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THE EFFECT OF CROPS ON THE AGROPHYSICAL PROPERTIES OF SOIL IN SHORT-ROTATION CROP ROTATION SYSTEMS

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Annotation: *In this article, the effect of crops on the agrophysical properties of the soil in short-rotation rotation systems in the light gray soils of Andijan region, i.e., the effect of the main crop cotton and grain on the agrophysical properties of mung beans, soybeans, and corn as an acceptable predecessor crop is presented and analyzed.*

Keywords: *Water permeability, secondary crops, leguminous grain crops, cotton, vegetables, mung bean, soybean, soil porosity, productivity.*

Relevance: Among leguminous grain crops, soybean and mung bean are particularly notable for improving soil fertility, ensuring ecological stability, being non-demanding to land conditions, drought-resistant, and serving as good predecessor crops for most agricultural crops, especially wheat and cotton. At present, these crops are cultivated under various soil and climatic conditions across the Republic. Increasing soil fertility and meeting the population's demand for food remains one of the most urgent and priority issues. [1, 2] Based on this, the cultivation of leguminous grain crops on fields freed from cotton and grain, as well as growing them as secondary crops after winter cereals, will contribute to maintaining and improving soil fertility in the future.

One of the most important organizational and agrotechnical measures in agriculture that improves soil reclamation status, increases fertility, ensures efficient use of irrigated lands, controls weeds, plant pests, and diseases, and provides consistently high and high-quality yields of agricultural crops is crop rotation. [5, 6]

In the multi-sector farming systems of Andijan region, the lack of a sufficiently developed scientifically grounded system for the rational placement of crops such as vegetables, potatoes, melons, grain, and legumes within the cotton–winter wheat structure restricts the potential for obtaining high yields. Under these conditions, there is a growing need to scientifically develop new crop rotation systems or improve existing ones.

Degree of Study:

In the Republic, the system of alfalfa–cotton crop rotation aimed at increasing soil fertility and obtaining high-quality yields has been researched by Z. Tursunkhodjaev, V. Berezovsky, A. Bolkunov, Q. Mirzajonov, Sh. Nurmatov, N. Urazmatov, and A. Qashqarov. Later, short-rotation cotton–grain crop rotation systems were investigated by R. Oripov, R. Tillayev, B. Khalikov, F. Namazov, B. Izbosarov, and M. Avliyakulov, as well as foreign scholars such as S. Brown, J. Keatinge, D. Luquet, A. Vidal, and M. Smith. However, under the conditions of light gray soils in the valley regions of the Republic, particularly in Andijan region, the role of crops such as vegetables, potatoes, mung bean, soybean, and maize as predecessor crops for winter wheat and cotton within vegetable–grain and vegetable–cotton rotation systems has not been sufficiently studied.

In order to meet the population's demand for food, agricultural research is being conducted in the region to identify crops that maintain and enhance soil fertility in short-rotation systems in cotton, grain, and vegetable-oriented farms and to obtain high and quality yields.

Methods and Materials:

Phenological observations and calculations on secondary crops and winter wheat varieties were carried out based on the manuals *Methodology of State Variety Testing of Agricultural Crops*, *Methodology for Research on Grain Legumes*, as well as methodological guidelines adopted at UzPITI (1973, 1981, 2007). Statistical analysis of the data was performed using WinQSB-2.0 and Microsoft Excel programs according to B.A. Dospekhov's method *Methods of Field Experiments* (1964).

Research Results:

Field experiments were conducted on the lands of the *Ming Urik Osoni* farmer household located in Asaka district of Andijan region. The soil of the experimental field is light gray, of medium loamy texture, long-irrigated, non-saline, with groundwater located 4–5 m below the surface. In the plow layer, humus content was 0.8–1.0%, total nitrogen 0.079–0.081%, phosphorus 0.150–0.153%, and bulk density 1.40–1.43 g/cm³.

The research was carried out under short-rotation (1:1) vegetable–grain and vegetable–cotton systems [8], consisting of the following: for background preparation in 2016, potato was planted in background 1, cabbage in background 2, cucumber in background 3, and carrot in background 4. After harvesting the main crops, soybean, mung bean, and maize were planted as secondary crops in each agro-background. The varieties used were: potato — *Zarafshon*, cabbage — *Iyunskaya*, cucumber — *Hosildor*, and carrot — *Mushak-95*. Mineral fertilizers were applied at NPK 200:140:100 kg/ha. For secondary crops, soybean (*Orzu*), mung bean (*Navruz*), and

maize (*Uzbekistan-306 AMV*) were planted. Secondary soybean and mung bean received NPK 60:90:60 kg/ha, while maize received NPK 200:140:100 kg/ha.

After the early vegetable harvest, soil samples were taken to determine initial agrochemical properties. Before sowing secondary crops, soil bulk density and other water-physical properties were also measured. The first experiment consisted of 16 variants, with a total plot size of 240 m² for each variant (50 m in length, 4.8 m in width), of which 120 m² was accounted for as the measurement area. Experiments were carried out in three replications, covering a total area of 1.15 ha. [8]

EXPERIMENT SYSTEM 1

(Short-rotation (1:1) vegetable–grain crop rotation system, 2019–2023)

№	Early vegetable crops	Secondary crops	Main crop
1	Potato (NPK 200:140:100 kg/ha)	No secondary crop (control)	Winter wheat
2	Cabbage (NPK 150:105:75 kg/ha)	No secondary crop (control)	Winter wheat
3	Cucumber (NPK 150:105:75 kg/ha)	No secondary crop (control)	Winter wheat
4	Carrot (NPK 200:140:100 kg/ha)	No secondary crop (control)	Winter wheat
5	Potato (NPK 200:140:100 kg/ha)	Mung bean (NPK 60:90:60 kg/ha)	Winter wheat
6	Cabbage (NPK 150:105:75 kg/ha)	Mung bean (NPK 60:90:60 kg/ha)	Winter wheat
7	Cucumber (NPK 150:105:75 kg/ha)	Mung bean (NPK 60:90:60 kg/ha)	Winter wheat
8	Carrot (NPK 200:140:100 kg/ha)	Mung bean (NPK 60:90:60 kg/ha)	Winter wheat
9	Potato (NPK 200:140:100 kg/ha)	Soybean (NPK 60:90:60 kg/ha)	Winter wheat
10	Cabbage (NPK 150:105:75 kg/ha)	Soybean (NPK 60:90:60 kg/ha)	Winter wheat
11	Cucumber (NPK 150:105:75 kg/ha)	Soybean (NPK 60:90:60 kg/ha)	Winter wheat
12	Carrot (NPK 200:140:100 kg/ha)	Soybean (NPK 60:90:60 kg/ha)	Winter wheat
13	Potato (NPK 200:140:100 kg/ha)	Maize (NPK 200:140:100 kg/ha)	Winter wheat

14	Cabbage (NPK 150:105:75 kg/ha)	Maize (NPK 200:140:100 kg/ha)	Winter wheat
15	Cucumber (NPK 150:105:75 kg/ha)	Maize (NPK 200:140:100 kg/ha)	Winter wheat
16	Carrot (NPK 200:140:100 kg/ha)	Maize (NPK 200:140:100 kg/ha)	Winter wheat

Note: *In the cultivation of winter wheat, mineral fertilizers were applied at the rate of* ***NPK 200:140:100 kg/ha****.*

2nd experiment consisted of 12 variants, with a total plot size of 240 m² for each variant, of which 120 m² was taken into account. The research was carried out in 3 replications, and the total experimental area covered 0.8 ha. [8]

In accordance with the goals and objectives of the research — determining the effect of crop rotation on the main physical and chemical properties of soil — soil bulk density and porosity were first measured. Bulk density and porosity are the key indicators that create favorable soil conditions for plant growth and development.

From this perspective, the agrophysical conditions formed under potato and cabbage cultivation created a specific soil environment, playing an important role in plant development throughout the vegetation period. For example, in plots where soybean was grown as an after-crop on potato and cabbage backgrounds, bulk density in the topsoil layer (0–30 cm) was 1.31 g/cm³ at the beginning of the vegetation period and increased to 1.37 g/cm³ by the end of the period, i.e. a compaction of 0.06 g/cm³ was observed (variants 1 and 4). In the subsoil layer (30–50 cm), bulk density increased by 0.05 g/cm³, reaching 1.38 g/cm³. Such conditions can be considered favorable for plant growth and development.

Similar soil conditions were observed in variant 2, where mung bean was grown as an after-crop. Compared to the beginning of the vegetation period, bulk density increased by 0.04–0.05 g/cm³, showing results similar to soybean. In maize plots, soil compaction reached 0.07 g/cm³, which was 0.02–0.03 g/cm³ higher than in soybean and mung bean plots. This was due to row cultivation practices, irrigation, and intensive root system development, causing stronger influence on soil water-physical properties.

Soil porosity also showed a positive relationship relative to bulk density. In soybean plots, porosity in the topsoil (0–30 cm) was 51.5% at the beginning of the vegetation period and decreased by 2.2%, reaching 49.3% at the end. In mung bean plots, porosity decreased by only 0.3% compared to soybean. In maize plots (variant 3), porosity decreased more strongly — by 1.6–1.8%, amounting to 48.9–48.2% in the corresponding soil layers. In cabbage background plots (variants 4–6), similar results were obtained for bulk density and porosity as in potato plots.

Thus, after potato and cabbage cultivation, growing soybean and mung bean as after-crops contributed to maintaining favorable soil conditions. The properties of the root systems of soybean and mung bean improved soil water and physical characteristics, which also positively influenced chemical processes and enhanced nutrient accumulation in the soil.

Conclusions.

It was determined that early potato and cucumber cultivation reduced soil bulk density by 0.04–0.05 g/cm³, improved porosity by 0.8–1.3%, and increased water permeability by 12–14% (70–80 m³/ha) compared to other vegetable crops.

After potato and cucumber, soybean as an after-crop provided better soil conditions compared to mung bean and maize, reducing bulk density by 0.02–0.03 g/cm³, improving porosity by 0.5–0.9%, and enhancing water infiltration capacity by 10–16%.

References.

1.Мирзиёев Ш.М. - Ўзбекистон Республикаси Президентининг 14.03.2017 й. ПҚ-2832-сонли «2017-2021 йилларда республикада соя экини экишни ва соя дони етиштиришни кўпайтириш чора-тадбирлари тўғрисида»ги қарори. - Тошкент. 2017.

2.Халиков.Б.М., Ф.Ғ.Расулова., Ф.Б.Намазов. Алмашлаб экишда дала тажрибаларини ўтказиш услублари // Тошкент, 2017. Б 23.

3.Атабаева Х.Н. Соя. // Ўзбекистон миллий энциклопедияси. Давлат илмий нашриёти. Тошкент, 2004, Б. 96.

4.Дала тажрибаларини ўтказиш услублари -Тошкент, 2007, Б.180.

5.Сулаймонов Б.А., Хакимов Р.А. Тошкент вилоятида сабзавот, полиз ва картошка экинларини етиштириш агротехнологияси бўйича тавсия. // Тошкент, 2015, Б. 1-27.

6.Халиков Б.М. Янги алмашлаб экиш тизимлари ва тупроқ унумдорлиги. // Тошкент, 2010, Б. 118.

7.Холиқов Б.М., Номозов Ф.Б. Алмашлаб экишнинг илмий асослари. Тошкент, 2016. Б. 47.

8.Холиқов Б., Иминов А. Суғориладиган ерлардан унумли фойдаланиш ва тупроқ унумдорлигини ошириш бўйича ғўза-ғалла навбатлаб экиш тизимида ўсимликлар диверсификацияси бўйича тавсиялар. // Тавсия, ИКАРДА ЦАЗ, Тошкент, 2003. Б. 18.