FUNCTIONAL RELATIONSHIP BETWEEN TECHNOLOGICAL INDICATORS OF RICE GRAIN AND CLEANING EFFICIENCY

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Abstract. *This article analyzes the biological and technological characteristics of rice varieties grown in local conditions and studies their suitability for the cleaning process on a scientific basis. In particular, the varieties were evaluated for their compatibility with the technological requirements for the cleaning process based on their vegetation period, yield, grain shape and density, disease resistance, and rice yield indicators. The results of the study showed that some varieties (for example, "Tantana", "Mustaqillik", "Uzros 7-13") have high purity and whole rice yield indicators, and they can be effectively processed on modern grain cleaning equipment. The article highlights the practical importance of selecting varieties suitable for the technological process of rice cleaning.*

Keywords: *rice, cleaning process, rice varieties, grain density, clarity level, grain shape, processing, grain hardness.*

Introduction. Rice cultivation is one of the leading directions in the Republic of Uzbekistan and plays an important role in ensuring the country's food security. The volume and quality of rice cultivation in our country is increasing year by year, which requires a new approach to research and development of rice varieties, agro-technological approaches and processing stages. In particular, the physical, mechanical and technological properties of rice grain (grain shape, density, clarity, shell density, rice yield percentage) directly affect the efficiency of the technologies used in its cleaning process. Varieties created by the Uzbekistan Rice Research Institute and its branches, such as "Tantana", "Ilgor", "Mustaqillik", "UzROS 7-13", are distinguished by high yield, disease resistance and rice yield. However, their technological suitability for the cleaning process has not yet been fully analyzed. Existing cleaning equipment (sieves, triers, separators and air separators) is designed for grains of a certain density, shape and hardness, and the compliance of rice varieties with these requirements directly affects the amount of losses during processing. The physical, mechanical and technological indicators of some rice varieties grown in

Uzbekistan are systematically analyzed in terms of their suitability for the cleaning process. The goal is to identify the technological advantages of the varieties, recommend them as optimal options for cleaning lines and create a scientific basis for strengthening the selection-industrial integration in rice cultivation.

Literature review. Scientific research on rice cultivation in Uzbekistan is mainly focused on breeding directions - high yield, agro climatic adaptability and disease resistance. In particular, the vegetation period, growth vigor, grain shape and weight, and disease resistance of varieties such as "Ilgor", "Tantana", "Mustaqillik", "UzROS 7-13" created by the Uzbekistan Rice Research Institute have been scientifically studied. The technological suitability of these varieties at the processing stages, in particular the physical and mechanical parameters affecting the cleaning process, has not been widely analyzed in the literature. The technological suitability of rice for the cleaning stage depends, first of all, on indicators such as grain density, shape, size and degree of smoothness. The manual "Technology of Grain Processing" by G. Tulaganov and S. Gulomov (2018) describes the principles of operation of grain cleaning equipment - sieves, triers, air separators and separators. It emphasizes the effective separation of heavy, dense grains during the sorting process based on grain density and gravity.

Although the research conducted by B. Jo'rayev (2015) on rice agro technology covered the yield of varieties and planting agro technology, the effect of indicators such as grain shell thickness, percentage of whole rice, virtuousness', and grain clarity on the cleaning process was not separately considered. However, for effective separation in optical sorters, the clarity level of rice is required to be higher than 90%, which is available in the varieties "Tantana" (92–95%) and "UzROS 7-13" (96–98%).

Among the parameters studied by A. Rustamov (2020) in the configuration of grain cleaning lines, special attention is paid to the technological importance of grain shape. In his opinion, elongated rice (for example, "Ilgor", "Tarona") provides high separation accuracy in trier separators. Rounded varieties are better sorted in multi-stage sieves, but consume more energy.

In foreign experiments, in particular from Chinese and South Korean sources, cleaning device designs have been developed based on specific parameters of grain density (750–850 kg/m³), size (5.5–7 mm), and hardness. However, these approaches have not been sufficiently applied to local rice varieties, which increases the relevance of technological analysis of domestic varieties.

Discussion. A number of physical and mechanical indicators are of decisive importance in assessing the suitability of locally grown rice varieties for cleaning technology. The results of the analysis showed that some varieties fully comply with the design capabilities of cleaning equipment and provide high processing efficiency, while others are characterized by some technological limitations.

Grain density determines how rice varieties are sorted in air separators. For example, varieties "Tantana", "Mustaqillik" and "UzROS 7-13" have a high density, which allows them to be clearly separated from straw, dust and light impurities by air flow. In varieties with a low density (for example, "Nukus 2"), the accuracy of separation decreases, which requires an increase in the number of secondary cleaning stages. Grain shape and size directly affect the efficiency of trier and sieve sorting equipment. The varieties "Ilgor", "Tarona" and "UzROS 7-13" have elongated grains, which can be separated with high accuracy using trier separators. This shape plays an important role, especially in separating shelled and semi-shelled grains. Varieties with round or oval grains (for example, "Nukus 70") require multi-stage sieves, which complicates the technological process.

The yield of whole rice and the degree of clarity are important parameters for sorting in optical sorters. The varieties "Ilgor" (95%), "Tantana" (92–95%) and "UzROS 7-13" (90–95%) are distinguished by a high percentage of whole rice. In these varieties, product losses after cleaning are minimal, which increases economic efficiency. In varieties with low clarity, the quality of rice decreases during visual selection, which may not meet export requirements. The density and hardness of the husk affect mechanical husking equipment. Varieties with a high degree of husking can cause damage to the grain on machines with high rotation speeds. Therefore, varieties with a glassiness of 98–100%, such as "Mustaqillik" and "Tarona", require gentle husking.

The cleaning period of late-ripening varieties (for example, "Lazurniy", "Tarona") in terms of the growing season and planting date coincides with the final stage of harvesting. This increases the load on cleaning equipment and increases the risk of interruptions in the technological line. On the contrary, mid-ripening and early-ripening varieties (for example, "Iskandar", "Guljahon") allow for an even distribution of the cleaning load throughout the season. The level of disease resistance also indirectly affects the cleaning process. Varieties that are less affected by pests have a lower content of foreign particles and fungal impurities, which improves the performance of equipment on the cleaning line and reduces wear.

The above analysis shows that the suitability of each rice variety for cleaning technology depends on a set of indicators. When selecting varieties, not only yield or agronomic indicators, but also their technological suitability for processing should be considered as the main criterion. This approach is of great importance in ensuring the seamless integration between the selection and industrial processing stages in rice cultivation.

Conclusion. The results of the study showed that rice varieties grown in Uzbekistan have significant differences not only in agrobiological, but also in technological indicators. In ensuring the effectiveness of cleaning technology,

physical and mechanical parameters such as grain density, shape, clarity, whole rice yield, and shell hardness are of decisive importance. Among the analyzed varieties, the varieties "Tantana", "Ilgor", "UzROS 7-13" and "Mustaqillik" have high technological indicators and can be effectively processed with minimal product loss on modern cleaning equipment. These varieties are sorted with high accuracy in air separators, triers and optical sorters, which increases production productivity on an industrial scale. On the other hand, varieties with a round shape or relatively low density (for example, "Nukus 2", "Nukus 70") can lead to technological inaccuracies, excessive consumption or an increase in processing stages during the cleaning process. This situation requires additional technological measures to adapt them to the industry. In the future, selecting rice varieties adapted to cleaning, adapting technological lines to the characteristics of the varieties, will help reduce losses during processing and ensure the stability of product quality.

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