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EFFECT OF N, P AND K ON THE YIELD OF COWPEA, VARIETY P. 118

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In Kerala though cowpea occupies the first position among pulsee in acreage its productivity is very low; since grown on marginal lands without manuring. Balanced fertilizer application and use of high yielding crop varieties are two well established means of raising agricultural efficiency and production. Increase in the yield of cowpea by the application of nitrogenous fertilizers has been reported by Rao and Patel (1975). But Horner and Mojtehedi (1970) reported that applied nitrogen had no signifcant effect on the yield of cowpea. Thus, research reports on the relative efficiency of nitrogenous fertilizers on cowpea yields are contradictory. Trials conducted on cowpea by Prasad *et al.* (1968) and Olsen and (Woe (1971) using phosphatic fertilizers have given promising results. Bains (1969) reported that application of potash had no significant effect on the yield of legumes. The present investigation was designed to study the performance of the cowpea variety P-118 under varying levels of N, P and K; and to find out the optimum doses of these nutrients under the agroclimatic conditions of Vellanikkara.

Materials and Methods

The field experiment was conducted at the Instructional Farm of the College of Horticulture, Vellanikkara. The soil of the experimental site was a deep moderately well drained medium clay loam; with total N 8.1008 per cent, avilable P 0.0004 per cent and available K 0.0047 per cent and pH 5.1. The treatments involved three levels each of N (10, 20 and 30 kg/ha). P_2O_5 (20, 30 and 40 kg/ha) and K_2O (0, 10 and 20 kg/ha) and were studied in a 3^* confounded factorial design partially confounding NPK^2 in replication I and NP^2K^2 in replication II. N, P and K fertilizers were applied at the time of sowing. A uniform basal dressing of lime at the rate of 500 kg/ha was made a week before sowing. The cowpea variety P—118 was sown on the 18th of August 1977 and harvested from October 11 to 28th 1977.

Grain yield, its components, haulm yield and grain haulm ratio were statistically analysed. To the grain yield data a quadratic surface response function of the form $Y = b_0 + b_1 N + b_2 P + b_3 N^2 + b_4 P^2 + b_5 NP$ was fitted.

Results and Discussion

Grain Yield: Results obtained are given in Table 1. It is evident that application of 20 kg N/ha registered the highest yield and it was statistically superior to all the other levels of nitrogen. Significant positive response

to applied nitrogen at 20 kg/ha was observed in all the growth attributes also The number of pods/plant, number of seeds per pod, pod length and hundred seed weight were the maximum at 20 kg N/ha. Tne conjunctive effect of these attributes **led to** increased yields. Kumar *et al.* (1976) reported that pod yield in cowpea was intimately associated with the number of branches per plant.

Table 1 Effect of levels of N, P & K on yield and its components

Treatment	Grain Yd. kg/ha	Haulm Yd. kg/ha	Grain-haulm ratio	No. of pods per plant	No. of seeds per pod	Length of pods (cm)	Hundred seed weight (g)	Number of branches/ plant at 50 days aftgr sowing
Nitrogen Kg/ha.								
30	396,36	313.89	1.302	6.17	8.56	14.49	15.095	3,24
20	566.26	383.43	1.604	7,69	9.95	15.31	15.477	3.52
30	451.44	431.94	1.089	6.56	8.18	14.10	15.342	3.75
F test	Sig	Sig	Sig	Sig	Sig	Sig	NS	Sig
SEM ±	18.02	16.75	0.089	0.38	0.20	0.15	0.145	0.11
CD (.05)	52.85	49.14	0.269	1.13	0,59	0.46	—	0.34
Phosphorus P_2O5 kg/ha.								
20	416.54	365.29	1,189	6.58	8.61	14.24	15.511	3,29
30	446.44	408.79	1.140	6.07	8.58	14.44	14.905	3.41
40	550.92	355.19	1.666	7.76	9.50	15.22	15.499	3.81
F test	Sig	NS	Sig	Sig	Sig	Sig	Sig	Sig
SEM ±	18.02	16.75	0.089	1.33	0.20	0.15	0.145	0.11
CD (.05)	52 85	—	0.269	1.13	0.59	0,46	0.426	0,34
Potassium K_2O Kg/ha.								
0	464.40	372.69	1.332	6.70	9.09	14.67	15.101	3.33
10	466.09	365.38	1.405	6.63	8,72	14.63	15.370	3.53
20	483.58	391.20	1.258	7.07	8.87	14.59	15.442	3,65
F test	NS	NS	NS	NS	NS	NS	NS	NS
SEM ±	18.02	16,75	0.089	0.38	0.20	0.158	0.145	0.11
CD (.05)	—	—	—	—	—	—	—	—

pods per plant, length of pods, seeds per pcd and hundred seed weight, Similar observations were reported by Rao and Patel (1975), The study clearly indicated that addition of readily available nitrogen was beneficial to the crop as it promoted a good start before nitrogen fixation commenced. The reduction in yield at higher doses of nitrogen might be attributed to the excessive vegetative growth leading to lower grain production.

There was significant increase in grain yield with graded doses of phosphorus upto 40 kg P_2O_5/ha. Phosphorus exerted a significant influence on the yield components namely number of pods per plant, length of pods, number of seeds per pod and hundred seed weight. The increase in grain yield obtained with the application of phosphorus might be due to the beneficial effect of phosphorus on root development, flower primordia initiation, stimulation of growth, formation and maturity of seeds. Moreover, phosphorus might have stimulated the rhizobial action in the root nodules lesding to larger fixation of atmospheric nitrogen (Mercer 1948), it also might have helped in the uptake of nitrogen and other nutrients from the soil. Corroboratory results have been obtained by Nair (1966) and Baumgartner *et al.* (1974).

The treatment combination of 20 kg N and 40 kg P_2O_5/ha recorded the highest grain yield of 706.63 kg/ha which was 99.36 per cent superior to the combination of 10 kg N and 20 kg P_2O_5/ha (Table 2). The synergestic influence of N and P is also evident from the number of pods per plant and seeds per pod (Table 3 and 4). The treatment receiving 20 kg N and 40 kg P_2O_5/ha was significantly superior to all other combinations. The average number of pods per plant obtained was 10.55 and the number of seeds per pod was 11.48 for the combination. Applied potash did not exhibit any marked influence on grain yield and/or the components at any of the levels tried. The lack of response to application of potassium on yield might be due to the higher amount of available K in the soil.

Table 2 Combined effects of N & P on grain of cowpea (kg/ha)

Levels of P_2O_5 kg.'lia	Levels of nitrogen kg/ha			
	10	20	30	Mean
20	353.58	472,75	423.30	416.54
30	432.18	519.40	3S7.73	446.43
40	403.31	706.63	543.30	= 51.08
Mean	396.35	566.26	451.44	
	SEm ±	31.21		
	CD (0.05)	91.53		

Table 3 Combined effect of N & P on the number of pods

Levels of P_2O_5 kg/ha	Levels of nitrogen kg/ha 10	20	30	Mean
20	6.2	6.66	6.77	6.54
30	6.1	5.83	6.22	6.05
40	6.0	10.55	6.66	7.73
Mean	6.10	7.68	6.55	—
SEm ±	6.667			
CD (0.05)	1.960			

Table 4 Combined effect of N & P on the number of seeds per pod

Levels of P_2O_5 kg/ha	Levels of nitrogen kg/ha 10	20	30	Mean
20	8.56	9.16	S.08	8.60
30	8.51	9.20	8.01	8.57
40	8.58	11.48	8.43	9.49
Mean	8.55	9.94	8.17	
SEm ±	0.356			
CD (0.05)	1.041			

Halum yield: Nitrogen had significantly influenced the haulm yield. The role of nitrogen in the promotion of vegetative growth is well established. A perusal of the data on the number of branches per plant indicate that there has been significant improvement in this growth attribute due to the addition of N. The excessive vegetative growth even at the expense of grain production would have resulted in higher yield of halum. This is in conformity with the findings of Nair (1966) and Vijayakumar (1967) on cowpea. The response to phosphorus and potassium were not conspicuous.

Grain-Haulm Ratio: The effect of N was not significant. Application of 20 kg N/ha recorded the highest grain-haulm ratio. The higher level of N had a depressive effect on it. Application of 20 kg N/ha and 40 kg P_2O_5/ha registered the highest mean value for grain-haulm ratio of 2.34; which was significantly superior to all other combinations (Table 5), Potassium did not have any marked influence on grain-haulm ratio.

Table 5 Combined effect of N and P on grain-haulm ratio

Levels of P_2O_5 kg/ha	Levels of Nitrogen kg/ha			
	10	20	30	Mean
20	1.23	1.27	1.06	1.18
30	1.29	1.21	0.92	1.13
40	1.37	2.34	1.28	1.66
Mean	1.29	1.60	1.08	
SEm ±	0.161			
CC (0.05)	0.472			

Optimum doses of Nutrients: The quadratic response equation developed from the data is given below. $Y=541.3447+27.542N+67.269P-142.359N^2+37.375P^2+17.567NP$. The optimum level of nitrogen for maximum grain yield was arrived at 21.6 kg/ha from the quadratic surface response equation. For phosphorus, optimization was not possible since the yield tended to increase with increasing levels of applied phosphorus. As there is lenear response to P_2O_5 its economic optimum fall outside the range tried. Further experimenttion is required for arriving at the optimum dose of phosphorus for the crop.

Summary

An experiment was conducted at the Instructional Farm of the College of Horticulture, Vellanikkara to study the effect of different levels of N, P and K on the yield of cowpea variety P-118. Nitrogen at 21.6 kg/ha was found to be the optimum level for maximum grain production. Optimum level of P could not be estimated since the crop exhibited a linear response beyond the maximum level tried. Applied K did not exhibit any significant influence on the yield components indicating the adequacy or soil supplies of the nutrient.

സംഗ്രഹം

വിവിധ അളവുകളിൽ പാക്യജനകം (ഹെക്ടറൊന്നിന് 10, 20, 30, കിലോഗ്രാം വീതം), ഭാവകം (ഹെക്ടറൊന്നിന് 20, 30, 40 കിലോഗ്രാം വീതം) ക്ഷാരം ഹെക്ടറൊന്നിന് 0, 10, 20 കിലോഗ്രാം വീതം) എന്നിവ നൽകുന്നതുകൊണ്ട് പി-118 എന്ന പയറിനത്തിന്റെ വിളവിലും വിളവുല്പാദന ഘടകങ്ങളിലും ഉണ്ടാകുന്ന പ്രതികരSIDങ്ങൾ നിരീക്ഷിക്കുന്നതിനു വേണ്ടി വെള്ളാനിക്കര ഇൻസ്ട്രക്ഷനൽ ഫാമിൽ ഒരു പരീക്ഷണം നടത്തുകയുണ്ടായി. ഇതിൽ നിന്നും പാക്യജനകവും ഭാവകവും ഈ ഇനത്തിന്റെ വിളവിൽ അനുകൂലപ്രതികരണങ്ങൾ ഉണ്ടാക്കുന്നുവെന്ന മനസ്സിലായി. പാക്യജനകം ഹെക്ടറൊന്നിന് 21.6 കിലോഗ്രാം എന്ന തോതു് പരമാവധി വിളവ് നൽകിയപ്പോൾ ഭാവകം അതിന്റെ തോതു് കൂട്ടുന്നതനുസരിച്ച് ക്രമമായ വിളവുവർദ്ധനയുണ്ടാക്കി. പാക്യജനകം 20 കിലോഗ്രാമും, ഭാവകം 40 കിലോഗ്രാമും ചേർത്തു് ഉപയോഗിച്ചപ്പോൾ ഹെക്ടറൊന്നിന് 706.63 കിലോഗ്രാം എന്ന തോതിൽ പരമാവധി വിളവ് ലഭിക്കുകയുണ്ടായി.

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