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Research Article

EFFECT OF PHOSPHORUS AND SULPHUR LEVEL ON NITROGEN UPTAKE BY MUSTARD CROP AT SUCCESSIVE STAGES OF CROP GROWTH (*Brassica juncea* L)

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Abstract: A field experiment entitled "Effect of phosphorus and sulphur level on Nitrogen uptake by mustard crop at successive stages of crop growth (*Brassica juncea* coss.)" variety Varuna, was conducted at the research plot of Kulbhaskar Ashram Post graduate farm Allahabad (U.P.) during the *Rabi* Season 2008-09 and 2009-10 India. The experiment was laid out in a Factorial Randomized Block Design having four levels of phosphorus (0, 25, 50 and 75 kgha^{-1}) and sulphur (0,20, 40 and 60) kg ha^{-1}) each with three replications. The phosphorus and sulphur were applied through DAP and gypsum, respectively. Indian mustard variety Varuna was sown on 11th October, 2008 with the seed rate of 5.0 kg ha^{-1}. The Nitrogen uptake by crop at 30 and 60 DAS increased with increasing levels of P and S upto 75 kg phosphorus and 60 kg S ha-1. Phosphorus application increased N uptake by seed, respectively.

Keywords: Phasphorus, Sulphur, Zypsum, Nitrogen

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Introduction

Oilseed crop has been the backbone agriculture economy of India from time immemorial. Amongst the various oilseeds, rapeseed and mustard (*Brassica* Spp.) are the third most impotent oilseed crop after groundnut and soya been in India occupying 6.18 M.ha acreage, 7.36 Mt. production and 1109 kg hectare productivity [1]. In India Brassica Species are mostly grown in North India Region Consisting of Rajasthan, Uttar Pradesh, Parts of Madhya Pradesh, Gujarat, Punjab, Haryana Part of Himanchal Pradesh and are adopted to varies agro-climatic condition. Mustard Is also called as raj raya or Laha it is supposed to be native of India. Among India Sates, Rajasthan First Ranks First Both Area and production of mustard with 2.33 Mt and 2.70 Mt respectively it is followed the state of Uttar Pradesh where mustard is grown on 12.95 lakh/ha with 8.00 lakh ton seed production and 730 Kg/ha productivity [2]. However, Gujrat states highest productivity of mustard (1510 kg/ha) in the country. Brassica Species are commonly believed to have high requirement for phosphorus. Many soils provide much, although not at the entire requirement the rapeseed and mustard crop for this nutrient. The effect of Phosphorus and fertilizer on is yield and usually small and much less than that of Nitrogen but notice evenly grater then that of Potassium. The function of phosphorus of fundamental to many of the chemical transformation that take place in plant. Organic phosphorus compound is involved in energy transfer reaction and respiration. Phosphorus is a Consistent of nucleic acid and nucleoproteins and, therefore intimately involved in the transformation of hereditary characteristics. Deficiency of phosphorus restricts growth of roots and of aerial parts of rapeseed and mustard plants and in extreme cases can prevent flowering. The crop remaining dwarf with small leaves and no inflorescence. Where phosphorus deficiency is slight, growth is restricted in the rosette stage but the crop tension to recover and the flowering stage may be little affected. Flowering may be delayed by a day or two by slight phosphorus deficiency as may ripen of the seed.

Sulphur is a secondary plant nutrient which plays a significant role in increasing production specially in oil seed. Sulphur is Essential for synthesis of sulphur containing amino acids *viz*., methionine, cysteine, and chlorophyll. It is also responsible for synthesis of coenzyme-A. Sulphur deficiencies are occurring with greater frequency at various locations in India. The uptake of N was worked out at successive crop growth stages of 30 and 60 DAS and at harvest for Nitrogen nutrient. Therefore, keeping these facts in view, a field experiment entitled, 'Effect of Phosphorus and Sulphur Level on Nitrogen Uptake by Mustard Crop at Successive Stages of Crop Growth (*Brassica juncea* L)' was planned and conducted during *rabi* season of 2008-09 and 2009-10 at and 24.2 Kg ha^{-1}) with 30 kg S ha^{-1} application in mustard crop research farm of Kulbhaskar Ashram Post Graduate College, Allahabad.

Material and Method

The experiment was conducted at the research plot of Kulbhaskar Ashram Post Graduate College farm, Allahabad during the *Rabi* season of the year 2008-09 and 2009-10. The Farm is situated on the east side of the Medical College, Rambagh Road. (0,20, 40 and 60 kg ha^{-1} (Ph D Thesis)) each was conducted in Factorial Randomized Block Design with three replications during winter *Rabi* season of the year 2008-09 and 2009-10. The soil of the experimental field was alluvial loamy in texture having pH 7.2, determined by pH meter method in a field experiment including four levels of phosphorus (0,25, 50 and 70 kg ha^{-1}) and sulphur Soil pH was determined by glass electrode pH [3], Electrical Conductivity with Solu-bridge method [4]. Organic carbon 0.57% was determined Walkley and Black rapid titration method [5], with the available nitrogen 127 kg ha^{-1} alkaline $KMnO_4$ method [6], available phosphorus 10.7 it was estimated by Olsen's method [7] kg ha^{-1}.

Table-1 Effect of phosphorus and sulphur levels nitrogen uptake (kg ha^{-1}) by mustard crop at successive stages of crops

Treatments	Nitrogen uptake by plant (kg ha^{-1})						Nitrogen uptake (kg ha^{-1}) at harvest								
	30 DAS			60 DAS			By seed			By Stover			Total N uptake		
	2008-09	2009-10	Mean	2008-09	2009-10	Mean	2008-09	2009-10	Mean	2008-09	2009-10	Mean	2008-09	2009-10	Mean
P Level (kg ha^{-1})															
0	5.21	5.40	5.31	38.38	40.11	39.25	40.25	43.86	42.06	29.82	30.75	30.29	70.07	81.83	75.95
25	6.36	6.52	6.44	42.30	44.45	43.38	56.38	60.65	58.52	40.30	42.85	41.58	96.68	96.48	96.58
50	6.60	6.79	6.70	44.54	46.80	45.67	69.05	74.39	71.72	48.91	52.31	50.61	117.77	119.66	118.72
75	6.74	6.94	6.84	45.32	47.31	46.32	64.95	67.45	66.20	43.60	46.95	45.28	99.18	118.85	109.02
S.Ed.	0.21	0.24	-	0.81	0.81	-	0.79	1.58	-	0.99	1.21	-	1.67	2.44	-
C.D.(P=0.05)	0.42	0.49	-	1.66	1.65	-	1.62	3.23	-	2.03	2.48	-	3.42	4.98	-
S Level (kg ha^{-1})															
0	4.96	5.13	5.05	36.10	38.30	37.20	53.95	53.11	53.53	33.01	35.08	34.05	77.48	88.19	82.84
20	6.11	6.30	6.21	41.69	44.06	42.88	56.92	61.40	59.16	39.11	42.49	40.80	96.15	103.83	100.02
40	6.73	6.94	6.84	45.95	47.63	46.79	58.70	65.90	62.30	45.23	47.50	46.37	104.06	113.40	108.73
60	7.11	7.27	7.19	46.81	48.67	47.74	61.06	65.95	63.51	45.28	47.78	46.53	106.01	113.73	109.87
S.Ed.	0.21	0.24	-	0.81	0.81	-	0.79	1.58	-	0.99	1.21	-	1.67	2.44	-
C.D.(P=0.05)	0.42	0.49	-	1.66	1.65	-	1.62	3.23	-	2.03	2.48	-	3.42	4.98	-

Table-2 effect of PxS interaction on nitrogen uptake by seed and nitrogen uptake by whole mustard crop (kg ha^{-1})

P Levels (kg ha^{-1})	N uptake by Seed (kg ha^{-1})				N uptake by crop (kg ha^{-1})			
	S Level (kg ha^{-1})				S Level (kg ha^{-1})			
	0	20	40	60	0	20	40	60
2008-09								
0	35.49	39.30	42.11	44.10	59.80	67.80	74.77	77.89
25	48.72	56.60	60.44	59.76	81.14	96.28	105.34	103.93
50	56.96	69.11	75.06	74.65	95.05	115.45	131.05	129.55
75	56.70	63.14	65.30	64.05	73.93	105.06	105.06	112.65
S.Ed.		1.58				3.34		
C.D.(P=0.05)		3.24				6.83		
2009-10								
0	38.43	43.35	45.67	47.89	63.18	72.58	79.62	83.06
20	51.92	60.74	65.45	64.50	86.39	103.99	112.49	111.12
40	61.18	74.09	81.27	81.01	102.52	125.47	139.54	139.27
60	60.0	67.41	71.10	70.38	100.68	113.52	121.93	121.46
S.Ed.		3.16				4.88		
C.D.(P=0.05)		6.45				9.96		

Available Sulphur (Extraction was done by using 0.15% $CaCl_2$ as extractant following the procedure of Williams and Steing berg, [8] 8.25 kg ha^{-1} respectively. Treatment wise plant samples were collected at different stages of plant growth and at harvest. The plant samples were first dried and then rinsed with distilled water. The sample were first dried in shade and then in oven at 65^{0}C, Thereafter, the plant samples were powdered with the help of stainless steel grinder, after mixing well, the ground samples were kept in labelled bottles for analysis. The samples were analyzed for nitrogen in plant samples was determined by Kjeldahl's method using digestion mixture consisting of $CuSO_4$, K_2SO_4, selenium powder and H_2SO_4. Half –a gram plant sample was digested in block design unit. After complete digestion, the samples were distilled by using micro – Kjeldahl unit and the liberated ammonia was trapped in boric acid containing mixed indicator and titrated against 0.01N H_2SO_4 [9].

Result and Discussion

Result show in [Table-1] that N content in plant at both stages of 30 and 60 DAS and in stover at harvest increased with increasing level of P application significantly up to 50 kg 1 during both the years, but in seed, N content was not influenced significantly by phosphorus application It might be due to the phosphorus stimulation at early root development and growth which are helpful in absorbing more nitrogen from soil and thus, N content in Plants increases. Increase in N content of mustard due to increasing level of P application has also been reported by Zimik, *et al*., (2010); Sumeria, (2003); Singh and Thenua, (2016) and Rambharose, *et al*. (2011) [10-13]. Increasing level of sulphur shown [Table-1] application improved N content in plant at 30 and 60 DAS and in stover at harvest upto 60 kg S ha^{-1}, but increase beyond 40kg S ha^{-1} was significant in plants only at 30 DAS [Table-1]. Since sulphur is linked with protein metabolism in plants, its availability in soil and absorption by plant might have increased N content in plant at increasing rate of application. Singh, (2009) stated that sulphur is essential in formation of plant protein because it is a part of certain amino acids which act as building blocks of protein [14]. The result conforms the finding of Ahmad, *et al*., (2001), Mishra, (2001), Yadav and Sharma, (2002), Mishra, *at al*. (2002), Jat and Mehra, (2007), Sumeria, (2003) and Ravindra Kumar Rajput, (2018) [15-20]. The amount of absorbed N in plant which could not be translocated to seed remained in stover, therefore, increased application of P or S increased N content in mustard stover significantly. Almost similar effects have also been observed by Davaria, *et al*. (2001) [21]. Nitrogen content in mustard was not influenced significantly by P x S interaction in any case of study [Table-2]. However, the combined application of both P and S at 75kg P_2O_5 and 60kg S ha^{-1} recorded maximum values of N content in plant, seed and stover during both experimental years. Rambharose, *et al*., (2011) also reported similar result.

Conclusion

N uptake by crop at 30 and 60 DAS increased with increasing level of P and S upto 75kg P_2O_5 and 60kg S ha^{-1}. Phosphorus application increased N uptake by seed, stover and total uptake upto 50kg P_2O_5 ha^{-1} application, while sulphur application increased N uptake by seed stover and total and total uptake upto 60kg S ha^{-1}.

Application of Research: This research is helpful for increasing nitrogen content in plants especially in oilseeds with the addition of phosphorus and sulphur.

Research Category: Crop Science

Abbreviations: DAS:

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