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# FUNDAMENTALS OF SOIL PRODUCTIVITY IMPROVEMENT

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**Annotation:** This work explores the fundamental principles and practices essential for improving soil productivity, a key factor in sustainable agricultural development. It discusses the physical, chemical, and biological properties of soil that influence its ability to support plant growth, such as soil structure, nutrient availability, organic matter content, pH balance, and microbial activity. The study also evaluates various soil management techniques including crop rotation, fertilization, organic amendments, conservation tillage, and erosion control. Emphasis is placed on integrated soil fertility management as a holistic approach to enhancing and maintaining productive soils over the long term.
**Keywords:** soil productivity, soil fertility, soil management, soil health, nutrient cycling, organic matter, soil structure, sustainable agriculture, soil improvement, fertility enhancement.

In the agriculture of our republic, cotton is currently one of the main crops. Currently, the sown areas of all cotton-growing farms have been allocated to farms. Conditions have been created for increasing agricultural practices, crop yields, and soil fertility.

Cotton is a crop that requires specific agrotechnical measures. Its yield depends on various internal and external factors, among which soil is the most fundamental phenomenon, fundamentally influencing crop yields. Based on the physical and chemical properties of the soil, the growth and development of the cotton root system depends on the physical and chemical properties of the soil and affects the development, yield, and quality of the above-ground part of the plant. Our farmers have long used organic fertilizers to increase soil fertility.

The value of local fertilizer is that it contains a large amount of micro and macro elements necessary for the normal growth and development of the plant. One ton of manure contains 5 kg of nitrogen, 2.5 kg of phosphorus, 6.0 kg of potassium, 115 g of manganese, 2.5 g of boron, 5 g of copper, and 10 g of lead.

The lower reaches of the Amu Darya are typically poorly supplied with organic matter, comprising approximately 0.5-1.3% of the majority of irrigated land.

Due to the continuous cultivation of cotton for several years under irrigated farming conditions, the depletion and decrease of organic matter in the soil led to the loss of favorable physical properties and a decrease in nitrogen elements. Experiments conducted over many years at the Karakalpakstan Agricultural Research Institute have shown that alfalfa is beneficial for increasing soil fertility, preventing soil salinization, and reducing wilt disease.

After the third year of alfalfa, up to 200-300 kilograms of biological nitrogen accumulate in the soil per hectare. Alfalfa not only accumulates organic matter in the soil but also plays a significant role in improving its physical and chemical properties. It increases the number of high-water resistance aggregates in the soil with a size of 0.25 mm. Cotton-alfalfa crop rotation

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is one of the key measures for continuously increasing soil fertility. Furthermore, applying local fertilizers (manure) to cotton fields has a positive effect on the nutrient content in the soil.

With the regular introduction of cotton-alfalfa crop rotation, the soil composition becomes enriched with organic matter, the amount of humus increases, and as a result, the fertility of irrigated soil increases.

When implementing a crop rotation system that includes perennial grass crops, the soil composition is enriched with organic matter containing 9-12 tons of carbon, protein, and other substances per hectare.

The remains of three-year-old alfalfa are the most important basis for enriching the soil with organic matter. Plant residues contribute to the enrichment of the soil with organic matter. In this case, great importance should be attached to the growth and development of alfalfa and the number of plants.

Organic fertilizers improve the physical properties of the soil, regulate the moisture absorption and moisture retention capacity of soil aggregates, and continuously provide the plant with the necessary organic matter, contributing to the uniform growth and development of cotton and increasing the activity of beneficial microorganisms in the soil.

With a sufficient amount of organic fertilizers, the soil's thermal regime improves, and the soil is preserved in granular state. In this case, good opportunities are created for obtaining a high yield of cotton.

**Alfalfa yield of different ages**

| Soil type by mechanical composition | Alfalfa root number in the 3rd year (thousand) | Obtained alfalfa yield c/ha | | | | Root mass accumulation (0-50 cm) c/ha | | | Accumulated nitrogen, kg | Accumulated organic matter (humus) 0-50 cm, c/ha |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1st year | 2nd year | 3rd year | 4th year | 1st year | 2nd year | 3rd year | | |
| Average | 850 | 3-330 | 140-150 | 160-170 | 110-120 | 45-50 | 98-105 | 115-120 | 445 | 325-310 |
| -//- | 1020<br>1010 | 64-70 | 160-164 | 165-172 | - | 10-80 | 106-123 | 155-177 | 520 | 325 |

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|---|---|---|---|---|---|---|---|---|---|---|
| -//- | 800-820 | 30-35 | 130-140 | 160-170 | - | 43-47 | 103-120 | 118-129 | 422 | 400-422 |
| Heavy | 805 870 | 50-58 | 123-152 | 152-154 | 121-130 | 30-40 | 93-100 | 103-134 | 530 | 340-375 |
| -//- | 650-665 | 43-51 | 124-131 | 132-136 | - | 37-43 | 81-86 | 91-103 | 470 | 320-330 |
| -//- | 650-665 | 43-51 | 124-131 | 132-136 | - | 37-43 | 81-86 | 91-1036 | 470 | 320-330 |

Thus, the application of organic fertilizers and the introduction of crop rotation are the basis for increasing soil fertility.

**Conclusion.** Improving soil productivity is a multifaceted process that requires a deep understanding of the soil's physical, chemical, and biological characteristics. This study emphasizes that maintaining soil health through balanced nutrient management, enhancement of organic matter, proper pH regulation, and sustainable farming practices is essential for long-term agricultural productivity. Techniques such as crop rotation, conservation tillage, and the use of both organic and mineral fertilizers contribute significantly to enhancing soil fertility and structure. Importantly, soil productivity cannot be improved through a single method or input. Instead, an integrated approach that combines good agricultural practices with site-specific soil management strategies is vital. By prioritizing soil as a living and dynamic resource, farmers and land managers can ensure not only higher yields but also the sustainability of ecosystems and food systems. The fundamentals discussed provide a strong foundation for the development of resilient and productive soils in both current and future agricultural landscapes.

**References**

1. Ismailov U.E., Sadikov E. Features of air circulation intensification. // Seed Rotations - the Basis for Increasing Crop Yields and Land Fertility. // Proceedings of KKNIIZ - Issue. 14 - Nukus "Bilim" 1992 - P. 13-16.
2. Namozov F.B. Improvement of short-rotation sowing systems to increase soil fertility and cotton yield. // Abstract of the dissertation for the degree of Doctor of Agricultural Sciences. - Tashkent. 2016. - 76 p.
3. Namozov F.B., Iminov A.A. Influence of crop rotation of cotton, winter wheat, repeated and intermediate crops on soil fertility. // journal "Agroilm" - Tashkent. 2016 - No. 4 (42) - P. 21-22.
4. Sadikov E. Intensification of fodder fields of cotton rotations on meadow soils of Karakalpakstan. // Abstract of the dissertation for the degree of Candidate of Agricultural Sciences. - Tashkent. 1993 - 20 p.
5. Turdishev B., Sadikov E., Berdikeev B., Nazarimbetov I. Influence of forage crops on the agrochemical properties of soil in clean and compacted sowing. // "Agroilm" journal. - Tashkent. - 2019. - No. 3 (59) - P. 97-98.
6. Khalikov B.M. Namozov F.B. Scientific Basis of Crop Rotation. // monograph. Tashkent. - 2016. - 222 p.
7. Methods of agrophysical research of soils of Central Asia // 4th ed.
Tashkent. - Soyuz NIXI - 1973. - 132 p.