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Irrigated Rice Yield Influenced by Sulfur Sources in Fertilization

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INTRODUCTION

The yield of irrigated rice grains in Brazil has increased considerably in the last decade, reaching a level around 9 t/ha in 2019/2020 harvest. This progress is a result of the red rice control with the "Clearfield" technology and the implementation of a set of management practices including the use of sulfur (S) in balanced fertilization (MENEZES et al. 2012).

Around 90% of the sulfur in plants is found on amino acids that are essential for plant development. The S demanded for one ton of irrigated rice is around 2.1 kg, of which 1.1 kg is exported in grain and 1 kg is in straw. The aim of this experiment was to evaluate the use of different S sources in the yield and quality of irrigated rice.

METHODS

The experiment was conduced at Chasqueiro Technological Center, Arroio Grande, Rio Grande do Sul state in Brazil, 2020/2021 growing season. The soil was an Planossolo Háplico Eutrófico Solódico according STRECK et al. (2008) (Alfisol in american soil taxonomy) and contained 280 g kg^{-1} of clay; 9.0 g kg^{-1} of organic matter; 8.5 mg dm^{-3} of P, 69 mg dm^{-3} of K; 11.40 mg dm^{3} of S; 3.7 $cmol_c$ dm^{-3} of Ca and 2.5 $cmol_c$ of Mg. CEC was 7 $cmol_c$ dm^{-3} and pH 5.3. Experimental design was in randomized blocks and contained 7 treatments and 4 replications and consisted in blends among urea, MAP, KCl and other sources in order to supply 185 kg ha^{-1} of N, 108 kg ha^{-1} P_2O_5, and 102 kg ha^{-1} of K_2O, except Treatment 1 without any fertilization. The S sources to supply 25 kg ha^{-1} of S are described in Table 1, except treatments 1 and 2 without S application.

The crop was implanted on conventional cultivation system and management was carried out based on research indications for irrigated rice cultivation (SOSBAI, 2018). The variety IRGA 424 RI was sown in the amount of 60 kg ha^{-1} of seeds, with a 17 cm spacing between rows. Irrigation was carried out with permanent water depth in all plots simultaneously.

It was evaluated the effect of S sources on the height of rice plants, grain yield, number of grains per panicle, spikelet sterility, and percentage of broken grains. Data were submitted to analysis of variance using F test, and the means compared by the t test at the level 5% of probability.

Table 1. Sulfur sources and rates of nutrients applied in the experimental plots.

TREATMENTS / SULFUR SOURCES	N	P_2O_5	K_2O	S
	kg ha^{-1}			
T1. NO FERTILIZATION	0	0	0	0
T2. NO SULFUR	185	108	102	0
T3. ELEMENTAL S (90%S)	185	108	102	25
T4. SINGLE SUPERPHOSPHATE (10%S)	185	108	102	25
T5. AMMONIUM SULPHATE (21%S)	185	108	102	25
T6. BLEND 08-40-00 + 9.3%S	185	108	102	25
T7. POLYHALITE (19.2%S)	185	108	102	25

RESULTS AND DISCUSSION

Table 2 shows the results found for each variable. The development of plants, evaluated according to their height, was significantly affected by the application of fertilizers, and the use of Polyhalite as a source of S favored the formation of taller plants. The yield of irrigated rice grains have significant differences between the S sources, and Polyhalite was the only source with a positive response in relation to the treatment without S.

The application of Polyhalite also favored the development of a greater number of grains per panicle. No differences were observed related to the application of fertilizers or for the sources of S in relation to the spikelet sterility. However, the use of fertilizers significantly reduced the amount of broken grains, and the sources of S showed good results, highlighting the use of ammonium sulfate.

Table 2. Height of rice plants (cm), grain yield (Mg ha^{-1}), number of grains per panicle, spikelet sterility (%), an amount of broken grains (%), as a function of treatments with different sulfur sources

TREATMENTS	Height of plants, cm	Grain yield, Mg ha^{-1}	grains per panicle	Spikelet sterility, %	Broken grains, %
T1. NO FERTILIZATION	99.3 b	14.14 c	113.6 b	17.6 a	10.2 a
T2. NO SULFUR	103.8 a	16.37 b	122.2 ab	14.7 a	7.8 ab
T3. ELEMENTAL S (90%S)	102.5 a	17.49 ab	128.1 ab	15.1 a	9.3 ab
T4. SINGLE SUPERPHOSPHATE (10%S)	103.4 a	17.51 ab	128.1 ab	15.7 a	8.0 ab
T5. AMMONIUM SULPHATE (21%S)	103.5 a	17.42 ab	127.9 ab	16.2 a	6.6 b
T6. BLEND 08-40-00 + 9.3%S	102.0 ab	17.05 ab	122.2 ab	17.0 a	7.1 ab
T7. POLYHALITE (19.2%S)	102.5 a	18.13 a	128.9 a	15.4 a	7.7 ab
CV%	1.88	4.83	8.05	15.02	26.55

Means followed by the same letter do not differ from each other by Testa at 5% probability

CONCLUSIONS

The dataset analyzed allows us to state that rice cultivation responded to sulfur, especially when high yields are expected or when soils are deficient. The greatest potential was obtained with the Polyhalite source.

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