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Response of Soybean varieties to graded doses of Nitrogen and Phosphorus*

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ABSTRACT

A manurial experiment was conducted during Khariff 1969 with two varieties of soybean, with 3 levels of nitrogen and 4 levels of phosphorus. The results revealed that among the two varieties *EC. 39821* was found to be good for seed yield than *EC. 39824*. The response to phosphrous varied with varieties. The variety EC 39821 required 100 kg whereas EC. 39824 required 50 kg of phosphorus per ha. Protein yield was influenced by the application of phosphorus and protein content was increased by the application of nitrogen. Phosphorus significantly increased the oil per cent and oil yield.

Soybean (*Glycine max* (L-Merrill)is recognized world wide as one of the important sources of protein and oil (43.2 and 19.5 per cent respectively). Though soybean was introduced at the same time both in U. S. A. and India, it has not made any headway in our country.

In a fertilizer trial in Illinois, U.S.A., the highest yield was obtained from plots receiving 445 kg of ammonium nitrate per ha (Anon. 1949). Gandhi (1956) recommended 22 kg nitrogen per ha in the form of ammonium sulphate for good yield. Recent work at Pantnagar revealed best performance of soybean at 30 kg nitrogen per ha (Anon. 1968). Jethmalani *et al.* (1969) recommended 20 kg nitrogen per ha for inoculated soybean based on the work at Jabalpur. Similar trials in Tamil Nadu soils are lacking.

In Mississipi, U. S. A., Anthony (1967) reported that an annual application of atleast 50 kg per ha of phosphoric acid was found necessary. At rates up to 224 kg per ha of phosphorus. Islam (1964) found increased seed and dry matter yield. Singh and Singh (1968) obtained linear response to applied phosphorus up to 80 kg per ha. Gandhi (1956) recommended 66 kg per ha but Sethmalani *et al.* (1969) recommended 80 kg per ha of phosphoric acid for profitable yield. Singh and Saxena (1969) advocated the application of 100 kg phosphoric acid per ha based on the studies at Pantnagar.

Application of nitrogen and potash resulted in a slight decrease in oil and increase in protein content (Fillers, 1918). Stark (1924) found that application of phosphate in addition to lime stone and organic matter increased protein and decreased oil content to a marked degree. In Italy, Ramagnoli (1949) found phosphorus and potash fertilizers to favour oil formation and nitrogen fertilizers result in high protein and seed yield.

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MATERIALS AND METHODS

An experiment was conducted to study the response of two soybean varieties to graded doses of nitrogen and phosphorus under inoculated conditions in Central Farm, Coimbatore during Khariff 1969. Split plot design with three replications was adopted assigning the two varieties viz., EC 39821 (V1) and EC 39824 (V2) and four levels of P_2O_5 viz., 0, 50, 100 and 150 kg per ha to the main plots and three levels of nitrogen viz., 0, 30 and 60 kg per ha to the sub plots. The growth, yield and quality characters of soybean were studied. Iron deficiency was noted on the leaves during the seventh week and a uniform spraying of 0.4 per cent ferrous sulphate neutralised with lime was given.

RESULTS AND DISCUSSION

The results of plant height, number of pods per plant, total dry matter production, seed yield protein and oil content are presented in Table 1and 2.

Plant height

The height of the plant differed significantly among the two varieties due to their genetic make up. EC 39824 was taller (42.13 cm.) than EC 39821 (28.23 cm).

The levels of phosphoric acid had significant negative influence on the plant height; successive additions of phosphoric acid gradually reduced the plant height but the difference was non-significant.

Number of pods per plant

There was a significant difference between the varieties with V2 giving increased number of pods (29.58 pods/ plant).

The influence of phosphorus over the number of pods per plant was significant. Pods being one of the important yield attributes, and because phosphorus play a vital role in the productive phase of the crop such increase is anticipated. This is in conformity with Singh and Saxena (1969).

Total dry matter production

Varieties differed in their total dry matter production. Since V2 is taller with more nodes it recorded more dry matter production with 3.168 gm/plant as compared to 1.572 gm / plant in V1.

Application of phosphoric acid significantly influenced the total dry matter production. Maximum dry matter production of 3.393 gm/plant was recorded in treatment 100 kg P_2O_5 / ha followed by 2.370 gm / plant in the treatment with 50 kg P_2O_5 / ha. The highest level and no phosphorus were on par.

There was significant varietal difference in their response to P_2O_5 application (Table 2) while the variety EC. 39821 responded up to 100 kg P_2O_5/ ha with an yield of 1706 kg. The variety 39824 responded only up to 50 kg P_2O_5 / ha with 1394 kg. This differential response was reported by Howell (1954) and De Mooy (1965).

Protein content of seed and protein yield

Protein content was 41.69 and 46.69 per cent respectively in the varieties EC 39821 and EC 39824. This is in agreement with the findings of Krishnaswami and Pundarikakshudu (1970) wherein they had recorded 41.22 and 47.13 per cent of protein in

Table 1.

Influence of varieties on yield and different growth and yield attributes

Varieties	Mean height in cm	Mean No. of pods per plant	Total dry matter production in gm	Seed yield kg/ha	Protein content %	Protein yield kg/gm	Oil per cent
V1	28.23	15.95	1.572	804.5	41.69	336.7	20.89
V2	42.13	25.58	3.168	914.0	46.69	428.1	19.20
SE	0.63	0.60	0.061	—	—	24.9	—
CD	1.93	1.82	0.184	—	—	75.6	—
F Test	Sig.	Sig.	Sig.	—	—	Sig.	—

Table 2.

Influence of phosphorus on yield and different growth and yield attributes

Levels of P_2O_5	Mean height in cm	Mean No. of pods per plant	Total dry matter production in gm	Seed yield kg/ha	Protein content %	Protein yield kg/ha	Oil per cent
0	38.40	17.22	1.751	618.01	42.80	269 6	18.95
50	34.32	21.22	2.370	991.63	43.46	443.7	19 31
100	33.63	25 55	3.393	1179.40	44.51	513 4	20.34
150	33.25	27.05	1 965	649.80	45.99	302.9	21.50
S E	0.87	0.84	0.086	3.10	0.07	35 3	0 22
C D	2.66	2.54	0.262	9.41	0.22	107.0	0.67
F Test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.

Table 3.

Influence of levels of N on protein content

Levels of Nitrogen	Protein per cent	S.E	C.D
N_0	43.87		
N_1	44.28	0.09	0.26
N_2	44.42		
Conclusion : $\overline{N2}$ N2 NO			

the varieties EC. 39821 and EC. 39824 respectively.

Protein content showed linear trend with increasing levels of phosphoric acid in both the varieties. The importance of phosphorus to protein formation was emphasized in general by Sircar and Sen (1941) and Eaton (1950). Stark (1924) and Fuleky (1943) reported increased protein content for applied phosphoric acid.

The influence of nitrogen is seen in increasing the protein content of seed (Table 3) Increased protein content for the applied nitrogen was reported by Fellers (1918), Norman (1944) and others.

Oil content in seed and oil yield:

Oil content in E.C. 39821 and EC. 39824 was 20.89 and 19.20 per cent respectively. Application of phosphoric acid influenced the oil content significantly. Maximum oil per cent of 21.50 was recorded by the application of 150 kg $P_2 O_5$ per ha followed by 20.34 per cent at 100 kg $P_2 O_5$/ha. The evidences of Kornberg and Pricer (1953). and Van Baalan and Gurin (1953) indicated the need for phosphorus compounds both in formation of fatty acids and their esterification to form oils.

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