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Effect of Spacing, Nitrogen and Phosphorous levels on yield and Protein content of Soyabean*

by

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Soyabean *(Glycine max)* is cultivated in temperate condition of Himalayan region particularly in Kumaun and Garhwal Zones, where it is locally known as "Bhat". The main reason for the popularity of this corp is its richest protein content and exceptionally high oil content as compared to other pulse crops. Sufficient information is lacking in regard to its agronomical practices such as proper spacing and manurial requirements in the condition of plains of Uttar Pradesh. In order to find out suitable spacing and requirements of nitrogen and phosphorus for soyabean, the present experiment was conducted at Government Agricultural College, Kanpur during the *Kharif*, 1966—'67.

Review of Literature: Optimum plant population of a crop at particular level of fertility is the chief yield contributing factor. Many workers like Hartwing (1957), Mitrovice (1959) and Nelson and Robert (1964) have studied the effect of varying row spacing on yield of soyabean. Spacing has also been reported to affect the protein content of grain. Donovan *et. al.* (1963) reported that protein content tended to be lower with closer spacing. Calland (1960) recommended 20 lb. N per acre for soyabean. Further, Welch *et. al.* (1949) and Howell (1955) have reported beneficial effect of phosphate fertilization on yield of soyabean. The protein content of soyabean seed is also reported to increase due to phosphate fertilization (Fuleky, 1947).

Material and Method: The experiment comprised three row spacings (25, 50 and 75 cm), two levels of N (0 and 10 kg. N/hectare) and 5 levels of P (0, 20, 40, 60 and 80 kg P_2O_5/hectare) was conducted with the variety T_{49} in split plot design replicated thrice with spacing in main-plots and N and P in sub-plots. Ammonium sulphate and single superphosphate were used for N and P respectively.

Result and Discussion: The data on grain and straw yield and protein content of grain are presented in Table 1.

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TABLE 1. *Grain and Straw Yield.*

Treatment		Grain yield (Q/ha)	Straw yield (Q/ha)	Protein (%)
Row spacing:	25 cm	10·52	19·048	42·06
	50 cm	8·38	12·571	42·13
	75 cm	6·62	12·571	42·01
	S. Em.	± 1·70	± 3·05	± 0·126
		(Not significant)		
Nitrogen :	0 kg	8·22	13·905	41·66
	10 kg/ha	8·71	14·238	42·59
	S. Em	± 0·13	± 0·48	± 0·01
	C. D. at 5%	0·381	N. S.	0·021
	C. D. at 1%	N. S.	N. S.	0·037
Phosphorus :	0 kg	7·71	12·66	42·01
	20 kg/ha	8·38	12·95	42·03
	40 kg/ha	8·38	13·90	41·99
	60 kg/ha	8·43	15·00	42·13
	80 kg/ha	9·48	15·76	42·12
	S. Em.	± 0·209	± 0·733	± 0·014
	C. D. at 5%	0·600	2·09	0·044
	C. D. at 1%	0·757	2·78	0·053

Grain Yield: Grain yield did not differ significantly due to various spacings but showed marked increase with the application of 10 kg N/ha. The findings of Lyons and Earley (1952) and Nelson *et. al.* (1964) also confirm the beneficial effect of nitrogen on yield. The effect of P was pronounced at its various levels and grain yield increased linearly. The linear trend in grain yield ($y = a + bx$) indicates that the optimum level of manuring has not yet reached and the dose of phosphorus can be safely increased beyond 80 kg P_2O_5/ha for more profitable returns. Krugel *et. al.* (1943) reported increased yield of 300 per cent with highest phosphorus application.

The interaction effect of N and P was found significant as given below :

TABLE 2. *Grain yield in Q/ha.*

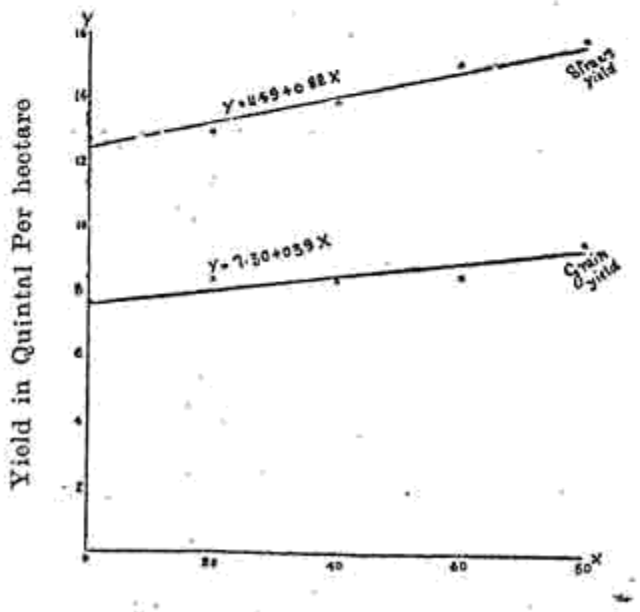
N doses (kg/ha)	Phosphorus doses (kg/ha)				
	0	20	40	60	80
0	7·48	7·90	8·28	8·81	8·76
10	7·90	8·90	8·09	8.09	10·18
S. Em. ±	0·305	C. D. (P = 0·05) = 0·848			

Application of 80 kg P_2O_5 and 10 kg N per hectare increased the rain yield significantly over other combination of N and P. The increase ı grain yield due to above combination may be due to the supply of alanced nutrients.

Straw Yield : Straw yield remained unaffected under the overall ffects of spacing and N (Table 1). However, it increased with increasing oses of P, indicating a linear increase (Fig. 1). Maximum yield of straw ith 80 kg P_2O_5/ha may be attributed to enhanced growth resulted from he availability of high amount of P in presence of initially high soil itrogen (0·054).

FIG. 1.

Line of best fit curve for grain and straw yield
1 Quintal = 1 Cms.



The interaction effect of spacing and P was found significant as shown in table 3.

TABLE 3. *Straw yield in Q/ha.*

P_2O_5 doses (kg/ha)	Row spacing in cm		
	25	50	75
0	18·26	8·86	10·43
20	16·71	12·43	9·76
40	19·29	12·62	9·90
60	19·06	16·95	9·00
80	21·48	11·90	14·00

S. Em. ± 1·295 C. D. (P + 0·05) = 3·67, C. D. (P = 0·01) = 6·83

The application of 80 kg P_2O_5/ha to soyabean sown at 25 cm row spacing produced the maximum straw yield, which may be attributed to good growth resulted from more availability of P and increased population of plants at this closer spacing of 25 cm.

Protein content: The protein content in grain was almost the same under different spacings but it increased with N application (Table 1). Since N is the chief constituent of protein, its application tended to increase the protein in soyabean. As regards P, the highest two doses increased the protein content over the other doses of P. Fuleky 1947 & 1948) reported, increase in protein percentage in seed with the application of phosphatic fertilizer.

The interaction effect of spacing and N enhanced significantly the protein content in grain as shown in table 4.

TABLE 4. *Protein Percentage in seed of Soyabean.*

N doses (kg/ha)	Row spacings in cm		
	25	50	75
0	41·55	41·70	41·45
10	42.62	42·57	42·58

S. Em· ± 0·018 C. D. (P = .0·05) = 0·048 & C. D. (P = 0·01) = 0·053

Maximum protein content in soyabean was found with the application of 10 kg N/ha, sown at 25 cm row spacing.

--mmary: Results of an experiment to study the effect of different row spacings, N doses and P levels on yield of grain and straw of soyabean and protein content of soyabean grain revealed that: (i) Grain and straw yield and protein content of soyabean grain did not differ due to different row spacings. (ii) Application of 10 kg N/ha increased significantly the the grain yield but not the straw yield. However, the protein in grain was significantly increased by 2·23 per cent due to the application of N. (iii) The grain and straw yield showed linear increase upto 80 kg. P_2O_5/ha, indicating that the level of P application can be increased. (iv) The interaction of 10 kg N/ha and 80 kg P_2O_5/ha significantly increased the grain yield by 36·23 per cent over control (7·48 Q/ha), while the interation of 80 kg P_2O5/ha and 25 cm row spacing has considerably enhanced the straw yield and (v) The application of 10 kg N/ha to soyabean sown at the row spacing of 25 cm has had the maximum protein content of 42·62 per cent in grain.

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REFERENCES

Calland, J. W.	1960	Soyabean fertilization. *Crops* and *Soils.*, **13** : 7-9.
Donouan, L. S., F. Dimmock and R. B. Carson	1963	Some effects of planting pattern on yields, per centage of oil content and percentage of protein in Mandarin Soyabean. *Canad. J. Plant Sci.* **43** : 131–40.
Fuleky, G.	1947	The protein and oil content of soybean artificially fertilized. *Biol. Abst.*, **21** (No. 15275).
———	1948	Effect of fertilization and inoculation on the protein and oil contents of soyabeans. *Soils* and *Fert.*, **11** : 130.
Hartwig, E. E.	1957	Row width and Rates of planting in the Southern States. *Field Crop Abst.*, **10** : 180.
Howell, R. W.	1955	Phosphorus nutrition of soybean. *Pl. Physiol.*, **29** ; 477–83.
Krugel, C., C. Dreyspring and F. Henerico	1943	The effect on soybean of increasing phosphoric acid fertilizers. *Soil* and *Fert.*, **6** : 145.
Lyons, J. C. and N. B. Earley	1952	The effect of ammonium nitrate application to field soils on nodulation, seed, yield and nitrogen and oil content of seed of soybeans. *Ibid.*, **15** : 426.
Mitrovic, A.	1959	The effect of density and method of sowing on the morphological features and yield of soybean in South Banat. *Field Crop. Abst.*, **12** : 119.
Nelson, G. E. and S. Roberts	1964	Effect of plant spacing and planting date on six varieties of soybeans. *Ibid.*, **17** : 32.
Nelson, G. E. S. Roberts and G. D. Nelson	1964	Yield and plant responses of six soybean varieties to N and Zinc fertilization. *Ibid.*, **17** : 144.
Welch, C. D., N. S. Hall and W. L. Nelson	1949	Utilization of fertilizer and soil phosphorus by Soybeans. *Soil Sci. Soc. Amer. Proc.*, **14** : 231-35.