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Study on Different Varieties of Aerobic Rice with N, P and K Fertigation Levels on SCMR Values, Yield Effecting Parameters and Drymatter Production

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A B S T R A C T

A field experiment was conducted at Water Technology Centre, College farm, Rajendranagar, Hyderabad during *kharif*, 2015 to study the "Response of different varieties of aerobic rice (*oryza sativa l.*) under drip fertigation levels." The experiment was conducted with three main treatments and four sub treatments. The main treatments were three rice varieties (RNR 15048, MTU 1010 and Anagha) and the sub treatments were four different fertigation levels (S_0: Control, S_{75}:90-45-30 kg N-P_2O_5-K_2O ha^{-1}, S_{100}:120-60-40 kg N-P_2O_5-K_2O ha^{-1}, S_{125}:150-75-50- N-P_2O_5-K_2O ha^{-1}. Drip irrigation was scheduled once in 3 days based on daily data of USWB class 'A' pan evaporimeter at 1.5 Epan. The amount of total irrigation water used including effective rain fall (277 mm) for different varieties were Anagha (9720 m^3), MTU 1010 (9910 m^3) and RNR 15048 (10110 m^3) through drip irrigation. The differences in amount of water used were different for different varieties due to the differences in their crop growth period. The crop growth period noticed was 131, 139 and 151 days for Anagha, MTU 1010 and RNR 15048 respectively. The data on SCMR values at different plant growth stages, yield effecting parameters like no. of panicles m^{-2}, panicle length (cm), no. of grains $panicle^{-1}$, test weight (g), grain yield (kg ha^{-1}), straw yield (kg ha^{-1}) and dry matter production (kg ha^{-1}) were recorded.

Introduction

Rice is a semiaquatic plant and grows well under lowland flooded anaerobic conditions. Most high yielding varieties yielding 6–8 t/ha have been developed to suit such conditions.

Aerobic rice system (ARS) is a new production system in which rice is grown under non-puddled, non-flooded, and non-saturated soil conditions. The expected yields in ARS are somewhat lower than those obtained under lowland flooded conditions, but double or treble of that obtained under upland conditions.

Fertigation is a frontier technology, which permits application of various nutrients and fertilizer formulations directly at the site of active roots in desired concentration, time and thus improves the nutrient use efficiency and the yield of crops.Information on the performance of aerobic conditions with drip fertigation levels is meager. The improved fertilizer application use efficiency results from small, controlled amount of fertilizers that applied throughout the season in contrast to large amount of fertilizer placed on the bed at the beginning of the season (Dangler and

Locasscio, 1990). This practice contributes to the achievement of higher yields and better quality by increasing remarkably the efficiency of the fertilizer application, which allows reducing the amount of applied fertilizer. This, not only reduces the production cost but also lessens the potential of groundwater pollution caused by the fertilizer leaching. Fertigation allows adapting the amount and concentration of the applied nutrients in order to meet the actual nutritional requirement of the crop throughout the growing season for maximum yield and production quality. It is specific for each crop and climate and is to be determined in different experiments.

Materials and Methods

A field experiment was conducted at Water Technology Centre, College farm, Rajendranagar, Hyderabad during *kharif*, 2015 to study the response of different varieties of aerobic rice (*Oryza sativa l.*) under drip fertigation levels**.** The experiment was conducted with three main treatments and four sub treatments. The main treatments were three rice varieties (RNR 15048, MTU 1010 and Anagha) and the sub treatments were four different fertigation levels (S_0: Control, S_{75}:90-45-30 kg N-P_2O_5-K_2O ha^{-1}, S_{100}:120-60-40 kg N-P_2O_5-K_2O ha^{-1}, S_{125}: 150-75-50- N-P_2O_5-K_2O ha^{-1}).

The experimental soil was sandy clay loam in texture, slightly alkaline in reaction, non-saline, low in organic carbon and available nitrogen, medium in available phosphorous and high in available potassium. The mean weekly maximum (RH-II) and minimum relative humidity (RH-I during the crop growing period varied from) 73 to 95.28 % and 39.5 to 75.42 % respectively, during *kharif*, 2015 and 369.9 mm of rainfall was received in 26 rainy days. The mean bright sunshine hours per day varied from 1.77 to 8.25. The average wind speed varied from 0.1 to 11.34 km h^{-1} in 2015. With respect to pan evaporation, mean pan evaporation ranged 2.7 to 7.98 mm day^{-1} in 2015. The seasonal cumulative pan evaporation during the crop period of *kharif*, 2015 was 687.6 mm.

Out of the varieties chosen, RNR 15048 is recently released by P.J.T.S.A.U. as Telangana Sona and is gaining wider popularity among farming community. Hence there is a need to generate the data on this new variety in different management practices. Hence this variety was included. The other variety MTU 1010 is a widely accepted, cold tolerant, bold seeded variety in both Telangana and Andhra Pradesh state and was found to perform better under aerobic conditions than other popular varieties. Hence this variety was included under the study. The third variety Anagha is a variety specially released for growing under aerobic conditions by U.A.S, Bangalore. To test its suitability under Telangana, this variety was also included under the present study.

Results and Discussion

Data on growth parameters like SPAD values at different growth stages, yield effecting parameters like, no. of panicles m^{-2}, panicle length (cm), no. of grains $panicle^{-1}$, test weight (g) and dry matter production (kg ha-1) at different growth stages were recorded.

The data regarding SCMR values is represented in Table 1, and dry matter production in Table 2 and yield effecting parameters in Table 3 respectively. It is significantly influenced by the varieties, fertigation levels but not by their interaction.

The leaf chlorophyll content, a key factor in determining the rate of photosynthesis, is also considered as an index of the metabolic efficiency of plants. This pigment, responsible for harnessing solar energy and converting it into chemical energy, exhibits a differential pattern in its accumulation in response to irrigation and nutrients applied at different levels. A slight fluctuation in chlorophyll content is enough to trigger changes in physiological processes of plants, particularly, photosynthesis.

The data on leaf chlorophyll content (SCMR values) of aerobic rice at 30, 60 and 90 DAS is presented in Table 1. The leaf chlorophyll content (SPAD chlorophyll meter readings) was significantly influenced by the treatments and their interactions. It was observed that the leaf chlorophyll content of aerobic rice continued to increase from 30 DAS to 90 DAS and it gradually decreased from 90 DAS to harvest.

At 30 DAS, chlorophyll content (SCMR values) ranged from 26.9 to 48.6. Among all varieties, Anagha (36.2) recorded higher chlorophyll content and it was on par with RNR 15048 (35.3) and followed by MTU 1010 (29.4).The Anagha, recorded 2.55%and 23.1% higher chlorophyll content than RNR 15048 and MTU 1010 respectively. Among the NPK fertigation levels, S_{125} (36.9) recorded significantly the highest chlorophyll content followed by S_{100} (33.9) which was on par with S_{75} (33.7) and significantly higher over S_0 (29.9).The S_{75}, S_{100} and S_{125} have recorded 12.7, 13.4 and 23.4 per cent higher SCMR value over control (S_0). The S_{125}, recorded 8.85% and 9.49% higher chlorophyll content in S_{100} and S_{75} respectively. Among interactions, significantly the highest chlorophyll content was observed in Anagha at S_{125}(48.6) followed by RNR 15048 at S_{75} (39.7), RNR 15048 at S_{125} (39.2), Anagha at S_{75} (34.4), RNR 15048 at S_{100} (33.5), Anagha at S_{125} (33.4), MTU 1010 at S_{100} (32.8), RNR 15048 at S_0 (30.9), MTU 1010 at S_0 (30.7), Anagha at S_0 (28.2), RNR 15048 at S_{75} (26.9) and MTU 1010 at S_0 (26.9) respectively.

At 60 DAS, leaf chlorophyll content (SCMR values) ranged from 30.1 to 51.6. Among all varieties, Anagha (36.2) recorded higher chlorophyll content and it was on par with RNR 15048 (37.1) and followed by MTU 1010 (33.1). Anagha, recorded 5.83% and 20.54% higher chlorophyll content than RNR 15048 and MTU 1010 respectively. Among the NPK fertigation levels, S_{125} (41.1) recorded significantly the highest chlorophyll content followed by S_{100} (36.4), S_{75} (35.4) and S_0 (33.9) respectively which were on par among themselves. The S_{75}, S_{100} and S_{125} have recorded 4.4, 7.4 and 21.20 per cent higher SCMR value over control (S_0). The S_{125}has recorded 12.91% and 16.8 % higher chlorophyll content than $S_{100}$and S_{75} respectively. Among interactions significantly the highest chlorophyll content was observed by Anagha at S_{125}(51.6) followed by RNR 15048 at S_{125} (41.2), RNR 15048 at S_{75} (38.7), Anagha at S_{100} (37.5), Anagha at S_{75} (37.3), RNR 15048 at S_{100} (36.1), RNR 15048 at S_0 (35.9), RNR 15048 at S_{100} (35.6), Anagha at S_0 (33.4), RNR at S_0 (32.2), MTU 1010 at S_{125} (30.4) and MTU 1010 at S_{75} (30.1) respectively.

At 90 DAS, leaf chlorophyll content (SCMR values) ranged from 30.4 to 50.4. Among all varieties, Anagha (39.7) recorded higher chlorophyll content and it was on par with RNR 15048 (37.7) and significantly higher over MTU 1010 (33.5). Anagha recorded 5.3%, 11.8% higher chlorophyll content than RNR 15048 and MTU 1010 respectively. Among the NPK fertigation levels, S_{125} (40.9) recorded significantly the highest chlorophyll content, followed by S_{100} (36.4) which is on par with S_{75} (35.9) and S_0 (34.5).The S_{75}, S_{100} and S_{125} have recorded 4.05, 5.50 and 18.6 per cent higher LAI over control (S_0). The S_{125}has recorded 12.36% and 13.93% higher chlorophyll content than S_{100} and S_{75} respectively. Among interactions significantly the highest chlorophyll content was observed in Anagha at S_{125}(50.4) followed by RNR 15048 at S_{125} (41.7), RNR 15048 at S_{75} (38.7), Anagha at S_{100} (37.5), Anagha at S_{75} (37.3), RNR 15048 at S_{100} (36.1), RNR 15048 at S_0 (34.2), MTU 1010 at S_{100} (35.9), MTU 1010 at S_0 (35.6), RNR at S_0 (34.2), MTU 1010 at S_{75} (31.9) and MTU 1010 at S_{125} (30.4) respectively.

The chief pigment of leaves, which impart the green colour is chlorophyll. Nitrogen is premier of photosynthetic activity directly related to chlorophyll synthesis. As, nitrogen is the main constituent of all amino acids in proteins and lipids that act as structural compounds of the chloroplast, the phenomenon of increased chlorophyll content with increased NPK nutrition under fertigation could be due to uniform distribution and adequate availability of nutrients and water through laterals in the root zone of the crop. Among the varieties, at all the growth stages, Anagha, the variety specially released for aerobic cultivation by U.A.S., Bangalore has recorded relatively higher leaf chlorophyll content followed by RNR 15048 and lower values were recorded by MTU 1010. It indicates that Anagha has higher potential to utilise the available nutrients relatively better and develop the leaf chlorophyll contents, than the other two varieties under aerobic cultivation.

The data on dry matter production of aerobic rice at 30, 60, 90 and at final harvest is presented in Table 2. Dry matter production was significantly influenced by the treatments and their interactions. It was observed that the dry matter production of aerobic rice continued to increase from 30 DAS to till harvest.

At 30 DAS, dry matter production ranged from 198 to 347 kg ha^{-1}. Among all varieties, Anagha (305 kg ha^{-1}) recorded significantly the highest dry matter production followed by RNR 15048 (252 kg ha^{-1}) and MTU 1010 (249 kg ha^{-1}). Anagha recorded 21.03 % and 22.5% higher dry matter production than RNR 15048 and MTU 1010 respectively. Among the NPK fertigation levels, S_{125} (302 kg ha^{-1}) recorded higher dry matter production which was on par withS_{100} (295 kg ha^{-1}) and significantly higher over S_{75} (265 kg ha^{-1}) and S_0 (212 kg ha^{-1}).The S_{75}, S_{100} and S_{125} have recorded 25, 39 and 42.5 per cent higher dry matter production over control (S_0). The S_{125}has recorded 2.37 % and 13.96% higher dry matter production over S_{100} and S_{75}. Among interactions, higher dry matter production was observed in Anagha at S_{125} (347 kg ha^{-1}) which was on par with same variety at S_{100} (342 kg ha^{-1}) and was significantly higher over all other treatments. The lowest dry matter production was recorded in MTU 1010 at S_0 (198 kg ha^{-1}) which was on par with RNR 15048 at S_0 (210 kg ha^{-1}) and significantly lower than all other treatments.

At 60 DAS, dry matter production ranged from 1948 to 4815 kg ha^{-1}. Among all varieties, Anagha (3692 kg ha^{-1}) recorded significantly the highest dry matter production followed by MTU 1010 (2494 kg ha^{-1}) and RNR 15048 (2368kg ha^{-1}). Anagha recorded 48.03%, 55.91% higher dry matter production than RNR 15048 and MTU 1010 respectively. Among the NPK fertigation levels, S_{125} (3584 kg ha^{-1}) recorded significantly the highest dry matter production followed by S_{100} (3050 kg ha^{-1}), S_{75} (2607 kg ha^{-1}) and S_0 (2164 kg ha^{-1}). The S_{75} and S_0 were found to be on par to each other. When compared to S_{125}, there was a difference of 17.51%, 37.47% and 65.62% decreased dry matter production in $S_{100,}$ S_{75} and S_0 respectively. Among interactions significantly the highest dry matter production was observed in Anagha at S_{125} (4815 kg ha^{-1}) followed by the same variety at S_{100} (4015 kg ha^{-1}) at S_{75} (3363kg ha^{-1}), MTU 1010 at S_{125} (3094 kg ha^{-1}), RNR 15048 at S_{125} (2843kg ha^{-1}), RNR 15048 at S_{100} (2574kg ha^{-1}), Anagha at S_0 (2574kg ha^{-1}), MTU 1010 at S_{100} (2561kg ha^{-1}), MTU 1010 at S_{75} (2343 kg ha^{-1}), RNR 15048 at S_{75} (2115 kg ha^{-1}), MTU 1010 at S_0 (1978 kg ha^{-1}) and RNR 15048 at S_0 (1941 kg ha^{-1}) respectively. Significantly the lowest was recorded by RNR 15048 at S_0 which was on par with MTU 1010 at S_0 and RNR 15048 at S_{75}.

At 90 DAS, dry matter production ranged from 2215 to 5495 kg ha^{-1}. Among all varieties, Anagha (4213 kg ha^{-1}) recorded significantly the highest dry matter production followed by MTU 1010 (2846 kg ha^{-1}) and RNR 15048 (2702 kg ha^{-1}). The varieties MTU 1010 and RNR 15048 were found to be on par to each other. Anagha recorded 49.03%, 55.92% higher dry matter production than RNR 15048 and MTU 1010 respectively.

Among the NPK fertigation levels, S_{125} (4089 kg ha^{-1}) recorded significantly the highest dry matter production followed by S_{100} (3480 kg ha^{-1}), S_{75} (2975 kg ha^{-1}) and S_0 (2470 kg ha^{-1}) respectively.

Table.1 Effect of different levels of NPK fertigation levels on SCMR values of different Varieties of rice at 30, 60 and 90 DAS under aerobic cultivation during *kharif*, 2015

30 DAS

Varieties	Fertigation levels*				**Mean**
	S_0	S_{75}	S_{100}	S_{125}	
RNR 15048	30.9	39.7	33.5	39.2	**35.9**
MTU 1010	30.7	26.9	32.8	26.9	**29.4**
Anangha	28.2	34.4	33.4	48.6	**36.2**
Mean	**29.9**	**33.7**	**33.9**	**36.9**	
	Main (V)**	Sub (S)	V at same S	S at same V	
SE+/-	1.7	1.1	2.2	2.7	
CD (P=0.05)	6.9	3.3	4.7	6.5	

60 DAS

RNR 15048	32.2	38.7	36.1	41.2	**37.1**
MTU 1010	35.9	30.1	35.6	30.4	**33.1**
Anangha	33.4	37.3	37.5	51.6	**39.9**
Mean	**33.9**	**35.4**	**36.4**	**41.1**	
	Main (V)	Sub (S)	V at same S	S at same V	
SE+/-	1.0	1.2	1.6	1.9	
CD (P=0.05)	3.8	3.5	3.3	4.7	

90 DAS

RNR 15048	34.2	38.7	36.1	41.7	**37.7**
MTU 1010	35.9	31.9	35.6	30.4	**33.5**
Anangha	33.4	37.3	37.5	50.4	**39.7**
Mean	**34.5**	**35.9**	**36.4**	**40.9**	
	Main (V)	Sub (S)	V at same S	S at same V	
SE+/-	1.4	0.8	1.4	1.8	
CD (P=0.05)	5.4	2.3	2.9	4.5	

* S_0= Control (No N, P_2O_5,K_2O), S_{75} = 90-45-30 kg N, P_2O_5,K_2O ha^{-1},
S_{100} = 120-60-40 kg N, P_2O_5,K_2O ha^{-1}, S_{125} = 150-75-50 kg N, P_2O_5,K_2O ha^{-1}
** Main (V) = Main treatments (Rice varieties); Sub (F) = Sub treatments (Fertigation levels)
Interactions = Main treatments x Sub treatments (Rice varieties x fertigation levels)

Table.2 Effect of different levels of NPK fertigation levels on dry matter production (kg ha-1) different Varieties of rice at 30, 60, 90 DAS and at final harvest under aerobic cultivation during *kharif* 2015

30 DAS

Varieties	Fertigation levels*				**Mean**
	S_0	S_{75}	S_{100}	S_{125}	
RNR 15048	210	243	272	282	**252**
MTU 1010	198	248	272	278	**249**
Anangha	227	303	342	347	**305**
Mean	**212**	**265**	**295**	**302**	
	Main (V)**	Sub (S)	Interactions		
SE+/-	6.2	5.1	6.2		
CD (P=0.05)	24.4	15.1	18.4		

60 DAS

RNR 15048	1941	2115	2574	2843	**2368**
MTU 1010	1978	2343	2561	3094	**2494**
Anangha	2574	3363	4015	4815	**2368**
Mean	**2164**	**2607**	**3050**	**3584**	**2851**
	Main (V)	Sub (S)	Interactions		
SE+/-	80.0	67.0	82.0		
CD (P=0.05)	315.0	199.0	244.0		

90 DAS

RNR 15048	**2215**	2414	2938	3242	**2702**
MTU 1010	**2257**	2674	2922	3531	**2846**
Anangha	**2937**	3838	4581	5495	**4213**
Mean	**2470**	**2975**	**3480**	**4089**	
	Main (V)	Sub (S)	Interactions		
SE+/-	92.0	77.0	94.0		
CD (P=0.05)	361.0	228.0	279.0		

At final harvest

RNR 15048	3611	3935	4789	5284	**4405**
MTU 1010	3678	4359	4763	5754	**4639**
Anangha	4788	6256	7468	8956	**6867**
Mean	**4026**	**4850**	**5673**	**6665**	
	Main (V)	Sub (S)	Interactions		
SE+/-	150.0	125.0	153.0		
CD (P=0.05)	588.0	371.0	454.0		

* S_0= Control (No N, P_2O_5,K_2O), S_{75} = 90-45-30 kg N, P_2O_5,K_2O ha^{-1},
S_{100} = 120-60-40 kg N, P_2O_5,K_2O ha-1, S_{125} = 150-75-50 kg N, P_2O_5,K_2O ha^{-1}

** Main (V) = Main treatments (Rice varieties); Sub (F) = Sub treatments (Fertigation levels)

Interactions = Main treatments x Sub treatments (Rice varieties x fertigation levels)

Table.3 Effect of different levels of NPK fertigation levels on no. of panicles m-2, panicle length (cm), no. of grains panicle-1, test weight (g) of different varieties of rice at final harvest under aerobic cultivation during *kharif*, 2015

Varieties	Fertigation levels*				**Mean**
	S_0	S_{75}	S_{100}	S_{125}	
RNR 15048	137	163	172	188	**165**
MTU 1010	149	174	175	187	**171**
Anangha	168	186	195	201	**188**
Mean	**152**	**174**	**181**	**192**	
	Main (V)**	Sub (S)	V at same S	S at same V	
SE+/-	2	2	3	4	
CD (P=0.05)	6	7	NS	NS	
RNR 15048	19.5	19.3	20.1	20.7	**19.9**
MTU 1010	19.9	18.6	19.6	19.6	**19.5**
Anangha	22.1	21.1	21.8	22.5	**21.9**
Mean	**20.5**	**19.7**	**20.5**	20.9	
	Main (V)	Sub (S)	V at same S	S at same V	
SE+/-	0.3	0.4	0.6	0.6	
CD (P=0.05)	1.2	1.1	NS	NS	
RNR 15048	71	89	94	105	**90**
MTU 1010	83	89	96	102	**93**
Anangha	84	97	105	110	**99**
Mean	**80**	**92**	**99**	**106**	
	Main (V)	Sub (S)	V at same S	S at same V	
SE+/-	1	2	3	3	
CD (P=0.05)	4	6	NS	NS	
RNR 15048	17.3	16.1	16.2	19.2	**17.2**
MTU 1010	21.1	20.9	21.6	21.9	**21.4**
Anangha	24.6	24.2	23.5	24.1	**24.1**
Mean	**21.1**	**20.4**	**20.5**	**21.7**	
	Main (V)	Sub (S)	V at same S	S at same V	
SE+/-	0.7	0.4	0.6	0.8	
CD (P=0.05)	2.6	NS	NS	NS	

* S_0= Control (No N, P_2O_5,K_2O), S_{75} = 90-45-30 kg N, P_2O_5,K_2O ha^{-1},
S_{100} = 120-60-40 kg N, P_2O_5,K_2O ha^{-1}, S_{125} = 150-75-50 kg N, P_2O_5,K_2O ha^{-1}
** Main (V) = Main treatments (Rice varieties); Sub (S) = Sub treatments (Fertigation levels)
Interactions = Main treatments x Sub treatments (Rice varieties x fertigation levels)

Table.4 Effect of different levels of NPK fertigation levels on grain yield (kg ha-1) of different Varieties of rice at final harvest under aerobic cultivation during kharif, 2015

Varieties	Fertigation levels*				**Mean**
	S_0	S_{75}	S_{100}	S_{125}	
RNR 15048	1103	1226	1504	1606	**1360**
MTU 1010	1177	1376	1481	1692	**1432**
Anangha	1382	1852	2136	2578	**1987**
Mean	**1221**	**1485**	**1707**	**1959**	
	Main (V)**	Sub (S)	V at same S	S at same V	
SE+/-	59	45	78	90	
CD (P=0.05)	233	134	163	215	
RNR 15048	2508	2708	3285	3682	**3046**
MTU 1010	2501	2979	3311	4062	**3213**
Anangha	3406	4404	5332	6378	**4880**
Mean	**2805**	**3364**	**3976**	**4707**	
	Main (V)	Sub (S)	V at same S	S at same V	
SE+/-	136	120	181	206	
CD (P=0.05)	527	309	378	491	

* S_0= Control (No N, P_2O_5,K_2O), S_{75} = 90-45-30 kg N, P_2O_5,K_2O ha^{-1},
S_{100} = 120-60-40 kg N, P_2O_5,K_2O ha^{-1}, S_{125} = 150-75-50 kg N, P_2O_5,K_2O ha^{-1}
** Main (V) = Main treatments (Rice varieties); Sub (S) = Sub treatments (Fertigation levels)
Interactions = Main treatments x Sub treatments (Rice varieties x fertigation levels)

Among interactions, significantly the highest dry matter production was observed in Anagha at S_{125} (5495 kg ha^{-1}) followed by the same variety at S_{100} (4581 kg ha^{-1}), at S_{75} (3838 kg ha^{-1}), MTU 1010 at S_{125}(3531 kg ha^{-1}), RNR 15048 at S_{125} (3242 kg ha^{-1}), RNR 15048 at S_{100} (2938 kg ha^{-1})' Anagha at S_0 (2937 kg ha^{-1}), MTU 1010 at S_{100} (2922 kg ha^{-1}), MTU 1010 at S_{75} (2674 kg ha^{-1}), RNR 15048 at S_{75} (2414 kg ha^{-1}), MTU 1010 at S_0 (2257 kg ha^{-1}) and RNR 15048 at S_0 (2215 kg ha^{-1}) respectively. Significantly the lowest was recorded by RNR 15048 at S_0 which was on par with MTU 1010 at S_0 and RNR 15048 at S_{75}.

At harvest, total dry matter production ranged from 3611 to 8956 kg ha^{-1}. Among all varieties, Anagha (6867 kg ha^{-1}) recorded significantly the highest dry matter production followed by MTU 1010 (4639 kg ha^{-1}) and RNR 15048 (4405 kg ha^{-1}). Anagha recorded 48.02 % and 55.89 % higher dry matter production than RNR 15048 and MTU 1010 respectively. Among the NPK fertigation levels, S_{125} (6665 kg ha^{-1}) recorded higher dry matter production followed by S_{100} (5673 kg ha^{-1}), S_{75} (4850 kg ha^{-1}) and S_0 (4026 kg ha^{-1}) respectively. The S_{75}, S_{100} and S_{125} have recorded 20.5, 40.9 and 65.5 per cent higher dry matter production over control (S_0). The S_{125}has recorded 17.48 % and 37.42% increase in dry matter production in $S_{100}$and S_{75} respectively. Among interactions, significantly the highest dry matter production was observed by Anagha at S_{125}(8956 kg ha^{-1}) followed by the same variety at S_{100} (7468 kg ha^{-1}), at S_{75} (6256 kg ha^{-1}), MTU 1010 at S_{125} (5754 kg ha^{-1}), RNR 15048 at S_{125} (5284 kg ha^{-1}), RNR 15048 at S_{100} (4789 kg ha^{-1})' Anagha at S_0 (4788 kg ha^{-1}), MTU 1010 at S_{100} (4763 kg ha^{-1}), MTU 1010 at S_{75} (4359 kg ha^{-1}), RNR 15048 at S_{75} (3935 kg ha^{-1}), MTU 1010 at S_0 (3678 kg ha^{-1}) and RNR 15048 at S_0 (3611 kg ha^{-1}) respectively. The lowest was recorded by RNR 15048 at S_0

which was on par with MTU 1010 at S_0 and significantly lower than other treatments.

It was noticed that among the varieties, Anagha was found to record higher dry matter production under aerobic cultivation. All the three varieties tested gave response to application of NPK up to 125% by fertigation. Increased NPK nutrition under fertigation resulted in uniform distribution and adequate availability of nutrients and water through laterals in the root zone of the crop which in turn promoted the photosynthesis and resulted in higher dry matter production. Increased dry matter production with increase in NPK levels up to 180-90-60 kg N-P_2O_5 and K_2O along with iron sulphate application was reported by Rakesh *et al.*, (2012). Ramamoorthy *et al.*, (1998) observed increased yield attributes leading to higher dry matter production as a result of frequent irrigations. Increase in dry matter production with increase in N level was also reported by Kumar *et al.*, (1996) and they concluded that when rice is grown under aerobic condition, the inability of roots to acclimatise to such changes in soil water regimes may result in reduced growth and function thereby, dry matter production when compared to flooded conditions.

Data regarding yield effecting parameters is represented in Table 3. It is significantly influenced by the varieties, fertigation levels but not by their interactions. At harvest, no. of panicles m^{-2} ranged from 138 to 201. Among all varieties, Anagha (188) recorded significantly the highest no. of panicles m^{-2} followed by MTU 1010 (171) and RNR 15048 (166). The varieties MTU 1010 and RNR 15048 were found to be on par to each other. Anagha recorded 9.94 % and 13.25 % higher no. of panicles m^{-2} than MTU 1010 and RNR 15048 respectively. Among the NPK fertigation levels, S_{125} (192) recorded significantly the highest no. of panicles m^{-2} followed by S_{100} (181), S_{75} (174) and S_0 (152) respectively. The S_{75}, S_{100} and S_{125} have recorded 14.47 %, 19.08 % and 26.32 % higher number of panicles m^{-2} over S_0. The S_{125}, has recorded 7.24 % and 11.85 % of higher no. of panicles m^{-2} than S_{100} and S_{75} respectively. Among interactions, higher no. of panicles $m^{-2}$was observed in Anagha at S_{125} (201) followed by the same variety at S_{100} (195) and the lowest in RNR 15048 at S_0 (138) followed by MTU 1010 at S_0 (149) respectively. Application of NPK fertilizers by fertigation at regular intervals resulted in better availability of these nutrients during the active vegetative stage and panicle initiation stage and resulted in more number of panicles m^{-2}. Among the varieties, even at lower level of fertigation also the variety Anagha was observed to produce more no. of panicles m^{-2} when compared to the other two varieties. Increase in no. of panicles m^{-2} with increase in N fertilizer level was also reported by Adikant Pradhan *et al.*, (2014) among different varieties.

The data regarding panicle length (cm) is represented in Table 3. It was significantly influenced by the varieties and fertigation levels but not by their interactions. The mean panicle length ranged from 19.3 to 22.5 cm. Among all varieties, Anagha (21.9 cm) recorded significantly the highest panicle length followed by MTU 1010 (19.9 cm) and RNR 15048 (19.5 cm). Anagha recorded 10.05% and 21.32% higher than MTU 1010 and RNR 15048 respectively. Among the NPK fertigation levels, S_{125} (20.9 cm) recorded higher panicle length followed by S_{100} (20.5 cm), S_0 (20.5 cm) and S_{75} (19.7 cm) respectively. The S_{125} was on par with S_{100} and S_0 and was significantly higher over S_{75}.The S_{125} recorded 1.95 higher panicle length than both S_{100} and $S_0$and 6.09% higher panicle length than $S_{75.}$ Among interactions, higher panicle length was observed in Anagha at S_{125} (22.5 cm) and the lowest in RNR 15048 at S_{75}.Nonsignificant influence of irrigation methods, schedules and water management practices was reported by Balamani *et al.*, (2012) and Patel *et al.*, (2010). Significant influence of varieties was noticed by Patel *et al.*, (2010) and Rakesh *et al.*, (2012) reported higher panicle length with increasing NPK levels from 120-60-40 to 180-90-60 along with iron sulphate application.

The no. of grains panicle^{-1} was significantly influenced by varieties, fertigation levels but not by their interactions. The no. of grains panicle^{-1} ranged from 71 to 110. Among all varieties, Anagha (99) recorded significantly the highest no. of grains panicle^{-1} followed by MTU 1010 (93) and RNR 15048 (90). The varieties MRU 1010 and RNR 15048 were on par to each other. Anagha recorded 6.4% and 10.0% higher no. of panicles than MTU 1010 and RNR 15048 respectively. Among the NPK fertigation levels, S_{125} (106) recorded significantly the highest no. of grains panicle^{-1} followed by S_{100} (99), S_{75} (92) and S_0 (80) respectively. The S_{75}, S_{100} and S_{125} have recorded 15 %, 23.8 % and 32.5 % higher no. of grains panicle^{-1} over control (S_0).The S_{125} has recorded 7.07% and 15.21% higher no. of grains panicle^{-1} in S_{100}andS_{75}respectively. Among interactions, higher no. of grains panicle^{-1} was observed in Anagha at S_{125} (110) followed by the same variety at S_{100} (105), and the lowest was noticed in RNR 15048 at S_0 (71) followed by MTU 1010 at S_0 (83). Increase in no. of grains panicle^{-1} with increase in NPK doses by fertigation indicates favourable effect of NPK nutrition in increasing the number of grains panicle^{-1}. Rakesh *et al.*, (2012), Mall Reddy *et al.*, (2012) and Adikant Pradhan *et al.*, (2014) also reported higher no. of grains panicle^{-1} with increase in NPK/N levels to aerobic rice.

Test weight (g) was significantly influenced by the varieties but not by the fertigation levels and their interactions. The test weight ranged from16.1 to 24.6 g. Among all varieties, Anagha (24.1 g) recorded significantly the highest test weight followed by MTU 1010 (21.4 g) and RNR 15048 (17.1 g). Anagha recorded 12.61%, and 40.11% increase in test weight than MTU 1010 and RNR 15048 respectively. Among the NPK fertigation levels, S_{125} (21.7 g) recorded higher test weight. Among interactions, higher test was observed in Anagha at S_{0} (24.6 g) followed by Anagha at S_{75} (24.2 g), and the lowest in RNR 15048 at S_{75} (16.1 g).The present study revealed that test weight varied mostly with varieties but not by fertigation levels indicating that is it mostly a genetically influenced parameter. Non-significant influence of irrigation schedules on test weight under aerobic cultivation was reported by Balamani (2012). However, Rakesh *et al.*, (2012) reported higher test weight of variety MTU 1010 at higher dose of N, P_2O_5 and K_2O (180-90-60 kg ha^{-1}) levels.

Data on grain yield, straw yield is represented in Table 4. The grain yield ranged from 1103 to 2578 kg ha^{-1}. Among all varieties, Anagha recorded significantly the highest grain yield followed by MTU 1010 and RNR 15048. The varieties MTU 1010 and RNR 15048 were observed to be on par to each other. Anagha, recorded 38.75 % and 46.10 % higher grain yield than MTU 1010 and RNR 15048 respectively. Among the NPK fertigation levels, S_{125} recorded significantly the highest grain yield followed by S_{100}, S_{75} and S_0 respectively. The S_{75}, S_{100} and S_{125} have recorded 21.6 %, 39.8 % and 60.4 % higher grain yield over control (S_0).Among interactions, higher grain yield was recorded by Anagha at S_{125} followed by the same variety at $S_{100,}$at S_{75} and MTU 1010 at S_{125}. The lowest was recorded by RNR 15048 at S_0 which was on par with MTU at $S_{0.}$ It was noticed that under aerobic cultivation, among the varieties tested, Anagha was observed to perform better over other two varieties. As it is the variety specially released for aerobic cultivation, it could adopt to aerobic conditions better than the other two varieties. Katsura and Nakaide (2011) found that the varieties with greater sink activity and source capacity per plant during the ripening period could produce larger grain weight under aerobic culture.

The straw yield ranged from 2501 to 6378 kg ha^{-1}. Among all varieties, Anagha recorded significantly higher grain yield followed by MTU 1010 and RNR 15048. Anagha, recorded 51.88% and 60.22% higher straw yield than MTU 1010 and RNR 15048 respectively. Among the NPK fertigation levels, S_{125} has recorded significantly the highest straw yield followed by S_{100}, S_{75} and S_0 respectively. The S_{75}, S_{100} and S_{125} have recorded 19.9 %, 41.7 % and 67.8 % higher straw yield over control (S_0). Among the interactions, significantly the highest straw yield was observed by Anagha at S_{125} followed by the same variety at S_{100}.The lowest was recorded by MTU at S_0 which was on par with RNR 15048 at S_0. Increase in straw yield with increase in NPK / N fertilizer doses was also reported by Rakesh *et al.*, (2012) and Malla Reddy *et al.*, (2012).

Thus based on the growth parameters like SPAD values, yield effecting parameters like no. of panicle m^{-2}, panicle length (cm), no. of grains panicle^{-1}, test weight (g) and dry matter production (kg ha^{-1}), it can be recommended to go for fertigation of NPK up to 125% level (150-75-50 kg N-P_2O_5-K_2O ha^{-1}), applied in ten splits at weekly interval to aerobic rice from emergence to flowering stage. Among the varieties tested, Anagha was found to be more suitable for aerobic rice cultivation followed by MTU 1010 and RNR 15048.

Thus based on the growth parameters like SPAD values, yield effecting parameters like no. of panicle m^{-2}, panicle length (cm), no. of grains panicle^{-1}, test weight (g) and dry matter production (kg ha^{-1}), it can be recommended to go for fertigation of NPK up to 125% level (150-75-50 kg N-P_2O_5-K_2O ha^{-1}), applied in ten splits at weekly interval to aerobic rice from emergence to flowering stage. Among the varieties tested, Anagha was found to be more suitable for aerobic rice cultivation followed by MTU 1010 and RNR 15048.

Taking in to consideration of economics, it is suggested to eliminate phosphorus from fertigation programme and go for fertigation of only N and K up to 125% through urea and potassium chloride (white) and better to go for soil application of phosphorus fertilizer as single basal dose to make the fertigation programme of aerobic rice as more economically viable.

References

Abid Khan, S. N., Muhammad Shah, A.B., Muhammad Sajid, K.A and Shah Faisal, A.A. 2014. Influence of nitrogen and potassium levels on growth and yield of chilli (*a*.) *International Journal of Farming and Allied Sciences* 3(3):260-264.

Adikant Pradhan, Thakur, A and Sonbior, H. L. 2014. Response of rice (*Oryza sativa*) varieties to different levels of nitrogen under rainfed aerobic ecosystem. Indian journal of agronomy. 59 (1): 76-79.

Balamani, K., Ramulu V., Reddy M. D and Uma Devi, M. 2012. Effect of irrigation methods and irrigation schedules on aerobic rice. *Journal of Research*. ANGRAU. 40 (4) 84 86.

Dangler, J. M. D and Locasscio, S. J. 1990. Yield of trickle irrigated tomatoes as affected by time of N and K application. *Journal of American Society of Horticultural Science*. 115: 585-589.

Govindan, R and Myrtle Grace, T. 2012. Influence of drip fertigation on growth and yield of rice varieties. *Madras Agricultural Journal*.99 (4-6): 244-247.

Kastura, K and Nakaide, Y.2011. Factors that determine grain weight in rice under high yielding aerobic culture: The importance of husk size. Field crops research. 123: 266-272.

Kumar, N., Singh, V. K. and Thakur, B. R. 1996.Leaf are index of winter rice as influenced by level and time of nitrogen application. *Journal of Applied biology*. 5(1/2): 87-88.

Malla Reddy, M., Padmaja. B., Veeranna, G and Vishnu Vardhan Reddy, D. 2012. Evaluation of popular *kharif* rice (*Oryza sativa* L.). Varieties under aerobic condition and their response to nitrogen dose. *The Journal of Research, ANGRAU*. 40 (4): 14-19.

Patel, D. P., Anup Das, Munda, G. C., Ghosh, P. K., Juri Sandhya Bordoloi and Manoj Kumar. 2010. Evaluation of yield and physiological attributes of high - yielding rice varieties under aerobic and flood-irrigated management practices in mid- hills ecosystem. *Agricultutal Water Management*. 97: 1269-1276.

Rakesh, D., Raghu Rami Reddy. P and Latheef Pasha, Md. 2012. Response of aerobic rice to varying fertility levels in relation to iron application. *The Journal of Research ANGRAU*. 40 (4): 94-97.

Ramamoorthy, K, Arokiaraj, A and Balasubramanian, A.1998.Response of upland direct-seeded rice.

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