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RESPONSE OF CASTOR (*RICINUS COMMUNIS* L.) TO SULPHUR UNDER IRRIGATED CONDITIONS OF UTTAR PRADESH, INDIA

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Abstract

A field experiment was carried out at Oilseeds Research Farm, C.S.A. University of Agriculture and Technology, Kanpur (U.P.), India; during *kharif* 2011-2012 to assess the response of castor to sulphur application and to identify good source of sulphur for higher seed yield and economic returns. The treatment comprised of 4 levels of sulphur (0, 10, 20 and 30kg S/ha) and 3 sources of sulphur application (Single superphosphate, Gypsum and Elemental sulphur) in randomized block design with 3 replications. The results showed that application of 20 kg sulphur/ha through single superphosphate recorded significantly higher seed yield (2685 kg/ha) compared to no sulphur application (2093 kg/ha). Application of 20 kg sulphur/ha through gypsum also produced significantly higher seed yield (2577 kg/ha) compared to no sulphur application (control).

The economic analysis revealed that application of 20 kg sulphur/ha through single superphosphate accrued the highest gross returns (Rs. 88,605/ha), net returns (Rs. 66,233/ha) and B:C ratio (3.96) while no application of sulphur (control) treatment resulted in lowest gross returns (Rs. 69,069/ha) and net returns (Rs. 47,003/ha). Application of 20 kg sulphur/ha through gypsum also recorded higher gross returns (Rs. 85,041/ha), net returns (Rs. 61,988/ha) and B:C ratio (3.69) compared to no sulphur application (control).

Key words : Elemental sulphur, single superphosphate, gross returns, B:C ratio.

Introduction

Castor (*Ricinus communis* L.) is a non edible, industrial oilseed crop, which plays an important role in Indian economy. The crop is well known for its non-edible oil (45-50% oil in seeds), which is completely biodegradable with its tremendous uses. India plays a lead role in the production and productivity of castor in the world with a production of 2.34 million tones seeds while China, producing 0.18 million tones of castor is the second largest producer (FAO, 2013). Cultivation of castor in India has mainly been confined to Gujarat, Andhra Pradesh, Telengana, Rajsthan and Tamilnadu. If this leadership in castor production is to be sustained in future, its cultivation must be extended in non-traditional area. Though, Uttar Pradesh is considered to be non-traditional area of castor, but the climate is best suited for its cultivation (Srivastava, 2007). Sulphur plays an important role in the formation of amino acids, synthesis of proteins, chlorophyll, oil content and nutritive quality (Jamal *et al*., 2009). Use of non-sulphur fertilizers in intensive agricultural activities results soil sulphur deficiency in the country. Sulphur –containing fertilizers being susceptible to leaching losses, do not necessarily resolve the problem. Application of elemental sulphur may be good option to take care of leaching problem. Sulphur nutrition to the crop is influenced by sources and doses. Pandey *et al*. (2014) observed that foliar application of gypsum @ 2% gave better result than foliar application of micro-ionized S in wheat. Considering this, a study was undertaken to find out the effect of various sources and doses on the performance of castor under irrigated conditions of Uttar Pradesh.

Materials and Methods

A field experiment was conducted at Oilseeds Research Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (Uttar Pradesh, India) during *kharif* season of 2011-12 and 2012-13. The experimental field was sandy loam in texture with low available nitrogen (180 kg) and medium available phosphorus (16.2 kg) and available potash (170 kg). Ten treatments comprised from 4 sulphur doses, *i.e*. 0 (control), 10, 20 and 30 kg S/ha supplied through 3 sources, *i.e*. single superphosphate (SSP), gypsum and elemental sulphur was tested on castor hybrid 'DCH-

144', in randomized block design and replicated thrice. Sowing was done on August 02, 2011 and July 19, 2012. The crop was fertilized with recommended dose of NPK (50:25:15 kg/ha). Half dose of nitrogen and full dose of P & K was applied through diammonium phosphate (DAP), urea and murriate of potash at the time of sowing as basal and remaining half nitrogen was applied through top dressing of urea in two equal splits in standing crop at 30 and 45 DAS. Sulphur was applied basal as per treatment (doses and sources were used as per treatment). Seeds were treated with carbendazim @ 1 g/kg of seeds to protect from seed borne diseases. Seeds were dibbled @ 2 seeds/hill at a depth of 4-5cm in the rows made at 90cm keeping 60cm plant to plant distance. All the

Table 1 : Effect of treatment on growth and yield attributes of castor.

Treatment	Plant height (cm)		Branches/plant		Spikes/plant		Spike length (cm)		Capsules/spike	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
10 kg S/ha (SSP)	124.5	131.2	6.2	6.3	6.6	7.3	54.0	49.2	62.3	62.7
20 kg S/ha (SSP)	130.3	134.5	6.6	6.8	7.1	8.0	56.7	50.5	65.1	65.5
30 kg S/ha (SSP)	129.1	133.7	6.3	6.7	6.9	7.8	56.2	49.5	63.8	64.2
10kg S/ha (Gypsum)	123.6	126.8	5.9	6.0	6.3	6.9	53.9	47.9	61.0	61.3
20kg S/ha (Gypsum)	128.6	131.1	6.4	6.7	6.9	7.6	56.2	50.0	64.0	64.5
30kg S/ha (Gypsum)	128.1	131.0	6.1	6.5	6.7	7.4	55.5	49.3	63.5	63.7
10kg S/ha (Elemental Sulphur)	123.5	126.5	5.6	5.9	6.1	6.5	53.4	47.3	60.3	60.3
20kg S/ha (Elemental Sulphur)	127.7	130.7	6.3	6.6	6.5	7.4	55.8	49.5	62.1	62.5
30kg S/ha (Elemental Sulphur)	127.9	130.6	5.9	6.4	6.3	6.7	53.3	48.6	61.5	61.7
Control	120.5	123.6	4.8	5.3	5.3	6.0	44.3	43.3	50.9	51.1
S.Em.±	3.8	3.6	0.3	0.28	0.26	0.35	2.8	2.9	4.0	3.1
C.D. (P=0.05)	NS	NS	0.8	0.9	0.8	1.03	8.3	NS	11.9	9.1

Table 2 : Total seed yield and economic returns as influenced by sulphur doses and sources.

Treatment	Seed yield (kg/ha)		Gross returns (Rs./ha)		Cost of cultivation (Rs./ha)		Net returns (Rs./ha)		B : C ratio	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
10 kg S/ha (SSP)	2370	2416	78210	72480	21940	24783	56270	47697	3.56	1.92
20 kg S/ha (SSP)	2685	2716	88605	81480	22372	25383	66233	56097	3.96	2.21
30 kg S/ha (SSP)	2577	2593	85041	77790	22812	26228	62229	51562	3.73	1.97
10kg S/ha (Gypsum)	2349	2369	77517	71070	22563	24388	54954	46682	3.44	1.91
20kg S/ha (Gypsum)	2577	2431	85041	72930	23053	24565	61988	48365	3.69	1.97
30kg S/ha (Gypsum)	2494	2508	82302	75240	23550	24742	58752	50498	3.49	2.04
10kg S/ha (Elemental Sulphur)	2290	2307	75570	69210	24483	26213	51087	42997	3.09	1.64
20kg S/ha (Elemental Sulphur)	2358	2376	77814	71280	26900	28214	50914	43066	2.89	1.53
30kg S/ha (Elemental Sulphur)	2330	2316	76890	69480	29115	30215	47775	39265	2.64	1.30
Control	2093	2138	69069	64140	22066	24211	47003	39929	3.13	1.65
S.Em.±	140	129	-	-	-	-	-	-	-	-
C.D (P=0.05)	416	383	-	-	-	-	-	-	-	-

Sale rate of castor's seed – Rs. 33/kg in 2011-12 and Rs. - 30/kg in 2012-13.

recommended cultural practices and required suitable plant protection measures were adopted to raise a good crop. The crop was harvested in three pickings manually based on physiological maturity of the capsules.

Results and Discussion

Growth and yield attributes

Different doses and sources of sulphur could not bring significant variation in plant height during both the years. Aonymous (2012) from Hiriyur also did not observe significant effect of sulphur on plant height of castor. Yield attributes like number of branches/plant, number of spikes/plant and number of capsules/spike were significantly influenced with sulphur application where application of 20 kg S/ha through SSP being comparable with 20 kg S/ha through Gypsum increased the number of these attributes significantly as compared to control. Application of 20 kg S/ha either through Gypsum or through SSP increased significantly the yield attributes like spike length, number of capsules/spike and 100 seed weight in Hiriyur (Anonymous, 2012) (table 1).

Total seed yield and economics

The results revealed that application of sulphur influenced the total seed yield during both the years. Application of 20 kg S/ha through SSP recorded significantly higher seed yield compared to control. This was due to more number of branches/plant, more spikes/plant and increased number of capsules/spike. Application of 20 kg S/ha through Gypsum also gave significantly higher seed yield compared to control. Anonymous (2012) also reported maximum seed yield and oil yield kg/ha with application of 20 kg S/ha through SSP from Navsari (Gujarat), India.

Application of 20 kg S/ha through SSP showed highest gross returns, net returns and B:C ratio during both the years of experimentation. The next best treatment was application of 20 kg S/ha through Gypsum while control resulted in lowest value of economic returns. Anonymous (2012) reported from Hiriyur (Karnataka, India) that application of 20 kg S/ha through Gypsum being close to 20 kg S/ha through SSP recorded higher gross returns, net returns and B:C ratio in castor crop (table 2).

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