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Evaluation of rice (*Oryza Sativa* L.) hybrids on growth and yield under agro-climatic conditions of Allahabad Uttar Pradesh in kharif season

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Abstract
The field experiment was conducted during kharif season of 2016 at Crop Research Farm SHUATS, Allahabad (UP). The experiment was carried out to find the performance of 10 hybrids, which laid out in Randomized Block Design (RBD) & replicated thrice. The experiment finding revealed that the treatment T_9 (KR 09) significantly performed better than all other varieties viz; Plant height (142.31 cm), Dry weight (41.87 g), Number of effective tillers per hill (12.15), Panicle length (28.63 cm), Number of filled grains plant^{-1} (227.67), Test weight (32.33 g), Grain yield (8.51 t ha^{-1}), Straw yield (16.30 t ha^{-1}), Biological Yield (24.81 t ha^{-1}). While the same treatment T_9 (KR 09) recorded highest gross return (201400 Rs ha^{-1}), net return (133722 Rs ha^{-1}) and B: C ratio (3.1), however treatment T_8 (KR 08), T_7: (KR 07) and (KR 10) were statistically at par with treatment T_9.

Keywords: panicle initiation, green revolution, days after transplanting (DAT) and one quadrate

Introduction
Rice belongs to genus *Oryza* and the family Gramineae (Poaceae). The genus Oryza contains 24 recognized species, of which 22 are wild species and two cultivated (*O.sativa* and *O. glaberrima*). Rice is the most important cereal food crop of the world, providing major source of the food energy for more than half of the human population. Rice is the staple food of about 65% of Indian population. Our rice requirement by the year 2020 is estimated to be around 122 million tons as against the present production of about 100 million tons, thus leaving a gap of about 22 million tons rice. It accounts for about 43% of total food grain production and 46% of total cereal production in the country Anonymous 2006 [1]. More than 90 per cent of the world's rice is produced and consumed in Asia, where it is an integral part of culture and tradition. Rice occupies a pivotal place in Indian agriculture and it is contributes to 15 per cent of annual GDP and provides 43 per cent calorie requirement for more than 70 per cent of Indians. Around 65% of the total population in India depends on rice and it accounts for 40% of their food production Anonymous 2005 [2]. India has 44.14 million hectare area under rice and production of 106.65 million tonnes with an average yield of 2416 kg ha^{-1} during 2013-14, Uttar Pradesh has an area of 5.98 m ha, production of 14.64 million tonnes and productivity of 2.447 t ha^{-1} of rice GOI 2016 [3]. It is estimated that 5000 liters of water is needed to produce 1 kg of Rice Bouman *et al*., 2009 [4]. Manual transplanting is the most common practice of rice cultivation in south and south-east Asia. Rice production and productivity was significantly enhanced with the introduction and cultivation of semi-dwarf, fertilizer responsive and non-lodging high yielding varieties in the early seventies leading to the "Green Revolution". The yield level of high yielding varieties is planting in recent year to meet the demand of increasing population and maintain this self sufficiency the present production level needs to be increased up to 140 million tonnes by 2025 which can be achieved only by increasing the rice production by over 2 million tonnes per year incoming decade. Hybrid rice technology has provided farmers with high yields, saved land for agricultural diversification and created rural employment opportunities. Among the limited options hybrid technology is the only prove technology currently available for stepping up rice production significantly, therefore the introduction of hybrids and popularization of their production technology is feasible and readily adoptable to achieve adoptable targeted population. Systematic, goal-oriented, and time-bound research on hybrid rice in India began in 1989 through a national network project. The project was strengthened further with funding from the United Nations Development Programme, Asian Development Bank, and the World Bank.

Materials and Methods

A field experiment was conducted during kharif season of 2016 at the Crop Research farm, Department of Agronomy, Allahabad School of Agricultural, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad. The experiment site lies between 25-27° N latitude, 8.5°E Longitude and 98 meters altitude. The climate is characterized by the alternate hot rainy season from late June to early September with mean temperature of 38°C. The soil was sandy loam in texture having a pH (7.0), EC (0.13 dSm^{-1}), organic carbon (0.40%), available N (228 kg ha^{-1}), P (22.5 kg ha^{-1}), K (336 kg ha^{-1}), S (17.00 ppm), and Zn (0.50 ppm) during the experimental year. The experiment was laid down in randomized block design (RBD) with 10 treatments and 3 replications. Twenty two days old seedlings were transplanted to main field on 21-07-2016 conventionally at a spacing of 20 x 10 cm. The crop was fertilized with recommended dose of NPK 150:80:60 kg ha^{-1} was applied. The (100%) full dose phosphorus and potassium whereas (50%) of Nitrogen was applied at the time of planting as basal dose and the remaining Nitrogen was applied in two equal split doses as top dressing at active (Tillering & Panicle Initiation stage) respectively. Irrigation was scheduled at 8-10 days interval; however other normal cultural practices were followed timely as; weeding at 30 DAT & 45 DAT. One quadrate ($1m^2$) was harvested in every plot for the determination of results and data was subjected to statistical analysis separately by using analysis of variance technique. The difference among treatment means was compared by using least significant difference test at 5% probability levels. The treatment consisted of Hybrids T_1: KR 01 (Damini), T_2: KR 02 (Indam7- 205), T_3: KR 03 (LP1623), T_4: KR 04 (LP 1632), T_5: KR 05 (LP 1624), T_6: KR 06 (27P36), T_7: KR 07 (27P37), T_8: KR 08 (28P67), T_9: KR 09 (28S41), T_{10}: KR 10 (28S50).

Results and Discussion

Growth attributes

Plant height (cm)

Plant height is not a yield component especially in grain crops but it indicates the influence of various nutrients on plant metabolism. Significantly maximum plant height (142.31 cm) was recorded in treatment T_9 (KR 09) and minimum plant height (121.74 cm) was recorded in treatment T_1 (KR 01) at 80 DAT. However treatment T_8, T_7 and T_6 were statistically at par with treatment T_9 (KR 09) respectively (Table 1) and (Fig 1). The increase in plant height might be due to the genetic makeup of the variety. This may be due to first generation hybrid vigor of the plant compared to other cultivars Paramasivan *et al*., 1988 [5]. Increase in plant height may also be due to synchronized availability of essential plants nutrients to the crop especially nitrogen for a longer period during its growth stages Deshpande and Devasenpathy 2011 [6]. Similar finding was also reported by Parihar *et al.*, 2005 [7], Kalyani *et al.*, 2012 [8] and Kumar *et al*., 2015 [9].

Plant dry weight (g)

The observations regarding plant dry weight are being presented and were observed significant difference between the treatments. Maximum plant dry weight (41.87 g) was observed in treatment T_9 (KR 09) and minimum plant dry weight (31.60 g) was recorded in treatment T_1 (KR 01) at 80 DAT. However treatment T_7, T_8 and T_{10} were statistically at par with treatment T_9 (KR 09) respectively (Table 1) and (Fig 1). The increase in plant dry weight (g) might be due to more assimilatory surface leading to higher dry matter production coupled with effective translocation and distribution of photosynthates from source to sink. Dry matter accumulation depends upon the photosynthesis and respiration rate and during vegetative growth; hybrid rice accumulates more dry matter in the early and middle growth stages which results in more spikelets per panicle. They have bigger panicles and more spikelets per panicle. These factors result in higher yields usually 15% or more than ordinary rice Philrice *et al.*, 2002 [10]. These results are confirmed by Singh and Khan 2003 [11].

Crop growth rate (g m^{-2} day^{-1}) and Relative growth rate (g g^{-1} day^{-1})

Crop growth rate (g m^{-2} day^{-1}) and Relative growth rate (g g^{-1} day^{-1}) of rice recorded at different intervals was found non-significant difference among the treatments. Maximum CGR (56.92) and RGR (0.07) were recorded in treatment T_{10} (KR 10) at 40-60 DAT, while minimum CGR (37.17) and RGR (0.03) was recorded in treatment T_5 (KR 05) has been presented in (Table 1) and (Fig 1). The percentage increase in CGR is due to prevelance of low temperature coupled with less humidity at the reproductive stage or at flag leaf stage which might be reduced in yield as compare to earlier planting. The availability of ample supply of nutrients especially nitrogen through foliar feeding may be the reason for the better performance with regard to CGR & RGR. Similar results have been reported by Yadav *et al.,* 2004 [12].

Days to 50 % flowering and days to maturity

Maximum days to 50 % flowering (80 days) and days to maturity (104.33days) was recorded in treatment T_9 (KR 09), while minimum days to 50 % flowering (50 days) and days to maturity (87.33 days) was recorded in treatment T_5 (KR 05) However treatment T_7, T_8 and T_{10} were statistically at par with treatment T_9 (KR 09) respectively (Table 2) and (Fig 2). Probably heritability is a measure of extent of phenotypic variation caused by the action of genes. In the present study high heritability was observed for traits *viz*., Days to 50% flowering and days to maturity. These results are reported by Haque *et al.* 2015 [13]. Prevelance of low temperature coupled with less humidity at flag leaf stage which might be reduced in duration as compare to earlier planting. The availability of ample supply of nutrients especially nitrogen through foliar feeding may be the reason for the better performance with regard to Days to 50% flowering and days to maturity. Similar results have been reported by Yadav *et al.,* 2004 [12].

Yield Attributes

The yield attributes of hybrid rice, viz. Highest number of effective tillers $hill^{-1}$ (12.15), number of grains $panicle^{-1}$ (51.00), panicle length (28.63 cm) and number filled grains $plant^{-1}$ (227.67) was recorded in Treatment T_9 (KR 09), while lowest yield attributes, viz., number of effective tillers $hill^{-1}$ (6.92), number of grains $panicle^{-1}$ (42.11) and panicle length (20.65 cm) and number filled grains $plant^{-1}$ (99.13) was recorded in Treatment T_1 (KR 01), however treatment T_7, T_8 and T_{10} were statistically at par with treatment T_9 (KR 09) respectively (Table 2) and (Fig 2). The yield attributes are significantly influenced by genetic potential of the variety and also may be due to synchronized availability of essential plants nutrients to the crop especially NPK for a longer period during its growth & reproductive stages. Increased number of effective tillers $hill^{-1}$ may have helped in increasing the photosynthetic area for photosynthesis in plant. In several rice

cultivars, the effect on number of effective tillers production at all the growth stages was significant, the number increased till 77 DAT followed by a decline to harvest due to death of some undeveloped tillers, thus tillers development was found to be more in hybrid varieties apart from local variety reported by Akram *et al.,* 2007 [14]. The higher grains panicle^{-1} might be due to optimum utilization of the nutrient. The another reason of the high grains panicle^{-1} of variety is due to better growth attribute resulting to produce higher grains panicle^{-1} reported by Ranjitha *et al.,* 2013 [15]. According to Gulzar *et al.,* 2012 [16] demonstrated that grains panicle^{-1} of had maximum positive correlation coefficient with grain yield. According to Neelam *et al.,* 2009 [17] hybrid rice have longer panicles and more spikelets panicle^{-1} and thus in the study had significantly produced the longest panicle among the hybrid experiment. The favourable reason might be that hybrid rice produces long roots and broad leaves that enable them to take up more nutrients and produce more grains. (Hybrid KR-09), is due to favorable environmental condition at grain filling stage. Similar results have also been reported by Mahadevappa *et al*., 1996 [18].

Yield

Rice hybrids had a significant effect on the yield parameters. Significant and highest grain yield (8.51 t ha^{-1}), straw yield (16.30 t ha^{-1}) and test weight (32.33 g) was recorded in treatment T_9 (KR 09), while lowest grain yield (6.09 t ha^{-1}), straw yield (11.63 t ha^{-1}) and test weight (22.33 g) was recorded in treatment T_1 (KR 01). However treatment T_7, T_8 and T_{10} were statistically at par with treatment T_9 (KR 09). Similarly highest harvest index (58.52 %) was recorded in treatment T_5 (KR 05) and lowest harvest index (51.35 %) was recorded in treatment T_6 (KR 06) respectively (Table 3) and (Fig 3). This might be due to genetic ability of the plant attributed to higher biomass accumulation coupled with effective translocation and distribution of photosynthates from source to sink, which in turn resulted into elevated stature of yield attributes, which of course was due to favourable weather conditions such as rainfall distribution, evaporation and relative humidity prevailed during the crop growth period. Such varietal differences were also reported by Singh and Khan 2003 [11], Parihar *et al.,* 2005 [7] and Kalyani *et al*, 2012 [8]. Similar findings were reported by Ranjitha et al., 2013 [15], Rahman *et al.,* 2013 [19]. Hybrid KR-09 due to low mortality percent of tillers resulted increased grain ratio and total biological yield. Similar results have been also reported by Yadav *et al*., 2010 [20].

Economics

The highest gross return (201400 ₹ ha^{-1}), net return (133722 ₹ ha^{-1}) and B:C ratio (3.1) was observed in treatment T_9 (KR 01), while lowest gross return (124126 ₹ ha^{-1}), net return (56514 ₹ ha^{-1}) and B:C ratio (1.8) was observed in treatment T_1 However treatment T_7, T_8 and T_{10} were statistically at par with treatment T_9 (KR 09) respectively (Table 3) and (Fig 4).

Conclusion

In conclusion, from the data pertaining to the different treatments, it may be indicated that by using hybrid KR 09 (28S41) higher grain yield and monetary benefits can be realized over local cultivars. Hybrid KR 09 (28S41) was found to be the best for obtaining highest Seed yield, Stover yield, Gross return, Net return and benefit cost ratio. Since the findings are based on the research done in one season it may be repeated for conformation.

Table 1: Evaluation of Rice (*Oryza Sativa* L.) Hybrids on Growth Attributes viz, Plant height, Plant dry weight, Crop growth rate and Relative growth rate.

	Treatments : Hybrid	Plant height (cm)	Plant dry weight (g)	Crop growth rate (g m^{-2} day^{-1})	Relative growth rate (g g^{-1} day^{-1})
		80 DAT	80 DAT	40-60 DAT	40-60 DAT
T_1	KR 01 (Damini)	121.74	31.60	37.51	0.04
T_2	KR 02 (Indam7- 205)	134.68	31.87	41.16	0.05
T_3	KR 03 (LP1623)	126.37	31.67	46.26	0.06
T_4	KR 04 (LP 1632)	141.73	31.77	38.24	0.05
T_5	KR 05 (LP 1624)	133.79	36.70	37.17	0.03
T_6	KR 06 (27P36)	140.60	31.97	45.80	0.05
T_7	KR 07 (27P37)	139.59	38.47	54.57	0.06
T_8	KR 08 (28P67)	141.43	37.77	48.29	0.05
T_9	KR 09 (28S41)	142.31	41.87	52.78	0.05
T_{10}	KR 10 (28S50)	122.31	38.30	56.92	0.07
F-test		S	S	NS	NS
SEd(±)		5.61	2.28	7.83	0.01
CD (P=0.05)		11.78	4.79	--	--

Table 2: Evaluation of Rice (*Oryza Sativa* L.) Hybrids on Yield Attributes viz., Number of effective tillers hill^{-1}, Panicle length, Number of grains panicle^{-1}, Number of filled grains plant^{-1}.

	Treatments : Hybrid	Days to 50 % Flowering	Days to Maturity	No. of effective tillers hill^{-1}	Panicle length (cm)	No. of grains panicle^{-1}	No. of filled grains plant^{-1}
T_1	KR 01 (Damini)	62.00	97.00	6.92	20.65	42.11	99.13
T_2	KR 02 (Indam7- 205)	66.33	100.33	7.37	23.52	42.78	212.80
T_3	KR 03 (LP1623)	49.00	87.00	8.80	22.25	43.22	185.95
T_4	KR 04 (LP 1632)	62.33	96.33	8.20	21.72	45.78	215.87
T_5	KR 05 (LP 1624)	50.00	87.33	8.83	23.47	47.67	142.93
T_6	KR 06 (27P36)	67.33	100.33	11.37	27.75	47.87	199.40
T_7	KR 07 (27P37)	67.00	100.33	8.33	25.79	47.22	179.20
T_8	KR 08 (28P67)	74.33	103.67	7.60	24.91	49.78	174.60
T_9	KR 09 (28S41)	80.00	104.33	12.15	28.63	51.00	227.67
T_{10}	KR 10 (28S50)	76.67	103.67	10.16	21.24	49.56	159.33

F-test	S	S	S	S	S	S
SEd(±)	1.47	0.76	0.23	1.17	0.40	7.70
CD (P=0.05)	3.08	1.59	0.47	2.47	0.82	16.17

Table 3: Evaluation of Rice (*Oryza Sativa* L.) Hybrids on Grain yield, Straw yield, Test weight, Gross return, Net return and B: C ratio

	Treatments : Hybrid	**Grain yield (t ha^{-1})**	**Straw yield (t ha^{-1})**	**Test weight (g)**	**Harvest Index (%)**	**Gross return (₹ ha^{-1})**	**Net return (₹ ha^{-1})**	**B:C ratio**
T_1	KR 01 (Damini)	6.09	11.63	22.33	52.36	12,4126	56514.25	1.8
T_2	KR 02 (Indam7- 205)	6.20	12.03	26.67	51.53	14,8060	80448.25	2.1
T_3	KR 03 (LP1623)	7.81	14.03	25.00	55.66	18,4260	116648.25	2.7
T_4	KR 04 (LP 1632)	8.32	16.03	27.67	51.90	19,8460	130848.25	2.9
T_5	KR 05 (LP 1624)	6.83	11.67	25.67	58.52	15,9940	92328.25	2.3
T_6	KR 06 (27P36)	8.13	15.83	25.00	51.35	19,4260	126648.25	2.8
T_7	KR 07 (27P37)	8.03	15.43	28.67	52.04	19,1460	123848.25	2.8
T_8	KR 08 (28P67)	7.84	13.97	23.00	56.12	18,4740	117128.25	2.7
T_9	KR 09 (28S41)	8.51	16.30	32.33	52.20	20,1400	133722.25	3.1
T_{10}	KR 10 (28S50)	6.62	11.53	23.10	57.41	15,5460	87848.25	2.2
F-test		S	S	S	S	--	--	--
SEd(±)		0.16	0.76	1.23	0.40	--	--	--
CD (P=0.05)		0.33	1.59	2.59	0.81	--	--	--

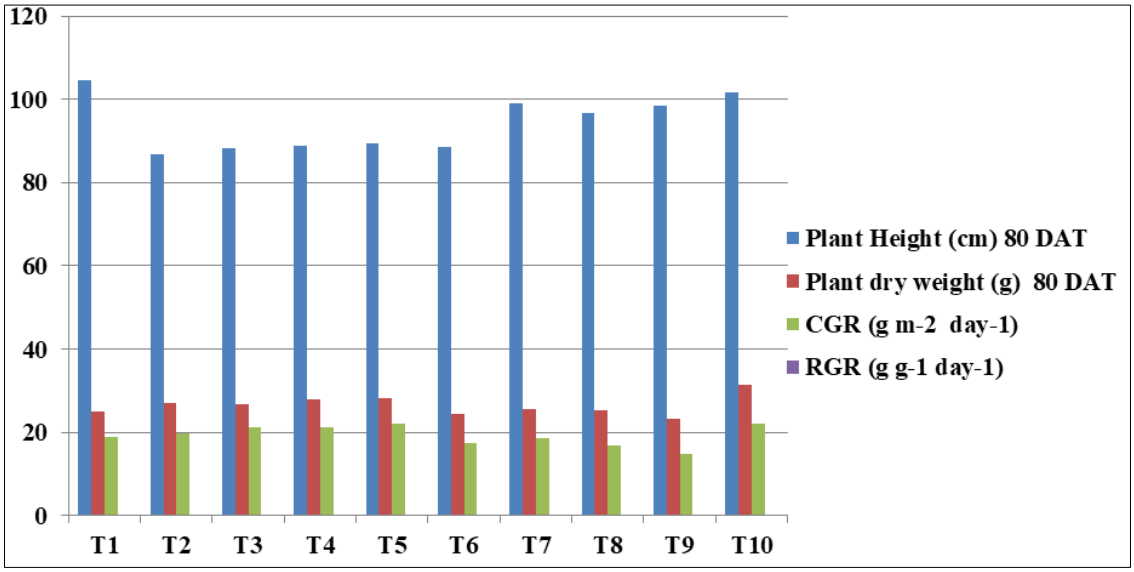

Fig 1: Evaluation of Rice (*Oryza Sativa* L.) Hybrids on Growth Attributes viz, Plant height (cm), Plant dry weight (g), Crop growth rate (g m^{-1} day^{-1}) and Relative growth rate (g g^{-1} day^{-1}).

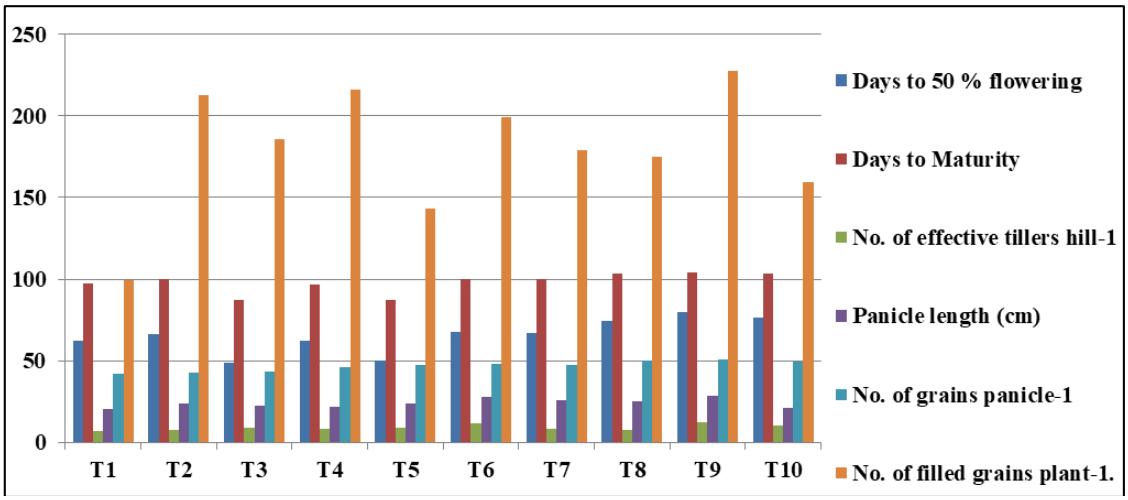

Fig 2: Evaluation of Rice (*Oryza Sativa* L.) Hybrids on Yield Attributes viz., Number of effective tillers hill^{-1}, Panicle length, Number of grains panicle^{-1}, Number of filled grains plant^{-1}.

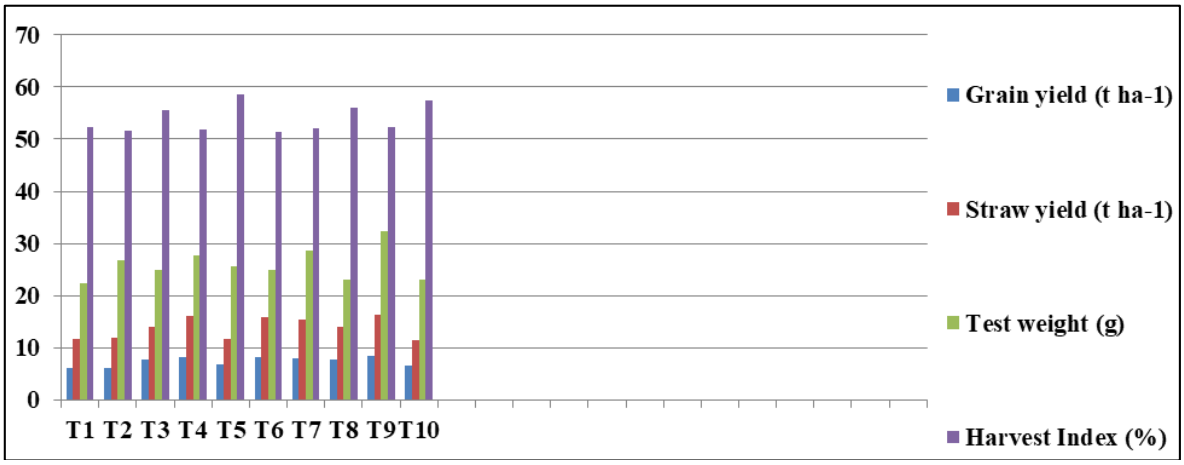

Fig 3: Evaluation of Rice (*Oryza Sativa* L.) Hybrids on Grain yield, Straw yield, Test weight and Harvest index.

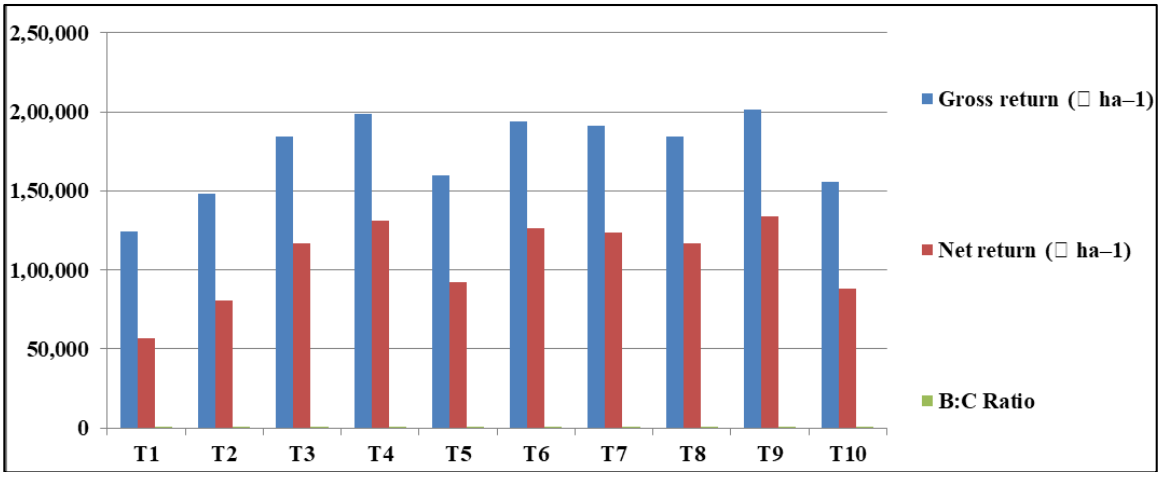

Fig 4: Evaluation of Rice (*Oryza Sativa* L.) Hybrids on Gross return, Net return and B: C ratio

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References

1. Anonymous. The Hindu Survey of Indian Agriculture, 2006, 50-54.
2. Anonymous. The Hindu Survey of Indian Agriculture, 2005, 41- 46.
3. GOI. Agricultural statistics at a glance: Ministry of Agriculture, Govt. of India, 2016.
4. Bouman BAM. How much water does rice use? Rice Today. 2009; 8(1):28-29.
5. Paramasivan KS, Rangaswamy SRS. Genetic analysis of yield and its components in rice. Oryza. 1988; 25:111-119.
6. Deshpande HH, Devasenapathy P. Effect of green manuring and organic manures on yield, quality and economics of rice (*Oryza sativa* L.) under lowland condition. Karnataka Journal of Agricultural Sciences. 2011; 23(2):235-238.
7. Parihar CM, Kaushik MK, Palsaniya DR. Effect of varieties, plant density and phosphorus levels on growth and yield of clusterbean (*Cyamopsis tetragonoloba* L.), Annals of Agril. Res. 2005; 26(1):5-7.
8. Kalyani D, Lakshmi. Performance of clusterbean (*Cymopsis tetragonoloba* L.) genotypes under varied time of sowing. Legume Res. 2012; 35(2):154-158.
9. Kumar Manoj, Patel HK, Patel CN, Umale AA, Patel JJ. Varietal response of summer clusterbean (*Cymopsis tetragonoloba* L.) to different irrigation scheduling (IW: CPE ratios) under middle Gujarat conditions, Eco. Env. & Cons, 2015, S159-S163.
10. PhilRice. Hybrid Rice. Q & A Series, *PhilRice Maligaya, Muñoz*, Nueva Ecija. 2002; 1:4-6.
11. Singh R, Khan MA. Response of clusterbean (*Cyamopsis tetragonoloba* L.) varieties to fertility levels and cropping systems under arid condition. Advances in arid legume research. 2003, 225-228.
12. Yadav Priyanka, Rangare NR, John Anurag P, Chaurasia AK. Quantitative analysis of rice (*Oryza sativa* L.) in Allahabad agro climate zone. Journal of Rice Research. 2004; 3:(1).
13. Haque MD, Elora Pervin, Romel Biswash MD. Identification of Potential Hybrid Rice Variety in Bangladesh by Evaluating the Yield Potential World Journal of Agricultural Sciences. 2015; 11(1):13-18.
14. Akram M, Rehman A, Ahmad M, Cheema AA. Evaluation of rice (*Oryza sativa* L.) hybrids for yield and yield components in three different environments. J Anim. Pl. Sci. 2007; 17:(3-4).
15. Ranjitha Sri, Kumar R, Mahender, Jayasree G. Evaluation of rice (*Oryza sativa* L.) varieties and hybrids in relation to different nutrient management practices for

yield, nutrient uptake and economics in SRI Annals of Biological Research. 2013; 4(10):25-28.
16. Gulzar S, Sanghera Subhash, Kashyap C. Genetic Parameters and Selection Indices in F3 Progenies of Hill Rice Genotypes. Not Sci Biol. 2012; 4(4):110-114.
17. Neelam Sandhyakishore, Ramesha MS, Dayakar Reddy T, Siva Sankar A. Study of heterosis by utilizing male sterility restoration system in rice (*Oryza sativa* L.) Journal of Rice Research. 2009; 2(2):93-98.
18. Mahadevappa M, Ratho SN, Vijaykumar R, Shenoy VV. Hybrid rice: a novel approach to augment rice production. Indian Farming. 1996; 46(9):12-15.
19. Rahman MM, Islam MT, Faruq AN, Akhtar N, Ora N, Uddin MM. Evaluation of Some Cultivated Hybrid Boro Rice Varieties Against BLB, ShB and ALS Diseases Under Natural Epiphytic Conditions Middle East Journal of Scientific Research. 2013; 15(1):146-151.
20. Yadav SK, Suresh BG, Pandey Praveen, Kumar Binod. Assessment of genetic variability, correlation and path association in rice (oryza sativa L.) Journal of bioscience. 2010; 18:1-8.