# Effects of irrigation technologies on the productivity of reproducted soy varieties in Uzbekistan

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**Abstract.** This article deals with the timing of sowing, germination, growth, development, obtaining high and quality grain crops, irrigation timing, irrigation procedures, development of irrigation standards and effective care agrotechnology in the conditions of light soils of grassland-gray mechanical composition of Jizzakh province in Uzbekistan and data on the conducted scientific researches are given.

## 1 Introduction

It is known that one of the main factors of high yields of agricultural crops is the improvement of land reclamation and fertility. In recent years, a number of scientists have found that the amount of humus in the soils of Uzbekistan is declining. This leads to the degradation of all the properties and characteristics of the soil [1-3].

At present, the average humus content in the soil in Uzbekistan is only 0.6-0.7%. One of the main reasons for this is that mistakes and shortcomings are made in crop rotation and soil fertility is not taken into account when planting crops [4, 5]. As a result of planting the same crop without paying attention to the chemical, physical and reclamation conditions of the soil, microbiological processes in the soil are disrupted, and the environment for humus and other nutrients in the soil is lost [3, 6].

Similarly, the soil fertility of Jizzakh province is low, the amount of humus is 0.8-0.9%, the area of saline soils is increasing due to limited water resources [6].

Even in such extreme conditions, it is necessary to increase the productivity of cotton and other agricultural crops, efficient use of land and increase soil fertility. The total area of irrigated lands in Jizzakh province is 300,000 hectares, of which 165,000 hectares are 55.1% weak, 70,700 hectares are 23.6% medium and 6,200 hectares are 2.7% strongly saline, and 20% are low-yielding lands [6, 7].

In such lands, it is absolutely impossible to get high yields of cotton, wheat and other agricultural crops without increasing soil fertility [7-10]. In this regard, one of the most pressing issues in Jizzakh province is the development of water and resource-saving technologies for the care of soybeans from legumes to increase the productivity of irrigated lands, in order to increase soil fertility.

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Such studies have not been conducted before in the soil climate of Jizzakh province. Extensive scientific work has been carried out by a number of scientists abroad and at home on the cultivation of legumes, soybeans and sunflowers in the main and secondary periods, as well as the study of their biology and cultivation technologies [6-10]. However, today, at a time of growing water shortages not only in Uzbekistan but around the world, it is important to develop optimal irrigation technologies for the cultivation of soybeans as a secondary crop after winter wheat.

Therefore, the purpose of the study was to determine the water-saving technology for irrigation of Nafis and Orzu varieties of soy in the conditions of hydromorphic, meadow-gray, lightly sandy, weakly saline soils, groundwater level at a depth of 2.0-3.0 meters in Jizzakh province. to study the impact of varieties on growth, development and productivity, and to develop scientific and practical recommendations for farms.

## 2 Materials and methods

Laboratory analysis and field experiments were conducted on the basis of methodological manuals such as "Methods of conducting field experiments" UzPITI, Tashkent, 2007. The work on soil and plant sampling and their agrochemical analysis was carried out on the basis of " Methods of agrochemical, agrophysical and microbiological research in irrigated cotton provinces" and " Methods of agrochemical analyzes of soils and plants in Central Asia". The data obtained on productivity were statistically evaluated by mathematical processing by the method of B.A. Dospekhov (1985) [8, 10].

## 3 Results and discussion

Soil volume weight and field moisture capacity In order to determine the timing and norms of irrigation depending on soil moisture, the experimental field soil volume weight and field moisture capacity were determined in early spring and autumn in order to determine its change. The results of our findings showed that the volumetric weight of the soil in the 0-30.0-50.0-70 and 0-100 cm layers of the soil was 1.36-1.37-1.39-1.40 g/cm$^3$. The field moisture capacity of the soil in these layers was 18.5-18.9-19.5-20.2% relative to the absolute dry mass of the soil (Table 1), and the volume weight of the soil at the end of the growing season was determined by the options. According to the results of the observation, at the end of the growing season the weight weight of the soil increased slightly and was 1.43-1.44-1 in layers 0-50, 0-70 and 0-100 cm in the options irrigated in the normal way (option No. 1, 4, 7, 10) , Was 46 g/cm$^3$, while in the options mulched with film (option No. 3, 6, 9, 12) it was 1.41-1.43-1.44 g/cm$^3$.

By the end of the growing season, the increase in the volume weight of the soil was due to the passage of seasonal irrigation and their norms, as well as the use of tillage techniques between rows. In the experiment, it was found that in options 3, 6, 9, and 12, which were irrigated with a film covering the soy, the soil was less compacted by 0.01-0.02 g/cm$^3$.

**Table 1.** Volume weight of the experimental field soil and the limited field moisture capacity (LFMC).

| Layers, cm | Volume weight of soil, g/cm$^3$ | | | LFMC, % |
|---|---|---|---|---|
| | Summer | Autumn | | |
| | | No mulching | With mulching | |
| 0-10 | 1.35 | 1.42 | 1.40 | 17.8 |
| 10-20 | 1.36 | 1.41 | 1.39 | 18.6 |
| 20-30 | 1.37 | 1.42 | 1.41 | 19.2 |
| 30-40 | 1.43 | 1.44 | 1.43 | 19.4 |
| 40-50 | 1.47 | 1.47 | 1.45 | 19.6 |
| 50-60 | 1.42 | 1.48 | 1.46 | 20.6 |
| 60-70 | 1.43 | 1.47 | 1.47 | 21.0 |
| 70-80 | 1.45 | 1.50 | 1.49 | 21.4 |
| 80-90 | 1.44 | 1.52 | 1.51 | 22.0 |
| 90-100 | 1.43 | 1.54 | 1.53 | 22.9 |
| | | | | |
| **0-30** | **1.36** | **1.41** | **140** | **18.5** |
| **0-50** | **1.39** | **1.43** | **1.41** | **18.9** |
| **0-70** | **1.40** | **1.44** | **1.43** | **19.5** |
| **0-100** | **1.41** | **1.46** | **1.44** | **20.2** |

The water permeability of the experimental field soil was determined in spring and autumn. Data on this are given in Table 2.

**Table 2.** Soil water permeability, m3/ha.

| # | Timing | In spring | In autumn | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Bare soil | | | Filmed with plastic mulch | | |
| | | | Option 1 | Option 4 | Option 7 | Option 3 | Option 6 | Option 9 |
| | | Amount of water absorbed into the soil, m$^3$/ha | | | | | | |
| 1 | In first hour | 585 | 415 | 445 | 440 | 405 | 425 | 430 |
| 2 | In second hour | 315 | 220 | 235 | 240 | 215 | 230 | 240 |
| 3 | In third hour | 265 | 165 | 180 | 185 | 180 | 195 | 205 |
| 4 | In fourth hour | 205 | 120 | 145 | 140 | 165 | 180 | 190 |
| 5 | In fifth hour | 120 | 85 | 90 | 85 | 105 | 110 | 105 |
| 6 | In sixth hour | 60 | 40 | 50 | 60 | 35 | 60 | 75 |
| | Within six hours | 1,550 | 1,045 | 1,145 | 1,150 | 1,105 | 1,200 | 1,245 |

As a result of soil compaction during the season, its water permeability also decreased. At the beginning of the growing season, the water permeability of the soil was 1,550 m$^3$/ha for 6 hours. The water permeability of the soil decreased from 585 m$^3$/ha in the first hour of observation to the following hours, and the water absorption to the ground in the sixth hour was 60 m$^3$/ha. Observations show that as a result of irrigation during the growing season

and their norms, as well as the transition of techniques between rows, soil water permeability decreased slightly in autumn, and soybean varieties are irrigated in the usual way. If there is a film-lined irrigation between the edges, 3,6,9,and 12 options was consumed 1,105-1,245 $m^3$/ha.

Adequate moisture in the soil during the growing season for soybean varieties is important for its growth, development and harvest. To keep the soil moisture before irrigation at 70-70-60% of the limited field moisture capacity, Nafis and Orzu varieties of soybean are applied once during the application period, and soy to maintain the soil moisture before irrigation at around 75-75-65% of the limited field moisture capacity. varieties were required to irrigate 2 times. Irrigation timing and norms Soybean varieties are irrigated from 1 to 4 cm, depending on the amount of soil moisture in the layer 0-50 cm before flowering, 0-70 cm during the formation of pods and 0-50 cm during ripening. In options 2, 5, 8, and 11, depending on the amount of soil moisture in the layer 0-50 cm before flowering, 0-50 cm during the formation of pods and 0-50 cm during ripening, in rows 3, 6, 9, and 12 irrigated with film between rows and 0-30 cm before flowering, 0-50 cm during the formation of pods and 0-30 cm during ripening, depending on the amount of soil moisture in the layer. During the period of application of soybean varieties, the established irrigation regime was fully followed, and the error was around 0.3-1.9%. Pre-irrigation soil moisture in the order of 70-70-60% relative to the limited field moisture capacity In the 1st option, irrigated from all branches, the soil moisture after irrigation (in the 0-100 cm layer of soil) is 15.1% from 212.9 mm - 18.1 % Up to 255.2 mm, in the 2nd option irrigated between the rows from 16.1% to 227.0 mm - from 18.0% to 253.8 mm, in the 3rd option irrigated with a film between the rows of soy 16.4% (232.1 mm) - increased by 17.8% to 250.9 mm. Nafis variety of soy In the 4,5, and 6 options irrigated in the order of 75-75-60% relative to the limited field moisture capacity of the soil before irrigation, the soy is from 16.0% to 225.6 mm to 17.8% to 250.9 mm , from 16.7% to 235.4 mm to 18.0% to 253.8 mm when irrigated, and from 16.8% to 236.8 mm to 17.6% to 248.1 mm in the case of irrigated with a film between the rows of soy. found to increase. Similar data preceded the planted varieties of the soy Orzu variety (Tables 3 and 4).

**Table 3.** Soil moisture after irrigation, 70-70-60% relative to LFMC.

| **Layers, cm** | **Irrigations** | | | | | |
|---|---|---|---|---|---|---|
| | **Option 1** | **Option 2** | **Option 3** | **Option 7** | **Option 8** | **Option 9** |
| 0-10 | 14.3 | 13.3 | 12.6 | 13.0 | 13.7 | 13.0 |
| 10-20 | 15.7 | 14.7 | 14.3 | 16.1 | 13.9 | 14.9 |
| 20-30 | 17.0 | 15.8 | 16.2 | 17.8 | 15.5 | 16.1 |
| 30-40 | 17.4 | 16.9 | 17.4 | 18.1 | 16.7 | 17.2 |
| 40-50 | 18.3 | 18.2 | 18.5 | 18.7 | 18.3 | 18.3 |
| 50-60 | 18.7 | 19.6 | 18.7 | 19.0 | 19.6 | 19.7 |
| 60-70 | 19.2 | 20.1 | 19.1 | 19.1 | 20.3 | 20.4 |
| 70-80 | 19.7 | 20.3 | 19.9 | 20.2 | 20.7 | 20.8 |
| 80-90 | 20.3 | 20.7 | 20.8 | 20.7 | 20.9 | 21.2 |
| 90-100 | 21.9 | 21.1 | 21.3 | 21.2 | 21.0 | 21.6 |
| | | | | | | |
| **0-30** | **15.6** | **14.6** | **14.3** | **16.3** | **14.3** | **14.6** |
| **0-50** | **16.5** | **15.7** | **15.8** | **17.1** | **15.5** | **15.9** |
| **0-70** | **17.2** | **16.9** | **16.6** | **17.6** | **16.8** | **17.0** |
| **0-100** | **18.1** | **18.0** | **17.8** | **18.5** | **18.0** | **18.3** |

**Table 4.** Soil moisture after irrigation, 75-75-65% relative to LFMC.

| Layers, cm | Irrigations | | | | | |
|---|---|---|---|---|---|---|
| | **Option 4** | **Option 5** | **Option 6** | **Option 10** | **Option 11** | **Option 12** |
| 0-10 | 13.2 | 14.9 | 12.4 | 14.0 | 12.6 | 13.1 |
| 10-20 | 15.6 | 15.2 | 14.0 | 15.1 | 13.9 | 14.2 |
| 20-30 | 16.1 | 16.3 | 15.9 | 15.5 | 14.2 | 15.3 |
| 30-40 | 16.3 | 16.2 | 16.9 | 15.8 | 16.8 | 16.4 |
| 40-50 | 17.2 | 17.9 | 18.0 | 16.7 | 17.4 | 18.2 |
| 50-60 | 19.5 | 19.4 | 18.8 | 17.4 | 19.0 | 18.9 |
| 60-70 | 19.6 | 19.7 | 19.2 | 18.8 | 19.8 | 20.1 |
| 70-80 | 19.9 | 19.9 | 19.8 | 19.2 | 20.0 | 20.3 |
| 80-90 | 20.2 | 20.0 | 20.2 | 19.8 | 20.6 | 20.7 |
| 90-100 | 21.0 | 20.8 | 20.4 | 21.1 | 20.8 | 20.9 |
| | | | | | | |
| **0-30** | **14.9** | **15.4** | **14.1** | **14.8** | **13.5** | **14.2** |
| **0-50** | **15.6** | **16.0** | **15.4** | **15.4** | **14.9** | **15.4** |
| **0-70** | **16.7** | **17.0** | **16.4** | **16.1** | **16.2** | **16.6** |
| **0-100** | **17.8** | **18.0** | **17.6** | **17.3** | **17.4** | **17.8** |

In order to keep the soil moisture before irrigation at 70-70-60% of the limited field moisture capacity, Nafis and Orzu varieties of soy were used once during the application period, and soy to maintain the pre-irrigation soil moisture at 75-75-60% of the limited field moisture capacity. varieties were required to irrigate 2 times. Irrigation terms and norms of soybean varieties are irrigated in all options 1, 4, 7, and 10, depending on the amount of soil moisture in the layer 0-50 cm before flowering, 0-70 cm during the formation of pods and 0-50 cm during ripening. In options 2, 5, 8, and 11, depending on the amount of soil moisture in the layer 0-50 cm before flowering, 0-50 cm during the formation of pods and 0-50 cm during ripening, in rows 3, 6, 9, and 12 irrigated with film between rows and 0-30 cm before flowering, 0-50 cm during the formation of pods and 0-30 cm during ripening, depending on the amount of soil moisture in the layer.

Nafis variety of soybean In all irrigated options, 375-600 $m^3$/ha of water was used for each irrigation, and the norm of seasonal irrigation was 600-900 m3/ha. In the case of intermittently irrigated soy varieties of Nafis, 335-425 $m^3$/ha of water was used for each irrigation, and the norm of seasonal irrigation was 425-680 $m^3$/ha.

In the case of mulched irrigation between rows of soy, 195-345 $m^3$/ha of water was used per hectare, and 260-540 $m^3$/ha during the season. The Orzu variety of soy uses 375-615 $m^3$/ha for each irrigation in all irrigated options, 615-935 $m^3$/ha during the season, 335-435 $m^3$/ha for each irrigation in the soy irrigated options, and the seasonal irrigation norm is 435-710 $m^3$/ha, in the case of mulched irrigation between the rows of soy, 210-265 $m^3$/ha of water was used per hectare, and 265-560 $m^3$/ha was used during the season.

Nafis variety of soybean saves 175-220 $m^3$/ha (27-29%) of water per irrigation in the case of inter-irrigated options compared to all irrigated options, while 340-355 $m^3$/ha (40-56%) in the case of film-irrigated options. was found to be saved.

These figures were 180-225 $m^3$/ha (24-29%) in the inter-irrigated options of the Orzu variety of soy and 350-375 $m^3$/ha (40-56%) in the irrigated options of the soy.

In the experiment, the lowest yield in the options planted with fine soybeans was observed in the irrigated options of soybeans in the order of 70-70-60% relative to the limited field moisture capacity before irrigation with the lowest yield. The yield was 25.4-26.6 q/ha. The minimum yield in the options was 25.4-26.6 q/ha.

## 4 Conclusions

In the conditions of meadow-gray soils of Jizzakh province, the most favorable conditions for their growth and development in the care of Nafis and Orzu varieties of soy were pre-irrigation in the order of 75-75-65% of the limited field moisture content of the soil. In the experiment, the bulk weight of the soil increased slightly towards the end of the growing season and the bulk weight of the soil in the 0-50, 0-70 and 0-100 cm layers increased slightly and the soybean varieties were irrigated from all branches in the 0-50, 0-70 and 0-100 cm layers of the soil. 1.43-1.44-1.46 g/$cm^3$, while in the irrigated options covered with a film on the soy branches is 1.41-1.43-1.44 g/$cm^3$. It was found to be less dense at 01-0.02 g/$cm^3$.

While the water permeability of the soil was 1,550 $m^3$/ha in 6 hours in spring, the water permeability of the soil decreased slightly in autumn as a result of irrigation during the growing season and their norms and the passage of techniques between rows, and 1,045-1,050 $m^3$/ha was 1,105-1,245 $m^3$/ha in the irrigated options with a film between the edges.

It was found that 175-220 $m^3$/ha of 27-29% of water was saved in each irrigation in the irrigated options of the Shaf Nafis variety compared to all irrigated options, while 40-56% of water was saved in the 340-355 $m^3$/ha of film irrigated options. These figures were 24-29% for 180-225 $m^3$/ha in the inter-irrigated options of the Orzu variety of soy and 40-56% for 350-375 $m^3$/ha in the irrigated options with film coating on the soy.

In the experiment, the highest yields in the options of Nafis and Orzu soybeans were obtained from the options irrigated by covering the soil moisture in the order of 75-75-65% with respect to the limited field moisture capacity before irrigation, and the yield was 33.6-31.1 q/ha.

In the experiment, the minimum water consumption for the cultivation of 1 q of soybean was 8.4 $m^3$/q in 3 options of film soy for the owners of Nafis variety of soybeans and 9.7 $m^3$/q in the option of 9 varieties of soybeans irrigated with film.

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