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Evaluation of Technological Quality Indicators of Rice Samples Under the Conditions of Karakalpakstan

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Abstract: This study analyzed the technological quality indicators—such as head rice yield, broken grain ratio, and translucency—of rice variety samples adapted to the agroecological conditions of the Republic of Karakalpakstan. Based on the research results, rice samples with complex valuable agronomic traits such as D-8 otb D-133 K-99, D-281, D-18 Urazbay, and D-249, D-106 otb Damir (8) oct were identified. These samples demonstrated high technological quality and are recommended as starting materials for breeding programs.

Keywords: Rice, variety, selection, grain, technological indicator.

Introduction: Rice is one of the world's major staple food crops, and with the growing global population, the demand for rice is increasing annually. In Uzbekistan, the rice industry plays a crucial role in ensuring national food security. In particular, rice cultivation in the Republic of Karakalpakstan is carried out under harsh agroclimatic conditions, making the development of highly productive and technologically suitable rice varieties adapted to the region's environment a pressing issue.

The region's specific climatic conditions—including saline soils with heavy texture, water scarcity, spring frosts, and a short growing season—negatively affect rice development. Therefore, creating early-maturing, stress-tolerant varieties that meet the requirements for technological processing is of significant importance.

Karakalpakstan's geography and climate differ greatly from other regions of Uzbekistan. Located in the lower reaches of the Amu Darya, fields often contain various types of alluvial soils with differing salinity levels. The climate is hot and dry in summer, but spring temperatures remain cool until the second decade of May. Early frosts in the third decade of September limit the rice growing season due to insufficient biological active temperatures.

The rice varieties currently cultivated in Karakalpakstan often do not fully meet the technological and industrial processing requirements, which necessitates comprehensive research into developing improved varieties. Soil salinity is the main factor behind the reduction in rice productivity and quality. Creating salt-tolerant varieties is therefore a critical priority.

Depending on these factors, it is necessary to develop early- and ultra-early-maturing rice varieties with high technological characteristics suitable for global markets. Under extreme environmental stress, the role of resistant varieties becomes especially important in increasing rice productivity.

In addressing these challenges, the selection of appropriate hybrid combinations and varieties adapted to the soil and climatic conditions is crucial for improving rice yield and quality. Studying international and working collections under stress conditions to identify promising genotypes is one of the key solutions. Varieties selected from global collections can be used as donors for creating new, high-yielding, stress-resistant lines.

Abiotic stresses such as drought, extreme temperatures, heavy metals, and salinity significantly impact the biochemical processes and development of crops, leading to reduced productivity and threatening food security. Among these stresses, salinity is the most widespread and detrimental factor, limiting plant growth, soil health, and crop yields [3].

Given the severe soil and climatic conditions of Karakalpakstan, developing resilient rice varieties is crucial to achieving stable productivity [1]. The region suffers from chronic water shortages, making irrigation a major challenge for farmers [2]. Therefore, scientific research focused on identifying rice varieties that are productive, salt-tolerant, disease- and pest-resistant, and commercially viable under these conditions is essential.

METHODS

The study was conducted at the Grain and Rice Scientific Production Association. Quantitative and qualitative evaluations of rice samples were carried out using methods based on the standards of the International Rice Research Institute (IRRI).

Rice grains were polished using a Micromputer RicePolisher SKZ 111 B-4 model device.

- Grain shape (L/W ratio) was determined.
- External grain traits were assessed visually without instruments.
- Each fraction was weighed with 0.01 g precision on an electronic scale and expressed in percentage:

Percentage (%) = (Fraction mass / 100 g) × 100

The following main indicators were calculated:

- **Total rice yield (%) = Whole + Broken + Fragments**
- **Bran yield (%) = Bran mass / 100 × 100**
- **Broken rice (%) = Broken mass / 100 × 100**
- **Whole rice (%) = Whole rice mass / 100 × 100**

RESULTS AND DISCUSSION

When studying the early-ripening characteristics of the studied variety samples compared to the widely distributed Gulistan (standard) variety in our republic, comparative analysis was conducted based on technological quality indicators compared to the "Gulistan" standard (Table 1).

Table 1 Classification of technological quality indicators of samples selected from breeding nurseries

№	Sample Names	Seed Structure	Translucency %	Husk Yield (g)	Total Rice Yield (g)	Whole Rice Yield (g)	Fragment Yield (g)	Total Rice Yield (%)	Whole Rice Yield (%)
1	Gulistan st oct	large	93	29.32	70.68	63.87	6.81	70.68	63.87
2	D-76 D-19 D-173 otb 1(10) (2)	d/z	95	22.0	78.0	57.0	21.0	78.0	63.87
3	D-95 D-91 uzin Sali	d/z	92	31.7	68.3	59.0	9.3	68.3	57.0
4	D-32(otb almaz)	d/z	95	24.2	75.8	63.6	12.2	75.8	59.0
5	D-90 otb Almaz	d/z	92	28.3	71.7	61.3	10.4	71.7	63.6
6	D-425(D-20)(D-145)(353-20) 3	d/z	96	25.0	75.0	64.8	10.2	75.0	61.3
7	D-8 otb D-133 K-99	d/z	97	25.3	74.7	70.4	4.3	74.7	64.8
8	D-281 D-18 Urazbay	d/z	94	22.7	77.3	69.3	8.0	77.3	70.4
9	D-249 D-106 otb Damir (8)oct	large	95	26.3	73.5	70.1	3.4	73.5	69.3
10	D-167 otb Urazbay (3)	d/z	94	24.3	75.7	57.0	18.7	75.7	70.1

According to experimental results, technological quality indicators were evaluated for 10 rice samples selected from breeding nurseries (Table 1). Based on seed structure, samples were divided into "large" and "d/z" (dense grain) groups. The translucency level ranged from 92-97%, indicating high-quality grain formation in these samples.

Total rice yield varied from 68.3 g to 78.0 g, averaging 73.18 g. This indicator corresponds to the medium-high rice yield category according to international standards. The highest rice yield of 78.0 g was recorded by sample D-76 D-19 D-173 otb 1(10)(2).

Whole rice yield varied from 57.0 g to 70.4 g, averaging 63.15 g. The highest whole rice yield was determined in samples D-8 otb D-133 K-99 (70.4 g) and D-281 D-18 Urazbay (69.3 g). This indicates their resistance to breakage and high technological profitability during processing.

Fragment yield varied from 3.4 g to 21.0 g, averaging 10.56 g. The lowest fragment yield was in sample D-249 D-106 otb Damir (8)oct (3.4 g), indicating mature and unbreakable grain characteristics.

Additionally, total and whole rice yield percentages were shown, with the highest values around

78.0% (total rice) and 70.4% (whole rice), which fully comply with international quality standards (according to IRRI: ≥70% whole rice yield is required for high-quality varieties).

CONCLUSION

From the conducted research, it can be concluded that the selected rice varieties and samples with high indicators for whole grain yield, fragment content, and translucency were presented to breeding scientists for creating new types of varieties and samples.

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