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Impact of iron nutrition on yield and economics of aerobic rice cultivars

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Abstract

A field experiment entitled was conducted during *kharif* season, 2012 and 2013 at College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad to evaluate the response of cultivars and iron nutrition on yield and economics. Experiment was carried out with three rice cultivars *i.e.* Tellahamsa (M_1), MTU 1010 (M_2) and KRH 2 (M_3) as main treatments and twelve iron nutrition treatments *i.e*, control (S_1), basal application of iron sulphate @ 25 kg ha^{-1} (S_2), basal application of iron chelate @ 25 kg ha^{-1} (S_3), 3 foliar sprays of iron sulphate from 21 DAS @ 7 days interval (S_4), 3 foliar sprays of iron sulphate from 21 DAS @ 10 days interval up to maximum tillering (S_5), 3 foliar sprays of iron sulphate from 21 DAS @ 15 days interval up to panicle initiation stage (S_6), basal application of iron sulphate @ 25 kg ha^{-1} + 3 foliar sprays of iron sulphate from 21 DAS @ 7 days interval (S_7), basal application of iron sulphate @ 25 kg ha^{-1}+ 3 foliar sprays of iron sulphate from 21 DAS @ 10 days interval up to maximum tillering (S_8), basal application of iron sulphate @ 25 kg ha^{-1} + 3 foliar sprays of iron sulphate from 21 DAS @ 15 days interval up to panicle initiation stage (S_9), basal application of iron chelate @ 25 kg ha^{-1}+3 foliar sprays of iron sulphate from 21 DAS @ 7 days interval (S_{10}), basal application of iron chelate @ 25 kg ha^{-1}+ 3 foliar sprays of iron sulphate from 21 DAS @ 10 days interval up to maximum tillering (S_{11}), basal application of iron chelate @ 25 kg ha^{-1}+ 3 FS of iron sulphate from 21 DAS @ 15 days interval up to panicle initiation stage (S_{12}) as sub treatments laid out in split plot design replicated thrice. The higher grain and straw yield recorded with KRH 2 which was significantly superior over Tellahamsa and MTU 1010 during 2012 and 2013. Similarly, highest gross returns, net returns and B: C ratio was noticed with KRH 2 cultivar. Among sub plots, higher gross returns were observed with BA of IC @ 25 kg ha^{-1}+ 3 FS of IS from 21 DAS @ 7 DI. But, higher net returns and B: C ratio was observed with BA of IS @ 25 kg ha^{-1} + 3 FS of IS from 21 DAS @ 7 DI.

Keywords: Iron nutrition, Aerobic rice, Yield, Economics, Cultivars

1. Introduction

Rice (*Oryza sativa L.*) is one of the most important staple food crop in the world. Globally rice is grown over an area of 161.83 million ha with an annual production of 717.8 million tonnes (IRRI, 2017). In Asia more than two billion people are getting 60-70 % of the energy requirements from rice. In India, rice occupies an area of 44.50 million ha with an average production of 159.02 million tonnes with productivity of 3.57 t ha^{-1} (IRRI, 2017). Rice deserves a special status among cereals as world's most important wetland crop. The water requirement for traditional transplanted rice is 1500 mm. It means to produce one kg of rice, about 3000-5000 litres of water is required under irrigated conditions (Bouman and Tuong, 2001) [2]. The application of water for rice production is 5-6 times more than the other crops (wheat and maize). The appalling paucity of water threatens the sustainability of irrigated rice ecosystems these days. Such water shortage in many rice growing areas is prompting a search for production systems that use less water to produce rice (Farooq *et al.*, 2011) [3].

The aerobic rice system is a new production system in which rice is grown under non-puddled, non-flooded and non-saturated soil conditions as other upland crops (Prasad, 2011). Thus in aerobic rice system, soils are kept aerobic almost throughout the rice growing season. In addition to lesser water availability, other factors in aerobic rice system include soil mechanical impedance, increased oxygen supply to roots, accumulation of ethylene and carbon dioxide in root tissue and availability of nitrogen as nitrate in place of ammonium (the dominant N ion under flooded conditions), and a changed soil fauna (Vosenek and Van der Veen, 1994) [10]. But despite the usefulness of aerobic rice system there are still many constraints that restrict its adoption by rice farmers. The major constraints in aerobic rice system are unavailability of cultivars specifically bred for it, large weed and nematode infestation and the iron deficiency. Since rice plants cannot easily acquire iron from soil under aerobic condition despite its abundance, iron deficiency is one of the major limiting factor affecting rice grain yield and quality of aerobic rice. For sustainable aerobic rice cultivation there is a need to find out the ways and means of effective iron management. Keeping these points in view, the study was taken to evaluate different iron nutrition levels in rice cultivars to obtain maximum yield.

2. Material and Methods

A field experiment was carried out for two consecutive years during *kharif* 2012 & 13 at College Farm, College of Agriculture, Rajendranagar, Hyderabad, Telangana state to study the performance and economics of aerobic rice cultivars with iron nutrition. The soil of the experimental field was sandy clay loam in texture, neutral to slightly alkaline in reaction (7.2 and 7.3), low in organic carbon (0.45) as well as available nitrogen (210 and 221 kg ha^{-1}), medium in available phosphorus (22.6 and 32.6 kg ha^{-1}) and available potassium (250 and 257.8 kg ha^{-1}) at the start and end of the experiment, respectively. The total rainfall of 499 and 620.8 mm was received in 34 and 40 rainy days during 2012 and 2013, respectively.

The treatments consisted of 36 combinations comprising of three rice cultivars (Tellahamsa (M_1), MTU 1010 (M_2) and KRH 2 (M_3)), twelve iron nutrition levels i.e. control (S_1), basal application of iron sulphate @ 25 kg ha^{-1} (S_2), basal application of iron chelate @ 25 kg ha^{-1} (S_3), 3 foliar sprays of iron sulphate from 21 DAS @ 7 days interval (S_4), 3 foliar sprays of iron sulphate from 21 DAS @ 10 days interval up to maximum tillering (S_5), 3 foliar sprays of iron sulphate from 21 DAS @ 15 days interval up to panicle initiation stage (S_6), basal application of iron sulphate @ 25 kg ha^{-1} + 3 foliar sprays of iron sulphate from 21 DAS @ 7 days interval (S_7), basal application of iron sulphate @ 25 kg ha^{-1}+ 3 foliar sprays of iron sulphate from 21 DAS @ 10 days interval up to maximum tillering (S_8), basal application of iron sulphate @ 25 kg ha^{-1}+ 3 foliar sprays of iron sulphate from 21 DAS @ 15 days interval up to panicle initiation stage (S_9), basal application of iron chelate @ 25 kg ha^{-1}+ 3 foliar sprays of iron sulphate from 21 DAS @ 7 days interval (S_{10}), basal application of iron chelate @ 25 kg ha^{-1}+ 3 foliar sprays of iron sulphate from 21 DAS @ 10 days interval up to maximum tillering (S_{11}), basal application of iron chelate @ 25 kg ha^{-1}+ 3 FS of iron sulphate from 21 DAS @ 15 days interval up to panicle initiation stage (S_{12}).

The experiment was laid out in split plot design with three replications. The seeds were soaked in water for 24 hours and incubated for 48 hours in moist gunny bag for sprouting. The furrows were opened with the help of hand hoe at 20 cm spacing between the rows and sprouted seeds were dibbled in solid rows at a seed rate of 40 kg ha^{-1}. Thinning and gap filling were done at 10 DAS to maintain the uniform plant stand in all the plots. Recommended nitrogen @ 120 kg ha^{-1} was applied in three equal splits *i.e*, at sowing, maximum tillering and panicle initiation stage of the crop, in the form of urea. Phosphorus and potassium were applied basally as per the recommended dose of 60 kg of P_2O_5 and 40 kg of K_2O ha^{-1} in the form of SSP and MOP, respectively. Iron sulphate and chelate @ 25 kg $FeSO_4$ ha^{-1} were applied at the time of sowing as per the treatments. Three foliar sprays of Iron sulphate @ 2% + citric acid 2.0 g l^{-1} of water were sprayed starting from 21 DAS at weekly, 10 days interval and 15 days interval as per the treatments. The data on yield and economics were recorded in each treatment for two years. Standard procedures were followed for drying and recording observations.

3. Results and Discussion

3.1. Grain and straw yield

The data on grain and straw yield of aerobic rice as influenced by cultivars and iron nutrition is presented in Table 1. Among the rice cultivars, significant difference was observed with respect to grain and straw yield. KRH 2 produced significantly higher grain and straw yield over the other two cultivars *i.e*, MTU 1010 and Tellahamsa. Lowest grain and straw yield was observed in Tellahamsa cultivar. The difference in the yield may be attributed due to their genetic constitution. Similar results were also reported by Sridhra *et al*. (2012) and Reddy and Padmaja (2013) [7].

Among the twelve sub plots, During 2012 and 2013, highest grain and straw yield was produced with basal application of iron chelate @ 25 kg ha^{-1} + three foliar sprays of 2.0 % $FeSO_4$ from 21 DAS at 7 days interval (S_{10}) followed by 25 kg ha^{-1} iron chelate as basal + three foliar sprays of 2.0 % $FeSO_4$ at 10 days interval (S_{11}) and was at par with S_{12} (iron chelate @ 25 kg ha^{-1}+ three foliar sprays of 2.0 % $FeSO_4$ from 21 DAS @ 15 days interval). The next order of treatments which produced higher grain and straw yield were basal application of iron sulphate + 3 foliar sprays of iron sulphate at 7, 10 and 15 days interval *i.e*, S_7, S_8, S_9.

Among the foliar sprays of iron sulphate, 7 days interval sprays *i.e*, S_4 registered higher grain and straw yield followed by sprays at 10 days interval *i.e*, S_5 and was at par with 15 days interval sprays (S_6). All foliar sprays were significantly superior over only basal application of iron sulphate @ 25 kg ha^{-1} (S_2) and iron chelate @ 25 kg ha^{-1} (S_3) and control (S_1). Lowest grain and straw yield was observed in control i.e S_1. Between the two iron sources, iron chelate applied basally @ 25 kg ha^{-1} had produced higher grain yield but at par with S_2 treatment. Higher grain and straw yield with iron nutrition was mainly due to higher crop growth with more number of effective tillers, higher number of filled grains, more panicle weight and thousand grain weight and increased supply of photosynthates from source to sink. These results also confirms the findings of Shaygany *et al.*, 2012, Yadav *et al.*, 2013, Kumar *et al.*, 2015) [8, 5].

3.2. Economics

3.2.1. Gross returns

In case of cultivars, KRH 2 recorded significantly higher gross returns (84005 and 89211Rs. ha^{-1}) as compared to rest of the cultivars under study. However, the next best cultivar was MTU 1010 (66713, 72139 Rs. ha^{-1}). Tellahamsa recorded lower gross returns (40322 and 43471 Rs. ha^{-1}) during 2012 and 2013 (Table 2). Higher yield produced by the hybrid KRH 2 resulted in maximum gross returns.

Among the years, the second year sown crop recorded highest gross returns to first year crop as the grain and straw yield are more during second year. During 2012 and 2013, 887691 and 93287 Rs. ha^{-1} gross returns was produced with basal application of iron chelate @ 25 kg ha^{-1} + three foliar sprays of 2.0 % $FeSO_4$ from 21 DAS at 7 days interval (S_{10}) followed by 81649 and 86785 Rs. ha^{-1} gross returns produced with 25 kg ha^{-1} iron chelate as basal + three foliar sprays of 2.0 % $FeSO_4$ at 10 days interval (S_{11}) which was at par with S_{12} (78044 and 84358 Rs. ha^{-1}) (iron chelate @ 25 kg ha^{-1}+ three foliar sprays of 2.0 % $FeSO_4$ from 21 DAS @ 15 days interval). The next best treatmental combination which produced higher gross returns were basal application of iron sulphate + 3 foliar sprays of iron sulphate at 7, 10 and 15 days interval i.e. S_7 (74175 and 80285 Rs. ha^{-1}), S_8 (69007 and 73694 Rs. ha^{-1}), S_9 (66540 and 71043 Rs. ha^{-}

^{1}). Among the foliar sprays of iron sulphate, 7 days interval sprays i.e. S_4 (60657 and 64820 Rs. ha^{-1}) registered higher gross returns followed by sprays at 10 days interval i.e. S_5 (55286 and 59282 Rs. ha^{-1}) and was at par with 15 days interval sprays (53568 and 57233 Rs. ha^{-1}) (S_6). All foliar sprays were significantly superior over only basal application of iron sulphate @ 25 kg ha^{-1} (S_2) and iron chelate @ 25 kg ha^{-1} (S_3) and control (S_1).

Lowest gross returns was observed in control i.e S_1 (43237 and 47012 Rs. ha^{-1}). Between the two iron sources, iron chelate applied basally @ 25 kg ha^{-1} had produced higher grain yield (48088 and 51778 Rs. ha^{-1}) and at par with S_2 treatment (46220 and 49707 Rs. ha^{-1}) i.e. basal application of iron sulphate @ of 25 kg ha^{-1}. Higher level of biomass accrual and efficient translocation to the reproductive parts due to supply of adequate nutrients through iron nutrition might be responsible for production of elevated yield attributes and thereby yield which lead to higher monetary returns. Similar findings were reported by Baishya *et al.* (2016). The interaction effect on gross returns was found non significant between cultivars and iron nutrition in aerobic rice.

3.2.2. Net returns

The net income was estimated treatment wise on the basis of existing market rates of inputs and the produce obtained. The data thus obtained are presented in Table 2. Among the rice cultivars, significant difference was observed with respect to net returns. KRH 2 produced significantly higher net returns over the other two cultivars i.e. MTU 1010 and Tellahamsa. During 2012 and 2013 the net returns of KRH 2 was 54213 and 59418 Rs. ha^{-1} respectively followed by MTU 1010 (40521 and 45946 Rs. ha^{-1}). Lowest net returns of 14130 and 17279 Rs. ha^{-1} was observed in Tellahamsa cultivar. Higher grain and straw yield produced by the hybrid KRH 2 resulted in maximum net returns. These results are in accordance with Naik *et al.*, (2015).

During 2012 and 2013, however, in case of net returns highest of 51140 and 57250 Rs. ha^{-1} was produced with basal application of iron sulphate @ 25 kg ha^{-1} + three foliar sprays of 2.0 % $FeSO_4$ from 21 DAS at 7 days interval (S_7) which was on par with 25 kg ha^{-1} iron chelate as basal + three foliar sprays of 2.0 % $FeSO_4$ at 7 days interval (S_{10}) i.e. with 50406 and 56002 Rs. ha^{-1} net returns.The next best treatmental combination which produced higher net returns was basal application of iron sulphate + 3 foliar sprays of iron sulphate at 10 days interval *i.e*, S_8 (45972 and 50659 Rs. ha^{-1}) and was on par with S_{11} (44364 and 49500 Rs. ha^{-1}), S_9 (43505 and 48008 Rs. ha^{-1}) and S_{12} (40759 and 47073 Rs. ha^{-1}).

Among the foliar sprays of iron sulphate, 7 days interval sprays i.e. S_4 (38372 and 42535 Rs. ha^{-1}) registered higher net returns and was on par with sprays at 10 days interval i.e. S_5 (33001 and 36997 Rs. ha^{-1}) and significantly superior to 15 days interval sprays (31283 and 34948 Rs. ha^{-1}) (S_6). All foliar sprays were significantly superior over only basal application of iron sulphate @ 25 kg ha^{-1} (S_2) and iron chelate @ 25 kg ha^{-1} (S_3) and control (S_1). Lowest net returns was observed in basal application of iron chelate @ 25 kg ha^{-1} *i.e*, S_3 (11373 and 15063 Rs. ha^{-1}) during the both years of investigation. Iron sulphate applied basally @ 25 kg ha^{-1} *i.e*, S_2 had produced higher net returns over basal application of iron chelate (23755 and 27242 Rs. ha^{-1}) and at par with control i.e. S_1 (21522 and 25297 Rs. ha^{-1}). Though higher gross monetary returns were obtained with combined application of iron chelate basal and foliar sprays of iron sulphate, but higher net monetary returns obtained with application of sulphate as basal and foliar combination this is due to very high cost of cultivation with chelate application compared to sulphate. Similar findings were reported by Kumar *et al.*, (2015) [5]. The interaction effect on net returns was found non significant between cultivars and iron nutrition in aerobic rice.

3.2.3 B: C Ratio

The data variation in B:C ratio of aerobic rice in relation to different cultivars and iron nutrition is furnished in the Table 2. Among the cultivars, Tellahamsa recorded lower B:C ratio (0.59 and 0.72) compared to other cultivars. MTU 1010 recorded higher B:C ratio over Tellahamsa (1.63, 1.84) but significantly inferior to KRH 2 (1.89 and 2.07) during two successive years of field investigation. Thus KRH 2 proved significantly superior over other two cultivars in 2012 and 2013.

Iron nutrition also had significant effect on B:C ratio. The highest B:C ratio was recorded with S_7 *i.e*, iron sulphate as basal @ 25 kg ha^{-1} + 3 foliar sprays of iron sulphate at 7 days interval (2.19, 2.46) followed by S_8 (iron sulphate as basal @ 25 kg ha^{-1} + 3 foliar sprays of iron sulphate at 10 days interval) (1.97 and 2.18) and S_9 *i.e*, iron sulphate as basal @ 25 kg ha^{-1} + 3 foliar sprays of iron sulphate at 15 days interval (1.86 and 2.06) during 2012 and 2013 respectively due to lower cost of iron sulphate fertilizer as compared to the cost of iron chelate when used as basal application @ 25 kg ha^{-1}. Further, these treatments were followed by only foliar application of iron sulphate *i.e*, S_4, S_5 and S_6. Among these sprays, B:C ratio was high with S_4 *i.e*, 3 foliar sprays of Iron Sulphate @ 7 days interval (1.69 and 1.88) followed by S_5 (1.45 and 1.63) and was at par with S_6 (1.38 and 1.54) during 2012 and 2013 respectively. S_{10} *i.e*, iron chelate as basal @ 25 kg ha^{-1} + 3 foliar sprays of iron sulphate at 7 days interval registered less B:C ratio of 1.34, 1.49 and was on par with S_{11} (iron chelate as basal @ 25 kg ha^{-1} + 3 foliar sprays of iron sulphate at 10 days interval) (1.17 and 1.31) and significantly superior to S_{12} *i.e*, iron chelate as basal @ 25 kg ha^{-1} + 3 foliar sprays of iron sulphate at 15 days interval (1.08 and 1.25) during 2012 and 2013 respectively.

S_1 had obtained B:C ratio of 0.96 and 1.13 and was on par with S_2 (1.03 and 1.18) during both the years of study. Though the grain yields are lower with S_1 there was no cost incurred on iron nutrition, hence high BCR of S_1. Lowest B:C ratio was recorded with iron chelate as basal @ 25 kg ha^{-1} (S_3) *i.e*, 0.30 and 0.40 though significantly higher grain and straw yield was obtained due to higher cost of iron chelates BC ratio is lower with S_3 compared to S_1 and S_2. Though higher gross monetary returns were obtained with combined application of iron chelate basal and foliar sprays of iron sulphate, but higher net monetary returns obtained with application of sulphate as basal and foliar combination due to low cost of iron sulphate fertilizer in comparison with the chelate. The treatments which include basal application of iron chelate reduced the BCR due to more price of iron chelate nutrient. Similar findings were reported by Yadav *et al.* (2011) [11]. The interaction effect of cultivars and iron nutrition on B:C ratio was not significant.

4. Conclusion

From this investigation it can be concluded that, out of three cultivars KRH 2 was ideal in realizing higher yield and economics. Among twelve iron nutrition treatments, S_{10} was ideal for realizing yield and gross returns whereas, S_7 had shown better in terms of net returns and B:C ratio.

Table 1: Grain yield (kg ha^{-1}) and Straw yield (kg ha^{-1}) of aerobic rice as influenced by cultivars and iron nutrition.

Treatments		Grain yield (kg ha^{-1})		Straw yield (kg ha^{-1})	
		2012	2013	2012	2012
Main plots (M)					
M_1- Tellahamsa		2663	2765	3732	3840
M_2 - MTU 1010		4460	4651	5735	5842
M_3- KRH 2		5665	5786	6827	6935
SE m (±)		79	103	83	52
CD (P=0.05 %)		312	405	325	202
Sub plots (S)					
S_1- Control (no iron)		2793	2938	4503	4593
S_2-BA of IS @ 25 kg ha^{-1}		3023	3135	4515	4615
S_3- BA of IC @ 25 kg ha^{-1}		3152	3276	4640	4720
S_4-3 FS of IS from 21 DAS @ 7 DI		4049	4161	5264	5404
S_5- 3 FS of IS from 21 DAS @ 10 DI		3662	3786	5027	5107
S_6- 3 FS of IS from 21 DAS @ 15 DI		3544	3645	4906	5016
S_7- BA of IS @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 7 DI		5011	5223	5959	6109
S_8- BA of IS @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 10 DI		4646	4769	5670	5820
S_9- BA of IS @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 15 DI		4464	4587	5599	5699
S_{10}- BA of IC @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 7 DI		5976	6111	6623	6743
S_{11}- BA of IC @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 10 DI		5548	5671	6302	6392
S_{12}- BA of IC @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 15 DI		5285	5508	6169	6249
SE m (±)		149	155	116	101
CD (P=0.05 %)		420	437	327	285
Interaction					
Main at sub	SE m (±)	258	268	201	175
	CD (P=0.05 %)	NS	NS	NS	NS
Sub at main	SE m (±)	259	276	209	175
	CD (P=0.05 %)	NS	NS	NS	NS

BA-Basal application, IS-Iron Sulphate, IC-Iron Chelate, FS-Foliar spray, DI-days interval

Table 2: Gross returns (Rs. ha^{-1}), Net returns (Rs. ha^{-1}) and B:C ratio (%) of aerobic rice as influenced by cultivars and iron nutrition.

Treatments		Gross returns		Net returns		B:C ratio	
		2012	2013	2012	2013	2012	2013
Main plots (M)							
M_1- Tellahamsa		40322	43471	14130	17279	0.59	0.72
M_2 - MTU 1010		66713	72139	40521	45946	1.63	1.84
M_3- KRH 2		84005	89211	54213	59418	1.89	2.07
SE m (±)		1013	1352	1013	1352	0.04	0.05
CD (P=0.05 %)		3977	5310	3977	5310	0.16	0.20
Sub plots (S)							
S_1- Control (no iron)		43237	47012	21522	25297	0.96	1.13
S_2-BA of IS @ 25 kg ha^{-1}		46220	49707	23755	27242	1.03	1.18
S_3- BA of IC @ 25 kg ha^{-1}		48088	51778	11373	15063	0.30	0.40
S_4-3 FS of IS from 21 DAS @ 7 DI		60657	64820	38372	42535	1.69	1.88
S_5- 3 FS of IS from 21 DAS @ 10 DI		55286	59282	33001	36997	1.45	1.63
S_6- 3 FS of IS from 21 DAS @ 15 DI		53568	57233	31283	34948	1.38	1.54
S_7- BA of IS @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 7 DI		74175	80285	51140	57250	2.19	2.46
S_8- BA of IS @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 10 DI		69007	73694	45972	50659	1.97	2.18
S_9- BA of IS @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 15 DI		66540	71043	43505	48008	1.86	2.06
S_{10}- BA of IC @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 7 DI		87691	93287	50406	56002	1.34	1.49
S_{11}- BA of IC @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 10 DI		81649	86785	44364	49500	1.17	1.31
S_{12}- BA of IC @ 25 kg ha^{-1}+3 FS of IS from 21 DAS @ 15 DI		78044	84358	40759	47073	1.08	1.25
SE m (±)		1918	2091	1918	2091	0.07	0.08
CD (P=0.05 %)		5415	5905	5415	5905	0.21	0.23
Interaction							
Main at sub	SE m (±)	3322	3622	3322	3622	0.13	0.14
	CD (P=0.05 %)	NS	NS	NS	NS	NS	NS
Sub at main	SE m (±)	3338	3722	3338	3722	0.13	0.14
	CD (P=0.05 %)	NS	NS	NS	NS	NS	NS

BA-Basal application, IS-Iron Sulphate, IC-Iron Chelate, FS-Foliar spray, DI-days interval

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