INFLUENCE OF OIL CROPS SOWN AFTER WINTER WHEAT ON SOIL FERTILITY AND THE YIELD OF THIN FIBERED COTTON

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Annotation. In the extreme climate and takyr-like low-humus soils of the Surkhandarya region, located in the southernmost desert zone of Uzbekistan, the study of the influence of winter wheat and repeatedly sown oilseeds on soil fertility, wilt of fine-fiber cotton, and cotton yield under short-rotation crop rotation is the most pressing problem of agriculture. As a result of the accumulation of organic substances in winter wheat and various oilseeds sown after it and their mineralization, an increase in soil humus and other nutrients, soil fertility, improvement of the agrophysical and agrochemical state of the soil, and a decrease in the damage caused by wilt, as a result of which the cotton yield of fine-fiber cotton increased by 4.5-5.5 t/ha^{-1} compared to the control, and the level of profitability of the farm increased by 20-25%.

Keywords. Winter wheat, short-rotation crop rotation, repeated oilseeds, soybeans, sunflower, peanuts, safflower, sesame, soil moisture, density, water permeability, agrochemical properties, fine-fiber cotton, yield, wilt disease, etc.

Log in. In the conditions of the southern extreme climate of our republic, water shortage, abnormally hot weather, and persistent hot winds, obtaining high yields from irrigated lands is a problem. In an era of rapid population growth, ensuring food security is a pressing issue. In such conditions, the importance of growing 2-3 crops from irrigated areas is invaluable.

Scientists of our country and foreign countries have conducted numerous scientific research on improving soil fertility, especially its agrophysical properties, under conditions of crop rotation and short-term crop rotation. It is known that the agrophysical properties of the soil are one of the important factors influencing the growth and development of plants, as well as the accumulation of high yields and product quality.

On highly fertile soils, high yields and high-quality products are grown from all agricultural crops in any weather conditions. However, low yields and low-quality agricultural products are grown on low-fertility soils.

In recent years, unjustified management of agriculture has led to imbalances in the structure of agriculture [Gao, C. et al. 2019; Huang, D. 2007]. Long-term sowing of the same crop leads to a serious deterioration in soil quality [Zhu, S.W. et al 2022], a negative impact on the growth and development of crops, a decrease in the accumulation of organic matter in the soil, an increase in cotton yield by 2.6-4.5% compared to continuous sowing [Li, Y.H. et al. 2012], a decrease in photosynthesis [Wang, C.B. et al. 2007], an increase in pests and diseases [Liu, W. et al. 2015; Afrin, S. et al. 2017] and thus leads to a decrease in crop yields [Zhu, S.W. et al 2022].

It has been established that repeated, intermediate, and green manure crops sown after winter wheat increase soil fertility by 0.08-0.10%, and cotton yield by 19.4-26.6% compared to the control [M.Tadjiev, K.M.Tadjiev, 2015].

It has been established that winter wheat and repeated and green manure crops sown in the short-term crop rotation system ensured vigorous growth of fine-fiber cotton, significantly reduced cotton wilt and root rot diseases, and the cotton yield in the experimental variants was 0.40-0.55 t/ha^{-1} higher compared to the control [M.Tadjiev, K.M.Tadjiev; (2013].

It has been established that winter wheat and repeated oilseeds in the short-term crop rotation system contain a large amount of macro- and microelements in the stubble and root residues, after which cotton is sown, soil fertility improves, cotton growth is guaranteed, and high cotton yields and quality fiber are obtained [M.Tadjiev, K.M.Tadjiev, Sh.Ch.Tursunov; 2014].

As a result of improving the agrochemical, agrophysical, meliorative, and ecological state of the soil, it has been proven that winter wheat and repeatedly sown repeated, intermediate, and green manure crops lead to vigorous growth of cotton crops and an additional cotton yield of 0.51-0.33 t/ha^{-1} compared to the control [M.Tadjiev, K.M.Tadjiev; 2013].

It has been established that repeated, intermediate, and green manure crops sown after winter wheat increase soil humus by 0.8-0.10% and cotton yield by 19.4-26.5% compared to the control [M.Tadjiyev, K.M.Tadjiyev; (2013).

In sustainable agriculture, crop rotation and intermediate crops are used worldwide to increase crop yields [David, T. et al. 2011]. It has been proven that crop rotation effectively reduces unfavorable conditions and increases yields [Johnson, A.W. et al. 2000].

After the harvest of the main crops, the possibility of obtaining two harvests per year with the sowing of intermediate crops arises, while simultaneously reducing the sowing of the same crop. It has been established that in crop rotation, the main crops have a higher yield compared to intermediate crops [Cheriere, T. Et al. 2020; Li, L. et al. 2021).

Cotton cultivation is carried out on five continents in different agro-climatic conditions, with different yield levels and negative effects of cultivation [Mao, L.L. et al. 2015]. The development of productive and sustainable, environmentally efficient crop systems in cotton fields is of great importance for increasing yields and economic benefits. Crop rotation is a planned sequence of several crop types grown in a repeating sequence on the same land area [Liu, C. Et al. 2022]. Cotton-based crop rotation is an important way to increase yields in agroecosystems.

Replacement also stimulates vegetative and reproductive growth of cotton and increases plant height; the number of true leaves, fruit branches, squares and buds; and bud weight [Qi, H. et al. 2016].

Cotton-based crop rotation also increases profitability, which is a key factor influencing farmers' decisions on applying the crop rotation system [Dhaliwal, N.S. et al. 2015, Feng, L. et al. 2017]. Cotton → wheat crop rotation yields 25% higher gross profit than continuous crops due to lower production costs [Forster, D. et al. 2014]. Cotton → legume crop rotation is widely used in Australia and India due to increased profitability [Turkhede, A.B. et al. 2017; Williams, E.J. et al. 2011). Thus, productivity and economic benefits in cotton-based crop rotations are higher than in continuous cotton, especially in legume crop rotations.

Crop rotation increases microbial biomass by 21% [McDaniel, M.D. et al. 2017]. Changes in the structure of microbial communities are also associated with differences in the diversity of crop rotation [Alvey, S. et al. 2003; Johnson, M.J. et al. 2003; Yin, C. et al. 2010]. The diversity of crop rotation increases the diversity of microbial communities and the relative abundance of fungi relative to bacteria [González-Chávez, M.D.C.A.et al. 2010, Suzuki, C.et al. 2012].

For example, in the cotton→spring wheat→replanted→fodder rapeseed crop rotation system, the level of net photosynthesis of cotton increases by 44.88% compared to continuous sowing to 50.37%, and the efficiency of light energy use increases by 18.82% to 59.17% [Zhang, Z.Q.et al. 2022].

Mixed sowing is a method of sowing at least two crops in rows or strips in one season [Li, L. et al. 2014].

Cotton-based mixed crop planting systems are a promising strategy for sustainable cotton production, especially for small landowners [Tariq, M. et al. 2018]. Wide row spacing, slow growth at the initial stage, and a relatively long growing and development period make cotton suitable for sowing mixed crops [Surendran, U. et al. 2016].

Research Methods. Phenological observations were carried out in accordance with the methodological guidelines “Methodology for Conducting Field Experiments” and “Methodology of Field Experiments with Cotton” of the Uzbek Research Institute of Cotton Growing. The “Methodology for Conducting Agrophysical, Agrochemical, and Microbiological Research” and “Methodology for State Variety Testing of Agricultural Crops” were used, and yield indicators were mathematically processed according to the method of B.A. Dospekhov.

Research results. In our studies, the influence of winter wheat and repeated oilseed crops on growth, development, yield, stubble and root formation, and the agrophysical and agrochemical properties of the soil was determined. It was established that when sowing fine-fiber cotton on fields freed from winter wheat and repeated oilseed crops, it has a positive effect on the growth, development, and cotton yield. When sowing fine-fiber cotton on fields freed from winter wheat and repeated oilseed crops, an increase of 0.45-0.55 t/ha^{-1} compared to the control field, a decrease in cotton wilt by 1.8 times, a decrease in the number of weeds by 2.2 times, and an improvement in soil fertility were fully proven in the conducted research.

In the conducted studies, it was established that winter wheat and repeatedly sown oilseeds accumulate different amounts of stubble and roots in the plowed (0-30 cm) and sub-plowed (30-50 cm) soil layers.

The root and stubble residues of oilseeds sown after winter wheat enrich the soil with humus and improve the water-physical properties of the soil, increasing soil fertility. Organic substances not only increase soil fertility, but also radically improve the meliorative, ecological, and microbiological state of the soil. Improves soil structure, restores its granularity, and increases porosity.

Organic matter residues (leaves, stems, stubble and roots), manure compost increase the amount of humus in the soil, as a result of which soil fertility is preserved and increased. Cultivating cotton and winter wheat on fertile soils increases yields and improves product quality.
According to the results of the conducted research, it was established that different oilseed crops sown after winter wheat accumulate stubble and roots at different rates.
It was established that repeatedly sown agricultural crops accumulate fewer roots in the subsoil layer compared to the plow layer.

When sowing soybeans after winter wheat, 0.02 t/ha^{-1}, sunflower 0.018 t/ha^{-1}, peanuts 0.013 t/ha^{-1}, sesame 0.019 t/ha^{-1}, and safflower 0.019 t/ha^{-1} of roots were collected in the subsoil layer.

The combined accumulation of stubble and root residues by oilseeds sown on winter wheat and stubble is shown in the table.

Table 1
Root and stubble accumulation of winter wheat and repeated oilseeds, t/ha^{-1}

N	Options	Winter wheat, t/ha^{-1}			Repeated crops t/ha^{-1}		Stem crops 0-50 cm, t/ha^{-1}	Total winter wheat and stubble crops in the 0-50 sm soil layer, t/ha^{-1}
		0-30 sm	30-50 sm	0-50 sm	in the 0-30sm soil layer	in the soil layer of 30-50 sm		
1.	Winter wheat (control)	4.27	0.29	4.56	-	-	-	4.56
2.	After winter wheat - soybeans	4.27	0.29	4.56	3.44	0.20	3.64	8.20
3.	After winter wheat - sunflower	4.27	0.29	4.56	3.84	0.18	4.02	8.58
4.	Peanut after winter wheat	4.27	0.29	4.56	2.42	0.13	2.55	7.11
5.	After winter wheat - sesame	4.27	0.29	4.56	3.39	0.19	3.59	8.15
6.	After winter wheat - safflower	4.27	0.29	4.56	3.41.	0.19	3.60	8.16

According to the table data, in the 0-50 sm soil layer, winter wheat accumulated 4.56 t/ha^{-1} of organic matter, winter wheat and soybeans together 8.20 t/ha^{-1}, winter wheat and sunflower 8.58 t/ha^{-1}, winter wheat and peanut 7.11 t/ha^{-1}, winter wheat and sesame 8.15 t/ha^{-1}, and winter wheat and safflower 8.16 t/ha^{-1}.

In conclusion, it was established that oilseeds sown in stubble after winter wheat accumulate almost twice as much organic matter as a single crop of winter wheat.

Knowledge of the chemical composition of agricultural crops is of great importance. The stubble and root residues left by plants enrich the soil with organic matter. From this point of view, the analysis of the chemical composition of stubble and root residues of plants has practical and theoretical significance.

When analyzing the chemical composition of plants at the end of the growing season in the experiment, the lowest nitrogen content (0.38%) was found in winter wheat straw, and the high nitrogen content in soybeans, peanuts, sunflowers, sesame, and safflower was 3.22-3.77%.

The phosphorus content in plants was 1.0-1.64 percent, while the phosphorus content in sunflower and safflower was 0.12-0.64 percent lower compared to other crops, potassium was 0.75-1.10 percent, and the potassium content in sunflower was slightly higher compared to other crops and amounted to 3.0 percent.

The nitrogen content in the stubble and roots of plants was 0.310-2.77%, and the highest nitrogen content was observed in legumes (soybeans and peanuts) - 2.24-2.77%. It was established that the nitrogen content in the stubble and root residues of winter wheat was 0.31%. The amount of phosphorus and potassium in the stubble and roots of winter wheat was relatively high.

Table 2
Agrochemical composition of plants, in percent

No	Experimental options	Chemical composition, percent		
		Nitrogen	Phosphorus	Potassium
1.	Winter wheat	0.380	1.20	1.21
2.	After winter wheat - shade	3.74	1.64	0.93
3.	Peanut after winter wheat	3.77	1.12	1.12
4.	Sunflower after winter wheat	3.55	1.00	3.00
5.	After winter wheat - sesame	3.22	1.24	1.26
6.	After winter wheat - safflower	3.33	1.00	0.75
Composition of stubble and roots, percent				
1.	winter wheat	0.310	1.16	1.15
2.	After winter wheat - shade	2.24	0.95	1.05
3.	Peanut after winter wheat	2.77	1.12	1.05
4.	Sunflower after winter wheat	0.72	0.70	0.75
5.	After winter wheat - sesame	0.75	0.95	0.94
6.	After winter wheat - safflower	0.72	0.60	0.94

The data on the content of potassium in the root and stubble residues of plants (0.75-1.15%) did not differ significantly.

It can be concluded that leguminous crops (soybeans and peanuts) are rich in nitrogen. Although there was no significant difference in the amount of phosphorus and potassium in the composition of plants, it was found that the amount of potassium in the composition of sunflower plants is higher than in other oilseeds.

In the conducted experiment, the influence of various oilseeds sown after winter wheat on the cotton yield was determined (Table 3).

In the control variant with cotton sowing, the average cotton yield was 3.13 t/ha^{-1}, while in the control field sown after winter wheat, this indicator was 3.24 t/ha^{-1}.When sowing soybeans after winter wheat and sowing cotton the following year, a cotton yield of 3.76 t/ha^{-1} was obtained, which is 0.63 t/ha^{-1} more compared to the control variant with cotton sowing, and 0.52 t/ha^{-1} more compared to the control variant with cotton sowing after winter wheat.

When sowing sunflower, sesame, peanuts, safflower after winter wheat and sowing cotton the following year, the average yield was 3.40; 3.44; 3.57 and 3.44 t/ha^{-1}, respectively, compared to the control variant with cotton sowing, the average cotton yield was 0.27; 0.31; 0.44 and 0.31 t/ha^{-1}, respectively, and 0.16; 0.20; 0.33 and 0.20 t/ha^{-1} respectively.

Table 3
Influence of various oilseeds sown after winter wheat on cotton yield, t/ha^{-1}

No	Experimental options	collections		Average	Difference from the control, t/ha^{-1}			
		2.X.	30.X		After winter wheat		After cotton	
					t/ha^{-1}	percent	t/ha^{-1}	Percent
1.	Winter wheat	3.0	0.13	3.13	-	-	-	-
2.	Cotton (control)	3.07	0.17	3.24	-	-	0.11	0.40
3.	Stem shade	3.53	0.23	3.76	0.63	1.60	0.52	2.01
4.	Sunflower for stubble	3.23	0.17	3.40.	0.27	0.49	0.16	0.86
5.	Sesame for stubble	3.27	0.17	3.44	0.31	0.62	0.20	0.99
6.	Peanut for stubble	3.37	0.20	3.57	0.44	1.02	0.33	1.41
7.	Straw safflower	3.27	0.17	3.44	0.31	0.62	0.20	0.99

SR_{05}=0.12 t/ha^{-1}
SR_{05}=2.31%

In the experiment, after sowing oilseeds after winter wheat, cotton was sown and cultivated the following year, and the influence of cotton on wilt was studied (Table 4).
It was established that oilseeds sown after winter wheat are infected with wilt in all variants at the end of budding and cotton growth. Signs of wilt disease (yellow wilting of leaves) were determined by the condition of the plants in the budding phase and by cutting the plant stem at the end of the growing season.
In the control variant, cotton was infected with 5.0% wilt during the budding period and 7.0% at the end of the growing season. In the control field, where cotton was sown after winter wheat, these indicators were 2.0% and 3.0%, respectively.

Table 4
Cotton wilt infection of oilseeds sown after winter wheat, %

No	Experimental options	Contamination by wilt			
		In the budding phase		End of the growing season	
		Plant density	Including morbidity, %	Number of plants	Including morbidity, %
1.	Cotton (control)	100	5.0	100.	7.0
2.	Cotton after winter wheat (control)	100	2.0	100.	3.0
3.	Cotton after winter wheat + soybeans	100	1.0	100.	1.5
4.	Cotton after winter wheat + sunflower	100	1.0	100.	1.0
5.	Cotton after winter wheat + sesame	100	1.0	100.	1.5
6.	Cotton after winter wheat + peanuts	100	-	100.	1.0
7.	Cotton after winter wheat + safflower	100	1.0	100.	1.0

When sowing soybeans after winter wheat and sowing cotton the following year in the budding period of cotton 1.0%, at the end of the growing season 1.5%, when sowing sunflowers after winter wheat and sowing cotton the following year in the budding period of cotton 1.0%, at the end of the growing season 1.0%, when sowing sesame after winter wheat and sowing cotton the following year in the budding period of cotton 1.0%, at the end of the growing season 1.5%, when sowing peanuts after winter wheat and sowing cotton the following year in the budding period of cotton wilt was not observed, at the end of the growing season 1.0%, when sowing safflower after winter wheat and sowing cotton the following year in the budding period of cotton 1.0%, at the end of the growing season 1.0%, when sowing cotton after winter wheat and sowing cotton the following year in the budding period of cotton 1.0%, at the end of the growing season 1.0%, when sowing cotton after winter wheat and sowing cotton the following year in the budding period of cotton 1.0; 1.0; 1.0; 0; 1.0%, at the end of the growing season 1.5; 2.0; 1.5; 2.0; 2.0%, compared to the control variant, where cotton was sown after cotton, in accordance with the periods of plant development, respectively 4.0; 4.0; 4.0; 0; 4.0% and 5.5; 6.0; 5.5; 6.0; 6.0% of plants were less affected by wilt.

It can be concluded that when cultivating cotton in the following year after sowing oilseeds after winter wheat, a decrease in cotton wilt infection by 4.0-6.0% was observed compared to the control.

It is known that the agrophysical properties of the soil are one of the most important factors influencing the growth, development, and harvesting of plants, as well as the quality of products. In the experiment, when cultivating cotton after winter wheat and various oilseeds, soil moisture, density (volume mass), and water permeability were determined in the plowed (0-30 cm) and sub-plowed (30-50 cm) soil layers (Table 5).

Soil moisture in the 0-30 cm layer before sowing cotton variants was 12.1-13.1 percent, and in the subsoil layer 13.9-14.9 percent. At the end of the growing season, soil moisture was 14.4-15.7%, and in the subsoil layer 16.9-18.7%.

Soil bulk density before sowing crops in the 0-30 cm soil layer was 1.25-1.28 g/sm^3 and in the subsoil layer 1.33-1.34 g/sm^{3,} and in autumn in the 0-30 sm soil layer 1.30-1.34 g/sm^{3}and in the subsoil (30-50 cm) layer 1.41-1.43 g/sm^3.

Table 5
Influence on the agrophysical properties of soils when growing cotton after sowing winter wheat and various oilseeds.
(2019 data)

No	Pre-sowing - March				End of the growing season - September				Water permeability, m^3/ha^{-1}	
	Moisture content, percent		Density, g/cm^3		Moisture content, percent		Density, g/cm^3		for 6 hours	
	0-30 sm	30-50 sm	0-30 sm	30-50 sm	0-30 sm	30-50 sm	0-30 sm	30-50 sm	March	September
1	12,1	13,9	1,28	1,34	14,4	16,9	1,34	1,42	541,1	345,5
2	12,2	13,8	1,27	1,33	14,4	17,2	1,33	1,42	615,5	410,1
3	13,1	14,9	1,25	1,34	15,5	17,3	1,30	1,41	654,0	450,5
4	12,7	14,6	1,26	1,33	14,5	17,0	1,33	1,43	601,1	435,0
5	12,5	14,5	1,26	1,34	15,5	18,7	1,30	1,42	631,1	430,5
6	12,4	14,6	1,25	1,33	15,0	17,2	1,32	1,42	620,0	436,5
7	12,4	14,6	1,25	1,33	15,7	18,0	1,30	1,42	634,7	435,0

It was established that the soil moisture and density in the 0-30 sm soil layer are relatively less than the subsoil moisture and soil density.

Soil permeability under experimental conditions before sowing was 541.1-654.0 $m^3/ha^{-1}$and at the end of growing season 345.5-450.5 m^3/ha^{-1}.
The water permeability of the field before sowing after oilseeds was higher by 64.6-105 m^3/ha^{-1} compared to the control, and after such measures as soil cultivation and irrigation, a decrease in the water permeability of the soil was observed.

In our studies, the influence of various oilseeds sown on winter wheat and stubble on soil moisture, density (volume mass), and water permeability in the plowed (0-30 sm) and sub-plowed (30-50 sm) soil layers was determined (Table 6).

Soil moisture in the 0-30 sm layer before sowing cotton variants was 13.8-14.7%, and in the subsoil layer 16.0-16.7%. At the end of the growing season, soil moisture was 15.0-15.8%, and in the subsoil layer 16.3-18.0%.

Soil bulk density before sowing crops in the 0-30 sm soil layer was 1.25-1.30 g/sm^3 and in the subsoil layer 1.40-1.40 g/sm^3, and in autumn in the 0-30 sm soil layer 1.30-1.34 g/sm^3 and in the subsoil (30-50 sm) layer 1.39-1.43 g/sm^3.

Table-6
Influence on the agrophysical properties of soils during the cultivation of various oilseeds for winter wheat and stubble.
(2019 data)

No	Presowing - July				End of the growing season - September				Water permeability, m^3/ha^{-1}	
	Moisture content, percent		Density, g/cm^3		Moisture content, percent		Density, g/cm^3		for 6 hours	
	0-30 sm	30-50 sm	0-30 sm	30-50 sm	0-30 sm	30-50 sm	0-30 sm	30-50 sm	July	August
1	13,7	16,3	1,26	1,31	14,5	16,0	1,30	1,40	520	370
2	13,6	16,4	1,26	1,30	14,6	16,2	1,30	1,40	530	380
3	13,9	16,5	1,27	1,31	14,6	16,3	1,29	1,40	540	390
4	14,0	16,7	1,27	1,30	14,7	16,4	1,29	1,39	550	400
5	14,2	16,8	1,28	1,32	14,7	16,5	1,28	1,39	540	400
6	14,4	16,9	1,26	1,30	14,7	16,3	1,28	1,39	540	400

It was determined that soil moisture and density in the plow layer are relatively lower compared to the subsoil layer.

The water permeability of the soil under experimental conditions was found to be 521-570 m^3/ha^{-1} before planting and 360-420 m^3/ha^{-1} at the end of the growing season.
The water permeability of the field before sowing after oilseeds was 25-45 m^3/ha^{-1} higher than in the control, and after irrigation and soil cultivation, a decrease in the water permeability of the soil was observed.

In conclusion, based on the results of the conducted experiment, it was proven that various oilseeds sown after winter wheat have a positive effect on the agrophysical properties of the soil compared to the control.

Soil fertility, types and rates of fertilizers, predecessors, soil cultivation methods, soil melioration status, soil types, and their thermal regime strongly influence the agrochemical properties of the soil.

The agrochemical composition of the soil is the main factor determining soil fertility, influencing the growth, development, and yield of agricultural crops, as well as product quality.

According to the results of the conducted research, humus in the initial general state was 0.669% in the plowed horizon and 0.597% in the subsoil horizon, total nitrogen 0.059% in the 0-30 cm horizon and 0.054% in the 30-50 cm horizon, and total phosphorus 0.124% in the plowed (0-30 cm) horizon and 0.100% in the subsoil horizon (Table 7).

It was established that the nutrients in the general state change somewhat positively after oilseeds sown after winter wheat.

When the 0-30 cm soil layer initially contained 0.693% humus, 0.054% total nitrogen, and 0.130% total phosphorus, planting various families of oilseed crops on stubble resulted in an increase of humus to 0.716-0.785%, total nitrogen to 0.059-0.080%, and total phosphorus to 0.124-0.139%. Additionally, a slight increase was observed in the subsoil layer compared to its initial state (Table 8).

Table 7
Influence of winter wheat and oilseeds on the agrochemical properties of soils (2019 data)

N	Experimental options	Soil layer, cm	Nutrients in the general state (initial state), %			Nutrients in general condition, after stubble crops, %		
			humus	nitrogen	phosphorus	humus	nitrogen	phosphorus
1.	Winter wheat	0-30	0.669	0.059	0.124	0.693	0.054	0.130
		30-50	0.597	0.054	0.100	0.623	0.050	0.124
2.	Cotton (control)	0-30	0.669	0.059	0.124	0.692	0.053	0.129
		30-50	0.597	0.054	0.100	0.621	0.049	0.123
3.	Stem shade	0-30	0.669	0.059	0.124	0.785	0.080	0.137
		30-50	0.597	0.054	0.100	0.700	0.069	0.127
4.	Sunflower for stubble	0-30	0.669	0.059	0.124	0.739	0.067	0.135
		30-50	0.597	0.054	0.100	0.705	0.058	0.125
5.	Sesame for stubble	0-30	0.669	0.059	0.124	0.740	0.068	0.137
		30-50	0.597	0.054	0.100	0.667	0.060	0.125
6.	Peanut for stubble	0-30	0.669	0.059	0.124	0.782	0.077	0.139
		30-50	0.597	0.054	0.100	0.700	0.062	0.126
7.	Straw safflower	0-30	0.669	0.059	0.124	0.755	0.070	0.139
		30-50	0.597	0.054	0.100	0.670	0.059	0.125

Table 8
Influence of winter wheat and oilseeds on nutrients in the soil in a mobile state (2019 data)

No	Experimental options	Soil layer, sm	Nutrients in the general state after stubble crops, %			Nutrients in mobile form after stubble crops, mg/kg in the soil		
			humus	nitrogen	phosphorus	N-NO_3	P_2O_5	K_2O
1.	Winter wheat	0-30	0,693	0,054	0,130	1,925	13,8	125
		30-50	0,623	0,050	0,124	1,55	12,0	125
2.	Cotton (control)	0-30	0,692	0,053	0,129	1,922	13,7	124
		30-50	0,623	0,049	0,123	1,54	12,0	124
3.	Stem shade	0-30	0,790	0,080	0,134	9,025	15,0	100
		30-50	0,716	0,069	0,127	1,700	13,8	100
4.	Sunflower for stubble	0-30	0,739	0,077	0,135	2,925	18,0	125
		30-50	0,705	0,059	0,125	2,360	5,2	125
5.	Sesame for stubble	0-30	0,740	0,068	0,137	5,29	15,0	125
		30-50	0,660	0,060	0,125	4,96	14,1	125
6.	Peanut for stubble	0-30	0,785	0,87	0,139	7,01	15,8	100
		30-50	0,710	0,062	0,120	2,54	15,0	100
7.	Straw safflower	0-30	0,775	0,080	0,139	5,180	15,8	125
		30-50	0,700	0,062	0,125	2,36	19,2	125

It has been proven that the amount of nutrients in mobile form in the soil increases after repeated sowing of oilseeds. In the control field, nitrate in the plow layer was 1.92 mg/kg, mobile phosphorus 13.8 mg/kg, and potassium 125 mg/kg, in the subsoil layer nitrate 1.55 mg/kg, phosphorus 12.2 mg/kg, and potassium 115 mg/kg. Among the mobile nutrients in the soil, nitrates in the 0-30 cm soil layer after soybeans and other crops amounted to 1.92-9.0 mg/kg, mobile phosphorus 13.8-18.8 mg/kg, and potassium 100-125 mg/kg.
Since the accumulated stubble and root residues did not decompose sufficiently in a short time, the difference in nutrient content between crops is insignificant.
In conclusion, it can be said that as a result of the accumulation of organic substances in the composition of winter wheat and various oilseeds sown after it, and their mineralization, an increase in soil humus and other nutrients improves soil fertility, agrophysical and agrochemical soil conditions, and reduces the damage caused by wilt, the cotton yield of fine-fiber cotton increased by 0.45-0.55 t/ha^{-1} compared to the control, and the farm's profitability increased by 20-26 percent.

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