Influence of seed plant systems and irrigation regulations on soil agrophysical properties of Uzbekistan

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Abstract. The world's economic situation, the growing population, the lack of food reserves, the long-running drought in Australia, which supplies the majority of the world's population with products from leguminous crops, and the rising demand for food products in nations like China and India all coexist at the same time. It will soon be necessary to cultivate grain crops in additional places. Based on this, increasing the area under food crops is necessary to ensure Uzbekistan's food security and sustainable growth. In recent years, particular focus has been placed on tasks like developing new rice varieties in Uzbekistan in accordance with various soil and climate conditions, adapting the existing ones, determining the demand for soil moisture and nutrients, and creating agro-cultivation strategies. Numerous scientific studies have been done in this area, and pertinent findings have been made. This article presents the results of studies of the influence of soybean varieties grown on the agrophysical properties of the soil in the conditions of meadow-serozem soils of the Jizzakh region in Uzbekistan.
Keywords. Meadow, serozem, soil, agrophysics, soy plant, cultivation, Uzbekistan.

1 Introduction

Meanwhile, the economic situation in the world, the increasing population, the lack of food reserves, the drought that has been going on for a long time in the country of Australia, which provides the main population of the world with products from leguminous crops, and the increasing demand for food products in countries such as China and India [1-3]. in the future, it will require the planting of grain crops in more areas. Based on this, ensuring food safety in Uzbekistan and its sustainable development requires expanding the area of food crops [4].

In the conditions of Uzbekistan, in recent years, special attention has been paid to such tasks as creating varieties of rice in accordance with different soil and climate conditions, adapting the existing ones, determining the demand for soil moisture and nutrients, and

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developing agro-cultivation measures. A number of scientific researches have been conducted in this regard and relevant conclusions have been given [5-7].

One of the important agrophysical properties of the soil is its volume mass, which indicates the layering of the soil, and its porosity is determined based on the volume mass of the soil. According to the results of the scientific research of Isaev and Kadyrov [7], in conditions of meadow alluvial, weakly saline soils of the Bukhara region of Uzbekistan, the volume mass of the soil before planting sorghum as the main crop at the beginning of the growing season is 1.34 g/cm^3 in the 0–30 cm layer, 0–50 cm layer was 1.38 g/cm^3, and by the end of the growing season, it increased by 0.01–0.03 g/cm^3. The granularity, that is, the structure of the soil, affects the movement of water and air, as well as factors such as the nutrition regime [8-10].

In the research of Nematov [8], before planting the varieties of rice, 1.20 g/cm^3 in 0-30 cm of the soil; It was 1.25 g/cm^3 at 30-50 cm, and at the end of the growing season, it was proved that it increased by 0.19 and 0.15 g/cm^3 in comparison to the initial condition in all tested options. It was found that 0.02 and 0.01 g/cm^3 were reduced when irrigation was carried out through all the furrows.

2 Materials and methods

In the research conducted in 2019-2021 in the meadow-serozem soils of Jizzakh region in Uzbekistan, the effect of irrigation of rice varieties in different irrigation methods on the volume mass of the soil was studied. When the obtained results were analyzed in the example of 2019, initially it was 1.22 g/cm^3 in the 0-30 cm layer of the soil, and it was 1.30 g/cm^3 in the sub-cultivation (30-50 cm) layer. At the end of the season, under the influence of irrigation procedures, the increase in soil volume mass was observed to change depending on the cultivar and seedling thickness. According to it, in options 1-2, where the Uzbekistan-6 variety was planted, soil moisture before irrigation was 60-65-65% relative to limited field moisture capacity (LFMC), and the volume mass of the soil was 1.28 g/cm^3 when irrigated. In the irrigation regime with LFMC 70-75-70%, the volume mass of the soil was equal to 1.30 g/cm^3.

3 Results and discussion

In the Sevinch and Selekta-201 varieties of soy, it was equal to 1.29-1.30 g/cm^3 in the cultivation layer of the soil in the first irrigation, and 1.31-1.33 g/cm^3 in the second irrigation. It can be explained by the fact that 1 less irrigation in 60-65-65% soil moisture compared to 70-75-70% irrigation method caused soil cultivation to be 0.2-0.3 g/cm^3 higher in the 0-30 cm layer. The data are presented in Table 1.

Another characteristic of the soil that determines the quality indicators is its porosity, which is an important indicator for determining the duration and rate of irrigation, and it changes in relation to the volume mass of the soil. That is, with an increase in the volume mass of the soil, its porosity decreases or vice versa.

When analyzing the data obtained in 2019, at the beginning of the season, the porosity of the soil in the cultivation (0-30 cm) layer was equal to 53.1%, but at the end of the season, it changed depending on the types of streams and irrigation methods. When studying the porosity of the soil, the specific gravity was determined to be equal to 2.65% according to the methodological manuals.

Table 1. Volumetric mass of the soil of the experimental area, g/cm^3.

Options	Soil layers, cm	2019		2020		2021	
		In the beginning of the growing season					
	0-30	1.22		1.24		1.23	
	30-50	1.30		1.32		1.31	
In the end of the growing season							
According to irrigation procedures		60-65-65%	70-75-70%	60-65-65%	70-75-70%	60-65-65%	70-75-70%
1-2	0-30	1.28		1.29		1.30	
	30-50	1.34		1.36		1.36	
3-4	0-30		1.30		1.32		1.32
	30-50		1.37		1.37		1.37
5-6	0-30	1.29		1.28		1.29	
	30-50	1.36		1.35		1.36	
7-8	0-30	-	1.31		1.30		1.32
	30-50	-	1.38		1.37		1.38
9-10	0-30	1.30	-	1.29		1.29	
	30-50	1.36	-	1.35		1.36	
11-12	0-30	-	1.33		1.31		1.31
	30-50	-	1.39		1.38		1.39

It was observed that the porosity of the soil in the varieties planted with the Uzbekistan-6 variety was equal to 51.7% in the cultivation layer and decreased by 1.39% compared to the beginning of the season. In the high 70-75-70% irrigation order, it was found that it decreased by 3.11% compared to the beginning of the season. In the Sevinch variety, it was found that it decreased by 1.77% and 2.53%, respectively, according to the irrigation procedures. In the Selekta-201 variety of soy, this indicator decreased by 2.16% in the 60-65-65% irrigation regime and by 3.29% in the 70-75-70% irrigation regime compared to LFMC (Figure 1).

The indicators recorded in the obtained results can be related to the biological characteristics of each variety and the number and rates of irrigation, as observed in the soil volume mass indicators. This principle was also confirmed in the results recorded in the second and third years of the experiments. However, the different seasonality of each year has affected the results of the study to be different, decreasing or increasing. The effects of planting systems and irrigation regimes of rice varieties on soil grain size were studied in the conditions of meadow soils.

When analyzing the obtained data according to the 2019 data of the research, at the beginning of the season fractions larger than 10 mm made up 23.4% in the 0-30 cm layer of the soil, 24.2% in the sub-cultivation layer, and the most important was 10-0.25 mm. fractions are 72.4 for soil layers; It was 71.1%. The amount of fractions smaller than 0.25 mm is at least 4.3; It was noted that it was equal to 4.8%. Hence, the amount of agronomically important fractions was found to be high and optimal for plant growth development.

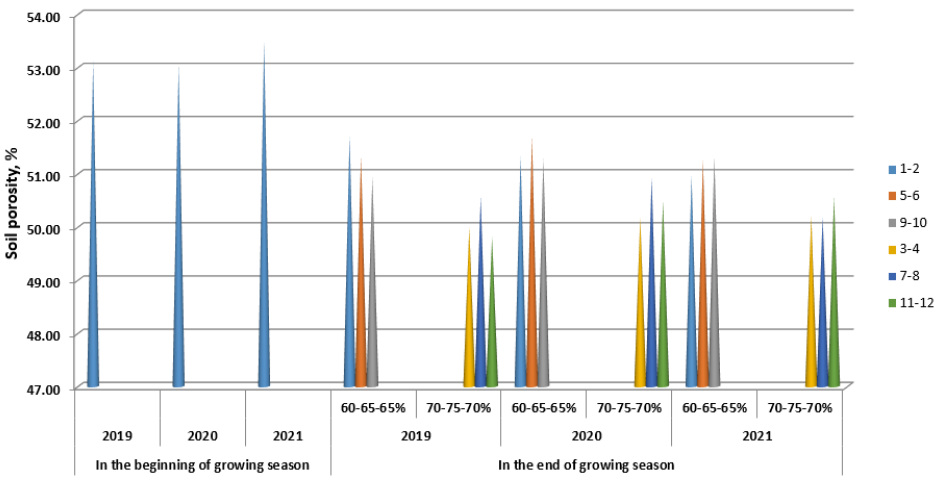

Figure 1. Influence of irrigation methods of soybean varieties on soil porosity, %

By the end of the season, soil samples were taken and analyzed to study the effect of the investigated factors on soil grain size.

Table 2. Effect of planting system of soybean varieties and irrigation methods on soil grain, %.

Options	Soil layers, cm	2019			2020			2021		
		>10	<10->0.25	<0.25	>10	<10->0.25	<0.25	>10	<10->0.25	<0.25
		In the beginning of the growing season								
	0-30	23.4	72.4	4.3	23.6	72.1	4.3	23.8	71.9	4.3
	30-50	24.2	71.1	4.8	24.4	70.8	4.8	24.6	70.6	4.8
		In the end of the growing season								
1-2	0-30	24.3	72.0	3.7	24.4	71.7	3.9	24.5	71.6	3.8
	30-50	25.2	70.7	4.1	25.2	70.4	4.3	25.4	70.3	4.3
3-4	0-30	24.9	71.2	3.9	25.0	70.9	4.1	25.1	70.8	4.0
	30-50	25.9	69.7	4.4	26.0	69.5	4.6	26.1	69.4	4.5
5-6	0-30	24.4	71.9	3.7	24.5	71.6	3.9	24.7	71.5	3.8
	30-50	25.8	70.1	4.2	25.9	69.8	4.4	26.0	69.7	4.3
7-8	0-30	25.1	71.0	3.9	25.2	70.8	4.1	25.3	70.7	4.0
	30-50	26.1	69.6	4.4	26.1	69.3	4.6	26.3	69.3	4.5
9-10	0-30	25.0	71.1	3.9	25.1	70.8	4.1	25.2	70.8	4.0
	30-50	26.0	69.7	4.4	26.0	69.4	4.6	26.2	69.3	4.5
11-12	0-30	25.8	70.4	3.9	25.9	70.1	4.1	26.0	70.0	4.0
	30-50	26.7	69.0	4.3	26.8	68.7	4.5	26.9	68.6	4.4

The amount of fractions above 10 mm increased by 0.9% compared to the beginning of the season in the cultivation layer of the soil (0-30) in variants (1-2) treated with 60-65-65%

irrigation of Soy Uzbekistan-6 variety. In the sub-cultivation layer, this indicator increased by 1.0%. Also, in the options irrigated in the 70-75-70% irrigation order, this indicator increased by 1.5-1.7%.

Compared to the beginning of the season, in the cultivation (0-30) layer, which studied the soil in fractions of 10-0.25 mm, it was observed that it decreased by 0.4% in the 60-65-65% irrigation system, and by 1.2% in the 70-75-70% irrigation system.

In the Sevinch variety of Soy, in cultivated variants, the amount of fractions larger than 10 mm was 24.4% in the cultivation (0-30) layer in the order of 60-65-65% irrigation. In addition, the amount of fractions of 10-0.25 mm size was 71.9% and the amount of fractions smaller than 0.25 mm was 3.7%. The obtained data are presented in Table 2.

When the samples were taken in the 70-75-70% irrigation order compared to LFMC, it was found to be 25.1%, 71.0%, and 3.9%, respectively. In the sub-cultivation layer, this figure was 26.1%, 69.6%, and 4.4%. It was found that when the LFMC was equal to 60-65-65%, it increased by 0.3%, 0.5%, and 0.2% compared to the irrigation regime.

Also, the increase in the thickness of seedlings does not have a significant effect on the change in the amount of fractions when treated by the double-row method.

4 Conclusions

In conclusion, the soil moisture before irrigation of the double-row method in the order of 70-75-70% compared to the LFMC increased the soil volume mass during the season from spring to autumn and from the top layer to the bottom. However, it did not have a negative effect on the growth, development, yield and other parameters of the cultivars.

The porosity of the soil is 1.77% and 2.53%, respectively, in the 0-30 and 30-50 cm layers with increasing soil moisture from 60-65-65% to 70-75-70% compared to LFMC and in the Selekta-201 variety it was observed that it decreased by 2.16%-3.29%.

In the variants maintained at 60-65-65% soil moisture before irrigation, the amount of 10 mm fractions in the cultivation layer of the soil in the Selekta-201 variety of the stream is 25%, and the amount of fractions equal to 10-0.25 mm is 71.1%, and <0.25 mm made up 3.9%. In the 70-75-70% irrigation system, these indicators were found to be 25.8%, 70.4% and 3.9%, respectively.

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