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EFFECT OF NITROGEN LEVELS ON GROWTH, YIELD AND ECONOMICS OF AEROBIC RICE (*Oryza sativa* L.)

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ABSTRACT

A field experiment was carried out at college farm, college of agriculture, Rajendranagar, Hyderabad during *Kharif*- 2012 to evaluate effect of nitrogen levels on growth, yield and economics of aerobic rice (*Oryza sativa* L.). The experiment was laid out in randomized block design with six nitrogen levels replicated four times. The treatments include nitrogen levels from 90 to 240 kg/ha at an increment of 30 kg/ha. The results revealed that application of 180 kg N/ha resulted in highest grain yield (3306 kg/ha), number of tillers/m^2 (333), number of panicles/m^2 (318) and number of grains per panicle (170) than all other N levels. However, increase in straw yield, leaf area index, chlorophyll content and dry matter production was observed with each successive increment of N dose from 90 to 240 kg/ha. Economic parameters *viz.*, gross returns, net returns and benefit cost ratio were significantly higher with the application of 180 kg N/ha followed by 210 and 240 kg N/ha. The experiment was carried out with BPT5204 rice cultivar growing under aerobic condition.

Key Words : *SPAD meter, aerobic rice, fertilization, yield, leaf area index*

Rice (*Oryza sativa* L.) is the world's second most important cereal crop and staple food for more than 60% of the global population and forms the cheapest source of food and energy. Aerobic rice is unique in its characteristics to withstand both flooding and dry soil conditions, which make it an ideal crop for areas prone to surface flooding where other crops would suffer or fail. Aerobic rice have water saving production system in which potentially high yielding, fertilizer responsive adapted rice varieties grown in fertile aerobic soils that are non-puddled and have no standing water. Nitrogen is the most important nutrient and high yield are associated with large nitrogen application. Nitrogen fertilization and proper time of application is the major agronomic practice that affects the yield and quality of rice crop which requires as much as possible at early and mid tillering stages to maximize panicle numbers and during reproductive stages to produce more number of spikelets per panicle and percentage filled spikelets (1). Dry matter production and yield attributes are the main components which determine the grain yield of crop would result from nitrogen uptake by the plants.

MATERIALS AND METHODS

An experiment was conducted during *Kharif* season 2012 at the college farm, college of agriculture, Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad. The soil was sandy loam in texture, neutral in reaction, low in organic carbon (0.31%), low in available nitrogen (210 kg/ha), medium in phosphorus (21 kg/ha) and medium in available potassium (182 kg/ha). Six nitrogen levels were imposed in randomized block design with four replications. The treatments comprised with six N levels *viz.* 90, 120, 150, 180, 210 and 240 kg/ha respectively from T_1 to T_6 in main plots. Half of the N as per treatments and full dose of P (60 kg/ha) and K (60 kg/ha) were applied at the time of sowing and remaining half dose of N was top dressed in two equal split at 45 DAS and at panicle initiation stage. Growth parameters like leaf area index (LAI), dry matter production and total leaf chlorophyll content (SPAD value) were recorded at 15 days interval starting from sowing. The hills were carefully pulled to keep the whole root system and then transferred to the laboratory to determine plant attributes. Grain yield was measured from 12 m^2 (3m x 4m) in the centre of plots. Ten panicles were randomly collected from each plots to determine 1000 grain weight (Test Weight) and number of grains per panicle. Number of panicle per m^2 was determined at harvest time by counting the number of panicle per m^2 randomly in each plot.

RESULTS AND DISCUSSION

Growth parameters : The average leaf area index (LAI) of rice increased at a slower rate up to 45 days after sowing and thereafter it increased with the ontogeny of the plant, reaching a peak value at 60 days after sowing, it decreased towards maturity due to natural senescence of leaves (Table-1). LAI was observed significantly higher with 240 kg N/ha over lower levels of N levels at panicle initiation and flowering stage of the crop. The development of leaf area index reflected a sigmoid pattern of growth (2).

Each higher level of nitrogen from N_{90} to N_{240} significantly increased the dry matter production over its lower level of nitrogen (Table-2). At harvest, statistical analysis revealed that N_{180} and N_{210} were at par and were significantly superior over N_{90}, N_{120} and $N_{150.}$ The treatments received 240 kg N ha^{-1} was recorded highest dry matter production at all stages of crop growth due to high vegetative growth.

Chlorophyll content of leaf was measured by SPAD meter. A perusal of the mean data indicated that with increase in the nitrogen level, corresponding significant increase in the Chlorophyll content of rice at different crop growth stages. Higher chlorophyll content is the indication of higher photosynthetic efficiency of plants (3).

Significant increase in plant dry matter production at different stages of growth due to increase in nitrogen

Table-1 : Effect of variable nitrogen levels on Leaf Area Index of rice crop

Treatments	Leaf area index (LAI)									
	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS	120 DAS	135 DAS	At harvest
T_1 – 90 kg N/ha	0.75	2.12	3.21	4.65	4.03	3.23	2.55	1.88	1.69	1.65
T_2 – 120 kg N/ha	0.80	2.39	3.45	4.89	4.50	3.40	2.97	1.95	1.95	1.79
T_3 – 150 kg N/ha	0.85	2.48	4.22	5.50	4.95	4.18	3.23	3.05	2.28	1.92
T_4 – 180 kg N/ha	0.93	2.63	4.68	5.56	4.96	4.23	3.60	3.31	2.65	2.02
T_5 – 210 kg N/ha	0.95	2.94	4.76	5.72	4.98	4.27	3.74	3.32	2.81	2.13
T_6 – 240 kg N/ha	0.96	2.97	4.88	5.94	5.22	4.33	3.82	3.49	2.85	2.28
CD (P = 0.05)	NS	0.11	0.25	0.26	0.39	0.42	0.42	0.41	0.19	0.33
S.Em. ±	0.05	0.04	0.08	0.09	0.13	0.14	0.14	0.14	0.06	0.11

Table-2 : Effect of variable nitrogen levels on dry matter production (kg/ha) of rice crop

Treatments	Dry matter production (kg/ha)									
	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS	120 DAS	135 DAS	At harvest
T_1 – 90 kg N/ha	1046	2362	3024	3875	4655	5822	6050	7315	7487	7785
T_2 – 120 kg N/ha	1221	2717	3212	4650	5387	6112	6942	7847	7937	8185
T_3 – 150 kg N/ha	1600	3317	3950	5300	6145	6867	7300	8267	8352	8562
T_4 – 180 kg N/ha	2262	3837	4520	5900	6850	7292	7947	8667	9142	9162
T_5 – 210 kg N/ha	2852	4025	5065	6297	7399	7887	8262	8730	9215	9245
T_6 – 240 kg N/ha	2987	4131	5200	6710	7835	7950	8855	9075	9307	9335
CD (P = 0.05)	236	408	420	548	600	527	574	626	647	679

Table-3 : Effect of variable nitrogen levels on yield and yield attributes of rice.

Treatments	No of Tillers/m	No of Panicle/m	No of Grains Panicle	Test Weight (g)	Grain Yield (kg/ha)	Straw Yield (kg/ha)
T_1 – 90 kg N/ha	271	259	128	12.04	2644	5141
T_2 – 120 kg N/hA	305	274	139	12.87	2886	5303
T_3 – 150 kg N/ha	310	292	154	13.10	3009	5588
T_4 – 180 kg N/ha	333	318	170	13.76	3306	5866
T_5 – 210 kg N/ha	321	297	156	14.18	3152	5984
T_6 – 240 kg N/ha	311	294	145	14.27	3041	6116
CD (P = 0.05)	29	23	15	NS	232	435
S.Em. ±	9	7	5	0.59	77	144

Table-4 : Effect of different nitrogen levels on economics of rice crop

Treatment	Total cost of cultivation (₹/ha)	Gross returns (₹/ha)	Net returns (₹/ha)	B : C ratio
T_1 – 90 kg N/ha	29100	43337	14237	1.49
T_2 – 120 kg N/ha	29466	46681	17215	1.58
T_3 – 150 kg N/ha	29836	48788	18952	1.64
T_4 – 180 kg N/ha	30205	53057	22852	1.76
T_5 – 210 kg N/ha	30571	51368	20797	1.68
T_6 – 240 kg N/ha	30938	50244	19306	1.62

Price of grain: 12.50 Rs/kg Price of straw: 2.00 Rs/kg

levels might be attributed to increasing the amount and efficiency of chlorophyll which influenced the photosynthetic efficiency resulting increase plant height, number of tillers and number of panicles which contributed dry matter yield (14).

Significant increase in leaf area index (LAI), dry matter production, number of tillers per m^2, number of panicle per m^2, number of grains per panicle and chlorophyll content in leaf was observed with high N application.

Yield and yield attributes

At harvesting stage, the number of panicles m, number of tillers/m, number of grains per panicle was significantly superior at N_{180} kg over its lower levels of N (Table-3). Significant variation in test weight was not observed with variable N application. The supply of nitrogen at higher levels was found sufficient in favouring structural and functional activities of the crop, resulting in production of more number of effective tillers and panicle per plant (5).

Each higher level of nitrogen improved the grain yield over its lower level up to 180 kg N/ha (3306 kg) and slightly decreased by application of 210 and 240 kg (3152, 3041 kg/ha respectively) (Table-3). This increase in grain yield with increasing N dose was due to more number of productive tillers, number of grains per panicle. However, the straw yield increased with successive increase in N levels upto 240 kg/ha (6116 kg) followed by 210 and 180 kg/ha (5984, 5866 kg respectively).

The cost economics of the different levels of N revealed that the lowest net return (14237 ₹/ha) and B: C ratio (1.49) was observed with the application of 90 kg N/ha where as highest net return (22852 ₹/ha) and benefit cost ratio (1.76) was obtained in T_4 (180 kg N) followed by T_5 (210 kg N) and T_6 (240 kg N). The increase in net return and benefit cost ratio due to higher yield and minimum investment in these treatments (Table-4). (6)

CONCLUSION

The aerobic rice best responded up to 180 kg N/ha resulting increase the number of panicles, number of tillers, number of grains and grain yield. Application of 240 kg N/ha resulted in highest dry matter production, LAI, chlorophyll content and straw yield of aerobic rice than all other levels of N application. However, yield and yield attributes increased up to application of 180 kg/ha and then onwards statistically on par with higher levels of N *i.e.,* 210 kg/ha and 240 kg/ha. Application of 180 kg N/ha in aerobic rice was cost effective than higher as well as lower doses of nitrogen.

REFERENCES

1. Lampayan, R.M.; Bouman, B.A.M.; Dios, J.L.D.; Espirity, A.J.; Soriano, J.B.; Lactaoen, A.T.; Faronilo, J.E. and Thant, K.M. (2010). Yield of aerobic rice in rainfed lowlands of the Philippines as affected by nitrogen management and row spacing. *Field Crops Research. 116 :* 165-174.
2. Devi, G. and Sumathi, V. (2011). Effect of nitrogen management on growth, yield and quality of scented rice under aerobic conditions. *Journal Research ANGRAU. 39 (3) :* 81-83.
3. Bhattacharya, H.C and Singh, K.N. (1992). Response of direct seeded rice to levels and time of nitrogen applications. *Indian Journal of Agronomy* 37: 681-685.
4. Latheef Pasha, M.D. (2010).Performance of aerobic rice under different levels of irrigation, nitrogen and weed management. *M.Sc.(Ag.) Thesis. Acharya N G Ranga Agricultural University,* Hyderabad, India.
5. Sathiya, K., Sathyamoorthi, K and Martin, G.J. (2008). Effect of nitrogen levels and split doses on the productivity of aerobic rice. *Research on Crops. 9 (3) :* 527-530
6. Sudhakar, G.; Solaimalai, A and Ravi Sankar, N. (2001).Yield and economics of semi-dry rice as influenced by cultivars and levels of nitrogen. Indian *Journal of Dryland Agricultural Research and Development. 16 (1) :* 42-44.