https://doi.org/10.29321/MAJ.10.A01686

Madras Agric. J. 80 (9) : 481 - 485 September 1993

TIME OF INITIAL FLOODING AND NITROGEN SPLITS ON THE UPTAKE OF NUTRIENTS IN DRY SEEDED BUNDED RICE

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ABSTRACT

Field investigations were conducted during summer and *Kharif* seasons to study the influence of six irrigation schedules and three nitrogen splits on the uptake of six nutrients by dry seeded bunded rice. Plants flooded early (20 and 35 days after sowing) recorded higher iron and manganese contents whereas it was generally reverse in the case of nitrogen and zinc. However, the uptake of nitrogen, phosphorus, potassium, iron, manganese and zinc were increased both at active tillering and harvest stages due to early flooding.

Key Words: *Irrigation Schedule, Nutrients Uptake, Early Flooding*

INTRODUCTION

Dry seeded bunded rice or semi-dry rice experiences two hydrologic phases during growth period. The initial upland phase extends upto the fourth or fifth leaf stage. Thereafter the crop undergoes a lowland phase upto harvesting. This causes widely differing chemical reactions in soil influencing soil nutrient availability and plant uptake of essential nutrients. Though a large number of studies are available on the uptake of nutrients by rice in a totally upland or lowland condition, such experiments are few in dry seeded bunded rice and hence the present investigation.

MATERIALS AND METHODS

Field experiments were conducted at the Wetland Farm of the Tamil Nadu Agricultural University, Coimbatore during summer and *Kharif* seasons of 1988. The soil was clay loam in texture with a nutrient status of 220.0, 18.5 and 351.0 kg/ha of available nitrogen, phosphorus and potassium, respectively. The pH value was 8.3. The experiment was laid out in split plot with three replications. The irrigation schedules were assigned to main plot and time of nitrogen application to subplots. The irrigation schedules were (i) Flooding at 20 days after sowing followed by either I_1, continuous submergence of 5+2 cm or I_2, 7cm irrigation one day after the disappearance of water (DADW) (ii) Flooding at 35 DAS followed by either I_3, continuous submergence of 5+2 cm or I_4, 7cm irrigation one DADW and (iii) Flooding at 50 DAS followed by either I_5, continuous submergence of 5+2 cm or I_6, 7cm irrigation one DADW. The time of application of nitrogen were; application of 50 :25:25 (T_1), 25:50:25

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Table 1. Content and uptake of nitrogen as influenced by irrigation Schedules and nitrogen splits

Treatments	N Content (%)						N Uptake (kg/ha)			
	Summer			Kharif			Summer		Kharif	
	Active tillering	Harvest Grain	Harvest Straw	Active tillering	Harvest Grain	Harvest Straw	Active tillering	Harvest	Active tillering	Harvest
Irrigation Schedules										
I_1	1.56	1.10	0.51	2.01	1.19	0.56	29.9	68.8	33.0	65.4
I_2	1.67	1.10	0.53	1.94	1.22	0.54	31.1	68.1	31.3	65.4
I_3	1.64	1.04	0.51	2.17	1.09	0.64	28.1	64.3	31.3	61.3
I_4	1.71	1.08	0.54	2.13	1.10	0.52	28.6	65.5	3.06	57.6
I_5	1.79	1.10	0.60	2.10	1.15	0.64	24.9	54.9	28.0	53.2
I_6	1.77	1.15	0.58	2.11	1.11	0.60	23.6	51.7	28.2	50.3
CD (0.05)							3.9	6.0	3.3	5.0
Nitrogen splits										
T_1	1.78	1.12	0.54	2.16	1.10	0.57	30.9	63.5	33.5	58.1
T_2	1.66	1.14	0.55	2.08	1.19	0.61	26.5	66.7	29.1	63.4
T_3	1.64	1.05	0.54	2.00	1.14	0.57	25.8	56.5	28.7	55.1
CD (0.05)							2.2	3.1	1.7	2.9
Interaction: CD (0.05)							NS	8.6	NS	7.6

(T_2) and 33.3: 33.3 (T_3), percentage or 100kg/N/ha at 20 DAS, active tillering and panicle initiation stages, respectively.

The seeds of the test variety ADT 36 were sown at the rate of 100kg/ha in small furrows spaced at 15 cm apart at a depth of two to three cm in finely tilled soil. The whole of P_2O_5 and K_2O(50kg/ha each) were applied as basal at the time of sowing. Upto the time of flooding, all the plots were given 50mm irrigation at 1.10 1W/CPE ratio (1W=Irrigation Water depth and CPE=Cumulative Pan Evaporation) apart from a common post-sowing (o-day) and life (5 DAS) irrigations of 50mm each. The nitrogen, phosphorus and potassium contents in plants at active tillering and in grain and straw at harvest during summer and **Kharif** were determined using methods suggested by Jackson (1973). The content of iron, manganese and zinc were determined in the above said stages during **Kharif** by using Atomic Absorption Spectrophotometer (Varian Techtron 120) after extracting with diacid. The uptake values were computed from the content of individual nutrients and drymatter production.

RESULTS AND DISCUSSION

Content and Uptake of nitrogen

There was a general trend of increasing nitrogen content with delay in submergence (Table.1). This was attributed to the dilution effect in early

Table 2. Uptake of phosphorus and potassium as influenced by irrigation Schedules and nitrogen splits

Treatments	Phosphorus uptake (Kg/ha)				Potassium uptake (Kg/ha)			
	Summer		Kharif		Summer		Kharif	
	Active tillering	Harvest	Active tillering	Harvest	Active tillering	Harvest	Active tillering	Harvest
Irrigation Schedules								
I_1	5.32	21.19	4.26	17.84	47.8	123.8	39.5	97.3
I_2	5.51	20.80	4.13	17.85	47.1	117.0	40.2	98.9
I_3	5.19	20.43	3.70	16.32	45.1	118.4	37.1	93.5
I_4	5.03	20.07	3.69	16.61	43.1	116.0	37.8	93.5
I_5	4.25	15.64	3.33	13.65	35.9	87.8	33.3	78.9
I_6	4.09	15.26	3.38	13.52	34.5	78.9	33.4	79.3
CD (0.05)	0.99	2.34	NS	1.93	3.7	6.0	4.4	7.0
Nitrogen splits								
T_1	5.17	19.28	4.00	16.33	44.2	108.7	39.4	90.3
T_2	4.82	19.64	3.63	16.50	41.2	110.2	35.1	94.1

flooded treatments on account of increased production of drymatter. However, nitrogen uptake (Table 1) showed a strikingly different picture with appreciably higher uptake in early flooded treatments. Poor root growth and higher losses of nitrogen due to nitrification - denitrification reactions (Humphreys et al., 1987) of the applied nitrogen, especially the first dose would be the reason for lower nitrogen uptake in late flooded plants. De Datta et al.(1973) observed more NH_4+NO_3- nitrogen present in continually flooded plots. Increased availability in soil and the demand by the expanding shoot might have resulted in increased nitrogen uptake in early flooded treatments. Since split application of nitrogen at the rate of 50:25:25 (T1) received 50 per cent of nitrogen basally, it led to increased uptake and higher nitrogen content at active tillering stage. The nitrogen split of 25:50:25 per cent (T2) which received 50 per cent of its nitrogen at active tillering stage recorded higher nitrogen content at maturity. The same trend as that of nitrogen content could be observed in the case of uptake also at the respective stages. The schedule receiving nitrogen at 33.3 per cent each at 20 DAS, active tillering and panicle initiation stages, respectively, resulted in low nitrogen content and uptake.

Uptake of Phosphorus

The uptake pattern of phosphorus (Table2) showed an explicitly clear increase in early flooded treatments. Iruthayaraj and Morachan (1980) indi-

Table 3. Content and uptake of iron and manganese as influenced by irrigation schedules

Irrigation Schedules	Iron					Manganese				
	Content (ppm)			Uptake(g/ha)		Content (ppm)			Uptake (g/ha)	
	Active tillering	Harvest Grain	Harvest Straw	Active tillering	Harvest	Active tillering	Harvest Grain	Harvest Straw	Active tillering	Harvest
I_1	300	164	230	492	1492	228	48	124	374	656
I_2	288	150	210	463	1353	205	41	111	330	576
I_3	275	156	235	396	1394	214	51	129	308	645
I_4	251	139	212	361	1271	187	43	114	269	573
I_5	243	156	229	323	1161	178	45	121	237	504
I_6	239	141	210	319	1062	167	42	109	223	463

Table 4. Content and uptake of zinc as influenced by irrigation schedules

Irrigation schedules	Content (ppm)			Uptake (g/ha)	
	Active tillering	Harvest Grain	Harvest Straw	Active tillering	Harvest
I_1	40.1	23.8	35.6	65.8	223.3
I_2	48.5	25.0	38.8	78.0	240.1
I_3	53.6	24.4	36.1	77.2	215.6
I_4	57.7	26.1	39.3	82.9	236.9
I_5	60.8	26.7	38.0	80.9	195.1
I_6	65.4	28.0	43.0	87.4	215.1

cated that reduced conditions helped in the conversion of insoluble phosphates in to soluble form and thereby increased the availability of phosphorus to plants. increased availability of phosphorus due to early creation of reduced conditions in early flooded treatments along with enhanced shoot weight might be responsible for increased phosphorus uptake in these treatments.

The nitrogen splitting of 50:25:25 per cent and 25;50;25 per cent at 20 DAS, active tillering and panicle initiation stages recorded increased phosphorus uptake which was largely due to increased dry matter production.

Uptake of Potassium

Increased concentration of potassium in the soil solution due to prolonged submergence was reported by Yoshida (1981). A corresponding increase in absorption and increased production of dry matter resulted in marked increase in potassium uptake (Table 2) in early flooded treatments. Among the times of nitrogen application, potassium uptake was generally higher in the application of nitrogen at 50;25;25 per cent and 25;50;25 per cent.

Content and uptake of Iron and Manganese

The iron and manganese followed almost similar trend in respect of their content and uptake (Table 3). They increased with earliness in submergence of field. Maintenance of continuous submergence, rather than irrigation one day after disappearance of water resulted in increased content and uptake of both of these nutrients. In submerged soils, under most conditions, microbial reduction increases the concentration of ferrous iron in the soil solution (Yoshida, 1981). He further observed that manganese was more readily reduced and rendered soluble than iron. The increased iron and manganese absorption due to the cumulative effect of increased availability in soil and enhanced dry matter production led to appreciable increase in the uptake of these nutrients.

Contents and uptake of zinc

Unlike iron and manganese, zinc showed a tendency to increase with delay in submergence. The 50-day flooding record maximum zinc content (Table 4). So also irrigation one day after disappearance of water recorded higher zinc content than continuous submergence. This was due to the fact that the availability of zinc was much higher in upland soils than in submerged soils (Yoshida, 1981). Though zinc content was less under early flooded and continuously submerged plots, it was compensated by a substantial increase in dry matter resulting in higher zinc uptake in these treatments.

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