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Spacing-cum-manurial Studies in Brinjal (*Solanum melongena* L.)

by

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Introduction: Brinjal (*Solanum melongena* L.) is being cultivated on a large scale in view of its easy cultural practices, keeping quality and high yield. As brinjal is a commonly accepted vegetable, coming all round the year with wide adoptability, it is necessary to step up its yield by judicious cultural practices. An experiment was conducted at the Agricultural College and Research Institute, Coimbatore to find out the optimum dose of the major plant nutrients and economical spacing required for brinjal and the results are presented.

Materials and Methods: The effects of spacing and manuring with N, P and K were studied singly and in combination for three consecutive seasons commencing from 1965 on the popular variety of brinjal Cluster White (SM-62) adopting 34 confounded factorial design. The experiment included 81 different combinations of treatments involving three different spacings and three graded doses of N, P and K over a basal dressing of 20 tonnes of farm yard manure/ha, namely. (i) Spacing at 3 levels *viz*. 75 × 45 cm (So) 75×60 cm (S1) and 75×75 cm (S2). (ii) N at 3 levels *viz*. 0 (No), 50 (N1) and 100 (N2) kg/ha (in the form of Ammonium sulphate). (iii) P_2O_5 at 3 levels *viz*. 0 (Po), 50 (P1) and 100 (P2) kg/ha (in the form of Super phosphate) and (iv) Potash at 3 levels *viz*. 0 (Ko), 30 (K1) and 60 (K2) kg/ha (in the form of Muriate of Potash). Fertilizers were applied to each plot according to schedule. All fertilizers were applied as basal dressing except N of which only 50% dosage was applied along with basal dressing. The seedlings were planted on one side of the ridges at specified spacings. On the 45th day after transplanting, the remaining half dose of N was applied and the crop earthed up. Other routine cultural operations were the same for all treatments and were attended to regularly. Yield of fruits (both by number and by weight) and crop earliness as per Bartlett (1937) were recorded and analysed statistically. The economics of the various treatments were computed.

A response curve was fitted up for the mean yield of fruits under the different doses of N, P and K for the purpose of determining the regression of yield on fertilizers.

Results: *Spacing*: The effect of spacing on the yield and other characters is presented in Table 1. The differences in yield due to different spacings

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TABLE 1. *Effect of spacing on the yield of Brinjal.*

Particulars	Monsoon 1965			Monsoon 1966			Summer 1967			Mean of three seasons		
	S_0	S_1	S_2	S_0	S_1	S_2	S_0	S_1	S_2	S_0	S_1	S_2
YIELD/ha												
1. No. of fruits in 100s	3,840	3,424	2,920	996	1,266	894	6,414	5,240	4,976	3,750	3,319	2,930
% on G.M.	113.10	100.83	86.00	95.58	121.49	85.79	115.63	96.26	89.22	112.42	99.40	87.99
% of increase over S_2	131.50	117.26	100	111.41	141.61	100	128.87	105.30	100	127.98	112.97	100
Whether sig. or not		No			No			No			Yes	
S.E.		—			—			—			11.9	
C.D.		—			—			—			46.7	
Conclusion		—			—			—			$\overline{S_0, S_1, S_2}$	
2. Wt. of fruits in kg/ha	6,583	8,083	6,619	2,173	2,275	2,596	10,891	10,603	10,283	6,549	6,987	6,509
% on G.M.	92.65	113.79	93.58	92.55	96.89	110.60	102.82	100.10	97.08	98.01	104.56	97.41
% on increase over S_2	99.00	121.58	100	83.70	87.64	100	105.91	103.10	100	100.61	107.34	100
Whether sig. or not		No			No			No			No	

TABLE 2. (a) *Effect of nitrogen on yields of Brinjal*

Particulars	Monsoon 1965			Monsoon 1966			Summer 1967			Mean of three seasons		
	N_0	N_1	N_2	N_0	N_1	N_2	N_0	N_1	N_2	N_0	N_1	N_2
YIELD/ha												
1. No. of fruits in 100s	4,374	4,834	4,770	436	486	760	4,460	5,480	5,420	3,090	3,600	3,650
% on N_0	100	110.52	107.11	100	113.74	151.37	100	122.87	121.52	100.00	116.50	118.12
Whether sig. or not		No			Yes			Yes			Yes	
S.E.		—			85			21.9			8.6	
C.D.		—			243			63			33.7	
Conclusion		—			N_2, N_1, N_0			N_1, N_2, N_0			N_2, N_1, No	
2. Wt. of fruits kg/ha	7,298	6,785	7,544	1,800	1,848	3,211	9,298	11,459	10,938	6,129	6,697	7,231
% on N_0	100	92.96	103.37	100	102.66	178.33	100	123.24	117.63	100	109.26	117.98
Whether sig. or not		No			Yes			Yes			No	
S.E.		—			433			590			—	
D.E.		—			1257			1686			—	
Conclusion		—			N_2, N_1, N_0			N_1, N_2, N_0			—	

(b) *Effect of phosphorus on yields of Brinjal*

YIELD/ha	P_0	P_1	P_2	P_0	P_1	P_2	P_0	P_1	P_2	P_0	P_1	P_2
1. No. of fruits 100s	2,062	1,790	2,318	567	768	566	4,920	5,861	5,168	2,516	2,806	2,684
% on P_0	100	87.29	112.42	100	134.39	99.82	100	119.12	105.04	100	111.13	106.67
Whether sig. or not		No			No			No			No	
2. Wt. of fruits (kg/ha)	7,086	8,483	7,954	2,483	2,381	2,279	9,487	11,456	10,794	6,352	7,432	7,009
% on P_0	100	119.71	112.22	100	95.08	91.79	100	120.74	113.77	100	117.02	110.34
Whether sig. or not		No			No			No			No	

(c) *Effect of Potash on yields of Brinjal*

YIELD/ha	K_0	K_1	K_2	K_0	K_1	K_2	K_0	K_1	K_2	K_0	K_1	K_2
1. No. of fruits in 100s	1,907	2,410	1,816	484	544	647	4,969	5,299	4,902	2,453	2,751	2,455
2. % on K_0	100	126.37	95.22	100	112.39	133.67	100	106.64	98.61	100	112.10	100.07
Whether sig. or not		No			No			No			No	
2. Wt. of fruits (kg/ha)	6,669	8,399	6,825	2,037	2,331	2,673	10,180	11,536	9,905	6,295	7,402	6,468
% on K_0	100	125.94	102.33	100	114.43	131.23	100	113.32	94.11	100	114.40	102.75
Whether sig. or not		No			No			No			No	

were not significant statistically. Closer spacing has recorded higher yields per hectare in terms of number of fruits in all the seasons, the increase being 31.50%, 28.87% and 11.41% over the wider spacing at 75×75 cm and 14.24% and 23.57% over the spacing at 75×60 cm. The mean yields for the three seasons were statistically significant with closer spacing at 75×45 cm recording a mean increase of 27.98% over the wider spacing at 75×75 cm.

With regard to weight of fruits, the results were not significant in all the seasons of trial and also in the pooled analysis. However, the mean of the three seasons has indicated increase of 7.34% and 6.73% by spacing the plants at 75×60 cm over 75×75 cm and 75×45 cm respectively.

Closer spacing of 75×45 cm produced early crop as evidenced by the mean Bartlett's index of earliness of 0.6458 and was followed by 75 cm×75 cm spacing (0.6433) and 75 cm×60 cm spacing (0.6306).

Nitrogen: Yield differences in the number of fruits/ha due to the application of N were statistically significant except in 1965 monsoon season. Application of N at 100 kg/ha recorded significantly higher yields of 51.37% over no N plots during the monsoon 1966 season and 21.52% in 1967 summer season with a mean increase of 18.12% for all the three seasons. Even though 50 kg N/ha was significantly superior to other treatments during summer 1967, the treatment was on par with N at 100 kg/ha.

The same trend was noticed in the weight of fruits/ha with 100 kg N and 50 kg N having recorded significantly increased yields of 78.33% and 23.24% over no N plots during 1966 monsoon and 1967 summer seasons. However, the yield differences of monsoon 1965 and pooled analysis were not statistically significant as shown in Table 2.

Regarding earliness of the crop, it was noticed that early crops could be obtained from plots treated with N at 100 kg/ha followed by 50 kg/ha and 0 kg/ha and the maturity is hastened by the application of N. The mean Bartlett's index was 0.6646 for N at 100 kg/ha, 0.6429 for 50 kg N/ha and 0.6176 for no N plot.

Eventhough the yield can be increased by the application of N at 50 kg and 100 kg/ha the dose of 100 kg N/ha was better as it gave an additional monetary return of Rs. 30-60/ha (vide Table 3).

TABLE 3. *Economics of N on yields of brinjal*

Levels of N (kg/ha)	Mean yield (kg/ha)	Extra yield (kg/ha)	Value at Rs. 0.30/ kg (Rs.)	Cost of fertilizers applied (Rs.)	Profit or loss (Rs.)
0	6,129	—	—	—	—
50	6,697	568	170.40	150.00	+20.40
100	7,231	1,102	330.60	300.00	+30.60

Phosphoric acid: The yield differences in all the three seasons were not statistically significant, even though P_2O_5 at 50 kg/ha has recorded higher yields ranging from 19.12% to 34.39% over no P_2O_5 during summer 1967 and monsoon 1966 seasons, respectively in terms of numbers of fruits (Table 2). Yield in terms of weight of fruits was also increased by 50 kg P_2O_5 resulting in an extra 19.71% to 20.74% in all the seasons excepting monsoon 1966 season. There was an increase in the mean yield both in number and weight in the plots treated with 50 kg P_2O_5 over no P_2O_5 and P_2O_5 at 100 kg/ha.

Application of P_2O_5 induced earliness in brinjal and was more pronounced at 100 kg/ha. The trend of increase was linear. The mean Bartlett's index was 0.6149 for no P_2O_5, 0.6465 for 50 kg and 0.6581 for 100 kg P_2O_5/ha.

The economics of P_2O_5 on brinjal are furnished in Table 4.

TABLE 4. *Economics of P_2O_5 on yields of brinjal*

Levels of P_2O_5 (kg/ha)	Mean yield (kg/ha)	Extra yield (kg/ha)	Value at (Rs. 0.30/ kg)	Cost of fertilizers applied (Rs.)	Profit or loss (Rs.)
0	6,352	—	—	—	—
50	7,433	1,081	324.30	125.00	+199.30
100	7,009	657	197.10	250.00	— 53.00

Eventhough the yield can be increased by the application of P_2O_5 at 50 kg and 100 kg/ha, the dose of 50 kg/ha was better as it gave an additiona monetary return of Rs. 199.30/ha.

When the dose of P_2O_5 is increased to 100 kg/ha, the extra yield obtained does not compensate with the cost of fertilizer applied thereby causing a loss of Rs. 53/ha.

Potash: The yield differences during all the three years were not statistically significant even though K_2O at 30 kg/ha has recorded numerically higher yields ranging from 6.64 to 26.37% over no K_2O during 1967 summer and 1965 monsoon seasons, respectively in terms of number of fruits. But the increase in the weight of fruits due to 30 kg K_2O/ha was more than no K_2O in 1967 summer and 1965 monsoon seasons which ranged from 13.32 to 25.94%.

Application of K_2O at 30 kg/ha has more influence in increasing the weight of fruits than the number of fruits (vide Table 3-c).

Application of K_2O also induced earliness of the crop as evidence by the Bartlett's index of earliness. The earliness increassed from 0.6353 for no K_2O plot to 0.6369 for 30 kg/ha and to 0.6524 for 60 kg/ha.

The economics of the application of K_2O are furnished in Table 5.

TABLE 5. *Economics of K_2O on yields of brinjal*

Levels of K_2O (kg/ha)	Mean yield (kg/ha)	Extra yield (kg/ha)	Value at Rs. 0.30/ kg. (Rs.)	Cost of fertilizers (Rs.)	Profit or loss (Rs.)
0	6,295	—	—	—	—
30	7,402	1,107	332.10	17.50	+314.60
60	6,468	173	51.90	35.00	+ 16.90

Application of K_2O at 30 kg/ha has increased the mean yield of brinjal resulting in a profit of Rs. 314.60/ha.

The interaction effects of the different treatments were not statistically significant.

Discussion: Among the three different spacings studied, the closest spacing of 75 × 45 cm gave the highest yield on account of the larger number of population of 28,695 plants/ha as against 21,518 plants/ha when spaced at 75 × 60 cm and 16,623 plants/ha for a spacing of 75 × 75 cm. The reduction per plant yield has been thus amply compensated by numerical increase in the population per unit area. The effect of spacing on yields of brinjal was linear. The finding, that closer the spacing, higher is the yield is in agreement with the observations of Campbell and Hodnett (1961).

Application of N at 100 kg/ha gave significantly higher yields compared to lower doses of 50 kg and no manure plot and also higher doses of N induced earliness. These are in confirmity with the findings of Campbell and Hodnett (1961). The influence of N on yield in brinjal was linear indicating that brinjal can respond even above 100 kg of N/ha. But the difference in the response of the plant for the same quantity of increased N was not uniform as the dosage of N increased. This is due to the corresponding decline in flower and fruit production as reported by Assami and Kodata (1933) and also due to the failure of flowers to set fruits as suggested by Kraus and Karybill (1918) in tomato. The optimum dosage of N was estimated at 100 kg/ha to realise economical yield in brinjal.

While N showed a linear trend of increase in fruit yield, the effect of P_2O_5 was noted to be quadratic with 50 kg P_2O_5/ha being the optimum to realize economic yields. Higher the dose of P_2O_5, earlier was the fruit yield as was observed in tomatoes by Boker (1938) (quoted by Patnaik and Farooqui, 1964), Tiessen (1957) and Popouskaya (1957) and by Gericke (1940) and by Parker (1957) in chillies. But higher doses of P_2O_5 over 50 kg/ha have depressing effect on yield.

Potash also showed a similar trend as P_2O_5 in influencing the yield of fruits and earliness in brinjal. K_2O induced early habit by early ripening of fruits as reported by Sayre (1933) and Carvato (1938) in tomato and Pal (1937) in brinjal. However, application of K_2O at 30 kg/ha was the best to realize economic yields.

The interaction effects of the different treatments were not statistically significant though the combined effect of NPK was reported by Eguchi *et al* (1958) and P and K by Ramu and Muthusamy (1964) in brinjal. The experiment indicated that spacing the plants at 75 × 45 cm and application of 100 kg N, 50 kg P_2O_5 and 30 kg K_2O/ha are the best to realize economic yields.

Summary and Conclusion : A spacing *cum* manurial trial conducted with Cluster White variety of brinjal for three consecutive seasons at Coimbatore revealed that closer spacing of 75 × 45 cm with 100 kg N, 50 kg P_2O_5 and 30 kg K_2O/ha is the best to realize maximum economic yields.

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