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Performance of direct seeded rice varieties at different levels of nitrogen in Rewa region of Madhya Pradesh

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Abstract
A experiment entitled "Performance of rice varieties at different levels of nitrogen under direct seeded upland condition" was conducted during rainy season of 2017 at the JNKVV college of agriculture instruction farm, Rewa (M.P.). Objective of this experiment was to find out Performance of rice varieties at different levels of nitrogen under direct seeded upland condition. The experiment was laid out in a split plot design with four replications. The treatments comprised twelve varieties IET-24797(V_1), Gotra Bidhan (V_2), PR 124(V_3), juit (V_4), Sahbhag (V_5), PS-5 (V_6), DRR Dhan 43 (V_7), PS-3 (V_8), JR-767(v_9), JR -81 (v_{10}), US 314 (v_{11}) and IR -64(v_{12}) and three nitrogen levels (50, 100 and 150% RDF i.e. N_{50}, N_{100} and N_{150}). The experiment were sown on 03 July, 2017 keeping a seed rate of 50 kg/ha and row spacing 30 cm and plant spacing 10 cm. the fertilizers were applied as per treatment. Among the variety IR-64 gave higher values of most of the growth and yield component characters and resulted in significantly highest grain yield (45.61 q/ha) and net income Rs. 57237/ha. Application of 150 kg N/ha produced highest growth characters: yield attributing traits and grain yield (37.70 q/ha) and net income (Rs. 46065/ha). The combination of variety IR-64 and 150 kg N/ha was found the best in respect of most of the growth and yield attributing characters along with grain yield (53.91 q/ha) followed by US-314 sown with 150 kg N/ha (47.90 q/ha). The economics of treatment 150 kg N/ha and variety IR-64 was also found the most net income Rs 77184/ha and B: C ratio 4.12.

Keywords: Rice, direct seeded RDF and economics

Introduction
Rice (O*ryza sativa* L.) is the central to the lives of billions of people around the world. Possibly the oldest domesticated grain (10,000 years), rice is the staple food for 2.5 billion people and growing rice is the largest single use of land for producing food, and rice covers 42% of total cropped area. Rice provides 21% of global human per capita energy and 15% of per capita protein. In India, rice is cultivated in an area of 43.3 million hectares with the production of 104.32 million tones and average productivity of 2404 kg/hectare 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 (Anonymous 2017) [1]. Madhya Pradesh contributes 1.76 million hectares area under rice with an annual production of 1.8 million tones and productivity is 1188 kg/hectare (Anonymous 2014) [2]. In Rewa region rice occupies an area of 135.80 thousand hectare with the production of 367.34 thousand tones and productivity is 2705 kg/ha (FW & ADD 2014) [5]. Nitrogen is the most essential element in determining the yield potential of rice and nitrogenous fertilizer is one of the major inputs to rice production. Many workers have reported a significant response of rice to nitrogen in different soils (Bhuiyan *et al.*, 2008) [3]. Many workers found that there was a significant increase in grain, straw and biological yield of rice variety with higher dose of N/ha. (Lar *et al.*, 2007) [6]. Almost every farmer has tendency to apply costly N fertilizer in excess to get a desirable yield of Aman rice (Saleque *et al.*, 2004) [8], but imbalance use of N fertilizer causes harm to the crop and decreases grain yield. Grain and straw yield of rice increased significantly with increase in the dose of fertilizer nitrogen, (Pal *et al.* 2005) [7]. The N uptake by grain and straw and also total uptake increased significantly with increasing levels of N owing to production of higher amount of biomass. (Dwivedi and Thakur, 2000) [4].

Material and Methods
The experiment was conducted at JNKVV, Agriculture College Farm, Rewa (M.P.) during *Kharif* season, 2017. It was the part of an approved research programme launched under "All India Coordinated Rice Improvement Project" at Rewa centre. The field was well leveled or bounded from all sides.

The soil of the experimental field was sandy having pH 7.17, available N_1 P_2 O_5 and K_2O 238, 18.8 and 357kg/ha, respectively. The electrical conductivity was 0.31 d s/m and organic carbon 0.67%. The experiment was laid out in a split plot design with four replications. The treatments comprised twelve varieties IET-24797 (V_1), Gotra Bidhan (V_2), PR 124 (V_3), juit (V_4), Sahbhag (V_5), PS-5 (V_6), DRR Dhan 43 (V_7), PS-3 (V_8), JR-767(v_9), JR -81 (v_{10}), US 314 (v_{11}) and IR - 64(v_{12}) and three nitrogen levels (50, 100 and 150% RDF i.e. N_{50}, N_{100} and N_{150}). Thus the 144 treatment combinations were formed in one replication. Crop was grown totally under rainfed condition. Total rainfall during the crop season was 689.2 mm with rainy days Experiment were sown on 03 July, 2017 keeping a seed rate of 50 kg/ha and row spacing 30 cm and plant spacing 10 cm. Fertilizers were applied as per treatment. Each of the nitrogen levels were applied through urea containing 46% N, in three split doses i.e. 50% as basal, 25% at tillering and 25% at panicle initiation stages as second and third top dressing, respectively. An uniform dose of 40 kg P_2O_5/ha through Single Super Phosphate (16% P_2O_5) and 20 kg K_2O/ha through murate of Potash (60% K_2O) was applied as basal in all the plots. Crop was harvested on 25 November, 2017. Various observations were recorded periodically in relation to growth and yield attributing characters and finally, economics of the treatments was calculated.

Results and Discussion

Phonological characters

Days to 50% panicle emergence were the change in different varieties (74.92 to 82.50 days). Consequently, the different varieties of rice attained the days to maturity in the different duration i.e. within 101.50 to 105.67 days. However, Gotra Bidhan-3 that recorded panicle emergence earlier in 74.92 days reached up to days to maturity not too late in 101.50 days than those in other varieties. In terms of crop maturity, the data is quite irrelevant from the fundamental truth, therefore not conclusive. The varieties N_{100} fertilizers mature from 103.54 to 104 days with full dose N_{50}. Thus, the duration of the crop maturity was almost differing whether the crop was higher fertilized or lower fertilized with N levels. Application of these three nitrogen levels, 50% RDF (N_{50}) took significantly less period to reach into panicle emergence and days to maturity over 150% RDF (N_{150}).

Yield attributing characters

Yield attributing characters viz. number of panicles/m^2, number of sound grains/panicle, length of panicle, weight of grains/panicle and test weight were found to deviate up to significant extent due to different varieties and nitrogen levels. Out of twelve varieties, IR-64 brought about significantly and higher number of panicles 466.33/m^2 over all the remaining varieties. However, the other yield attributing characters were in the highest range case of US-314 and IR-64 varieties (103.08 to 100.78 sound grains/panicle, 23.93 cm panicle length in case of DDR Dhan-43, 2.13 g grains weight/panicle and 23.10 g 1000-grain weight in case of PR-124). In case of Gotra Bidhan-3 the grains/panicle, panicle length in case of Juit and grains weight/panicle in PR-124, PS-3 were in the lowest range whereas 1000 grains weight was in the lowest level (21.045g). The highest nitrogen level (N_{150}) resulted in significantly higher above mentioned yield attributes over the lower nitrogen levels (N_{50} and N_{100}). The number of panicles was 382.21/m^2 grains/panicle were 99.33, panicle length 22.26 cm, grains weight/panicle 1.94 g and 1000 grains weight 22.88 g due to highest nitrogen level.

Productivity parameters

The data reveal that the grain and straw yields were secured maximum from IR-64 variety i.e. 45.61 And 100.34 q/ha, respectively. However, the harvest index was in the higher range (31.85%) in case of Juit variety. The second best variety was US-314 producing 43.58 q/ha grain an lower 93.72 q/ha straw with 31.81% harvest index. PR-124 was found lowest producer of grain and straw i.e. 28.17 and 66.26 q/ha in case of Juit, respectively. The higher productivity in case of IR-64 and US-314 might be owing to increased number of panicles per meter square, the main yield attributing character.

The highest nitrogen level (N_{150}) proved significantly superior to the lower nitrogen levels with respect to grain and straw yields of rice. The highest nitrogen level (N_{150}) resulted in highest grain and straw yield i.e. 37.70 and 85.78 q/ha, respectively, being higher by 33.15 and 77.01 q/ha, respectively over N_{50}.

Economical gain

Out of twelve varieties of rice under study, IR-64 took a lead with respect to economical gain. The maximum net income from this variety was up to Rs. 61247/ha with B:C ratio 3.54. The second best variety was US-314 giving net income up to Rs. 57237/ha with B: C ratio 3.38. The lowest net income (Rs. 29207/ha) and B: C ratio (2.21) were obtained from IET-24767 and PR-124 variety. This was eventually as the net income is directly positively correlated with the grain and straw yields per hectare from those varieties.

Under maximum nitrogen level (N_{150}), the net income was also highest up to Rs. 46065/ha with B: C ratio 2.86. It was higher by Rs. 39025 and Rs. 42848/ha over N_{50} and N_{150}, respectively. This was owing to highest grain and straw yields from N_{150} nitrogen level which hiked higher market value. The economical gain was further aggravated when IR-64 and US-314 was grown with N_{150} nitrogen level. The maximum net income was up to Rs. 77184 and 65275/ha and B:C ratio 4.12 and 3.64, respectively.

Table 1: Phonological characters, yield attributing characters and economics of rice at different intervals as influenced by varieties, nitrogen levels and their interaction

Treatments	Leaf length (cm)		Number of panicle/m^2	Number of sound grain/panicle	Number of chaffy grain/panicle	Panicle length (cm)	Weight of grain/ panicle	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)	Net return Rs/ha	B:C ratio
	50% panicle emergence	Day to maturity											
Nitrogen level													
50% RDF of Nitrogen	78.92	104.00	351.77	92.98	19.22	22.26	1.81	21.94	30.20	69.6	29.93	39025	2.67
100% RDF of Nitrogen	77.77	103.54	369.77	94.45	18.84	22.53	1.92	22.05	35.48	76.50	31.52	42848	2.78
150% RDF of Nitrogen	77.42	103.98	382.21	99.33	15.60	22.26	1.94	22.88	41.21	97.93	30.78	46065	2.86
S.Em+	0.33	0.28	4.19	0.62	0.26	0.19	0.357	0.27	1.64	0.51	0.38		
C.D. @ 5%	0.94	NS	11.84	1.74	0.75	NS	NS	0.77	4.69	1.43	1.07		
Varieties													
IET-24797	80.75	104.92	312.83	92.28	18.83	21.20	1.62	22.55	28.91	79.28	29.70	30480	2.28
Gotra Bidhan-3	74.92	101.50	272.08	90.63	18.42	22.88	1.89	21.69	29.68	66.78	30.07	29952	2.24

PR 124	76.83	103.75	329.00	92.93	18.47	23.58	1.72	23.10	28.17	67.64	29.29	29207	2.21
Juit	82.50	107.42	308.58	92.57	18.73	23.70	1.69	21.57	30.39	66.26	31.85	33831	2.40
Sahbhagi	77.75	103.67	349.92	94.57	18.53	20.13	1.84	22.55	33.27	77.75	30.76	36853	2.54
PS-5	75.58	102.33	373.25	90.03	18.50	22.20	1.86	22.10	34.10	77.69	31.39	39942	2.66
DDR Dhan 43	76.17	102.50	364.17	96.57	18.47	23.93	1.86	22.92	34.14	77.75	30.57	40069	2.66
PS-3	80.50	105.67	368.33	93.40	17.70	22.28	1.89	21.04	36.61	80.77	31.18	44446	2.84
JR-767	77.08	103.33	410.33	100.47	18.46	20.00	1.99	22.59	42.49	95.39	30.20	55060	3.30
JR-81	76.75	102.17	459.67	99.73	16.38	21.75	2.07	22.30	40.58	92.75	30.61	53428	3.22
US-314	76.83	103.50	400.50	103.08	15.80	23.47	2.13	22.87	43.58	93.72	31.81	57237	3.38
IR-64	80.75	105.33	466.33	100.78	16.37	23.08	2.12	22.21	45.61	100.34	31.49	61247	3.54
S.Em+	0.44	0.532	8.66	1.23	0.51	0.57	0.357	0.27	1.02	0.98	0.59		
C.D. @ 5%	1.28	1.539	25.01	3.56	1.48	1.66	NS	0.77	2.96	2.84	NS		

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