American Journal of Applied Science and Technology

VOLUME Vol.06 Issue 05 2026
PAGE NO. 231-234
DOI 10.37547/ajast/Volume06Issue05-40

The Effect of No-Till Technology on The Physical Properties of Irrigated Sierozem-Meadow Soils of The A. Navoi Massif

Ashurmatov Narzullo
Second-year Master's Student at Gulistan State University, Uzbekistan

Kurvantayev Raxmon
Doctor of Agricultural Sciences, Professor at GulSU, Uzbekistan

Musurmanov Alisher Amirqulovich
Doctor of Philosophy in Agricultural Sciences (PhD), Associate Professor at Gulistan State University, Uzbekistan

Received: 18 April 2026; **Accepted:** 06 May 2026; **Published:** 31 May 2026

Abstract: This article studies the effect of soil bulk density on the yield of cotton among agricultural crops in the irrigated sierozem-meadow soils of the A. Navoi massif, Boyovut district, Syrdarya region. In the variant where no-till technology was applied to the soil, the retention of plant residues leads to the accumulation of organic matter from year to year and affects soil bulk density and porosity. During the cotton vegetation period, the application of no-till technology to the soil made it possible to maintain the bulk density of the upper soil layer at an optimal level (1.36–1.38 g/cm³).

Keywords: Sierozem-meadow soil, general physical properties of soil, specific gravity, bulk density, total porosity.

INTRODUCTION

Among the factors determining soil fertility, soil bulk density and the structural condition of the arable layer occupy a leading place. The density of soil layers determines the size and amount of aggregates in structure formation, the water-air ratio, heat exchange in the soil, and their interrelation.

The density of the soil layer depends on its quantitative composition, the ratio of aggregates of different sizes, and its granulometric composition. Soil bulk density changes significantly under the influence of human activity. Monitoring the density of soil layers and maintaining them in an optimal state is of great importance in obtaining high yields from agricultural crops [1;2;3;4;5;6;7;8].

Many scientists in Uzbekistan have conducted scientific research on optimizing the agrophysical properties of irrigated soils. As a result of these scientific studies, it was determined that the optimal bulk density of the main irrigated soils is within the range of 1.2–1.4 g/cm³ [3;5].

The density of the solid phase of soil, that is, its specific gravity, depends on its mineralogical composition and the amount of organic matter. When no-till technology was applied, it was observed during the years of the experiment that the retention of plant residues on the soil surface caused only insignificant changes in its value, because the amount of plant residues was very small and therefore had little effect on the density of the solid phase. The research results showed that in the control variant, at the beginning of the vegetation period, the specific gravity fluctuated around 2.63–2.65 g/cm³, and at the end of the vegetation period around

2.64–2.66 g/cm³. In the variant where no-till technology was applied, it was 2.64–2.66 g/cm³ at the beginning of the vegetation period and 2.65–2.66 g/cm³ at the end of the vegetation period. As can be seen from the results, a relative change can be observed in the variant where no-till technology was applied (Table 1).

When no-till technology was applied, soil bulk density in the arable layer after sowing was equal to the optimal density values. In the variant where no-till was applied, although the soil bulk density indicator was higher at the beginning of the experiment, by the end of the vegetation period, as the plant residues left in the upper layer turned into humus from year to year and as the composition of macro- and microaggregates improved, it was observed that the aggregates were arranged more loosely (Table 1).

Table 1

The effect of no-till technology on the general physical properties of irrigated soils of the A. Navoi massif (2025–2026)

Variant	Layer depth, cm	SO, g/cm³	HO, g/cm³	UG‘, %	SO, g/cm³	HO, g/cm³	UG‘, %
After cotton seed sowing					At the end of cotton vegetation		
1-control	0-15	2,64	1,34	49	2,65	1,42	46
	15-30	2,63	1,36	48	2,64	1,44	45
	30-50	2,65	1,44	45	2,66	1,49	44
2-no-till	0-15	2,65	1,36	48	2,66	1,38	48
	15-30	2,64	1,38	47	2,65	1,40	47
	30-50	2,66	1,45	45	2,66	1,46	45

At the beginning of the vegetation period, the bulk density of the upper layer of the cotton-sown field in the control variant was 1.34–1.36 g/cm³, and by the end of the vegetation period, as a result of the implementation of agrotechnical measures, it became compacted and amounted to 1.42–1.44 g/cm³. In the variant where no-till technology was applied, the bulk density of the upper layer was 1.36–1.38 g/cm³, and at the end of the vegetation period it amounted to 1.38–1.40 g/cm³. As can be seen from the results, compaction was greater in the control variant; in the no-till variant, compaction also occurred, but it was not higher than in the control (Table 1).

Soil porosity is of great importance in moving water and water-soluble substances upward, retaining water, and ensuring air exchange in the root-inhabited layer.

In the variant where no-till technology was applied, the total porosity (TP) of the soil is of great importance. The obtained results show that at the beginning of the vegetation period, in the upper soil layer of the cotton-sown field, total porosity in the no-till variant was 45–48%, while in the control variant it was 45–49%; at the end of the vegetation period, it was determined to be 45–48% in the no-till variant and 44–46% in the control variant. It can be seen that total porosity decreased in the control variant during the vegetation period (Table 1).

The experimental results show that in the variant where no-till technology was applied to the soil, as a result of leaving plant residues, organic matter accumulates from year to year, and due to their decomposition, under the influence of humic and fulvic acids, the soil structure is restored to a certain extent not only in the arable layer but also in the subarable layers.

In increasing the productivity of agricultural crops, soil structure, that is, its granularity, occupies a leading place. The amount of organic matter is of great importance in the formation of soil structure, and the introduction of agrotechnologies that increase its amount is considered an urgent issue. When a sufficient amount of organic mass is maintained in the soil, it provides the opportunity to use mineral fertilizers in smaller quantities. The sufficient presence of organic matter in the soil leads to a normal supply of nutrients and to the transformation of its physical

properties into an optimal state. At the same time, it contributes to assessing healthy soil condition, preserving soil moisture, and ensuring nutrient cycling.

Soil condition optimizers — green manure crops, covering the soil surface with plant residues, selecting plants for crop rotation, using compost, reducing soil tillage, decreasing soil bulk density and improving aeration, organizing improved nutrition, and controlling erosion formation — are considered strategic methods for the development of farming. The problems explained above are the most urgent and are aimed at improving soil structure.

In our conducted studies, under the conditions of irrigated sierozem-meadow soils, we also studied the effect of applying no-till technology and leaving plant residues on the surface of areas where agricultural crops are grown on general physical properties, moisture content, nutrient regime, and soil structural condition.

In irrigated sierozem-meadow soils, the amount of agronomically valuable aggregates (10–0.25 mm) in the cotton-sown variant where no-till was applied amounted to 52.6%, while in the control variant it amounted to 51.8%. In terms of the amount of agronomically valuable aggregates (10–0.25 mm), the no-till variant had an advantage of 0.8% compared to the control variant (Table 2).

Table 2

Changes in the macroaggregate composition of cotton field soils under the influence of no-till technology (2025–2026)

Variant	Layer depth, cm	Aggregate size, mm											
		>10	10-7	7-5	5-3	3-2	2-1	1-0,5	0,5-0,25	<0,25	>10	10-0,25	<0,25
Cotton field													
1	0-15	41,8	9,4	8,5	9,1	8,2	10,4	2,7	3,5	6,4	41,8	51,8	6,4
	15-30	43,2	5,2	5,9	14,2	8,8	10,3	2,3	3,3	6,8	43,2	50,0	6,8
	30-50	44,6	7,9	5,7	6,4	7,7	10,7	1,9	4,4	9,4	44,6	46,0	9,4
2	0-15	42,2	9,2	8,0	8,3	9,4	13,2	1,8	2,9	5,2	42,2	52,6	5,2
	15-30	40,5	6,6	7,3	7,1	12,0	12,1	1,2	4,8	8,4	40,5	51,1	8,4
	30-50	44,2	9,5	7,6	8,1	8,2	9,5	1,3	2,8	8,8	44,2	47,0	8,8

It was determined that the variant where no-till was applied had an advantage over the control variant in terms of the amount of macroaggregates. When mini-till and no-till experiments are conducted, it is known from the literature that more years are required to obtain a positive result. The main reason for this can be explained by the fact that in the formation of soil macroaggregates, a greater amount of plant residues being left and their humus participate as a binding substance.

The water stability of soil aggregates is considered an important agronomic indicator; the higher the water stability of aggregates, the more fertile the soil is considered. As shown in the data of Table 3.1.8, it was determined that in the cotton-sown field, the amount of water-stable aggregates with sizes of 3–2 and 5–3 mm increased in the no-till variant compared to the control. In particular, in the soils of the cotton-sown field where no-till was applied, the amount of water-stable aggregates with a size of 3–2 mm was high, amounting to 4.10–4.41%; in the control variant, the amount of water-stable aggregates with a size of 3–2 mm amounted to 3.83–4.06%. It was determined that the variant where no-till technology was applied had an advantage of 0.04–0.35% compared to the control variant (Table 3).

The amount of water-stable aggregates with a size of 5–3 mm amounted to 4.85–5.05% in the control variant, respectively, while in the variant where no-till was applied it was recorded at 5.12–5.35%, showing that the no-till variant had an advantage of 0.27–0.30% compared to the control variant (Table 3).

Table 3

The effect of no-till technology on the amount of water-stable aggregates, %

Variant №	Layer depth, cm	3–2 mm aggregates, mm			5-3 mm aggregates, mm		
		>1	1-0,25	Total aggregates	>1	1-0,25	Total aggregates
Cotton field							
1	0-15	1,45	2,38	3,83	2,30	2,75	5,05
	15-30	1,64	2,36	4,00	2,24	2,78	5,02
	30-50	1,68	2,38	4,06	2,15	2,70	4,85
2	0-15	1,69	2,72	4,41	2,18	3,17	5,35
	15-30	1,60	2,64	4,24	2,05	3,24	5,29
	30-50	1,58	2,52	4,10	1,92	3,20	5,12

In tilled variants, as a result of tillage and the influence of mechanical force, water-stable aggregates are observed to break down and turn into dust; this can also be observed in the subarable layers.

It should be especially emphasized that in the control variant, after sowing, the amount of aggregates with a size of 3–2 mm was recorded to be lower than the amount of water-stable aggregates with a size of 5–3 mm. The main reason for this is the water stability of the aggregate size.

REFERENCES

1. Кирюшин В.И. Минимализация обработки почвы: итоги дискуссии // Ж.: Земледелие. -М. 2007. -№ 4. -С. 28-30.
2. Кроветто К. Прямой посев (No-till). -Самара, 2010. 206 с.
3. Musurmanov A.A., Qurvontoev R. Mirzacho‘l vohasi sug‘oriladigan tuproqlarining umumiy fizikaviy xossalariga mulchalash va kam ishlov berishning ta‘siri. O‘zbekiston agrar fani xabarnomasi”, Toshkent, 2018, №1 (71), 2018.
4. Маматожиев, Ш. И. Минимальная до посевная обработка почвы после распашки люцерны при интенсивной технологии возделывания хлопчатника // Актуальная наука. - 2019. - № 11 (28). -С. 68-73.
5. Qurvontoev R., Musurmanov A. Tuproqlar umumfizikaviy xossalari va agregatlar miqdoriga kam ishlov berish va mulchalashning ta ‘siri. Guliston Davlat Universiteti Axborotnomasi. Guliston-2021. 2021/3.
6. Турусов В.И. Возможности минимализации обработки черноземных почв в Воронежской области // Достижения науки и техники АПК. -М. 2014. -Т. 28. -№12. -С. 5-8.
7. Håkansson I., Reeder R. C. Subsoil compaction by vehicles with high axle load - extent, persistence and crop response // Soil and Tillage Research. - 1994. - Vol. 29, № 2-3. - P. 277-304.
8. Lal R., Stewart B. A. Principles of Sustainable Soil Management in Agroecosystems. - Boca Raton: CRC Press, 2013. - 568 p.