International Archive of Applied Sciences and Technology
Int. Arch. App. Sci. Technol; Vol 8 [3] September 2017: 29-31
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www.soeagra.com/iaast.html

IAAST
ONLINE ISSN 2277- 1565
PRINT ISSN 0976 - 4828

CODEN: IAASCA **ORIGINAL ARTICLE**

DOI: .10.15515/iaast.0976-4828.8.3.2931

Effect of Nitrogen and Sulphur levels on nutrients uptake and yield of Indian mustard [*Brassica juncea* (L.) Czern & Coss.]

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ABSTRACT
Field experiment entitled "Effect of nitrogen and sulphur levels on growth, yield and nutrient uptake by Indian mustard [Brassica juncea (L.) Czern and Coss.] in salt affected soil" was carried out during 2006-07 and 2007-08 at instructional farm of N.D. University of Agriculture & Technology, Kumarganj, Faizabad. The experiment comprised of four nitrogen levels (0, 40, 80 and 120 kg ha^{-1}) and four sulphur levels (0, 20, 40 and 60 kg ha^{-1}) tested in Randomized Block Design and replication three times. The maximum uptake of nitrogen (114.21 kg ha^{-1}) and sulphur (103.53 kg ha^{-1}) by crop was found at 120 kg N ha^{-1} and 60 kg S ha^{-1}. The uptake of sulphur by crop significantly over 20 kg S ha^{-1} and control, which was at par with 40 kg S ha^{-1}. The maximum uptake was sulphur (30.80 kg S ha^{-1}) was found at 120 kg N ha^{-1}. The maximum sulphur was recorded at 60 kg S ha^{-1}. The maximum seed yield (19.20 q ha^{-1}) and stover yield (59.49 q ha^{-1}) was recorded at 120 kg N, which was at par with 80 kg N ha^{-1}. In case of sulphur application the maximum seed yield (18.89 q ha^{-1}) and stover yield (58.38 kg ha^{-1}) was recorded at 60 kg S ha^{-1}, which was at par with 40 kg S ha^{-1}. Interaction between nitrogen and sulphur was found significant seed yield.
Keywords: Indian mustard, nutrients uptake

Received 16/07/2017 Revised 18/08/2017 Accepted 31/08/2017

Citation of this article
Ravindra Kumar Rajput. Effect of nitrogen and sulphur levels on nutrients uptake and yield of Indian mustard [*Brassica juncea* (L.) Czern & Coss.]. Int. Arch. App. Sci. Technol; Vol 8 [3] September 2017. 29-31.

INTRODUCTION

Indian mustard is an important winter season oil seed crop but its productivity in the eastern Uttar Pradesh is very low. One of the important factors responsible for its low yield is inadequate use of plant nutrient particularly nitrogen and sulphur. The importance of nitrogen fertilization to achieve the higher production potential in mustard is well recognized. Nitrogen is an important metabolic element for growth and development of plant. It is considered essential for metabolism of protein and other biochemical products such as nucleic acid, chlorophyll and protoplasm. It is thus, the basic constituent of plant life. It tends to encourage vegetative growth and governs a considerable degree the utilization of other nutrients. Sulphur is involved in various metabolic process on the plants. It is indispensable for synthesis of essential amino acids like–cysteine, cystine and methonine; the SH-Sulphydry linkages provide the source of pungency in oils; It involves in the formation of glycosides or glucosinolates, which on hydrolysis increase the oil content of mustard; and improve the quantity and quality of oilseeds. It is also constituent of glutathione, a compound supposed to be associated with plant respiration and in the synthesis of essential oils, flavored compound in crucifers and improved marketing quality of many crops. It play a vital role in chlorophyll formation.

MATERIALS AND METHODS

Field experiment entitled "Effect of nitrogen and sulphur levels on growth, yield and nutrient uptake by Indian mustard [*Brassica juncea* (L.) Czern and Coss.] in salt affected soil" was carried out during 2006-07 and 2007-08 at instructional farm of N.D. University of Agriculture & Technology, Kumarganj, Faizabad. The soil characteristics as follows: silty loam texture, pH (1:2.5)8.69, EC 0.35 dS/m, organic carbon 0.33%, available nitrogen 197.25 kg/ha, available phosphorus 10.30 kg/ha and available potash 162.20 kg/ha and available sulphur 8.10 kg/ha The experiment comprised of four nitrogen levels (0, 40, 80 and 120 kg ha^{-1}) through urea and four sulphur levels (0, 20, 40 and 60 kg ha^{-1}) through gypsum tested in Randomized Block Design and replication three times. As per treatment, full dose of P, K and S and half dose of nitrogen was applied as basal dressing through urea, diammonium phosphate, muriate of potash and gypsum. The crop was sown in row 45 cm apart on 1 November, 2006 and 27 October, 2007 and harvested on 24 March, 2006 and 20 March, 2006. The remaining half dose of nitrogen was applied as top dressing after first irrigation. At maturity yield of seed was recorded.

RESULTS AND DISCUSSION

Nutrients uptake:

The total nitrogen uptake by crop was significantly increased with increasing levels of nitrogen up to 120 kg N ha^{-1} in 2006-07. The highest total nitrogen uptake by crop was found with 120 kg N ha^{-1} (114.21 kg ha^{-1}), which was significantly superior over 0, 40 and 80 kg N ha^{-1} (66.74, 84.53 and 104.56 kg ha^{-1}, respectively). The minimum total uptake of nitrogen by crop was obtained in control treatment (66.74 kg ha^{-1}). Sulphur levels showed significant effect on total nitrogen uptake by crop. The highest total nitrogen uptake was found in 60 kg S ha^{-1} (103.53 kg ha^{-1}) during 2006-07, which was significantly superior over control (77.73 kg ha^{-1}) and 20 kg S ha^{-1} (88.72 kg ha^{-1}), which was at par with 40 kg S ha^{-1} (100.06 kg ha^{-1}). This might be due to N fertilization as it increase the cation exchange capacity of plant roots with increase in nitrogen fertilization, which enabled making them efficient in absorbing more nutrient ions these results corroborates with the findings of Singh *et al.* (2008), **T**otal sulphur uptake by crop was significantly increased with increasing levels in nitrogen upto 120 kg ha^{-1} during 2006-07. The highest total sulphur uptake by crop (30.80 kg ha^{-1}) was found with 120 kg N ha^{-1}, it was significantly superior over control (21.19 kg ha^{-1}) and 40 kg N ha^{-1} (24.99 kg ha^{-1}), which was at par with 80 kg N ha^{-1} (29.40 kg ha^{-1}) and lowest uptake of sulphur by crop in control treatments was found 21.19 kg ha^{-1}. The sulphur levels showed significant effects on sulphur uptake by crop. The highest sulphur uptake was found at 60 kg S ha^{-1} (32.53 kg ha^{-1}), which was significantly superior over control 20 and 40 kg S ha^{-1} (19.62, 24.30 and 29.77 kg ha^{-1}, respectively). This might be due to N nitrogen fertilization as it increase the cation exchange capacity of plant roots with increase in nitrogen fertilization, which enable making them efficient in absorbing nutrient ions, Singh and Meena [6], Tomar *et al.* [7].

Yield:

The maximum seed yield of mustard was obtained at 120 kg N ha^{-1} and 60 kg S ha^{-1}. The seed yield was 19.20 q ha^{-1} and 18.89 q ha^{-1}, respectively. Seed yield was at part with 80 kg N ha^{1} and 40 kg S ha^{-1}. Minimum yield was recorded in control treatments of nitrogen and sulphur. The seed yield was 13.85 q ha^{-1} and 14.58 q ha^{-1}, respectively.The interaction between nitrogen and sulphur was found significant. Increasing levels of nitrogen with increasing levels of sulphur gave higher yield. The maximum yield was recorded at 120 kg N ha^{-1} and 60 kg S ha^{-1} (20.30 q ha^{-1}). However, it was at par with 80 kg N ha^{-1} and 40 kg S ha^{-1} (19.95 q ha^{-1}). Per cent increase in grain yield at lower levels of sulphur was more than at higher levels of sulphur with same levels of nitrogen. The increase in seed yield was associated with increase all the yield contributing characters *viz.*, siliqua $plant^{-1}$, length of siliqua, seeds $siliqua^{-1}$ and test weight. Adequate supply of nitrogen facilitated better growth and development of crop plant, enhanced nutrient uptake and resulted significant increase in yield attributes. Similar results have also been reported by Sharma [4], Kumar *et al.* [3]. The stover yield was influenced by nitrogen and sulphur levels and has been presented in Table-1. Increasing levels of nitrogen increased stover yield significantly up to 120 kg N ha^{-1} and was recorded (59.49 q ha^{-1}), which was significant over the control and 40 kg N ha^{-1} 44.72, 50.62 ha^{-1} and at par with the 80 kg N ha^{-1} (58.78 q ha^{-1}).Stover yield increased with increasing levels of sulphur. The maximum stover yield for 2006-07 and 2007-08 (58.38

and 55.16 q ha^{-1}) was obtained significant at 60 kg S ha^{-1}. The minimum stover yield was recorded under control treatment (45.64 and 52.06 q ha^{-1}, respectively years). This might be due to the fact that nitrogen application increased all the growth contributing characters *viz.*, plant height, branches $plant^{-1}$, and leaf area which enhanced the stover production. The beneficial effect of nitrogen fertilization on stover yield of mustard has also been reported by Kachroo and Kumar [1], Kumar *et al.* [2].

Table-1: Effect of nitrogen and sulphur levels on nutrient uptake and yield of mustard

Treatments	Total N uptake by crop (kg/ha)		Total S uptake by crop (kg/ha)		Seed yield (q/ha)		Stover yield (q/ha)	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
Levels of nitrogen								
N_0	66.74	61.10	21.19	19.27	13.85	13.05	44.72	39.94
N_{40}	84.53	79.04	24.99	23.25	16.85	15.65	50.62	48.48
N_{80}	104.56	99.24	29.40	27.54	18.63	17.84	58.75	55.91
N_{120}	114.21	108.33	30.80	28.73	19.20	18.39	59.49	57.21
SEm±	**2.04**	**1.87**	**0.50**	**0.53**	**0.25**	**0.25**	**1.21**	**1.06**
CD (P=0.05)	**5.90**	**5.40**	**1.45**	**1.53**	**0.72**	**0.73**	**3.50**	**3.05**
Levels of sulphur								
S_0	77.73	73.10	19.62	18.58	14.58	13.78	45.64	44.08
S_{20}	88.72	82.41	24.30	22.31	16.40	15.60	52.06	48.45
S_{40}	100.06	93.82	29.97	27.98	18.26	17.48	57.50	53.85
S_{60}	103.53	98.42	32.53	29.92	18.89	18.08	58.38	55.16
SEm±	**2.04**	**1.87**	**0.50**	**0.53**	**0.25**	**0.25**	**1.21**	**1.06**
CD (P=0.05)	**5.90**	**5.40**	**1.45**	**1.53**	**0.72**	**0.73**	**3.50**	**3.05**
N x S	**NS**	**NS**	**NS**	**NS**	**S**	**S**	**NS**	**NS**

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