

## Performance of hybrid rice cultures under different levels of nitrogen in combination with growth regulators

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**Abstract:** Field experiments were carried out during the North East Monsoon season of 1995-96 and 1996-97 with the objectives of studying the performance of newly developed rice hybrid in response to nutrient management practices and growth regulators. Rice hybrid TNRH-17 showed a good response to 175 kg N ha<sup>-1</sup> applied in four splits along with K<sub>2</sub>O in both the years and gave significantly higher grain yield of 8.17 t ha<sup>-1</sup> with foliar application of mepiquat chloride @ 1500 ml ha<sup>-1</sup> at flowering stage. The highest returns and benefit cost ratio were recorded in the same treatment combination, compared to the other treatments.

**Keywords:** Hybrid rice, Nitrogen, Split application, Growth regulators, Foliar spray.

### Introduction

Rice is cultivated under varied edaphic and environmental conditions. In Tamil Nadu, rice is mainly cultivated during South-West and North-East monsoon season. The cultivation in North East Monsoon season is highly challenging as the yield is affected due to many weather based problems such as low irradiance, low temperature and incessant rain.

The degree of variation in yield is so conspicuous that weather constitutes the nucleus of yield barrier in North East Monsoon season. Nevertheless, the farmers largely cultivate rice in North East monsoon season because of higher rainfall and consequent adequate water supply. With the advent of hybrids even in highly self pollinated crops like rice, exploitation of heterosis matching with the weather of North East Monsoon season would go a long way in improving the productivity and the present study has been oriented on these lines.

### Materials and Methods

Field experiments were conducted under irrigated lowland condition at Coimbatore, during the North East Monsoon (NEM) season of 1995-1996 and 1996-1997. The soil of experimental field was medium in available N (397 and 284 kg ha<sup>-1</sup>) and P (19.4 and 12.9 kg ha<sup>-1</sup>), high in available K (643 and 747 kg ha<sup>-1</sup>), with a pH of 7.8 and 7.7 and the organic carbon content of 0.74 and 0.87 per cent in experiment 1 and experiment 2 respectively. The experiments were laid out in split plot design with three replications. The F<sub>1</sub> hybrid entries viz. TNRH-17 (H<sub>1</sub>) and

TNRH-15 (H<sub>2</sub>) were tested in the first year and in the next year TNRH -15 was replaced by TNRH-16 (H<sub>3</sub>). Nitrogen was applied at two levels viz. 150 and 175 kg ha<sup>-1</sup>. Nitrogen was applied in split doses viz. 150 kg N was applied in 3 and 4 splits, while 175 kg N was applied in 4 splits. Three splits were given at basal, tillering and panicle initiation @ 50, 25 and 25 per cent respectively. Four splits were given at basal, tillering, panicle initiation and heading stages @ 40, 20, 20 and 20 per cent, respectively. The recommended dose of 50 kg P<sub>2</sub>O<sub>5</sub> was applied as basal. The recommended dose of 50 kg K<sub>2</sub>O was applied @ 33, 33 and 33 per cent in 3 splits; and in 4 splits @ 25, 25, 25 and 25 per cent, along with N as per treatment. Hybrid entries and nutrient management practices were combined with spray of growth regulators viz. water spray (F<sub>0</sub>), coconut water spray @ 5 per cent v/v (F<sub>1</sub>) and paclobutrazol @ 200 ml ha<sup>-1</sup> (F<sub>2</sub>) in the first year and in addition, mepiquat chloride @ 1500 ml ha<sup>-1</sup> (F<sub>3</sub>) in the second year. Hybrid entries and nutrient management practices constituted the main plots and growth regulators in the sub plots and statistical analysis were carried out as per Gomez and Gomez (1984).

### Results and Discussion

Rice grain yield is a function of number of panicles per unit area, filled spikelets panicle<sup>-1</sup> and test weight. In the present study, panicle number m<sup>-2</sup>, filled grain panicle<sup>-1</sup> and test weight were found to be more in TNRH -17, when N was applied @ 175 kg ha<sup>-1</sup> in four splits followed by N at 150 kg ha<sup>-1</sup> in

Table 1. Effect of hybrids, nutrients and foliar spray on yield component, yield and economics of hybrid rice, during 1992 - 96 North East Monsoon season

Treatments	Panicle number (m <sup>-2</sup> )	Panicle length (cm)	Panicle weight (g)	Filled grain panicle <sup>-1</sup>	III filled grain panicle <sup>-1</sup>	Spikelet sterility (%)	1000 grain weight(g)	Straw yield (t ha <sup>-1</sup> )	Grain yield (t ha <sup>-1</sup> )	Harvest Index	BC ratio
<b>Hybrids</b>											
H <sub>1</sub> : TNRH - 17	486	23.2	3.10	107	27	25.73	27.1	8.27	6.85	0.45	2.818
H <sub>2</sub> : TNRH - 15	396	20.9	2.12	93	3.1	21.62	24.0	8.39	5.95	0.41	2.456
CD (P=0.05)	23	10.34	0.07	4.01	1.46	1.26	0.51	0.16	0.15	0.007	
<b>Nutrients</b>											
N <sub>1</sub> : 150:50:50 kg NPK ha <sup>-1</sup> in 3 splits	414	21.6	2.45	90	33	25.13	25.2	8.59	5.82	0.41	2.419
N <sub>2</sub> : 150:50:50 kg NPK ha <sup>-1</sup> in 4 splits	444	22.2	2.64	100	29	23.18	25.6	8.36	6.46	0.44	2.676
N <sub>3</sub> : 175:50:50 kg NPK ha <sup>-1</sup> in 4 splits	466	22.4	2.74	109	26	22.79	25.9	8.04	6.91	0.46	2.816
CD (P=0.05)	21	0.41	0.09	4.92	1.79	0.97	0.63	0.198	0.190	0.009	
<b>Foliar spray</b>											
F <sub>0</sub> - Control (water spray)	433	21.0	2.38	94	40	28.52	25.1	8.11	5.98	0.42	2.530
F <sub>1</sub> - Coconut water (5 % v/v)	442	22.2	2.58	106	24	20.44	25.6	8.40	6.45	0.43	2.631
F <sub>2</sub> - Paclobutrazol (200 ml ha <sup>-1</sup> )	449	23.3	2.36	112	23	22.15	25.9	8.47	6.77	0.45	2.757
CD (P=0.05)	25	0.31	0.05	5.70	1.30	1.54	0.56	0.27	0.45	0.010	

similar splits and mepiquat chloride spray @ 1500 ml ha<sup>-1</sup> resulted in higher yield than paclobutrazol at 200 ml ha<sup>-1</sup> and coconut water spray 5 per cent v/v. Higher grain yield was recorded in TNRH - 17 than the other entries (Table-1 and Table-2). Higher grain yield of TNRH- 17 could be attributed to higher amount of solar radiation and sunshine hours, which worked out to 52.3 and 70.0 per cent respectively in the second year. Similarly rice grain yield associated with the solar radiation during later stage of plant growth. De Datta and Zarate (1970) correlated solar radiation during the 45 days before maturity in the grain yield and obtained co-efficient ranging from 0.50\*\* to 0.77\*\*.

Low light intensity during North East Monsoon season particularly between panicle initiation and harvest was an important constraint for higher productivity. It affected the yield component and finally the grain yield. Thus, as explained in the yield components, it is the weather exploitation rather than the genetic potential that made TNRH-17 to perform relatively better than TNRH-15 and TNRH-16 in producing more panicles, filled grain per panicle and test weight culminating in higher yield.

Three split application of nitrogen was found superior to basal or two splits as observed in AICRIP trials. Similarly, Meelu (1980) observed the usefulness of three splits of N compared with basal application. More number of N splits resulted in increase in panicle per unit area (Wagh

Table 2. Effect of hybrids, nutrients and foliar spray on yield component, yield and economics of hybrid rice, during 1996 - 97 North East Monsoon season

Treatments	Panicle number (m <sup>-2</sup> )	Panicle length (cm)	Panicle weight (g)	Filled grain panicle <sup>-1</sup>	Ill filled grain panicle <sup>-1</sup>	Spikelet sterility (%)	1000 grain weight(g)	Straw yield (t ha <sup>-1</sup> )	Grain yield (t ha <sup>-1</sup> )	Harvest Index	B:C ratio
<i>Hybrids</i>											
H <sub>1</sub> - TNRH - 17	460	24.7	3.30	131	33	20.4	27.5	8.27	7.04	0.46	2.899
H <sub>2</sub> - TNRH - 16	433	23.0	3.24	113	35	23.9	27.3	6.39	6.90	0.46	2.836
CD (P=0.05)	0.18	0.71	NS	2.1	1.1	1.98	0.05	0.148	0.088	NS	
<i>Nutrients</i>											
N <sub>1</sub> - 150:50:50 kg NPK ha <sup>-1</sup> in 3 splits	420	23.6	3.07	114	36	24.3	26.9	8.23	6.54	0.45	2.715
N <sub>2</sub> - 150:50:50 kg NPK ha <sup>-1</sup> in 4 splits	448	24.0	3.32	124	35	21.9	27.4	8.39	6.98	0.46	2.886
N <sub>3</sub> - 175:50:50 kg NPK ha <sup>-1</sup> in 4 splits	471	21.1	3.44	128	32	20.1	28.0	7.87	7.39	0.49	3.003
CD (P=0.05)	0.22	NS	0.16	2.5	1.3	2.05	0.06	0.177	0.108	0.014	
<i>Foliar spray</i>											
F <sub>0</sub> - Control (water spray)	409	22.9	2.95	105	43	29.1	26.9	7.88	6.24	0.44	2.640
F <sub>1</sub> - Coconut water(5 % v/v)	425	23.8	3.17	116	36	23.6	27.4	7.93	6.77	0.46	2.764
F <sub>2</sub> - Paclobutrazol (200 ml ha <sup>-1</sup> )	455	24.2	3.47	126	30	19.4	27.7	8.59	7.32	0.47	2.974
F <sub>3</sub> - Mepiquat chloride (1500 ml ha <sup>-1</sup> )	497	24.6	3.50	142	28	16.5	27.8	8.24	7.56	0.48	3.093
CD (P=0.05)	0.16	0.44	0.13	1.6	1.0	1.54	0.07	0.082	0.062	0.01	

and Thorat, 1987). Extended period of N application upto heading, increased the panicle and spikelet number, filled grain percentage and 1000 grain weight even in a short duration variety (IR 50) of 105 days (Vijayalakshmi *et al.* 1992). These reports were in conformity with the present findings and resulted in higher yield for N at 175 kg ha<sup>-1</sup> applied in four splits followed by N at 150 kg ha<sup>-1</sup> in similar splits.

Increased values of yield attributes and higher yield for the growth regulator mepiquat chloride followed by paclobutrazol could not be reassured out as the former inhibits GA biosynthesis and the latter on the shoot or root growth depending upon the enantiomer (Lenton *et al.* 1994). Possibly in rice at the rates applied, these growth regulators might have induced better growth and increased yield attributes and the yield finally.

Increased in the value of yield attributes for coconut water spray at 5 per cent might be due to slowing down of senescence. Thangaraj and Sivasubramanian (1992) found significant increase in the number of panicles m<sup>-2</sup>, filled grains panicle<sup>-1</sup> and grain yield due to spray of coconut water at 2 per cent v/v. The present studies are in agreement with these findings. The rice hybrid TNRH-17 gave the highest yield of 8166 kg ha<sup>-1</sup> during 1996-97 when N was applied @ 175 kg ha<sup>-1</sup> in four splits along with K and use of mepiquat chloride.

Due to better growth and increased values of yield attributes and yield, TNRH-17 hybrid entry gave higher net returns and B:C ratio in both 1995-96 and 1996-97 years. While increased returns realized by TNRH-17 over TNRH-15 during 1995-96 was 25.3 per cent and it was meagre to the tune of 3.3 per cent over TNRH-16 during the next year.

Improved nutrient management practice of N at 175 kg ha<sup>-1</sup> applied in four splits along with K gave higher net returns and B: C ratio

working out to 30.5 per cent more returns than the currently recommended practice of N at 150 kg ha<sup>-1</sup> in three split along with K and 19.24 per cent correspondingly in the next year.

Spraying of growth regulators was cost worth with mepiquat chloride @ 1500 ml ha<sup>-1</sup> securing a B:C ratio of 3.09, 2.18 for paclobutrazol @ 200 ml ha<sup>-1</sup> and 2.57 for coconut water spray @ 5 per cent. For continued promotion of yield favoring characters and more profit, growth regulators were found to be promising. A combination of TNRH-17 hybrid entry, N at 175 kg ha<sup>-1</sup> in four splits along with K and use of mepiquat chloride @ 1500 ml ha<sup>-1</sup> during flowering was found to be more profitable.

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(Received : September 2001 ; Revised : March 2002)