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Effect of different Phosphorus Levels on Urd Bean under Custard Apple based Agri-Horti System

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ABSTRACT

An experiment was conducted in *kharif* season of 2009 to study the effect of phosphorus on Urd bean under custard apple based agri-horti system. The treatments compared were six levels of phosphorus (0, 15, 30, 45, 60 and 75 kg P_2O_5/ha) tested in a Randomized Block Design. The growth and yield attributes *viz*. plant height, number of branch perplant, number of trifoliate leaf perplant, total dry matter accumulation perplant, number of pod per plant, number of seed per pod, test weight, seed yield and stover yield increased with the increase in the levels of phosphorus up to 75 kg/ha. All the growth parameters of custard apple produced non-significant result with increasing doses of phosphorus application up to highest level in the crop growth period.

Keywords : Phosphorus levels, Urd bean, Custard Apple, Agri-Horti System

INTRODUCTION

Agri-Horti System is one of the important components of agroforestry in which the integration of fruit crops in croplands is practiced. Aonla, ber, citrus, custard apple, guava etc. are major promising fruit crops suitable for agri-horti system. Fruit crops are first preference of farmers under agroforestry system due to short gestation period, regular income, risk cover and aesthetic value.

Urd Bean (*Vigna mungo* L.) is one of the most highly prized pulses of India. It is also known as mash bean and improves soil fertility through symbiotic N fixation. Being a cheap source of vegetable protein for direct human consumption it is also called as “poor man’s meat”. In spite of being widely adapted crop, it is per hectare yield is very low, this might be due to poor fertility status of the soils, therefore, fertility management is imperative to ensure better crop production on exhausted soils (Asghar*et al*., 1994). Fertilizer is one of the most important factors that affect crop production. Fertilizer recommendation for soils and crops is a dynamic process (Singh and Kumar, 2009; Singh *et al*., 2013) and the management of fertilizer is one of the important factors that greatly affect the growth, development and yield (Asaduzzaman *et al*., 2008). Phosphorus is the second most critical plant nutrient among all, but for legumes it assumes primary importance. It participates in the synthesis of vitally important substances. It also takes part in energy fixing and releasing process in the plants. Phosphorus helps in proper root development, which increases nodules per plant and consequently more nitrogen is fixed in soil by pulse crops (Carter and Stoker, 1988). However, the phosphorus content is low in Indian soil and a major portion of applied phosphorus is retained in soil is in unavailable form. So, it is necessary to supplement the deficient amount of phosphorus and increase the efficiency of applied phosphorus with optimum dose of phosphorus for enhancing the production and productivity.

Keeping in view these circumstances, it was contemplated to work out the optimum level of phosphorus to be applied for improving growth and yield of urd bean under custard apple based agri-horti system.

MATERIALS AND METHODS

The experiment was carried out at the Agronomy Farm of Rajiv Gandhi South Campus, Barkachha (BHU), Mirzapur which is situated in *Vindhyan*

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region of district Mirzapur (25° 10' latitude, 82º 37' longitude and altitude of 147 mabove mean sea level) occupying over an area ofmore than 1000 ha where variety of crops like agricultural, horticultural, medicinal and aromatic plants are grown. *Vindhyan* soil comes under rainfed and have invariably poor fertility status. This region comes under agro-climatic zone III A (semi-arid eastern plain zone). The climate of Barkachha is typically semi-arid, characterized by extremes of temperature both in summer and winter with low rainfall and moderate humidity. Maximum temperature in summer is as high as 42.1°C and minimum temperature in winter falls below 9.3ºC. The annual rainfall of locality was 1073.2mm in 2009, of which nearly 88% is contributed by South West monsoon between July to September. The total rainfall during the crop duration was 288.5 mm; maximum and minimum temperature fluctuated between 34.6 and 14.6°C, and relative humidity between 81.9% and 61.5%. The experimental field had sand silt and clay 44.63, 30.10 and 25.13% and available N, P, K 137.2, 14.5 and 185.7 kg/ha respectively while pH was 6.5.The experiment was conducted in Randomized Block Design with 6 (six) treatments which were replicated thrice. These treatments were different doses of phosphorus, that is, 0 kg/ ha (T_1), 15 kg/ha (T_2), 30 kg/ha (T_3), 45 kg/ha (T_4), 60 kg/ha (T_5), and 75 kg/ha (T_6). The fertilizer application was done with fixed doses of nitrogen at 22.6 kg/ha and potassium at 30 kg/ha. Phosphorus application was done according to the treatments. All the nutrients were applied as basal and the sources of N, P and K were urea, DAP and MOP respectively. The Custard Apple variety "Mammoth" was planted at 5 m × 5 m distance. Urd Bean variety "PU-7" was sown as an intercrop. The seeds were sown manually in the furrow opened by spade at a row distance of 30 cm and plants were sown at a distance of 10 cm. Seed rate of 20 kg/ha were used for proper maintenance of plant population. Recommended intercultural operations were practiced. The biometric observations on growth attributes were recorded at an interval of 15 days, that is, 15^{th}, 30^{th} and 45^{th} days after sowing and at maturity. Growth attributes that is, plant height, number of trifoliate leaf per plant, number of branch per plant, total dry matter accumulation per plant and yield attributes i.e. number of pod per plant, number of seed per pod, test weight, seed yield and stover yield were measured.

RESULTS AND DISCUSSIONS

Effect of Phosphorus on Growth Parameters of Urd bean

1. Plant Height (cm)

Significant differences were observed in plant height of urd bean due to application of different phosphorus levels (Table 1). Plant height (46.00 cm) was highest when phosphorus was applied at 75 kg/ha which was statistically at par to 60 and 45 kg phosphorus per hectare. Lowest plant height (46 cm) was obtained when no phosphorus was applied but non-significant with 15 and 30 kg/ ha. These results are also in conformity with Tariq *et al*. (2001) in mung bean.

Table 1 : Effect of phosphorus on growth parameters of urd bean under custard apple based agri-horti system

Phophorus (kg/ha)	Plant height (cm)	Number of branches per plant	Number of trifoliate leaf per plant	Total dry matter accumulation per plant
0	35.33	2.7	8.67	32.70
15	36.33	2.9	9.33	36.83
30	39.00	3.8	10.00	40.17
45	43.67	3.9	11.33	42.70
60	45.00	4.1	12.00	44.00
75	46.00	4.3	12.50	44.10
S.Em.±	1.21	0.15	0.49	0.31
LSD 0.05	3.80	0.47	1.54	0.96

2. Number of Branch per Plant

Maximum number of branch per plant (4.3) was recorded in 75 kg phosphorus per hectare though the differences were not significant with 60 and 45 kg/ha, against minimum (2.7) in control which was found at par only with 15 kg/ha phosphorus

application (Table 1). Tariq *et al*. (2001) also reported that the phosphorus application up to 70 kg ha/ha in mung bean significantly increased the number of branch per plant.

3. Number of Trifoliate Leaf per Plant

Highest number of trifoliate leaf per plant recorded with 75 kg phosphorus per hectare which were found at par with 60 and 45 kg/ha while lowest number of trifoliate leaf per plant obtained with no phosphorus application found non-significant with 15 and 30 kg/ha. With increasing doses of phosphorus application up to highest level maximum number of trifoliate leaf per plant was also recorded by Ram and Dixit (2001).

also reported the higher number of pod per plant with highest dose of phosphorus (100 kg/ha) application in mungbean.

2. Number of seed per pod

Maximum number of seed per pod (6.67) was recorded with 75 kg/ha phosphorus though the differences were only significant with 0 kg/ha which was found lowest (4.67) (Table 2). Similar result in mungbean was obtained by Reddy *et al.* (2000).

3. Test weight

Test weight of Urd Bean with each increment of phosphorus level found significant. In mungbean

Table 2 : Effect of phosphorus on yield parameters of Urd bean under custard apple based agri-horti system.

Phosphorus (kg/ha)	Number of pod per plant	Number of seed per pod	Test weight (g)	Seed yied (kg/ha)	Stover yield (kg/ha)
0	11.67	4.67	29.67	442	1701
15	16.00	5.67	31.67	562	1928
30	17.33	6.33	33.33	687	2184
45	19.67	6.53	35.33	734	2353
60	20.33	6.63	38.00	864	2683
75	23.00	6.67	38.20	957	2841
S.Em.±	1.36	0.43	0.06	7	79
LSD 0.05	4.28	1.36	0.19	21	244

4. Total dry matter accumulation per plant

Phosphorus level of 0 kg/ha recorded significantly lowest total dry matter accumulation than remaining doses while 75 kg/ha though at par with 60 kg phosphorus per hectare recorded the highest total dry matter accumulation over rest of the phosphorus levels. Increasing levels of phosphorus application up to highest level also recorded maximum total dry matter accumulation per plant in an experiment conducted in mungbean crop by Chaturvedi *et al*. (2004).

Effect of Phosphorus on Yield Parameters of Urd Bean

1. Number of pod per plant

Maximum number of pod per plant (23.00) was obtained when phosphorus applied at 75 kg/ha though the differences were remained at par with 60 and 45 kg/ha (Table 2). Minimum number of pod per plant (11.67) was obtained where no phosphorus was applied, that too was found at par with 15 and 30 kg/ha. Sultan and Mahmood (2002)

significant effect of phosphorus application was also concluded by Chaturvedi*et al*. in 2004.

4. Seed yield

Seed yield affected significantly by phosphorus with every dose applied (Table 2). Minimum seed yield (442 kg/ha) was observed with 0 kg phosphorus/ha. Seed yield/ha were significantly increased with the increasing levels of phosphorus up to highest level and minimum with no application. Higher values of yield may be ascribed to the effect of P on root development, energy transformation and metabolic processes of the plants, which in turn resulted in greater translocation of photosynthates towards the sink development. These results are in agreement with Jain *et al.* (2007) as well as Singh and Ahlawat (2007). The highest seed yield (957 kg/ha) in case of 75 kg /ha phosphorus can be attributed to more number of pod per plant and test weight. Similar result was obtained by Malik*et al*. (2003) in mung bean.

Table 3 : Effect of phosphorus on growth parameters of custard apple in custard apple based agri-horti system.

Phosphorus (kg/ha)	Tree height (m)		Collar diameter (cm)		Canogy spread (m)	
	At corp sowing	At crop maturity	At crop sowing	At crop maturity	At crop sowing	At crop maturity
0	2.0	2.12	3.40	3.92	2.03	2.73
15	1.7	1.73	4.11	4.58	1.58	2.33
30	2.3	2.36	4.59	4.68	2.00	2.72
45	1.9	1.98	4.25	4.59	1.84	2.71
60	1.6	1.71	5.05	5.33	1.38	2.03
75	2.1	2.17	4.21	4.49	1.83	2.52
S.Em.±	1.8	0.06	1.04	0.98	0.07	0.10
LSD 0.05	NS	NS	NS	NS	NS	NS

5. Stover yield

Highest stover yield was found with the application of 75 kg phosphorus/ha remained at par with 60 kg phosphorus/ha but significantly different with rest of the levels. Lowest stover yield was recorded in 0 kg phosphorus/ha which was also found non-significant with 15 kg phosphorus/ha but significantly different with remaining phosphorus levels. These results are in the confirmation with the results of Jain *et al.* (2007).

Effect of phosphorus on growth parameters of custard apple

Non-significant differences (Table 3) recorded in the growth parameters of custard apple might be due to limited growth period of Urd bean. Similar results were also obtained by Kumar *et al*., (2014).

CONCLUSION

On the basis of above experimental findings it can be inferred that Urd bean should be fertilized with 75 kg phosphorus/ha for taking the higher yield under custard apple based agri-horti system in the *Vindhyan* region

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