https://doi.org/10.33451/florafauna.v27i2 pp279-283
FLORA AND FAUNA ISSN 2456 - 9364 (Online)
2021 Vol. 27 No. 2 PP 279-283 ISSN 0971 - 6920 (Print)

# Effect of phosphorus and zinc supplementation on growth, yield attributes and yields on pea (*Pisum sativum*) in district Jhansi (UP) India

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***Received*** **:** 15.10.2021; ***Accepted*** : 08.11.2021

## ABSTRACT

A field experiment was conducted during winter season at Organic Research Farm Kurguan ji, Deptt. of Soil Science and Agricultural chemistry, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (U.P.) on red soil (Parwa) to study the effect of phosphorus and zinc application with four levels of each on pea crop. Application of 120 kg $ha^{-1}$ P and 30 kg $ha^{-1}$ Zn produced highest values and their percentage increment in respect to plant height (102.2 cm:10.3% and 97.9 cm:7.8%), no of branches (23.4 : 33.71% and 22.6: 31.39%), pod length (6.4 : 56.1% and 5.8 : 48.71%) and no of pods per plant (25.8 : 21.12% and 26 : 1.30.5%) respectively, over control followed by $P_2$ (90kg $ha^{-1}$), $P_1$ (60 kg $ha^{-1}$) and $Zn_2$ (15 kg $ha^{-1}$) and $Zn_1$ (7.5 kg $ha^{-1}$). The application of 120 kg $ha^{-1}$ phosphorus treatment is proved as most superior among treatments. On the basis of analysis of soil samples after harvesting indicated neutral in reaction, safe in soluble salt concentration, low in organic carban and Nitrogen, medium in Phosphorus and Zinc, high in potash in present study.

Figure : 00 References : 15 Tables : 03
KEY WORDS : Biological yield, Grain yield, Pea, Phosphorus, Stover yield, Zinc.

## Introduction

The garden pea is the principal winter pulse crop on the Indian subcontinent (*Pisum sativum*). Pulses are produced, consumed and imported in huge quantities in India. Each year, India consumes approximately 26.0 million tones of pulses. The IPGA (India Pulses and Grains Association) has also urged for the removal of import duties and quotas on peas due to their nutritional benefits. Despite a demand of around 30 MT tones, the country produced 23.02 MT tones in 2019-2020, according to IPGA. Peas are a nutritious, frost-hardy leguminous vegetable grown for its green pod all over the world during the winter season. Legumes have long been recognized as important part of any farming system and a low-cost way to improve soil fertility. They are good sources of protein (25 percent), amino acids, sugar (12 percent), carbohydrate, vitamins A and C, calcium and phosphorus, in addition to providing a trace bit of gram. Originally, pea green grains are dried and preserved for lengthy periods of time in order to give nutrition during the off-season. Peas are eaten both fresh and dried. In temperate climes, it is often planted for its fresh green seed. Peas are a delicious human meal[4] that can be eaten raw or cooked into soup. Peas are a nutrient-dense food because they are high in protein, complex carbs, vitamins, minerals, dietary fibres, and antioxidant components. Pea area, production, and productivity (2017-2018) in India are 540.5 ha-1, 5422.1Mt, and 10.0 Mt ha-1, respectively; in Uttar Pradesh, they are 221.00 ha-1, 2511.38 MT, and 11.36 MT ha1. Because fertilizer nutrients are one of the most expensive production inputs, how effectively and efficiently this input is used determines the crop's yield potential. Furthermore, high fertility levels not only put a financial strain on producers, but they also reduce partial productivity, jeopardizing the basic production system. The use of a balanced fertilizer improves yield and quality while also boosting vegetative development. Protein and phospholipids, notably nitrogen and phosphorus, are important components of the nutrients supplied to plants. Nucleic acid, phytin, and phospholipids all include phosphorus, which is critical for energy storage and transport. Early in their existence, plants reproductive parts require a sufficient amount of phosphorus. . It has a direct link to cell division and growth, giving plants a head start, strengthening straw, and reducing the likelihood of lodging. Zinc affects the manufacture of specific growth hormones in plants, which plays a function in plant nutrition. Zinc helps a variety of plants reproduce. It has to deal with the water uptake and relationship of the plant. Auxins, such as tryptophan synthetase and tryptamine are metabolised by this enzyme. Zinc also aids in the stability of ribosomal fractions. As a result, during the

**TABLE-1 : Physico-chemical characteristics of experimental soils (On the basis of mean value)**

| Parameters | Before sowing | After Harvest | |
|---|---|---|---|
| | | Range | Mean values |
| **pH (1:2.5) soil + water suspension** | 7.4 | 6.8-7.2 | 7.0 |
| **EC ($dSm^{-1}$)** | 0.45 | 0.41-0.38 ($dSm^{-1}$) | 0.37 |
| **Organic carban (%)** | 0.18 | 0.4-0.5 (%) | 0.45 |
| **Available N (kg $ha^{-1}$)** | 100.1 | 100-108 (kg/ha) | 104 |
| **Available P (kg $ha^{-1}$)** | 18.7 | 22.2-24.6 (kg/ha) | 23.4 |
| **Available K (kg $ha^{-1}$)** | 207 | 204-208 (kg/ha) | 206 |
| **Zinc (ppm)** | 0.52 | 0.70-0.66 (ppm) | 0.68 |

winter season of 2017-2018, the current study was conducted to assess the influence of phosphorus and zinc application on pea (*Pisum sativum*) cv. Azad pea growth, yield characteristics and yield. India grows a quarter of the world's pulse crop acreage and produces a quarter of the total production. People who eat a vegetarian diet can rely on pulse crops as a consistent supply of protein. Pulse crops provide succulent and nutritious for our cattle, in addition to its well-known role in restoring fertility and its physical conditions, giving them the moniker "Unique pearls of Indian crop husbandry." Pulses give 0.8 to 1.5 tones of organic matter to the soil through their roots, which remain after the crops are harvested; on average, one hectare of crop adds 15 to 30 kg nitrogen to the soil in conveniently available form[9]. Peas (*Pisum sativum*), a grain legume from Central or Southeast Asia, are grown all over the world. It prefers chilly temperatures and plenty of moisture. Humans are supposed to have domesticated peas as one of the first agricultural crop. It is the most important agricultural legume, after soybeans, peanuts, and beans. It appears to have developed thousands of years ago in Central Asia and the Middle East.

## Materials and Methods

A field experiment was conducted at organic research farm, Karguan ji ,Institute of Agricultural Sciences, Bundelkhand University, Jhansi, Uttar Pradesh during 2018-19. Geologically, Jhansi is the district of Uttar Pradesh situated between the two rivers Pahuj and Betwa at an average elevation of 225 meters above mean sea level (MSL) at 78°342 113 E longitude and 25°262 553 N latitude. The Bundelkhand region falls under agro-climatic zone VI. The soil of the experimental site was red Parwa, having low organic carbon (0.18%), low available nitrogen (100.1 kg $ha^{-1}$), medium available phosphorus (18.7 kg $ha^{-1}$), potassium (207 kg $ha^{-1}$) and Zn (0.52ppm), with pH 6.8. With three replications, the experiment included four levels of phosphorus (control, 60, 90, and 120 kg ha-1 through ssp) and four levels of zinc (control, 7.5, 15, and 30 kg ha-1 through zinc sulphate). The recommended nitrogen (urea) and potassium (murate of potash) doses, as well as all treatment doses, were applied at the time of seeding. *Rhizobium* culture was introduced in pea seeds. In experimental plots, the crop was grown using a recommended set of methods that included maintaining optimum soil moisture and improving plant stands. At maturity, data on all growth and yield variables, including plant height (cm), number of branches plant-1, number of pods plant-1, length of pod, number of grain pod-1, seed yield q ha-1, stover yield, biological yield, and Harvest index, were recorded and analysed using RBD (randomized block design)during investigations. The crop was sown with using the seed rate of @ 100 -120 kg $ha^{-1}$, in 15 cm rows to maintain the plants at 20 cm on November 21-11-2018. The other crop management practices were performed as per standard recommendation. Harvesting of crop was done on 10th March in 2019. The data were analysed statistically by the analysis of variance method[2]. Soil samples were collected from the soil 0-15 cm depth, air dried kept in an oven at $105^0$c for 48 hrs for drying, passed through 2 mm

**TABLE-2 : Effect of phosphorus and zinc applications on yield attributes of pea**

| Treatments | Plant height (cm) | Number of branches | Length of pod | Number of pods plant$^{-1}$ | Number of grain pod$^{-1}$ |
|---|---|---|---|---|---|
| **$P_0$** | 91.7 | 17.5 | 4.1 | 21.3 | 5 |
| **$P_1$** | 94.8 | 18.1 | 4.3 | 22.7 | 5.1 |
| **$P_2$** | 98 | 22.6 | 5.8 | 24.1 | 6.3 |
| **$P_3$** | 101.2 | 23.4 | 6.4 | 25.8 | 6.4 |
| SE(m) ± | 0.656 | 0.04 | 0.126 | 0.08 | 0.224 |
| $CD_{5\%}$ | 2.313 | 0.227 | 0.444 | 0.283 | 0.791 |
| | | | | | |
| **$Zn_0$** | 90.8 | 17.2 | 3.9 | 20 | 4.8 |
| **$Zn_1$** | 93.1 | 18.7 | 4.3 | 22.1 | 4.8 |
| **$Zn_2$** | 96.4 | 20.9 | 5.8 | 23.3 | 6.7 |
| **$Zn_3$** | 97.9 | 22.6 | 5.7 | 26.1 | 6.9 |
| SE(m) ± | 1.401 | 0.134 | 0.121 | 0.074 | 0.146 |
| **CD at $_{5\%}$** | **4.941** | **0.474** | **0.428** | **0.262** | **0.516** |

sieve, soil were analysed by using standard procedures as described for pH[3], EC[15](dsm$^{-1}$), organic carbon[14] (%), available nitrogen[12] (kg ha$^{-1}$), phosphorus[7] (kg ha$^{-1}$ ) and potassium[13] (kg ha$^{-1}$ ).

## Results and Discussion

**Effect on growth parameters:-**

The reaction of P and Zn application on crop growth parameters is shown in Table-1. On each level of phosphorus and zinc application alone, plant heights, number of branches, length of pod and number of pod plant-1 increased significantly over control. The maximum values and their percentage increment in respect to plant height (102.2 cm:10.3% and 97.9 cm:7.8%), no of branches (23.4:33.71% and 22.6:31.39%) pod length (6.4:56.09% and 5.8:48.71%) and no of pods per plant (25.8:21.12% and 26:1.30.5%) were recorded with the application of 120 kg ha$^{-1}$ phosphorus and 30 kg ha$^{-1}$ Zinc application respectively, over control followed by $P_2$ (90kg ha$^{-1}$) $P_1$ (60 kg ha$^{-1}$) and $Zn_2$ (15 kg ha$^{-1}$) and $Zn_1$ (7.5 kg ha$^{-1}$) which is proved as most superior among treatments. The present study observed the phosphorus and Zn applications alone which were effective in enhancing plant height, no of branches plant$^{-1}$, length of pod and no of pods plant$^{-1}$, over control. However, the lowest values were obtained with (60 kg ha$^{-1}$) P and (7.5 kg ha$^{-1}$) Zn application alone. The similar response of P was also the relationship of plant height, no of branches, pod per plant, pod length and application phosphorus and zinc were liner in nature. It could be because of the availability of both nutrients (phosphorus and zinc) in the soil and their synergistic influence on root extension and nodulation, resulting in a suitable root zone environment that boosts chlorophyll content, metabolic activities and plant development indices.The result confirming the findings[10] state that the increase in these parameters may be owing to the vigor of the plants possibly by balanced supply[5,8,11].

**TABLE-3 : Effect of phosphorus and zinc applications on yield of pea.**

| Treatment | Seed yield q $ha^{-1}$ | Stover yield q $ha^{-1}$ | Biological yield (q $ha^{-1}$) |
|---|---|---|---|
| **$P_0$** | 20.13 | 23.33 | 43.46 |
| **$P_1$** | 24.32 | 26.73 | 51.05 |
| **$P_2$** | 26.75 | 34.10 | 60.85 |
| **$P_3$** | 28.01 | 34.30 | 62.31 |
| SE(m) ± | 0.451 | 1.064 | 1.33 |
| CD at $_{5\%}$ | 1.589 | 3.753 | 4.702 |
| | | | |
| **$Zn_0$** | 21.67 | 24.50 | 46.17 |
| **$Zn_1$** | 27.18 | 28.43 | 55.61 |
| **$Zn_2$** | 28.91 | 32.16 | 61.07 |
| **$Zn_3$** | 29.67 | 34.10 | 63.77 |
| SE(m) ± | 0.018 | 0.344 | 0.347 |
| **CD at $_{5\%}$** | **0.065** | **1.215** | **1.22** |

## Effect on yield attributes and yield

The reaction of P and Zn application on crop yield characteristics and yield is shown in Table-2. Every increasing quantity of phosphorus and zinc application enhanced the number of grains per pod, seed yield (q ha-1), stover yield (q ha-1)0 and biological yield over control. The maximum values and percentage increasement were recorded with the application of phosphorus and zinc in respect to no of grains $pod^{-1}$ (6.4 : 28% and 6.9 : 43.45%) seed yield q $ha^{-1}$ (2.8 : 01.39.14% and 29.67 : 36.91%) stover yield, (34.30 : 47.02 and 34.10 : 39.18%) biological yield (62.31 : 43.37% and 63.77 : 38.11%) with the application of 120 kg $ha^{-1}$ phosphorus and (30 kg $ha^{-1}$) Zn doses respectively, over control allowed by $P_2$ (90 kg $ha^{-1}$) $P_1$ (60 kg $ha^{-1}$) and $Zn_2$ (15 kg $ha^{-1}$) and $Zn_1$ (7.5 kg $ha^{-1}$). The current study found that applying phosphorus and zinc alone increased the number of grains pod-1, seed production (q ha-1), stover yield (q ha-1), and biological yield over control. However, the low values were obtained with 60 kg $ha^{-1}$ P and (7.5 kg $ha^{-1}$) Zn application alone. It could be because phosphorus and zinc play such a vital part in grain formation, carbohydrate synthesis, and enzymatic activities. Our findings have nearly agreed with the results of previous finding[11]. The improvement in these characteristics could be due to the plants' increased vigour, which could be due to a more balanced supply of P.

## Soil studies

With the treatment of Phosphorus and Zinc to the pea crop, the pH and EC were somewhat lowered. The pH 6.8-7.2, and EC 0.41- 0.38, with the mean value 7.0 and EC 0.37 ($dSm^{-1}$). Organic carbon concentration in soil samples ranged from 0.5 to 0.4 percent, with a mean of 0.45 percent. The findings revealed a low level of organic carbon, nitrogen, phosphorus, potassium, and zinc concentrations ranged from 100 to 108, 22.2-24.6, 204 to 208, and 0.70-0.66, respectively, with mean values of

104, 23.4, 2.6, and 0.68. The samples were low in available K and zinc was deficient. Over the initial soil samples, the result was found in the medium soil fertility class.

## References


1. Bhat TA, Gupta M, Ganai MA, Ahanger Ahanger A, hilal Bhat A. Yield, soil health and nutrient utilization of field pea (*Pisum sativum L.*) as affected by phosphorus and bio- fertilizers under subtropical condiation of Jammu. *International Journal of Modern Plant & Animal Science.* 2013; **1**(1):1-8.
2. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research (2nd Ed.). John Wiley &Sons, New York. 1984; 20-30.
3. Jackson ML. Soil chemical analysis, Prentice Hall, Inc, *Englewood Cliffe*, N.J. 1958.
4. Kakar A, Saleem M, Shah Rahim, Qaim Shah SA. Growth and Marketable Pod Performance of Pea (*Pisum sativum* L.) under Varying Levels of NPK Fertilizers. *Asian Journal of plant science*. 2002; **1**(5):532-534.
5. Karwasra RS, Kumar Anil. Effect of phosphorus and zinc application on growth biomass and nutrient uptake by chikpea in calcareous soil, *Haryana journal of Agronomy.* 2007; **23**:111-112.
6. Kumar M, Sinha KK, Roysharma RP. Effect of organic manure, NPK and boron application on the productivity of French bean in sandy loam soil of North Bihar. *Indian J. of Pulse res*. 2004; **17**:42-44.
7. Olsen SR, Cole CV, Watnahe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate U.S. Deptt. *Agr. Circ.* 1954; 939.
8. Pathak Satyajit, Namdeo KN, Chakrawarti VK, Tiwari RK. Effect of biofertilizers, diammonium phosphate and zinc sulphate on growth and yield of chikpea (*Cicer arietium* L.) *Crop Research.* 2003; **26**(1):42-46.
9. Singh S, et al. Three- dimensional structure of the AAH26994.1 protein from *Mus musculus,* a putative eukaryotic Urml. *Protein Sci.* 2005; **14**(8) : 2095-102.
10. Singh D, Khare A, Singh SV. Effect of phosphorus and molybdenum nutrition on yield and nutrient uptake in yield and nutrient uptake of chick pea (*Cicer arietinum* L) *Indian Journal of Agronomy*. 2017; **17**(3):496-502.
11. Singh Dashrath. Effect of sources of phosphorus on growth, yield, and nutrient uptake in pea (*Pisum sativum*).Department of Soil Science and Agricultural Chemistry, Brahma Nand Post Graduate College, Rath Hamirpur (U.P.) 210431. *Annals of Plant and Soil Research.* 2017; **19**(2): 240 - 242.
12. Subbiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soil. *Current Science.* 1956; **25**: 259-260.
13. Toth SJ, Prince AL. Estimation of Cation Exchange Capacity and exchangeable Ca, K and Na content of soil by Flame Photometer technique. *Soil Sci.* 1949; **67** : 439-445.
14. Walkey A, Black's IA. Critical examination of rapid method for determining organic carbon in soils, effect of variance in digestion conditions and of inorganic soil constituents. *Soil Sci.* 1947; **632** : 251.
15. Wilcox LV. Electrical conductivity, *Am water works Assoc.J.* 1950; **42**:775-776.