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INNOVATIVE SOLUTIONS AIMED AT INCREASING SOIL FERTILITY

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Annotation: This article analyzed the problems that arise due to the decrease in soil fertility and the possibilities of introducing innovative technologies for its prevention. The decrease in soil fertility has a serious impact on the efficiency of agricultural production. In this regard, ways to restore soil fertility were considered through the development and introduction of modern technologies, especially agrotechnics. The article provides recommendations on the application of innovative technologies in soil restoration, strengthening the educational and production system.

Keywords: soil fertility, innovative technologies, water and wind erosion, erosion protection, agrotechnics, sustainable agriculture, reclamation, ecological restoration.

Annotatsiya: ushbu maqolada tuproq unumdorligining pasayishi sababli yuzaga kelayotgan muammolar va uning oldini olish bo‘yicha innovatsion texnologiyalarni joriy etish imkoniyatlari tahlil qilindi. Tuproq unumdorligining pasayishi qishloq xo‘jaligi ishlab chiqarishining samaradorligiga jiddiy ta'sir ko‘rsatmoqda. Shu munosabat bilan, zamonaviy texnologiyalarni, ayniqsa agrotexnikalarni rivojlantirish va joriy etish orqali tuproqning unumdorligini tiklash yo‘llari ko‘rib chiqildi. Maqolada tuproqni tiklashda innovatsion texnologiyalarni qo‘llash, o‘quv va ishlab chiqarish tizimini mustahkamlashga oid tavsiyalar keltirilgan.

Kalit so’zlar: tuproq unumdorligi, innovatsion texnologiyalar, suv va shamol eroziyasi, eroziyadan muhofaza qilish, agrotexnikalar, barqaror qishloq xo‘jaligi, melioratsiya, ekologik tiklanish.

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Аннотация: в данной статье были проанализированы проблемы, возникающие из-за снижения плодородия почвы, и возможности внедрения инновационных технологий ее предупреждения. Снижение плодородия почв серьезно сказывается на эффективности сельскохозяйственного производства. В связи с этим были рассмотрены пути восстановления плодородия почв путем развития и внедрения современных технологий, особенно агротехники. В статье даны рекомендации по применению инновационных технологий в восстановлении почв, укреплению учебно-производственной системы.

Ключевые слова: плодородие почвы, инновационные технологии, водная и ветровая эрозия, защита от эрозии, агротехника, устойчивое сельское хозяйство, мелиорация земель, экологическое восстановление.

Introduction: nowadays, the decline in soil fertility remains one of the most pressing global issues. Due to climate change, improper use of agricultural techniques, and the reduction of water resources, lands gradually deteriorate, leading to a decrease in crop yields. This situation particularly increases the impact of agriculture on the economy in developing countries. On June 10, 2022, the President of the Republic of Uzbekistan issued Decree PQ-277, 'On measures to create an effective system to combat land degradation,' which outlines a number of tasks for the Ministry of Agriculture of the Republic of Uzbekistan to fight land degradation in the country, prevent its negative consequences, mitigate desertification in regions, and improve or restore the fertility of degraded lands. The mountainous areas of our country are suffering from water erosion, while Karakalpakstan and the Bukhara and Navoiy regions are experiencing wind erosion. Meanwhile, there is a need to apply innovative technologies to restore soil fertility and maintain its stability.

Problem statement: The decline in soil fertility is mainly related to several negative factors, such as overusing the land, improper irrigation systems, lack of nutrients, and climate change.

Research conducted across the country shows that due to water erosion, up to 100-150 tons of soil are washed away per hectare each year. As a result, the amount of humus, nitrogen, and phosphorus decreases. This situation reduces crop yields by 20-60%. Erosion is the process of soil and rock breaking down under the influence of water and wind and the loss of the fertile layer. Water erosion is called soil erosion, while wind erosion is called deflation. If erosion happens without human involvement, it is called 'natural' or 'geological' erosion. If it occurs under human influence, it is called 'anthropogenic' erosion.

Research Method: This article analyzes the factors leading to a decrease in soil fertility and explores ways to apply innovative technologies to address them. The use of mineral fertilizers, irrigation systems, and agronomic measures aimed at increasing fertility are extensively examined. Information on the effects of various mineral fertilizers, their application methods, and their impact on soil composition is summarized, and the effectiveness of both traditional and drip irrigation methods is compared. At the same time, the results of using mineral fertilizers are evaluated based on practical experiences, and the most optimal methods are identified. Research is conducted on environmentally friendly and economically efficient technologies, and their potential applications in agriculture are studied. Based on the results obtained, the most effective methods to improve soil fertility are recommended.

1. Fighting erosion:

Active measures used against soil erosion include the following.

1. Against water erosion:

- ❖ Creating furrows and artificial micro-reliefs in the fields (collecting melted snow and rainwater);

- ❖ Driving according to the structure of the field surface;
- ❖ Plowing without overturning the soil layer;
- ❖ Building various obstacles (floors, ditches, special structures);
- ❖ Planting different crops in the fields;
- ❖ Using improved, modern water-saving irrigation techniques and technology (sprinkling, drip, underground irrigation, etc.);

2. Against wind erosion:

- ❖ Create maps of fields where dust storms (movement of particles) may occur, justify projects and technological processes;
- ❖ Organize soil protection (avoid plowing areas prone to deflation, reduce soil tillage);
- ❖ Increase moisture in the topsoil (implement crop rotation, plow without turning the soil);
- ❖ Improve soil fertility (apply organic fertilizers, practice crop rotation, create microstructure in the tilled layer of the soil);
- ❖ Preserve the top layer of soil (compaction, use polymer materials, colmatation);
- ❖ Open furrows, remove ridges (obstacles);
- ❖ Plant shelterbelts, various fast-growing perennial plants

In our opinion, along with the above, using biogumus is very important in increasing soil fertility and boosting crop yields.

2. Increasing soil fertility: Soil fertility is its main indicator and is considered the key criterion describing the suitability of soil for agriculture. Soil fertility comes in three types: 1-Natural fertility, 2-Artificial or effective fertility, 3-Potential or hidden fertility. The soil layer contains organic matter made up of plant, animal, and microorganism residues. Under the influence of biochemical processes, the organic matter decomposes and forms a complex ecological compound called humus (compost). By purposefully using organic and mineral fertilizers, the humus balance can be maintained and improved. In our opinion, nowadays the best way to maintain humus balance is through "biogumus" prepared with the help of California red worms.

Biogumus is currently the most optimal solution for improving agricultural products and soil fertility. In our region, there are many lands with low fertility. California red worms help us in producing biogumus (see the picture). These worms are deep red, 8 to 10 centimeters long, and weigh about 1 gram. The main sources of food for the California red worms are livestock manure, tree leaves, and various vegetables, for example, carrots. The waste that the worms produce by feeding on these things is called biogumus. Research on the chemical composition of biogumus has identified 38 different substances. Examples include sodium, copper, iron, nitrogen, and so on.

Effects and benefits of biogumus:

1) Increases soil fertility by 20-25%;
2) Enriches the soil with organic compounds;
3) Boosts plant growth rate by 10-24%;
4) Helps retain soil moisture;
5) Reduces the time for crops to be ready (see picture).




This photo was taken in the village of Pargos in the Bostanlik district of Tashkent region. Nowadays, not only in Tashkent region but also in all other regions, people are increasing biogumus using California red worms. Many families are using biogumus as a home-based business to keep themselves busy and reduce poverty. Biogumus is mainly sold in flower shops. During the process of taking this photo, I personally saw the worms with my own eyes; it's hard to distinguish this worm from an ordinary earthworm. From conversations with those who raise California red worms, I became sure that before raising the worms, you need to prepare a special place for them. That way, the California red worms won't mix with ordinary earthworms. During the raising process, it's also necessary to water them several times. This ensures that the biogumus will be of good quality.

3. Implementing Innovative Technologies: as we know, the irrigation process can be carried out in two ways. The first is gravity irrigation, which relies on water moving across the surface due to its own weight, and the second is pressurized irrigation, which is based on delivering water under high pressure. Methods of pressurized irrigation are engineering techniques designed to deliver water directly to the locations of crops using pipes and hoses. Pressurized irrigation methods include drip, sprinkler, and subsurface irrigation.

Conclusion: the decline in soil fertility is a global problem, and preventing it and restoring fertility requires the implementation of modern technologies. Research shows that combating erosion, effectively using mineral and organic fertilizers, and applying water-saving irrigation technologies help improve soil quality.

Innovative approaches, including the use of biogumus, drip and underground irrigation methods, and planting shelterbelts are also important for increasing soil fertility. Additionally, properly organizing agrotechnical measures boosts crop yields and ensures the stable production of agricultural products.

Today, Uzbekistan has state programs and legislative documents aimed at preventing water and wind erosion in agriculture, and it is necessary to fully implement them in practice. Using scientific advancements in agriculture not only helps increase crop yields but also contributes to maintaining ecological sustainability. So, widely implementing innovative technologies to restore and preserve soil fertility remains one of the pressing issues.

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5. The scientific article is recommended for publication by **T. Shavazov**, an assistant at the Department of Geodesy and Geoinformatics.
6. Ilmiy maqolani Geodeziya va geoinformatika kafedrasi assistenti **T.Shavazov** nashrga tavsiya qiladi.