Agri. Res. J. Kerala, 1970, 8 (2) : 93-97

STUDIES ON THE EFFECT OF NPK IN COMBINATION WITH TRACE ELEMENTS ON THE YIELD OF BHINDI*

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Among the vegetable crops grown in India, bhindi (*Abelmoschus esculentus* Moench) is probably one of the most important by virtue of its high nutritive and culinary values. Thampan (1963) reported increase in yield of fruits with increased doses of nitrogen (upto 84 kg N per hectare). Apart from this nothing more is known about the various fertilizer requirements of bhindi. The present studies were hence undertaken to determine the effect of increasing doses of nitrogen, phosphorus and potash applied in combination with secondary and micro-nutrient elements on the yield of bhindi. (" Spartin-A " a proprietory formulation of M/S Swati Industries (P) Limited, Bombay, was used as the source for the secondary and micro-nutrient elements)

Material and Methods

The experiment was conducted in the Agricultural College Farm, Vellayani, during 1964-1965. The analysis of the soil samples from the experimental plot showed, 0.0490 percent total nitrogen, 0.0024 percent available P_2O_5 and 0.0230 percent available K_2O. A 3^3 X 2 factorial confounded design with a single replication was adopted. The plot size was 3.81 m X 3.04m with a spacing of 0.76 m between rows and 0.61 m between plants in the row. The treatments consisted of 3 levels of nitrogen as ammonium sulphate (N_0 84 kg/ha, N_1 112 kg/ha and N_2 140 kg/ha), 3 levels of P_2O_5 as superphosphate (P_0 112 kg/ha, P_1 168 kg/ha and P_2 224 kg/ha), 3 levels of potash in the form of muriate of potash (K_0 56 kg/ha, K_1 84 kg/ha and K_2 112 kg/ha) and two levels of " Spartin-A " (S_0 O kg/ha and S_1 336 kg/ha).

" Pusa Sawani " a mosaic resistant strain of bhindi was used in the experiment. Farm yard manure at 25 tonnes per hectare was applied uniformly to all the plots along with spartin, a week prior to the dibbling of the seeds. The entire quantity of P_2O_5 and potash and one third of nitrogen were given as basal dressing just before the dibbling of seeds, while the

*Abridged from the M. Sc. (Ag.) thesis submitted by the first author to the University of Kerala in 1965.

remaining quantity of nitrogen was applied in split doses as top dressing 20 and 30 days after dibbling. Two seeds were dibbled at uniform depth in each pit of one foot diameter. Hoeing, weeding and watering were done as and when required.

The results were assessed by taking counts of the flowers produced, fruits set and total number of fruits produced per plant and per plot.

Results and Discussion

The results are given in Tables 1 to 4.

Table I

Average number of flowers produced by bhindi plants receiving different fertilizers

Levels (doses)	N	P	K	S
0	18.98	18.84	19.60	20.17
1	20.36	19.48	19.70	19.50
2	20.17	21.20	20.20	

SE for NP & K = 0.993 SE for S = 0.811

Table 2

Average number of fruits per plant produced by bhindi plants receiving different fertilizers

Levels (doses)	N	p	K	S
0	14.28	16.62	14.58	14.86
1	15.45	15.24	14.97	15.05
2	15.14	14.99	15.31	

SE for NP & K = 0.7179 SE for S = 0.5865

Table 3

Mean percentage of fruit set in bhindi plants receiving different fertilizers

Levels (doses)	N	P	K	S
0	75.97	78.85	74.73	74.42
1	76.75	78.85	77.33	78.05
2	75.98	70.99	76.65	

C.D. at 5% 5.96 Inference $\overline{P_0\ P_1}\ P_2$

Table 4

Average yield of fruits per plot (gm) of bhindi plants receiving different fertilizers

Levels	N	P	K	S
0	2272	2333	2231	2285
1	2327	2385	2387	2385
2	2411	2292	2392	

SE for NP & K = 126.39 SE for S = 102.184

Table 1 shows that nitrogen at 112 kg/hectare had no effect over that of 100 kg/ha in increasing the number of flowers. At higher levels there appeared to exist an adverse effect on the flower setting. Phosphorus at 168 kg and 224 kg/ha recorded a slightly higher number of flowers over 112 kg/ha though the increase was not significant. A slight increase in the number of flowers with potash at 112 kg/ha was observed.

Table 2 reveals that nitrogen at higher levels enhanced the number of fruits produced only very slightly and that the increase in yield was not statistically significant. It is seen that phosphorus application had also not produced any significant effect on the number of fruits. In the case of potash, with increasing levels applied, there was gradual increase in the number of fruits. A slight increase in the number of fruits produced consequent on application of spartin was far from significant. In this connection it may be mentioned that according to Nagarajan and Shanmughasundaram (1961) micronutrient application resulted in increased production of fruits in brinjal. It would therefore appear that the requirement of micro-nutrients of bhindi differed widely from that of other vegetable crops such as brinjal.

It may be seen from Table 3 that nitrogen at higher levels (112 kg and 140 kg/ha) did not significantly increase the setting percentage over that at 84 kg/ha. With regard to phosphorus the setting percentage was significantly reduced by the application at 224 kg/ha. According to Greenwood and Hallsworth (1960), at low levels of calcium, higher quantities of phosphorus became injurious and there was a tendency to shed blossoms and buds. The

low setting percentage noticed in this study with the highest level of phosphorus might possibly be due to the inadequate levels of calcium in the soil. In the case of potash higher levels viz. 84 kg and 112 kg/ha appeared to exert a beneficial effect on flower setting. In the case of 'spartin' too, its application enhanced the setting percentage.

It may be observed that changing the levels of nitrogen from 84 to 140 kg per hectare did not affect the number of flowers produced and the number of fruits set and produced. Thampan (1963) reported maximum yield of fruits at 84 kg per hectare of nitrogen as compared to lower levels. The present studies showed that increases over this level did not benefit the crop in the matter of yield.

Phosphorus was seen not influencing the flower production and fruit production significantly at the dosage changes from 112 to 224 kg per hectare of P_2O_5. But at the highest level of 224 kg P_2O_5 per hectare a significant reduction in fruit set was in evidence. This might be due to the inadequacy of calcium which as reported by Greenwood and Hallsworth (1960) led to higher levels of phosphorus becoming injurious and causing shedding of blossoms and buds. Thus levels of phosphorus above 112 kg per hectare did not appear to be in any way beneficial.

Changes of potash doses from 56 to 112 kg K_2O per hectare did not affect to any significant level flower production and fruit production. However, at higher concentrations, K_2O appeared to be beneficial to fruit set. Thus potash at 56 kg per hectare appeared to be the optimum dose for bhindi.

'Spartin' did not affect the flower and fruit production to any significant level indicating that micro-nutrients did not induce any responses in bhindi.

Summary

A field experiment to study the effect of different levels of nitrogen, phosphorus and potash alone and in combination with " Spartin-A " a secondary and trace element formulation on the growth and yield of *Abelmoschus*

esculentus (Var: Pusa Sawani) was conducted at the Agricultural College Farm, Vellayani, Kerala. N. P and K above 84, 112 and 56 kg per hectare respectively did not give any significant increase in yield. The trace element formulation also did not give any response.

Acknowledgement

Grateful acknowledgements are due to the Principal, Agricultural College, Vellayani, for providing the facilities for the investigation.

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(*Accepted : 29-4-1971*)