academicresearchJournals

Academic Research Journal of Agricultural Science and Research

Full Length Research

Evaluation of Some Promising Chinese Rice Hybrids for Yield, Yield Attributes and Quality Traits in Punjab, Pakistan

Muhammad Akhter*, Zulqarnain Haider*, Muhammad Usman Saleem* and Abid Mahmood**

*Rice Research Institute, Kala Shah Kaku, Lahore, Pakistan
**Ayub Agricultural Research Institute, Faisalabad, Pakistan

Eight (08) Chinese rice hybrids contributed by IQS (a Chinese seed company) including one check variety i.e. Supri were evaluated for yield, yield attributing traits and quality traits at Rice Research Institute, Kala Shah Kaku. Lahore, Pakistan. Three hybrids viz., IQS234, IQS98 and IQS47 produced considerably more paddy yield as compared with that of check variety Supri. Almost all the hybrids produced more number of grains per panicle and higher 1000-grain weight. All the hybrids had better average grain length, average grain width and average grain thickness, as well as cooked grain length as compared with that of check. Yield advantage of the hybrids over the commercially grown rice variety ranges between 5-57%. Conclusively, IQS234, IQS98 and IQS47 were found best among all the studied hybrids due to its yield advantage over check, better average grain and cooked grain length than check, shorter maturity duration and short plant height.

Key words: Food security, Rice (*Oryza sativa L.*), Rice hybrids, Agronomic traits, Quality traits, Morphological traits

INTRODUCTION

In Pakistan, rice is an important crop due to its significance as country's second staple food after wheat and as a source of foreign exchange earnings. The rice export has steadily increased during current years (Anonymous, 2016). This amount can further be enhanced with the increase in rice production. Rice yield in Pakistan is very low as compared to other rice growing countries of the world. In future, there is no scope for further expansion in rice area; hence vertical increase in rice production is vital with increase in yields. To achieve this goal, conventional breeding methods need to be supplemented with the innovative techniques. Hybrid rice technology is one among these techniques. This technology is globally known since China announced the successful development and cultivation of the rice hybrids in 1976 (Kueneman, 2006).

In Pakistan research work has been initiated for the development of commercially viable rice hybrids by different institutions in the public and private sectors. In addition, some multinational and national seed companies are importing rice hybrids for commercial use. Rice is cultivated in diverse climatic conditions of Pakistan. Such conditions demand an extensive testing of imported rice hybrids with local cultivars for yield, yield related traits and quality attributes.

MATERIAL AND METHODS

The trial was conducted during kharif season of 2017 at research farms of Rice Research Institute, Kala Shah Kaku near Lahore. Eight (08) rice hybrids viz., IQS938, IQS8, IQS98, IQS47, IQS1688, IQS983, IQS130, IQS234 were evaluated along with the local cultivar Supri as check. The trial was conducted in plots with spacing was maintained at 20cm x 20cm. Normal cultural practices were followed. The fertilizer application was given @ 120:60:60:: N:P:K (kg/ha) according to the recommended time and doses. Data on days to 50% flowering (FF), plant height (PH), productive tillers/m^2 (PT), panicle length (PL), 1000-grain weight (TGW) andyield (Y) (tons/ha) were recorded. Data for grain quality traits such as average grain length (AGL), average grain thickness (AGT), average grain width (AGW); cooking quality traits i.e. cooked grain length (CGL), bursting percentage (B); and milling quality traits i.e. brown rice percentage (BR %), total milling recovery (TMR %) and head rice recovery (HR %) were also collected to assess the quality of these hybrids with reference to consumer preferences.

For milling data, cleaned paddy samples were milled at 12% moisture content (wet basin). Milling was done in first step by husking through SATAKE lab husker model number THU-35 made by SATAKE Corporation Tokyo Japan. In second step husked rice (brown rice) was milled in Grain-Man Polisher (McGill Mill No. 3) made by Seed-Buro equipment company (Pvt. Ltd.) USA. Time during whitening was set at 35 seconds with 1 kg of pressure. After whitening, total milled recovery (TMR) of rice was recorded. After this, to get head rice recovery (HR) length grader of local origin was used. All the milling process was done at room temperature.

For cooked grain length (CGL) and bursting percentage (B), milled grains of entries were pre-soaked for 30 minutes in water at room temperature and then boiled at 100°C for 6 minutes. Ten grains were used to measure the CGL for each entry.

RESULTS AND DISCUSSION

A.   AGRONOMIC TRAITS

Results as depicted in table 1 shows significant (p ≤ 0.05) variation in yield of all the studied hybrids. The maximum paddy yield was recorded for IQS234 (5.8 t/ha), followed by IQS98 (4.8 t/ha), IQS47 (4.6 t/ha), IQS1688 (4.1 t/ha), IQS983 (3.9 t/ha) and the check variety Supri (3.7 t/ha). While the rest of the hybrids performed less in terms of paddy yield as compared with that of check. Minimum paddy yields were recorded in case of IQS938 (3.2 t/ha). Highest yield of IQS234 was attributed to its highest 1000 grain weight (TGW) value i.e. 39 g, followed by IQS130 (37.3 g), IQS1688 (35.6 g) and IQS47 (35.1 g). TGW of

check variety was recorded minimum among all the studied hybrids having TGW of 25.6 g. Overall, significant variation was also observed in case of TGW of all the studied hybrids.

Likewise, in case of number of filled grains per panicle, significant variations were observed. Maximum filled grains per panicle were recorded for IQS98 (115 grains per panicle), followed by IQS1688 (110 grains) and check variety Supri (109 grains per panicle). Minimum filled grains per panicle were recorded for hybrid IQS983 (80 grains per panicle) as depicted in table 1.

Maximum plant height was observed in IQS47 (126 cm), followed by Supri (120 cm), IQS983 (119 cm), IQS98 (117 cm) as given in table 1. Minimum PH was observed in IQS234 hybrid (88 cm). Tillering ability is also a very important character for evaluating rice varieties. In this study, significant variation was observed in case of this trait also. Maximum tillering ability was observed in check variety Supri (13 tillers per plant), followed by IQS983 (11 tillers), IQS938 & IQS234 (10 tillers each) and minimum tillers were recorded in case of IQS1688 (7 tillers each) as given in table 1.

Maturity duration of a crop shows the duration of a crop that it remains in the fields, longer the duration of the crop maturity, more water will be required, more chances of diseases and insect attack. Short duration hybrids are more preferred in especially in Pakistan, where farmers are reluctant to delay wheat sowing. Rice crop is followed by wheat crop, therefore, fields are necessarily required to be prepared for timely sowing of wheat crop. A hybrid with crop duration more than 120 days, delays the wheat sowing, therefore, a rice hybrid is needed to be having less than 120 days life cycle so that the field could be emptied in time and be prepared for timely sowing of wheat. In this study, almost all the rice hybrids were observed to get mature in less than 120 days. From minimum to maximum maturity duration, minimum days to maturity were recorded in IQS938 (103 days), followed by IQS234 (104 days), IQS130 (110 days) and IQS983 (111 days) as depicted in table 1.

B.   QUALITY TRAITS

Quality attributes are also the most important criteria in evaluating the rice hybrids and varieties due to natural inclination of rice consumers towards aesthetic and taste. In Pakistan, both, quality as well as quantity was equally important that depicts the success of a rice variety or hybrid. Therefore, five (05) quality tests i.e. average grain length (AGL). Average grain width (AGW), average grain thickness (AGT). Cooked grain length (CGL) and bursting percentage after cooking

(B) were also included in evaluation of these rice hybrids.

Table 1: Comparative performance of IQS hybrids with check Supri at RRI, KSK

Hybrids	H1 IQS938	H2 IQS8	H3 IQS98	H4 IQS47	H5 IQS1688	H6 IQS983	H7 IQS130	H8 IQS234	Check Supri
Yield (t/ha)	3.2 ^{E}	3.6 ^{D}	4.8 ^{B}	4.6 ^{B}	4.1 ^{C}	3.9 ^{CD}	3.7 ^{D}	5.8 ^{A}	3.7 ^{D}
Filled grains per panicle	94	91	115	90	110	80	105	92	109
1000 GW (g)	30.3	25.9	31.5	35.1	35.6	26.1	37.3	39.0	25.6
Plant Height (cm)	107	108	117	126	111	119	103	88	120
Tillers per plant	10	8	9	9	7	11	7	10	13
Panicle Length (cm)	24.2	23.6	26.5	29.9	31.2	25.6	28.6	20.8	25.2
Days to 50% flowering	73	89	90	88	89	81	80	74	87
Days to Maturity	103	119	120	118	119	111	110	104	117
Avg. Grain Length (mm)	7.28	6.74	7.02	7.26	6.6	7.12	6.98	7.06	6.98
Avg. Grain Width (mm)	1.82	2.12	2.18	2.26	2.22	2.18	2.14	2.12	1.66
Avg. Grain Thickness (mm)	1.6	1.7	1.82	1.88	1.78	1.82	1.74	1.72	1.42
Cooked Grain Length (mm)	11.6	11.2	12	12	11	12.1	11.2	11.3	10.4
Bursting (%)	30	20	14	16	8	5	4	6	11
Brown Rice (BR) %	84	84	85	85	85	84	85	84	77
Total Milling Recovery (TMR) %	72	74	74	74	74	74	73	73	67
Head Rice (HR) %	41	55	54	54	54	49.5	51	52	48

Table 2: Comparison of IQS hybrids with local cultivar Supri

Hybrids		Paddy grain increase % over check	Average grain length (AGL)	Cooked grain length (CGL)
IQS938	H1	-14	> Check	> Check
IQS8	H2	-3	< Check	> Check
IQS98	H3	30	> Check	> Check
IQS47	H4	24	> Check	> Check
IQS1688	H5	11	< Check	> Check
IQS983	H6	5	> Check	> Check
IQS130	H7	0	= Check	> Check
IQS234	H8	57	> Check	> Check
Supri	Check	-	-	-

The results shows that all the studied hybrids showed significant variation in case of all the quality traits. IQS938 showed the maximum average grain length (AGL) i.e. 7.28 mm, followed by IQS47 (7.26 mm), IQS983 (7.12 mm), IQS234 (7.06 mm) and IQS98 (7.02 mm), and also showed better average grain length (AGL) as compared with that of check variety Supri (6.98 mm) also indicated by the table 1. Grain width and thickness are also important in the sense that these two traits are more correlated with the rice yield as well as heading rice recovery percentage after milling due to less breakage. All the studied hybrids showed more average grain thickness AGT and average grain width AGW as compared with check variety. Maximum AGW was recorded in IQS47 (2.26 mm), followed by IQS1688 (2.22 mm), IQS983 & IQS98 (2.18mm each), IQS130 (2.14 mm) and IQS234 (2.12 mm) as shown in table 2.

Average cooked grain length (CGL) is also an important trait regarding the consumer preferences. All the hybrids showed more CGL as compared to check. Maximum CGL was observed in case of IQS983 (12.1 mm), followed by IQS98 and IQS47 (12.0 mm each) while the check variety showed minimum CGL value of 10.4 mm as given in table 2. Bursting after cooking was higher than normal in two hybrids i.e. IQS938 (30%) and IQS8 (20%). In case of all other hybrids studied had insignificant bursting percentage after cooking. High ratio of bursting in some of the hybrids might be due to lower Gelatinization Temperature (GT) as compared to other hybrid entries and check variety.

In case of milling quality traits, almost all the hybrids showed higher brown rice percentages (BR %) compared with that of check variety Supri. It ranged from 84 to 85 % in hybrids while the check variety showed 77% brown rice percentage. Similarly TMR ranged from 72 to 74 % in case of hybrids while Supri had 57% of TMR percentage.

Head Rice Recovery (HR %) showed highly significant (p ≤ 0.01) variation among the tested hybrids. Maximum HR of 55 % was recorded in case of IQS8, followed by IQS98, IQS47 & IQS1688 (54%) while the minimum value of HR was recorded in Supri also depicted in table 2.

CONCLUSION

Eight (08) IQS rice hybrids contributed by IQS (a Chinese seed company) including one check variety i.e. Supri were evaluated for yield, yield attributing traits and quality traits at Rice Research Institute, Kala Shah Kaku. Lahore, Pakistan. Three hybrids viz., IQS234, IQS98 and IQS47 produced considerably more paddy yield as compared with that of check variety Supri. Almost all the hybrids produced more number of grains per panicle and higher 1000-grain weight. All the hybrids had better average grain length, average grain width and average grain thickness, as well as cooked grain length as compared with that of check. Yield advantage of the hybrids over the commercially grown rice variety ranges between 5-57%. Conclusively, IQS234, IQS98 and IQS47 were found best among all the studied hybrids due to its yield advantage over check, better average grain and cooked grain length than check, shorter maturity duration and short plant height.

REFERENCES

Anonymous, (2016). Agricultural Statistics of Pakistan 2005-06. GOP, MINFAL, Economic Wing, Islamabad.

Davis. M.D, and J. N. Rutgar. (1976). Yield of F1, F2, and F3 hybrids of rice (Oryza sativa L). Euphytica 25: 587-595.

FAO. (2003). Terminal report of project TCP / EGY / 8923 (T). Training in hybrids rice technology through technical cooperation between developing countries.

Jones. J.W. (1926). Hybrid vigor in rice. J. Am. Soc. Agron. 18: 423-428.

Kueneman, E.A. (2006). Improved rice production in a changing environment: From concept to practice. Intl. Rice Commission NWSL. 56: 1- 21.

Malabanan, M. (2007). Hybrid rice commercialization in the Philippines. Asian Seed. 14 (1): 4-6.

Paroda, R. S. (1998). Hybrid rice technology in India: Problems and Prospects. Proceedings 3rd International Symposium on Hybrid Rice. 14-16 November, 1996. Hyderabad, India.

Peng, J.Y. and S.S. Virmani. (1991). Heterosis in some inter-varietal crosses of rice. Oryza 28: 31-36.

Pingali, P.L., M. Morris and P. Moya. (1998). Prospects of hybrid rice in tropical Asia. Proceedings 3rd International Symposium on Hybrid Rice. 14-16 November, 1996. Hyderabad, India.

Rehman, A. (2003). Screening and evaluation of rice germplasm for leafolder resistance. Final Technical Report. Rice Programme, NARC, Islamabad, 31pp.

Shinjyo. C. (1969). Cytoplasmic genetic male sterility in cultivated rice. Oryza sativa L.II. The inheritance of male sterility. Jpn. J. Genet. 44: 149-156.

Virmani. S.S; R.C. Chaudhary and G.S. Khush. (981) Current outlook on hybrid rice. Oryza 18: 67-84.

Virmani, S.S; R.C. Aquino and G.S Khush. (1982). Heterosis breeding in rice, Oryza sativa L. Theor. Appl. Genet. 63: 373-380.

Virmani, S.S. (1986). Prospects of hybrid rice in developing countries. Rice: Progress, assessment and orientation in the 1980s. Int. Rice Comn. Newsl. 34 (2): 143-152.

Way. M.O. (2004). Texas rice production guide line. Texas Agricultural Experiment Station. Young J.B and S.S. Virmani. (1990). Heterosis in rice over environments. Euphytica 51: 87-93.