www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(1): 792-795

www.thepharmajournal.com
Received: 17-11-2021
Accepted: 28-12-2021

Sanikommu Venkata Sirisha
Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Umesha C
Assistant Professor, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Sachchida Nand Singh
Assistant Professor, Department of Agriculture, Himgiri Zee University, Dehradun, Uttarakhand, India

Corresponding Author:
Sanikommu Venkata Sirisha
Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh, India

Influence of phosphorus levels on growth, yield and economics of cowpea (*Vigna unguiculata* L.) Varieties

Sanikommu Venkata Sirisha, Umesha C and Sachchida Nand Singh

Abstract
A field experiment on effect of phosphorus levels on growth and yield of cowpea (*Vigna unguiculata* L.) varieties was conducted during *Zaid* season 2019 at Central Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, (U.P.). The present investigation was laid out in Randomized Block Design (RBD) which is replicated thrice and the treatments consisted of nine treatments and three components of Varieties like Kashi Gauri, Gomti, Sadabahar and Phosphorus levels i.e 100% RDP, 50% RDP, and 25% RDP *viz.* whose effect is observed on Cowpea. The experimental findings reveal the growth parameters *viz.,* maximum plant height (53.81cm) was noticed in Sadabahar + 100% RDP. Similarly maximum number of branches/plant (5.60), leaf area index (16.79 m^2), number of pods/plant (6.40), number of seeds/pod (13.07), Seed yield (1308.23 kg/ha) was noticed in Gomti + 100% RDP.

Keywords: Cowpea, varieties, phosphorus, growth and yield

Introduction
Pulses are the important sources of proteins, vitamins and minerals for the predominantly vegetarian population and are popularly known as “Poor man’s meat” and “Rich man’s vegetable”. Pulses contain two to three times more protein than cereals ranging approximately between 20 to 40 percent, apart from these pulses fix atmospheric nitrogen, improving soil fertility. India is the largest producer and consumer of the world accounting for about 29 percent of the world area and 19 percent of world’s production. There was stagnation in the production and productivity of pulses over past two decades, hence then there is a diversion of area from pulses to cereals as a result of “Green Revolution” brought by the high yielding varieties of cereals. This is mainly due to the low yield potential of legumes under irrigation and instability of yield. The daily per capita availability of pulses had decreased from 69 to 40 grams as against the Worlds Health Organization’s recommendation of 80 grams per day.
The important pulses grown in India are Red gram, Green gram, Black gram, Cowpea, Moth bean, Horse gram, Peas etc. Among them Cowpea (*Vigna unguiculata* L.) is a native to Central Africa and belongs to the family Leguminaceae with subfamily Papilionaceae. The common names are ‘Black-eye-pea” “Southern pea”, “China pea”, “Marble pea”. Cowpea is annual herbaceous plant known for its drought hardy nature with large tap root system and alternate trifoliate leaves with ovate leaflets. It can either be short and bushy or act like a vine by climbing supports or trailing along the ground. Generally, colours of cowpea flowers are purple, pink, yellow, white and blue. A pod can contain 6-13 seeds that are usually kidney shaped although the seed become more spherical and more restricted within the pod. It is eaten in the form of grain, green pods and leaves. Like other legumes, cowpea grains are cooked to make it edible, usually by boiling but the most important way to eat them is in curries. The roots are eaten in Sudan and Ethiopia. Peduncles and stems are used as fiber in Nigeria. The grain contains 24.8 percent protein, 1.9 percent fat, 63.6 percent carbohydrates, 6.3 percent fiber, 0.00074 percent thiamine, 0.00042 per cent Riboflavin, 0.00281 percent Niacin **(**Shaw 2007) [11]. It also has the useful ability to fix atmospheric nitrogen through its root nodules. It grows well in poor soils with more than 85 percent sand and with less than 0.2 percent organic matter and low level of phosphorus.
Phosphorus (P) is important for plants growth, but its availability is mostly limited. It has been reported to enhance the formation of lateral, fibrous and adventitious roots which play an important role in Nitrogen fixation, nutrient and water uptake (Niu *et al.*, 2012) [11]. It was rated the second to nitrogen in terms of its importance to crop performance (Halder and Panda, 2014) [3]. Phosphorus (P) is one of the most limiting plant nutrients in crop production.

The added phosphorus is reported to serve dual purpose in legumes by increasing the yield of current as well as succeeding crop. An adequate supply of phosphorus has been reported beneficial for growth and yield, better quality and enormous nodule formation in legumes (Sammauria *et al*., 2009) [15]. It acts as a structural component of membrane system of cells, chloroplast and mitochondria. It is a constituent of energy phosphates like ADP and ATP, nucleic acid, nucleoli proteins, purines, pyrimidine, nucleotides and several co-enzymes. It is involved in the basic reaction of photosynthesis and plays an important role in cell division, breakdown of carbohydrate, transfer of inherited characteristics and hastening the maturity of plants. It is also an essential constituent of majority of enzymes which are important in the transformation of energy in carbohydrate, fat metabolism and also in respiration of plants. Phosphorus, although not required in large quantities is critical to cowpea yield particularly for improved photoperiod-insensitive varieties because of its multiple effects on nutrition. Phosphorus is very significant element to enhance the cowpea biomass and crop yields because it stimulates growth, initiate nodulations as well as influence the efficiency of rhizobium-Legume symbiosis (Haruna and Usman, 2013) [4]. Therefore, the requirement of Phosphorus for cowpea is quite higher than nitrogen of single phosphate or SUPA (Nka *et al*., 2014) [10].

Now a day's many new improved varieties of cowpea are recommended for cultivation. Varieties play an important role in crop production and the potential yield of variety within in the genetic limit is determined by its environment. The yield of any crop production potential of the varieties and climatic, edaphic and management practices to which varieties is exposed. By indicating the scope to improve its productivity, the release of high yielding varieties has contributed a great deal towards the improvement of cowpea yields. Next to nitrogen, phosphorus is major yield limiting nutrient. Cowpea, being the leguminous crop, responds more to phosphoric fertilizers to produce higher yields and fodder also. Yield and fodder quality of cowpea varieties increase with increasing levels of phosphorus up to 80 kg/ha (Jha *et al*., 2014) [7]. There are ample evidence that indicated impact of phosphorus and varieties showed possible yield relation. The yield potential of these high yielding varieties can further exploit through better agronomic practices with respect to different phosphoric levels. Thus, it is utmost needed to find out the suitable varieties along with optimum dose of phosphorus for the production of cowpea. When promising varieties with higher yield potential identified, it is necessary to establish their appropriate agronomic manipulation or cultivation practices obtaining higher yield, that including nutrient management, field management, water management and plant protection to obtain such yield.

Materials and Methods

A field experiment on effect of phosphorus levels on growth and yield of cowpea (*Vigna unguiculata* L.) varieties was conducted during *Zaid* season 2019 at Central Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, (U.P.). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.4), low in organic carbon (0.281%), available N (219 kg/ ha), available P (11.6 kg/ ha) and available K (217.2 kg /ha). Nutrient sources were Urea, DAP, MOP to fulfill the requirement of Nitrogen, phosphorous and potassium. The treatments which are with T_1 - Kashi Gauri + 50% RDP, T_2 - Kashi Gauri + 75% RDP, T_3 - Kashi Gauri + 100% RDP, T_4 - Gomti + 50% RDP, T_5 - Gomti + 75%, T_6 - Gomti + 100% RDP, T_7 - Sadabahar +50% RDP, T_8 - Sadabahar + 75% RDP, T_9 - Sadabahar + 100% RDP. The Experiment was laid out in Randomized Block Design, with nine treatments which are replicated thrice. Date of sowing was on 06th March 2019 with the seed rate of 25 kg/ha. In the period from germination to harvest several plant growth parameters like Plant height (cm), No. of branches/plant and leaf area index (cm^2) were recorded at frequent intervals along with it after harvest several yield parameters like No. of pods/ plant, No. of seeds/ pod, Seed yield (kg/ha) and Economics were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design (Gomez K.A. and Gomez A.A. 2010) [5].

Results and Discussion

Growth parameter

The data pertaining to the Growth Parameter was listed in Table 1.

Maximum plant height (53.81 cm) was obtained in Sadabahar variety with application of 100% phosphorus which is significantly superior over rest of all treatments. Sadabahar shows maximum height it might be due to application of phosphorus enhanced the cell division lead to increase in the plant height in cowpea, application of recommended phosphorus increased the plant height and early maturing varieties produced dwarf plants, while late maturing variety showed highest plant height which was confirmation with Sanginga *et al*.(2013) [16], Yogesh *et al*.(2016) [21], Srinivasa *et al*. (2017) [19] and Namakka *et al*. (2018) [8].

Maximum no. of branches/plant (5.60) and leaf area index (16.79 m^2) were observed in Gomti variety with application of 100% phosphorus. No. of branches/plant which was significantly superior over the rest of all the treatments expect in Kashi Gauri + 100% RDP, Gomti+ 50% RDP, Gomti + 75% RDP, Sadabahar + 100% RDP. The maximum no. of branches attributed due to application of phosphorus which helps in efficient utilization of nutrients, which resulted in attaining better crop canopy and simulation of root growth and increased metabolic activities in variety Gomti which was confirmation with Futuless *et al*., (2010) [2], Amin *et al*., (2014) [1].

Leaf Area Index which is significantly superior over rest of all the treatments. Higher Leaf Area Index is due to higher Leaf Area per unit land area, as Gomti is bushy type variety which covers maximum ground area at which crop canopy receives maximum solar radiation whereas Phosphorus enhanced the number of branches per plant, number of leaves per plant and leaf area could be responsible for enhancing leaf area index along with variation in different varieties which was confirmation with Ndor *et al*. (2012) [9] and Nkaa *et al*. (2014) [10].

Yield attributes and Yield

The data pertaining to the Yield attributes and Yield was listed in Table 2.

The maximum no. of pods/plant (6.40) was recorded under treatment where Gomti variety along with 100% Phosphorus application as basal dose which was significantly superior over all the treatments except in Kashi Gauri variety (6.33) along with 100% Phosphorus.

The maximum no. of seeds/pod (13.07) recorded under treatment where Gomti variety along with 100% Phosphorus

application as basal dose which was significantly superior over all the treatments except in Kashi Gauri variety (12.53) along with 100%Phosphorus, Sadabahar variety (11.93) along with 100% Phosphorus, Gomti variety (11.53) along with 75% Phosphorus and Kashi Gauri variety (10.80) along with 75% Phosphorus application.

The maximum seed yield (1308.23kg/ha) was recorded under treatment where Gomti variety along with 100% Phosphorus application as basal dose which was significantly superior over all the treatments except in Kashi Gauri variety (1262.50kg/ha) along with 100% Phosphorus and Sadabahar variety (1250.33kg/ha) along with 100% Phosphorus.

The progression in yield attributes and yield of cowpea is due to the application of phosphorus as basal dose with prominent varieties of cowpea. Peculiarity of varieties is more importance when we evaluate different varieties. Grain yield depends upon number of factors which have direct or indirect impact. However, variation in yield was observed, due to peculiar characters of variety i.e. higher number of branches per plant, no. of pods per plant, number of seeds per pod. Such variations in yield of different varieties also found significant difference in no. of pods per plant, No. of seeds per pod, and grain yield which was confirmation with Padi and Marfo (2005) [13], Olaleye *et al*. (2012) [12].

Economics

The data pertaining to the Economics was listed in Table 3.

Cost of cultivation was varied due to different phosphorus levels and varieties ₹ 43378.55 to 40886.55/ha.

Benefit Cost ratio (1.54) was recorded in treatment Gomti variety along with 100% phosphorus as compared to other treatment.

Different Phosphorus levels as basal dose with different varieties was significantly influenced the economics of Cowpea. The higher B: C ratio was obtained in Gomti variety along with application of 100% phosphorus such variation under different varieties and level of phosphorus was exactly in accordance with the pods per plant, seed yield produced which was confirmation with Shivananda (2005) [18], Pathan *et al*. (2006) [14], Jat *et al*. (2013) [6], and Sutar *et al*. (2016).

Table 1: Effect of Phosphorus levels on Growth parameters of Cowpea Varieties at 60DAS

Treatments	Plant height (cm)	No. of branches / plant	Leaf Area Index (m^2)
Kashi Gauri + 50% RDP	48.03	4.73	10.10
Kashi Gauri + 75% RDP	51.54	5.13	10.93
Kashi Gauri + 100% RDP	52.92	5.47	11.56
Gomti + 50%RDP	47.90	5.33	13.11
Gomti + 75%RDP	50.76	5.47	14.40
Gomti + 100%RDP	52.62	5.60	16.79
Sadabahar + 50% RDP	49.62	4.73	9.65
Sadabahar + 75% RDP	51.61	5.00	11.00
Sadabahar + 100% RDP	53.81	5.40	11.53
SEm(±)	0.28	0.14	0.70
CD(P=0.05)	0.84	0.84	2.11

Table 2: Effect of Phosphorus levels on Yield and Yield attributes of Cowpea Varieties

Treatments	No. of Pods/plant	No. of Seeds/pod	Seed yield (kg/ha)
Kashi Gauri + 50% RDP	5.47	7.60	942.90
Kashi Gauri + 75% RDP	5.80	10.80	957.73
Kashi Gauri + 100% RDP	6.33	12.53	1262.50
Gomti + 50%RDP	5.67	8.20	948.37
Gomti + 75%RDP	5.93	11.53	1043.20
Gomti + 100%RDP	6.40	13.07	1308.23
Sadabahar + 50% RDP	5.33	7.53	650.67
Sadabahar + 75% RDP	5.73	8.73	949.40
Sadabahar + 100% RDP	6.13	11.93	1250.33
SEm(±)	0.09	0.99	71.88
CD(P=0.05)	0.27	2.98	215.52

Table 3: Effect of Phosphorus levels on Economics of Cowpea Varieties

Treatments	Cost of cultivation (Rs/ha)	Benefit Cost Ratio (B:C)
Kashi Gauri + 50% RDP	49886.55	0.63
Kashi Gauri + 75% RDP	51128.47	0.60
Kashi Gauri + 100% RDP	52378.55	1.06
Gomti + 50% RDP	40886.55	1.01
Gomti + 75% RDP	42128.47	1.12
Gomti + 100% RDP	43378.55	1.54
Sadabahar + 50% RDP	48686.55	0.16
Sadabahar + 75% RDP	49928.47	0.63
Sadabahar + 100% RDP	51178.55	1.08

Conclusion

On the basis of one year experimentation it is concluded that among three varieties Gomti with 100% application of phosphorus found to be more productive (1308.23kg/ha) as well as economic feasible also (B: C ratio 1.54).

References

1. Amin AU, Agalodia AV, Prajapati DB. Performance of cowpea varieties on growth, yield and quality parameters. Published in state seed committee. CRSS, Jagudan. 2014.
2. Futuless Ngodi, Kaki, Bake, Dauda, Ibrahim. Evaluation of yield and yield attributes of some cowpea (*Vigna unguiculata* (L.) Walp) varieties in Northern Guinea Savanna. Journal of Agriculture Science. 2010;6(12).
3. Halder D, Panda RK. Determination of appropriate sowing date and phosphorus fertilization strategy for peanut in Eastern India. African Journal of Agricultural Research. 2014;9:2475-2487.
4. Haruna IM, Usman A. Agronomic efficiency of cowpea varieties (*Vigna unguiculata* (L.) under varying Phosphorus rates in Lafia, Nassarawa state, Nigeria. Asian Journal of Crop Science. 2013;5:209-215.
5. Gomez KA, Gomez AA. Statistical procedures for agricultural research *2nd edition*. New York, 2010, 680.
6. Jat SR, Patel BJ, Shivran AC, BR, Jat G. Effect of P and S levels on growth and yield of cowpea under rainfed conditions. Annals of Plant and Soil Research 2013;15:114-117.
7. Jha AK, Shrivastava A, Raghuvanshi NS. Effect of different phosphorus levels on growth, fodder yield and economics of various cowpea genotypes under Kymore plateau and Satpura hills zone of Madhya Pradesh. International Journal Agricultural Science. 2014;10:409-411.
8. Namakka A, Jibrin DM, Hamma L, Bulus J. Effect of Phosphorus levels on Growth and Yield of Cowpea (*Vigna unguiculata* L.) in Zaria, Nigeria Journal of Dryland Agriculture. 2018;3(1):85-93.
9. Ndor E, Dauda N, Abimuku E, Azagatu D, Anzaku H. Effect of phosphorus fertilizer and spacing on growth, nodulation count and yield of cowpea (*Vigna unguiculata* (L.) Walp) in southern guinea savannah of Nigeria. Asian Journal of Agricultural Sciences. 2012;4:254-257.
10. Nkaa FA, Nwokeocha OW, Ihuoma O. Effects of Phosphorus fertilizer on growth and yield of cowpea (*Vigna unguiculata* L.). Journal of Pharmaceutical and Biological Sciences. 2014;9(5):74-82.
11. Niu YF, Chai RS, Jin G, Wang H, Tang CX, Zhang YS. Response of root architecture development to low phosphorus availability: a review. Annals of Botany. 2012;112:391-408.
12. Olaleye Oladiran, Fagbola Olajire, Abaidoo Robert. Phosphorus Response Efficiency in Cowpea Genotypes. Journal of Agricultural Sciences. 2012;4(1).
13. Padi FK, Marfo KO. Selection criteria for early maturing cowpea (*Vigna unguiculata* L. Walp.) genotypes in Northern Ghana. Ghana Journal of Agricultural Sciences. 2005;1:79-86.
14. Pathan SH, Gethe RM, Kadlag AD, Manjare MR. Seed yield of forage cowpea as influenced by promising cultivars and spacing. Journal of Maharashtra Agricultural University. 2006;31(3):289-291.
15. Sammauria R, Yadav RS, Nagar KC. Performance of clusterbean (*Cyamopsis tetragonoloba*) as influenced by nitrogen and phosphorus fertilization and biofertilizers in Western Rajasthan. Indian Journal of Agronomy. 2009;54(3):319-323.
16. Sanginga N, Lyasse O, Singh BB. Phosphorus use efficiency and nitrogen balance of cowpea breeding lines in a low 'P' soil of the derived savannah zone in West Africa. Plant and Soil. 2013;220:119-128.
17. Shaw M. Most Protein Rich Vegetarian Foods Smarter Fitter Blog. Retrieved. 2011, 100.
18. Shivananda Malagi. Responce of cowpea genotypes to plant density and fertilizer levels under Rainfed Vertisols. M. Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharawad. 2005.
19. Srinivasa J, Vijay S Kale, Nagre PK. Evaluation of Different cowpea varieties and genotypes. International Journal of Pure and Applied Bioscience. 2017;5(3):329-334.
20. Sutar VK, Chavan LS, Game VN. Response of cowpea (*Vigna unguiculata* L) varieties to different sowing dates and effect on yield, quality and soil fertility. Journal of Indian Society of Coastal Agricultural Research. 2014;32(1):16-20.
21. Yogesh P, Varma LR, Verma P, Kulkarni MV. Varietal performance of Cowpea (*Vigna unguiculata* L.) against growth, seed yield and quality attributes. Ecology, Environment and Conservation. 2016;22(3).