Vision: Journal of Biomedical Research & Environmental Sciences main aim is to enhance the importance of science and technology to the scientific community and also to provide an equal opportunity to seek and share ideas to all our researchers and scientists without any barriers to develop their career and helping in their development of discovering the world.
Effect of Rice Cultivation on Soil Agrochemical Properties in Meadow-Swamp Soils

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Abstract

The article presents the properties of meadow-swamp soils in Tashkent region, where rice is grown. Changes in morphological characteristics and agrochemistry properties of these soils during rice cultivation are described. In the upper layers of these soils, the content of humus and nutrients is good and moderate, and it was observed that the content of nutrients decreased rapidly due to the beginning of sandy fractions from the bottom 50 cm.

Introduction

Hydromorphic soils of the serozem soil zone have a specific water regime. Soil types such as alluvial meadow, sedge meadow, alluvial swamp, sedge swamp are distributed in the zone of serosems. These soils are widely distributed on the lower terraces of rivers, at the edges of the plains, in the lowlands between the plains, and in the lower parts of the foothills. Hydromorphic soils in the serozem soil zone are characterized by a number of properties, including a stable wetting regime compared to similar soils in the desert zone. Here, the level of groundwater does not change drastically during the season, so the soil moisture regime does not change much. The level of mineralization of groundwaters is low, the hydromorphic soils of the region of light serozem soils located near the desert zone are highly saline, and in the region of typical and dark gray soils, the salinity is very low.

In hydromorphic areas, especially in meadow-swamp soils, mainly rice is cultivated. Rice paddy soils are useful areas for the cultivation of food grain crops, which are widely distributed on our planet. It feeds more than 3 billion people on Earth and provides more than 30% of their calories. Rice plays an important role in food balance. Rice is the most important food for more than 50% of the world’s population, and it is grown on almost 155 million ha of the world’s surface (http://beta.irri.org/index.php/). World rice production in 2008 was approximately 661 million tons, with more than 90% produced in Asia. At least 114 countries grow rice. China is the world’s largest rice producer, accounting for 30% of total world production, followed by India (22%), Indonesia (9%), and Bangladesh (7%) [1].
In 2023, it was grown on 165.25 million hectares in the whole world, and the total yield of rice was 742,541,804 tons, the yield was 60 t/ha. At the same time, the yield of rice in Tashkent region was 42 tons/ha. This is significantly lower than the agro-ecological potential of released varieties that produce more than 10.0 s/ha of grain with appropriate technology. A significant difference between potential and actual yields indicates that the biological potential of rice plants is not fully utilized [2].

Rice is the most important food for more than 50% of the world's population, and it is grown on almost 155 million ha of the world’s surface (http://beta.irri.org/index.php/). Rice is grown in 113 countries, mainly in the tropical and subtropical zones of Southeast Asia. It has been known for more than 4000-5000 years in China, India and Japan [3-5]. In Europe, this crop is grown in Spain, Italy, Greece and Turkey; It is grown in America, mainly in the USA and Brazil. 93% of world rice production is concentrated in Asia, 4.3% in South America, 1.5% in Africa, 1.2% in North America and 0.6% in Europe [4].

Rice agroecosystem is a complex agroecological multicomponent system. It differs from soils affected by periodic flooding by the complexity of the physical, chemical and biochemical processes occurring in them. The specific oxidation-reduction regime of soils disrupts the natural balance of conditions created in other hydrological environments, affects the intensity of migration of chemical compounds and the profile of individual elements, the synthesis and decomposition of mineral and organic substances, the speed of microbiological and biochemical processes. processes that largely determine their level of productivity.

Soils changed due to agrotechnical practices necessary for rice cultivation are traditionally called rice soils [6], aquarisms ("aquariz" means "flooded rice", "zem" means land means), aquazemes [7]. Their surface is completely or partially filled with water during the growing season. They are located in a wide geographical range formed by a complex system of specific phenomena of hydromorphic and automorphic soils. Regardless of the origin and landscape location, these soils pass into a special use regime, their initial profile changes under the influence of three main factors: flooding, suspensions with turbid waters and flow of mud (puddles) and periodic drainage [3].

Rice cultivation depends more on the moisture conditions under which the plant is grown than upon the former nature of the soils. Rice is not very sensitive to prior soil conditions with respect to texture and nutrient status, except for high sulphate contents [8]. Thus, paddy soil development is driven by the specific soil management practices that mask the soil's original character [1]. Also, processes of soil salinization during rice cultivation have been studied. Nadezhda Malysheva et al determined the direction of changes in soil salinity in the long term. Salinity was studied as part of rice soil condition monitoring. The degree, type and causes of their salinity were determined, the relationship between the regime of soil salinity and the regime of the level and chemical composition of underground water was established. Recommendations for managing the productivity of rice agricultural landscapes are provided [9].

Materials and Methods

Research Rice Research Institute is located in the south-eastern part of Tashkent region, Chirchik oasis, 15 km away from Tashkent city, on the left bank of the Chirchik river. In terms of geographical location, the coordinates of the institute are limited to 69°01'8" east longitude and 41°20' north latitude on the Greenwich scale.

In the research work, Nurmatov, et al. [10] "Methods of conducting field experiments", mobile nitrogen in the soil according to the method of I. V. Tyurin, phosphorus in acidic soil according to the method of A. N. Kirsanova, in alkaline soils according to the method of B. P. Mochigin, experiment transfer, phenological observation and plant sampling were carried out according to the "Metodika polevogo opyta" method and on the basis of the methodological manuals "Methodological instruction on rice cultivation in Uzbekistan".

The experimental scheme includes the following options: 1. Control - without fertilizer 2. Mineral fertilizers (N120, P120, K120) 3. Manure + 40 t/ha every two years. 4. FOSSTIM-3 bacterial (N120,P120,K120) 5. RIZOKOM-2 bioprep (N120,P120,K120) 6. Alfalfa+soybean+rice (N120, P90, K60). Soil samples were taken from the 0–30 cm layer before flooding the soil and planting rice, during the growing season and after harvesting. Their content of humus, nitrogen, phosphorus and potassium was determined.

Results and Discussion

Agricultural production has always been closely
correlated with soil quality. Soil fertility was primarily determined by the chemical, physical, and biological characteristics of the soil before automation and the widespread use of fertilizers. Farmers had few choices for enhancing soil quality and crop productivity. Furthermore, even while a greater range of technologies are available today that lessen the significance of naturally occurring soil fertility and quality for agricultural output, they are not always cost-effective, cannot overcome all obstacles, or are not readily available to farmers for other reasons [11].

The construction of irrigation systems with the movement of large soil volumes, agricultural activities, and especially rice cultivation, where rice cultivation technology is associated with the presence of water layer in the field for three months a year, transformed natural landscapes into agricultural landscapes, characterized by fairly large variety of soils, mesorelief forms, geochemical, hydrochemical and other indicators [12,13].

Our research was carried out in meadow-swamp soils. These soils are formed in alluvial deposits. Alluvial fans are conveyed internationally and are a common fluvial geomorphological component [14]. There are many influencing factors for the advancement of alluvial fans, including structural action, environment, catchment geography, catchment bedrock, catchment region, etc [15]. The alluvial fan is a significant land asset, particularly in a few rugged regions.

Improvement of the set of effective agrotechnologies that improve productivity and its quality, which prevent the decrease in soil fertility in accordance with the level and state of climate change, including biofertilizers and biopreparations that feed the plant from the leaves without growing rice using only mineral fertilizers. use, it is necessary to develop agro-measures that improve the physico-chemical properties of the soil. In practice, a new scientifically-based bioagrotechnology focused on ecological farming was created and approved. This bioagrotechnology consists of the complex use of bacterial fertilizers and biopreparations.

Many researches and 48 years of practice on rice cultivation show that the formation of soil fertility, their productivity and the level of productivity of this reclamation crop are inextricably linked with the amount of organic matter in the soil.

Soil flooding in paddy fields causes a significant loss of humus, especially in the early years of rice cultivation, and later this process slightly reduced the amount of humus in grassland-swamp soil by 1.15% after 48 years of continuous rice cultivation. showed. Soil humus loss after 48 years of rice cultivation in grassland-wetland rice fields showed a reduction of 37 t/ha in total humus, nitrogen, and mobile potassium in paddy soils, where losses in the first 3 years were 40 t/ha.

Soil morphological features are a set of external features of the soil, which are the result of the soil formation process and therefore represent the origin (genesis) of the soil, its development history, physical and chemical properties [16].

In order to study the soils of the study area, pits were dug and soil samples were taken. The relief of the land where the section is located is wide undulating, old irrigated, medium–cultivated, soil–forming rocks are located in alluvial deposits, the condition of crop cultivation is good, the soil surface is flat, and it is located in the mid–mountain plain (Figure 1).
The most comprehensive indicator reflecting the general state and direction of processes occurring in soils is the Oxidation-Reduction Potential (ORP). This value has a direct impact on the movement of elements with variable valence in the profile [17].

In the 1st option in the experimental field, humus is 1.992%, total nitrogen is 0.138%, mobile phosphorus is 16.7 mg/kg, potassium is 120 mg/kg. The soil environment was pH 7.08. In option 2, humus 2.451%, total nitrogen 0.219%, mobile phosphorus 21.4 mg/kg, exchangeable potassium 131.2 mg/kg, in option 3 humus 3.824%, total nitrogen 0.211%, mobile phosphorus 24 mg/kg, potassium 134.6 mg/kg in the 4th option humus 3.721%, total nitrogen 0.207%, total phosphorus 28 mg/kg, potassium 136.2 mg/kg in the 5th option humus 3.846%, total nitrogen 0.218%, mobile phosphorus 30.0 mg/kg, potassium was 134.4 mg/kg. In option 6, humus was 3.921%, total nitrogen was 0.227%, mobile phosphorus was 24 mg/kg, potassium was 136.2 mg/kg. The amount of carbonates in the soil fluctuates around 5–8%. The amount of nutrients listed above decreases towards the lower layers of the soil.

There are no mineral salts due to the fact that the experimental area is partially sloping, the subsoil consists of sand and small stones, and the groundwater flows from the north–east to the south–west.

If the amount of dissolved iron in the rooting medium of rice exceeds 300 to 500 ppm, the leaves usually turn inky-brown or orange (bronzing), and the rice suffers from iron toxicity. Iron concentrations below 30 ppm can be toxic in soils that are low in nutrients (especially potassium and phosphorus) or contain inhibitors of respiration such as hydrogen and 2–valent iron.

Iron toxicity was observed only in waterlogged soils with pH below 6.5 but aerobically below pH 5. Often in young acid sulfate soils (Sulfaquepts) showing dissolved iron concentrations greater than 500 ppm for long periods of time, iron toxicity/toxicity occurs even when plants are adequately nourished. But in most other soils, iron toxicity/toxicity is usually associated with nutrient deficiencies and sometimes hydrogen sulfide toxicity/toxicity (Table 1).

Research conducted on the high inspection of meadow-swamp soils showed that the total amount of mobile iron (FeO + Fe2O3) in the plowed horizon is 173.1 to 173.1 against the background of the relevant

<table>
<thead>
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<th>№</th>
<th>Option</th>
<th>Depth, cm</th>
<th>Humus %</th>
<th>Nitrogen %</th>
<th>Phosphorus %</th>
<th>mg/kg</th>
<th>Potassium %</th>
<th>mg/kg</th>
<th>CO2 %</th>
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redox regime of the previous rice rotation. 385.2 mg/100 g, containing from 3.0 to 8.0% of the total amount of iron oxide. Iron oxides dominate, their share is 92.0–97.0% of the total FeO+Fe2O3. Down the soil profile, the content of mobile forms of iron decreases. The maximum amount of FeO and Fe2O3 is limited to the plowed horizon. At the same time, the quantitative ratio of FeO/Fe2O3 in the soil profile does not change much.

In our research, a sharp decrease in iron oxide was observed in the upper layers of the soil (Figure 2).

This differentiation of the profile into the oxidized upper and reduced lower zones is explained by several reasons. One of which is associated with the formation of water-soluble iron-organic complexes, which can migrate freely in a neutral and alkaline environment characteristic of the soil under study [18]. The formation of these complexes was repeatedly pointed out in their studies by I.S. Kaurichev and E.M. Nozdrunova [19].

On the other hand, the migration of ferrous iron can occur actively, where drainage conditions and filtration properties of soils provide downward movement of moisture [20]. Such processes in the soils of rice fields are undesirable, as they cause degradation changes – the loss of iron from the arable layer. Thus, in the meadow-chernozem soil involved in rice cultivation, the development of the eluvial-gley process is pronounced.

**Conclusion**

It can lead to reduction of silty fractions in the cultivation of repeated crops of rice for 2–3 years in a row, as well as in continuous cultivation of this crop for long years. Cultivation of Muttasil rice limits the leaching of silt and even helps to consolidate it in the soil layers. The use of perennial grasses and leguminous crops (soybean, alfalfa) in rice rotation leads to a positive change in the agrochemistry properties of the soil. The studied meadow–swamp also has a positive effect on the fixation of clay fractions by the mineral part of the soil.

In meadow–swamp soils, the predominant soil processes are gleying, lessivage, and leaching of carbonates. As a result of the development of the eluvial–gley process, carbonates, silt fraction, water-soluble humus, mobile iron and phosphorus are washed out from the arable horizons. Soil profiles are formed according to the eluvial–illuvial type, the degree of differentiation of which depends on the drainage and reclamation state of the soils of the rice fields.

**Acknowledgment**

The authors would like to thank all the our gratitude to the scientific staff of the Scientific Research Institute of Rice (Tashkent), who helped us closely in conducting the research.

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