

Influence of Winter Wheat, Intermediate and Green Crops on the Growth, Development and Yield of Cotton

*Mardankul Tajiev**, and *Karim Tajiev*

Surkhandarya experimental research station of scientific research institute of selection and seed production and agrotechnology of cotton growing, Surkhandarya, Uzbekistan

Abstract. This article presents data from a field experiment conducted in the south of Uzbekistan, growth, development and fruiting, the cotton yield in one box is much better compared to the control. In this article, the tables give materials for August 1 and September 1, which can be considered more final materials. The yield of raw cotton in the control variant was 31.3 centners/ha, and the yield of cotton after harvesting winter wheat with soybeans for green manure was 35.1 centners/ha, while the maximum yield was 36.8 centners/ha. The yield of cotton after harvesting winter wheat with sowing oats on green manure is 35.3 c/ha. The data obtained indicate that the cotton harvest on the studied variants of short-rotation crop rotation, the formation of bolls of the Bukhara 102 variety occurred more intensively than on the plants of the control variant. The weight of one box in the control was 4.7-5.0 grams, and in the variants where intermediate and green manure crops were the predecessors of cotton, the weight of one box was 5.2-5.5 grams. Regarding the control, in the crop rotation variant, more income was received from the sale of raw cotton and, 600 thousand sums, where it was, formed the maximum yield and the best quality of cotton fiber.

Key words: winter wheat, intermediate and green manure crops, cotton, growth, development, raw cotton harvest in one box, September and total cotton harvest.

1 Introduction

The President of the Republic of Uzbekistan Sh.M.Mirziyayev pays great attention to the development of agriculture. In the government document "On the further development of agriculture for 2020-2030. to increase the production of agricultural products to solve the Food Program by regions, by sectors of the republic. To increase agricultural products in the country, special attention is paid to further increase in food production through the introduction of repeated, intermediate and green manure crops after harvesting winter wheat. The introduction of repeated, intermediate and green manure crops is a topical issue in the irrigated zone of the Republic of Uzbekistan [1-2].

* Corresponding author: karimgeobio@mail.ru

The implementation of the measures set by the President of the Republic of Uzbekistan is possible through the introduction of modern digital technologies in agriculture [3-7], as well as the formation of legal bases for their use [8-14] and other mechanisms of sustainable development [15-20].

Repeated, intermediate and green manure crops are additional food products, animal feed and the best predecessors of cotton, winter wheat.

The soil and climatic conditions of the south of Uzbekistan with very rich solar energy, which allows growing two or three crops of grain and fodder crops per year, which favors the use of this unit in practice. At the same time, it should be noted that the enrichment of the soil with organic matter, in turn, contributes to the preservation and increase of soil fertility.

In the agricultural literature abroad and in domestic science, there are materials on the effectiveness of repeated, intermediate and green manure crops in the irrigated region of agriculture.

A. Khalikov notes that obtaining 2-3 crops during the year increases productivity by 2-2.5 times both soil fertility and the yield of subsequent crops. A.F.Ustinovich notes that the bulk density of the soil in the range of 1.2-1.3 g/cm³ ensures a high cotton yield.

M.A. Belousov, F.I. Ismoilov, also note that the plowing of fodder crops reduces the volumetric mass of soil from 1.43 g/cm³ to 1.31 g/cm³.

American scientists H.M.Taylor, H.R.Gardner note that a high bulk density negatively affects the root system of plants, and ultimately the plants die.

M. Mukhammadzhanov, M.U. Umarov note that the optimal indicator for normal growth and development of cotton is the volumetric weight in the range of 1.1-1.3 g/cm³.

H.S. Romanov note that at the end of the growing season soybeans accumulate 35-40 c/ha of plant residues and enrich with biological nitrogen 130-150 kg per hectare.

The German scientist I.Volger notes that intermediate crops enrich the soil with organic matter.

Yu.G.Koryagin, who conducted the experiment in the conditions of Kazakhstan, came to the conclusion that soybean improves the agrophysical and agrochemical properties of the soil, enriches the soil with 300 kg/ha of biological nitrogen.

To achieve this goal, it is necessary to note the role of the intensification of agricultural production on the general rise in the culture of agriculture, extensive chemicalization, melioration, efficient use of irrigated lands, improvement of selection and seed production, development of cotton crop rotations [21, 22].

Academician D.N. Pryanishnikov attached great importance to winter green manure on irrigated lands. He pointed out that it would be desirable in the future not to leave empty fields for the winter, so that every ray of the autumn and early spring sun would be used to enrich the soil with nitrogen and organic matter [23].

Short-rotation crop rotations are an essential part of farming. They determine the directions and rational combination of various branches of production to ensure the maximum yield of the main crop of the fodder field at the lowest cost of labor and material resources [24].

One of the most important elements of a proper farming system is the introduction of rational crop rotations in relation to each soil-climatic zone [25-32].

The integrated development of all branches of agriculture is possible on the basis of improving the culture of farming, through the use of a scientifically based system for the introduction of farming in farms and clusters [33-34]. This will ensure the harmonious development of all sectors of production, and above all, cotton growing and animal husbandry, while the implementation of such measures as the rational use of irrigated lands, improving the structure of sown areas and the use of the most rational crop rotation systems will be of great importance.

The existing structure of sown areas in Uzbekistan does not allow the development of cotton-alfalfa crop rotations, where the application of high doses of local fertilizers is limited, which leads to a decrease in humus in the soil and a loss of land quality. To preserve and increase soil fertility, it is necessary to sow after wheat, repeated and intermediate crops, which provide an increase in soil fertility and farming culture in farms of the Republic of Uzbekistan.

2 Materials and methods

Field experiments to study the effectiveness of repeated, intermediate and green manure crops sown after harvesting winter wheat on soil fertility and after the impact on the cotton crop were carried out according to the method developed at the Uzbek Research Institute of Cotton Growing (1976), and also the “Methods for conducting field experiments” were used. with cotton (2007), and the methodology of “State variety testing of agricultural crops” (1981), Field and laboratory studies were carried out in 2012-2014 on the experimental farm of the Surkhandarya scientific and experimental station of the NIISAVKh in conditions of takyrl-like soils. After harvesting winter wheat, irrigation was carried out for high-quality tillage for sowing intermediate and green manure crops. After the soil was sown, the fields were loosened with chisels twice, then the layout was carried out, followed by the sowing of seeds of legumes and grain crops. According to the mechanical composition, the soils of the experimental plot are classified as heavy loamy, with a close occurrence of groundwater.

The soils of the experimental plot are saline, poorly supplied with humus and other nutrients, and rich in carbonates (8-10%). The experiment was carried out in three repetitions, the plot area was 360 m², with a length of 33.3 m and a width of 9.6 m. The total area of the experimental plot was 1.5 ha.

3 Results and discussions

The research results show that leguminous and grain crops sown after harvesting winter wheat as secondary, intermediate and green manure crops affect the growth and development of cotton in different ways (Table 1-2).

Plant height on September 1 in the control variant was 81.0-87.2 cm, fruit branches 14.1-15.2 pcs, the number of elements 12-13 pcs, of which 9.5-10.5 bolls, of which opened 8.4-9.3 pcs, plant density 76.3-90.0 thousand plants per 1 hectare, and experimental variants plant height 85.0-97.5 cm, fruit branches 14.0-16.1 pcs, fruit elements 12.6-15.0 pcs, of which bolls 8.4-11.1 pcs, number of bolls 8.4-11.0 pcs, of which open bolls 8.4-9.7 pcs, plant density 76 0-89.1 thousand plants per hectare.

In the second half of October, winter wheat of the Termiz-5 variety was sown. After sowing, cutting furrows for irrigation was carried out, which ensures the receipt of friendly shoots of winter wheat. Phenological observations were carried out before harvesting, and where the height of winter wheat plants was 97.0-98.5 cm, the number of leaves 5.4-5.7 pieces, the length of the ear 9.5-9.7 cm, the weight of one ear 1, 2 g, the number of grains in one ear is 38-41 pcs, the weight of grain in one ear is 1.2 g and the absolute weight of 1000 seeds is 39.8 g. Including the total number of stems per 1 m² 489.5 pcs, of which the number of productive stems 481.5 pcs. The average grain yield of winter wheat is 55.6 c/ha, root and stubble residues in the arable layer of soil are 43.7 c/ha. The harvest of catch crops was harvested for livestock feed, and green manure crops were crushed.

As a result, studies have established that the best growth and development of cotton was noted after winter wheat and soybeans for green manure by 40 cm and winter wheat and

oats for green manure by 40 cm compared with controls. In these green manure variants (6, 7, 8), the plant height is 8.5-10.0 cm, the number of fruit elements is 1-2 pcs, the number of pods is 1.6-2.1 more than in the control variant.

Table 1. Influence of winter wheat, repeated and green manure crops on the growth, development and fruiting of cotton
 (Data for 2016)

№	Options	August 1						September 1					
		plant height, cm	fruit-branches, pcs	fruit elements, pcs	of which box-barrels, pcs	plant height, cm	fruit branches, pcs	fruit elements, pcs	of which box-barrels, pcs	of which disclosed, pcs	standing density, thousand/ha		
1	Cotton after winter wheat (control)	80.0	14.0	13.2	9.4	81.0	14.0	12.0	9.5	8.4	76.0		
2	Cotton after winter wheat and soybeans	84.0	14.1	13.1	10.1	85.0	14.0	12.5	10.4	8.4	76.0		
3	Cotton after winter wheat and soybeans on green manure	85.6	14.6	13.5	11.0	87.0	14.6	12.7	11.1	8.3	75.0		
4	Cotton after winter wheat and oat sowing	88.0	14.6	13.3	11.5	86.0	14.0	12.6	10.7	9.0	75.5		
5	Cotton after winter wheat and sowing oats on green manure	87.0	14.7	13.6	11.3	88.0	14.5	13.6	11.4	10.1	75.1		
6	Cotton after winter wheat and soybeans	84.0	14.9	13.6	10.4	85.5	14.9	13.0	10.7	9.7	74.0		
7	Cotton after winter wheat and oat sowing	85.0	14.2	13.5	11.0	87.0	14.2	13.0	11.0	10.0	75.0		
8	Cotton after winter wheat and soybeans on green manure	86.0	14.5	14.0	11.7	88.0	14.5	14.8	11.7	10.5	74.5		
9	Cotton after winter wheat and sowing oats on green manure	85.8	14.4	13.6	11.0	86.9	14.4	13.0	10.3	10.0	75.0		

Winter wheat, repeated and intermediate crops and green manure contributed to an increase in the yield of raw cotton in one box, September and the total yield of raw cotton in comparison with the cotton control (3, 4, 5 tables).

The yield of raw cotton in one box at the first harvest is higher (6.1-6.5 g) compared to the second harvest of raw cotton (3-table).

Relatively large boxes (5.7-6.5) were on green manure (3, 5, 7, 9) variants in comparison with the control. The average weight in one box in the control was 4.7-4.8 grams, the average weight in one box of raw cotton, the yield of green mass of intermediate crops (2, 4, 6, 8) was used for livestock feed, and the maximum cotton yield was raw in one box marked, where the yield of green mass of intermediate crops (soybeans, oats) on green manure (3, 5, 7, 9 var.). 5.1-5.4 grams, the average yield of raw cotton for two years on average in the control was 31.3 q/ha (4-5 tables). The yield of raw cotton on options where the green mass of intermediate crops (soybeans, oats) was used for feed in livestock (2, 4, 6) yield is 1.6-2.0 c/ha higher, and where the green mass of the intermediate crop was used (3, 5, 7, 9 var.) on green manure 3.4-6.1 c/ha higher than in the control. In addition, green manure plowing is 1.4-3.1 q/ha higher than that used for livestock feed.

Where the crop of green mass of the intermediate crop was used for livestock feed after green manure, the cotton yield is 1.6-3.8 centners/ha higher than in the green manure options. The yield of raw cotton on green manure variants (3, 5, 8, 9) is 3.0-5.5 q/ha higher than on the control variant.

Table 2. Influence of winter wheat, repeated and green manure crops on the growth, development and fruiting of cotton
 (Data for 2017)

№	Options	August 1						September 1					
		plant height, cm	fruit-branches, pcs	fruit elements, pcs	of which box-barrels, pcs	plant height, cm	fruit branches, pcs	fruit elements, pcs	of which box-barrels, pcs	of which disclosed, pcs	standing density, thousand/ha		
1	Cotton after winter wheat (control)	79.9	14.9	14.9	10.3	87.2	15.2	13.0	10.5	9.3	90.0		
2	Cotton after winter wheat and soybeans	81.4	15.5	15.6	10.3	91.5	16.0	13.5	11.8	9.7	91.0		
3	Cotton after winter wheat and soybeans on green manure	91.3	16.2	16.4	11.0	94.0	16.2	13.7	11.9	9.5	89.5		
4	Cotton after winter wheat and oat sowing	87.8	15.8	15.9	10.9	91.2	15.7	13.4	11.0	9.8	89.1		
5	Cotton after winter wheat and sowing oats on green manure	91.4	15.6	15.7	11.2	95.8	16.2	13.9	11.6	9.7	90.9		
6	Cotton after winter wheat and soybeans	85.6	15.6	15.8	11.0	91.2	15.9	13.3	11.0	9.5	91.0		
7	Cotton after winter wheat and oat sowing	89.9	15.5	15.6	11.4	95.5	16.0	13.8	11.1	9.5	90.7		
8	Cotton after winter wheat and soybeans on green manure	87.8	15.5	15.5	11.0	97.5	16.1	15.0	11.2	9.7	90.4		
9	Cotton after winter wheat and sowing oats on green manure	92.0	15.9	15.8	11.3	96.5	16.2	14.5	11.3	9.6	90.7		

Table 3. Influence of winter wheat, repeated and green manure crops on the yield of raw cotton in one box, in gr.

№	Options	2016			2017		
		harvest			harvest		
		the first	second	average	the first	second	average
1	Cotton after winter wheat (control)	6.1	4.0	5.0	5.6	3.8	4.7
2	Cotton after winter wheat and soybeans	6.2	4.1	5.1	5.7	3.9	4.8
3	Cotton after winter wheat and soybeans on green manure	6.3	4.3	5.1	6.1	4.1	5.1
4	Cotton after winter wheat and oat sowing	6.2	4.2	5.2	5.9	4.0	4.9
5	Cotton after winter wheat and sowing oats on green manure	6.5	4.3	5.4	6.2	4.1	5.1
6	Cotton after winter wheat and soybeans	6.4	4.3	5.4	6.1	4.1	5.1
7	Cotton after winter wheat and oat sowing	6.5	4.5	5.5	6.2	4.3	5.2
8	Cotton after winter wheat and soybeans on green manure	6.4	4.2	5.3	6.1	4.0	5.0
9	Cotton after winter wheat and sowing oats on green manure	6.5	4.4	5.4	6.2	4.2	5.2

Table 4. Influence of winter wheat, repeated and green manure crops on the yield of raw cotton

№	Options	Years		Average yield, c/ha	Deviation from control	
		2016	2017		c/ha	%
		1	Cotton after winter wheat (control)	31.0	31.7	31.3
2	Cotton after winter wheat and soybeans	33.0	32.9	32.9	1.6	5.1
3	Cotton after winter wheat and soybeans on green manure	34.4	34.2	34.3	3.0	9.6
4	Cotton after winter wheat and oat sowing	32.6	33.6	33.1	1.8	5.7
5	Cotton after winter wheat and sowing oats on green manure	35.5	35.1	35.3	4.0	12.8
6	Cotton after winter wheat and soybeans	34.1	33.9	34.0	2.7	8.6
7	Cotton after winter wheat and oat sowing	34.3	34.2	34.0	3.0	9.6
8	Cotton after winter wheat and soybeans on green manure	35.3	34.8	35.1	3.8	12.0
9	Cotton after winter wheat and sowing oats on green manure	37.3	36.4	36.8	5.5	17.5

Table 5. Economic efficiency of winter wheat, repeated and green manure crops in the system of short-rotation crop rotation

№	Options	Average yield of raw cotton, c/ha	Deviations from control, c/ha	Purchase price of cotton, c/ha	Cotton production costs, c/ha	Conditionally net profit, thousand/ha	The degree of profitability, %
1	Cotton after winter wheat (control)	31.3	-	4686.3	4256.8	429.0	10.1
2	Cotton after winter wheat and soybeans	32.9	1.6	4701.2	4074.4	602.7	14.8
3	Cotton after winter wheat and soybeans on green manure	34.3	3.0	5151.7	4347.1	804.0	16.5
4	Cotton after winter wheat and oat sowing	33.1	1.8	4971.6	4281.0	680.0	15.9
5	Cotton after winter wheat and sowing oats on green manure	35.3	4.0	5302.0	4444.5	917.0	20.6
6	Cotton after winter wheat and soybeans	34.0	2.7	5106.0	4307.6	780.0	15.5
7	Cotton after winter wheat and oat sowing	34.0	2.7	5106.0	4305.6	775.0	21.3
8	Cotton after winter wheat and soybean sowing on green manure	35.1	3.8	5272.0	4357.8	930.0	22.3
9	Cotton after winter wheat and sowing oats on green manure	36.8	5.5	5527.4	4493.1	1034.0	23.0

The economic efficiency of winter wheat, intermediate and green manure crops in the system of short-rotation crop rotation is shown in Table 5. The average yield of raw cotton in the experiment was 34.1 q/ha. The purchase price of cotton by options amounted to 4686.3-5527.4 sums. The cost of cotton production is 4256.8-4493.1 soums per hectare, and the conditionally net profit in the control amounted to 499.0 thousand soums, and in the control options 602.7-1034.0 thousand soums. Conditionally net income per degree of profitability production, where the green mass of the intermediate mass was used for livestock feed, especially for green manure, is significantly higher in comparison with the control.

The profitability of production on the control is 10.1%, on options where the green mass of intermediate crops was used for livestock feed 14.8-20.3%, and where the green mass of intermediate crops was used for green manure 16.5-23.0 %.

4 Conclusion

In conclusion, it can be noted that the best predecessors of cotton turned out to be winter wheat with intermediate sowing of soybeans, broad-leaved oats, which contributed to an increase in the yield of raw cotton by 3.0-5.5 c/ha. When sowing green manure crops after winter wheat (soybeans, oats), the yield was also increased by 3.0-5.5 c/ha or 12.8-17.5% compared to the control.

To preserve and increase the fertility of takyr-like soils of the Surkhan-Sherabad Valley after winter wheat, we recommend sowing leguminous and grain crops as intermediate and green manure crops. Green manure crops were more effective than intermediate crops with green mass harvesting. Green manure crops gave an increase in the yield of raw cotton by 4.0-5.5 c/ha higher than the control variant.

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