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Influence of Nitrogen and Sulphur on Drymatter, Yield and Protein Content of Indian Mustard *(Brassica juncea)*

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ABSTRACT

A field experiment was conducted during the *rabi* season of 2002 to study the effect of nitrogen and sulphur levels on dry matter , yield and protein content of Indian mustard . Application of nitrogen and sulphur @120 and 90 kg ha^{-1} respectively gave the highest drymatter, seed yield and protein content.

Key words : Drymatter,Indian Mustard, Nitrogen, Sulphur, Yield

Mustard is an important oil seed crop and occupies a prominent place amongst all oilseed crops. It plays an important role in oilseed economy of India. Inadequate supply of nutrients and lack of high yielding varieties are the two most detrimental factors responsible for the low yields of mustard. Exploitative agriculture, making use of high analysis sulphur free nitrogenous and phosphatic fertilizers like Urea, DAP without organics has progressively depleted the nature N and S of soils leading to their deficiencies. Fertilizer application assumes added importance in mustard cultivation due to intensive growth in comparatively short period. Fertilization, especially with nitrogen and sulphur are of vital significance in increasing the yields. In view of the above it was felt necessary to study the effect of different levels of nitrogen and sulphur on mustard.

MATERIAL AND METHODS

A field experiment was conducted during *rabi* 2002 on sandy-clay loam soil at Agricultural College Farm, Bapatla. The soil of the experimental site was medium in available nitrogen, low in phosphorus and sulphur and high in potassium status with pH 7.2. The experiment was laid out in randomized block design with factorial concept with each treatment replicated thrice. The treatments consisted of four doses of 'N' (0, 40, 80, 120 kgha^{-1}) and four doses of 'S' (0, 30, 60, 90 kgha^{-1}).The mustard variety LBM 428-1 was sown during the first fortnight of December . Nitrogen and phosphorus were supplied through diammonium phosphate (18:46:0)and KH_2PO_4 while the balance of nitrogen was made up with urea (46% N). Potassium was supplied through muriate of potash (60%K_2O) after deducting the amount supplied through KH_2PO_4, while the source of sulphur was gypsum. Five representative plants were harvested from each replication for recording growth and yield. Estimation of protein content in seeds was made by the method developed by Lowry *et al.(*1951) and expressed as percentage.

RESULTS AND DISCUSSION

Nitrogen:

Dry matter production is a measure of growth and development of a plant. The drymatter production at harvest was increased by 35, 68 and 114 percent with N_{40},N_{80},and N_{120} respectively over N_0.The highest level of nitrogen was significantly superior to all other levels. Similar results were reported by Sharma & Arvind Kumar (1988) and Sahadeva Singh & Gangasaran (1993) .The increase in dry matter production could be attributed to more vegetative growth obtained because of nitrogen which plays a significant role in the plant growth .

The highest seed yield (1238 kgha^{-1}) was obtained with N_{120} level, which was significantly superior to N_0 and N_{120}.The per cent increase in seed yield with N_{40},N_{80} and N_{120} over control was 58, 93 and 112, respectively. With regard to seed yield , the level N_{80} was on a par with N_{120}. The results were in conformity with findings of Singh and Dixit (1989) and Sharma et.al. (1994). The increase in N was responsible for increased number of leaves and leaf area index per plant causing higher assimilation rate and metabolic activity which in turn were responsible for the significant increase in growth characters, yield attributes and ultimately the seed and stover yields.

Table 1. Effect of nitrogen and sulphur fertilization on drymatter production (kg/ha) by mustard at different stages of crop growth

	30 DAS				
	S_0	S_{30}	S_{60}	S_{90}	Mean
N_0	170.75	179.47	188.74	212.62	187.89
N_{40}	271.05	331.55	397.66	448.33	362.14
N_{80}	509.59	562.35	619.38	666.48	589.45
N_{120}	714.75	756.39	799.40	841.52	778.02
Mean	416.53	457.44	501.29	542.23	

	SEm(±)	CD(0.05)
N	6.93	20.03
S	6.93	20.03
NxS	13.87	40.06

	60 DAS				
	S_0	S_{30}	S_{60}	S_{90}	Mean
N_0	891.62	930.54	974.36	1019.86	954.09
N_{40}	1104.59	1150.52	1189.42	1237.56	1170.52
N_{80}	1329.36	1380.54	1429.67	1473.87	1403.36
N_{120}	1567.92	1612.36	1659.58	1711.39	1637.81
Mean	1223.374	1268.49	1313.25	1360.67	

	SEm(±)	CD(0.05)
N	30.53	88.19
S	30.53	88.19
NxS	-	-

	At Harvest (Seed+Stover)				
	S_0	S_{30}	S_{60}	S_{90}	Mean
N_0	2119.0	2246.0	2354.0	2607.0	2331.50
N_{40}	2807.0	3063.0	3291.0	3430.0	3147.75
N_{80}	3582.0	3733.0	3952.0	4459.0	3931.50
N_{120}	4299.0	4799.0	5184.0	5723.0	5001.25
Mean	3201.75	3460.25	3695.25	4054.75	

	SEm(±)	CD(0.05)
N	170.08	491.10
S	170.08	491.10
NxS	-	-

Table 2. Effect of nitrogen and sulphur fertilization on drymatter production, yield and protein content.

	Dry matter kg ha^{-1})	Grain yield(kg ha^{-1})	protein content(%)
Nitrogen(kg ha^{-1})			
N_0	2331.50	581.66	15.61
N_{40}	3147.75	919.5	16.41
N_{80}	3931.50	1128.5	17.89
N_{120}	5001.25	1238.5	19.21
CD (P=0.05)	491.10	143.42	1.54
Sulphur(kg ha^{-1})			
S_0	3201.75	808.00	14.84
S_{30}	3460.25	917.75	17.00
S_{60}	3695.25	982.75	17.47
S_{90}	4054.75	1154.16	19.54
CD(P=0.05)	491.10	143.45	1.54

With increased levels of nitrogen from N_0 to N_{120}, the protein content increased significantly. The highest protein content (19.2%) was recorded by N_{120} and the lowest (15.6%) by N_0. The increase in protein content from N_{40}, N_{80},and N_{120} over N_0 was 3, 14 and 23 per cent respectively. Nitrogen plays an important role in the synthesis of aminoacids, which resulted in higher protein content in seeds at higher rates of N application. The protein content might be due to depressing effect of nitrogen on oil content since a negative correlation between oil and protein content exists.

Sulphur:

The present increase in drymatter was 8, 15 and 26 with S_{30},S_{60} and S_{90} respectively over no sulphur .The highest level S_{90} was superior to S_{30} and S_0 whereas it was on par with S_{60}. The improved nutritional environment as a result of increased sulphur supply might have favourably influenced the carbohydrate metabolism.The lowest drymater production was recorded by the control N_0S_0 at all the stages of crop growth, which might be due to N and S starvation as the native soil fertility was unable to support optimal productivity. The drymatter production increased significantly with increased levels at all the stages but their interaction effect was found to be non significant at all stages except at 30 DAS.

There was an increase in the seed yield with increase in the sulphur levels. The level S_{30} was on par with S_0 and S_{60} while S_{90} was found superior to S_{60}. The highest yield (1154.1 kg ha^{-1}) was recorded by S_{90} whereas , the lowest (808 kg ha^{-1}) by S_0. Sulphur fertilization significantly improved the yield attributes. Sulphur application influenced the productivity by improving both the infra structural frame (bearing capacity) and the leaf area. Sulphur regulates these parameters because it is a part of amino acids like methionine, cystine, lipoic acid , coenzyme (SCOAH) and vitamin / thiamine pyro phosphate.

The protein content increased significantly with increased levels of sulphur from S_0 to S_{90}. The level S_{60} was on par with S_{30} .The lowest protein content (14.84%) was recorded by S_0.The treatment S_{90} recorded significantly the highest protein content (19.54%) .The increase in protein content might be due to the utilization of nitrogen by the adequate supply of sulphur.

The interaction effect of nitrogen and sulphur on seed yield, drymatter and protein content was found to be non significant.

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