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Influence of the Properties of Soil Bulk and Porosity on Repeated Crops in the Vegetable Crop Rotation System

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Abstract: ***The article presents the results of a study of several crop species (mung-bean, soybeans, maize) as an optimal precursor for the main crops- cotton and cereals under the conditions of light gray soils of the Andijan region, as well as their effect in comparison with soil, cotton and cereals.***

Keywords: light gray soil, cotton, cereals, vegetables, soybean, mung-bean, maize, bulk mass, porosity

1. Introduction

Regular high yields and increased crop yields depend on soil fertility and crop production.Fertility of the soil is understood as the natural property of the soil, the maximum satisfaction of its nutrients and moisture throughout the growing season of plants. The more fertile the soil, the plant is saturated with nutrients and moisture, the higher its ability to form a yield. Crop rotation is an important component of agriculture. Measures for tillage, top dressing, protection against weeds, diseases and pests, various types of soil erosion are the basis of the crop rotation system. Currently, the full provision of the country's population with food products is the main task. To perform these tasks, it is necessary to enter into the system of the existing crop rotation of the area under the potatoes, vegetables and melons.

Currently, the main tasks of agriculture are preservation and improvement of soil fertility during crop rotation, regular maintenance of it, the introduction of constant monitoring of the general condition of the land and its effective use, maintaining the balance of the withdrawal and input of nutrients, the introduction of local fertilizer and organic matter, widespread adoption of resource-saving technologies. To restore and increase the lost soil fertility from farms, it is necessary to focus on siderate, repetitive and intermediate crops that increase soil fertility, increase food production, feed nutrition for livestock; grow legumes, vegetables and melons, grains and legumes.

Recent years in the republic, there has been a decrease in soil fertility, an increasing decrease in the required nutrients in the soil for normal plant growth and development limits the possibility of obtaining high and high-quality crop yields.

One of the most important organizational and agrotechnical measures ensuring the improvement of the ameliorative state of the soil in agriculture, increasing fertility, efficient use of irrigated lands, combating weeds, diseases and plant pests, as well as obtaining stable high and high-quality crops is crop rotation.

The insufficient formation of a science-based system for the rational distribution of agricultural crops, such as vegetables, potatoes, melons, cereals, legumes in the cotton and spring wheat complex for diversified farms in Andijan region limits the possibility of obtaining high agricultural yields cultures. In this regard, it is required to develop on a scientific basis a new crop rotation system or improve the existing one.

2. Methods and materials

Field experiments were conducted on the fields of farms «Ming o`rikosmoni» and «VictoriyaAsaka» of Andijan region. The soils of the experimental plots are light gray soils, the medium-sandy mechanical composition, old-irrigated, non-saline, groundwater are located at a depth of 4-5 m. The humus content in the arable soil layer is 0.8-1.0%, total nitrogen is 0.079-0.081%, phosphorus- 0.150-0.153%, bulk density- 1.40-1.43 g/cm^3. The experiments were carried out in a short alternation (1: 1) of crop rotation in the «vegetables-cereals» and «vegetables-cotton» systems. These experimental systems were as follows: to create the agrobackground in 2016, as the main crop, 1agrobackgroundis potato, 2 agrobackground is cabbage, 3 agrobackgroundis cucumber and 4 agrobackgroundis carrot. After harvesting the main crops for each agricultural background, repeated crops were sown: soybean, mung-bean and maize. Used cultivars: potato-«Zarafshon», cabbage-«Iyunskaya», cucumber- «Khosildor» and carrots- «Mishak 95». Fertilizing with mineral fertilizers was carried out on an annual basis per hectare $N_{200}P_{140}K_{100}$. Cultivars used as re-crops: soybean- «Nafis», mung-bean- «Pobeda-104», maize- «Uzbekistan-306 AMV». Fertilizing soy and mash during the research period was carried out at the rate of $N_{60}P_{90}K_{60}$, maize- $N_{200}P_{140}K_{100}$. The experiments were carried out in 16 variants, the total area of each variant is 240 m^2 (length is 50 m, width is 4.8 m), of which the estimated area is 120 m^2, in triplicate; the total area is 1.15 hectares.

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3. Research Results

According to the purpose and objectives of the research, as a result of studying the influence of crops during crop rotation on important physical and chemical properties of the soil, the indicators of volumetric mass and porosity of the soil in the field sites are determined. The bulk density and porosity of the soil creates a favorable condition for the growth and development of the plant.

In this regard, as a result of growing potatoes and cabbage, the formed agricultural backgrounds each create a special soil environment, which plays an important role in life activity during the period of full growth and development of the plant. For example, in the variant with an agricultural background, where potato and cabbage appeared as the main crop, the average volumetric mass of the arable layer of soil (0-30 cm) was 1.31 g/cm^3 at the beginning of the action periods, at the end of the period action compaction is observed at 0.06 g/cm^3 and it amounted to 1.37 g/cm^3 (1 and 4 variants). The compaction of bulk density up to 0.05 g/cm^3 in the subsurface layer (30-50 cm) of soil was established and it amounted to 1.38 g/cm^3. In this variant, we can say that favorable soil conditions have been created for the normal growth and development of plants. In the second variant, where it was sown as a re-culture of mung-bean, a similar phenomenon is observed. At the same time, the soil density was 0.04-0.05 g/cm^3 when compared with the beginning of the period of action and the same results were obtained with the variant where soybean was sown. In the variant where maize is used, soil compaction is observed to 0.07 g/cm^3. A strong compaction was established at 0.02-0.03 g/cm^3 when compared with options where soybean and mung-bean were sown. In this embodiment, soil compaction increased under the influence of activities such as inter-row tillage, irrigation, etc. In addition, it can be said that maize has a strong effect on water and the physical properties of the soil due to its strong root system and nutritional status.

Moreover, soil porosity, depending on the bulk density, also showed positive properties. For example, in the variant where soybean was sown, at the beginning of the period of action, the porosity of the soil of the arable layer (0-30 cm) was 51.5%. At the end of the period of action, there is a decrease of 2.2% and amounted to 49.3%. In the variant where the mung-bean was sown, the creation of such a soil condition is also observed, and in comparison with the variant where soybean was used, a decrease in soil porosity of only 0.3% is noted. In the third version, where maize is sown, soil porosity decreased by 1.6-1.8% and amounted to 48.9-48.2% of the arable layer. Also, in the variants of the cabbage agricultural background, where soybean, mung-bean and maize were sown (4-6 variants), similar results were obtained with respect to the bulk density and soil porosity as with a potato agricultural background.

Thus, as a result of sowing potato and cabbage in agricultural backgrounds, where the second crops were soybean and mung-bean, a uniform conservation of soil conditions was achieved. Soil conditions, as well as according to the properties of the root system of soybean and mung-bean crops repeated crops, water and physical properties of the soil are improved. Moreover, an increase in nutrients is ensured as a result of a positive effect on chemical processes on the basis of improving the physical properties of the soil in variants where soybean and mung-bean were used as repeated cultures in studies.

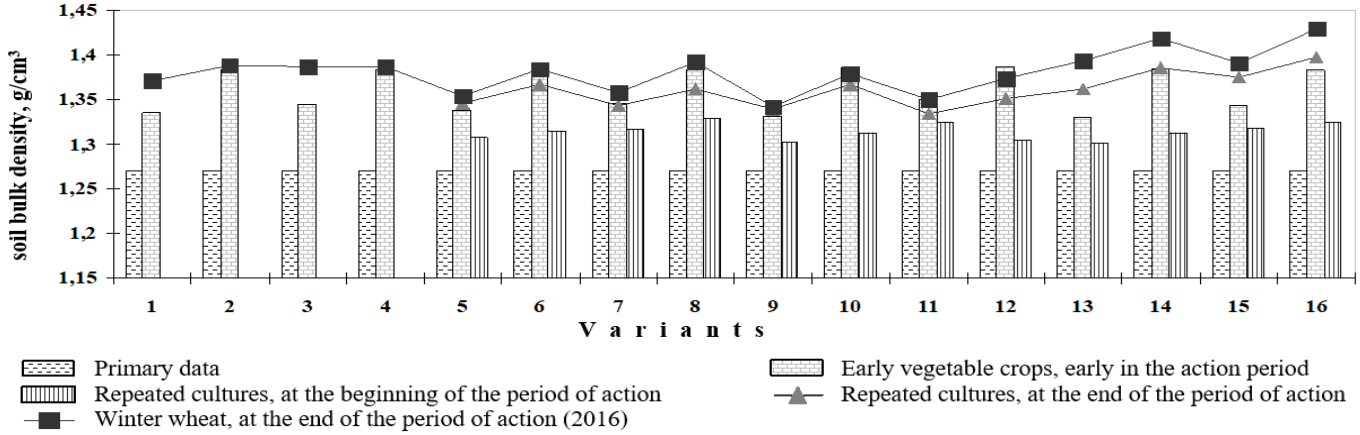

Figure 1: The effect of early vegetables, second crops and winter wheat on the volumetric mass of the soil (0-30 soil layer), g/cm^3, (2015, experiment 1)

4. Conclusion

1) It has been established that during the cultivation of soybean and mung-bean as a second crop after early potato and vegetables, the process of splitting of humus and nitrogen organic substances slows down due to a decrease in the amount of oligotrophic and dendratification microorganisms in the soil, as well as the pedotrophic index, the number of bacteria assimilating the mineral increases nitrogen, ammoniation and oligonitrophilic microorganisms, this in turn leads to the accumulation of a large amount of carbon and nitrogen organic substances.
2) It has been established that for re-cultivation of soybean and mung-bean, cucumber is a good precursor, residues of roots and stubble in the soil after mung-bean are 2.0-2.6 t/ha, and after soybeans 1.2-1.7 t/ha, respectively, nitrogen is returned to the soil through them- 22-36 kg; 26-30 kg, phosphorus 11-17 kg; 9-13 kg, potassium - 22-35 kg; 14-20 kg respectively.
3) An average grain yield of 48-51 kg/ha was obtained when cultivating winter wheat instead of soybean and mung-bean after early potato and cucumber, an addition-

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al crop was obtained with agricultural backgrounds: «potato + mung-bean» and «cucumber + mung-bean» in the amount of 2.6 and 2.8 c/ha, respectively; «potato + soybean» and «cucumber + soybean»- 4.7 and 5.1 c/ha, respectively. The highest protein content in the grain was obtained by sowing mung-bean and soybean after early potato, after which, when growing winter wheat, 1.4-7.2% compared to other options, the highest gluten content in the grain was 4.7-5.4% was obtained by sowing mash and soybeans after cucumber, then when growing winter wheat.

4) A high yield was established when growing cotton after mung-bean and soybean, the precursor of which was early potato in the amount of 33.8 and 34.7 kg/ha, respectively, the additional yield was 3.6 and 4.5 kg/ha, respectively. When growing mash after early potato, soybean after cucumber, then cultivating cotton compared to the control, 1000 seed weight was higher by 2.8 and 3.1 g, respectively, the oil content in the grain was 1.1 and 1.2%, the fiber length- 2.0 and 2.3 mm, fiber yield 1.1 and 1.4%, respectively.

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