Effect of Intercropping of Cotton and Peanut on Quantity and Quality of Soil Microorganisms

Usmonov Nodirjon Botiraliyevich

Senior lecturer of the department "Technology of storage and primary processing of agricultural products", Fergana Polytechnic Institute;Fergana, Republic of Uzbekistan.

ABSTRACT

The effect on the increase in the number and quality of soil microorganisms under the conditions of co-planting of cotton with peanut in the conditions of sandy soils of the desert region is highlighted.

Keywords: Intercropping, microorganisms, oligonitrophil, amino-factor, phosphoromobile, actinomycete and micromycete.

Microorganisms participate in most of the metabolic processes in the soil, ensuring that complex organic and mineral substances pass into a state that can be absorbed by plants.

According to E. N. Mishustin, 300 million (podzol soil) to 3 billion (black soil) microorganisms live in 1 g of soil [1].

According to M.V. Feodorov, the living weight of microorganisms in the arable layer of 1 ha of cultivated area is 3.5 tons in turfy podzol soils, 5.0 tons in gray soils, and 5.2 tons in black soils.

Microorganisms actively develop in fertile soils with improved air, heat, and moisture regimes, with a large amount of humus [2].

Therefore, the increase in the number of microorganisms indicates the improvement of soil fertility.

Soil microorganisms are divided into 3 categories: bacteria (about 70 %), actinomycetes (27-30 %) and fungi (1-3 %), more than 260 species of bacteria alone have been identified.

In our research, the amount of oligonitrophils, aminofactors, phosphoromobile microorganisms, as well as actinomycetes and micromycetes in the soil was studied in order to determine the true nature of the increase of total and easily assimilable nitrogen and mobile phosphorus in the conditions of co-planting of cotton with peanuts.

The researches were carried out in the conditions of the sandy soils of the degraded desert region of Fergana region, Yozhiovon district, with very low productivity.

Oligonitrophils have the property of absorbing nitrogen from the atmosphere and enriching the soil with nitrogen, and it was found that their amount in sandy soils is more than 10 times less than the established norm (n x 10^7).

In particular, when cotton was maintained using only mineral fertilizers ($N_{250}P_{175}K_{125}$ kg/ha) (control option) it was 1.7 million (1.7x10^6) (Table 1).

Table 1 Quantities of the main physiological groups of microorganisms in the soil under co-planting conditions (2019)

Planting method	Soil layer, cm	The number of microorganisms in 1 g of soil				
		Oligo-nitrophils	Aminifiers	Phosphoro mobiles	Actino-mycetes	Micro-mycetes
Cotton intercropped without partner crops (control)	0-30	$1,7x10^6$	$3,7x10^7$	-	-	$1,5x10^4$
	30-50	$8,2x10^5$	$1,3x10^7$	-	-	$7,5x10^3$
Cotton and peanuts are planted in every row in succession	0-30	$1,4x10^7$	$1,6x10^8$	$6,0x10^7$	$7,5x10^4$	$2,5x10^4$
	30-50	$1,3x10^7$	$1,2x10^8$	-	-	-
Cotton and peanuts are planted alternately in separate rows	0-30	$2,7x10^7$	$5,7x10^8$	$3,7x10^7$	$1,7x10^5$	$7,5x10^4$
	30-50	$1,2x10^7$	$1,2x10^8$	-	-	$1,5x10^4$
Standard indicator		$n\ x10^7$	$n\ x10^8$	$n\ x10^{7-8}$	$n\ x10^{5-6}$	$n\ x10^{2-3}$
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Standard indicator		$n\ x10^7$	$n\ x10^8$	$n\ x10^{7-8}$	$n\ x10^{5-6}$	$n\ x10^{2-3}$

When cotton was co-cultivated with peanuts, the amount of oligonitrophils increased significantly and reached 14-27 million ha.

That is, the amount of oligonitrophils increased by 6.5-10.1 times in case 1, and by 6.2-15.8 times in case 2.

It is noteworthy that when cotton is planted together with peanuts, it was found that the amount of oligonitrophils increases by 9.4-18.5 times in the sub-field (50-70 cm) layer.

Aminifiers have the property of breaking down complex organic compounds, proteins into ammonia, and enrich the soil with nitrates.

The amount of amino acids in sandy soils was 10 percent less than the accepted norm (n $x10^8$), in the plowed layer (0-30 cm) it was 37 million, and in the sub-ploughing layer (50-70 cm) it was 13 million.

Under conditions of co-planting of cotton with peanuts, the amount of amino acids increased sharply, cotton increased by 160-570 million (4.3-15.4 times).

The amount of amino acids also increased in the sub-row (50-70 cm) layer and increased by 3.2 times when cotton was planted together with peanuts.

Phosphoromobile bacteria ensure that phosphorus in the soil is transferred to a state (P_2O_5) that is easily absorbed by the plant.

In the conditions of sandy soils, phosphoromobile bacteria were much less than the standard level (n $x10^{7-8}$) and were not detected in the analysis samples obtained from the control option.

A dramatic increase in phosphoromobile microorganisms was achieved when cotton was co-planted with peanut.

In particular, when cotton was cultivated together with peanuts, it reached 37-60 million.

Actinomycetes are a microorganism that has the ability to break down the most complex organic compounds, including cellulose and lignin, and even humus, which is a component of the soil, living even in an alkaline environment.

Nevertheless, in the conditions of the sandy soils of the researched desert region, their amount is very low, and it was not detected in the samples taken from the control variant, which was maintained using only mineral fertilizers ($N_{250}P_{175}K_{125}$ kg/ha) without cotton as a partner crop.

However, when cotton was planted together with peanuts, their quantity in the soil layer (0-30 cm) reached 150-230 thousand and increased to the standard level (n $x10^{5-6)}$.

Micromycetes have the ability to break down complex organic compounds and proteins, and play an important role in enriching the soil with organic substances.

It is noteworthy that the amount of micromycetes in sandy soils is higher than the established norm (n $x10^{2-3)}$.

In particular, when cotton was treated with mineral fertilizers at the rate of N_{250}, P_{175}, K_{125} kg/ha without partner crops, the number of micromycetes in the khaydov layer (0-30 cm) was 15,000.

The amount of micromycetes increased up to 75 thousand (5 times) when cotton was planted with peanuts.

In the conditions of co-planting, the amount of micromycetes also increased in the sub-stem (50-70 cm) layer, and in the control variant, it was 7.5 thousand, and when co-planted with cotton and peanut, it was 15.0-25.0 thousand (2-3.3 times more) .

Similar related changes were identified in the 2020 research year (Appendix 6). This year, the amount of microorganisms was a little less because the analyzes were conducted at the end of September (19.09).

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