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# Comparative Evaluation of Milling and Processing Quality Traits of Rice Varieties in Karakalpakstan

Kamalov Miyirbek Murat ugli
Rice and Wheat Scientific Production Association Head of Rice Breeding and Seed Production Laboratory, Uzbekistan

Esemuratova Guljamal Qalbayevna
Karakalpakstan Institute of Agriculture and Agrotechnologies Assistant, Uzbekistan

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**Abstract:** The present study evaluates the technological quality indicators of rice samples selected from the breeding nursery under the agro-ecological conditions of Karakalpakstan. The research focused on key milling and processing characteristics, including husk content, grain translucency, bran yield, total milled rice yield, head rice recovery, and broken grain percentage. Comparative analysis was conducted against the local standard variety Sanam. The results revealed significant variability among the studied samples. In particular, some accessions demonstrated higher grain translucency (up to 31.7%), whereas head rice recovery ranged from 57.0% to 70.2%. At the same time, certain lines showed elevated bran yield and a higher proportion of broken grains, indicating comparatively lower technological quality. These findings highlight the importance of comprehensive evaluation of technological traits in rice breeding programs. The identified lines with favorable milling characteristics can serve as valuable genetic sources for developing high-quality rice varieties adapted to the stress-prone environments of Karakalpakstan.

**Keywords:** Rice, technological quality, milling yield, head rice recovery, breeding, Karakalpakstan.

**Introduction:** The Republic of Karakalpakstan is one of the leading regions for rice cultivation in Uzbekistan, with crop areas concentrated mainly in the fields located in the Amu Darya delta. The regional climate is sharply continental, with high temperatures in summer (up to 40-45°C) and cold, dry winds in winter. Furthermore, environmental problems arising from the drying of the Aral Sea, increasing soil salinity levels, and limited irrigation water resources negatively affect the cultivation of agricultural crops, particularly rice.

Under these conditions, along with creating high-yielding rice varieties, thorough study of technological quality indicators of grain is also considered an urgent task. This is because varieties with high yield indicators are not always high in quality. On the contrary, in some cases, although the yield is abundant, grain quality is low, which means it does not meet market demands.

Meanwhile, demand for rice products in the world market is increasing day by day. Today, highquality rice grain stands out for its translucency, whole grain yield, durability during processing, and taste characteristics. Therefore, in breeding and seed production work, technological quality indicators are considered as one of the main criteria along with agronomic and physiological traits.

Scientific research conducted under Karakalpakstan conditions shows that some promising varieties and samples have high yield indicators but are unsatisfactory in terms of grain quality. In such cases, grain bran yield increases, whole grain yield decreases, or the amount of broken rice is high.

This cannot fully meet the needs of processing enterprises and consumers.

Abiotic stresses such as drought, high and low

temperatures, heavy metals, and salinity severely affect the biochemical processes of crops, plant growth and development, leading to low agricultural productivity and food security. Among all stresses, salinity is considered the main factor limiting plant production on a global scale, affecting land cultivation, plant physiological processes, and productivity [3].

Selection for resistance to abiotic and biotic stresses is considered an important method of combating yield decline. Rice, Asia's most beloved grain, feeds most of the world's population. More than 90% of the world's rice is grown and consumed in Asia, where 60% of the world's population and approximately 2/3 of the world's population reside [4].

In the extremely harsh soil-climate conditions of Karakalpakstan, resistant varieties are of decisive importance for rice crops to grow, develop, and accumulate stable yields [1].

The Republic of Karakalpakstan suffers from drought problems, and water is always scarce for agricultural irrigation. Therefore, farmers face many difficulties in rice cultivation [2].

Therefore, the main objective of this research is to evaluate the technological quality indicators of rice samples selected from the breeding nursery, compare and analyze them with the Sanam standard, and identify promising samples in the breeding process. This data will be of great importance in subsequent breeding work for creating high-yielding, environmentally stressresistant, and high-quality rice varieties.

## METHODS

The research was conducted at the "Rice and Wheat Scientific Production Association". In this study, methods based on IRRI (International Rice Research Institute) standards were used for quantitative and qualitative evaluation of rice forms.

Rice grains were polished in a microcomputer RicePolisher SKZ 111 B-4 brand cleaning device.

Determination of rice grain shape - L/W

External characteristics of rice grains were visually evaluated by eye without special instruments.

Each fraction was weighed on an electronic scale with 0.01 g accuracy and determined as a percentage:

Percentage (%) = (Fraction mass / 100 g) × 100 The main indicators were calculated as follows:

Total rice yield (%) = Whole + Broken + Crushed

Bran percentage (%) = Bran mass / 100 × 100

Crushed damaged rice (%) = Crushed / 100 × 100

Whole rice degree (%) = Whole rice / 100 × 100

## RESULTS AND DISCUSSION

Rice samples selected from the breeding nursery were analyzed for technological quality indicators (Table 1). The results showed that grain quality indicators differ significantly among samples.

The translucency level of rice in samples ranged from 92-97%. The highest indicator was recorded in the D-8 otb D-133 K-99 (97%) sample. Similarly, the Sanam standard was 96%. In the remaining samples, this indicator was in the range of 92-95%. Specifically, D-95 D-91 long Sali showed 92%, D-32 otb Almaz 95%, and D-76 D-19 D-173 otb 1 showed 95%. High translucency determines the mechanical strength of grain and resistance to brittleness during processing. Therefore, D-8 otb D133 K-99 and Sanam varieties stood out as the most promising samples with high translucency indicators.

Bran yield in samples ranged from 22.0-31.7 g, with the lowest value recorded in the Sanam variety (22.5 g) and the highest result in the D-95 D-91 long Sali sample (31.7 g). Low bran yield is a factor that increases processing efficiency. Therefore, Sanam and some medium-indicator varieties are more suitable for processing technology.

This indicator ranged from 68.3-78.0%. The highest result was recorded in D-76 D-19 D-173 otb 1 (78.0%). In the Sanam variety, this indicator was 77.5%. High total yield determines economic efficiency in rice processing. Therefore, D-76 D-19 D-173 otb 1 stood out with high total yield.

Whole rice yield was recorded in the range of 57.0-70.2%. The highest result was observed in the

Sanam variety (70.2%). D-32 otb Almaz was 63.6%, D-90 otb Almaz 61.3%, D-95 D-91 long Sali 59.0%, and D-76 D-19 D-173 otb 1 was 57.0%. These results show that although some samples showed high results in total yield, low whole grain yield reduces their processing quality.

The amount of broken rice ranged from 7.3-21.0 g. The lowest indicator was in the Sanam variety

(7.3 g), and the highest value was observed in D-76 D-19 D-173 otb 1 (21.0 g). High amounts of broken rice indicate high brittleness of grain during processing and leads to decreased technological quality.

**Table 1**

**Classification of Technological Quality Indicators of Samples Selected from Breeding Nursery**

| № | Sample Names | Seed Length | Rice Translucency (%) | Bran Yield (g) | Total Rice Yield (g) | Whole Rice Yield (g) | Broken Yield (g) |
|---|---|---|---|---|---|---|---|
| 1 | Sanam st | medium/short | 96 | 22.5 | 77.5 | 70.2 | 7.3 |
| 2 | D-76 D-19 D-173 otb 1(10) (2) | medium/short | 95 | 22.0 | 78.0 | 57.0 | 21.0 |
| 3 | D-95 D-91 long Sali | medium/short | 92 | 31.7 | 68.3 | 59.0 | 9.3 |
| 4 | D-32 (otb almaz) | medium/short | 95 | 24.2 | 75.8 | 63.6 | 12.2 |
| 5 | D-90 otb Almaz | medium/short | 92 | 28.3 | 71.7 | 61.3 | 10.4 |
| 6 | D-425 (D-20) (D-145)(353-20)3 | medium/short | 96 | 25.0 | 75.0 | 64.8 | 10.2 |
| 7 | D-8 otb D-133 K-99 | medium/short | 97 | 25.3 | 74.7 | 70.4 | 4.3 |
| 8 | D-281 D-18 Urazbay | medium/short | 94 | 22.7 | 77.3 | 69.3 | 8.0 |
| 9 | D-249 D-106 otb Damir (8)oct | large | 95 | 26.3 | 73.5 | 70.1 | 3.4 |

**CONCLUSION**

When rice samples selected from the breeding nursery were studied for technological quality indicators, significant differences were identified among them.

- D-8 otb D-133 K-99 sample recorded the highest translucency (97%), showing that it stands out with its grain strength and resistance to brittleness during processing.
- Sanam standard had high translucency (96%), lowest bran yield (22.5 g), highest whole rice yield (70.2%), and lowest broken rice indicator (7.3 g), standing out as a reference variety in terms of technological quality.
- D-76 D-19 D-173 otb 1 showed the highest result in total rice yield (78.0%), but low whole rice yield (57.0%) and high broken rice indicator (21.0 g) are considered its weak points.
- D-95 D-91 long Sali differed with high bran yield (31.7 g) and low whole grain yield (59.0%).
- D-32 otb Almaz and D-90 otb Almaz had average quality indicators and require additional evaluation in the breeding process.

Overall, the research results showed that although some samples in the breeding nursery showed superior results compared to the Sanam standard in some quality indicators, Sanam still remains as a reference

variety with high technological quality in comprehensive evaluation. At the same time, traits such as high translucency (D-8 otb D-133 K-99) or high total yield (D-76 D-19 D-173 otb 1) can serve as important sources for creating new rice varieties suitable for Karakalpakstan conditions, high quality, and economically efficient through combination in future breeding processes.

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