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Effect of Phosphorus and Sulphur Level on Plant Growth and Dry Matter Prodection of Mustard (*Brassica juncea* L.)

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ABSTRACT

A field experiment entitled "Effect of phosphorus and sulphur level on Plant growth and dry matter production of Mustard (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 plant height, dry weight per plant, no. of siliqua plant-1, seed yield and stover yield increased significantly at 50 kg phosphorus and 40 kg sulphur ha-1. Over without P and with 25 and 75kg ha-1. P. and without S with 20kg and 60 kg S ha-1 Respectively.

Key word: *Phasphorus, Sulphur, Stover, Brassica juncea*

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 importent oilseed crop after groundnut and soya been in India occupying 6.18 Mha acreage, 7.36 Mt production and 1109 kg hectare productivity. 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.

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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 evely 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 are involve in energy transfer reaction and respiration. Phosphorus is a Consistent of nucleic acid and nucleoproteins and, therefore intimately involve 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 tence to recover and the flowering stage may be little affected. Floring 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, systine and chlorophyll. It is also responsible for synthesis of coenzyme-A. Sulphur deficiencies are occurring with greater frequency at various location in India

Generally, oilseeds crop respond to the application of phosphorus and sulphur, even in marginally deficiency and medium soils. Phasphorus and sulphur are two important nutrients for better growth and yield of oil seed crops. A relative change in their levels bring about a considerable effect on growth and yield of oil seed crop. Phasphorus and sulphur inter – relationship in promoting mutual uptake and there by influencing yield and growth of rapeseeds and mustard has been studied by many researchers. Thus the proper nutrition of phosphorus and sulphur may be helpful in increasing the productivity of mustard crop.

Therefore keeping these facts in view a field experiment entitled, ‘‘EFFECT OF PHOSPHORUS AND SULPHUR LEVEL ON PLANT GROWTH AND DRY MATTER PRODECTION OF MUSTARD (*BRASSICA JUNCEA* L.)’’ was planned and conducted during rabi season of (2008-09) and (2009-10) at 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) 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 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[18]. Electrical Conductivity with Solu-bridge method[2], Organic carbon 0.57% was determined walkley and Black rapid titration method, with the available nitrogen127 kg ha- alkaline KMnO4 method[25], available phosphorus 10.7 it was eatimated by Olsen’s method.kg ha-1 and available Sulphur (Exraction was done by using 0.15% $CaCl_2$ as extractant following the procedure of Williams and Steing berg[28] 8.25 kg ha-1 respectively. After preparation of the field nitrogen and Potassium were applied at the rate of 60 kg and 40 kg kg ha-1 through Urea and murate of potash respectively. Phasphorus was applied through DAP and

Sulphur Through Zypsum. Half dose of nitrogen full dose of potassium and all different doses of phosphorus and sulphur as per treatment were applied as besal dressing and rest of nitrogen was applied as top dressing, maintaining the spacing of 30 cm × 10 cm. Harvesting was done by manual labour . it was tied in bundles and labeled properly the bundle were left for sun drying in respective treatment plots. Data For growth and Dry matter.

1. Plant height - It was recorded at successivecrop growth stages of 30 and 60 days after sowing (DAS) and at crop harvest the Data for all stages under main effect of treatements are presented in Table-1.

2. Number of Branches Plant^{-1} – The primary and secondary branches were separately counted at the time of crop harvest. The data for both type of branches are furnished under main effect of treatments in Table -2.

3. Dry Matter Production Dry matter yield was recorded at successive crop growth stages of 30 and 60 DAS and at crop harvest. The data for all stages arearrenged under main effect of treatments in Table -3.

RESULT AND DISCUSSION

Application of phosphorus increased plant height and number of primary branches significantly upto 25 kg P_2O_5 ha^{-1} while the number of secondary branches and dry matter production increased significantly up to 50 kg P_2O_5 ha^{-1} (table 1 , 2 , 3) it might be attributed to increased availability of phosphorus for plant growth as the phosphorus in combination with organic acids forms essential constituent of the plant cells like esters, phosphapides and phosphiolipids, thus place a vital role in photosynthesis respiration energy storage, transfer, cell division, cell elongation and several other processes in the living plants[10,24]. The rate of increases in plant height, number of branches and dry matter. Production was more at lower dose of phosphorus, beyond which it decline, perhaps due to better nutritional environment for plant growth at active vegetative stage as result of improvement in root growth, eel multiplication, elongation and cell expression in the plant body[8]. Increase in growth carectoe of mustard due to phosphorus application as also been reported by[9,11,23,7] and[20].

Sulpher application increased significantly the plant height (Table 4.1) number of branches plant^{-1} table 4.2 and dry matter production (Table 4.3) up to 40kg S^{-ha} Such significant increases in growth parameters due to increased sulpher application might be probably due to enhanced various metabolic constituents of some amino acid sulpher is essential in information of in plant protein because it is a part of certain animo-acids which at as building blockes of protein[10,24]. Increase in growth parameter of mustard due to increased apllivation of sulpher as also been repoted by kumar and[8,11,23,20,26] and various other research workers.

The effect of P x S interaction was found significant on dry matter production at harvest stage during both years (4.4).It shows that increasing levels of sulpher without phosphorus application increase matter up to 60kg S $^{-ha\ But}$ with phosphorous dry matter reduced beyond the application 40kg S ha $^{-1}$ it might due to antagonistic effect of phosphorus application with higher doses of sulpher application. However, highest dry matter production was recorded with treatment of 50kg P_2O_5 +40 kg S ha^{-1}. At highest level of 75 kg P_2O_5 and/ or 60kg S ha^{-1} dry matter production reduced with might be due to their antagonistic effect of higher levels of application.[1] also reported that interaction effect of PxS on mustard was found synergistic at low level and antagonistic at higher levels of their application. These result or in harmony of the result reported by saran and.

Table 1: Effect of phosphorus and sulphur levels on plant height (cm) of mustard at successive stage of growth

Treatments	Plant Height (cm)								
	30 DAS			60 DAS			Harvest		
	2008-09	2009-10	Mean	2008-09	2009-10	Mean	2008-09	2009-10	Mean
P Levels (Kg ha $^{-1}$)									
0	19.94	20.16	20.05	8.95	84.13	83.04	129.59	135.69	132.64
25	20.57	20.70	20.64	84.00	86.74	85.37	136.72	141.79	139.26
50	20.77	20.77	20.77	85.88	87.74	86.81	139.19	143.25	141.19
75	20.89	20.80	20.85	85.31	87.82	86.57	138.20	141.34	139.77
S.Ed. ±	0.19	0.21	-	1.15	1.24	-	2.10	3.01	-
C.D.(P=0.05)	**0.39**	**0.43**	**-**	**2.35**	**2.54**	**-**	**4.28**	**3.15**	**-**
S Levels (Kg ha $^{-1}$)									
0	19.58	19.46	19.52	80.98	83.83	82.41	125.55	128.84	127.20
20	20.59	20.82	20.71	83.73	85.95	84.84	134.35	139.24	36.80
40	20.99	21.05	21.03	85.93	87.86	86.90	140.98	145.95	43.47
60	21.01	21.09	21.05	86.52	88.78	87.65	142.82	148.05	145.44
S.Ed. ±	0.19	0.21	-	1.15	1.24	-	2.10	3.01	-
C.D.(P=0.05)	**0.39**	**0.43**	**-**	**2.35**	**2.54**	**-**	**4.28**	**6.15**	**-**

Table 2: Effect of phosphorus and sulphur levels on no of different types of branches Plant $^{-1}$ of mustard

Treatments	No. of primary branches plant^{-1}			No of secondary branches plant^{-1}		
	2008-09	2009-10	Mean	2008-09	2009-10	Mean
P Levels (Kg ha $^{-1}$)						
0	4.88	5.09	4.99	8.25	8.650	8.43
25	5.39	5.68	5.54	8.75	9.65	9.20
50	5.60	5.85	5.73	9.66	10.66	10.16
75	5.40	5.58	5.49	9.45	10.42	9.94
S.Ed. ±	0.13	0.14	-	0.24	0.30	-
C.D.(P=0.05)	**0.26**	**0.29**	**-**	**0.49**	**0.61**	**-**
S Levels (Kg ha $^{-1}$)						
0	4.21	4.41	4.31	7.67	8.47	8.07
20	5.50	5.72	5.61	8.71	9.40	9.06
40	5.81	5.98	5.90	9.75	10.31	10.03
60	5.89	6.07	5.98	9.98	11.14	10.56
S.Ed. ±	0.13	0.14	-	0.24	0.30	-
C.D.(P=0.05)	**0.26**	**0.29**	**-**	**0.49**	**0.61**	**-**

Table 3: Effect of phosphorus and sulphur levels on dry matter production (qt ha^{-1}) of mustard at successive growth stages

Treatments	Dry matter (qt ha^{-1})								
	30 DAS			60 DAS			Harvest		
	2008-09	2009-10	Mean	2008-09	2009-10	Mean	2008-09	2009-10	Mean
P Levels (Kg ha $^{-1}$)									
0	1.59	1.64	1.62	13.64	14.10	13.87	76.97	81.37	79.70
25	1.88	1.92	1.90	14.53	15.13	14.83	99.81	104.21	102.01
50	1.90	1.95	1.93	15.00	15.54	15.27	116.76	112.50	119.63
75	1.91	1.96	1.94	15.44	15.91	15.68	105.17	110.53	107.87
S.Ed. ±	0.01	0.04	-	0.23	0.28	-	1.94	2.36	-
C.D.(P=0.05)	**0.03**	**0.09**	**-**	**0.47**	**0.57**	**-**	**3.97**	**4.83**	**-**
S Levels (Kg ha $^{-1}$)									
0	1.55	1.59	1.57	12.90	13.54	13.22	90.25	94.62	92.44
20	1.82	1.86	1.84	14.42	15.06	14.74	100.47	105.45	102.96
40	1.93	1.98	1.96	15.55	15.98	15.77	104.73	109.55	107.14
60	1.99	2.03	2.01	15.74	16.10	15.92	103.27	108.99	106.13
S.Ed. ±	0.01	0.04	-	0.23	0.28	-	1.94	2.36	-
C.D.(P=0.05)	**0.03**	**0.09**	**-**	**0.47**	**0.57**	**-**	**3.97**	**4.83**	**-**

Table 4: Effect of PXS interaction on dry matter (q ha^{-1}) Production of Muatard at harvesting stage

P levels (kg *ha^{-1})*	S Levels (kg ha^{-1})			
	0	20	40	60
2008-09				
0	71.13	75.58	79.60	81.57
25	90.11	101.00	105.33	102.80
50	101.12	118.21	125.24	122.48
75	98.63	107.10	108.74	106.22
S.Ed. ±	3.89		C.D. (P=0.05)	7.94
2009-10				
0	74.75	81.21	83.73	85.78
25	93.79	105.24	110.00	107.79
50	106.71	123.62	130.46	129.21
75	103.22	111.73	114.00	113.17
S.Ed. ±	4.73		C.D. (P=0.05)	9.65

CONCLUSION

Plant height at harvest was noted highest with 50 kg P_2O_5 ha^{-1} (141.19 cm) and with 60 kg S ha^{-1} (145.44). The dose of 50 kg P_2O_5 ha^{-1} produced maximum of 5.73 primary and 10.16 secondary branches plant $^{-1}$ while among S level 60 kg S ha^{-1} produced maximum of 5.98 primary and 10.56 secondary branches plant $^{-1}$. However in every years data analysis, The differences between 50 and 75 P_2O_5 doses and between 40 and 60 kg ha^{-1} S doses where not significant foe plant height or branches plant^{-1}. Dry matter at 30 and 60 DAS increased up to 75 kg P_2O_5 ha^{-1} and 60 kg S ha^{-1} but in increase in doses beyond 50 kg P_2O_5 and 40 kg S ha^{-1} where not significant. At harvesting stage dry matter production was significantly height of 129.63 qt ha^{-1} with 50 kg P_2O_5 ha^{-1} and highest of 107.14 q ha^{-1} with 40 kg S ha^{-1} application. Interaction PXS showed that combined application of 50 kg P_2O_5 + 40 kg S ha^{-1} produced highest of 125.24 and 130.46 qt ha-1 dry matter during two years of study respectively at crop harvesting stage^{-1}.

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