J. Indian bot. Soc. 62 : 68—72, 1983

CUMULATIVE ROLE OF BASAL AND FOLIAR FERTILISATION IN ENHANCING THE YIELD OF LAHA-101[1]

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ABSTRACT

The effect of eight combinations of leaf-applied nitrogen, phosphorus and sulphur (20Kg N, 2Kg P_2O_5 and 2 Kg S/hectare), in the presence of two basal doses of nitrogen and phosphorus i.e. 60Kg N+20Kg P_2O_5/ and 30Kg N+10 Kg P_2O_5/ hectare, on yield attributes of mustard (*Brassica juncea* L. Czern. & Coss.) variety Laha-101 was studied in the field in 1976-77.

The basal dose of 60 Kg N and 20Kg P_2O_5/hectare and the combined spray of nitrogen, phosphorus and sulphur gave the best results. Considering the interaction effect, it was noted that each spray treatment proved better for most of the yield attributes at the higher basal level. However, the response of leaf-applied nutrients, on the basis of percent increase over control, was more with the lower basal dose.

The combined spray of 20 Kg N and 2 Kg each of P_2O_5 and S/hectare on plants receiving the basal dose of 60 Kg N and 20 Kg P_2O_5/ hectare may be recommended for optimum yields of Laha-101.

INTRODUCTION

India is facing an "edible oil crisis" as the production of oilseeds has failed to keep pace with the enlarging domestic demands. If the shortage continues, it is feared to assume very serious proportions. It has been estimated that by 1985-86 we would have to import about 1.7 million tonnes of edible oil which is more than three times of the present figure (Parvaiz, 1980).

This alarming situation warrants immediate redressing measures to boost oilseed yield. Breeding high yielding varieties and exploiting their genetic potential by judicious application of fertilisers are the two methods at the disposal of researchers to help improve the situation. In the present experiment, an attempt has been made to optimise the yield of Laha-101, a high yielding variety of mustard, using the technique of foliar fertilisation.

MATERIAL AND METHODS

A field experiment was conducted on sandy loam soil (sand, 75.6%; silt, 15.2%; clay 9.2%; pH (1 : 2), 8.0; available N, P & K : 225.45, 17.92 & 924.00 Kg/ hectare respectively). In a split plot design, with 40 Kg K_2O/hectare added uniformly as muriate of potash, urea and calcium superphosphate were applied in two combinations. One set comprised of 60 Kg N and 20 Kg P_2O_5/hectare, while in the other the dose of the two nutrients were halved to 40 Kg N and 10 Kg P_2O_5/ hectare. In all, there were sixteen treatments, including the control, comprising eight foliar applications of nitrogen, phosphorus and sulphur singly or in various

1. Accepted for publication on May 25, 1982.

combinations (sub-plot treatments) and two basal treatments as explained above (main plot treatments). Each treatment was replicated thrice. Nitrogen was sprayed as urea (2%) at the rate of 20 Kg N/hectare; phosphorus, as sodium dihydrogen orthophosphate (0.2%) at the rate of 2 Kg P_2O_5/hectare and sulphur, as sodium sulphate (1%) at the rate of 2 Kg S/hectare. All the plots were sprayed at 70 days (flowering stage) and 90 days (fruiting stage) after sowing (Naqvi, 1976 and Naqvi *et al.*, 1977).

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/hectare. 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 growth of plants. "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, hecto-litre weight, oil percentage, seed yield per hectare and oil yield per hectare.

RESULTS AND DISCUSSION

The effect of main plot, as well as of of sub plot, treatments was found significant on all the characters studied (Tables I & II). The difference between two

TABLE I

EFFECT OF VARIOUS COMBINATIONS OF LEAF-APPLIED N, P AND S WITH TWO BASAL DOSES OF N AND P ON PODS/PLANT, SEEDS/POD AND HECTO-LITRE WEIGHT IN LAHA-101

(Mean of three replicates)

Foliar Treatments (Sub plot)	Pods/plant			Seeds/pod			Hecto-litre weight (g)		
	Basal Treatments (Main plot)								
	$N_{30}P_{10}$	$N_{60}P_{30}$	Mean	$N_{30}P_{10}$	$N_{60}P_{30}$	Mean	$N_{30}P_{10}$	$N_{60}P_{30}$	Mean
Water	167.333	307.666	237.500	9.000	9.666	9.333	678.126	642.143	660.135
N	183.666	322.000	252.833	10.000	10.666	10.333	642.100	632.083	637.091
P	198.666	311.333	255.000	9.333	10.000	9.666	690.130	678.100	684.115
S	194.333	312.333	253.333	9.333	9.666	9.500	692.073	682.683	687.378
NP	191.000	314.666	252.833	9.666	11.333	10.500	682.266	650.176	666.221
NS	199.333	318.000	258.666	9.666	10.666	10.166	687.216	675.176	681.196
PS	193.666	315.666	254.666	9.000	9.666	9.333	698.256	692.223	695.240
NPS	196.666	346.666	271.666	10.000	10.666	10.333	690.076	678.076	684.076
Mean	190.583	318.541		9.500	10.291		682.530	666.332	

N.B. Potassium was added uniformly to the soil at 40Kg K_2O/hectare.

	C.D. at 5%	C.D. at 5%	C.D. at 5%
Main plot treatment	6.841*	0.358*	0.087*
Sub plot treatment	5.436*	0.547*	0.067*
The difference of the main plot means at the same level of sub plot	9.373*	N.S.	0.117*
The difference of the sub plot means at the same level of main plot	7.688*	N.S.	0.094*

*=Significant

N.S.=Non-significant

TABLE II

EFFECT OF VARIOUS COMBINATIONS OF LEAF-APPLIED N, P AND S WITH TWO BASAL DOSES OF N AND P ON OIL PERCENTAGE, SEED AND OIL YIELD IN LAHA-101

(Mean of three replicates)

Foliar Treatments (Sub plot)	Oil percentage			Seed yield (Kg/hectare)			Oil yield (Kg/hectare)		
	Basal Treatments (Main plot)								
	$N_{30}P_{10}$	$N_{60}P_{20}$	Mean	$N_{30}P_{10}$	$N_{60}P_{20}$	Mean	$N_{30}P_{10}$	$N_{60}P_{20}$	Mean
Water	36.113	33.060	34.586	626.666	1080.000	853.333	226.301	357.068	291.684
N	32.993	30.040	31.516	933.333	1320.000	1126.666	307.933	396.530	352.232
P	40.073	38.046	39.060	893.333	1253.333	1073.333	357.984	476.850	417.417
S	41.046	38.066	39.556	653.333	1201.666	927.500	268.176	457.433	362.804
NP	38.113	34.100	36.106	1013.333	1362.666	1188.000	386.208	464.669	425.438
NS	39.013	34.980	36.996	946.666	1274.666	1110.666	369.322	450.201	409.762
PS	42.053	40.993	41.523	966.666	1292.000	1129.333	406.508	529.633	468.070
NPS	40.066	36.020	38.043	1060.000	1413.333	1236.666	424.717	509.085	466.901
Mean	38.684	35.663		886.666	1274.708		343.393	455.184	

N.B. Potassium was added uniformly to the soil at 40Kg K_2O/hectare.

	C.D. at 5%	C.D. at 5%	C.D. at 5%
Main plot treatment	0.068*	36.023*	13.649*
Sub plot treatment	0.067*	28.641*	11.038*
The difference of the main plot means at the same level of sub plot	0.107*	49.370*	18.890*
The difference of the sub plot means at the same level of main plot	0.095*	40.504*	15.611*

*=Significant

treatment means at the same level of basal or spray treatment was significant in all the characters considered, except the number of seeds per pod.

Of the two basal treatments, the higher dose (N_{60} P_{20}) proved better for pods/plant, seeds/pod as well as yield of seed and oil (Tables I & II), whereas hecto-litre weight (Table I) and oil percentage (Table II) were higher at the $N_{30}P_{10}$ level. The enhancing effect at $N_{60}P_{20}$ level confirmed the earlier findings of Naqvi (1976), Naqvi *et al.*, (1977) and Afridi *et al.*, (1978) and was apparently due to a higher production of pods/plant and seeds/pod as noted above. It may be mentioned that Dayanand and Mahapatra (1974) and Aulakh *et al.* (1977), found an increase in seed yield with higher doses of nitrogen. Such results would be expected due to ameliorative effect of this essential macronutrient on plant growth in general. As far as the effect of phosphorus is concerned, it may

be pointed out that many workers have found doses close to 20 Kg P_2O_5/hectare to give good results. Thus, Mehrotra *et al.* (1972) and Naqvi *et al.* (1977), among others, found 20-25 Kg P_2O_5/hectare as the optimum dose of this nutrient for mustard in the presence of nitrogen varying between 40 and 66 Kg N/hectare.

The lower hecto-litre weight and oil percentage in N_{60} P_{20} (Tables I ; & II) indicate that the higher dose of nitrogen in the absence of high phosphorus depressed oil formation. Similar conclusions for nitrogen have been drawn by Arora and Bhatia (1970). However, despite its depressing effect on oil formation, the higher dose more than compensated for this drawback by producing more seeds (Table II) which ultimately resulted in higher oil yield (Table II). A similar compensating effect of nitrogen (through higher seed yields) has been reported by Sotomayor (1977).

A perusal of Tables I & II gives a clear indication of a beneficial effect of nitrogen spray (alone and with other nutrients) on pod and seed production and, consequently, on seed yield, However, the highest values for hecto-litre weight and oil percentage were obtained by the spray of PS, with that of S and P following close behind. Almost similar findings have been reported for oil percentage by Afridi *et al.* (1978).

It was noted that for most of the characters considered, including seed and oil yield, each spray treatment at the basal fertiliser dose of N_{60} P_{20} gave a higher value compared to that given by the corresponding spray at N_{30} P_{10} level (Tables I & II).

In comparing the differences of the values for the sub plots at the same level of main plot, it was noted that, at the lower fertiliser level (N_{30} P_{10}), seed and oil yields were increased most by NPS spray followed by NP and PS. Apparently, the fertiliser dose being sub-optimal, these plants developed a "hidden hunger" and responded very favourably to the spray of nutrients.

On the other hand, at the higher fertiliser level (N_{60} P_{20}), seed yield was maximum in spray of NPS, followed by those of NP and N alone, which confirms the role of nitrogen for this criterion. However, oil yield was highest in spray of PS and was depressed considerably by sprays containing nitrogen. It appears that these plants were adequately provided with nitrogen. Hence, further application of nitrogen containing sprays lowered the oil yield by adversely affecting oil percentage and hecto-litre weight as discussed.

Interestingly, it was noted that, for each spray treatment, though higher yields were obtained with the higher basal dose i. e. N_{60} P_{20}, the percent increase in yields over respective controls was more in N_{30} P_{20}. This indicates that the response of leaf-applied nutrients was less with the higher basal fertiliser dose as compared to their response with the lower dose. This implies that foliar fertilisation technique may come to the rescue of the farmer if he is somehow constrained to apply full dose of fertiliser to his crop at the time of sowing.

On the basis of results presented here, spray of NPS may be recommended for obtaining seed and oil yield of Laha-101.

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