



Effect of Irrigation Schedules and Nitrogen Levels on Growth and Yield of Aerobic Rice

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ABSTRACT

Aerobic rice is a new production system in which specially developed varieties are grown under unpuddled, non flooded and unsaturated soil condition. A field experiment was conducted at Agricultural Research Station, Utukur, Kadapa during *kharif*, 2009 and 2010 to study the effect of irrigation schedules and nitrogen levels on growth and yield of aerobic rice. Four irrigation schedules and three nitrogen levels were tested in split-plot design with three replications. Results revealed that irrigations scheduled once in three days interval registered significantly higher number of tillers, filled grains per panicle, test weight and grain yield as compared to other irrigation schedules during first year while there was no disparity among them in the second year due to continuous rains. Application of 160 kg N/ha was found superior than the other nitrogen levels with respect to growth, yield attributes and grain yield of aerobic rice in both the years.

Key words : Aerobic rice, Irrigation, Nitrogen levels.

Increasing scarcity of water for agriculture particularly for rice cultivation due to the demand of water for industries and other sectors has threatened the sustainability of the irrigated rice ecosystem. In this context, aerobic rice cultivation offers an opportunity to produce rice with less water. In aerobic rice system, fields remain unsaturated throughout the season like an upland crop, such as maize or wheat. This way of growing rice saves water by eliminating continuous seepage and percolation during land preparation (Bouman *et al.*, 2002). When the rice is grown in aerobic cultures irrigation is one of the most important factors for assured crop production as it permits better utilization of all other production factors.

Nitrogen is one of the important yield limiting nutrients and its efficient use is important for economic sustainability. Nitrogen fertilization 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 stage and during reproductive stage to produce more number of spikelets per panicle and percentage of filled spikelets (Murthy *et al.*, 1992). Since the aerobic rice is a new method of rice cultivation and moreover the availability of nitrogen is entirely differing from puddled paddy soil, optimization of nitrogen dose for aerobic rice is more important for higher grain yield. In the light of the above, the present investigation was taken up to study the effect of irrigation schedules and nitrogen management on growth and yield of aerobic rice.

MATERIAL AND METHODS

A field experiment was conducted at the Agricultural Research Station, Utukur, Kadapa during two consecutive *kharif* seasons of 2009 and 2010. The experimental soil was red sandy loam in texture, slightly alkaline in reaction (pH 8.3) and low in organic carbon (0.4 %), available N (197 kg ha⁻¹), available P₂O₅ (12.5 kg ha⁻¹) and high in available K₂O (280 kg ha⁻¹). The treatments were laid out in split-plot design, replicated thrice with four irrigation schedules *viz.*, I₁-irrigation once in three days; I₂-irrigation once in 6 days; I₃-irrigation once in 9 days and I₄-irrigation when hairline cracks develop as main-plots and three nitrogen levels *viz.*, 80, 120 and 160 kg N ha⁻¹ as sub-plots. A presowing irrigation was given to all the treatments and the remaining irrigations were given as per treatment schedule. The total rainfall received during crop season was 377 mm and 458 mm during 2009 and 2010, respectively. The test variety NLR-145 was sown @ 40 kg ha⁻¹ at a spacing 20 x 10 cm on 22-06-2009 and 21-06-2010 during the year 2009 and 2010, respectively. One third dose of nitrogen and whole of phosphorus and potassium were applied as basal through urea, single super phosphate and muriate of potash, respectively. Remaining nitrogen was top dressed in two equal splits at 20 and 40 DAS. Data obtained from the experiment was statistically analyzed following standard statistical methods (Gomez and Gomez, 1984).

Table 1. Growth parameters of aerobic rice as influenced by irrigation schedules and nitrogen levels.

Treatments	Plant height (cm)		No. of tillers hill ⁻¹		Productive tillers m ⁻²	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
Irrigation Schedule						
I ₁ -Irrigation at 3 days interval	73	65	11.3	9.2	62	34
I ₂ -Irrigation at 6 days interval	67	65	9.6	9.1	44	35
I ₃ -Irrigation at 9 days interval	61	62	7.9	8.9	35	34
I ₄ -Irrigation when hairline cracks developed	52	62	7.3	9.4	28	34
SEm±	2.3	-	0.65	-	1.0	-
CD (0.05)	5.63	NS	1.59	NS	2.6	NS
N levels (kg ha⁻¹)						
N ₁ -80	58	52	8.2	6.9	39	30
N ₂ -120	65	64	9.0	9.2	42	34
N ₃ -160	67	76	10.0	11.4	45	39
SEm±	63	1.1	0.23	0.19	0.44	0.42
CD (0.05)	1.26	2.23	0.49	0.42	0.93	0.90

Table 2. Yield components and grain yield of aerobic rice as influenced by irrigation schedules and nitrogen levels.

Treatments	Grains panicle ⁻¹		Test Wt (g)		Grain yield (kg ha ⁻¹)		Straw yield (kg ha ⁻¹)	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
Irrigation Schedule								
I ₁ -Irrigation at 3 days interval	129	95	20.98	17.11	1509	720	3718	5221
I ₂ -Irrigation at 6 days interval	110	97	19.11	17.32	1225	746	3109	5345
I ₃ -Irrigation at 9 days interval	93	99	19.6	18.86	863	749	2186	5378
I ₄ -Irrigation when hairline cracks developed	70	98	20.12	18.12	710	745	1775	5182
SEm±	5.9	-	-	-	42	-	134	-
CD (0.05)	14.6	NS	NS	NS	102	NS	330	NS
N levels (kg ha⁻¹)								
N ₁ -80	89	68.3	18.68	16.89	912	484	2332	4238
N ₂ -120	101	96.9	20.11	18.45	1100	761	2745	5303
N ₃ -160	112	123	20.68	18.21	1218	976	3015	6305
SEm±	2.2	1.5	-	-	32	13.1	81	62
CD (0.05)	4.7	3.2	NS	NS	69	27.8	172	133

RESULTS AND DISCUSSION

The grain yield was lower during second year of experimentation under all treatments than the first year mainly due to cloudy weather and continuous rainfall that prevailed during the entire crop growth period. Plant height, number of tillers/hill, productive tillers sq.m^{-1} , number of filled grains per panicle increased significantly with irrigation scheduled once in three days as compared to other irrigation schedules during the first year, while no significant effect of irrigation was obtained in view of continuous rainfall during second year (Table 1).

Irrigation scheduled once in three days interval recorded higher grain and straw yield and was significantly superior to the other treatments during 2009, while there was no disparity among the irrigation treatments during 2010. Increase in grain yield due to irrigation scheduled at three days interval over irrigation scheduled at 6 days, 9 days interval and when hairline cracks (12 days after irrigation) develop was 18.8, 42.8 and 52.9 per cent, respectively during 2009 (Table 2). The improvement in grain yield during the first year might be due to the optimum soil moisture favouring the nutrient availability during critical growth stages enhancing the growth and yield parameters.

Nitrogen levels influenced the plant height, number of tillers per hill, number of productive tillers per sq.m and number of filled grain per panicle. The highest stature of growth and yield attributes was recorded with the higher nutrient level N_3 (160 Kg ha^{-1}) which was significantly superior to other nutrient levels in both the years. Test weight was not influenced by nitrogen levels. Application of 160 kg N ha^{-1} registered maximum grain yield (1218 and 986 Kg ha^{-1}) which is higher by 306 and 492 kg ha^{-1} as compared to 80 kg N ha^{-1} during 2009 and 2010, respectively. Better translocation of

photosynthates from vegetative (source) to reproductive parts (sink) might have resulted in more number of productive tillers/ sq.m and number of grains per panicle which in turn increased the grain yield. These results are in consonance with those of Ramesh *et al.* (2009) and Maheswari *et al.* (2008). It can be concluded from the study that irrigation scheduled once in 3 days with 160 kg N ha^{-1} will be optimum to realize the maximum productivity under aerobic rice cultivation.

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