The Pharma Innovation Journal 2023; 12(12): 566-569

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(12): 566-569

www.thepharmajournal.com
Received: 16-09-2023
Accepted: 29-10-2023

Prasant
Department of Soil Science and Agricultural Chemistry, AKS University, Satna, Madhya Pradesh, India

Atul Kumar Singh
Department of Soil Science and Agricultural Chemistry, AKS University, Satna, Madhya Pradesh, India

Abhishek
Department of Soil Science and Agricultural Chemistry, AKS University, Satna, Madhya Pradesh, India

Corresponding Author:
Prasant
Department of Soil Science and Agricultural Chemistry, AKS University, Satna, Madhya Pradesh, India

Yield and nutrient uptake studies in relation to the use of phosphatic fertilizer in pea (*Pisum sativum* L.)

Prasant, Atul Kumar Singh and Abhishek

Abstract
During the winter (Rabi) season of 2022-23, a field experiment unfolded at the Research Farm of the Department of Soil Science and Agricultural Chemistry, AKS University, Sherganj, Satna (M.P.). The objective was to scrutinize the influence of phosphatic fertilizers on pea yield and the uptake of N, P and K. The experiment featured ten distinct treatments i.e., T_1-Control, T_2-10 kg P_2O_5/ha SSP, T_3-20 kg P_2O_5/ha SSP, T_4-30 kg P_2O_5/ha, T_5-40 kg P_2O_5/ha SSP, T_6-50 kg P_2O_5/ha SSP, T_7- 60 kg P_2O_5/ha SSP, T_8- 70 kg P_2O_5/ha SSP, T_9- 80 kg P_2O_5/ha SSP and T_{10}-90 kg P_2O_5/ha SSP which were arranged in a randomized block design with three replications each. Remarkably, the findings unveiled that treatment T_9 (80 kg P_2O_5/ha SSP) showcased a consistent trend: an increased application of phosphatic fertilizer corresponded to notable improvements in root nodulation, yield-related characteristics, and nutrient assimilation in pea seeds. Treatment T_9 (80 kg P_2O_5/ha SSP) stood out with the highest count of root nodules (22.14), along with superior fresh and dry weights of root nodules (47.35 and 38.23 g, respectively). This treatment also demonstrated the highest number of pods per plant (14.32), pod length (8.47 cm), grains per pod (7.40), pod weight (6.16 g), and overall pea crop yield (47.65 q/ha). Additionally, the uptake of nitrogen (23.60 kg/ha), phosphorus (4.52 kg/ha), and potassium (6.56 kg/ha) reached peak levels in Treatment T_9. These comprehensive results underscore the profound impact of phosphatic fertilizer on enhancing multiple facets of pea crop development and nutrient absorption.

Keywords: nutrient, relation, phosphatic, fertilizer, pea, *Pisum sativum* L.

Introduction
Field pea (*Pisum sativum* L.) holds significant prominence as a vital pulse crop in India, and the country stands as the world's second-largest cultivator of pea crops. This legume serves as a nutritional powerhouse, boasting high levels of protein, carbohydrates, vitamin A and C, as well as calcium and phosphorus. Uttar Pradesh, Madhya Pradesh, Bihar, and Maharashtra play pivotal roles as major states cultivating peas. Notably, Madhya Pradesh encompasses a substantial pea cultivation area, covering 57.80 thousand hectares and yielding 607.00 metric tons of production.

In the context of pea cultivation, phosphorus stands out as a key nutrient essential for its proper growth and development. This element is a fundamental component of adenosine diphosphate (ADP), sugar phosphate, nucleic acids, proteins, and various co-enzymes. These compounds play a crucial role in energy transformation and the metabolic processes vital to plant health. Phosphorus assumes a pivotal role in crop growth and development, directly influencing root proliferation, straw strength, grain formation, crop maturation, and overall crop quality. The vital need for phosphorus, crucial for root growth and nodulation, is primarily met through inorganic fertilizers (Sharma *et al*., 2002) [5].

In leguminous crops, the primary cause of subpar nodulation and diminished yields often stems from a deficiency in phosphorus. Research consistently highlights the positive impact of an ample phosphorus supply on enhancing the growth, yield, quality, and the formation of abundant nodules in legumes (Patra and Bhattacharya, 2000) [4]. The global cultivation of peas, spanning over 30% of arable land, encounters limitations in production due to insufficient phosphorus availability. Particularly in nutrient-deficient environments, phosphorus emerges as a critical constraint for legumes, given its substantial requirement in the nitrogen fixation process. Therefore, keeping the above-mentioned facts into consideration, an investigation was planned to find out the effect of phosphatic fertilizer on yield and nutrient uptake in pea.

Materials and Methods

The experimentation took place during the Rabi season of 2022-2023 at the Research Farm, Department of Soil Science and Agricultural Chemistry, AKS University, Satna (M.P.). The experimental field features clay loam soil texture. Although low in organic carbon (0.43%), the soil exhibits available nitrogen of 176.60 kg/ha, phosphorus of 12.50 kg/ha and potassium of 200.00 kg/ha. Nutrient sources comprised urea and Muriate of Potash for nitrogen (20 kg/ha) and potassium (20 kg/ha) requirements, while phosphorus was applied through Single Super Phosphate in accordance with the treatments. Sowing occurred on November 5, 2022, and the experimental design adopted was a Randomized Block Design with 10 treatments, each replicated thrice. The treatments included T_1-Control, T_2-10 kg P_2O_5/ha SSP, T_3-20 kg P_2O_5/ha SSP, T_4-30 kg P_2O_5/ha, T_5-40 kg P_2O_5/ha SSP, T_6-50 kg P_2O_5/ha SSP, T_7- 60 kg P_2O_5/ha SSP, T_8- 70 kg P_2O_5/ha SSP, T_9- 80 kg P_2O_5/ha SSP and T_{10}-90 kg P_2O_5/ha SSP. The biometric parameters such as the number of root nodules and fresh and dry weight of nodules were taken from five randomly selected plants in each treatment. Yield parameters, encompassing the number of pods per plant, number of seeds per pod, pod length (cm), pod weight (g) and seed yield (kg/ha), were also recorded. Statistical analysis, employing one-way ANOVA, was conducted for all parameters, and means were compared at a 5% significance level for results.

Results and Discussion

Root nodulation

Root nodulation in pea crops showed significant variations with the incorporation of phosphatic fertilizer into the soil, as highlighted in Table 1. The treatment T_9, involving 80 kg P_2O_5/ha SSP, resulted in the maximum number of root nodules (22.14) and a higher fresh and dry weight of nodules (47.35 and 38.23 g, respectively). The increased quantity and weight of root nodules could be attributed to the heightened phosphorus availability resulting from the application of 80 kg P_2O_5/ha SSP. This suggests that the incorporation of such elevated phosphorus has likely provided a richer nutritional environment, leading to the observed augmentation in both the number and mass of root nodules. These findings align with Singh and Singh (2019) [8] and Tripathi and Dwivedi (2020) [9].

Yield attributes and yield

With respect to yield attributes, phosphatic fertilizer significantly influenced pea yield. Treatment T_9 (80 kg P_2O_5/ha SSP) demonstrated the highest number of pods per plant (14.32), maximum pod length (8.47 cm), substantial pod weight (6.16 g) and number of grains per pod (7.40). The overall yield was also highest under T_9 (47.65 q/ha), comparable to T_{10}, T_8, T_7 and T_6 while the control treatment (T_1) exhibited the lowest values. The heightened presence of phosphorus appears to have played a pivotal role in elevating both the yield attributes and overall pea yield. This positive outcome can be ascribed to an enhanced availability of phosphorus, fostering an environment conducive to improved photosynthetic activity. This, in turn, has contributed to the overall advancement in the growth of pea plants, ultimately leading to more favourable yield characteristics and a higher overall yield. These results corroborate the studies of Singh *et al*. (2012), Singh and Singh (2019) [8] and Tripathi and Dwivedi (2020) [9].

Uptake of nutrients

The influence of organic manures on nutrient uptake was evident, with T_9 (80 kg P_2O_5/ha SSP) showing higher nitrogen (23.60 kg/ha), phosphorus (4.52 kg/ha), and potassium (6.56 kg/ha) uptake. As a result of the augmented availability of phosphorus in adequate quantities throughout the growth and reproductive phases of the crop, supplied by phosphatic fertilizer, the plant developed an effective root system which led to an elevated uptake of nitrogen, phosphorus, and potassium content. This enhanced nutrient provision during crucial stages of the crop's development substantially contributed to the increased absorption of nitrogen, phosphorus, and potassium., aligning with the findings of Bhat *et al.* (2013) [1], Kumar *et al.* (2013) [3], Kandil *et al.* (2013) [2] and Singh (2017) [7].

Table 1: Effect of phosphatic fertilizer on root nodulation, yield and uptake of nutrients in pea.

Treatments	Root nodulation			Yield attributes and yield					Uptake of nutrients (kg/ha)		
	Number of nodules per plant	Fresh weight of nodules (g)	Dry weight of nodules (g)	Number of pods per plant	Length of pod (cm)	Weight of pod (g)	Number of grains per pod	Yield (q/ha)	Nitrogen uptake	Phosphorus uptake	Potassium uptake
T_1	14.41	45.12	35.05	11.39	7.04	3.38	5.55	32.26	19.60	3.29	4.76
T_2	15.32	46.28	36.20	12.08	7.35	3.75	5.76	41.96	19.51	3.61	5.23
T_3	17.71	46.40	36.59	12.18	7.39	4.65	5.97	43.86	20.68	4.04	5.86
T_4	16.00	46.51	37.04	12.28	7.43	4.14	6.07	43.96	19.85	3.80	5.51
T_5	19.28	46.62	37.27	12.38	7.46	5.80	6.17	44.52	21.90	4.23	6.80
T_6	18.38	46.72	37.40	12.69	7.49	4.96	6.27	44.88	21.02	4.13	5.99
T_7	17.06	47.11	36.85	13.51	8.19	4.42	7.20	45.04	20.30	3.94	5.71
T_8	19.04	47.20	37.20	13.82	8.34	5.11	7.27	46.06	21.34	4.19	6.07
T_9	22.14	47.35	38.23	14.32	8.47	6.16	7.40	47.65	23.60	4.52	6.56
T_{10}	20.79	47.26	37.33	13.49	8.42	5.90	7.37	47.08	22.40	4.41	6.40
S.Em±	0.72	0.37	0.40	0.42	0.19	0.28	0.20	1.03	0.83	0.18	0.38
C.D. (*P*=0.05)	2.11	1.07	1.18	1.23	0.56	0.81	0.57	3.01	2.41	0.53	1.11

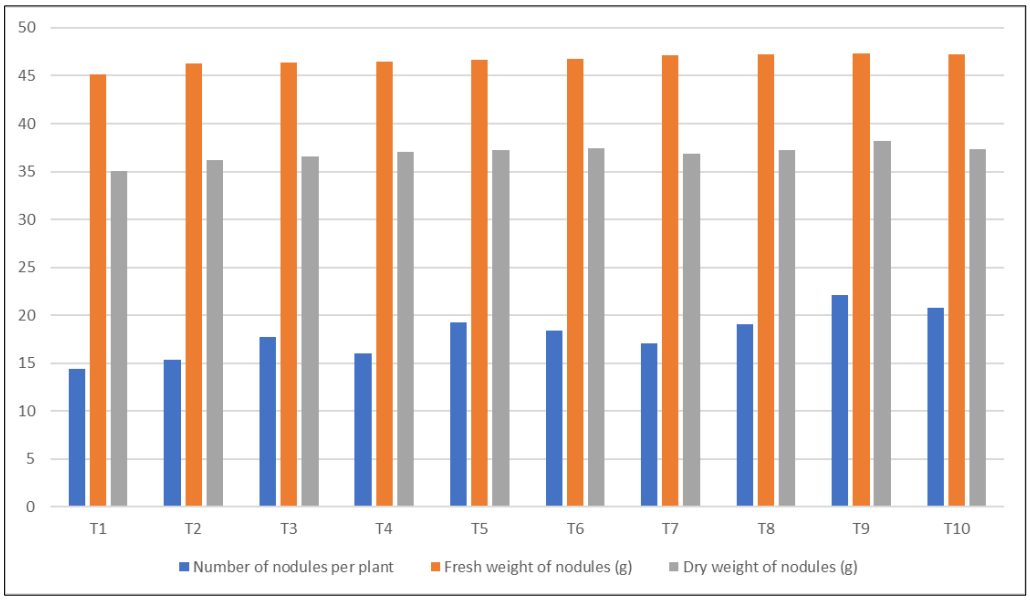

Fig 1: Effect of phosphatic fertilizer on root nodulation of pea.

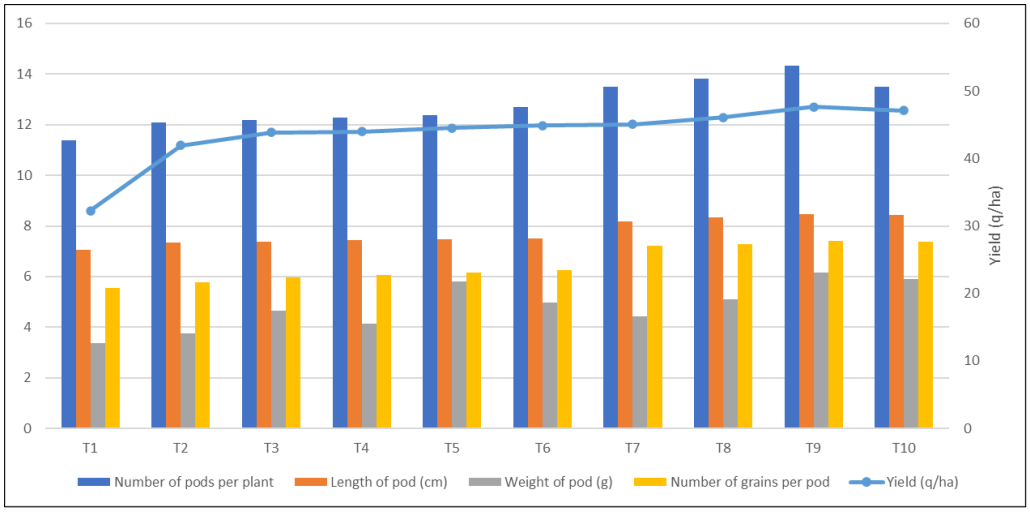

Fig 2: Effect of phosphatic fertilizer on yield attributes and yield of pea.

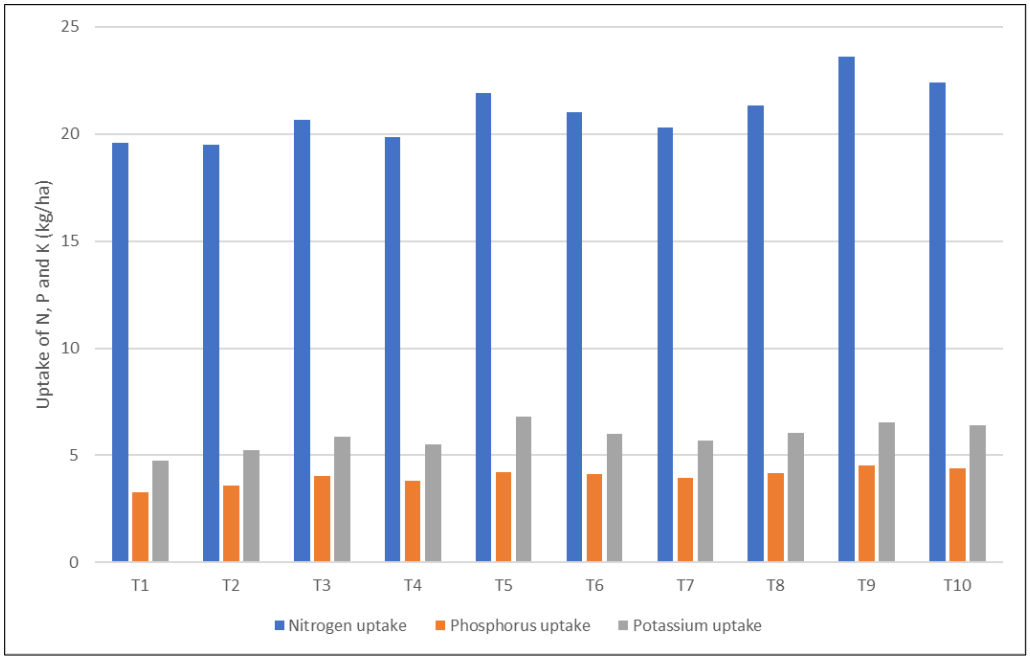

Fig 3: Effect of phosphatic fertilizer on uptake of N, P and K in pea.

Conclusion

In conclusion, 80 kg P_2O_5/ha SSP proved highly effective, resulting in superior yield and better yield attributes. This treatment not only yielded 47.65 q/ha but also exhibited significant improvements in other yield parameters. Additionally, the treatment demonstrated remarkable nutrient uptake, showcasing enhanced uptake of nitrogen (23.60 kg/ha), phosphorus (4.52 kg/ha), and potassium (6.56 kg/ha) content in pea seeds.

References

1. Bhat AT, Gupta M, Ganai MA, Ahanger AR, Bhat AH. Yield, soil health and nutrient utilization of field pea (*Pisum sativum* L.) as affected by phosphorus and bio-fertilizers under subtropical conditions of Jammu. International Journal of Modern Plant & Animal Sciences. 2013;1(1):1-8.
2. Kandil H, Gad N, Magdi TA. Effects of different rates of phosphorus and molybdenum application on two varieties of common bean (*Phaseolus vulgaris* L.). Journal of Agricultural and Food Technology. 2013;3(3):8-16.
3. Kumar M, Singh AP, Prakash J, Katiyar TPS, Kumar R, Bharose R. Effect of phosphorus and molybdenum on yield and nutrient uptake by cowpea. An Asian Journal of Soil Science. 2013;8(2):366-369.
4. Patra PK, Bhattacharya C. Response of pea (*Pisum sativum* L.) to phosphorus fertilizer in the red laterite zone of West Bengal. Environment and ecology. 2000;18:490-492.
5. Sharma SK, Choudhary RP, Dahama AK. Effect of phosphorus and thiourea on yield attributes and yield of green gram (*Vigna radiata*). Extended Summaries Vol. (1): Proceedings of the 2nd International Agronomy Congress, Nov. 26-30, New Delhi, India; c2002.
6. Singh SR, Najar GR, Singh U. Phosphorus management in field pea (*Pisum sativum* L.) rice (*Oryza sativa*) cropping system under temperate conditions. Indian Journal of Agricultural Sciences. 2012;82(6):494-499.
7. Singh D. Effect of sources of phosphorus on growth, yield, and nutrient uptake in pea (*Pisum sativum*). Annals of Plant and Soil Research. 2017;19(2):240-242.
8. Singh R, Singh AP. Effect of phosphorus, sulphur and biofertilizer on yield, quality and uptake of nutrients in pea (*Pisum sativum* L). Annals of Plant and Soil Research. 2019;19(2):175-179.
9. Tripathi B, Dwivedi DP. Effect of phosphorus doses on growth, yield attributes and nutrient uptake of pea (*Pisum sativum* L.) in saline-alkali soil. Journal of Pharmacognosy and Phytochemistry. 2020;Sp9(5):40-42.