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Effect of different varieties of rice cultivation under various fertility levels on yield and economics of late transplanted rice

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Abstract
The field experiment was conducted at Research Farm, Department of Agronomy, JNKVV, College of Agriculture, Rewa (M.P.) during *Kharif* season of 2018 to study economics of transplanted rice as influenced by different varieties of rice cultivation under various nitrogen levels. The experiment was laid out in split-plot design with three replications. Three nitrogen levels (N_1, 80 kg/ha; N_2, 100 kg/ha; N_3, 120 kg/ha) and six rice cultivars (V_1 - Kalanamak, V_2 - IR-64, V_3 - Chittimuthyalu, V_4 - BPT5204, V_5-IET-26375 and V_6 - IET-26383). Among the rice cultivar the V_5 - IET-26375 performed significance superior over rest of varies at all levels of nitrogen. Results revealed that application of nitrogen @ 120 kg/ha recorded significantly higher grain yield (46.92 q/ha) as compared to N_2 (100 kg/ha) (46.42 q/ha) and N_3 (80 kg/ha) (43.46 q/ha). Rice variety V_5 - IET-26375 showed significant superiority over other varieties under all the three nitrogen levels (80, 100 and 120 kg/ha) in terms of grain yield, NMR and B: C ratio. The net monetary returns and B: C ratio were found to be the maximum (Rs. 54909 ha^{-1} and 2.81, respectively) under IET-26375 variety of rice.

Keywords: Rice cultivation, various fertility levels, yield, economics, late transplanted rice

Introduction
Rice (*Oryza sativa* L.) plant belong to the family of Poaceae (Gmamineae). It is the most important staple food in Asia, providing average 32% of total calorie uptake (Singh *et al.*, 2019a and Singh *et al.*, 2019b) [8, 7]. Worldwide, rice is grown on 167 mha, with an annual production of about 769.65 million tonnes of paddy (FAO, 2017) [3]. India accounts for 22.3% of the worlds production of rice. India is the 2nd largest producer and consumer of rice in the world. In India, rice occupies 43.19 mha with a production of 109.70 MT and productivity of 2550 kg/ha, (Anonymous 2017) [1].
Continuous cultivation of rice for longer periods and often under poor soil and crop management practices, results in the loss of soil fertility as indicated by the emergence of multi nutrient deficiencies (Dwivedi *et al.*, 2001) [2] and deterioration of soil physical properties. Balanced fertilization right from the very beginning of crop growth is utmost essential to achieve better harvest of crop (Singh and Namdeo, 2004) [6].

Materials and Methods
The experiment was conducted at Research Farm, Department of Agronomy, JNKVV, College of Agriculture, Rewa (M.P.) during *Kharif* season 2018. It was the part of an approved research programme launched under "All India Coordinated Rice Improvement Project" at Rewa centre. The climate is sub-humid, sub-tropical and featured by hot dry summer and cool dry winter. The materials used and the techniques adopted for the studies were considered as the most important ones. The field experiment treatments comprising three levels of nitrogen (N_1, 80 kg/ha; N_2, 100 kg/ha; N_3, 120 kg/ha) and six rice cultivars (V_1 - Kalanamak, V_2 - IR-64, V_3 - Chittimuthyalu, V_4 - BPT5204, V_5 - IET-26375 and V_6 - IET-26383) sub-plot layout in split-plot design, replicated three times.

Results and Discussion
Effect of nitrogen levels, varieties and their interactions on grain and straw yield of rice
The different N levels and varieties exerted significant impact upon the grain and straw yield, however their interactions were found to be non-significant (Table 1). The increasing levels of nitrogen upto N120 was found in significant increase in grain yield.

Accordingly, the maximum grain and straw yield were (45.60 and 65.78 q/ha, respectively) in N_{120} followed by N_{100}. On the other hand, significantly lowest grain and straw yield (17.70 and 38.56 q/ha, respectively) were found in the lowest level of nitrogen (N_{80}). The variety IET-26375 recorded significantly higher grain and straw yield (45.60 and 65.78 q/ha, respectively) followed by BPT-5204 (39.44 and 60.41 q/ha, respectively). Chittimuthyalu was recorded as the significantly lowest grain and straw producer (17.70 and 38.56 q/ha, respectively). IET-26383 was the third best variety in productivity. The treatment interactions were found to be non-significant, however IET-26375 + N120 produced the maximum grain (46.92 q/ha). The minimum grain yield (16.27 q/ha). These results are is close conformity to the finding of Reddy *et al.*, (2011) [5]. Girdhari *et al.*, (2020) [4] reported that the Kranti variety of rice produce maximum yield in case of 15 June sowing.

Table 1: Mean grain and straw yield of transplanted rice as influenced by nitrogen levels, varieties and their interactions

Treatment	Grain yield (q ha^{-1})				Straw yield (q ha^{-1})			
	N_1	N_2	N_3	Mean	N_1	N_2	N_3	Mean
Kalanamak	19.49	21.03	22.83	21.11	39.75	40.60	41.87	40.74
IR-64	21.75	23.44	24.77	23.32	41.98	43.44	46.26	43.89
Chittimuthyalu	16.27	17.72	19.11	17.70	37.03	38.18	40.47	38.56
BPT5204	38.26	39.48	40.59	39.44	59.33	60.67	61.24	60.41
IET26375	43.46	46.42	46.92	45.60	64.24	65.39	67.73	65.78
IET26383	24.41	25.50	26.60	25.50	44.36	46.04	46.87	45.76
Mean	27.27	28.93	30.14	-	47.78	49.05	50.74	-
	N	V	NxV	VxN	N	V	NxV	VxN
SEm±	0.30	0.17	0.41	0.41	0.31	0.35	0.64	0.64
CD(P=0.05)	1.23	0.50	NS	NS	1.29	1.02	NS	NS

N_1, N_2 and N_3 – 80, 100 and 120 kg/ha nitrogen levels

Economics of the treatments

The economic indices calculated for various treatment have been given Table 2. The minimum cost of cultivation (Rs. 29761 ha^{-1}) was incurred for Chittimuthyalu the varieties fertilized with 80 kg N/ha and it was increased correspondingly with the increment in nitrogen levels being the highest (Rs. 30885 ha^{-1}) under the varieties IET-26375 when fertilized with 120 kg N/ha. And variety IET-26375 found with 120 kg N/ha accursed the highest net monetary returns and B:C ratio (Rs. 86537 ha^{-1} and 2.81, respectively) whereas the minimum net monetary returns and B:C ratio (Rs. 31362 ha^{-1} and 1.11, respectively) was under variety Chittimuthyalu fertilized with 80 kg N/ha. Late sowing adversely influenced the yield and there by net monetary returns. These results are in accordance to the findings of Girdhari *et al.*, (2020) [4] who reported that net monetary returns and benefit cost ratio were also higher in case of 15 June sowing with Kranti variety.

Table 2: Mean data of cost of cultivation, gross monetary returns, net monetary returns and B:C ratio of transplanted rice as influenced by nitrogen levels and varieties

Treatment	COC (Rs. ha^{-1})	GMR (Rs. ha^{-1})	NMR (Rs. ha^{-1})	B:C ratio
Nitrogen level (kg ha^{-1})				
N_1	29761.00	51709.50	16172.00	1.73
N_1	30323.00	54083.00	17633.00	1.78
N_1	30885.00	56306.33	19022.00	1.82
Varieties				
Kalanamak	30323.00	39961.00	9638.00	1.31
IR-64	30323.00	44033.33	47946.00	1.45
Chittimuthyalu	30323.00	33946.00	3623.00	1.11
BPT5204	30323.00	73109.00	42772.00	2.40
IET26375	30323.00	85232.00	54909.00	2.81
IET26383	30323.00	47932.00	17609.00	1.58

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