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Response of toria (*Brassica campestris* subsp. *oleifera* var. *toria*) to sources and levels of sulphur fertilization

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ABSTRACT

A field experiment was conducted at Shillongani during *rabi* 1995-96 and 1996-97 to find out suitable source and levels of sulphur on toria (*Brassica campestris* L. subsp. *oleifera* var. *toria*) variety 'TS 38' under rainfed conditions. Sulphur fertilization significantly improved most of the growth, yield attributes, seed yield (20.1%) in both the years as well as oil content (2.5%) during 1995-96 as compared to no sulphur application. Application of gypsum and elemental sulphur indicated their superiority in increasing the seed yield over pyrite as source of sulphur. The response per kg of sulphur applied reached a maximum of 9.4 kg seeds at 20 kg S/ha and it decreased thereafter to 5.8 and 4.1 kg seeds at 40 and 60 kg S/ha respectively.

Key words : *Toria*, Sulphur sources, Seed yield

Sulphur plays a multiple role in the nutrition of oilseed crops. Among oilseed crops, rapeseed - mustard have the highest requirement of S with the optimum level ranging from 20 to 60 kg S/ha, depending on the soil S status, yield potential and N level used (Aulakh and Pasricha, 1997). Recently, there has been a growing concern that the pool of available S in the soil may have been depleted particularly in light soils with little organic matter due to increased removal of S by adoption of high yielding fertilizer responsive crop varieties, increased cropping intensity, extensive use of sulphur free fertilizer and inclusion of pulses and oilseeds in cropping sequences (Tandon, 1991). But unfortunately, almost all the oilseeds growers of Assam use fertilizers containing the major nutrients only for raising their crop productivity. Information on the use of sulphur as plant nutrient is meagre in North eastern states of India. Therefore an attempt was made to study the effect of sources and levels of sulphur application on *toria.*

MATERIALS AND METHODS

A field experiment was conducted during winter (*rabi*) seasons of 1995-96 and 1996-97 at Regional Agricultural Research Station, Shillongani (Assam). The experimental soil was silty loam in texture with pH 5.6, medium in available N (296.0 kg/ha), low in

available P_2O_5 (23.7 kg/ha), rich in available K_2O (330.0 kg/ha) and NH_4OAC-extractable available S 20 ppm. Total 10 treatments comprising control (without sulphur), 3 sources of S (pyrite, gypsum and elemental sulphur) each at 3 levels (20, 40 and 60 kg/ha) were laid out in randomized block design replicated 3 times. A uniform basal dose of 60 kg N, 30 kg P_2O_5 and 30 kg K_2O/ha was applied to all the plots. Toria variety 'TS 38' was sown on 11 November 1995 and 10 November 1996 with a row spacing of 30 cm and harvested after 95 days in both the years. The total rainfall recorded during the crop seasons were 61.0 mm and 40.0 mm in *rabi* 1995-96 and 1996-97 respectively.

RESULTS AND DISCUSSION

Effect of sulphur fertilization

Sulphur fertilization (i.e. the average effect of sulphur application treatment over all sources and levels) significantly improved the number of branches/plant, siliquae/plant, test weight, seed weight/plant (1996-97), seed yield, stalk yield and oil content (1995-96) as compared to control (Tables 1 and 2). Increase in these parameters could be ascribed to the overall improvement in plant vigour and production of sufficient photosynthates through increased leaf area and chlorophyll content of leaves with applied sulphur (Tandon, 1991). Beneficial effect of sulphur on yield attributes might be due to better availability of N, K and S and their translocation which reflects in terms of increased yield attributes of the crops. The results confirm the findings of Rathore and Manohar (1989). But the increase in plant height and seeds/siliqua during both the years failed to bring any significant

Table 1. Growth and yield attributes of *toria* as influenced by sources and levels of sulphur

Treatment	Plant height (cm)		Branches/plant (No.)		Siliquae/plant (No.)		Seeds/siliqua (No.)		Test weight (g)	
	95-96	96-97	95-96	96-97	95-96	96-97	95-96	96-97	95-96	96-97
Control	82.9	96.8	5.10	6.57	60.6	93.0	12.6	13.1	3.18	3.20
S	85.8	101.3	6.17	7.61	75.9	125.4	13.4	13.5	3.58	3.59
CD (P = 0.05)	NS	NS	1.03	0.94	22.0	14.9	NS	NS	0.36	0.33
Sources of sulphur										
Pyrite	83.5	98.5	5.62	6.97	66.4	112.6	13.4	13.6	3.39	3.42
Gypsum	86.6	102.9	6.07	7.90	74.3	137.6	13.1	13.8	3.59	3.69
Elemental S	87.3	102.4	6.83	7.97	87.0	126.0	13.8	13.0	3.75	3.64
CD (P = 0.05)	NS	NS	0.80	0.73	12.1	11.5	NS	NS	0.20	0.18
Sulphur level (kg/ha)										
20	85.8	99.2	6.01	7.40	74.4	119.1	13.3	13.6	3.47	3.53
40	84.7	101.5	6.06	7.80	77.1	127.2	13.4	13.5	3.60	3.60
60	86.9	103.1	6.44	7.70	76.3	129.9	13.4	13.5	3.67	3.62
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

difference due to sulphur fertilization over control.

Effect of sources of sulphur

Significantly higher number of branches/plant, silliquae/plant, test weight of seeds, seed yield (kg/ha) and stalk yield (kg/ha) were observed due to application of gypsum or elemental sulphur as compared to pyrite. Average increase of seed yield over control was 12.9, 29.5 and 32.2% due to application of pyrite, gypsum and elemental sulphur respectively as sources of sulphur. High response to gypsum in respect of seed yield might be due to its readily available SO_4 - S and high calcium content, whereas pyrite might had further acidifying effect. The difference in plant height, seeds/siliqua, oil content and seed weight/plant failed to bring any marked change due to use of different sources of sulphur. Gypsum and elemental sulphur were found to be better source as compared to pyrite.

Effect of sulphur levels

Increasing levels of S increased the growth and yield attributes, viz. plant height, siliquae/plant, test weight, seed weight/plant as well as seed and stalk yields (kg/ha) in both the years without any statistical significance (Tables 1 and 2). The increase in seed yield of *toria* due to application of 20 kg S/ha over control was 141.3 kg/ha (16.9%) during *rabi* 1995-96. The rate of increase in yield was very low due to further increase of sulphur levels beyond 20 kg S/

Table 2. Effect of source and levels of sulphur on seed weight per plant, seed yield, stalk yield and oil content of *toria*.

Treatment	Seed weight (g/plant)		Seed yield (kg/ha)			Stalk yield (kg/ha)		Oil content (%)	
	1995-96	1996-97	1995-96	1996-97	Pooled	1995-96	1996-97	1995-96	1996-97
Control	2.64	3.50	836.0	923.3	879.7	1,295.8	1,505.1	43.52	44.41
Sulphur	2.89	4.43	986.9	1,215.5	1,101.2	1,524.1	1,871.0	44.61	44.70
CD (P = 0.05)	NS	0.92	129.5	132.8	116.7	203.6	208.3	0.82	NS
Sources of sulphur									
Pyrite	2.65	3.98	892.1	1,099.4	995.8	1,356.0	1,671.2	44.38	44.39
Gypsum	3.10	4.86	965.3	1,323.7	1,144.5	1,554.2	2,113.3	44.55	44.22
Elemental S	2.93	4.44	1,103.1	1,223.4	1,163.3	1,662.0	1,810.7	44.90	44.61
CD (P = 0.05)	NS	NS	102.9	104.0	65.0	157.7	161.1	NS	NS
Sulphur level (kg/ha)									
20	2.81	4.14	977.3	1,157.4	1,087.4	1,506.7	1,782.8	44.36	44.58
40	2.93	4.43	990.9	1,230.2	1,110.6	1,531.4	1,893.1	44.56	44.48
60	2.95	4.72	992.3	1,258.9	1,125.6	1,534.1	1,937.2	44.91	44.17
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	18.6	16.6	10.7	9.8	7.6	10.6	8.8	1.44	1.81

ha during the same season. In *rabi* 1996-97 the increase in seed yield due to sulphur fertilization @ 20, 40 and 60 kg/ha over control were 234.1 (25.4%), 306.9 (33.2%) and 335.6 kg/ha (36.3%) respectively. The highest response (7.07 to 11.71 kg seeds/kg S) to applied sulphur was recorded at lowest level of sulphur (20 kg/ha) during both the years and the response declined with increasing S level. Thus it is evident the fertilizing the *toria* crop with 20 kg S/ha was most beneficial because of higher crop response and comparable seed yields with higher sulphur levels. The results conforms to the findings of Chakraborty *et al.* (1994) and Mohapatra and Chandra (1992).

From the present study, it may be concluded that application of sulphur @ 20 kg/ha either in the form of gypsum or elemental sulphur in addition to recommended dose of N, P and K may increase the productivity of rainfed *toria* in Assam.

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