SATSA Mukhapatra - Annual Technical Issue **27** : 2023 ISSN 0971-975X

Evaluation of Hybrid Rice (Oryza sativa L.) Varieties in North-Eastern Hilly region of Tripura

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(Received : November 07, 2022; Revised : December 21, 2022; Accepted : January 15, 2023)

ABSTRACT

A field experiment was conducted at research farm, College of Agriculture, Tripura to evaluate the comparative performance of ten transplanted rice hybrids (PAC-8744, Lokenath-505, PHB-71, PAC-835, VNR-2111, DRRH-3, VNR-2355, VNR-2233, ARIZE-6444, KRH-2) towards growth parameters, yield parameters and yield and grain characteristics during Kharif season of 2015-16 and 2016-17.The experiment was laid out in randomized complete block design (RCBD) replicated thrice. The experimental results revealed that the tested hybrid rice varieties significantly differed among themselves with respect to different characters under study in both the years of experimentation. The highest plant height was recorded by PAC-8744 hybrid (120.82 cm) and the lowest was VNR-2111 (101.82 cm). The maximum root length at 90 days was recorded by PAC-8744 hybrid (26.35 cm) followed by Lokenath-505 (25.62 cm). The highest number of effective tillers recorded by the variety PAC-8744 hybrid (1423). However, the maximum test weight (25.65gm) was produced by the KRH-2 hybrid. The PAC-8744 hybrid produced the maximum grain yield followed by the VNR-2111. The grain yield of PAC-8744 is 27.29 % more over check hybrid i.e. KRH-2. The result of the various characters studied in the experiment suggested that some good characters exist in PAC-8744 hybrid rice cultivars which can be utilized for cultivation.

Key words : Hybrid, Rice, Varieties, North - Eastern, Tripura.

Introduction :

Rice, one of the three most important crops in the world, forms the staple diet of half the worlds' population. Its cultivation is of immense importance to food security of Asia, where more than 90% of global rice is produced and consumed. India is the largest rice growing country while China is the largest producer of rice. Rice is associated with prosperity and fertility. Rice is healthful as it does not contain fat, cholesterol and is sodium free. Rice is an excellent food to include in a balanced diet. It is a good source of protein, vitamins and minerals such as thiamine, niacin, iron, riboflavin, vitamin D, calcium, and fiber. It has low sugar content. All rice is gluten free, making rice the essential choice for people with gluten free dietary requirements. Rice does not contain all of

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the essential amino acids in sufficient amounts for good health, and should be combined with other sources of protein, such as nuts, seeds, beans, fish, or meat.

In India rice is cultivated annually in 43.8 mha with the production of 106.18 mt during 2011-12 (Anonymous, 2015). More than half of the rice area is rainfed and distribution-wise 80% of rainfed rice is in Eastern India, making its cultivation vulnerable to vagaries of monsoon. The increase in production is more than 4 folds from 20.6 mt in 1950-51 to 99.2 mt in 2008 – 2009. The impressive growth is mainly owing to wide adaptation of high yielding semi-dwarf varieties, hybrid varieties, increased use of chemical fertilizers and improved package of cultural practices. Hybrid rice technology is likely to play a key role in increasing the rice production particularly in SRI. The rice hybrids, recently introduced in cultivation, on an average, give 20-30% higher yield over the common high yielding varieties (Prasad, 2012).

At present, out of total 2.50 lakh hectares of rice growing area, only 10000 hectares of land has been brought under hybrid cultivation in Tripura. The total annual production of rice in Tripura is nearly 8.5 lakh metric tonnes but there remains a deficit of 1 lakh metric tonnes of rice per year in Tripura. For self – sufficiency in rice production of the state, more lands have to be brought under hybrid rice cultivation along with the spread of the newer hybrid varieties replacing the older hybrid varieties need to be closely monitored to take advantage of the superior characters of these newer varieties released by various Research Institutions as well as private seed companies. Therefore, the present experiment was undertaken to evaluate the performances of different hybrid rice varieties in comparison with the commercially cultivated KRH-2 rice variety in *Kharif* season at Tripura to find out the best hybrid rice variety in terms of yield.

MATERIALS AND METHODS :

A field experiment was conducted during two consecutive *kharif* seasons of 2015-16 and 2016-17 at the Experimental Low Land Paddy farm of College of Agriculture, Lembucherra, Tripura situated between 22°57' N latitude and 91°09' E longitude. The soil of the experimental site was sandy loam having *p*H of 5.4, organic carbon (0.79 gm kg^{-1}), available nitrogen of 260.0 kg ha^{-1}, available phosphorus of 19.0 kg ha^{-1}, and available potash of 123.0 kg ha^{-1}. The experiment was carried out during the *kharif* seasons where the climate of hilly zone is sub-tropical in nature with distinctive characteristics of high rainfall, high humidity and a prolonged winter. The treatments are comprised of ten varieties [T_1 - PAC-8744, T_2 - Lokenath-505, T_3 - PHB-71, T_4 - PAC-835, T_5 - VNR-2111, T_6 - DRRH-3, T_7 - VNR-2355, T_8 - VNR-2233, T_9 - ARIZE-6444, T_{10} - KRH-2]. The treatments were replicated thrice in randomized complete block design. The plot size was 5.0 m×3.0 m and spacing was maintained at 20 cm × 20 cm. Paddy seed rate was 20 kg ha^{-1}. The crop was harvested in November - December. Fertilizers were applied @ 80:40:40 kg ha^{-1}as N: P_2O_5 : K_2O in the form of urea, single super phosphate and muriate of potash, respectively. Half of the nitrogenous fertilizer and entire dose

of P_2O_5 and K_2O were applied at the time of land preparation and the rest half of nitrogen were top dressed at 30 days after transplanting (DAT). The data collected from the field experiments were subjected to statistical analysis appropriate to the design and the treatment variations were tested for significance by F test. Statistical analysis for SEm and CD was done by using methodologies as laid down in Gomez & Gomez (1984).

RESULTS AND DISCUSSION :

A. Response of different hybrids on different growth attributes of rice

Plant height :

The plant height was significantly influenced by the different hybrids of rice at harvest (Table 1). The tallest plant height was recorded in T_1 (PAC-8744) followed by T_2 (Lokenath-505) treatment and they are statistically at par. The shortest plant height was recorded in T_5 (VNR-2111) treatment. Sarkar *et al.* (2016) also reported that plant height increased progressively with the advancement of time and growth stages from early growth to maturity. Bhuiyan *et al.* (2014) reported the similar significant effects on plant height at maturity for different rice hybrid over high yielding varieties.

Root length :

The different hybrid varieties significantly influenced the root length of rice at harvest (Table 1). The T_1 (PAC-8744) recorded the maximum root length followed by T_2 (Lokenath-505) treatment and they are statistically at par. The minimum root length was observed in T_5 (VNR-2111) followed by T_{10} (KRH-2) treatment and they are statistically on at per as per 'F' test analysis. Bhuiyan *et al.* (2014) also have similar observations.

Number of hills m^{-2} :

The different hybrid varieties significantly influenced the number of hill m^{-2} of rice at harvest (Table 1). The T_3 (PHB-71), T_4 (PAC-835), T_5 (VNR-2111), & T_6 (DRRH-3), treatments recorded the maximum number of hill m^{-2} of rice at harvest followed by T_7 (VNR-2355) and T_{10} (KRH-2) treatment and they are statistically at par as per 'F' test analysis. Bhuiyan *et al.* (2014) and Uddin *et al.* (2007) corroborates the same finings.

Number of tillers $plant^{-1}$:

The different hybrid varieties also significantly influenced the number of tillers $plant^{-1}$of rice at harvest (Table 1). The T_1 (PAC-8744) treatment recorded the maximum number of tillers $plant^{-1}$ followed by T_9 (ARIZE-6444) treatment but they are statistically at par as per F analysis. The minimum number of tillers $plant^{-1}$ was observed in T_2 (Lokenath-505), T_6 (DRRH-3), & T_7 (VNR-2355). The significant differences could be attributed to the fact that high yielding varieties (HYV's) have relatively high tillering capacity. Sarkar *et al.* (2016) also reported similar findings.

B. Response of different hybrid varieties on different yield attributes of rice

Number of effective tillers $plant^{-1}$:

The different hybrid varieties significantly influenced the number of effective tillers $plant^{-1}$of rice at harvest (Table 1). The T_1 (PAC-8744) treatment recorded the maximum number of effective tillers $plant^{-1}$ followed by T_9 (ARIZE-6444) treatment but they are statistically at par

as per F analysis. The minimum number of effective tillers plant^{-1} was observed in T_6 (DRRH-3) followed by T_7 (VNR-2355). The results are also in agreement with Yang *et al.* (2007).

Number of filled grains panicle^{-1} :

The different hybrid varieties also significantly influenced the number of filled grains panicle^{-1} of rice (Table 1). The T_1 (PAC-8744) treatment recorded the maximum number of filled grains panicle^{-1} followed by T_6 (DRRH-3) treatment but they are statistically at par as per F analysis. The minimum number of filled grains panicle^{-1} was observed in T_{10} (KRH-2) followed by T_9 (ARIZE-6444). Akram *et al.* (2007) also have similar type of observations.

Number of chaffy grains panicle^{-1} :

The number of chaffy grains panicle^{-1} was significantly influenced by the different hybrid varieties of rice at harvest (Table 1). The maximum number of chaffy grains panicle^{-1} was recorded in T_6 (DRRH-3) followed by T_7 (VNR-2355) treatment and they are statistically at par. The minimum number of chaffy grains panicle^{-1} was recorded in T_1 (PAC-8744) followed by T_9 (ARIZE-6444) treatment. Sarkar *et al.* (2016) also reported similar results.

Fertility ratio :

The different hybrid varieties also significantly influenced the fertility ratio of rice (Table 1). The T_1 (PAC-8744) treatment recorded the maximum fertility ratio followed by T_2 (Lokenath-505) & T_9 (ARIZE-6444) treatment but they are statistically at par as per F analysis. The minimum fertility ratio was observed in T_6 (DRRH-3) and T_7 (VNR-2355) treatment. Chamling and Basu (2014) also reported similar observations.

1000 grain weight or test weight :

The test weight was significantly influenced by the different hybrids of rice (Table 1). The maximum test weight was recorded in T_{10} (KRH-2) followed by T_3 (PHB-71) treatment and they are statistically at par. The minimum test weight was recorded in T_1 (PAC-8744) treatment. The results were in unison with Krishnaveni *et al.* (2006) and Sarkar *et al.* (2016).

C. Response of different hybrids on yields of rice

The different hybrid varieties significantly influenced the grain yield and straw yield of rice (Table 1). The T_1 (PAC-8744) treatment recorded the maximum grain yield, straw yield and harvest index followed by T_7 (VNR-2355) treatment but they are statistically at par as per F analysis. The minimum grain yield and straw yield was observed in T_{10} (KRH-2) and T_5 (VNR-2111) treatment, respectively. The grain yield of T_1 (PAC-8744) treatment is 27.29 % more over check variety i.e. T_{10} (KRH-2) treatment. The results were in unison with Krishnaveni *et al.* (2006) and Chamling and Basu (2014). Viraktamath (2011) and Sarkar et al. (2016) reported similar type of findings.

Conclusion :

From the findings of the experiment, it can be concluded that Hybrid PAC-8744 was found superior among the tested hybrid varieties including the check variety for transplanting in the *Kharif* season of Tripura. It may be due to congenial agro-climatic scenario which probably took

active role for exhibition of higher yield of the hybrid types under consideration; it may also be confirmed through the average filled grain percentage of different types included in the trial. Test weight of all the hybrid types including KRH2 were significantly similar with each other and were of higher magnitude in comparison to that of standard varieties. Contribution of this parameter for higher yield of the concerned hybrids should also to be noted; and yield of both the hybrid types could be noticed as remarkably higher than that of other types included in the trial.

Acknowledgment :

The authors would like to appreciate college of Agriculture, Tripura for financial and other support for this research.

Conflict of Interest :

All the authors would like to declare that there is no conflict of interest among themselves that could possibly arise.

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Table 1 : Response of different hybrid varieties on different growth and yield attributes of rice (Pooled data of two years)

Varieties	No. of hills m^{-2} (at harvest)	Plant height (cm.)	Root Length (cm.)	No. of tillers $plant^{-1}$	No. of Effective tillers $plant^{-1}$	No. of Filled grains $Panicle^{-1}$	No. of Chaffy grains $Panicle^{-1}$	Fertility Ratio	1000 grain wt.(g)
T_1	14.00	120.82	26.35	23.00	14.23	158.31	12.01	0.93	22.36
T_2	15.00	116.32	25.62	18.00	12.32	149.61	15.71	0.91	23.65
T_3	15.67	106.59	21.96	19.00	12.12	124.10	24.22	0.84	25.32
T_4	15.67	114.65	22.05	20.00	12.78	125.39	13.93	0.90	24.65
T_5	15.67	101.82	20.12	17.00	11.35	125.70	13.93	0.90	24.96
T_6	15.67	108.69	24.32	18.00	10.95	156.21	42.44	0.79	23.95
T_7	15.33	111.63	21.85	18.00	11.96	148.11	40.54	0.79	25.21
T_8	14.00	112.87	21.65	19.00	12.63	145.68	19.64	0.88	24.01
T_9	14.00	105.11	21.11	22.00	13.52	122.91	12.30	0.91	24.96
T_{10}	15.33	110.30	20.32	21.00	13.12	112.20	17.92	0.87	25.65
SEm(+)	0.55	3.31	0.76	1.03	0.47	5.30	6.42	0.03	0.80
CD at 5%	**1.62**	**9.85**	**2.27**	**3.05**	**1.40**	**15.76**	**19.09**	**0.09**	**2.38**

[T1 - (PAC-8744), T2 - (Lokenath-505), T3 - (PHB-71), T4 - (PAC-835), T5 - (VNR-2111), T6 - (DRRH-3), T7 - (VNR-2355), T8 - (VNR-2233), T9 - (ARIZE-6444), T10 - (KRH-2)]

Table 2 : Response of different hybrid varieties on yield of rice (Pooled data of two years)

V**arieties**	**Grain Yield (t ha^{-1})**	**% change in yield over check**	**StrawYield (t ha^{-1})**	**Harvest Index (%)**
T_1	7.37	+27.29	8.85	45.44
T_2	6.54	+12.95	8.12	44.61
T_3	5.97	+3.05	7.60	44.02
T_4	6.19	+6.86	8.45	42.28
T_5	5.58	-3.65	7.21	43.63
T_6	6.33	+9.33	8.25	43.42
T_7	6.85	+18.27	8.51	44.60
T_8	6.18	+6.80	7.58	44.92
T_9	5.81	+0.31	8.05	41.86
T_{10}	5.79	-	7.89	42.38
SEm(+)	0.27	-	0.29	0.55
CD at 5%	**0.81**	**-**	**0.86**	**1.62**

[T1 - (PAC-8744), T2 - (Lokenath-505), T3 - (PHB-71), T4 - (PAC-835), T5 - (VNR-2111), T6 - (DRRH-3), T7 - (VNR-2355), T8 - (VNR-2233), T9 - (ARIZE-6444), T10 - (KRH-2)]