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RELATIVE EFFICIENCY OF NITROGEN, PHOSPHORUS AND SULPHUR ON YIELD AND YIELD CONTRIBUTORY COMPONENTS OF SOYBEAN (*GLYCINE MAX, L.*)

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The influence of nitrogen, phosphorus and sulphur alone and in combination was computed for yield and yield components of two soybean cultivars. The doses employed were zero, 0.382 mg N, 0.582 mg P, 1.97 mg S, 0.382 mg N + 0.582 mg P, 0.582 mg P + 1.97 mg S and 0.382 mg N + 1.97 mg S per pot containing 10 kg soil. There were five replications in all. As judged from this study nitrogen stimulated plant height and leaf area and phosphorus reduced days to flowering. Nitgrogen + phosphorus showed much improvement in pod setting, enhanced length of pod, reduced days to maturing and was high yielding combination Among the cultivars of soybean, Davis proved to be early maturing and high yielding.

INTRODUCTION

To enhance soybean production, use of fertilizers in appropriate amount and at proper time is of great imprtance. Application of nitrogen alongwith adequate supply of phosphorus helps in increasing soybean productivity considerably. Phosphorus also plays pivotal role in stimulation of nodule bacteria, while sulphur deficiency affects the chemical composition of stem, leaveas and seeds (Ishizuka, 1971; Sharma and Bradford, 1973; Moursi *et al.* 1976 and Hamissa, 1980). Sulphate application is known to increase and phosphorus application decrease dry matter yield significantly in *Trifolium alexandrium* L. (Marok and Dev, 1980). The seed yield and forage of *Vicia faba* L. were infrequently and unpredictably affected by the rate of nitrogen application, method or application date (Richards and Soper, 1982). The present experiment was planned to evaluate the effect of phosphorus, sulphur and nitrogen application on the yield of soybean cultivars.

MATERIALS AND METHODS

Experiments on soybean were conducted during 1982-83 in uniform sized pots. The soil used was collected from the fields of the experimental area of

the Department of Botany, University of Agriculture, Faisalabad and mixid up thoroughly, dried and sieved through 1mm sieve. Each pot, lined with polyethyline bag, contained 10 kg of soil. Certified seed of soybean cultivars namely, William and Davis was screened for uniformity of size. The experiment was laid out in a completely randomised design with five replicates. The fertilizer treatments of 0.382 mg N, 0.582 mg P, and 1.97 mg S, 0.382 mg N + 0.582 mg P, 0.382 mg N + 1.97 mg S and 0.582 mg P + 1.97 mg S per pot in the form of Urea, triple superphosphate and potassium sulphate were applied prior to sowing. There were 10 plants in each replicate. Observations on morphological characters were made throughout the experimental period. At maturity, plants were harvested and data on growth and yield were obtained. Analysis of variance (Steel and Torri, 1960) and Duncan's Multiple Range Test (Leclarg *et al.* 1962) were employed to compare the treatement and variety means.

RESULTS AND DISCUSSIONS

The data presented in Table 1 reveal that application of nitrogen brought about statistically significant change in plant height showing thereby that soybean plant is capable of making efficient use of nitrogen fertilizer towards vegetative growth irrespective of the combinations. On the average, the plant height ranged from 17.6 to 25.5 cm. Furthermore, the analysis of variance showed that Davis tended to be taller than William cultivar of soybean. This level of nitrogen seems to be the most favourable in creating a suitable balance between the supply and the sink i.e. nutrients and the plant height. An increase in plant height with nitrogen in non-nodulating isolines of soybeen has already been recorded (Olsen *et al.* 1975 and Moursi *et al.* 1976) but these findings are in contrary to Saleh (1976) who observed an increase in plant height of soybean after phosphorus application. Soybean plant responded well to nitrogen as well as nitrogen + phosphorus and nitrogen + sulphur combinations in building up of leaf area as indicated by significant differences among the treatments. The rate of stimulation was significantly higher in all the treated plants than in the control ones. William indicated greater leaf area (22.30 cm^2) than Davis (19.76 cm^2). The results are in agreement with that of Ishizuka (1971) who found that nitrogen fertilizer promoted vegetative growth in soybeen plant.

Phosphorus treatment reduced the number of days to flowering as compared to other treatments. In Davis, phosphorus treatment induced significantly

Table 2. *Total fish production in control and treated ponds*

Title	Treated			Control		
	Catla catla	*Labeo rohita*	*Cirrhina mrigala*	*Catla catla*	*Labeo rohita*	*Cirrhina mrigala*
Number of fish stocked	14	34	8	14	34	8
Number of recovered	14	34	8	14	34	8
Survival %	100	100	100	100	100	100
Initial average weight (gm)	27.14	36.70	17.5	25.00	27.50	15.5
Final average (weight (gm)	810.04	605.00	389.00	302.72	238.20	194.50
Total production/pond/ 9month (gm)	11340.56	20570 00	3112.00	4236.08	8098.80	1556.00
Total production/acre/ 9month (kg)	132.17	693.21	104.87	142.75	272.93	52.43
Gross production		All species			All species	
Kg/acre/9 months		1180.25			468.11	
Gross production (Approx.) Kg/acre/year		1573.66			624.14	

early flowering, whereas all the other treatments delayed it. In William, nitrogen + phosporus treatment stimulated early flowering where as other treatments tended to delay it. Similar results were recorded by Moursi *et al.* (1976) on lupin and by Saleh (1976) on soybean. As regard to the response involving the number of pods, treatment with phosphorus + sulpher and sulpher + nitrogen and phosphorus appeared to have statistically similar results. Davis produced more pods than William. The number of pods for nitrogen + phosphorus was the maximum and was closely followed by that of nitrogen treatment, whereas all other combinations of single treatments could not bring about much improvement in pod setting. The results of this investigation are in agreement with those of Ahmad and Shafi (1975), but are at variance with those of Muralidharan *et al.* (1975), Dahatonde and Rahate (1974) and Saleh (1976) who reported significant increase in pod setting after phosporus application on various plant species. The pod length was significantly stimulated by nitrogen + phosporus application. However, the difference in pod length due to nitrogen, phosphoras, sulphur and nitrogen + sulphur was statistically non-significant. These findings are in conformity with those of Moursi *et al.* (1976) and Rubes (1976) who also suggested an increase in length of pod after phosphorus or nitrogen application in different plant species.

The data on maturity showed that nitrogen + phosphorus combination induced early maturity, while all the other treatments could not show much improvement. Just like days taken to flowering, phosphorus also reduced the days for maturity in Davis (81 days), while William took 91 days to reach full maturity. This wide difference in response shown by the two cultivars could possibly be explained by the difference in their system of morphogenetic control. Similar findings have been reported by Saleh (1976) who recorded that phosphorus application reduced number of days to maturity in soybean plant. Yield is the total expression of most of the morphological and physiological characters of a plant and is the net result of the interaction of genotype with the environmental factors. On this basis, treatments with nitrogen, nitrogen + phosphorus and nitrogen + sulphur were classed as high yielding, phosphorus and sulphur as medium yielding and phosphorus + sulphur as low yielding. Thus, if a judicious amount of nitrogen alone or in combination with phosphorus and sulpher is applied through an appropriate method it may greatly boost up the yield. Nangju (1976), Aulakh and Pasricha (1977) and Marok and Dev (1980) have

showed that nitrogen, phosphorus, or their combinations were responsible for increased yield.

In the light of these results, one might speculate that there is a close correlation between vegetative growth and yield for both the cultivars. The failure of response to some fertilizer levels can well be attributed to the limited genetic potentials of the cultivars with respect to efficient use of the doses of fertilizers. Deficiency of mirconutrients like Fe, Cu and Zn may also cause failure in getting proper response to NPS. However, further studies of this nature involving micronutrients are warranted. Stimulation of vegetative growth induced by appropriate nitrogen, nitrogen + phosphorus and nitrogen levels may help the plants in realizing their potential yield. Therefore, this warrants an extreme caution while recommending fertilizer levels for a particular variety.

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