Vol.2 No. 1, 127-130 (2013)
Received Feb 2013, Accepted May, 2013

# Effect of Phosphorus on Yield and Biochemical Composition of Cowpea (Vigna unguiculata L. Walp) Pods

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## Abstract

The yield and quality parameters of cowpea varieties viz. Narendra Lobia I, Pusa Phalguni, Pusa Rituraj, Type-2 were tested in present investigation by the application of different levels of phosphorus (0, 30, 60, 90, kg $P_2O_5$ $ha^{-1}$). The field experiment was conducted during the zaid season at instructional farm of Narendra Deva University of Agriculture and Technology (U.P.). The effects of phosphorus levels on yield and Protein, sugar, amino acid, tryptophone, methionine, mineral were found in increasing order. Maximum yield and important biochemical constituents were obtained at 90 kg $P_2O_5$ /$ha^{-1}$. Improvement in protein, sugar, amino acids i.e. typtophane and methionene and mineral content in cowpea have been obtained due to various doses of phosphorus.

***Key words:*** *Amino acid, protein, sugar, mineral, yield*

## Introduction

The cowpea is commonly known as lobia and is used as a pulse. Being a major source of protein, this contain very high percentage of quality protein nearly two times as much as cereals. In India, cowpea is mostly grown in eastern part as a source of vegetables, pulses and fodder. It is a tropical and subtropical crop and prefers warm and humid season. Cowpea grains contain nearly 60.3% carbohydrate, 23% protein and 1.8% fat. Pulses are also a good source of vitamin B complex and minerals. Pulses are vital component of Indian agriculture by way of their nitrogen fixing ability, consequently increasing the fertility status of soil. Phosphorus application is very important as it promotes proper development of roots and function of Rhizobium bacteria. The present study was therefore carried out to know the effect of phosphorus application on yield and biochemical composition of cowpea pods.

**Material and Methods** Three levels of phosphorus as 0 ($F_o$), 30($F_1$), 60($F_2$) and 90 ($F_3$) kg $P_2O_5$ /$ha^{-1}$ and four cowpea varieties i.e. Pusha Phalguni ($V_1$), Narendra Lobial ($V_2$), Pusa Rituraj ($V_3$) and Type – 2 ($V_4$) were grown in Factorial

Randomized Block Design comprising 16 treatments during zayad 2002. In each replication $P_2O_5$ was applied by basal dressing through single super phosphate. On the basis of yield per plant, the total yield (Q/ha) was worked out. Protein content was determined in pod of cowpea by the Dinitro salicylic acid (DNS) method and total sugar was estimated using Phenol reagent method. Tryptophan and Methionine content and total mineral contents in cowpea pods were estimated using standard methods.

**Results and Discussion**

It is obvious from table that increasing levels of phosphorus from $P_o$ to $P_{90}$ kg $P_2O_5$/ha significantly increased the protein content, being highest at 90 kg $P_2O_5$ /ha$^{-1}$ and lowest at $P_o$ level. Among the varieties Narendra Lobia-1, ($V_1$) had higher protein content (5.69) than other varieties i.e. Pusa Phalguni (5.61), Pusa Rituraj (5.54), Type-2 (5.51). The higher nitrogen utilization of crop might be due to adequate supply of phosphorus which enhanced the protein synthesis in plants and ultimately improved the quality of produce by increasing the osmophyllic bodies. However the adequate supply of phosphorus may alter the protein synthesis because of accumulation of arginine, asparagines and glutamine in the tissues of leguminous plant as indicated by many researchers [3, 4, 5].

The result of various doses of phosphorus application had increased sugar content in pods of cowpea. Maximum sugar content was recorded in $P_{90}$ kg $P_2O_5$ level of phosphorus (5.14) followed by $P_2$ (60 kg $P_2O_5$ /ha$^{-1}$) (3.97) and $P_1$ (30 kg $P_2O_5$) (3.84). In general increases in content of carbohydrate were found due to increasing level of phosphors application. Phosphorus is the main constituent of NAD and ATP which is essential for the fixation of $CO_2$ in the process of photosynthesis and thus, the level of carbohydrate in term of sugar might have increased in the prods [4]. Maximum reducing (3.17) and non reducing sugar (1.97) content were obtained in $P_3$ level of phosphorus followed by $P_2$ and $P_1$ level of phosphorus and total sugar content was maximum in variety Narendra Lobia-1 (5.14). It may be probably due to the part that phosphorus is a constituent of nucleic acid, phytin, sugar phosphorus nucleotide and thereby it plays vital role in carbohydrate metabolism which leads to increase is sugar content of green pods of cowpea [5].

**Methionine and tryptophane content in cowpea pods**

The two important amino acids namely methionine and tryptophan were analysed in cowpea pods as influenced by phosphorus application have been noticed maximum in $P_3$ (90 kg $P_2O_5$/ha) treatment ($V_1P_3$). The enhancement of amino acid is mainly due to activity of two enzymes which oxidize the nitrate in to nitrite. The productivity of these enzyme may further enhance protein synthesis in cowpea pods. Since nitrate formed in the pod content in oxidized rapidly to nitrite. This mechanism is due to the disturbance in nitrogen metabolism which results in the synthesis of large number of protein and amino acid [4].

**Table-1 : Effect of phosphorus on protein and sugar content of cowpea pods.**

| Treatments | Protein (%) | Total Sugar (%) | Reducing sugar (%) | Non reducing sugar (%) |
|---|---|---|---|---|
| $V_1F_o$ | 3.22 | 3.22 | 1.58 | 1.64 |
| $V_1F_1$ | 4.41 | 3.84 | 2.02 | 1.82 |
| $V_1F_2$ | 5.51 | 3.97 | 2.10 | 1.87 |
| $V_1F_3$ | 5.69 | 5.14 | 3.15 | 1.97 |
| $V_2F_o$ | 2.97 | 2.95 | 1.41 | 1.54 |
| $V_2F_1$ | 3.85 | 3.83 | 2.07 | 1.76 |
| $V_2F_2$ | 5.52 | 3.96 | 2.14 | 1.82 |
| $V_2F_3$ | 5.54 | 5.04 | 3.13 | 1.92 |
| $V_3F_o$ | 3.18 | 3.13 | 1.49 | 1.63 |
| $V_3F_1$ | 4.41 | 3.81 | 2.06 | 1.75 |
| $V_3F_2$ | 5.20 | 4.05 | 2.17 | 1.88 |
| $V_3F_3$ | 5.51 | 5.08 | 3.14 | 1.94 |
| $V_4F_o$ | 3.15 | 3.00 | 1.46 | 1.54 |
| $V_4F_1$ | 4.47 | 3.79 | 2.05 | 1.75 |
| $V_4F_2$ | 5.29 | 4.05 | 2.23 | 1.84 |
| $V_4F_3$ | 5.61 | 5.05 | 3.12 | 1.93 |
| SEm± | 0.08 | 0.02 | 0.01 | 0.01 |
| CD at 5% | 0.22 | 0.05 | 0.04 | 0.02 |

Maximum mineral content was recorded in $P_3$ level (1.34) followed by $P_2$ (0.91) and $P_1$ (0.68). All the minerals present in plant come from the soil and are translocated into various plant parts like stem and finally reaches in the seeds of the plants. Maximum pod yield of cowpea was noticed in $P_3$ level (90 kg) of phosphorus followed by $P_2$ (60 kg) and $P_1$ (30 kg) over control. The yield of cowpea pods varied significantly among themselves. Cultivars Pusa Phalguni (60.51) gave superior results in comparison to Pusa Rituraj (58.06), Narendra Lobia-1 (59.13) and Type-2 (57.09). Pod yield can be increased by increasing their attributes either singly or in combination but it happens that if one attribute is increased the other will be affected adversely [1, 2].

**Table-2 : Effect of phosphorus on amino and mineral content of cowpea pods.**

| Treatments | Typtophan (g/100g/protein) | Methionine (g/100g/protein) | Total mineral (g/100g/protein) | Pod yield of cowpea ($q^{-1}$) |
|---|---|---|---|---|
| $V_1F_o$ | 0.47 | 0.63 | 0.43 | 43.81 |
| $V_1F_1$ | 0.62 | 0.78 | 0.08 | 51.8 |
| $V_1F_2$ | 0.89 | 0.91 | 0.91 | 54.98 |
| $V_1F_3$ | 0.96 | 1.49 | 1.31 | 59.13 |
| $V_2F_o$ | 0.53 | 0.71 | 0.35 | 43.69 |
| $V_2F_1$ | 0.67 | 0.83 | 0.58 | 50.92 |
| $V_2F_2$ | 0.80 | 0.94 | 0.73 | 54.39 |
| $V_2F_3$ | 0.84 | 1.36 | 1.24 | 58.06 |
| $V_3F_o$ | 0.46 | 0.74 | 0.15 | 42.84 |
| $V_3F_1$ | 0.62 | 0.88 | 0.71 | 50.68 |
| $V_3F_2$ | 0.71 | 0.95 | 0.87 | 53.88 |
| $V_3F_3$ | 0.82 | 1.32 | 1.27 | 57.09 |
| $V_4F_o$ | 0.42 | 0.81 | 0.26 | 45.07 |
| $V_4F_1$ | 0.65 | 0.92 | 0.50 | 56.69 |
| $V_4F_2$ | 0.75 | 1.15 | 0.76 | 57.98 |
| $V_4F_3$ | 0.88 | 1.38 | 1.16 | 50.51 |
| SEm± | 0.01 | 0.01 | 0.02 | 0.130 |
| CD at 5% | 0.02 | 0.02 | 0.04 | 0.374 |

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