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Effect of different nutrient levels on yield and yield attributes of hybrid and inbred rice varieties

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ABSTRACT

The effect of fifteen combinations of fertilizer doses in two rice varieties (one hybrid and one inbred) were studied on the yield attributes and yield. Different yield attributing parameters such as number of panicle m^{-2} number of grains $panicle^{-1}$, 1000-grain weight, grain and straw yields were significantly higher in hybrid rice cultivar PSD-1 compared to inbred cultivar Saket-4. Hybrid rice cultivar PSD-1 recorded highest grain yield (5.5 t ha^{-1}) with treatment T_{13} ($N_{200}P_{34.4}K_{66.6}Zn_{10}kgha^{-1}$) while inbred cultivar Saket-4 recorded maximum yield with T_9 ($N_{150}P_{34.4}K_{66.6}Zn_{10}$ kg ha^{-1}).

Key words: *Yield attributes, Harvest index, nutrient management, cultivar, grain and straw yield*

Response of rice cultivar to different nutrient doses have been studied by various workers (Om *et al.,* 1998) Hybrid rice gave maximum yield with doses of $N_{150}P_{34.4}K_{27.2}Zn_5$ kg ha^{-1}. Bisth *et al.* (1999) also recorded the maximum yield with $N_{200}P_{34.4}K_{27.2}Zn_5$ kg ha^{-1} in the same climatic conditions, soil and variety (PSD-1) at Pantnagar. Therefore, the present investigation was carried out to study the effect of different doses of N, P, K and Zn application on yield attributes and yield of hybrid and inbred rice varieties to find out optimum doses suitable for getting maximum yield.

MATERIALS AND METHODS

The field experiment was carried out during wet seasons of 1998 and 1999 at crop research center, Pantnagar. The experiment comprised of two rice varieties (PSD-1 and Saket-4) in main plot and 15 treatment combinations of various levels of N, P, K and Zn in sub plot replicated thrice in split plot design (Table 1). The soil of the experimental field was silty clay in texture with pH 7.67, organic carbon 1.21 %, EC 1.29 dS/m, and available N 193.0, P 24.3 and K155.5 kg ha^{-1}. Thirty days old seedlings were transplanted at a spacing of 20 cm x 15cm, by keeping 2 seedlings $hill^{-1}$. At the last puddling, full dose of P and K with Zn @ 10 kg ha^{-1} were broadcasted uniformly and nitrogen was applied in three splits (25% basal, 50 % at active tillering and 25% at panicle initiation stage). The yield attributing parameters and yield of the crop were recorded after physiological maturity. The data were analyzed by standard procedure (Tandon. 1995)

RESULTS AND DISCUSSION

Based on the data (Table1) on yield attributing characters viz., number of panicles m^{-2}, number of grains $panicle^{-1}$ and 1000- grains weight were significantly higher in hybrid cultivar PSD-1 than in inbred cultivar Saket-4. When the doses of NPK increased with and without Zn, yield-attributing characters also increased accordingly. The data also revealed that the highest yield attributing characters were recorded with the treatment T_{13} (N_{200} $P_{34.4}K_{66.6}Zn_{10}$ kg ha^{-1}) among all the treatment combination. The result of this experiment

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Table1. Yields (grain and straw) and yield attributes of rice crop as influenced by varieties and fertility levels (pooled data)

Treatments	No of panicles m^{-2}	No of grains $panicle^{-1}$	1000 grain weight (g)	Grainyield (t ha^{-1})	Straw yield t ha^{-1}	Harves tindex
Main plot (Varieties)						
PSD-1	212	111	27.07	5.5	6.4	0.46
Saket-4	202	98	26.22	3.7	5.0	0.43
CD (P= 0.05)	9.85	3.46	0.27	2.67	3.95	NS
Sub plot (Nutrients levels (kg ha^{-1})						
T1-(N_o P_o K_o Zn_o)	181	91	24.41	3.1	4.1	0.43
T2-($N_{100}P_{17.2}K_{33.3}Zn_0$)	187	99	25.91	3.9	4.8	0.44
T3-($N_{100}P_{17.2}K_{33.3}Zn_{10}$)	199	102	25.92	4.0	4.9	0.44
T4-($N_{100}P_{34.4}K_{66.6}Zn_0$)	203	101	26.36	4.2	5.1	0.45
T5-($N_{100}P_{34.4}K_{66.6}Zn_{10}$)	205	104	26.53	4.3	5.2	0.45
T6-($N_{150}P_{17.2}K_{33.3}Zn_0$)	206	103	26.72	4.5	5.5	0.45
T7-($N_{150}P_{17.2}K_{33.3}Zn_{10}$)	210	106	26.93	4.6	5.6	0.45
T8-($N_{150}P_{34.4}K_{66.6}Zn_0$)	210	107	27.0	4.8	5.8	0.44
T9-($N_{150}P_{34.4}K_{66.6}Zn_{10}$)	212	108	27.18	5.1	5.9	0.45
T10-($N_{200}P_{17.2}K_{33.3}Zn_0$)	211	109	27.05	5.3	6.3	0.45
T11-($N_{200}P_{17.2}K_{33.3}Zn_{10}$)	213	109	27.23	5.4	6.4	0.45
T12-($N_{200}P_{34.4}K_{66.6}Zn_0$)	215	110	27.32	5.4	6.5	0.44
T13-($N_{200}P_{34.4}K_{66.6}Zn_{10}$)	219	112	27.41	5.5	6.6	0.44
T14-($N_{250}P_{17.2}K_{33.3}Zn_0$)	213	104	26.86	5.0	6.6	0.43
T15-($N_{250}P_{17.2}K_{33.3}Zn_{10}$)	215	106	26.83	5.1	6.7	0.43
CD (P= 0.05)	6.33	4.15	1.07	4.98	2.72	0.001

was supported with the findings of Om *et al.* (1999) and Singh *et al.* (1998).

The hybrid cultivar PSD-1 performed better than the inbred cultivar Saket-4. Significantly higher grain (5.5 t ha^{-1}) and straw yields (6.4 t ha^{-1}) were recorded with hybrid variety PSD-1 in comparison to inbred variety Saket-4 (3.7 t ha^{-1} grain yield and 5.0 t ha^{-1} straw yield). Hybrid variety (PSD-1) gave 47.8% more grain yield and 28.2% more straw yield then inbred variety (Saket-4) (Table 2). The higher grain yield of hybrid rice might be due to more vigor and extensive root system and increased growth during vegetative growth (Yang and Sun, 1998) and more efficient sink formation and greater sink size (Kabaki, 1993).

Among the various fertility levels data revealed (Table1) that, the maximum grain (5.5 t ha^{-1}) and straw yield (6.6 t ha^{-1}) were recorded with treatment T_{13}.The grain yield of T_{13} was at par with T_{11}, T_{12} and T_{15} while, straw yield was at par with T_{11},T_{12}, T_{13} and T_{14} treatments level. Results of this experiment also supported the findings of Singh *et al.* (1998). Hybrid

Table2. Grain and straw yields (t ha^{-1}) as influenced by the interaction effect varieties and fertility (pooled data)

Varieties vs nutrients level	Grain		Straw	
Treatment (kg ha^{-1})	PSD-1	Saket-4	PSD-1	Saket-4
T1-(N_o P_o K_o Zn_o)	3.59	2.56	4.45	3.63
T2-($N_{100}P_{17.2}K_{33.3}Zn_0$)	4.48	3.43	5.05	4.59
T3-($N_{100}P_{17.2}K_{33.3}Zn_{10}$)	4.49	3.53	5.15	4.73
T4-($N_{100}P_{34.4}K_{66.6}Zn_0$)	4.72	3.75	5.45	4.82
T5-($N_{100}P_{34.4}K_{66.6}Zn_{10}$)	4.77	3.86	5.55	4.83
T6-($N_{150}P_{17.2}K_{33.3}Zn_0$)	5.9	3.93	6.0	5.02
T7-($N_{150}P_{17.2}K_{33.3}Zn_{10}$)	5.27	4.9	6.25	5.13
T8-($N_{150}P_{34.4}K_{66.6}Zn_0$)	5.65	4.0	6.47	5.22
T9-($N_{150}P_{34.4}K_{66.6}Zn_{10}$)	5.9	4.18	6.65	5.30
T10-($N_{200}P_{17.2}K_{33.3}Zn_0$)	6.6	3.97	7.2	5.45
T11-($N_{200}P_{17.2}K_{33.3}Zn_{10}$)	6.7	4.16	7.35	5.52
T12-($N_{200}P_{34.4}K_{66.6}Zn_0$)	6.88	38.2	7.55	5.53
T13-($N_{200}P_{34.4}K_{66.6}Zn_{10}$)	7.9	3.97	7.65	5.54
T14-($N_{250}P_{17.2}K_{33.3}Zn_0$)	6.3	3.75	7.75	5.53
T15-($N_{250}P_{17.2}K_{33.3}Zn_{10}$)	6.8	3.88	7.75	5.61
CD (P= 0.05)	3.28	3.42	3.19	3.95

cultivar PSD-1 was recorded higher harvest index (0.46) than inbred cultivar Saket-4 (0.43). Bisth *et al. (*1999) also reported similar harvest index with dose of $N_{175}+P_{64}+K_{33}$ kg ha^{-1} +0.5% zinc spray with same variety (PSD-1).

The interaction between variety and fertility treatments was statistically significant in grain and straw yield. Hybrid cultivar PSD-1 recorded maximum grain yield of 7.0 t ha^{-1} with the treatment T_{13}, which was at par with T_{11} and T_{12} while, inbred cultivar Saket-4 recorded highest grain yield of 4.1 t ha^{-1} with the treatment T_9, which was at par with all treatment levels except treatments T_1,T_2,T_3 and T_4. Hybrid variety recorded higher yield at all levels of fertility treatments than inbred variety. Thus hybrid rice is more responsive to higher fertility level as compared to inbred variety. The highest straw yield of 7.7 t ha^{-1} by the hybrid rice cultivar PSD-1 and (5.6 t ha^{-1}) by the inbred rice (cultivar Saket-4) was recorded with the treatment T_{15} (N_{250} $P_{17.2}K_{33.3}Zn_{10}$ kg ha^{-1}). The straw yield of hybrid rice cultivar PSD-1 was at par with T_{12}, T_{13} andT_{14} while, inbred rice cultivar Saket-4 was recorded straw yield at par with T_9,T_{10},T_{11}, T_{13} and T_{14} treatments level.

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