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INDICATORS OF THE QUALITY OF RICE GRAIN AND GROATS DEPENDING ON THE GENOTYPE OF CULTIVARS

D. Palamarchuk[1], researcher (post-graduate student)
M. Kozachenko[2], Doctor of Agricultural Sciences, Professor, Chief Resercher,
S. Sviatchenko[2], Candidate of Agricultural Sciences, Senior Researcher,
[1] Institute of Rice of NAAS, 11 Studentska St., Antonivka village, Skadovsky district, Khersonska Oblast, Ukraine, 75705
[2]Plant Production Institute named after VYa Yuriev of NAAS, 142 Heroiv Kharkova Ave., Kharkiv, Ukraine, 61060

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Correspondence:

D. Palamarchuk
*E-mail:*palamarchukdmytro86@gmail.com

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Abstract. The yield and the quality of grain and groats have been determined for rice varieties belonging to different ripening groups: early-ripening Komandor and Yuzhanin, mid-ripening Ukraina 96, Vikont, Admiral, Magic, and Lotto, and late-ripening Fukushikiri, Giza 177, and Sakha 101. As to the quantitative indicators of grain quality, the highest total yield of groats (about 70%) was recorded for early-ripening Yuzhanin, and mid-ripening Lotto, and Magic. The whole kernel output (about 90%) was registered for early-ripening Yuzhanin, mid-ripening Lotto, Vikont, and Ukraina 96, and late-ripening Sakha 101. Early-ripening Yuzhanin and mid-ripening Lotto were distinguished due to high yields and high values of major quantitative characteristics of grain quality (total output of groats, output of whole kernels, 1000-kernel weight). Yuzhanin also had a high content of protein in grain. Groats of mid-ripening Lotto, Magic, Admiral and Vikont, late-ripening Fukushikiri and Giza 177, and early-ripening Yuzhanin had high culinary qualities due to their high volume increase index (when boiled). The structure of groats was the best in early-ripening Yuzhanin, late-ripening Giza 177 and Fukushikiri, mid-ripening Lotto, Magic, and Admiral. Early-ripening Yuzhanin, mid-ripening Lotto, Magic, and Admiral, late-ripening Giza 177 and Fukushikiri were distinguished due to their groats colour; mid-ripening Vikont, Magic, and Admiral, late-ripening Giza 177, and early-ripening Yuzhanin – due to the groats aroma; mid-ripening Lotto, Vikont, Magic, and Admiral, early-ripening Yuzhanin, late-ripening Giza 177 and Sakha 101 – due to their palatability. By the set of parameters indicating the culinary quality of groats (increase index, structure, colour, aroma, palatability), early-ripening Yuzhanin, mid-ripening Lotto, Admiral, Magic, and Vikont, late-ripening Fukushikiri and Giza 177 were higher than the reference variety Ukraina 96. The results of comprehensive assessment of yields, grain quality, and culinary qualities of the groats have allowed singling out two cultivars: early-ripening Yuzhanin and mid-ripening Lotto. They have been found valuable enough to be more widely used in the production of rice grain and groats. New rice lines with high culinary qualities of groats have been originated from crossing the varieties having high-quality groats, in particular, Yuzhanin and Lotto.

Keywords: rice, cultivar, yield, vegetation period, grain quality indicator, groats quality.

Introduction. Formulation of the problem

Rice is one of the most common cereal crops. Its production involves using varieties of different ecogeographical origins, with different levels of economic characteristics and indicators of grain and groats quality. Besides, the dependence of the quality of rice grain and groats on their genotypes under identical growing conditions has not been sufficiently investigated. So, to select the best cultivars in terms of these characteristics, an important task is determining the specific features of the quality of grain and groats of different rice varieties grown under irrigation.

Analysis of recent research and publications

Rice groats is one of the main foods with excellent nutritional qualities and palatability. Rice is a cereal crop, so, along with boosting yields, it is important to improve grain quality. One of its main indicators is the total output of groats and whole kernels, which depend on such technological parameters of grain as 1000-kernel weight, vitreousness, fissuring, husk content, kernel shape and size. The global practice of rice sowing shows that production requires varieties giving highly competitive final products (groats).

Studies by different researchers have demonstrated unequal levels of quantitative characteristics of rice assessions, depending on conditions in different geographical regions. Collection material of Oryza sativa can differ in the yielding power of grain and quality of groats, as Z. Petkevych et al. pointed out [1]. In rice varieties suitable for production, the quality of grain and groats is supposed to show high indicators, as Peyman Sharifi, Ali Akbar Ebadi [2] and R. Anacleto et al. [3] highlighted. The collection accessions of different ecogeographical origins in N. Tumanyan et al.'s study [4] had different values of grain quality indicators. Both technological and physicochemical qualities of rice grain can have different ranges of variability. Sensory qualities of groats are of great importance, as P. Pavlenkova et al. pointed out [5]. According to B. Minten et al.'s data [6], different varieties of rice may be of unequal nutritional value. Rice samples were genetically diverse both in terms of grain quality, as R. P. Cuevas and M. A. Fitzgerald described [7], and in terms of the quality of groats, as shown in O. Danilov et al.'s studies [8]. Rice genotypes can be of different yielding power and have different quality of grain, which was noted by Wang Feng et al. [9] and Truong Thi Tu Anh et al. [10]. The yields and grain quality in Quan Xu's [11] and Seth Graham-Acquaah et al.'s [12] studies depended both on genotypes and on growing conditions. Rice grain quality depended on grain parameters according to Fan Feng et al.'s data [13]. Quantitative and qualitative characteristics of rice depended on genotypes in W. E. Marshal and J. I. Wadsworth's [14], V. Ravindra Babu et al.'s [15], and S. Hussain's [16] studies.

Thus, the studies available attest to the diversity of rice accessions and cultivars in terms of the performance and quality of grain and groats, depending on the growing conditions in specific regions.

Therefore, it is important to identify rice varieties suitable for cultivation due to the high technological qualities of their grain.

The study purpose was to identify, based on their high technological qualities, the best rice varieties grown under the same conditions (under irrigation in paddy fields), which has not been investigated before.

To accomplish this purpose, the following **objectives** were to be achieved:

– Determining the grain quality of different rice varieties;

– Determining the quality of groats of different rice varieties;

– Identifying the best rice varieties based on a set of indicators of performance and qualities of grain and groats.

Research materials and methods

Ten rice varieties of different ecogeographical origins, with different lengths of the growing period, were studied:

– Early-ripening Komandor (RUS) and Yuzhanin (RUS);

– Mid-ripening Ukraina96 (UKR), Magic (ITALY), Lotto (ITALY), Vikont (UKR), and Admiral (UKR);

– Late-ripening Fukushikiri (JPN), Giza 177 (EGYPT), and Sakha 101 (EGYPT).

The study was conducted in compliance with "Methods of the State Trials of Plant Varieties for Suitability for Dissemination in Ukraine" [17].

The grain quality of the new generation varieties was also assessed biochemically: the protein content in the grain was determined by Kjeldahl digestion (GOST 10846-91(2)).

The study was conducted under irrigation in an experimental paddy field by researchers from the Breeding Department of the Institute of Rice of NAAS (Khersonska Oblast) in 2013, 2014, and 2016.

The irrigation method used was shortened flooding. After rice sowing, the paddy fields were immediately flooded for 5 days, then the soil was dried until rice was fully sprouted. The second flooding of the paddy fields was started after rice had been fully sprouted and begun to grow. As the rice plants developed, the water level was raised to 15 cm. This level was maintained until complete maturity of rice grain. Against weeds, the herbicide Citadel 25 MD was applied (1.6 l/ha, using an OVM 650 sprayer). The fungicide Impact K was applied against rice blast at the dose 1.6 l/ha.

The fertilisers used, ammonium sulphate (N_{90}) and single superphosphate (P_{20}), were applied before disking the alfalfa layer in the spring during the first 10 days of April. The rice plants were fertilised with carbamide (urea) at the dose N_{50} AI per one ha during the tillering phase. The weather was different in different years. The Selyaninov hydrothermal coefficient (HTC) was 0.9, 0.9, and 1.2 in the years of the study respectively. Seeds were sown with a SKS 6A seed drill in the amount 7.7 million germinable seeds per hectare. Alfalfa was the forecrop. The plot area was 5 m^2, the rows were six, with the interrow spacing 12.5 cm, the replications were four. The yield was harvested with a harvester Yanmar.

The growing period length and the grain yield were measured.

The following grain quality characteristics were quantified: husk content, vitreousness, fissuring, kernel length/width ratio, total output of groats (using a rice grinder in compliance with the traditional method developed by the All-Russian Rice Research Institute, Krasnodar, RF), output of whole kernels, and 1000-kernel weight. The quality of groats was assessed by the following indicators: increase index (in units and points), structure, colour, aroma and palatability, in compliance with the traditional method developed by the All-Russian Rice Research Institute [18].

The experimental data were statistically processed by analysis of variance. The mean and $LSD_{0.05}$ were

calculated by B. Dospekhov's method [19] in Microsoft Excel.

Results of the research and their discussion

The findings of different authors indicate a significant diversity of both the collection material (Z. Petkovych *etal.*, 2016; N. Tumanyan *et al.*, 2013) and the varieties (R. P. Cuevas, M. A. Fitzgerald, 2012; B. Minten *et al.*, 2016) and mutants (Trung Thi Tu Anh *et al.*, 2018) in terms of rice performance and quality. The yield and quality of rice samples depend both on their origin (N. Tumanyan *et al.*, 2013) and genotypes (Reyman Sharifi, Ali Akbar Ebadi, 2018) and on the growing conditions (Quan Xu *et al.*, 2015; Seth Graham-Acquaah *et al.*, 2018; Fan Feng *et al.*, 2017). However, these studies were carried out on rice material different from ours, in different geographical regions, and only focused on individual characteristics of rice.

Our study, unlike others, stands out by comprehensiveness of investigating the agronomic value, in terms of yield, of rice varieties (which were registered and are important for production and breeding) of different geographical origin, with different lengths of the growing period, cultivated under irrigation in a specific region (Khersonska Oblast of Ukraine). The assessment was based on the quantitative indicators of the quality of grain, its biochemical characteristics, the quality of groats, and the efficiency of using rice cultivars with high-quality groats (determined in the same experiment) in selective breeding.

Thus, the three-year study (2013, 2014, and 2016) conducted under irrigation conditions in paddy fields has allowed characterising the rice cultivers in terms of yield, growing period, and quality indicators of grain and groats. 2015 was omitted because of force majeure.

On average, across the three years, the growing period of early-ripening Komandor and Yuzhanin lasted 108 and 111 days respectively, that of mid-ripening Ukraina 96, Magic, Lotto, Vikont, and Admiral – 121, 122, 122, 122, and 130 days respectively, and that of late-ripening Fukushikiri, Giza 177, and Sakha 101 – 132, 138, and 136 days respectively (Table 1).

As to the grain yield, the three-year mean across the experiment was 8.7 t/ha. Early-ripening Komandor and Yuzhanin yielded significantly more: 11.7 t/ha and 10.7 t/ha respectively. The yields from mid-ripening Lotto (9.7 t/ha), Admiral (9.3 t/ha), Vikont (9.0 t/ha), and Ukraina 96 (8.6 t/ha), as well as late-ripening Fukushikiri (8.0 t/ha) were comparable to the mean value 8.7 t/ha. The yields from the late-ripening varieties Giza 177 and Sakha 101 were significantly lower than the mean value (see Table 1).

Table 1 − Growing period and yield of the rice varieties, mean values across 2013, 2014, 2016

Variety	Growing period, days	Yield, t/ha
Komandor	108*	11.7*
Yuzhanin	111*	10.7*
Ukraina 96	121*	8.7
Magic	122	7.3*
Lotto	122	9.7
Vikont	122	9.0
Admiral	130*	9.3
Fukushikiri	132*	8.0
Giza 177	138*	7.0*
Sakha 101	136*	5.3*
Mean	124	8.7
$LSD_{0.05}$	1.93	1.36

*Significant difference in comparison with the mean across the experiment.

The specific features of the rice varieties belonging to different ripeness groups have been established by quantitative characteristics of grain quality (Table 2).

In particular, the total output of groats (the main indicator of grain quality) in early-ripening Yuzhanin and mid-ripening Lotto and Magic was around 70% (which was higher than the mean value across the experiment): 69.9%. 71.4%, and 69.0% respectively. The output of whole kernels was around 90% (significantly higher than the mean value across the experiment) in early-ripening Yuzhanin (90.5%), mid-ripening Lotto (91.3%), Vikont (91.4%), and Ukraina 96 (90.5%), and in late-ripening Sakha 101 (89.2%).

As to the biochemical characteristics of grain quality, the average protein content in grain in 2014 and 2016 was relatively high in Magic (8.6%), Vikont (8.5%), Admiral (8.2%), Sakha 101 (8.2%), Yuzhanin (8.1%), and Giza 177 (8.0%) (Table 3).

The indicators of the grain quality of the rice samples have been determined (Table 4).

As to the increase index, the mid-ripening varieties Lotto (7.00 points), Magic (6.23 points), Vikont (5.00 points), and Admiral (6.10 points), late-ripening Fukushikiri (7.00 points) and Giza 177 (5.50 points), and early-ripening Yuzhanin (5.00 points) were the best. This index was low in the cultivars Komandor (3.00 points) and Ukraina 96 (reference variety; 3.00 points).

The structure of the groats was the best in the early-ripening variety Yuzhanin (6.11 points), late-ripening Giza 177 (5.95 points) and Fukushikiri (5.90 points), mid-ripening Admiral (5.80 points), Magic (5.40 points), and Lotto (4.40 points).

The structure of groats was poor in Ukraina 96 (3.22 points) and Komandor (3.44 points). As to the colour of groats, early-ripening Yuzhanin, mid-ripening Lotto and Admiral, late-ripening Giza 177 were found the best varieties with a score of 6.00 points. Ukraina 96 (3.22 points), Komandor (4.20 points), and Sakha 101 (4.00 points) had low colour scores.

Table 2 – Grain quality of the rice varieties, mean values across 2013, 2014, 2016

Variety	Husk content, %	Vitreousness, %	Fissuring, %	Kernel length/width ratio	Total output of groats, %	Output of whole kernels, %	1000-kernel weight, g
Komandor	17.4	97*	3.7*	2.3	66.5*	81.4*	30.2*
Yuzhanin	18.2*	98*	2.0*	2.7	69.9*	90.5*	32.5*
Ukraina 96	17.0	91*	2.0*	2.2	69.0*	90.5*	32.8*
Magic	16.2*	97*	3.0*	2.2	69.0*	88.3	32.9*
Lotto	15.7*	91*	2.0*	2.6	71.4*	91.3*	32.9*
Vikont	17.4	97*	3.3*	2.2	68.9	91.4*	29.2*
Admiral	17.7	97*	2.0*	3.1*	67.7*	80.8	27.0*
Fukushikiri	17.4	98*	2.0*	2.2	66.8*	90.3*	30.1*
Giza 177	17.2	96	3.7*	2.4	67.6*	87.2*	31.6*
Sakha 101	17.1	97*	3.3*	2.5	69.1*	89.2*	31.7*
Mean	17.1	96	2.7	2.4	68.6	88.1	30.9
$LSD_{0.05}$	0.67	0.52	0.25	0.30	0.42	0.35	0.17

*Significant difference in comparison with the mean across the experiment.

Table 3 – Protein content in grain of the rice varieties, mean values across 2014 and 2016

Variety	Protein content, %
Komandor	7.8
Yuzhanin	8.1*
Ukraina 96	7.3
Magic	8.6*
Lotto	7.7
Vikont	8.5*
Admiral	8.2*
Fukushikiri	7.7
Giza 177	8.0*
Sakha 101	8.2*
Mean	8.0
$LSD_{0.05}$	0.50

*Significant difference in comparison with the reference variety (Ukraina 96).

Table 4 – Quality indicators of groats of the rice varieties, mean values across 2014 and 2016

Variety	Increase index, units	Increase index, points	Structure, points	Colour, points	Aroma, points	Palatability, points
Komandor	4.00	3.00	3.44	4.20	4.50	4.62
Yuzhanin	4.30	5.00	6.11*	6.00*	5.15	5.20*
Ukraina 96 (reference variety)	3.92	3.00	3.22	3.22	4.78	3.44
Magic	8.00*	6.23*	5.40*	5.39	5.80*	4.90
Lotto	7.57*	7.00*	4.40	6.00*	4.70	5.75*
Vikont	4.55	5.00	4.00	4.70	5.50*	5.00
Admiral	7.00*	6.10*	5.80*	6.00*	5.35	5.00
Fukushikiri	8.00*	7.00*	5.90*	5.50	4.45	5.35*
Giza 177	8.20*	5.50	5.95*	6.00*	5.80*	5.60*
Sakha 101	5.30	4.00	4.60	4.00	4.50	5.00
Mean	6.08	5.18	4.88	5.10	5.05	4.99
$LSD_{0.05}$	0.70	0.65	0.50	0.45	0.35	0.20

*Significantly higher than the mean across the experiment.

Magic (5.80 points), Giza 177 (5.80 points), Vikont (5.50 points), Admiral (5.35 points), and Yuzhanin (5.15 points) were the best varieties by the aroma of their groats. Lotto (5.75 points), Giza 177 (5.60 points), Fukushikiri (5.35 points), Yuzhanin (5.20 points), Vikont, Admiral, and Sakha 101 (5.00 points), and Magic (4.90 points) had high palatability scores. Poor palatability was noted in Ukraina 96 (3.44 points) and Komandor (4.62 points). Lotto, Fukushikiri, Admiral, Magic, Vikont, Giza 177, and Yuzhanin were found the best varieties due to a set of quality characteristics of groats. Ukraina 96 and Komandor were the varieties with low values of the quality indicators of their groats.

Lotto and Yuzhanin were the best varieties because of their grain yield and quantitative indicators

of grain quality. They yielded more than the reference cultivar Ukraina 96 (9.7 t/ha and 10.7 t/ha respectively vs 8.6 t/ha). Besides, they had better quality indicators of groats than Ukraina 96 (respectively, the increase index was 7.00, 5.00, and 3.00 points, the structure score 4.40, 6.11, and 3.22 points, the colour score 6.00, 6.00, and 3.22 points, the aroma score 4.70, 5.15, and 4.78 points, the palatability score 5.75, 5.20, and 3.44 points). The Yuzhanin grain also contained more protein (8.1%) than the grain from the reference variety Ukraina 96 (7.3%).

The varieties studied were used in hybridisation. This resulted in lines with higher values of the quality of groats (Table 5), as compared with the reference cultivar Ukraina 96: in particular, in the lines UIR-5756.17 (Lotto/Fukushikiri), UIR-5757.17 (Vikont/Yuzhanin), UIR–5758.17, UIR–5759.17, and UIR–5760.17 (Giza 177/Magic). They were originated from the varieties Lotto, Fukushikiri, Giza 177, Magic, Yuzhanin, and Vikont, which had higher values of the quality indicators of groats than the reference variety Ukraina 96 had.

Table 5 – Quality indicators of groats of the new rice lines, mean values in 2017

Line	Crossing combination	Increase index, units	Increase index, points	Structure, points	Colour, points	Aroma, points	Palatability, points
Ukraina 96 (reference variety)	–	3.92	3.00	3.22	3.22	4.78	3,44
UIR–5751.17	Sakha 101/Yuzhanin	4.75	5.00	4.11	4.11	4.56	4,78
UIR–5752.17	Admiral/Magic	4.45	5.00	4.11	5.89*	5.67*	5,22
UIR–5753.17	Sakha101/Yuzhanin	4.17	3.00	6.11*	5.56	5.44*	5,44*
UIR–5754.17	Vikont/Ukraina96	4.82	5.00	4.56	5.44	3.89	5,22
UIR–5756.17	Lotto/Fukushikiri	5.09	7.00*	4.78	5.89*	5.89*	5,67*
UIR–5757.17	Vikont/Yuzhanin	4.80	5.00	4.78	5.00	5.22	4,78
UIR–5758.17	Giza 177/Magic	4.42	5.00	6.11*	7.00*	5.67*	5,89*
UIR–5759.17	Giza 177/Magic	8.33*	7.00*	5.00*	5.22	5.89*	5,89*
UIR–5760.17	Giza 177/Magic	9.00*	7.00*	4.56	5.67*	5.22	4,33
UIR–5761.17	Vikont/Ukraina 96	4.73	5.00	3.44	4.33	5.22	4,78
UIR–5762.17	Giza 177/Magic	4.75	5.00	4.33	4.56	5.44*	4,78
Mean		5,27	5.17	4.59	5.16	5.24	5.02
$LSD_{0.05}$		0,90	0.85	0.40	0.45	0.19	0.40

*Significantly higher than the mean across the experiment.

Field Testing of the Results

The new lines UIR-5756.17, UIR-5757.17, UIR-5758.17, UIR-5759.17, and UIR-5760.17, which had higher values of the quality indicators of groats than those of the check variety, were originated from the varieties Lotto, Fukushikiri, Giza 177, Magic, Yuzhanin, and Vikont with the best culinary qualities of groats. These varieties, especially Lotto and Yuzhanin, are recommended for wide use in production and selective breeding.

Conclusion

1. In 2013, 2014, and 2016, the technological indicators of rice quality depending on genotypes were determined in the course of cultivation under irrigation in the paddy fields in the Skadovskyi District of the Khersonska Oblast of Ukraine. As to the quantitative indicators of grain quality, the highest total output of groats (around 70%) was recorded for early-ripening Yuzhanin, mid-ripening Lotto and Magic. The whole kernel output (around 90%) was recorded for early-ripening Yuzhanin, mid-ripening Lotto, Vikont, and Ukraina 96, and late-ripening Sakha 101. Early-ripening Yuzhanin, mid-ripening Magic, Vikont, and Admiral, late-ripening Sakha 101 and Giza 177 had the highest content of protein in grain. The highest yields were obtained from early-ripening Komandor and Yuzhanin, and the yields from mid-ripening Lotto, Admiral, Vikont, and Ukraina 96, and late-ripening Fukushikiri were high too.

2. As to the quality indicators of groats, mid-ripening Lotto, Magic, Admiral, and Vikont, late-ripening Fukushikiri and Giza 177, and early-ripening Yuzhanin had high values of the increase index. Early-ripening Yuzhanin, late-ripening Giza 177 and Fukushikiri, mid-ripening Lotto, Magic, and Admiral exceeded the other cultivars in the structure of groats. Early ripening Yuzhanin, mid-ripening Lotto, Magic, and Admiral, late-ripening Giza 177 and Fukushikiri had high colour scores, mid-ripening Vikont, Magic, and Admiral, late-ripening Giza 177, and early-ripening Yuzhanin had high aroma scores, mid-ripening Lotto, Vikont, Magic, and Admiral, early-ripening Yuzhanin, late-ripening Giza 177 and Sakha 101 had high palatability scores. The whole set of quality characteristics of groats has allowed rating mid-ripening Lotto, Magic, Admiral, and Vikont, late-ripening Giza 177 and Fukushikiri, and early-ripening Yuzhanin as the best varieties, as compared with the reference variety (Ukraina 96).

3. By the whole set of indicators (yield, quality of grain and groats), Lotto and Yuzhanin were the best cultivars. Crossing the varieties with high quality indicators of groats (in particular, Yuzhanin and Lotto)

have allowed creating new lines with groats of better quality than in the reference variety (Ukraina 96).

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ПОКАЗНИКИ ЯКОСТІ ЗЕРНА ТА КРУПИ РИСУ ЗАЛЕЖНО ВІД ГЕНОТИПУ СОРТІВ

Д.П.Паламарчук[1], науковий співробітник (аспірант), *E-mail*: palamarchukdmytro86@gmail.com
М.Р. Козаченко[2], доктор с-г. наук, професор, головний науковий співробітник, *E-mail*: yuriev1908@gmail.com
С.І. Святченко[2], кандидат с-г. наук, старший науковий співробітник, *E-mail*: yurievregion@gmail.com,
[1]Інститут рису НААН, вулиця Студентська, 11, с. Антонівка, Скадовський район, Херсонська область, Україна, 75705
[2]Інститут рослинництва ім. В.Я. Юр'єва НААН, проспект Московський, 142, м. Харків, Україна, 61060 .

Анотація. Визначено рівень показників врожайності та якості зерна і крупи сортів рису різних груп стиглості: ранньостиглих – Командор і Южанин, середньостиглих – Україна 96, Віконт, Адмірал, Magic і Lotto, пізньостиглих – Fukushikiri, Giza 177, Sakha 101. За кількісними ознаками якості зерна вищі показники загального виходу крупи на рівні 70% мали серед ранньостиглих сортів Южанин, середньостиглих – Lotto і Magic, а виходу цілого ядра на рівні 90% – ранньостиглий сорт Южанин, середньостиглі сорти Lotto, Віконт і Україна 96, пізньостиглий Sakha 101.За врожайністю та комплексом високих показників основних кількісних ознак якості зерна (загальний вихід крупи, вихід цілого ядра, маса 1000 зерен) виділено ранньостиглий сорт Южанин і середньостиглий сорт Lotto, а сорт Южанин також і за вмістом білка в зерні. Високі кулінарні якості крупи за коефіцієнтом привару мали середньостиглі сорти Lotto, Magic, Адмірал і Віконт, пізньостиглі Fukushikiri і Giza 177, ранньостиглий Южанин, за структурою – ранньостиглий сорт Южанин, пізностиглі Giza 177 і Fukushikiri, середньостиглі Lotto, Magic і Адмірал, за кольором – ранньостиглий сорт Южанин, середньостиглі Lotto, Magic, Адмірал, пізностиглі Giza 177 і Fukushikiri, за запахом – середньостиглі Віконт, Magic і Адмірал, пізностиглий Giza 177 і ранньостиглий Южанин, за смаком – середньостиглі Lotto, Віконт, Magic і Адмірал, ранньостиглий Южанин, пізностиглі Giza 177 і Sakha 101. За комплексом ознак кулінарної якості крупи (коефіцієнт привару, структура, колір, запах, смак) високі в порівнянні зі стандартом Україна 96 показники мали ранньостиглий сорт Южанин, середньостиглі – Lotto, Адмірал, Magic і Віконт, пізньостиглі – Fukushikiri і Giza 177. За комплексною оцінкою врожайності, якості зерна та кулінарних якостей крупи виділено два сорти: ранньостиглий Южанин і середньостиглий Lotto, які цінні для більш широкого використання у виробництві зерна та крупи рису. Створено нові з високими кулінарними якостями крупи лінії рису з використанням в схрещуваннях сортів з високими якостями крупи, зокрема сортів Южанин і Lotto.

Ключові слова: рис, сорт, урожайність, вегетаційний період, показник якості зерна, якість крупи.