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Research Article

EFFECT OF PHOSPHORUS NUTRITION ON GROWTH, YIELD AND QUALITY ATTRIBUTES OF COWPEA [*Vigna unguiculata* L. Walp.]

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Abstract- An experiment was conducted at College of Horticulture, Mandsaur campus of RVSKVV Gwalior during *kharif* season 2012-13 to study the effect of phosphorus level on growth, yield, yield parameters and quality in cow pea. It was observed that varieties excerted significant influence on all the growth parameters. Similarly it was also observed that increasing phosphorus level significantly increases growth, yield, yield parameters and quality in cow pea. Result reported that among the different varieties of cow pea, Kashi Shyamal (V_2) showed superior performance for growth attributes, yield attributes, yield and quality. Among the phosphorus levels P_5 (120 kg/ha) resulted in the highest growth parameters, yield parameters, yield and quality of cow pea. Combined effect of varieties and phosphorus levels exhibited significant influence number of pods per plant, protein content (%) and seed yield per plant (g).

Keywords- Cow pea, Phosphorus level, Seed yield and quality.

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Introduction

The cowpea is an important nutritious vegetable crop and commonly known as lobia. It is used as a green as well as dry in form of pulse. Cow pea is a multipurpose crop which is grown for vegetable purpose, pulses and also for fodder purposes. It also used for green manuring purpose. Being a leguminous crop it is a rich source of protein and it also fixes nitrogen in the soil. It is a tropical and subtropical crop and prefers warm and humid season. Cowpea is a nutritive vegetable which supplies protein 3.5g, calcium 72.0 mg, phosphorus 59.0 mg, Iron 2.5 g, carotene 564.0 mg, thiamine 0.07 mg, riboflavin 0.09 mg and vitamin C 24.0 mg per 100 g of edible pods [5] . Phosphorus plays an important role in the plant metabolism and is a constituent of various organic substances. It is important role in photosynthesis, respiration and other physiological processes of plant. The vital role played by the phosphorus in reaction involving energy transfer and move specifically ATP in nitrogenase, activity suggests that plants dependence on symbiotic nitrogen for growth may require more phosphorus than those dependent on combined nitrogen. There are research evidence suggesting that most legumes show a good response to phosphorus application owing to their favorable influence on root proliferation, nodule development, bacterial activity and nitrogen fixation [11]. Therefore, present investigation was carried out to know the effect of phosphorus application on growth, yield and quality in cow pea.

Materials and Methods

A field experiment was laid out to study about effect of phosphorus nutrition on growth, yield and quality attributes of cowpea (*Vigna unguiculata* L. Walp) in *kharif* season 2011- 12 at the Vegetable Research Farm, Department of Horticulture, College of horticulture, Mandsaur, RVSKVV, Gwaliar (M.P.). The experiment was laid out in factorial randomized design with 5 phosphorus level *viz.*; P_1, P_2, P_3, P_4, P_5 (0, 30, 60, 90, 120 kg/ha) and 3 varieties Kashi Kanchan (V_1), Kashi Gouri (V_3) and Kashi Shyamal (V_2). The seeds are sown 15 cm apart with row spacing is 45 cm. Nitrogen and potash was applied @ of 25 kg/ha and 70 kg/ha. Phosphorus was given as per treatments. According to the treatment the full quantity of the phosphorus was applied as basal dose at the time of sowing through SSP fertilizer. To maintaining the uniformity elemental sulphur was applied in the P_1 to P_4 treatment at the time of sowing. Before sowing seed were treated with 2g mancozeb+1g carbendazim per kg of seed. The recommended package of practices was followed to raise cow pea crop. Observations were recorded on five randomly tagged healthy plants for growth, yield and quality characters. The data obtained from set of observations for each treatment were subject to "Analysis of variance" [8].

Results and Discussion

Growth parameters: Observations on growth attributes *viz.*, showed that application of phosphorus level P_5 recorded maximum plant height (cm), number of leaves and number of branches. Plant height, number of leaves per plant and number of branches recorded at 60 DAS. Application of phosphorus level exerted significant influence on growth parameters. Similar findings have been reported by [9,3] in cowpea. These results can be explained, on the basic that the phosphorus is highly mobile and stimulates the growth of the root, allowing the plant to get more nutrients and water to distant areas of metabolic activity, resulting rapidly escalating, while plant in low doses, has no nutrients sufficient for metabolic activity. Higher growth attributes under P_5 level may be due to phosphorus addition increased vegetative growth and assimilative capacity of cowpea plants by increasing the leaf area or photosynthetic activity. Increments of phosphorus allowed the growth of roots which resulted in increased number of leaves, while phosphorus deficiency reduces plant growth by inhibiting leaf expansion and photosynthesis [4]. Varieties exhibited significant effect on growth parameters. Among varieties Kashi Shyamal (V_2) recorded the maximum plant height, number of branches, maximum number of leaves as compared to Kashi Kanchan (V_1) and

least under Kashi Gouri (V_3). Magani and Kuchinda (2009) also reported significant influence of varieties on plant height [7]. Combined effect of varieties and phosphorus had exerted non significant influence on growth parameters *viz.*, plant height, and number of leaves per plant and number of branches per plant. The earliest 50 % flowering was observed in Kashi Gouri (V_3) followed by Kashi Kanchan (V_1). Significantly more days to 50 % flowering were taken by variety Kashi Kanchan (V_1). Similar results were obtained by [9] in cowpea. Phosphorus application showed significant influence on days 50 % flowering. Higher doses of phosphorus induced earliest flowering consequently early 50 % flowering. [3] reported days to 50 % flowering with higher doses of phosphorus in cowpea. Combination of varieties and phosphorus levels did not show any remarkable influence on commencement of 50 % flowering in cowpea.

Table-1 *Effect of phosphorus level varieties and their interaction on growth, yield and quality parameters of cow pea*

Treatments	Plant Height (cm)	Number of leaves	Number of branches	Days to 50 % flowering	Number of pods per plant	Pod length (cm)	Number of seed per pod	Seed yield per plant (g)	Protein content (%)	Weight of 100 seed (g)
Varieties										
V_1	46.72	31.60	16.70	42.26	9.98	30.90	13.18	11.12	24.52	17.82
V_2	57.09	38.33	16.90	38.00	10.54	32.44	13.79	11.73	25.23	18.38
V_3	45.92	28.53	15.14	36.33	8.96	27.29	12.23	10.59	24.76	15.8
S.Em.±	**0.97**	**0.39**	**0.27**	**0.19**	**0.14**	**0.40**	**0.19**	**0.12**	**0.15**	**0.16**
C.D. at 5%	**2.81**	**1.15**	**0.78**	**0.14**	**0.43**	**1.17**	**0.43**	**0.37**	**0.43**	**0.46**
Phosphorus level										
P_1	44.10	26.32	13.84	40.89	6.90	27.94	6.90	8.27	21.6	16.51
P_2	47.66	30.50	15.61	39.78	9.02	29.08	9.02	10.34	23.70	17.00
P_3	50.27	33.71	16.48	38.78	9.91	30.24	9.91	11.37	24.94	17.28
P_4	53.69	36.47	17.18	37.78	11.42	31.47	11.42	12.76	26.71	17.78
P_5	53.86	37.11	18.14	37.11	11.89	32.33	11.89	13.02	27.21	18.10
S.Em.±	**1.25**	**0.51**	**0.34**	**0.25**	**0.19**	**0.52**	**0.19**	**0.16**	**0.19**	**0.20**
C.D. at 5%	**3.62**	**1.48**	**1.02**	**0.73**	**0.55**	**1.51**	**0.55**	**0.48**	**0.56**	**0.59**
Interaction (VXP)										
V_1P_1	41.07	26.30	14.47	45.00	6.73	28.73	11.13	8.43	21.43	17.03
V_1P_2	44.87	30.00	16.20	43.00	8.97	29.80	12.18	10.31	23.97	17.43
V_1P_3	46.67	32.67	16.90	42.00	9.67	30.73	13.40	11.23	24.90	17.67
V_1P_4	50.47	34.10	17.67	41.00	12.20	31.77	14.07	12.66	25.83	18.33
V_1P_5	50.53	34.93	18.30	40.33	12.33	33.47	15.13	12.97	26.47	18.65
V_2P_1	49.37	31.73	14.10	40.00	7.07	29.80	12.14	9.01	21.27	17.67
V_2P_2	53.57	35.73	16.17	39.00	9.73	31.17	13.06	10.63	24.10	18.07
V_2P_3	57.43	38.83	17.00	38.00	11.00	32.30	13.75	11.39	25.43	18.33
V_2P_4	62.40	42.83	17.93	37.00	12.10	33.90	14.31	13.80	27.53	18.83
V_2P_5	62.70	42.93	19.30	36.00	12.80	35.07	15.71	13.87	27.80	19.0
V_3P_1	41.87	20.93	12.97	37.67	6.90	25.30	10.14	7.37	22.13	14.83
V_3P_2	44.53	25.77	14.47	37.33	8.37	26.27	10.90	10.07	23.03	15.50
V_3P_3	46.70	29.63	15.53	36.33	9.07	27.70	12.30	11.50	24.50	15.83
V_3P_4	48.20	32.87	15.93	35.33	9.97	28.73	13.07	11.83	26.77	16.17
V_3P_5	48.33	33.47	16.83	35.00	10.53	28.47	14.77	12.21	27.37	16.67
S.Em±	**2.16**	**0.89**	**0.60**	**0.43**	**0.33**	**0.90**	**0.37**	**0.28**	**0.33**	**0.35**
CD at 5%	**NS**	**NS**	**NS**	**NS**	**0.96**	**NS**	**NS**	**0.83**	**0.96**	**NS**

Yield Parameters and Yield : Variety Kashi Shyamal (V_2) recorded maximum value for number of pods per plant, number of seeds per pod, length of pod (cm), seed yield per plant (g). It was followed by variety Kashi Kanchan (V_1) and Kashi Gouri (V_3). Higher photosynthetic area, more dry matter accumulation might have resulted in highest yield parameters and yield in variety Kashi Shyamal (V_2). Their findings are is agreement with [10]. Phosphorus application exhibited significant effect on yield parameters in cowpea. There was linear increase in yield parameters with increasing levels of phosphorus. Maximum number of pods per plant, number of seeds per pod, pod length (cm), and seed yield per plant (g) were found with application of P_5 phosphorus level. Though the difference between P_5 and P_4 phosphorus was non-significant. More availability of phosphorus might have resulted in higher growth parameters, yield parameters and yield with higher levels of phosphorus application. Seed yield is governed by number of factors, which have a direct or indirect impact. Among them are yield components such as number of pods per plant, number of seeds per pod and weight of 100 seed (g).

Phosphorus plays an important role in translocation of assimilates to the pods being a constituent of protoplasm, which may be responsible for increased length of pods, number of seeds per pod and in turn seed yield. The higher number of seeds per pod could be due to increased pod length with higher phosphorus level and it might have accommodated more number of seeds per pod [12]. The significant response of the measured yield characters of cowpea to phosphorus application could be attributed to the role of phosphorus in seed formation and grain filling. [6] reported significant effect of phosphorus level on yield of cow pea. Combined effect of varieties and phosphorus levels showed significant influence on number of pods per plant, seed yield per plant (g). Maximum number of pods per plant, seed yield per plant (g) was found with treatment V_2P_5 which was at par to V_2P_4. Number of seeds per pod, pod length (cm) did not show any remarkable influence of combination of variety and phosphorus levels.

Quality Parameters: Seed quality was studied with respect to 100 seed weight and crude protein content (%). Maximum value for test weight was recorded with variety Kashi Shyamal (V_2) followed by Kashi Kanchan (V_1) and Kashi Gouri (V_3). Highest crude protein content was recorded with variety Kashi Shyamal (V_2) followed by Kashi Gouri (V_3) and Kahi Kanchan (V_1). [12] reported significant effect of varieties on 100 seed weight. Phosphorus levels exerted significant influence on quality parameters *viz.,* test weight and crude protein content (%). [7] & [9] reported increase in 100 seed weight phosphorus level. Maximum value for test weight (g), crude protein content (%) found with application of P_5 level which was at par to P_4 phosphorus level. Both of these treatments were significantly superior over other phosphorus levels. Similar findings were also reported by [2] in french bean. Higher crude protein yield at increased levels of phosphate may be attributed to higher N uptake by the plant under higher dose of phosphate application. Moreover, the improvement in the quality of cowpea may be due to the fact that phosphorus being an essential constituent of DNA and various forms

of RNA for protein synthesis which resulted in higher content as well as yield of crude protein [1]. Combined effect of varieties and phosphorus levels exhibited non significant influence on test weight in seed and significant effect on crude protein content. Combined effect of variety and phosphorus levels showed significant effect on crude protein content (%) in seed in cowpea. Maximum crude protein content (%) was found with V_2P_5 which was at par to V_2P_4 and V_3P_5.

Conclusion

It is concluded that phosphorus and varieties had significantly improved the growth, yield and quality parameters of cow pea. Among the varieties Kashi Shyamal (V_2) showed superior performance for growth attributes, yield attributes, yield and quality. Phosphorus levels P_5 (120 kg/ha) resulted in the highest growth parameters, yield parameters, yield and quality of cow pea. Interaction of varieties and phosphorus levels exhibited significant influence on number of pods per plant, protein content (%) and seed yield per plant (g).

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Abbreviations

cm	: Centimeter
ha	: Hectare
mg	: Milligram
g	: Gram (s)
kg	: Kilogram
m	: Meter
/	: Per
%	: Per cent
Viz.	: namely

Conflict of Interest: None declared

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