International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

The Influence of Double Crops and Intercrops on Soil Fertility

Zukhriddin Muminovich Jumaboyev

Docent of Plant Growing Department, Candidate of Agricultural Sciences, Andijan branch of Tashkent State Agrarian University, PO. No 170600, Kuyganyor str., 3, Andijan, Uzbekistan

Abstract: ***In short double cropping systems 2:1, the cultivation of soybean as a second crop after winter wheat, and after soybean the cultivation of intercrops in autumn such as oats, green peas and rye in combination, and plowing of land with crop organic residues (roots and stubbles) after harvesting them in spring have resulted in increasing of humus and nitrogen in soil, the mass of soil and the capability of water permeability, and also allowed to easy absorption of phosphorous compounds which were difficult to absorb due to decomposition of this organic residue. As a result, the yield of cotton planted after them was increased.***

Keywords: winter wheat, soybean, intercrop, oats, green peas, rye, soil, mass, water permeability, organic residue, humus, nitrogen, phosphorus

1. Introduction

Soil weight is one of the factors that determine the basic agrophysical properties of the soil, because the normal form of this soil feature indicates positive water permeability of soil, porosity, air circulation, heat regime, nutritional regime and finally microbiological properties. All types of farm crops increase soil weight during the life cycle. Once they are pumped to the soil, the volume of soil decreases. This means that as much organic matter as possible accumulates in the soil, the soil mass will be improved.

In order to maintain soil fertility leguminous crops are generally preferable to sowing, as the soil had 0.65-0.72 percent humus content before and then it has been reported to be 0.95-1.03 percent [6].

The investigations have also revealed that due to root and stubble residues in the soil after cultivation of double crops mung-bean and soybean in the fields free from winter wheat, the yield of these crops made 2.3-2.7 tons, at the same 70 kg of nitrogen, 30 kg of phosphorus and 80 kg of potassium also accumulated in the layer of soil [3].

In the surveys conducted in light virgin soil conditions in Andijan region in order to obtain high and early cotton yield of "Andijan-36" and "Navruz" varieties, the better growth of cotton plant was scientifically proven in newly created background when $N_{25}P_{80}K_{60}$ kg/ha was applied to the second crop mung-bean and $N_{60}P_{90}K_{60}$ kg/ha was applied to soybean [2].

Water permeability of soil constituted 542-569 m^3/ha before sowing in experimental condition and at the end of growth period it was 357-413 m^3/ha. It was determined that double crops, intercrops and green manure crops sown after the winter wheat improved the soil's agrophysical properties compared to the control field. Before sowing the soil permeability constituted 4-13 m^3/ha after double and intercrops and compared to control variant after green manure crops it was 32-91 m^3/ha, the soil permeability decreased in autumn due to soil processing and irrigation. It has been proven that soil moisture, water permeability were higher than the control after green manure and soil density was lower than the control [7].

It is expedient to prove and to implement improved short-double cropping systems for increasing soil properties that maintain and improve the fertility of soil in Andijan region, and increasing cotton yield as well.

2. Methods of Research

Field experiments were conducted in 2001-2004 for 3 years as a control in short-double cropping system, cotton plant was grown in 1: 1 system (cotton + winter wheat), in 1: 2 system (winter wheat + cotton + cotton), and 1: 2 system (winter wheat + double crop – soybean : cotton : cotton) and 2:1 system (winter wheat + double crop- soybean, winter wheat + double crops-soybean + intercrops-oats + green peas + rye : cotton) and studied the influence of these crops on soil fertility and cotton plant productivity. Experiments were conducted in time and space (2 fields), with 5 variants of system, the area of each plot was 240 $м^2$ in three repetitions.

The accuracy of the productivity obtained on the basis of experimental variants and repetitions was analyzed by a dispersion analysis [1].

Agrochemical [4] and agrophysical [5] properties of the soil of experimental field were identified according to established methods.

3. Results and discussion

According to the obtained data, the initial soil weight (in 10.11.2000) in the first field of experiment was 1.365 g / cm^3 in 0-30 cm soil layer, and 1,390 g / cm^3 in 30-50 cm layer. In accordance with the seeding systems, the soil weight (0–30 cm layer) was 1,326; 1,287; 1,275 and 1,276 g / cm^3 respectively, at the beginning of 2001 in the variants where the winter wheat, winter wheat + second crop soybean (2–5) were sown. It was determined that this was 0,058; 0,078; 0,090; 0,089 and 0,047 g/cm^3 lower than the previous indications and also 0,007; 0,026; 0,038; 0,037 g/cm^3 lower

than control variant. Specifically, in the 4th variant of, 1: 2; winter wheat + double crop (soybean) and in variant 5, 2:1; winter wheat + double crop (soybean) the weight was 1,275 and 1,276 g / cm^3, which caused the improvement of soil structure and mass as a result of the decomposition of soybean organic residues as a second crop after winter wheat. At the end of the rotation of crops studied in the system of double cropping, the mass of soil was close to the previous indication (1,356 g/cm^3) when the data was analyzed on the next influence of double cropping on soil mass in the 2nd variant of experiment, 1: 1: 1; cotton plant: winter wheat+ cotton plant double cropping variant.

The best indications were in the 5th variant of the experiment, with 2:1 double cropping, winter wheat + second crop (soybean): winter wheat + second crop (soybean) + intercrop (oats + green peas + rye): cotton variant it was found that in 0–30 cm layer, there was a decrease of 0.039 g / cm^3 while in 30–50 cm layer it was 0.028 g / cm^3 lower.

It has been observed that sowing of soybeans as a secondary crop after the winter wheat has a positive effect on soil permeability in short-term double-cropping systems. According to the results of the analysis, variant 2, 1: 1, cotton plant: winter wheat: cotton plant of double cropping system the water permeability of the soil after the winter wheat constituted 105 m^3 /ha more than the control variant.

As per received data, the soil permeability before plowing was 260 m^3 /ha in the first (in 2000) field and 795 m3/ha in total six hours. In spring of 2001, before the seed sowing, the highest water permeability in the experiment was observed in variant 4, 1: 2, winter wheat + second crop (soybean): cotton plant: cotton plant, in variant 5, 2: 1 winter wheat + second crop (soybean): winter wheat + second crop + intercrop (oats + green peas): cotton plant of double cropping systems, and it constituted 379, 339 m3 /ha in the first hour, for total six hours - 980 and 928 m^3 /ha respectively. It was found that the soil in these variants contained 135 and 103 m^3 /ha more water than the control variant.

At the end of the rotation of short-term double cropping systems of cotton plant – wheat that was studied in experiment, in the 4th experimental variant the soybean was sown after winter wheat, after them the cotton plant was cultivated during the two years, and in this variant also the soil's water permeability (at the end of the life cycle in autumn of 2003) was in the amount of 100 m^3 /ha compared to previous indication. In experiment 5, when cotton plant was sown in the first year after winter wheat + second crop (soybean): winter wheat + second crop (soybean) + intercrop (oats + green peas + rye) of cropping system the above-mentioned indication was 150 m^3 /ha 1 year of planting cotton, the above figure was.

Thus, based on field experiments, we can conclude that in short-term double cropping systems, soybean is sown as a second crop after winter wheat, and then in autumn, intercrops oats, green peas and rye with three components are sown, then after their harvest in spring the land is plowed together with their roots and stubbles. As a result of the decomposition of these organic residues (stubble and root), a positive effect on soil mass and water capacity was identified.

Table: The influence of double cropping system on soil weight, g/cm^3 (field-1, in 2000-2003)

Variant order	Double cropping system	Soil layer, cm	In 2000, autumn, initial indications	In 2001, spring	In 2002, autumn	In 2003, autumn
1	control	0-30	1,365	1,313	1,374	1,385
		30-50	1,390	1,362	1,414	1,449
2	1:1	0-30	1,365	1,306	1,337	1,356
		30-50	1,395	1,344	1,365	1,418
3	1:2	0-30	1,365	1,287	1,314	1,347
		30-50	1,395	1,331	1,337	1,416
4	1:2	0-30	1,365	1,275	1,302	1,343
		30-50	1,395	1,315	1,325	1,408
5	2:1	0-30	1,365	1,276	1,284	1,326
		30-50	1,395	1,356	1,325	1,367

When analyzing the initial agrochemical parameters of the experimental soils, the humus content of soil constituted 1,196-1,172%, total nitrogen amount 0.115-0.110%, phosphorus 0.195-0,201% in 0-30 cm layer proportional to the 1st-2nd fields, while 30-50 cm soil layer it was 0.890-0,798; 0.080-0,069%; 0.180-0,190%. The amount of active nitrate (0-30 cm) nitrogen was found to be 14.1-20.5 mg / kg, the active phosphorus was 30.5-32.3 mg / kg, and changeable potassium was 190-200 mg / kg.

In accordance with the analysis on the impact of double and intercrops introduced on the double cropping systems on soil nutrients (1.03.2001) the amount of humus in the control variant decreased by 0.019%. in Variant 3, 1:2, winter wheat: cotton plant: cotton plant, in variant 4, 1: 2, winter wheat + second crop (soybean): cotton plant: cotton plant, in variant 5, 2: 1 winter wheat + second crop (soybean): winter wheat + second crop (soybean) + intercrop (oats + green peas + rye): cotton plant variants the amount of humus amount was higher than the original amount (10.10.2002) in layer 0-3, it increased to 0,022 %; 0,034%; 0,038 % and total nitrogen content was found to be 0.026%; 0.034%; 0.042% and total amount increased by 0.016%; 0.018%; 0.023% respectively.

The amount of nitrate nitrogen in the soil was 14.85 mg /kg in variant 3, in variant 4 it was 15.86 mg /kg while in variant 5 - 16.10 mg /kg which was 0,84 mg/kg; 1,85 mg/kg; 2,00 mg/kg more than the previous amount. Similar patterns were observed in the data obtained on mobile phosphorus and changing of potassium.

In this experiment, in the system of double cropping the soybean sown after winter wheat and three-components mixed intercrops – oats, green peas, rye not only increased the amount of humus and other nutrients in the soil, but also increased the growth, development and the yield of cotton. These increased amounts were scientifically proven.

As per the data obtained in autumn of 2004 in the 2nd field conditions (2002-2004) in variant 3, 1:2 system, winter wheat: cotton plant: cotton plant double cropping system the amount of humus in the soil constituted 1.186%, which was 0.014% higher than initial amount of humus, as well as, it

was found out that the parameters of nitrogen and phosphorus amounts increased compared to baseline levels (0.081%; 0.090%). In experimental variant 4, 1:2, winter wheat + second crop (soybean): cotton plant: cotton plant, in variant 5, 2:1 winter wheat + second crop (soybean): winter wheat + second crop (soybean) + intercrop (oats + green peas + rye): cotton plant variants, there was an increase in total nitrogen and humus amount in the soil, while the total phosphorus content remained the same.

According to the obtained information on the active quantities of nutrients, in experimental variant 4, 1: 2, winter wheat + second crop (soybean): cotton plant: cotton plant: double cropping system nitrate nitrogen amount constituted 26.7 mg / kg, and this is 6,7 mg / kg higher than the previous indication and in 5th variant 5.5 mg / kg higher. The amount of phosphorus and metabolizing potassium out of nutrients also increased respectively by 2-2.5; 50-60 mg / kg.

Based on the results of agrochemical analysis on the influence of double crops soybeans, intercrops oats, green peas and rye which were cultivated under short-term cotton plant-winter wheat double cropping systems, on humus and other nutrients in soil, we can conclude that under short-term double cropping systems the cultivation of soybean as a second crop after winter wheat; and sowing of oats, green peas and rye in combination caused the increase in humus content from 0.022% to 0.038%, nitrogen from 0.026% to 0.042%, phosphorus 0, 016% to 0.023%.

Due to the decomposition of organic residues of double and intercrops planted under particular systems, the levels of humus, nitrogen, and even phosphorus in the soil has increased. It is obvious from the analysis that the more organic matter remains in the soil, the greater the nutrient content. Because the legume soybean cultivation enriches the soil with biological nitrogen, accelerates microbiological processes in the soil, and enhances the decomposition processes following soilification. This, in turn, causes the increase of humus and nitrogen content in the soil, making it easy to absorb phosphorus compounds that are difficult to absorb.

4. Conclusions

Consequently, it can be concluded according to the results of field experiments that in short-term double cropping systems sowing soybean as a second crop after winter wheat during two years and then in autumn, intercrops oat, green peas and rye with the three-components, and harvesting them in spring following plowing the land with their organic residue (stubble and roots), decomposition of this residue allowed an increase in soil mass and influenced positively on water permeability feature of soil and capability of absorbing phosphorous compounds easily which was difficult to absorb before. As a result of aforementioned measures the fertility of soil and productivity of cotton plant also increased.

References

[1] Dospekhov B.A. (1985). Methodics on field experiments. Moscow: Agropromizdat, 351 p.
[2] Kholikov B.M., Nomozov B. (2009). Effective second crops. Uzbekistan agriculture, №4. p.24.
[3] Rakhmatullaev G. (2013). The influence of double crops on the productivity of cotton plant varieties. Agro-ilm. Tashkent, №2(26), pp. 27-28.
[4] The methods of agrochemical researches on soil of Central Asia. Tashkent, UzSREI, 1973. 135 p.
[5] The methods of agrophysical researches on soil of Central Asia. Tashkent, 4th edition. UzSREI, 1973. 132 p.
[6] Tojiev M., Tojiev K. (2013). The influence of grain-legumes crops sown after winter wheat on the productivity of cotton, Uzbekistan agriculture. №9, p. 23.
[7] Tojiev M., Tojiev K. (2016). The influence of intercrops and green manure sown after winter wheat on soil moisture and its mass. Collection of materials from international scientific-practical conference on the theme “Crop selection, seed-breeding and prior aspects of agrotechnology”. Part-2., Tashkent. pp.173-175.