Oryza Vol. 44. No.2, 2007 (169-171)

Integrated use of farmyard manure and sulfur for the growth and yield of rice

R. Bhuvaneswari*, M.V. Sriramachandrasekharan and M. Ravichandran

Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalainagar - 608 002, India

ABSTRACT

A field experiment was conducted in sulfur deficient soil to study the effect of farmyard manure and sulfur on the growth and yield of rice var. ADT 43. The treatments consisted of four levels of S applied through gypsum in the presence and absence of farmyard manure. The results revealed that the rice responded well to the application of sulfur and FYM. Physiological traits like CGR, RGR, NAR, LAI and chlorophyll content increased with S levels and highest value was noticed with 40 kg S ha^{-1} in the presence of FYM and declined thereafter with further rise in S level. The yield characters viz., number of panicles m^{-2}, number of filled grains $panicles^{-1}$, 1000 grain weight, grain and straw yield increased with S levels and highest grain and straw yield was noticed with 40 kg S ha^{-1} plus FYM @ 12.5 t ha^{-1}. The per cent increase over control due to this treatment was 32.2 and 30.4 for grain and straw yield respectively. Response ratio was maximum at 20 kg S $ha^{-1}$and declined with S levels. However, it was higher in the presence of FYM compared to sulfur alone.

Key words: *FYM, sulfur , growth , yield, rice*

Sulfur is increasingly being recognized as one of the major plant nutrients (Tandon, 1995). Sulfur deficiencies are wide spread in Indian soils and reports of more areas found deficient in S are coming in regularly (Tandon and Messick, 2002). Addition of organic matter represents an important sources for supply of nutrients specially sulfur. In Indian soils, organic sulfur in surface soil constitute 5 to 98% of total sulfur. Rate of decomposition of organic matter strongly influence availability of sulfur. Response of crops to sulfur fertilization has mainly carried out using only inorganic sulfur sources and there has been only few studies on integrated use of organics with inorganic sulfur on crops especially rice. Hence the present study was taken up on integrated use of FYM and sulfur on growth and yield of rice.

The field experiment was conducted in wetland farms, Faculty of Agriculture, Annamalai University in Kondal Series (Typic Haplusterts) during Kharif 2002. The experimental soil was clay loam in texture with pH 8.1, EC 0.36 dS m^{-1}, organic carbon 3.8 g kg^{-1},$KMnO_4$-N(210 kg ha^{-1}),Olsen-P (13.5 kg ha^{-1}), NH_4OAc-K (310 kg ha^{-1}) and 0.15% $CaCl_2$-S (8.4 mg kg^{-1}). The treatments consisted of four levels of S (0, 20, 40, 60 kg ha^{-1}) applied through gypsum in the presence or absence of FYM (12.5 t ha^{-1}). The experimental design was FRBD with 3 replications. Twenty five old rice seedlings (var. ADT 43) were transplanted one week after incorporation of FYM. The physiological parameters like CGR(crop growth rate), RGR(Relative growth rate), NAR(Net assimilation rate) and LAI (Leaf area index) were worked out. Chlorophyll content at tillering and flowering stages was analyzed. Yield attributes, grain and straw yields were recorded at harvest stage.

Application of sulfur alone or in combination with FYM significantly increased the physiological characters over control (Table 1). The CGR, RGR, NAR, LAI and chlorophyll content were least, which did not receive sulfur and FYM. Leaf area index (LAI) was significantly higher with application of 40 kg S ha^{-1} and 12.5 t ha^{-1} FYM over other levels of S and FYM. LAI was maximum at panicle initiation stage. Chatterjee and Maiti (1988) stated the grain yield was a stable function of LAI and maximum LAI was usually recorded at flowering or 15 days after panicle initiation.

Table 1. Effect of sulfur and FYM on physiological characters of rice

Organics (t ha^{-1}) S levels(kg^{-1})	Leaf area index (LAI)			Relative growth rate (RGR) (g g^{-1}day^{-1})			Crop growth rate (CGR) (gm^{-2} day^{-1})			Net assimilation rate (NAR) (g^{m-2} day^{-1})			Chlorophyll (mg 100 g^{-1} for unnit)		
	-FYM	+FYM	Mean	-FYM	+FYM	Mean	-FYM	+FYM	Mean	-FYM	+FYM	Mean	-FYM	+FYM	Mean
0	3.01	3.10	3.06	22.8	25.6	24.2	7.5	8.4	7.9	0.87	0.84	0.86	0.17	1.08	0.63
20	3.09	3.21	3.15	26.5	27.1	26.8	8.7	9.0	8.9	0.93	0.86	0.89	0.48	1.29	0.89
40	4.89	5.09	4.99	32.2	32.1	32.1	10.6	10.5	10.6	1.60	1.03	1.32	1.53	1.77	1.65
60	4.01	4.26	4.14	29.7	33.4	31.6	9.8	10.9	10.4	0.90	0.94	0.92	1.43	1.57	1.49
Mean	3.75	3.91	-	29.8	29.5	-	9.13	9.7	-	1.08	0.92	-	0.90	1.43	-
	S	FYM	S x FYM	S	FYM	S x FYM	S	FYM	S x FYM	S	FYM	S x FYM	S	FYM	S x FYM
CD (P=0.05)	0.03	0.02	0.05	0.60	0.43	0.86	0.08	0.06	0.12	0.03	0.02	0.04	0.04	0.03	0.06

Crop growth rate, relative growth rate and net assimilation rate increased with rice growth. This was due to higher assimilation of basic food material, through photosynthesis during these stages which in turn was due to vigorous root and shoot growth (Thakur and Patel, 1999). Application of 40 kg S ha^{-1} in the presence of FYM registered the highest CGR, RGR and NAR over other treatments. Similarly the chlorophyll content increased with crop growth and was highest in the presence of sulfur @ 40 kg ha^{-1} and FYM compared to rest of the treatments. All the physiological traits recorded lesser value at 60 kg S ha^{-1} than in 40 kg ha^{-1}. The beneficial effect of S in all cases seemed to be the result of its low initial status in soil and S application at 40 kg S ha^{-1} could be more advantageous for profuse vegetative and root growth which activated higher absorption of NPS from soil and improved metabolic. Similar result was obtained by Biswas *et al*. (1995). Favorable effect of FYM was visible due to greater nutritional contribution through enhanced physiochemical properties of soil and durable availability of plant nutrients for longer period (Singh *et al*., 2000).

Addition of sulfur in the presence of FYM attributes significantly increased yield and rice yield over control and individual application (Table 2, Fig.1). The maximum grain yield (5500 kg ha^{-1}) and straw yield (7125 kg ha^{-1}) was noticed with 40 kg S ha^{-1} and decreased thereafter with further increase in S level. The percent increase over control was 14.5 and 15.4 for grain and straw yield respectively. Similarly addition of 12.5 t ha^{-1} of FYM caused 11.1 and 9 per cent increase in grain yield and straw yield respectively over control. However, the highest grain yield (5750 kg

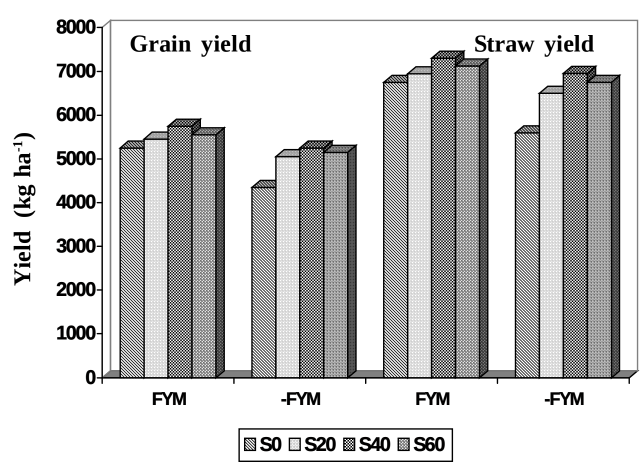

Fig1. Effect of sulfur and FYM on rice yield

Table 2. Effect of sulfur and FYM on yield attributes

S levels (kg ha^{-1})	Number of Panicles m^{-2}			Number of filled grains panicle^{-1}			1000 grain weight (g)		
	FYM	-FYM	Mean	FYM	-FYM	Mean	FYM	-FYM	Mean
S_1 - 0	281	272	277	79	75	77	19.5	19.4	19.4
S_2 - 20	291	288	290	86	84	85	20.2	20.1	20.1
S_3 - 40	299	296	298	96	95	96	21.0	20.9	20.9
S_4 - 60	293	290	292	91	85	88	20.6	20.5	20.5
Mean	291	287	-	88	85	-	20.3	20.2	-
	S	FYM	S x FYM	S	FYM	S x FYM	S	FYM	S x FYM
CD (P=0.05)	1.39	0.99	1.97	0.18	0.13	0.26	0.77	0.54	1.08

ha^{-1}) and straw yield (7300 kg ha^{-1}) was observed with 40 kg S ha^{-1} added with 12.5 t FYM ha^{-1}, the per cent increase over control was 32.2 and 30.4 for grain ands straw yield respectively. However, there was 9.5 per cent increase in grain yield only due to combined application over individual application of S at 40 kg ha^{-1} and FYM (12.5 t ha^{-1}). Favourable effect of S on yield characters and rice yield could be due to its stimulating effect in the synthesis of chloroplast protein resulting greater photosynthetic efficiency which in turn resulted in increased yield (Biswas and Tewatia, 1991) coupled with improved availability of nutrients and increased uptake which ultimately reflected on yield. The decrease in yield at 60 kg S ha^{-1} might be due to nutrient imbalance in plants (Mukhi and Shukla, 1991). Favorable effect of S on rice yield was reported by Wani and Refique (2000). Increase in grain and straw yield due to FYM could be due to conducive physical environment coupled with higher photosynthetic efficiency and nutrient absorption. The agronomic efficiency was highest at 20 kg S ha^{-1} and decreased with S levels and it was still higher in the presence of FYM (Fig. 2). Poongothai *et al*. (1999) reported higher agronomic efficiency due to combined application of green manure and S than their individual application.

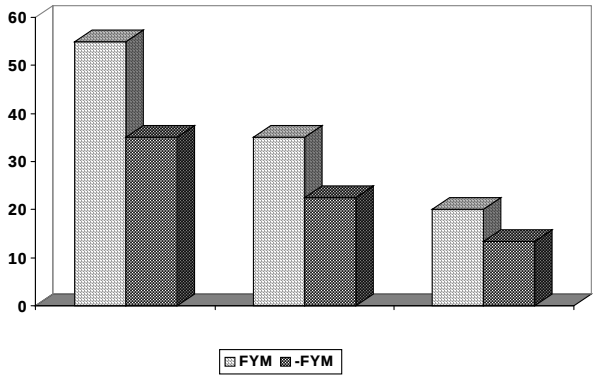

Fig. 2. Effect of sulfur and FYM on agronomic efficiency

REFERENCES

Biswas DR, Ali SA and Khera MS 1995. Response of gobhi sarson to nitrogen and sulfur. J Indian Soc Soil Sci 43(2): 220-230

Biswas BC and Tewatia RK 1991. Role of sulfur in balanced nutrition. In International Symposium on role of S, Mg and micronutrients in balanced plant nutrition, Chengdur, China, p.6.

Chatterjee BN and Maiti S 1988. Principles and practices of rice growing. 2nd Edn. Oxford and IBH Publication Co Ltd., New Delhi, pp. 133-135

Mukhi AK and Shukla VC 1991. Effect of S and Zn on yield and their uptake in rice in submerged soil conditions. J Indian Soc Soil Sci, 39: 730-734

Poongothai S, Savithiri P, Vennila RK and Joseph Biju 1999. Influence of gypsum and green leaf manure on rice and soil deficient in sulfur. J Indian Soc Soil Sci, 47(1): 96-99

Singh GR, Pandya KS, Chaure NK, Pacihav SS and Chadhan KK 2000. Soil fertility, productivity and profitability of rice under different organic manures. Oryza. 37(3): 208-212

Thakur DS and Patel SR 1999.Growth and sink potential of rice as influenced by split application of nitrogen with and without FYM in inceptisols of eastern part of Central Peninsular India. Oryza. 36(3): 280-282

Tandon HLS and Messick DL 2002.Practical sulfur guide. The Sulfur Institute, Washington. DC. Pp.20

Wani MA and Refique MM 2000. Effect of different levels of sulfur on yield and nutrient uptake of rice. Adv Plant Sci 13(1): 139-143