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Effect of phosphorus levels on growth and yield of different pea varieties (*Pisum sativum* L.)

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Abstract
A field experiment was conducted during the Rabi session of 2020-21 in Jaunpur district which lies Indo-Gangetic plains of Central Uttar Pradesh to study the effect of phosphorus levels on growth and yield of different Pea varieties (*Pisum sativum* L.). The trial was laid out in factorial randomized blocks design (FRBD) with three replications. The treatment in concert of two factors first factor *viz*. V_1 (Malviya-2), V_2 (Aparna), V_3 (Sapna), V_4 (Rachna) and second factor *viz*. P_0 (0 kg P_2O_5), P_1 (20 kg P_2O_5), P_2 (40 kg P_2O_5), P_3 (60 kg P_2O_5), P_4 (80 kg P_2O_5). The result revealed that the maximum growth characters *viz.*, plant population, plant height (cm), total number of branches plant^{-1} and days to 50% flowering were recorded on V_3 (Sapna) and minimum values was recorded with V_1 (Malviya-2). The yields attributing characters *viz.*, number of pods plant^{-1}, pod weight plant^{-1}, number seed pod^{-1} and test weight (g) were also recorded higher under variety of V_3 (Sapna) at par with V_1 (Malviya-2). The pea variety V_3 (Sapna) was gave significantly highest seed yield (q ha^{-1}), straw yield (q ha^{-1}), harvest index (%) and B:C ratio as compared to other. Among the Phosphorus levels 80 kg P_2O_5 ha^{-1} was found better in case all growth and yield parameters which was followed by 60 and 20 kg P_2O_5 ha^{-1}. Interaction effect was found significant in respect to pod weight plant^{-1}, test weight (g). Variety V_3 (Sapna) sown under 80 kg P_2O_5 ha^{-1} gave significantly higher values. It may be concluded that V_3 (Sapna) with 80 kg P_2O_5 ha^{-1} is possible to produce more yield in field pea cultivated under Indo-Gangetic plains of central Uttar Pradesh.

Keywords: Phosphorus levels, Growth and yield of pea, different varieties of Pea

Introduction
Pea (*Pisum sativum* L.) belonging to the Fabaceae (Leguminosae) family. It is an important legume crop and it has earned a place of salience in the diet of all sections of the society. Green peas are consumed as a raw or cooking vegetable separate or mixed with potato, cauliflower and many other vegetables or as a conserved, frozen product; dry seed as food; hay feed for animals and green manure (Bozoglu *et al*., 2007) [3]. Pea crop cultivated on a large scale for green pods and seeds. It is highly nutritive, containing high amount of digestible protein, carbohydrate, vitamins and minerals. Its fresh pod contains 19.8% carbohydrate, 7.2% protein, and 0.8% mineral matter, while dried peas grain contains, 56.6 per cent carbohydrate, 19.7 per cent protein, and 4.4 per cent iron, besides being a rich sources of vitamins A, B, D and C. In India average field pea production was recorded 21.99 lakh tones and area of 10.59 lakh ha, with an average productivity of 993 kg ha^{-1} (Singh *et al.*, 2023) [10]. It is grown with less care and low manorial requirements. The productivity of pea is low because of its cultivation generally in poor soils. Pulses have the inherent capacity to fix atmospheric nitrogen in symbiotic association with Rhizobium. Application of phosphorus increased the production of pulse crops (Sharma *et al.*, 2014) [7]. The response of phosphorus depends upon many factors like climate, variety and soil type and availability of nutrients during the period of growth. The requirement of phosphorus in legumes like pea is higher than other crops for their root development and metabolic activities. Phosphorus is the vital component of DNA, RNA, ATP and photosynthetic systems and catalyse a number of biochemical reactions from the beginning of seedling growth through to the formation of grain at maturity. Improper use of fertilizer is one of the major causes of poor yield of crops. Phosphorus is essential for seed production as it enhances root growth and promotes plant maturity. Therefore, an attempt has been made to evaluate pea

varieties under different levels of phosphorus to see the effect on the growth and yield as well as the economics of pea seed production.

Material and Methods

The field experiment was conducted at Agronomic Experimental Farm of Sri Ganesh Rai PG College, Dobhi, Jaunpur during 22 October to 31 March of the year 2020-21 located in sub-humid subtropical climatic zone of Indo-Gangetic alluvium of Eastern Uttar Pradesh. The experiment was laid out into factorial randomized block design with three replications and treatment in concert of two factors first factor is varieties *viz*. V_1 (Malviya-2), V_2 (Aparna), V_3 (Sapna), V_4 (Rachna) and second factor is level of phosphorus *viz*. P_0 (0 kg P_2O_5), P_1 (20 kg P_2O_5), P_2 (40 kg P_2O_5), P_3 (60 kg P_2O_5), P_4 (80 kg P_2O_5). The soil of the experimental plot was silt loam with pH 7.7, organic carbon 0.36%, Available N content 135.10 kg ha^{-1}, available P_2O_5 content 13.25 kg ha^{-1} and available K_2O content 231.10 kg ha^{-1}. The crop was provided with spacing of 30 cm × 10 cm (line sowing), plot size of 3.00 × 2.00 m and depth of seed sowing (2.5 cm). Standard culture practices followed uniformly in all experimental plots. The data regarding growth and yield parameters were analysed with statistical analysis and significance of treatments were tested with the help of 'F' test.

Results and Discussion

Plant growth parameters

The data pertaining to varieties perform with Phosphorus on growth parameters are 'presented in table-1. Highest plant height (cm), maximum number of branches plant^{-1} and days to 50% flowering was recorded with variety V_3 (Sapna) as compared to V_1 (Malviya-2), V_2 (Aparna) and V_4 (Rachna) variety. It might be due to the varietal dissonance due to genetics characters of seed. These findings were supported with the findings of Tripathi *et al.* (2020) [14] and Birari *et al.*, (1993) [2]. Among different Phosphorus levels, 80 kg ha^{-1} Phosphorus application produces significantly the highest plant height, maximum number of branches and minimum days to 50% flowering. On other hand lowest growth parameters recorded with control plot (P_0) 0 kg ha^{-1} Phosphorous application. It may be due to increased availability of phosphorus which encourages the cell division and cell elongation of the plants, besides helping in nitrogen fixation and thus increases availability of nitrogen in soil. Phosphorus increasing the activity of *Rhizobium* and thus increases N-fixation in the root nodules, thereby improving plant growth and development. Phosphorus is important in root developments and translocation of photosynthates and being ingredient like nucleic acid and phospholipids its application increases different growth parameters, (Srivastava and Ahlawat 1995) [8]. A similar result was founded by Singh *et al.* (2017) [9]. Their interaction, effects was found to be non-significant.

Yield parameters and yield

The data about yields attributes are significantly influenced by variety and Phosphorus level. The maximum values for number of pods plant^{-1}, pod weight plant^{-1} (g), number of seeds pod^{-1} and 1000 seed weight (g), grain yield (q ha^{-1}), Straw yield (q ha^{-1}) and harvests index (%) were found with V_3 (Sapna) followed by V_4 (Rachna), V_2 (Aparna) and V_1 (Malviya-2) variety. These findings were supported with the findings of Tripathi *et al.* (2020) [14], Birari *et al.*, (1993) [2] and Pan *et al.*, (2001) [6]. Among the Phosphorus significantly affected by various levels, maximum number of pods plant^{-1}, pod weight plant^{-1} (g), number of seeds pod^{-1} and 1000 seed weight, seed yields, Straw yield and harvest index found under 80 kg ha^{-1}. The seed and Stover yield increased gradually with increase in doses of Phosphorus, the higher grain yield (18.15 q ha^{-1}), stover yield (47.43 q ha^{-1}) and harvest index (25.46 %) were, found under 80 kg ha^{-1} phosphorous level followed by 60, 40 and 20 kg ha^{-1} P_2O_5. Lower yields were obtained without application of Phosphorus (P_0) 0 kg ha^{-1}, their values were grain yield (12.96 q ha^{-1}), stover yield (36.78 q ha^{-1}) and harvest index (22.10 %) respectively. Interaction, effects of test weight, pod weight plant^{-1} was found to be significant. Similar results were also reported by Shukla *et al.*, (2006) [11]. The trend of increases grain yield obtained due to the improvement in yield attributes and yield by P application may be attributed to profuse nodulation leading to increased N fixation, which in turn had a positive effect on photosynthetic organs and rate. Adequate supply of phosphorus plays a vital role in the metabolic process of photosynthesis, thereby improving the number of pods plant^{-1}, seeds pod^{-1} and test weight Mishra *et al.*, (2010) [4]. The increase in seed yield at higher levels of phosphorus may also be attributed to the role of phosphorus in the energisation processes and being the constituent of ribonucleic acid, deoxyribonucleic acid and ATP which regulate vital metabolic processes in the plant, helping in root formation and nitrogen fixation which in turn favours better yield of the crop. The significant increase in harvest index may be attributed to the fact that proportionate increase in seed yield was higher as compared to the stover yield due to translocation of more photosynthates from source to sink at the ripening stage Negi *et al.*, (2006) [5]. These results are in the line with those of Shukla *et al.* (2013) [12], Saket *et al.* (2014) [13] and Singh *et al.* (2017) [9].

Economics

The data pertaining to cost of cultivation, gross returns, net returns and B: C ratio have been submitted in Table 3. The result of the study showed that gross return (₹ 104081.45), net return (₹ 53665.24), and B: C (2.80) ratio were markedly higher in variety V_3 (Sapna) and lower values gross return (₹ 87762.3), net return (₹ 39834.84) and B: C (2.29) were recorded in V_1 (Malviya-2) at same cost of cultivation. Among different phosphorus levels, 80 kg ha^{-1} of Phosphorus dose gave highest gross returns (₹ 88642.8) and net returns (₹ 56349.05) which resulted in highest benefit-cost ratio (2.74), followed by under 60, 40 and 20 kg P_2O_5 ha^{-1}. Whereas, control (0 kg P_2O_5) gave lowest gross return (₹ 63884.8), net returns (₹ 35641.15) and benefit-cost ratio (2.25) under lowest cost of cultivation. This might be due to higher growth and yields attributes resulting in more seed and stover yield with 80 kg ha^{-1} P_2O_5. Similar results by Bhat *et al.*, (2013) [1].

Table 1: Effect of Phosphorus Levels on Growth attribute characters of different Pea Varieties

Treatments	Plant height (cm)	No. of Branches plant^{-1}	Days to 50% flowering
Varieties			
V_1 (Malviya-2)	55.38	2.61	71.00
V_2 (Aparna)	55.65	2.91	71.02
V_3 (Sapna)	154.45	4.35	69.99
V_4 (Rachna)	134.17	3.45	70.40

C.D. (P=0.05)	0.57	0.33	0.69
Phosphorus levels			
P_0 (0 kg P_2O_5 ha^{-1})	97.73	2.72	71.57
P_1 (20 kg P_2O_5 ha^{-1})	99.30	2.81	70.77
P_2 (40 kg P_2O_5 ha^{-1})	100.11	3.14	70.44
P_3 (60 kg P_2O_5 ha^{-1})	101.08	3.78	70.50
P_4 (80 kg P_2O_5 ha^{-1})	101.61	4.21	69.73
C.D. (P=0.05)	0.64	0.37	0.77
Interaction effect			
C.D. (P=0.05)	NS	NS	NS

Table 2: Effect of Phosphorus Levels on Yield attribute characters and yield of different Pea Varieties

Treatments	No of pod $Plant^{-1}$	Pod weight $Plant^{-1}$ (g)	No of seed pod^{-1}	Weight of 1000 seeds (g)	Grain yield (q ha^{-1})	Stover yield (q ha^{-1})	Harvest index (%)
Varieties							
V_1 (Malviya-2)	21.11	369.81	4.46	294.87	14.19	41.52	21.48
V_2 (Aparna)	28.61	497.49	4.56	299.69	15.49	42.24	24.90
V_3 (Sapna)	30.23	619.31	5.20	324.74	17.09	43.72	24.95
V_4 (Rachna)	28.11	597.80	5.25	318.28	16.01	42.95	23.97
C.D. (P=0.05)	0.55	2.33	0.31	3.05	1.18	1.55	1.28
Phosphorus levels							
P_0 (0 kg P_2O_5 ha^{-1})	25.72	442.93	4.22	294.00	12.96	36.78	22.10
P_1 (20 kg P_2O_5 ha^{-1})	26.22	466.71	4.56	303.07	13.91	42.64	23.47
P_2 (40 kg P_2O_5 ha^{-1})	27.17	522.84	4.76	309.44	16.27	42.30	23.81
P_3 (60 kg P_2O_5 ha^{-1})	27.84	570.09	5.16	317.25	17.29	43.88	24.28
P_4 (80 kg P_2O_5 ha^{-1})	28.00	602.94	5.64	323.23	18.15	47.43	25.46
C.D. (P=0.05)	0.62	2.60	0.35	3.40	1.32	1.74	1.43
Interaction effect							
C.D. (P=0.05)	NS	5.21	NS	6.81	NS	NS	NS

Table 3: Effect of different levels of integrated nutrient management on gross return, net return and B: C ratio

Treatments	Gross return (Rs.)	net return (Rs.)	B:C ratio
Varieties			
V_1 (Malviya-2)	87762.3	39834.84	2.29
V_2 (Aparna)	95004.3	45278.44	2.45
V_3 (Sapna)	104081.45	53665.24	2.80
V_4 (Rachna)	98484.5	48412.60	2.58
Phosphorus levels			
P_0 (0 kg P_2O_5 ha^{-1})	63884.8	35641.15	2.25
P_1 (20 kg P_2O_5 ha^{-1})	69212.5	39956.25	2.36
P_2 (40 kg P_2O_5 ha^{-1})	79408.75	49140.0	2.62
P_3 (60 kg P_2O_5 ha^{-1})	84183.7	52902.45	2.69
P_4 (80 kg P_2O_5 ha^{-1})	88642.8	56349.05	2.74

Conclusion

It is concluded from the study that variety V_3 (Sapna) was found higher growth, yield attributing characters and yields under 80 kg ha^{-1} P_2O_5 in Jaunpur district under Indo-Gangetic plains of Central Uttar Pradesh and Maximum nets returns and B:C ratio was obtained under 80 kg ha^{-1} P_2O_5 with Sapna variety of field pea.

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References

1. Bhat TA, Gupta M, Mahdi SS, Ganai MA, Bhat HA. Growth, Yield and Economics of Field pea (*Pisum sativum* L.) as Influenced by Phosphorus and Bio-fertilizers under Subtropical Conditions of Jammu. J Pure Appl. Microbiol. 2013;7:1.
2. Birari DS, Birari SP, Jamadagni BM. Stability analysis of promising genotypes of pea (*Pisum sativum*). Indian J Agric. Sci. 1993;63(2):103-106.
3. Bozoglu HE, Peksen A, Gulumser. Determination of the yield performance and harvesting periods of fifteen pea (*Pisum sativum* L.) cultivars sown in autumn and spring. Pak. J Bot. 2007;39(6):2017-2025.
4. Mishra A, Prasad K, Geeta R. Effect of bio-fertilizer inoculation on growth and yield of dwarf field pea (*Pisum sativum* L.) in conjunction with different doses of chemical fertilizers. J Agronomy. 2010;9:163-168.
5. Negi S, Singh RV, Dwivedi OK. Effect of bio-fertilizers, nutrient sources and lime on growth and yield of garden pea. Legume Res. 2006;29(4):282-285.
6. Pan RS, Prasad VSRK, Mathura Rai. Stability of yield and its components in garden pea (*Pisum sativum*). Indian J Agric. Sci. 2001;71(11):701-703.
7. Sharma AK, Raghubanshi BPS, Sirothia P. Response of chickpea to levels of zinc and phosphorus. Ann Plant Soil Res. 2014;16(2):172-173.
8. Srivastava TK, Ahlawat IPS. Response of pea (*Pisum sativum*) to phosphorus, molybdenum and biofertilizer.

Indian J Agron. 1995;40:630-636.
9. Singh S, Yadav V, Kumar S, Tomar PK. Effect of phosphorus fertilization on yield attributes and yield of table pea (*Pisum sativum* var. Hortense) varieties in light-textured soil of Western U.P. J Pharmacognosy Phytochem. 2017;6:607-609.
10. Singh B, Sidar RS, Kant K, Sahu CK. Effects of phosphorus levels and varieties on growth and yield of peas (*Pisum sativum* L.). The Pharma Innov. J. 2023;12(8):2391-2393.
11. Shukla VR, Thakur AK, Joshi A. Effect of organic and inorganic fertilizers on yield and horticultural traits in tomato (*Lycopersicon esculentum* Mill). Ann Bio. 2006;22(2):137-141.
12. Shukla AK, Sharma RD, Rajput SS, Pandey G, Marko GS. Effect of foliar and basal nourishment on chlorophyll content, yield, quality and economics of chickpea. Crop. Res. 2013;46:63-65.
13. Saket S, Singh SB, Namdeo KN, Parihar SS. Effect of organic and inorganic fertilizer on yield, quality and nutrients uptake of lentils. Ann Plant Soil Res. 2014;16(3):238-241.
14. Tripathi B, Chaubey SK, Pyare R, Kumar A, Dwivedi DP. Effect of varieties and phosphorus doses on growth, yield attributes and yield of pea (*Pisum sativum* L.) in saline-alkali soil. J Pharmacogn. Phytochem. 2020;Sp9(5):40-42.