International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(6): 2272-2274

Received: 02-08-2020
Accepted: 04-09-2020

Preethi S
PG Scholar, Department of Agronomy, AC & RI, Madurai, Tamil Nadu, India

Gurusamy A
Professor, Department of Agronomy, AC & RI, Madurai, Tamil Nadu, India

Subramanian E
Assistant Professor, Department of Agronomy, AC & RI, Madurai, Tamil Nadu, India

Indirani R
Assistant Professor, Department of Soils and Environment, AC & RI, Madurai, Tamil Nadu, India

Corresponding Author:
Preethi S
PG Scholar, Department of Agronomy, AC & RI, Madurai, Tamil Nadu, India

Screening of rice cultures and mitigation of iron deficiency in aerobic rice

Preethi S, Gurusamy A, Subramanian E and Indirani R

DOI: https://doi.org/10.22271/chemi.2020.v8.i6ag.11110

Abstract
The field experiment was conducted in Water management research block, Department of Agronomy, Agricultural college and Research Institute, Madurai during Rabi' 2019 to screen rice cultures and to mitigate the iron deficiency in aerobic rice system. The experiment was laid out in split plot design with three replications. The main plot comprised of rice culture namely Apo-1 (M_1), CBMAS 14065 (M_2) and CBMAS 14110 (M_3) and the sub plot comprised of foliar spraying of 0.5% $Fe\,SO_4$ on 25 & 45 DAS (S_1), foliar spraying of 0.5% $Fe\,SO_4$ on 45 & 65 DAS (S_2), foliar spraying of 1% $Fe\,SO_4$ on 25 & 45 DAS (S_3), foliar spraying of 1% $Fe\,SO_4$ on 45 & 65 DAS (S_4), soil application of iron chelates @ 2 kg ha^{-1}(S_5) and control (S_6 -water spray). The rice culture CBMAS 14110 responded well to the foliar application of $FeSO_4$ at 1% on 45 and 65 DAS (M_3S_4) as it recorded higher DMP (14260kg/ha). It also registered significantly higher number of panicles (247/m^2), filled grains (261/panicle), grain yield (5878 kg/ha) and straw yield (8449 kg/ha). The maximum plant height (126.8 cm) was recorded in Apo-1 which received 1% $Fe\,SO_4$ foliar spray on 45 and 65 DAS (M_1S_4).

Keywords: Rice cultures, iron, foliar application, aerobic rice

Introduction
Rice is most widely cultivated crop in the world which is the staple food for half of the world population. The cultivated area in India is 43.1 million ha with a total production of 112.9 million tons and with average productivity of 2.6 tons ha^{-1}. In Tamil Nadu, rice is cultivated in 1.82 million ha with the production of 8.0 million tons and productivity of 3.5 tons ha^{-1}(India stat, 2017-18) [3]. Traditional method of rice establishment is transplanting (Sathish *et al*., 2017) [5] which consumes a lion share of available water resources. Present water scarcity threatens the rice growers to adopt water saving technologies like aerobic rice system in which rice is grown as that of upland crops even in water scarce conditions (Bouman *et al*., 2005) [1]. The major problem in aerobic rice cultivation is unavailability of suitable varieties and deficiency of micronutrients especially iron. Iron plays major role in photosynthesis (Vikashkumar *et al*., 2018) [7]. Hence, it is imperative that identification of efficient rice culture suitable for aerobic rice system and amelioration of iron deficiency is very essential to sustain the productivity of aerobic rice cultivation.

Materials and Methods
The field trial was conducted during rabi ˙(2019) at Water management research block, Department of Agronomy, Agricultural College and Research Institute, TNAU, Madurai which is located in the latitude of 9°54˙ N and longtitude of 78□ 54˙ E with the elevation of 147 above mean sea level.
The experiment was laid out in split plot design with three replications. The main plot treatments were M_1- Apo-1, M_2 - CBMAS 14065 and M_3 - CBMAS 14110, and sub plot treatments were S_1 - foliar spray of 0.5% $Fe\,SO_4$ on 25 & 45 DAS, S_2 - foliar spray of 0.5% $Fe\,SO_4$ on 45 & 65 DAS, S_3 -foliar spray of 1% $Fe\,SO_4$ on 25 & 45 DAS, S_4 - foliar spray of 1% $Fe\,SO_4$ on 45 & 65 DAS, S_5- soil application of iron chelates @ 2 kg ha^{-1} S_6 -control (water spray). Broad bed and furrows were formed at 120 x 90/30 cm spacing after thorough land preparation. Dry paddy seeds were dibbled over raised beds at 20 x 10 cm so as to accommodate 5 rows in a bed. The recommended P (50 kg/ha) was applied as basal, while N (150 kg/ha) and K (50 kg/ha) were applied in four equal splits at 15 DAS, active tillering,

panicle initiation and at flowering stages (CPG-TNAU, 2020). The plant protection measures were taken based on necessity. The growth parameters namely plant height, DMP, LAI and SPAD N values and the yield parameters namely number of panicles m^{-2}, filled grains/panicle as well as grain and straw yield of aerobic rice were assessed. The collected data were subjected to the Fishers method of ANOVA technique and results were discussed.

Results and Discussion

Growth attributes of aerobic rice

Plant height, DMP, LAI, and SPAD N values of rice cultures differed significantly in response to foliar application of iron at different concentration and time. Among the cultures, the maximum plant height (105.8 cm) was recorded in Apo-1(M_1). With regard to iron application, foliar application of 1% F_eSO_4 on 45 and 65 DAS (S_4) recorded higher plant height (108.6 cm) which was on par with foliar application of F_eSO_4 at 1% on 25 and 45 DAS (S_3). The tallest plant (126.8 cm) was produced in Apo-1 which received 1% F_eSO_4 foliar spray on 45 and 65 DAS (M_1 S_4).

The data pertaining to DMP recorded at harvest stage is given in table 1. Among the cultures, the maximum DMP (12871 kg/ha) was recorded in CBMAS 14110 (M_3). With regard to iron application, foliar application of 1% F_eSO_4 on 45 and 65 DAS (S_4) recorded higher plant DMP (12063 kg/ ha) which was on par with foliar application of 1% F_eSO_4 on 25 and 45 DAS (S_3).

The availability of sufficient nutrient along with iron enhanced the photosynthetic activity of crop and dry matter production (Goverdhan *et al*., 2017) [2].

The maximum DMP of 14260 kg ha^{-1} was recorded in CBMAS 14110 which received 1% Fe_2SO_4 foliar spray on 45 and 65 DAS (M_3S_4).

Among the cultures, the higher LAI (5.1) and SPAD N (42.3) values were recorded in CBMAS 14110 (M_3). With regard to iron application, foliar spraying of 1% F_eSO_4 on 45 and 65 DAS (S_4) recorded higher LAI (5.6) and SPAD N values (42.2). The interaction was non -significant. The higher LAI may be due to looser soil in aerobic condition which facilitate root to access more water and nutrients which resulted in better crop establishment. The chlorophyll content (SPAD values) was found to be increasing up to flowering stage.

Yield attributes and yield of aerobic rice

Among the cultures, higher number of panicles (210/m^2) were obtained in CBMAS 14110 (M_3) and number of filled grains per panicle (207) were obtained in CBMAS 14110 (M_3) which was on par with CBMAS 14065 (M_2). With regard to iron nutrition, foliar application of 1% F_eSO_4 on 45 and 65 DAS (S_4) recorded higher number of panicles m^{-2} (212) and number of filled grains per panicle (216) which was on par with foliar application of 1% F_eSO_4 on 25 and 45 DAS. The maximum number of panicles m^{-2} (247) and number of filled grains per panicle (261) were recorded in CBMAS 14110 which received 1% F_eSO_4 foliar spray on 45 and 65 DAS (M_3S_4). Foliar application of F_eSO_4 might have increased chlorophyll content, antioxidant enzymes and their activities and finally increased the yield parameters (Kamali *et al*., 2020) [4].

Among the cultures, higher grain (5301 kg ha^{-1}) and straw yield (7625 kg ha^{-1}) were recorded in CBMAS 14110 (M_3). With regard to iron, foliar application of 1% F_eSO_4 on 45 and 65 DAS(S_4) recorded higher grain (5878 kg ha^{-1}) and straw yield (8449 kg ha^{-1}) which was on par with foliar application of 1% F_eSO_4 on 25 and 45 DAS. The maximum grain (5878 kg ha^{-1}) and straw yield (8449 kg ha^{-1}) were recorded in CBMAS 14110 which received 1% F_eSO_4 foliar spray on 45 and 65 DAS (M_3S_4).

The lowest yield were recorded in control. The highest grain and straw yield recorded in this particular treatment might be due to increased tiller production, dry matter accumulation and also influenced by more number of panicles, filled grains and test weight compared to Apo1 and CBMAS 14065.

Foliar spray of iron sulphate recorded higher grain yield. Even though concentration of foliar sprays were different the responses were similar when they were used at same frequency. (Vikash kumar *et al*., 2018) [7]. This was in accordance with the findings of (Ankush kumar singh *et al*., 2018) [6]. Foliar application of F_eSO_4 was more effective than soil application as the uptake and transport to edible parts were higher in foliar application (Fang *et al.*, 2008).

Table 1: Effect of iron application on plant height and DMP of rice cultures

Treatments	Plant height (cm)at harvest				DMP (kg/ha) at harvest			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_1	99.7	90.2	98.5	96	11134	9128	12466	10909
S_2	100	92.6	99.2	97.3	11885	9309	12528	11241
S_3	113	94.5	102	103.2	12360	9519	13328	11736
S_4	126.8	95.2	103.6	108.5	12379	9549	14260	12063
S_5	98.6	88.2	95.9	94	11005	9020	12370	10799
S_6	96	77	92.5	88.5	10360	8160	12273	10264
Mean	105.7	89.6	98.6		11521	9114	12871	
	M	S	M x S	S x M	M	S	M x S	S x M
SEd	1.94	2.64	4.60	4.57	170	172	321	298
CD (p=0.05)	5.39	5.39	10	9.34	472	351	721	608

Table 2: Effect of iron application on LAI and SPAD N values of rice cultures

Treatments	LAI (AT)	LAI (PI)	LAI (FLR)	SPAD N (AT)	SPAD N (PI)	SPAD N (FLR)
Factor 1: Rice cultures						
M_1	2.4	3.9	4.5	35	37	38.8
M_2	1.9	3	3.9	32.9	34	36
M_3	2.6	4.1	5	38	40.2	42.3
SEd	0.06	0.10	0.14	0.62	0.81	0.88
CD (p=0.05)	0.16	0.27	0.39	1.72	2.24	2.45
Factor 2: Iron application						
S_1	2.2	3.7	4.4	35.3	36.9	38.9
S_2	2.3	3.8	4.7	35.9	37.4	39.5
S_3	2.4	4	4.9	36.3	38.1	40.1
S_4	2.8	4.5	5.6	37.9	40.2	42.2
S_5	2.1	3.3	4	34.7	36.1	38
S_6	1.8	2.6	3.2	32.2	34	35.4
SEd	0.12	0.14	0.17	0.70	0.85	0.95
CD (p=0.05)	0.25	0.29	0.35	1.44	1.73	1.93

Table 3: Effect of iron application on yield attributes of rice culture

Treatments	No of panicles/m^2				No of filled grains/panicle			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_1	170	180	202	184	169	196	186	184
S_2	180	188	203	190	172	208	200	193
S_3	184	203	223	203	175	210	235	207
S_4	185	205	247	212	176	211	261	216
S_5	153	173	198	174	168	187	183	179
S_6	132	169	185	162	140	169	174	161
Mean	167	186	210		167	197	207	
	M	S	M x S	S x M	M	S	M x S	S x M
SEd	4.22	4.37	8.10	7.56	4.72	6.10	10.74	10.57
CD (p=0.05)	11.73	8.93	18.18	15.48	13.12	12.46	23.47	21.58

Table 4: Effect of iron application on grain and straw yield of rice culture under aerobic system

Treatments	Grain yield (kg ha^{-1})				Stalk yield (kg ha^{-1})			
	M_1	**M_2**	**M_3**	**Mean**	**M_1**	**M_2**	**M_3**	**Mean**
S_1	4057	3721	5134	4304	7077	5407	7494	6659
S_2	4349	3817	5141	4436	7375	5491	7515	6794
S_3	4715	3879	5502	4699	7473	5617	7962	7017
S_4	4756	3891	5878	4842	7480	5657	8449	7195
S_5	3983	3620	5114	4239	7022	5401	7410	6611
S_6	3827	3260	5035	4041	6884	4934	6921	6246
Mean	4281	3698	5301		7219	5418	7625	
	M	S	M x S	S x M	M	S	M x S	S x M
SEd	100	74	154	128	114	98	192	170
CD (p=0.05)	279	151	362	261	316	201	442	347

The study concluded that iron application improved aerobic rice yield. Foliar application of iron sulphate had better result than soil application. Hence, the rice culture CBMAS 14110 can be recommended for aerobic system of rice cultivation with 1% F_eSO_4 foliar spray on 45 and 65 DAS (M_3S_4) for getting economic yield.

Reference

1. Bouman BAM, Peng S, Castaneda AR, Visperas RM. Yield and water use of irrigated tropical aerobic rice systems. Agricultural Water Management 2005;74(2):87-105.
2. Goverdhan M. Influence of iron and zinc management on drymatter production and nutrient removal by rice (*Oryza sativa* L.) and soil fertility status under aerobic cultivation. Chem Sci Rev Lett 2017;6(24):2627-2635.
3. India stat, Socio – economic statistical information about India 2017-18. http://www.indiastat.com/default.aspx.
4. Kamali B, Chandra Sekaran, N, Kalaiselvi T, Chitdeshwari T. Exogenous foliar application of F_e SO_4 on enrichment of iron in rice grain and yield.Journal of Pharmacognosy and Phytochemistry 2020;9(4):3344-3348.
5. Sathish A, Kumar KA, Reddy PRR, Devi MU. Effect of different crop establishment methods and irrigation regimes on rice (*Oryza sativa* L.) Yield and Water Use Efficiency. Int. J. Curr. Microbiol. App. Sci 2017;6(9):90-95.
6. Singh AK, Singh V. Effect of Foliar application of Iron,Zinc and Age of Seedlings on Growth and Yield of Rice (*Oryza sativa* L.). Int. J Curr. Microbiol. App. Sci 2018;7(8):1062-1068
7. Vikash Kumar, Dinesh Kumar, Singh YV, Rishi Raj, Nain Singh. Effect of iron nutrition on plant growth and yield of aerobic rice. Int. J Curr. Microbiol. App. Sci 2018;6(4):999-1004.