

## ANNOTATION

**of the dissertation work of Kultasov Bekzatkhan Shamuratovich on the topic: "The influence of tillage techniques and methods of applying nitrogen fertilizer on rice productivity in the conditions of the Kazakhstan Aral Sea region" submitted for the degree of Doctor of Philosophy (PhD) in the specialty 6D080100-"Agronomy"**

### **Relevance of the research topic**

The prospects for the agro-industrial complex of the Kazakhstan Republic are very large, there is a sufficient supply of arable and pasture land. The dynamic development of crop production is the key to the country's food security; irrigated agriculture plays an important role in this direction.

In the Address of the President of the Kazakhstan Republic K. Tokayev "Constructive public dialogue is the basis of stability and prosperity of Kazakhstan," an order was given to increase the area of irrigated land to 3 million hectares by 2030 and to ensure an increase in the volume of agricultural production by 4.5 times.

One of the most important crop prospects for irrigated agriculture is rice, which is a staple crop - 4.5 billion people in Asia's largest part of the world, hundreds of millions of people in other continents. In 21 countries of the world, where more than half of the world's population lives, 75% of wealth and health is associated with rice. Rice grits contain 30-75% carbohydrates, 7.6% protein and 0.4% fat and are widely used as dietary, especially aged and baby food due to its high nutritional content, good taste and easy digestion. In the food balance, rice ranks first among cereals. The sown area of rice in the world is 150 million hectares, the average yield is about 3.2 tons/ha. The demand for rice groats in the world is growing from year to year, especially a great need arises from developed countries.

According to the FAO (UN Food and Agriculture Organization), rice is grown in more than 110 countries around the world. However, rice yields between the countries range from 0.9 to 6.8 tons per hectare. In recent years, potential yields (6 tons/ha) have also been achieved by the USA, Korea, Japan, Australia, and Russia. Colombia, China, France, Italy, Spain are also approaching this level.

Although Kazakhstan is located in the northernmost rice growing zone, it is among the countries with an average rice yield (3-4 tons/ha). The increase in rice yield is associated with the introduction of new varieties of intensive type and the intensive use of innovative technologies in rice production.

The part of extensive steppes of Kazakhstan, the irrigated oases of the Kyzylorda region located in the southwest are the region with the sufficient climatic conditions, soils, water stocks suitable for crops of culture of rice. Despite low fertility of the salted soils of the earth are suitable for cultivation of culture of rice, the cross-border Syrdarya River which can give the water necessary for irrigation of crops flows. On the basis of long advanced know-how of cultivation of rice and researches of scientists the modern technology of cultivation of rice is

developed. The agricultural formations and farmers who are engaged in the region in cultivation of crops, including the main culture of rice have to use technology to increase productivity and quality of products of this plant, to increase competitiveness and to focus on export of products in the world market.

Although rice has long been grown in this region for food production, its intensive development is associated with the migration of Far Eastern Koreans to the Kyzylorda region, and mass intensive large-scale production began in 1965. As a result of phased reclamation work over 20 years, special rice irrigation systems were built and prepared on an area of about 300 thousand hectares. Meadow and swamp lands along the Syrdarya became massifs of rice production. During the Soviet Union, when there was enough irrigation water, rice production quickly developed in the region, and this crop was cultivated annually for 100 thousand hectares. As a result of the painstaking work of scientists of the Kazakh Rice Research Institute, formed in the 70s of the last century on the basis of the Kyzylorda rice experimental station, which has been conducting research on agricultural science in the region for 40 years, a regional technology has been developed that has been mastered by local dikhans.

In recent years, there has been a shortage of irrigation water in the region, in connection with this, proposals have been received to reduce rice crops. In 2023, the region's dikhans grew rice on an area of more than 89 thousand hectares, of which the harvest was 56 c/ha. In the coming year, it is planned to reduce the volume of rice crops by 10% and get gross production by increasing yields. Mineral fertilizers, including nitrogen ones, are of great importance in increasing rice yields. On saline, low-fertile meadow-swamp soils of the region, nitrogen fertilizers against the background of phosphorus-potassium fertilizers double the yield of rice.

Since the rice crop grows in conditions of constant flooding, the regime of nitrogen nutrition of plants differs from dry crops, so the effectiveness of the applied nitrogen fertilizers will be lower due to the loss of this element. The deterioration of the agrophysical properties of the soils of fields sown with rice over the years negatively affects the absorption of nutrient elements of mineral fertilizers by the soil-absorbing complex and accessibility to plants. Due to the above circumstances, studies aimed at choosing forms, studying the doses and methods of applying nitrogen fertilizers using progressive methods of tillage of the rice field, increasing the efficiency of nitrogen fertilizers by increasing the coefficient of nitrogen use of fertilizers differ in their relevance.

### **Purpose of dissertation research**

The purpose of the work is to determine the forms and doses of nitrogen fertilizers, the optimal methods and timing of their application, ensuring a high yield of rice by improving the agrophysical properties of the soil of the rice field using modern tillage tools.

### **Research objectives:**

- study of agrophysical properties of rice field soil and determination of influence of tillage facilities on its properties;
- familiarization with the nitrogen regime of the soil of a rice field flooded in water, study of the movement of a nitrogen element in connection with the use of fertilizers, study of its use by plants;
- determination of the effect of forms of nitrogen fertilizers used against the background of phosphorus-potassium fertilizers on the growth and development of rice plants;
- study of the effect of doses and methods of applying highly concentrated nitrogen fertilizer - carbamide on the yield of rice plants;
- study of the effect of forms and doses of nitrogen fertilizers, methods and timing of application on the nitrogen content in rice plants and the nitrogen utilization rate of fertilizers;
- study of the effect of basic and pre-sowing methods of rice field soil treatment on increasing the efficiency of nitrogen fertilizers;
- determination of economic efficiency of soil treatment methods and methods of nitrogen fertilization in rice growing.

### **Research methods.**

The scientific and methodological, information basis of research was made up of data from the following international, scientific and public organizations: the Food and Agriculture Organization of the United Nations (FAO), the International Rice Institute (IRRI), based in the Philippines, the Methodology for State Sorting of Crops of the Republic of Kazakhstan (2002), "Field Experience Methodology" (B.A. Dospekhov, 1985), the state list of breeding achievements of the Kazakhstan Republic allowed for use (2000-2022), Recommendations for spring field work in the Kyzylorda region (2011).

### **Justification of the novelty and importance of the results obtained.**

#### **Scientific novelty of work**

In order to improve the agrophysical properties of saline, low-productivity, heavy loamy meadow-bog soils of rice systems, studies were carried out for the first time to treat soils with modern tillage tools and determine their impact on the effective use of nitrogen fertilizers. The novelty of the dissertation is the pre-sowing application of highly concentrated granulated nitrogen fertilizer - carbamide in a local way, after careful treatment of the soil surface with modern tools in rice farming. The influence of the new system of soil treatment, forms and doses, methods and terms for applying nitrogen fertilizers used against the background of phosphorus-potassium fertilizers on the nitrogen regime in the soil, the growth and development of the rice plant, the use of nitrogen at various stages of plant development, the yield of nitrogen fertilizers with the main and by-product of the rice plant, the calculation of the nitrogen utilization factor allow us to determine the effectiveness of the use of nitrogen fertilizers in rice farming.

In the rice farms of the Kyzylorda region, a new best practice for the effective use of nitrogen fertilizers is the application of granulated nitrogen fertilizer - carbamide in a local way when treating rice field soils with modern tillage tools.

### **Scientific and practical value of work**

The results of the research on the dissertation work make a significant contribution to the science of insufficiently studied rice culture in our country. Modern tractors and tillage tools, in addition to increasing labor productivity, improve the agrophysical properties of the soil, create favorable conditions for the growth and development of rice plants. The ideal possibility of local application of highly concentrated granular fertilizer - carbamide is provided.

In rice-growing farms, the costs of transportation, storage, and fertilization are reduced due to the high content of the active substance. With the local method of application, the coefficient of nitrogen use of fertilizers increases, gaseous losses of nitrogen and its washing out by wastewater are reduced, the negative impact of harmful nitrogen compounds on the ecological state of the region is reduced. This work will make it possible, in the conditions of a shortage of water in the region, to effectively use land and water resources in agricultural formations, to obtain high yields, saving on seeds, fertilizers, fuels and lubricants and labor costs.

The use of a sequence of modern techniques for the main and pre-sowing tillage of the rice field and local application of nitrogen fertilizers in soils with improved agrophysical properties makes it possible to regulate the agrochemical and agrotechnological properties of soils, as well as the ecological and reclamation state of the rice systems of the region.

The conclusions and recommendations drawn up based on the results of the dissertation are guided by the rice farms of the region as a methodological manual for high-quality soil tillage with modern tools and the effective use of mineral nitrogen fertilizers.

The recommendations developed based on the research results are aimed at high-quality processing and efficient use of rice crop rotation lands. In addition, the results of the dissertation research contribute to the replenishment of theoretical and practical knowledge of students at various levels of special agricultural educational institutions.

### **Main provisions submitted for protection:**

- results of soil treatment with a system of machines consisting of modern agricultural implements to improve the agrophysical properties of the rice field soil;

- change in the nitrogen regime of the soil depending on the forms and doses of nitrogen fertilizers, methods and timing of application;

- influence of forms and doses of nitrogen fertilizers, methods and terms of application on growth and development of rice plant, accumulation of dry matter and yield;

- influence of forms and doses of nitrogen fertilizers, methods and terms of application on nitrogen content in rice plants and nitrogen utilization factor of fertilizers;

- economic efficiency of soil treatment techniques and methods of nitrogen fertilization in rice farming.

### **Author's personal contribution to the work**

The doctoral student contributed to the selection of the research object, the definition of the purpose and tasks of the work, the preparation of the program and research methodology, the conduct of field experiments, data collection, their calculation and analysis, data processing, analysis, publication of articles.

### **Description of the doctoral student's contribution to the preparation of each publication**

The results of the dissertation research were annually heard and discussed at a meeting of the Department of Agrarian Technologies of the Kyzylorda University named after Korqyt Ata. The main results and conclusions of the work were published in the form of 10 articles in domestic and foreign scientific publications. Of these: 4 articles were included in the list of the control committee in the field of science of the Ministry of Science and higher education of the Kazakhstan Republic, 1 article was published in the SABRAO Journal of Breeding and Genetics, registered in the Scopus database.

### **Thesis scope and structure**

The dissertation work consists of an introduction, 5 parts, a conclusion, recommendations in production, a list of used literature and appendices. The work is presented on 144 pages of computer text, contains 16 figures, 42 tables, 172 used literature and 10 appendices.