

RESPONSE OF MUSTARD TO FOLIAR FERTILISATION WITH N, P AND S¹

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ABSTRACT

In a field experiment laid according to factorial randomised block design, the effect of five (including control) leaf-applied N, P and S combinations @ 20 kg N, 2 kg P₂O₅ and 2 kg S/hectare respectively, was studied on yield and yield-attributing characters in four selected varieties of mustard namely B. R-40, Laha-101, T-11 and Varuna. A basal dose of 40 kg N, 20 kg P₂O₅ and 40 kg K₂O/hectare was kept constant in all treatments.

The treatment N S gave highest seed and oil yields, P S gave maximum hecto-litre weight and oil percentage. The variety Varuna gave maximum values for all the characters considered, followed by Laha-101, B. R-40 and T-11, in that order. The interaction N S × Varuna registered highest values for seed and oil yield (increase of 31 and 49% over control, respectively).

Thus, Varuna and a combined spray of N and S may be recommended for optimum and economical yield.

INTRODUCTION

The first report about the application of nitrogen to foliage seems to be that of Ballard and Volck who in 1914 used this technique on dormant apple trees. In India, the technique has been used successfully ever since Sadaphal and Das (1956) published their results-with urea spray. The present day situation of Indian agriculture demands not only increased productivity (particularly on oilseed front which is draining Rs. 800 crores per annum to meet regular imports) but also consumption of minimum fertiliser which, though an essential requirement of HYV's, remains a costly and under-produced input (increase in fertiliser price of 40% in June, 1980 and 18% in 1981 ;

estimated gap of 8.7 lakh tonnes between demand and supply of phosphatic fertilisers by the end of the sixth plan).

Under such conditions of severe constraints, foliar application of nutrients has multi-dimensional advantages. It minimises wastage of fertiliser in soil through fixing and other phenomena, it reduces the consumption and hence inputs as small amounts are used and most important of all, plants get the nutrients at later stages of growth where they play an important role in proper fruit-set and seed filling (Parvaiz, 1980).

MATERIAL AND METHODS

In a field trial laid according to factorial randomised block design on sandy loan soil (sand, 76.7% ; silt, 15.2%, clay,

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8.1%; pH (1: 2), 8.0 ; available N, P and K, 240.20, 17.40 and 802.00 kg/hectare, respectively, a basal dose of 40 kg N (as urea), 20 kg P_2O_5 (as calcium superphosphate) and 40 kg K_2O (as muriate of potash) was applied uniformly to all plots. Aqueous solutions of 2% urea (@ 20 kg N/ha), 0.2% sodium dihydrogen orthophosphate (@ 2 kg P_2O_5 /ha) and 1% sodium sulphate (@ 2 kg S/ha) in four combinations (N+P, N+S, P+S, N+P+S) were applied in two operations at 70 and 90 days after sowing. Controls were sprayed with de-ionised water only. Four varieties of mustard, namely (1) B. R-40 (2) Laha-101 (3) T-11 and (4) Varuna, were selected to study the effect of leaf-applied nitrogen phosphorus and sulphur on various yield attributes.

Healthy seeds of uniform size and weight, pre-treated with absolute alcohol for surface sterilisation, were sown in 10 sq m plots at the rate of 10 kg/ha. The furrows were kept 22.5 cm apart and the number of seeds/furrow was maintained at 15. The field received three irrigations between sowing and harvesting. Weeding was done twice during the entire course of crop period. "Dimecron-100", containing phosphamidon, was sprayed for aphid control. The following parameters were studied at harvest : number of pods per plant, number of seeds per pod, hectolitre weight, oil percentage, seed yield per hectare and oil yield per hectare.

RESULTS AND DISCUSSION

The effect of various treatments, varietal responses and their interactions (treatment \times variety) were mostly found to be significant in relation to various yield attributes.

All foliar treatments containing nitrogen (NS, NP and N P S) gave higher

seed and oil yield compared to the spray of P S (Table III), indicating higher requirement of nitrogen for these plants. The contributing factor seems to be pod number per plant (Table I). It may be mentioned that, although spray of P S enhanced hecto-litre weight and oil percentage (Table II) more than the nitrogen-containing sprays, the higher number of pods per plant and total seed yield in plants receiving nitrogen-containing sprays, compensated for this drawback in oil yield.

It seems that, at the comparatively low level of basal nitrogen applied, against the optimal dose of 80 kg N (60 basal + 20 foliar) for these varieties (Parvaiz, 1980), the plants lacked this nutrient particularly as they grew older. Sprays containing nitrogen helped ameliorate this condition and gave better seed yield. Similar conclusions have been drawn in fertiliser trials by other workers (Arora and Bhatia, 1970; Henry and Macdonald, 1978 and Jain and Jain, 1979). The maximum yield response to N S also seems understandable as sulphur plays an equally important role in the over-all yield of seed and oil (Virmani and Gulati, 1971; Aulakh *et al.*, 1977 and Naqvi *et al.*, 1977).

Among the four varieties tested, Varuna gave the highest values for all yield attributing characters followed by Laha-101, BR-40 and T-11. It was, therefore, no surprise that this variety finally out-yielded the others (Table III).

The best combination of treatment \times variety interaction for yields was N S \times Varuna followed by N P \times Varuna and N P S \times Varuna. In fact, the remaining varieties also generally interacted better with nitrogen-containing sprays than with the spray of P S at this lower than recommended level of basal fertiliser, thus con-

TABLE I
EFFECT OF VARIOUS COMBINATIONS OF LEAF-APPLIED NITROGEN, PHOSPHORUS AND SULPHUR ON NUMBER OF PODS PER PLANT AND SEEDS PER POD
IN FOUR VARIETIES OF MUSTARD.

(Mean of three replicates)										
Foliar Treatments	Pods/Plant					Seeds/Pod				
	Varieties									
	B.R-40	Laha-101	T-11	Varuna	Mean	B.R-40	Laha-101	T-11	Varuna	Mean
Water	315.333	255.000	314.666	333.666	304.666	11.333	11.333	10.333	12.000	11.250
N P	414.000	380.666	702.666	462.666	490.000	11.333	12.333	11.333	12.000	11.750
N S	342.666	316.000	335.666	773.666	442.000	12.000	11.333	11.666	12.666	11.916
P S	508.000	350.333	382.333	442.333	420.750	11.666	12.000	11.000	12.000	11.666
N P S	368.666	373.000	338.666	428.333	377.166	11.666	11.666	11.333	12.000	11.666
Mean	389.733	335.000	414.800	488.133		11.600	11.733	11.133	12.133	

N. B. A basal dose of 40 kg N, 20 kg P₂ O₅ and 40 kg K₂O/hectare was added uniformly.

	C. D. at 5%		C. D. at 5%
Treatment	14.417*	Treatment	N. S.
Variety	12.895*	Variety	0.592*
Treatment × Variety	28.834*	Treatment × Variety	N. S.
*Significant		N. S.=Non-Significant	

TABLE II

EFFECT OF VARIOUS COMBINATIONS OF LEAF-APPLIED NITROGEN, PHOSPHORUS AND SULPHUR ON HECTO-LITRE WEIGHT AND OIL PERCENTAGE IN FOUR VARIETIES OF MUSTARD.

(Mean of three replicates)

Foliar Treatments	Hecto-litre weight (g)					Oil Percentage				
	Varieties									
	B.R-40	Laha-101	T-11	Varuna	Mean	B.R-40	Laha-101	T-11	Varuna	Mean
Water	676.233	675.333	675.216	678.243	676.256	35.473	35.066	35.066	36.089	35.423
N P	684.373	685.243	680.193	687.333	684.285	39.553	39.106	39.053	40.106	39.455
N S	687.410	686.266	686.516	690.383	687.644	40.526	40.106	40.093	41.053	40.445
P S	695.460	692.410	692.350	698.143	694.590	42.253	42.060	42.067	42.486	42.216
N P S	687.566	686.468	686.383	690.403	687.705	40.500	40.360	40.113	41.093	40.516
Mean	686.208	685.144	684.132	688.901		39.661	39.340	39.278	40.165	

N. B. A basal dose of 40 kg N, 20 kg P₂ O₅ and 40 kg K₂O/ hectare was added uniformly.

		C. D. at 5%	
Treatment		0.234*	Treatment
Variety		0.209*	Variety
Treatment × Variety		0.468*	Treatment × Variety
*Significant			

TABLE III

EFFECT OF VARIOUS COMBINATIONS OF LEAF-APPLIED NITROGEN, PHOSPHORUS AND SULPHUR ON THE SEED AND OIL YIELD IN FOUR VARIETIES OF MUSTARD (KG/HECTARE).

(Mean of three replicates)

Foliar Treatments	Seed Yield (kg/ha)					Oil Yield (kg/ha)				
	Varieties									
	B.R-40	Laha-101	T-11	Varuna	Meean	B.R-40	Laha-101	T-11	Varuna	Mean
Water	448.333	646.000	562.000	900.000	639.083	159.185	226.530	197.075	324.790	226.895
N P	803.333	859.333	841.000	1162.666	916.583	317.475	336.067	330.439	466.313	362.573
N S	841.666	857.666	796.000	1179.333	918.666	341.094	344.135	319.151	484.154	372.133
P S	666.666	802.666	706.000	969.000	786.083	281.700	337.592	296.990	411.701	331.996
N P S	806.666	663.333	864.666	974.333	827.250	326.698	265.953	346.851	400.390	334.973
Mean	713.333	765.800	753.933	1037.066		285.230	302.055	298.101	417.470	

N. B. A basal dose of 40 kg N, 20 kg P₂O₅ and 40 kg K₂O/hectare was added uniformly.

	C. D. at 5%		C. D. at 5 %
Treatment	18.172*	Treatment	7.279*
Variety	16.253*	Variety	6.511*
Treatment × Variety	36.344*	Treatment × Variety	14.559*
*Significant			

firming the universal requirement of nitrogen to maintain growth and yield. An increase of 31 and 49% over control in seed and oil yield respectively, highlights the advantage of small foliar doses when given at proper time. Thus, it may be concluded that Varuna can be profitably grown with a basal dose of 40 kg N and 20 kg P_2O_5 supplemented by foliar spray of N and S.

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