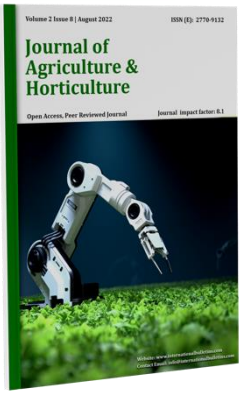

THE EFFECT OF REPEATED AND INTERCROPPED PLANTING ON COTTON YIELD IN A SHORT-ROTATION WHEAT–COTTON (1:1) CROPPING SYSTEM

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Abstract: The effect of repeated and intercropping crops on cotton yield was studied under the meadow-gray soil conditions of the Jizzakh region, located in the central part of Uzbekistan. After the winter wheat harvest, conditions were established with and without repeated cropping, where soybean was planted as the repeated crop. Against this background, sainfoin and clover were grown as intercrops, both separately and in mixed combinations. In spring, the intercrops were either mowed leaving 15–20 cm of green biomass or incorporated into the soil without mowing. The study investigated the changes in cotton yield as influenced by these treatments.

Keywords: repeated crop, soybean, intercrop, sainfoin, clover, cotton, yield.

Introduction. Using intercrops after main and repeated crops in cotton cultivation is considered one of the effective measures to improve soil fertility and cotton yield. Updating the composition of intercrops helps to increase the efficiency of this practice.

One of the fundamentals of agronomy is to widely implement crop rotation systems in agriculture to improve soil fertility and obtain higher and better-quality yields. Based on this, to achieve high crop yields under conditions of high annual temperatures and accelerated soil cultivation, it is recommended to include intercrops, repeated grain crops, leguminous grains, and cereal crops in crop rotation systems. As a result, the increase in plant residues contributes to improving soil fertility and enhancing cotton yield [1; p. 140].

In the research conducted by R. Sulaimonov, M. Nazarov, and O. Ibragimov [2; pp. 74-75], the effect of crop rotation on soil fertility and cotton yield was studied under the conditions of light-colored, dark-colored, and meadow-gray soils of the Fergana region. According to their findings, after a 3-year alfalfa stand plus the third cutting, maize was grown; following winter wheat, soybean and chickpea were planted; and rye was sown as an intercrop for one and two years, followed by incorporation as green manure in spring. The most effective variant was sowing rye followed by green manure incorporation, combined with mineral fertilization at rates of NPK 150-75-50 kg/ha. This treatment resulted in an additional cotton yield increase of 8,72 to 11,24.

Materials And Methods. Research was conducted to determine the effect of cultivating sainfoin and clover (red clover), both separately and in mixed stands as intercrops following soybean as a repeated crop, on soil fertility and cotton yield within a short-rotation 1:1 cotton:grain crop rotation system under meadow-gray soil conditions of the Jizzakh region.

One of the primary objectives of the study was to assess the impact of growing winter wheat, repeated soybean crops, and intercrops of sainfoin and clover (both separately and mixed) on soil fertility and cotton yield in the short-rotation 1:1 cotton:grain system under meadow-gray soil conditions.

The experiments were carried out from 2020 to 2022 on meadow-gray soils of the Jizzakh region. According to the groundwater distribution, the experimental field soil is classified as semi-hydromorphic, with groundwater levels fluctuating between 1,5 and 2,0 meters depth throughout the growing season.

The research was conducted under field and laboratory conditions based on the methodological guidelines outlined in the «Field Experiment Techniques» manual [3]. The reliability of the obtained data was statistically analyzed according to the «Field Experiment Methodology» manual [4].

Results And Discussions. According to data obtained from the 2021 experiment under meadow-gray soil conditions in the Jizzakh region, within the short-rotation 1:1 cotton:grain cropping system, the average cotton yield in the control variant was 34,2 centners per hectare. After winter wheat, in plots where soybean was used as a repeated crop or where the soil was left fallow (black fallow), and sainfoin and red clover were cultivated separately or in combination as intercrops, cotton yields ranged from 36,3 to 42,8 centners per hectare depending on the type of intercrop utilization. Compared to the control, this resulted in an additional cotton yield of 2.1 to 8,6 centners per hectare.

The highest yield was obtained in Variant 9, which involved the system of winter wheat + repeated crop (soybean) + intercrop (clover): cotton, where the intercrop was incorporated into the soil in spring without mowing. In this variant, the yield reached 42,8 centners per hectare, which is 8,6 centners more per hectare compared to the control. In the same system, Variant 8, where the intercrop was mowed to a height of 15–20 cm before incorporation, produced an additional yield of 7,1 centners per hectare.

When sainfoin was cultivated on black fallow background and incorporated into the soil after mowing to 15–20 cm (Variant 2), the cotton yield was 36,3 centners per hectare. In Variant 3, where sainfoin was incorporated without mowing, the yield was 37,1 centners per hectare.

Following the repeated soybean crop (Variants 4 and 5), cotton yields were 39,2 and 40,1 centners per hectare, respectively. These figures were 2,9 and 3,0 centners per hectare higher than in the variants without repeated cropping. However, compared to Variants 8 and 9, the yields in Variants 4 and 5 were lower by 2,1 and 2,7 centners per hectare, respectively.

When sainfoin and clover were cultivated as a mixed intercrop, in the background of repeated soybean cropping, cotton yield in Variant 12—where the green mass was mowed to a height of 15–20 cm before incorporation—amounted to 40,2 centners per hectare. In Variant 13, where the green mass was incorporated without mowing, the yield reached 41,4 centners per hectare. This was 3,2 and 3,4 centners per hectare higher, respectively, compared to treatments without a repeated crop. Under the same background, yields in these variants were 1,0 and 1,3 centners per hectare higher than those obtained from sainfoin alone. However, compared to clover grown alone, cotton yields were 1,1 and 1,4 centners per hectare lower.

Similar trends were observed in the data from 2022. According to these results, the average cotton yield in the control variant was 35,4 centners per hectare. The highest yield was recorded in Variant 9, where clover (red clover) was used as an intercrop after soybean and incorporated into the soil without mowing. In this case, cotton yield reached 43,4 centners per hectare, which was 8,0 centners per hectare more than the control.

Table 3.13

Effect of winter wheat, repeated soybean crop, and intercrops on cotton yield, c/ha
2020–2022

Var No.	**Crop rotation systems**	**Type of intercrop utilization**	Years			average cotton yield	additional yield, (c/ha)
			2020	2021	2022		
1	1:1. Winter wheat + black fallow : cotton	-	34,5	34,2	35,4	34,7	-
2	1:1. Winter wheat + black fallow + intercrop (sainfoin) : cotton	Harvested leaving a 15-20 cm stubble and then removed	36,5	36,3	37,9	36,9	2,2
3		Removed without incorporation	37,4	37,1	38,7	37,7	3,0
4	Winter wheat + repeated soybean crop + intercrop (sainfoin) : cotton	Harvested leaving a 15-20 cm stubble and then removed	39,5	39,2	40,2	39,6	4,9
5		Removed without incorporation	40,6	40,1	41,5	40,7	6,0
6	1:1. Winter wheat + fallow (black fallow) + intercrop (clover) : cotton	Harvested leaving a 15-20 cm stubble and then removed	37,6	38,0	39,0	38,2	3,5
7		Removed without incorporation	38,7	38,9	40,3	39,3	4,6
8	1:1. Winter wheat + repeated crop soybean + intercrop (clover) : cotton	Harvested leaving a 15-20 cm stubble and then removed	41,0	41,3	41,9	41,4	6,7
		Removed without incorporation	42,4	42,8	43,4	42,9	8,2
10	1:1. Winter wheat + fallow (black fallow) + intercrop (Sainfoin + clover) : cotton	Harvested leaving a 15-20 cm stubble and then removed	37,1	37,0	38,5	37,5	2,8
11		Removed without incorporation	38,3	38,0	39,7	38,7	4,0

12	1:1. Winter wheat + repeated crop soybean + intercrop (Sainfoin + clover) : cotton	leaving a 15-20 cm stubble and then removed	40,3	40,2	41,1	40,5	5,8
13		Removed without incorporation	41,3	41,4	42,3	41,7	7,0
		HCP_{05}=	1,08 c	1,41 c	1,35 c		
		HCP_{05}(A)=	0,75 c	1,00 c	0,96 c		
		HCP_{05}(B)=	0,63 c	0,80 c	0,78 c		
		HCP_{05}(C)=	0,75 c	1,00 c	0,96 c		

In Variant 8, where the intercrop was mown leaving 15–20 cm of biomass and then incorporated into the soil, the cotton yield was 6,5 centners/ha higher compared to the control, but 1,5 centners/ha lower than in the variant where it was incorporated without mowing. A similar trend was observed in variants where sainfoin was cultivated both separately and in combination. The obtained data are presented in Table 3.13.

Conclusion. As mentioned above, the relatively lower green mass yield of sainfoin also had an impact on cotton productivity. Accordingly, in the background without repeated cropping, where sainfoin was used as an intercrop, the cotton yield amounted to 37,9 and 38,7 centners per hectare, depending on the method of using the intercrop. In the background following repeated cropping with soybean, an additional cotton yield of 2,3 and 2,8 centners per hectare was obtained compared to the variant without repeated cropping.

In the background where intercrops were grown in mixed cultivation, the higher green mass yield compared to sainfoin sown alone also had a positive effect on cotton yield.

Thus, under the conditions of meadow gray soils, in a wheat–cotton crop rotation system, cultivating soybean as a repeated crop and using clover (Trifolium pratense) as an intercrop—either alone or in combination with sainfoin—ensures a cotton yield increase of 3,2–3,4 centners/ha compared to the variant without a repeated crop, and up to 8,6 centners/ha higher compared to the control variant in which no repeated or intercrops were grown after winter wheat. Harvesting intercrops at a height of 15–20 cm also contributes to strengthening the fodder base for livestock farming.

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