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Performance of Field Pea (*Pisum sativum* L.) Varieties with Various Level of Phosphorus underIrrigated Condition in North Western Plain Zone of India

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ABSTRACT

The field experiment was conducted during *rabi* season of 2018-19 at Agriculture Research Farm Raja Balwant Singh College, Agra, in sandy loam soil to find out the effect of phosphorus levels on growth and productivity of field pea varieties. The trial was carried out in factorial based Randomized Block Design with four replications by keeping four varieties and four levels of phosphorus. Results revealed that the maximum growth and yield attributing characteristics, seed yield (1488 kg ha^{-1}) and selling percent (76.80) was found in variety 'Prakash' with application of 90 kg phosphorus ha^{-1} and it was at par with variety 'P-3' with application of 60 kg phosphorus ha^{-1} where minimum growth and yield attributing characteristics, seed yield (1185 kg ha^{-1}) and selling percentage was obtained in variety, Adarsh' with application of 0 kg phosphorus ha^{-1}.

Keywords Field pea, Varieties, Phosphorus, Growth, Yield.

INTRODUCTION

Pulses crops are wonderful gift of the nature. These are next to cereals in term of their economic importance as human diet; they are energy rich crops (Bahadur *et al*. 2016). The ability of pulses to fix atmospheric nitrogen in the soil is their unique and beneficial characteristics among all the plant species. Thus, pulses can contribute significantly achieve the twin objective of increasing productivity and improving the sustainability. Field pea (*Pisum sativum* L. 2n = 14, Fabaceae), is one of the most important *rabi* season food legume crop; it contains a high amount of protein including amino acids, especially lysine (Azam *et al*. 2020). Field pea are considered to be the most nutritious part of the human diet because they contain 22.6% protein and iron (Fe), sodium (Na), phosphorus (P), potassium (K), and some other important elements. It is third most important pulse crop at global level, after dry bean and chickpea and third most popular *rabi* pulse of India after chickpea and

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lentil. India occupy fourth position in area (10.53%) and fifth position in production (6.96%) (FAO 2016). In India field pea is grown over an area of 1.15 m ha with annual production of 1.03 m tones. Uttar Pradesh is a major field pea growing state. It alone production about 49% of pea produced in India. Besides, Uttar Pradesh, Madhya Pradesh, Bihar and Maharashtra are the major pea producing states (Anonymous 2017). Phosphorus is one of the major plant nutrients which is essential for the growth and development of plants and also enhance the protein synthesis in pea. As a component of every living cell, phosphorus controls all living processes including heredity and energy transport system. Phosphorus contributes substantially to increase yield of legumes by enhancing the physiological functions of the crop plants, root development and nodulation (Bahadur *et al*. 2017).

MATERIALS AND METHODS

The field experiment was conducted during the *rabi* season of 2018-19 at Agriculture Research Farm, R. B. S. College, Agra, Uttar Pradesh. The experimental site was fairly uniform in topography and well drained. It has sub-tropical type of climate with hot summer and cold winter. Soil at the experimental field was sandy clay loam in texture with neutral in reaction (pH 7.20), EC (0.30 dSm^{-1}), bulk density (1.39 gcm^{-3}), low in organic carbon (0.32%), available N (183 kg ha^{-1}), high in available P (28.3 kg ha^{-1}) and medium in available K (290.0 kg ha^{-1}). The experiment was laid out in factorial based Randomized Block Design with four replications comprising four varieties (Prakash, P-13, KMPR-400 and Adarsh) and four levels of phosphorus (0, 30, 60 and 90 kg ha^{-1}). The gross plot size was 5.0 m × 4.0 m and sowing of all the four field pea varieties was done in furrow with 8 cm depth at a distance of 30 cm on 1 November 2018 apart with the help of *kudali* using 80 kg ha^{-1} seed. Before sowing seed was treated with thiram @2 .5 gm kg^{-1} and *Rhizobium* culture @ 20 gm kg^{-1} seed. The recommended dose of fertilizer was applied through urea, SSP and MOP. The full dose of nitrogen, phosphorous and potassium were applied at the time of sowing. The crop was raised under irrigated condition with two irrigations. All the general crop management practices are performed for the better growth and development of crop during experimentation. Recorded data were analyzed as per standard statistical procedure to draw a valid conclusion.

RESULTS AND DISCUSSION

Effect of varieties and phosphorus on growth attributes

The data on growth character of crop are given in Table 1. It was observed that the all growth attribut-

Table 1. Growth, yield attributes and yields of field pea as influenced by varieties and levels of phosphorus.

Treatments	Plant height (cm)	No. of branches $plant^{-1}$	Dry matter accumulation (g) $plant^{-1}$	Root length (cm)	Effective nodules $plant^{-1}$	No. of pods $plant^{-1}$	Wt. of pods $plant^{-1}$
Varieties							
Prakash	41.55	4.17	32.85	15.03	26.82	11.23	19.89
P-13	39.33	3.98	32.77	13.70	24.57	10.65	17.98
KMPR-400	38.64	3.84	31.67	13.65	24.05	9.35	15.69
Adarsh	37.22	2.91	31.20	13.18	18.90	8.54	8.21
SEm±	1.83	0.14	0.04	0.66	1.34	0.41	1.02
CD at 5%	2.71	0.29	0.09	1.35	2.72	0.84	2.08
Phosphorus levels (kg ha^{-1})							
0	34.44	3.05	30.24	13.15	19.32	8.79	9.58
30	39.87	3.41	32.57	13.79	23.17	9.87	13.19
60	42.73	3.72	33.35	14.27	25.17	10.25	16.20
90	43.92	3.82	33.44	15.66	26.63	10.85	18.09
SEm±	1.77	0.15	0.05	0.68	1.43	0.43	1.06
CD at 5%	3.54	0.28	0.11	1.45	2.82	0.92	2.12

Table 1. Continued.

Treatments	Length of pod (cm)	No. of seeds pod^{-1}	Wt. of seeds pods^{-1}(g)	1000-seed weight (g)	Seed yield (kg ha^{-1})	Selling %
Varieties						
Prakash	8.57	5.98	1.36	226.75	1488	76.80
P-13	7.76	5.83	1.30	223.45	1455	76.11
KMPR-400	6.35	4.95	1.20	214.42	1315	75.05
Adarsh	6.20	3.43	0.71	208.26	1185	73.85
SEm±	1.54	0.42	0.09	1.79	0.70	0.74
CD at 5%	2.14	0.87	0.12	3.66	4.42	1.51
Phosphorus levels (kg ha^{-1})						
0	6.24	4.22	1.00	209.38	1194	72.46
30	6.50	4.62	1.05	216.82	1328	74.84
60	7.84	5.48	1.21	221.55	1473	76.55
90	8.75	5.82	1.30	224.08	1884	77.95
SEm±	1.44	0.44	0.08	1.88	0.76	0.78
CD at 5%	2.22	0.89	0.17	3.82	1.48	1.74

ing characters viz. plant height, number of branches, dry matter accumulation, root length and effective nodules was recorded significantly in 'Prakash' which was found at par with the 'P-3'. Plant growth parameters were widely fluctuated due to better utilization of available resources like photoperiod and temperature for growth and development which may result in more nitrogen absorption for the synthesis of protoplasm responsible for rapid cell division which may increase the plant in shape and size or may be due to genetic characters of the variety similar results were reported by (Bahadur *et al*. 2016). Different level of phosphorus was affected significantly on the all growth attributing characters viz., plant height, number of branches, dry matter accumulation, root length and effective nodules were recorded with the phosphorus level @ 90 kg ha^{-1} which was at par with the phosphorus level @ 60 kg ha^{-1}. Higher values of these growth parameters at this higher level were the result of better supply of the phosphorus nutrients in a balanced amount that resulted in better crop growth and development. The result is earlier corroborated with the finding earlier (Vijaylaxmi 2013).

Effect of varieties and phosphorus on yield attributes and yield

Different varieties and level of phosphorus were affected significantly on the yield attributing characters, yield and selling % of the crop Table 1. Among the varieties, the highest number of pods, weight of pods, length of pod, number of seeds pod^{-1}, weight of seeds pod^{-1}, test weight, selling % and seed yield was recorded in variety 'Prakash' and which was found at par with the 'P-3' except seed yield. This could be ascribed due to profuse branching, formation of maximum flowers, increased availability of nutrients and photosynthates to these developing structure seems to have resulted in greater retention of flowers and the develop into fertile fruits (Vijaylaxmi 2013, Singh *et al*. 2014). All the yield parameters and yield were significantly increased with the increase in the levels of phosphorus up to 90 kg ha^{-1} (Table 1). Among the different levels of phosphorus, the highest number of pods, weight of pods, length of pod, number of seeds pod^{-1}, weight of seeds pod^{-1}, test weight, selling % and seed yield was recorded in variety 'Prakash' and which was found at par with the 'P-3' except seed yield. Application of 30, 60 and 90 kg phosphorus ha^{-1} resulted increased in all yield attributes and seed yield over control. These results were in close proximity with the results reported in the past (Al-Aysh *et al*. 2013, Bhat *et al*. 2013).

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