^3/ha, flowering-harvest collection irrigated 4 times at the rate of 220, 220, 220 and 220 m^3/ha in the ripening phase, and 5 times at the rate of 220, 220, 220, 220 and 220 m^3/ha in the ripening phase. It is recommended to water 10 days, the seasonal irrigation rate is 2440 m^3/ha.

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Reference:

1. Decree of the President of the Republic of Uzbekistan dated Iyun 10, 2020, No.6020: "Strategy of action on five priorities of development of the Republic of Uzbekistan", Tashkent, 2020.
2. http:www.soyka.rusoyarus.shtm.
3. http:// www. uz.denemetr.com.
4. https://lex.uz/docs/4567334.
5. Atabayeva X.N., Israilov I.A.-The influence of mineral fertilizers on the growth, development and fruitfulness of soybean replicated soybean sorts planted as re-sowing International symposium, Tashkent, 1998 Pp.12-14
6. Isaev S., Qodirov Z., Xamraev K., Atamuratov B., Sanaev X.-Scientific basis for soybean planting in the condition of grassy alluvial soil prone to salinization //Journal of Critical Reviews, Vol 7, Issue 4, 2020.
7. Gulom Bekmirzaev, Jose Beltrao, Sabirjan Isaev, Mirkodir Usmanov, Sunnat Tadjiev,Sanoatkhan Zakirova3 and Murodjon Isagaliev-Use of halophyte plants on saline soils and evaluation of salt removal efficiency-//E3S Web of Conferences 389, 03043 (2023) https://doi.org/10.1051/e3sconf/202338903043
8. Mehtods of conducting field experiments. Tashkent, 2007. P. 148.
9. 7. Rijov S.N. “Optimum soil moisture in cotton culture” //Soviet cotton, 1940. №6.
10. Kovda V.A. “Fundamentals of the doctrine of soils” //Publishing Nauka, №2. Moscow, 1973. - p. 29-47.
11. Bizhan Dauletbaev, Sbyrzhan Isaev, Odina Khasanova-The effectiveness of drip irrigation of almond and pistachio trees with local running water-// To learn more about ICITE 2023 www.icite.ukgu.kz, Proceeding X International Conference «Industrial Technologies and Engineering» ICITE – 2023, Volume III, 319-323 pp.
12. Sabirjan Isaev, Gulom Bekmirzaev, Mirkadir Usmanov, Elyor Malikov, Sunnat Tadjiev and Abdukadir Butayarov-Provision of remote methods for estimating soil salinity on meliorated lands-E3S Web of Conferences 376, 02014 (2023) https://doi.org/10.1051/e3sconf/202337602014