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Effect of planting dates and N levels on grain yield and N uptake by hybrid rice

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ABSTRACT

An experiment was conducted to find out grain yield and nitrogen uptake by hybrid rice under different planting dates and N levels during 2007 and 2008. The hybrid rice planted on July 1 or July 15 produced significantly higher grain yield and N uptake by both grain and straw. The delayed planting between August 1 and August 16 significantly reduced these crop parameters. The reduction of grain yield was to the extent of 21.1% and 36.4%, respectively compared with planting on July 1. Number of effective tillers, grains panicle^{-1}, test weight, grain yield, N concentration and uptake by grain and straw increased significantly with increasing levels of N from 60 to 120Kg N ha^{-1}.

Key words: *planting date, N level, N concentration, grain yield, N uptake, hybrid rice*

The yield improvement associated with hybrid rice necessitates for development of appropriate cultural management practices to achieve the potential yield. Production of hybrid rice can be increased by scheduling the planting date according to weather conditions. Studies carried out by Om *et al.* (1999) showed significant difference in grain yield of rice due to change in planting dates only. Higher yield also can be attained if N supply is maintained by planting the crop in appropriate time and maintaining favorable N supply in soil system. Efficiency of N in hybrid rice is greater than conventional rice, but to make soil environment favorable for N absorption by plant, sufficient amount has to be supplied in soil system. Therefore, an experiment was undertaken to study the effect of planting date and N levels on N concentration, yield and N uptake of hybrid rice.

The field experiment was conducted during wet season of 2007 and 2008 at Bhanjanagar, Odisha. The soil characteristics of the experimental field consisted of sand 76%, silt 11%, clay 13% with sandy loam texture, pH 6.61, EC 0.06 dsm^{-1}, organic C 5.05g kg^{-1}, available N 197 Kg ha^{-1}, available P 22 kg ha^{-1} and available K 246 kg ha^{-1}. In all, 12 treatment combinations consisted of 4 planting date and 3 nitrogen levels were laid out in split plot design with 3 replications having planting dates as main and N levels as sub-plot treatments. The 4 planting dates were July 1, July 15, August 1 and August 16 and 3 N levels were 60, 90 and 120 Kg ha^{-1}. A uniform dose of 60 Kg P_2O_5 and 60 Kg K_2O ha^{-1} was supplied to the crop. Twenty five % N, whole amount of P and 50% of K was given as basal while 25% N was supplied at tillering stage and rest 25% N and 50% K was applied at panicle initiation stage. Twenty-one days old seedlings of rice hybrid Rajalaxmi were planted at the spacing of 20cm x 15cm and appropriate water, and plant protection management measures were taken to raise a good crop. Nitrogen concentration of grain and straw and soil available nitrogen at harvest was analyzed.

Planting of hybrid rice on July 1 and July 15 being at par produced significantly higher grain yield than that of delayed planting on August 1 and 16 (Table 1). Hybrid rice planted on August 16 reduced the grain yield by 36.4% (based on pooled mean) compared with that planted on July 1. The reduction in grain yield due to planting on August 1 was to the extent of 21.1%. The grain yield increased in early planting positively due to favorable environmental

Table 1. Effect of planting dates and nitrogen levels on yield components and grain yield of hybrid rice(pooled data of 2007 and 2008)

Treatments	Effective tillers m^{-2} (No)	Filled grains ear $head^{-1}$ (No)	1000 grain weight (g)	Sterility (%)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Harvest index
Planting dates							
1st July	242	139	25.96	26.22	6.44	8.02	0.45
15th July	237	136	25.75	26.93	6.06	7.88	0.43
1st August	231	127	25.61	29.21	5.31	7.62	0.41
16th August	223	119	25.55	30.35	4.72	7.35	0.39
CD (P<0.05)	5.20	3.85	NS	3.26	0.38	0.12	0.01
N levels (Kg ha^{-1})							
60	221	127	25.35	26.86	5.20	7.43	0.41
90	246	133	25.65	27.35	6.09	7.78	0.44
120	261	142	26.98	32.54	6.74	8.24	0.45
CD (P<0.05)	4.25	4.47	0.24	3.76	0.34	0.22	0.02

conditions such as temperature and relative humidity during its different phenophases compared to late planting as described by Verma *et al.* (2008). The reduced yield at planting on August 1 and 16 was mainly associated with the significant reduction in effective tillers, numbers of filled grains and test weight. The sterility percentage also increased under planting of hybrid rice on August 1 and 16 as compared to earlier plantings. The results are in agreement with the findings of Lakpale *et al.* (1995) and Pandey *et al.* (2008). The harvest index of hybrid rice significantly reduced at planting on August 1 and 16 as compared to planting on July 1 or 15.

Delayed planting between August 1 and 16 significantly reduced N concentration and uptake by grain and straw (Table 2). The planting of hybrid rice on July 1 or 15 found to be equally effective for N concentration and uptake in grain and straw due to increased concentration and dry matter production as also reported by Pandey *et al* (2008). The N status in soil at harvest significantly increased while planting of hybrid rice on August 16 as compared to earlier planting due to reduced uptake on N from the soil.

Number of effective tillers, number of filled grains and test weight were significantly increased with increase in levels of N from 60 to 120Kg N ha^{-1} (Table 1). The increase in above yield components due to application of 120Kg N ha^{-1} significantly increased the grain yield of hybrid rice. The intensity and capacity of the soil to supply nitrogen to hybrid rice was met by

Table 2. Effect of planting dates and nitrogen levels on N concentration and uptake by grain and straw of hybrid rice

Treatments	Grain N conc. (%)	Straw N conc. (%)	Grain N uptake	straw N uptake	Total N uptake	Soil available N at harvest
Planting dates						
1st July	1.42	0.37	91.49	29.69	121.18	203
15th July	1.41	0.35	85.52	27.59	113.11	206
1st August	1.35	0.31	71.81	23.65	95.46	210
16th August	1.33	0.28	62.80	20.58	83.38	222
CD (P<0.05)	0.05	0.03	8.42	2.35	8.60	4.25
N levels (Kg ha^{-1})						
60	1.33	0.27	69.21	20.06	89.27	201
90	1.38	0.32	84.14	24.90	109.04	214
120	1.44	0.37	97.14	30.51	127.65	226
CD (P<0.05)	0.04	0.04	5.86	3.12	7.95	3.98

application of 120Kg N ha^{-1} thus increased yield components and grain yield. The application of 60Kg N ha^{-1} produced the lowest sterility percentage which was significantly lower than that of highest level of N application. The increase in yield attributes and grain yield due to N fertilization has also reported by Pandey *et al*. (1992) and Pandey *et al* (2008). The N concentration and uptake by both grain and straw increased significantly with increase levels of N from 60 to 120Kg ha^{-1} (Table 2). The N status in soil also increased significantly due to application on Nitrogen up to 120 Kg ha^{-1} as also reported by Pandey *et al.* (1992).

Thus, planting of hybrid rice between July 1 and 15 along with 120Kg N maintained sufficient N concentration in grain and straw as well as increased grain and straw yield during wet season.

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