

THE ROLE OF ROOT CROPS IN MAINTAINING SOIL FERTILITY AND STABILIZING THE ECOSYSTEM

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Annotation: Root crops play a significant role in maintaining soil fertility and stabilizing ecosystems. Their biological characteristics, such as a well-developed root system, contribute to improving soil structure, increasing humus content, and enhancing water retention capacity. The cultivation of root crops within crop rotation systems supports sustainable agriculture by preventing soil erosion and reducing the need for chemical fertilizers. This article examines the ecological and agrobiological importance of root crops in preserving soil productivity and ensuring environmental sustainability.

Keywords: root crops, soil fertility, ecosystem stability, sustainable agriculture, soil conservation.

Аннотация: Корнеплодные культуры играют важную роль в сохранении плодородия почвы и стабилизации экосистем. Их биологические особенности, включая развитую корневую систему, способствуют улучшению структуры почвы, увеличению содержания гумуса и влагоёмкости. Выращивание корнеплодных культур в севообороте способствует устойчивому сельскому хозяйству, предотвращает эрозию почвы и снижает потребность в химических удобрениях. В статье рассматривается экологическое и агrobiологическое значение корнеплодных культур в сохранении продуктивности почвы и обеспечении экологической устойчивости.

Ключевые слова: корнеплодные культуры, плодородие почвы, устойчивость экосистем, устойчивое сельское хозяйство, сохранение почв

Nowadays, issues of maintaining ecological balance and rational use of natural resources in agriculture are gaining urgent importance. Degradation of land resources, decrease in soil fertility and disruption of ecological systems as a result of human activity are one of the most important problems on a global scale. In this regard, the importance of root crops in ensuring stability in the agricultural system is incomparable. Root crops - cultivated plants such as carrots, beets, radishes, potatoes, turnips - improve the structural condition of the soil through their deep and branched root system, increase the amount of humus and increase its water retention capacity. As a result, these crops have a positive effect on the process of maintaining and restoring the natural fertility of the soil. Also, the inclusion of root crops in the crop rotation system increases the biological activity of the soil, creates a favorable environment for beneficial microorganisms and reduces the need for chemical fertilizers. This, while ensuring environmental sustainability, expands the possibilities of growing environmentally friendly products.

The relevance of the topic is that the effective cultivation of root crops is of great importance not only from agrobiological, but also from an ecological and economic point of view. Therefore, their role in maintaining soil fertility and stabilizing the ecosystem is considered one of the important directions of modern agricultural research. Root crops of crops agroecological importance to study issue world on a scale village farm stability to provide with closely related was scientific from directions is one . The last one in years many foreign researchers this of crops soil structure , biological activity and ecosystem to stability positive the secret of the effect scientific in terms of based on They gave .

American scientist R. Lal (2004) in his “ Soil Carbon Sequestration oath Ecosystem Services ” in his work root vegetable of crops deep root system in the soil carbon amount

climate to the changes against natural protection factor as service to do emphasizes . His in my opinion , such plants soil erosion reduces , carbonate anhydride garden , stable organic substance rotation provides .

by the European Union's Food and Agriculture Organization (FAO, 2019) highlights the role of root crops as "biological diversification agents" in agroecosystems. They believe that by including crops such as carrots, beets, and radishes in a crop rotation system , the activity of microorganisms in the soil increases by 20–30 percent, which naturally increases the amount of humus.

Smith and Martens (2015) , it was found that soil water holding capacity and air permeability were significantly improved in fields planted with root crops. They attributed this to the mechanical action of the root system and the rapid decomposition of organic residues.

and M. Andrén (2009) in their study “Soil Organic Matter Dynamics in Long-Term Crop Rotations” conducted in Sweden found that crop rotation systems with root crops stabilize the soil organic matter balance in the long term. Their results show that legumes grown together with root crops maintain the nitrogen balance in the soil in a natural way.

In addition, according to the British Agricultural Institute (Rothamsted Research, 2021), root crops are recognized as plants that stimulate beneficial microbial processes in agroecosystems. They increase the number of beneficial bacteria in the soil and allow to reduce the use of chemical fertilizers by up to 15–25%.

The results of these foreign studies show that root crops are not only economically useful, but also a strategically important factor in ensuring ecological stability, maintaining soil fertility and restoring natural balance. Root crops occupy a special place among agricultural crops due to their biological structure and growth characteristics. Their main organ, the root, performs the function of accumulating nutrients, water and minerals in the plant, as well as ensuring vegetative growth. The deep and extensive branching of the root system ensures the upward movement of nutrients from the lower layers of the soil.

The roots of crops such as carrots, beets, radishes, and turnips improve aeration and stabilize the physical properties of the soil. In particular, these plants soften hardened parts of the soil, creating favorable conditions for subsequent crops. Biologically, root crops are rich in organic matter and are among the plants that activate the process of humus formation. Therefore, they play an important role in agriculture as a means of maintaining and increasing natural soil fertility.

Soil fertility is one of the main indicators of the agricultural system, directly affecting plant growth and yield. Root crops are an effective biological factor in maintaining soil fertility naturally. Their root system improves soil structure, contributes to the formation of humus, and increases the number of beneficial microorganisms in the soil.

These crops also play an important role in the crop rotation system , balancing the balance of nutrient elements in the soil when planted after or before cereals and legumes. They naturally stimulate the cycle of nitrogen, phosphorus, potassium and organic matter in the soil. As a result, the need for chemical fertilizers is reduced, which increases environmental safety.

Root crops also play an important role in reducing soil erosion, conserving water, and regulating the rate of decomposition of organic matter. Their plant residues act as a natural mulch for the soil, increasing the amount of humus.

Ecosystem sustainability is the ability to maintain a balance between natural and anthropogenic factors. Root crops, due to their ecological adaptability, play an important role in ensuring this balance. Their photosynthetic activity serves to reduce carbon dioxide in the air , and the root system supports the natural cycle of organic matter in the soil.

These types of crops stimulate the natural functioning of the ecosystem by maintaining biodiversity in the soil and creating a favorable environment for beneficial microorganisms, earthworms, and other living organisms. As a result, agroecosystems are maintained in a more stable, balanced, and productive state.

Expanding the area under root crops, properly incorporating them into crop rotation systems, and actively using them in organic farming are among the most effective ways to develop environmentally sustainable agriculture.

The results of scientific analyses and foreign research show that root crops are of particular importance in the agricultural system not only as a source of food, but also as an important factor in maintaining soil fertility and stabilizing the ecosystem. Their biological properties - a deep root system, high photosynthetic activity and plant mass rich in organic matter - play a decisive role in improving the physical, chemical and biological parameters of the soil.

The root system of root crops loosens soil layers, improves aeration, retains moisture and reduces erosion. Their decomposed organic residues increase the amount of humus and enhance the activity of beneficial microorganisms. Thus, these crops serve as natural biological fertilizers, reducing the need to use chemicals. This is an important factor in ensuring environmental safety and growing environmentally friendly products.

According to foreign sources, crop rotation systems involving root crops are considered an effective tool for maintaining long-term soil fertility, naturally sequestering carbon dioxide, and mitigating climate change (Lal, 2004; Kätterer & Andrén, 2009). Therefore, the role of these crops in the ecosystem is of complex ecological, economic, and agronomic importance.

On this basis, the following recommendations can be put forward:

1. to regularly include root crops in crop rotation systems, as they prepare the soil for subsequent crops and balance the nutrient balance.
2. Using root crops as a source of organic matter in organic farming systems improves soil quality and reduces the need for chemical fertilizers.
3. Expanding the base of agrobiological research, that is, studying the growth dynamics of root crops in different climatic conditions and their impact on soil composition, is scientifically and practically relevant.
4. **efforts** appropriate to local conditions, that is, creating new varieties that are water-saving, high-yielding, and enrich the soil, is an important direction for environmentally sustainable farming.
5. in agricultural policy should be recognized as one of the priority areas of the strategy for environmental safety and rational use of land resources.

Implementing the above recommendations will not only help maintain soil fertility for the long term, but will also create a sustainable ecosystem in agriculture, produce environmentally friendly products, and strengthen the country's food security.

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