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Response of 'Cowpea 263' to varying levels of phosphorus, potassium and zinc application

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Abstract

A field experiment consisting of four levels each of phosphorus (0, 30, 60 and 90 kg/ha) and potassium (0, 15, 30 and 45 kg/ha) and three levels of zinc (0, 10 and 20 kg/ha) giving thereby 48 treatment combinations were tested on cowpea 263' in single split plot design keeping levels of P2O5 and potassium in main plots, and levels of zinc in sub-plots for two consecutive rainy seasons of 1997 and 1998 at R.B.S. College, Bichpuri, Agra. The data recorded on growth, yield and net profit concluded that the application of phosphorus, potassium and zinc at the rate of 90 kg, 45 kg and 20 kg/ha respectively proved considerably better than their respective doses during both the years of investigation.

Key word : 'Cowpea 263', phosphorus, potassium, zinc and yield.

Introduction

The importance of legume vegetable crops as a source of protein hardly needs any emphasis. Among these, cowpea is most nutritive containing about 24.6 g crude-protein and 500 mg vit. 'B' per 100 g fresh edible portion (Aykroyd, 1941). It has been recognized as highly nutritive and very delicious and cheapest source of vegetable both for green pods and seed and for number of dishes prepared economically too for which it is mainly grown for its green, long, tender and thin pods during spring – summer and rainy seasons all over the Southern and Northern plains of India (Kumar and Thakur, 1972). Morever vegetable cowpea like other legumes, enriches the soil in nitrogen through symbiotic activity of rhizobium bacteria.

Legumes in general and cowpea in specific donot require much nitrogen application as it has been proved deterimental and handicap for nodulation in such crops. However, legumes are benefited in case they are supplied with nitrogenous fertilizer when applied at the rate of 10-20 kg N/ha as starter dose.

'Cowpea 263' developed by the PALI, Ludhiana, was released in 1988 for commercial cultivation but it appears that no research trial has yet been conducted on its nutritional requirement in relation to phosphorus and potassium in conjuction with zinc at R.B.S. College, Agriculture Research Farm, Bichpuri, Agra. Hence, to put vegetable cowpea 263 on more scientific footings in this locality which seems to be quite imperative and obvious.

Research Methods

In this context a field experiment, comprising of four levels each of phosphorus (0, 30, 60 and 90 kg/ha) and potassium (0, 15, 30 and 45 kg/ha) and three levels of zinc (0, 10 and 20 kg/ha) giving thereby 48 treatment combinations, was conducted during two consecutive rainy seasons of 1997 and 1998 in single split plot design by putting level of phosphorus and potassium in main plots and level of zinc in sub-plots with three replications. The net plot size was 1.35 m x 1.35 m having 45 cm plot border all around. The soil of experimental field was
sandy loam having pH value 7.8, low in available nitrogen and zinc, medium in phosphorus and potassium. Basal dressing each of phosphorus, potassium and zinc as per their levels through single super phosphorus, potassium sulphate and zinc chloride respectively was done before sowing. An uniform application of nitrogen at the rate of 10 kg/ha through urea was also done as basal dressing.
The treated seed with rhizobium culture was sown in well prepared field in the rows of 45 cm

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at a distance of 15 cm apart in last week of July 1997 and 1998. All the normal cultural operations were performed as per need of the crop.

Research Findings Discussion

On examination of the data presented in Table-1, it may be revealed that the application of phosphorus, potassium and zinc at the rate of 90, 45 and 20 kg/ha, respectively tended to increase growth parameters namely plant height, diameter of main steam, number of primary branches per plant and fresh and dry weight of plant at peakstage of growth remarkably more than that of their respective lower doses in both the years of experimentation. Such findings are inclose agreement with these of Tarila et al. (1977). While on the hand, the initiation of flowering and pod formation were delayed greatly with each increase in the rate of phosphorus, potassium and zinc in each season of cropping. Hence, the maximum delay in flowering and pod formation was recorded with the highest dose of 90 kg P2O5/ha, 45 kg K2O/ha and 20 kg zinc/ha on account of the luxuriant and vigorous plant growth attributes as noted during both the seasons of trial.

The performance of yield contributing characters such as length and diameter of pod, number and weight of seeds per pod, test weight (100 seed weight), and ultimately number and fresh weight of marketable pods plant as well as per hectare basis was also found noticiable and best at the application of highest dose each of P2O5, K2O and zinc in this investigation. This may be attributed to the best plant performance in respect to growth as well as to the production of pods per plant and per hectare basis. However, both the cost of production and net profit per unit area were also found on increasing trend with each inverse in level of P2O5, K2O and zinc and hence the extent of increase in both these economic traits was recorded with the application of 90 kg P2O5, 45 kg K2O and 20 kg zinc/ha which was quite apparent and obvious too in each season of trial (Table 2).

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Table 1 : Effect of phosphorus, potassium and zinc levels on growth, flowering and pod formation

Treatments	Plant Height (cm)		Diameter of main stem/plant (cm)		Number of Primary branches/plant (cm)		Fresh weight/plant (g) at peak stage of growth		Dry weight/plant (g) at peak stage of growth		Days taken to flowering initiation		Days taken to pod formation	
(A) P Levels	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998
P_o	50.3	51.4	1.8	1.9	7.1	8.1	47.1	48.3	8.5	9.7	19.3	20.2	25.7	26.8
P_{30}	57.5	59.6	1.8	2.1	8.4	9.4	54.1	54.8	9.8	11.1	27.3	28.3	34.8	36.0
P_{60}	62.5	64.6	2.0	2.1	9.8	10.8	60.1	61.3	10.9	12.3	35.8	36.9	43.4	44.7
P_{90}	63.4	64.5	2.0	2.2	10.1	11.2	61.6	62.9	11.3	12.6	36.0	37.7	45.3	46.7
SEM ±	0.5	0.5	0.02	0.03	0.1	0.2	0.3	0.7	0.3	0.3	0.5	0.4	0.2	0.2
C.D. at 5%	1.5	1.4	0.07	0.09	0.4	0.5	0.9	2.1	1.0	0.8	1.5	1.2	0.6	0.6
(B) K levels														
K_o	49.2	50.3	1.8	1.9	6.8	7.8	46.9	48.2	8.4	9.6	18.7	19.7	25.0	26.3
K_{15}	56.9	58.1	1.9	2.1	8.3	9.3	53.6	54.8	9.7	10.9	26.1	27.0	33.6	34.8
K_{30}	61.6	62.7	1.9	2.1	9.8	10.9	59.1	60.3	10.8	12.1	35.7	36.8	43.9	45.1
K_{45}	65.9	67.0	2.0	2.2	10.5	11.7	63.3	64.0	11.6	12.9	38.5	39.6	46.7	48.1
SEM ±	0.5	0.5	0.02	0.03	0.1	0.2	0.3	0.7	0.3	0.3	0.5	0.4	0.2	0.2
C.D. at 5%	1.5	1.4	0.07	0.09	0.4	0.5	0.91	2.1	1.0	0.8	1.5	1.2	0.6	0.6
(C) Zn Level														
Zn_o	54.7	55.8	1.7	1.9	8.2	9.2	52.1	53.3	9.5	10.7	25.4	26.4	33.3	34.5
Zn_{10}	58.4	59.5	1.9	2.1	8.8	9.9	55.9	57.3	10.1	11.5	30.2	31.2	37.4	38.6
Zn_{20}	62.1	63.3	2.9	2.2	9.5	10.6	59.1	59.9	10.8	12.1	33.6	34.7	41.3	42.5
SEM ±	1.5	0.5	0.02	0.02	0.2	0.2	0.4	0.4	0.2	0.3	0.2	0.2	0.3	0.3
C.D. at 5%	1.5	1.4	0.06	0.07	0.5	0.4	1.2	1.3	0.8	0.8	0.6	0.8	0.9	0.9

Table 2 : Effect of phosphorus, potassium and zinc levels on pod attributes and economics.

Treatment	Length of pod (cm)		Diameter of Pods (cm)		Number of grains /pod		100 Seed weight (g)		Number of marketable pods/plant		Fresh weight of marketable pods/plants (g)		Number of marketable pods (million/ha)		Fresh weight marketable pods (q/ha)		Cost of production /ha (Rs.)		Net Profit /ha (Rs.)	
(A) P Levels	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998	1997	1998
P_o	19.0	20.0	0.9	1.0	10.2	11.2	11.5	12.6	24.0	25.2	120.2	121.2	11.5	11.6	57.3	58.5	4194.30	4198.87	7272.19	7467.87
P_{30}	24.4	25.4	0.9	1.2	11.5	12.7	12.2	13.3	35.0	36.3	173.3	174.6	16.6	16.7	83.1	84.2	4507.49	4511.87	12114.33	12328.62
P_{60}	30.5	31.7	1.3	1.5	13.6	14.7	12.9	14.1	43.0	44.6	216.3	217.5	20.6	20.7	103.0	104.3	4603.93	4608.39	16013.06	16241.60
P_{90}	31.7	32.8	1.4	1.6	13.8	15.0	13.4	14.5	45.2	44.6	226.3	227.5	20.6	21.6	107.2	108.3	4636.72	4639.41	16812.86	16944.58
SEM ±	0.6	0.1	0.004	0.003	0.1	0.1	0.9	0.10	0.3	0.4	0.8	2.0	0.001	0.018	0.3	0.8	-	-	-	-
C.D. at 5%	1.9	0.4	0.01	0.01	0.4	0.3	0.28	0.29	0.8	1.1	2.5	5.9	0.003	0.052	0.8	2.5	-	-	-	-
(B)K levels																				
K_o	16.3	17.4	0.8	1.0	10.1	11.1	10.2	11.2	23.7	24.9	118.3	119.4	11.4	11.4	56.2	57.1	3247.47	3451.04	7985.10	8174.44
K_{15}	24.3	25.4	0.9	1.1	11.4	12.4	11.9	12.9	34.5	35.8	172.7	173.9	16.5	16.5	82.4	83.5	4088.40	4092.97	12392.42	12612.02
K_{30}	30.4	31.4	1.3	1.4	13.6	14.8	13.8	14.8	43.0	44.5	215.6	216.8	20.6	20.7	102.8	103.9	4916.94	4922.46	15653.22	15924.35
K_{45}	34.6	35.7	1.5	1.6	14.1	15.2	14.3	15.4	46.1	47.4	229.5	230.7	21.9	22.0	109.4	110.6	5689.63	5692.04	16181.69	16271.83
SEM ±	0.6	0.1	0.004	0.003	0.1	0.1	0.9	0.10	0.3	0.4	0.8	2.0	0.001	0.018	0.3	0.8	-	-	-	-
C.D. at 5%	1.9	0.4	0.01	0.010	0.4	0.3	0.28	0.29	0.8	1.1	2.5	5.9	0.003	0.052	0.8	2.5	-	-	-	-
(C) Zn Level																				
Zn_o	23.0	24.2	1.1	1.2	10.4	11.4	11.9	13.0	33.2	33.2	159.8	161.0	15.3	15.3	76.0	77.2	4076.35	4080.19	11139.02	11334.55
Zn_{10}	26.4	27.5	1.1	1.3	12.5	13.6	12.6	13.6	38.2	38.2	184.6	185.8	17.6	17.7	87.9	88.9	4491.97	4493.97	13094.77	13172.48
Zn_{20}	29.7	30.8	1.2	1.3	14.0	15.2	13.1	14.1	43.1	43.1	207.6	208.8	19.9	19.9	99.0	100.3	4888.44	4894.73	14925.55	15230.01
SEM ±	0.2	0.1	0.005	0.004	0.2	0.1	0.05	0.05	0.3	0.3	1.2	1.7	0.001	0.017	0.3	0.8	-	-	-	-
C.D. at 5%	0.7	0.4	0.01	0.01	0.6	0.4	0.15	0.14	1.0	1.0	3.5	4.9	0.003	0.050	1.0	2.4	-	-	-	-

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