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Effect of sulphur on growth of mustard under late sown condition in Dhanbad

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Abstract
Mustard (Brassica species) is the major Rabi oilseed crop of India. Mustard seed is the second most important oil seed crop in India after soyabean accounting for nearly 20-22% of the total oilseeds produced in the country. This crop accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop. Since these crops are cultivated mainly in the rain-fed and resource scarce regions of the country, their contribution to livelihood security of the small and marginal farmers in these regions is also very important. A On Farm trials were conducted in 2018-19 during rabi season in ten location in the Dhanbad district. Results of the experiment revealed that yield attributes like number of branches per plant, no. of siliqua /plant, test weight of 1000 grains, cost of cultivation, net return and benefit cost ratio were recorded significantly higher with application of recommended dose of fertilizer (NPK -80 :40:40) with 20 kg sulphur/ha followed by RDF (80 :40:40) + 10 kg sulphur/ha. The net return and benefit cost ratio is also significantly higher than farmers practice ((30:20:0:0).

Keywords: Mustard, technological option, sulphur, silique, yield attributes, yield

Introduction
India is the fourth largest oilseed economy in the world. Among the seven edible oilseeds cultivated in India, mustard (*Brassica juncea* L. Czern and Coss) contributes 28.6% in the total oilseeds production and ranks second after groundnut sharing 27.8% in the India's oilseed economy. The site-specific nutrient management through soil-test recommendation based should be adopted to improve upon the existing yield levels obtained at farmers field. Effective management of natural resources, integrated approach to plant-water, nutrient and pest management and extension of mustard cultivation to newer areas under different cropping systems will play a key role in further increasing and stabilizing the productivity and production of mustard. In Dhanbad mustard is mostly cultivated under rain-fed condition on sandy loam to sandy soils. However, in Dhanbad district, mustard is grown in an estimated area of 7856 ha. With the total production of 7070 tone and 915 kg/ ha of productivity (District Agriculture Officer, Dhanbad).

The main causes for low production are large acreage under marginal land, which is deficient in major nutrients and imbalanced nutrient management. It has been establishing that there is a positive correlation between fertilizer use and crop production. On an average, crop absorbs as much sulphur as phosphorus. Sulphur can be rightly called as the 'fourth major elements' in plant nutrition after nitrogen, phosphorous and potash (Goswami, 1986) [1]. Tandon (1991) [6] reported that in India sulphur deficiencies occur in scattered manner in about 180 districts and yield response of oil seed crop to sulphur application under field condition. When a soil is deficient in sulphur and this deficiency is not rectified, then the full yield potential of a crop cannot be realized regardless of other nutrients applied, adoption of improved crop varieties or

top class crop husbandry practices. The present study planned to study the effect of different levels of sulphur on yield attributes and yield of mustard.

Methodology

The field experiment was conducted at the Dhanbad, by the Krishi Vigyan Kendra, Dhanbad at 10 farmer's field in *Rabi* season during 2017-18 and 2018-19. Mustard variety Pusa Bold was grown in Loamy sand soil with pH 6.5. The experiment was conducted with randomized block design with ten replication. Treatments includes three level of sulphur *i.e.* 0 kg S ha (TO_{-1})-Control, 10 kg S ha (TO_{-2}), 20 kg S ha (TO_{-3}). The soil test of the field also done to know the status of nutrients in the field before and after experiment. The result of the soil test is given below.

Soil status before and after harvest

Treatment	Soil status after harvest					
	(Kg/ha)			Sulphur (ppm)	OC%	pH
	N	P_2O_5	K_2O			
T_1	399.5	14.2	106.1	3.88	0.43	6.5
T_2	579.2	19.4	107.5	15.8	0.44	6.5
T_3	623.4	19.5	107.7	22.9	0.45	6.5
Initial soil status	399.	18.9	107.1	3.88	0.43	6.5

(Soil test done by minilab)

The crop was fertilized with recommended dose of fertilizer (half dose of Nitrogen and full dose of Phosphorus, potash) and sulphur as a basal doses and 50 percent of Nitrogen given as top dressing after 25-30 days of sowing. The seed rate of mustard was given@ 5 kg/hectare. The crop was sown in line and inter culture operation like weeding and thinning done as and when required. Observations on yield attributes and yield of mustard were recorded and analysis of cost of cultivation, net return and benefit cost ratio were analyzed.

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Technology option	No. of trials	Yield component			Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross return (Rs/ha)	Net return (Rs./ha)	BC ratio
		No. of branches/plant	No. of effective grain/siliqua	Test wt. (1000) grain wt.)					
Farmers practice	10	8.48	9.4	1.76	6.2	15600	26100	10500	1.67:1
Technological option$_1$		10.25	12.8	2.34	8.1	19400	34000	14600	1.75:1
Technological option$_2$		10.56	13.7	2.58	9.8	20800	41200	20400	1.98:1

Result and Discussion

The data shown from above table, show that, the no. of branches, no. of effective grain/siliqua and test weight of 1000 grain seed is significantly higher in case of technological option $_3$ i.e. when 20 kg sulphur is applied as compared to the Technological potion$_2$ and Technological option $_1$where only 10Kg and no sulphur was applied respectively. The yield attributes of all three treatments is quite different, the yield of farmers practice is very low (6.2q/ha) as compare to half and full dose of sulphur (8.1 and 9.8q/ha). The net return is significantly higher in case of application of sulphur 20 Kg/ha as compared to 10kg and 0kg/ha. The benefit cost ratio of Technological option$_3$ is significantly higher (1.98:1) than technological option $_2$ (1.75:1) and technological option$_1$ (1.67:1). Therefore, it is clear from table, the application of 20Kg sulphur /ha give more number of branches, No. of effective grain/siliqua, more seed weight per 1000 seed, net return and higher benefit ration and hence recommended to farmers to use full dose of sulphur for attaining higher yield.

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