https://doi.org/10.29321/MAJ.10.A02808

Madras agric. J. 67 (2): 102–105, Feb., 1980

Response of Cowpea (*Vigna sinensis* L.) (Savi) to Phosphorus and Growth Regulators *

R. JAYARAM[1] and S. RAMIAH[2]

A study on the effect on phosphorus and growth regulators on grain yield of cowpea showed that application of 26.9 kg P_2O_5/ha as economically optimum. It also revealed that foliar application of planofix at 40 ppm twice at stray and peak flowering stages of the crop increased the grain yield by 9.7 per cent over control with a net return of Rs. 1,742/ha.

Legumes have the ability to fix atmospheric N with the symbolic association of rhizobial bacteria. Hence, it is generally believed that these crops do not respond to N application. In order to make the crop more productive and also to have increased bacterial activity, it is essential that P is applied in adequate quantities. Prasad *et al.*, (1968), after evaluating a number of experiments, reported that about 25 per cent increase in grain legumes production could be achieved by fertilising with 33.6 kg P_2O_5/ha alone.

One of the major causes for low yield in pulses is high level of flower shedding. There are several reports which indicate that external application of growth regulators, like planofix and ethrel, reduces the flower drop considerably and thereby increase the pod setting and grain yield.

MATERIAL AND METHODS

A field experiment was conducted in Tamil Nadu Agricultural University farm (11°N latitude, 77°E longitude and at an altitude of 426 m.) during summer and *kharif* seasons of 1978 to study the response of cowpea PLS 370 to the graded doses of phosphorus and foliar spray of planofix (NAA) and ethrel (2-chloro ethyl phosphonic acid). The design adopted was split-plot, replicated thrice. Five levels of P_2O_5 viz, 0, 125·5, 25, 37·5 and 50 kg/ha were the main plot treatments and six treatments involving control, water spray, planofix at 20 and 40 ppm and ethrel at 100 and 150 ppm were the sub plot treatments.

Phosphorus as single super phosphate was applied as per treatment schedule. A uniform starter dose of N at the rate of 20 kg/ha as urea was also applied. Both the fertilizers were placed at planting in single band 5 cm away from seed line and at about 5 cm depth. Foliar spray of planofix and ethrel was done twice using teepol as adhesive with a hand operated sprayer. The first spray was given at stray flowering when there was atleast one open flower in a plant and the second

* Forms the part of the M. Sc. (Ag.) thesis submitted by the first author.

1-2 Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore.

spray at peak flowering stage of the crop.

RESULTS AND DISCUSSION

The data on grain yield for summer and *kharif* 1978 are given in Table I. Application of P increased the grain yield significantly in both the seasons. Linear increase in grain yield was observed upto 37·5 kg P_2O_5/ha and beyond that the yield levelled off. Maximum grain yield was recorded with 37·5 kg P_2O_5/ha (915 kg/ha) in summer and during *kharif* with 25 kg P_2O_5/ha (783 kg/ha). The increased pod number per plant and grain number per pod due to P application had contributed for increased grain yield. Similar yield increase in cowpea due to P application was reported by Kurdikeri *et al.* (1973) Badanur *et al.* (1974) and Subramanian *et al.* (1977).

Influence on grain yield due to foliar spray of planofix and ethrel was observed only in summer. The lack of response to growth regulator spray during *kharif* season might probably due to continuous drizzling at the time of spray. Planofix at 40 ppm gave a maximum grain yield of 895 kg/ha followed by ethrel at 150 ppm (871 kg/ha) and ethrel at 100 ppm (866 kg/ha). Though these three treatments gave significantly higher yields than the rest, the differences among them were not significant. Similarly the yield differences among control, water spray and plano-fix at 20 ppm were also not significant. The reduced flower shedding from 71.1 to 61·8 per cent due to spray of planofix (40 ppm) and increased pod set would have resulted increased grain yield of cowpea. Kaul *et al.* (1976) reported that application of 20 ppm planofix at the initial flowering stage of cowpea increased the grain yield by 33 per cent over control. Application of ethrel at 100 ppm increased the grain yield of redgram by 10.7 per cent (Anon., 1977).

TABLE II Net return (Rs./ha)

Treatments	Summer 1978	kharif 1978
P levels		
0 kg P_2O_5/ha	1401.35	1104.09
12.5 kg P_2O_5/ha	1478.45	1181.81
25.0 kg P_2O_5/ha	1730.10	1394.21
37.5 kg P_2O_5/ha	1721.37	1296.64
50.0 kg P_2O_5/ha	1490.00	1204.41
Growth regulators		
No spray	1542.06	1308.24
Water spray	1509.76	1302.26
Planofix 20 ppm	1507.81	1294.43
40 ppm	1742.22	1263.94
Ethrel 100 ppm	1562.00	1154.60
150 ppm	1521.72	1097.52

Response function and economic optimum level of phosphorus

Response function was fitted in for grain yield, pooled over two seasons The response equation was:

$$\hat{y} = 690{\cdot}30 + 8{\cdot}87\,x - 0{\cdot}1340\,x^2$$

and the physical optimum dose of P_2O_5 was found to be 33·09 kg/ha with an estimated yield of 842·09 kg/ha.

TABLE I Effect of phosphorus and growth regulators on yield components and yield of cowpea (PLS 370)

Treatments	Summer 1978			*Kharif* 1978		
	No. of pods per plant	No. of seeds per pod	Grain yield (kg/ha)	No. of pods per plant	No. of seeds per pod	Grain yield (kg/ha)
Phosphorus levels						
0 kg P_2O_5/ha	15.2	10.0	751	10.2	9.4	656
12.5 kg P_2O_5/ha	17.4	9.9	979	10.3	9.3	703
25.0 kg P_2O_5/ha	21.2	12.3	897	13.3	9.6	783
37.5 kg P_2O_5/ha	21.8	12.2	915	13.8	0.6	783
50.0 kg P_2O_5/ha	20.8	11.5	858	11.4	9.4	771
S. E.	0.96	0.37	23.18	0.32	0.18	14.78
C. D. (P=0.05)	3.12	1.21	75.58	1.05	NS	48.19
Growth regulators						
No spray	18.0	11.3	809	11.6	9.8	737
Water spray	17.7	11.1	808	12.1	9.4	747
* Planofix 20 ppm	17.9	11.4	813	12.0	9.5	743
40	22.0	11.4	895	11.6	9.6	739
Ethrel 100 ppm	20.8	11.5	866	11.0	9.7	734
150	20.9	11.1	871	11.4	9.5	735
S. E.	0.92	0.35	19.41	0.43	0.17	14.87
C. D. (P=0.05)	2.62	NS	55.11	NS	NS	NS

As there was quadratic response of grain yield to P levels the economic optimum dose of P was worked out with the formula :

$$X\,(opt) = \frac{q/p - b}{2c}$$

where,

X (opt) = Economic optimum dose of phosphorus (kg P_2O_5/ha)

b = Regression coefficient (8.87)

c = constant (-0·1340)

p = Cost per kg of P_2O_5 (Rs. 5·00)

q = Cost per kg of grain (Rs. 3.00)

$$X\,(opt) = \frac{\frac{5}{3} - 8{\cdot}87}{2\,(-0{\cdot}1340)}$$

$$= 26{\cdot}9 \text{ kg } P_2O_5\text{/ha}$$

The economics (net return Rs./ha) of the treatments are presented in Table II. The economic optimum dose of of 26.9 kg P_2O_5/ha is very close to 25 kg P_2O_5/ha. Application of 25 kg P_2O_5/ha gave comparatively higher net return in both the seasons. It gave a

net return of Rs. 1,730 and Rs. 1,394/ha as compared to Rs. 1,401 and Rs.1,104/ha in control for summer and *kharif* seasons respectively. Application of P beyond 25 kg P_2O_5/ha did not give any significant increase in net return.

With regard to the growth regulators, application of planofix at 40 ppm in summer gave higher net return of Rs. 1,742/ha than other treatments. It was observed that the net return due to ethrel application was not advantageous because of the higher cost (Rupees 300/1) of this chemical. As the application of growth regulators did not increase the grain yield in *kharif* seasan, there was no marked effect on net return.

REFERENCES

ANONYMOUS. 1977. Sixth Annual Report of Tamil Nadu Agricultural University, Coimbatore.

BADANUR, V. P., T. SATYANARAYANA and G. V. HARANAGI. 1974. Influence of calcium of super phosphate on grain yield of cowpea. *Curr. Res.* **3**: 19-20.

KAUL, J.N., H.S. SEKHON and J.S. BRAR. 1976 Effect of hormones on the grain yield of cowpea. *Trop. Grain Legume Bull.* **6**: 3-4.

KURDIKERI, C. B., R. V. PATIL and K. KRISHNAMOORTHY. 1973. Response of cowpea to various fertilizer levels. *Mysore J. agric. Sci.* **7**: 170-74.

PRASAD, R., M. L. BHENDIA and S. S. BAINS. 1968. Response of grain legumes to levels and sources of phosphorus on different soils. *Indian J. Agron.* **20**: 67-78.

SUBRAMANIAN, A., A. BALASUBRAMANIAN and C. VENKATACHALAM. 1977. Effect of varying levels of fertilizers and spacing on grain yield of cowpea. *Madras agric. J.* **64**: 614-15.

1 ml / 1000 ml
10 ml / 10 lit
100 ml / 100 lit