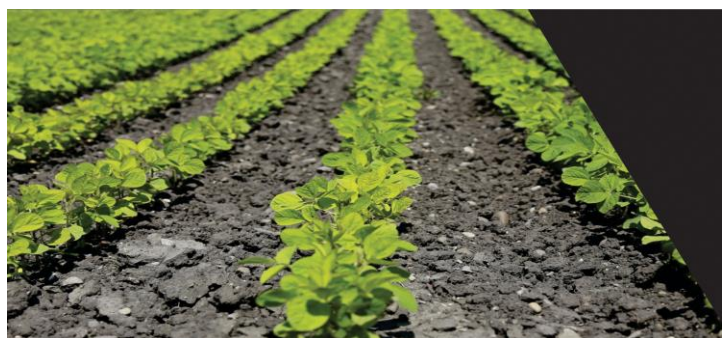




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## Impact of NPK and FYM on soil health of garden pea (*Pisum sativum* var. *Hortense* L. cv. PSM-3) under alluvial soil of Prayagraj

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### Abstract

A field experiment entitled “Impact of NPK and FYM on Soil Health of Garden Pea (*Pisum sativum* Var. *hortense* L. CV. Psm-3) Under Alluvial Soil of Prayagraj” was conducted during the Rabi season of 2025-26 at the Soil Science Research Farm, Department of Soil Science, Prof. Rajendra Singh (Rajju Bhaiya) University, Prayagraj, Uttar Pradesh, India. The experiment was laid out in a Randomized Block Design (RBD) comprising nine treatment combinations with three levels of NPK (0, 50 and 100% RDF) and three levels of FYM (0, 50 and 100%), replicated thrice. The results revealed that integrated application of NPK and FYM significantly improved soil physico-chemical properties, growth and yield attributes of garden pea. Treatment T<sub>9</sub> (100% RDF NPK + 100% FYM) recorded the bulk density (1.184 Mg m<sup>-3</sup>, and particle density values (2.522) Mg m<sup>-3</sup>, pore space (52.22%), water holding capacity (43.31%), electrical conductivity (0.42 dS m<sup>-1</sup>) organic carbon (0.585%), available nitrogen (321.86 kg ha<sup>-1</sup>), available phosphorus (30.20 kg ha<sup>-1</sup>), available potassium (221.42 kg ha<sup>-1</sup>). The study concluded that integrated application of 100% RDF NPK along with 100% FYM is an effective nutrient management strategy for improving soil fertility and maximizing productivity of garden pea under alluvial soils of Prayagraj.

**Keywords:** Garden pea, FYM, NPK, integrated nutrient management, soil health

### Introduction

Garden pea (*Pisum sativum* var. *hortense* L) is an annual herbaceous crop of the family Fabaceae with a diploid chromosome of  $2n = 2x = 14$ , it is a prominent cool -season legume crop. It is originated in the region comprising Central Asia, Mediterranean countries and Ethiopia. Garden pea is the second most important legume crop of the world. It can be grown on many types of soil-light sandy loam, to clay soil Singhal *et al.* (2021). Being Nitrogen fixing legume, its value has long been recognized as a soil fertility building crop This legume contain high Percentage of digestible protein (7.2 g), Carbohydrates (15.8 g), vitamin A(139I.U.), Vitamin C (9 mg), magnesium (34 mg) and Phosphorus (139 mg) per 100g of edible Portion Dhaliwal *et al.* (2017). According to the production and productivity of statistics for 2024-2025, India recorded approximately 540.5 thousand hectares under pea cultivation with a total production of about 5,422.1 thousand tonnes and an average productivity of 10.0 t ha<sup>-1</sup>. Uttar Pradesh, being one of the major pea-producing states of the country, accounted for nearly 221.0 thousand hectares area with a production of 2,511.38 thousand tonnes and productivity of 11.36 t ha<sup>-1</sup>. Nitrogen is an essential element required by the plants for growth and development Government of India (2025). Nitrogen is the chief constituent of several important elements like protein, nucleic acid and amino acids occurring in the plants. An adequate supply of nitrogen is associated with higher photosynthetic activity, vigorous vegetative growth, dark green color of leaves and carbohydrate utilization Verma *et al.* (2019). Phosphorus is an essential macronutrient involved in most growth processes. It is an essential component of most organic compounds in the plant, including nucleic acids, proteins, phospholipids, sugar phosphates, enzymes, and energy-rich phosphate compounds. It plays an important role in cell division, and in seed and fruit development. It stimulates early root development, leaf size, tillering, flowering, and grain yield and hastens the maturity of crops. It establishes the plant roots and helps them to go deep for getting moisture and

nutrients. Reta *et al.* (2021). Potassium not only increases yields but also enhances crop quality. Among plant nutrients, K is very closely associated with crop quality. It is required for good growth as well as for good crop quality, plant health, tolerance to various stresses, and seed quality Uddin *et al.* (2023). Farmyard manure (FYM) improves soil physical, chemical and biological properties by enhancing soil aggregation, water holding capacity and nutrient availability. Inorganic fertilizers supply nutrients in readily available forms and support rapid plant growth. Combined use of FYM and NPK fertilizers improves nutrient use efficiency and crop performance Yadav *et al.* (2023) [19, 6, 7, 24, 15, 23, 28].

## 2. Materials and Methods

The experiment was conducted during the Rabi season of 2025-26 at the Soil Science Research Farm, Department of Soil Science, Prof. Rajendra Singh (Rajju Bhaiya) University, Prayagraj, Uttar Pradesh. The experimental soil was sandy loam in texture. The experiment was laid out in Randomized Block Design (RBD) with nine treatments replicated three times. Treatments consist of nine combinations of NPK and FYM T<sub>1</sub> Control, T<sub>2</sub> FYM @ 50% T<sub>3</sub> FYM @ 100%, T<sub>4</sub> NPK @ 50%, T<sub>5</sub> NPK @ 50% + FYM @ 50%, T<sub>6</sub> NPK @ 50% + FYM @ 100%, T<sub>7</sub> NPK @ 100%, T<sub>8</sub> NPK @ 100% + FYM @ 50%, T<sub>9</sub> NPK @ 100% + FYM @ 100%.

RDF for NPK = 40:80:40 kg ha<sup>-1</sup> and FYM = 20 t ha<sup>-1</sup>.

Source: Handbook of Agriculture, by ICAR, 2016.

The physical properties of the soil samples, namely bulk density (Mg m<sup>-3</sup>), particle density (Mg m<sup>-3</sup>), pore space (%), and water-holding capacity (%), were determined standard analytical procedures described by Muthuvel *et al.* (1992). The chemical properties of the soil samples were analysed using standard analytical procedures. Soil pH (1:2 soil-water suspension) was determined by the method of Jackson (1973). Electrical conductivity (dSm-1) was estimated using the method described by Wilcox (1950). Organic carbon (%) was determined by the Walkley and Black's method (1934). Available nitrogen (kg ha<sup>-1</sup>) was estimated by the method of Subbiah and Asija (1956), while available phosphorus (kg ha<sup>-1</sup>) was determined using the Olsen *et al.* (1954), Available potassium (kg ha<sup>-1</sup>) was estimated by the method of Toth and Prince (1949) [11, 8, 25, 26, 20, 12, 22].

## 3. Results And Discussion

### 3.1 Effect on Soil Physical Properties

#### Bulk density (Mg m-3)

The bulk density (Mg m-3) of soil as influenced by organic and inorganic source of nutrients. The response bulk density of soil was found to be non-significant in levels of NPK and FYM. The maximum bulk density of soil was recorded 1.265 Mg m-3 at 0-15 cm and 1.272 Mg m-3 at 15-30 cm in treatment T<sub>1</sub> (Control) followed by 1.262 Mg m-3 at 0-15 cm and 1.270 Mg m-3 at 15-30 cm in treatment T<sub>2</sub> (FYM @ 50%) and minimum bulk density of soil was recorded 1.246 Mg m-3 at 0-15 cm and 1.263 Mg m-3 at 15-30 cm in treatment T<sub>9</sub> (NPK @ 100% + FYM @100%) respectively. Farmyard manure (FYM) reduces soil bulk density by acting as a lightweight bulking agent and significantly improving soil structure. Parallel outcomes were observed by (Kumar *et al.*, 2022, Das *et al.*, 2020 and Panday *et al.*, 2017) [9, 5, 13].

#### Particle density (Mg m-3)

The particle density (Mg m-3) of soil as influenced by NPK and FYM. The response of particle density of soil was found to be non-significant in levels of NPK and FYM. The maximum particle density of soil was recorded 2.522 Mg m-3 at 0-15 cm

and 1.531 Mg m-3 at 15-30 cm in treatment T<sub>1</sub> Control followed by 2.518 Mg m-3 at 0-15 cm and 1.524 Mg m-3 at 15-30 cm in treatment T<sub>2</sub> (NPK @ 100% + FYM @ 50%) and minimum particle density of soil was recorded 2.498 Mg m-3 at 0-15 cm and 1.502 Mg m-3 at 15-30 cm in treatment T<sub>9</sub> [control (NPK @100% + FYM @100%) respectively. As organic matter decomposes, it binds soil particles together to create stable pores and channels. This decreases overall compaction and allows for healthier root development and better water movement. Similar trends emerged, matching the baseline established by (Kumar *et al.*, 2022, Chanu *et al.*, 2020 and Sharma, N. and Thakur, K. S., 2016) [9, 3, 16].

#### Pore space (%)

The maximum pore space of soil was recorded 52.22% at 0-15 cm and 50.89% at 15-30 cm in treatment T<sub>9</sub> (NPK @ 100% + FYM @ 100%) followed by 49.80% at 0-15 cm and 49.54% at 15-30 cm in treatment T<sub>8</sub> (NPK @ 100% + FYM @ 50%) and minimum pore space of soil was recorded 42.28% at 0-15 cm and 39.09% at 15-30 cm in treatment T<sub>1</sub> [control (NPK @ 0% + FYM @ 0%)] respectively. Farm Yard Manure (FYM) naturally lowers bulk density while increasing pore space by improving soil aggregation, adding low density organic matter, and enhancing root growth. This trend aligns with previous data reported by (Chanu *et al.*, 2020 and Sharma, N. and Thakur, K. S., 2016) [3, 16].

#### Water holding capacity (%)

The maximum water holding capacity of soil was recorded 43.31% at 0-15 cm and 41.34% at 15-30 cm in treatment T<sub>9</sub> (NPK @ 100% + FYM @ 100%) followed by 42.10% at 0-15 cm and 39.80% at 15-30 cm in treatment T<sub>8</sub> (NPK @ 100% + FYM @ 50%) and minimum water holding capacity of soil was recorded 31.30% at 0-15 cm and 29.20% at 15-30 cm in treatment T<sub>1</sub> [control (NPK @ 0% + FYM @ 0%)] respectively. This improved soil structure creates more micropores (small spaces between soil particles) which are ideal for trapping and retaining water for plant roots. Equivalent results matching these observations were established by (Rani *et al.*, 2017 and Yadav *et al.*, 2018) [27].

### 3.2 Effect on Soil Chemical Properties

#### Soil pH (1:2.5) w/v

Recorded 6.95 at 0-15 cm and 6.97 at 15-30 cm in treatment T<sub>9</sub> (NPK @ 100% + FYM @ 100%) followed 6.92 at 0-15 cm and 6.90 at 15-30 cm in treatment T<sub>8</sub> (NPK @ 100% + FYM @ 50 T<sub>1</sub> [control (NPK @ 0% + FYM @ 0%)] respectively. Adding Farmyard Manure (FYM) brings soil pH closer to 7 because it acts as a natural buffer. These findings corroborate the earlier results reported by (Rani *et al.*, 2017 and Yadav *et al.*, 2018).

#### Soil EC (dSm-1)

The maximum EC of soil was recorded 0.469 dSm-1 at 0-15 cm and 0.476 dSm-1 at 15-30 cm in treatment T<sub>9</sub> (NPK @ 100% + FYM @ 100%) followed by 0.463 dSm-1 at 0-15 cm and 0.471 dSm-1 at 15-30 cm in treatment T<sub>8</sub> (NPK @ 100% + FYM @ 50%) and minimum EC of soil was recorded 0.429 dSm-1 at 0-15 cm and 0.435 dSm-1 at 15-30 cm in treatment T<sub>1</sub> [control (NPK @ 0% + FYM @ 0%)] respectively. It was also observed that EC of soil were gradually increased with increasing dose of NPK and FYM. This closely aligns with the data published by (Chethan *et al.*, 2018, and Rani *et al.*, 2017) [4].

**Organic carbon (%):** The maximum organic carbon of soil was recorded 0.585% at 0-15 cm and 0.578% at 15-30 cm in treatment

T<sub>9</sub> (NPK @ 100% + FYM @ 100%) followed by 0.573% at 0-15 cm and 0.567% at 15-30 cm in treatment T<sub>8</sub> (NPK @ 100% + FYM @ 50%) and minimum organic carbon of soil was recorded 0.512% at 0-15 cm and 0.504% at 15-30 cm in treatment T<sub>1</sub> Control (NPK @ 0% + FYM @ 0%) respectively. Comparable trends in soil organic carbon accumulation have been documented by (Kumar *et al.*, 2022, Chethan *et al.*, 2018, and Rani *et al.*, 2017)<sup>[9, 4]</sup>.

#### Available Nitrogen (kg ha<sup>-1</sup>)

The maximum available nitrogen of soil was recorded 321.81 kg ha<sup>-1</sup> at 0-15 cm and 315.60 kg ha<sup>-1</sup> at 15-30 cm in treatment T<sub>9</sub> (NPK @ 100% + FYM @ 100%) followed by 316.41 kg ha<sup>-1</sup> at 0-15 cm and 306.73 kg ha<sup>-1</sup> at 15-30 cm in treatment T<sub>8</sub> (NPK @ 100% + FYM @ 50%) and minimum available nitrogen of soil was recorded 252.15 kg ha<sup>-1</sup> at 0-15 cm and 245.37 kg ha<sup>-1</sup> at 15-30 cm in treatment T<sub>1</sub>[control (NPK @ 0% + FYM @ 0%)] respectively. FYM builds soil organic matter, stimulates microbial activity, and slows down nitrogen loss, resulting in a net accumulation of plant-available nutrients. Parallel outcomes regarding available nitrogen were previously reported by (Kumar *et al.*, 2022, Toppo *et al.*, 2017 and Singh *et al.*, 2015)<sup>[9, 21, 17]</sup>.

**Available phosphorus (kg ha<sup>-1</sup>):** The response of available phosphorus of soil was found to be significant in levels of NPK

and FYM. The maximum available phosphorus of soil was recorded 30.20 kg ha<sup>-1</sup> at 0-15 cm and 27.46 kg ha<sup>-1</sup> at 15-30 cm in treatment T<sub>9</sub> (NPK @ 100% + FYM @ 100%) followed by 28.50 kg ha<sup>-1</sup> at 0-15 cm and 25.33 kg ha<sup>-1</sup> at 15-30 cm in treatment T<sub>8</sub> (NPK @ 100% + FYM @ 50%) and minimum available phosphorus of soil was recorded 15.89 kg ha<sup>-1</sup> at 0-15 cm and 14.32 kg ha<sup>-1</sup> at 15-30 cm in treatment T<sub>1</sub>[control (NPK @ 0% + FYM @ 0%)] respectively. This substantiates the earlier data presented by (Kumar *et al.*, 2022, and Kimi *et al.*, 2021, Bunker *et al.*, 2018)<sup>[9, 29, 2]</sup>.

#### Available potassium (kg ha<sup>-1</sup>)

The maximum available potassium of soil was recorded 221.42 kg ha<sup>-1</sup> at 0-15 cm and 211.67 kg ha<sup>-1</sup> at 15-30 cm in treatment T<sub>9</sub> (NPK @ 100% + FYM @ 100%) followed by 217.95 kg ha<sup>-1</sup> at 0-15 cm and 208.65 kg ha<sup>-1</sup> at 15-30 cm in treatment T<sub>8</sub> (NPK @ 100% + FYM @ 50%) and minimum available potassium of soil was recorded 190.23 kg ha<sup>-1</sup> at 0-15 cm and 187.55 kg ha<sup>-1</sup> at 15-30 cm in treatment T<sub>1</sub>[control (NPK @ 0% + FYM @ 0%)] respectively. FYM acts as a direct potassium reservoir and releases organic acids during decomposition, which prevents the soil from "fixing" potassium and keeps it readily available for plants. A broadly similar trajectory has been recorded by (Bunker *et al.*, 2018,)<sup>[2]</sup>.

**Table 1:** Effect of NPK and FYM on Bulk Density, Particle Density, Pore Space, Water Holding Capacity of soil at Harvest.

| Treatments     |                         | Bulk density (Mg m <sup>-3</sup> ) |          | Particle density (Mg m <sup>-3</sup> ) |          | Pore space (%) |          | Water holding capacity (%) |          |
|----------------|-------------------------|------------------------------------|----------|----------------------------------------|----------|----------------|----------|----------------------------|----------|
|                |                         | 0-15 cm                            | 15-30 cm | 0-15 cm                                | 15-30 cm | 0-15 cm        | 15-30 cm | 0-15 cm                    | 15-30 cm |
| T <sub>1</sub> | Control                 | 1.265                              | 1.272    | 2.522                                  | 2.552    | 42.28          | 39.09    | 31.30                      | 29.20    |
| T <sub>2</sub> | FYM @ 50%               | 1.262                              | 1.270    | 2.518                                  | 2.526    | 44.26          | 40.42    | 32.66                      | 30.58    |
| T <sub>3</sub> | FYM @ 100%              | 1.260                              | 1.268    | 2.514                                  | 2.524    | 45.56          | 43.18    | 34.27                      | 32.85    |
| T <sub>4</sub> | NPK @ 50%               | 1.258                              | 1.269    | 2.511                                  | 2.523    | 43.92          | 41.95    | 35.80                      | 33.50    |
| T <sub>5</sub> | NPK @ 50% + FYM @ 50%   | 1.255                              | 1.264    | 2.509                                  | 2.521    | 46.17          | 44.87    | 37.56                      | 35.28    |
| T <sub>6</sub> | NPK @ 50% + FYM @ 100%  | 1.253                              | 1.266    | 2.507                                  | 2.519    | 48.18          | 47.45    | 39.14                      | 36.89    |
| T <sub>7</sub> | NPK @ 100%              | 1.251                              | 1.267    | 2.504                                  | 2.517    | 47.81          | 46.85    | 40.79                      | 38.12    |
| T <sub>8</sub> | NPK @ 100% + FYM @ 50%  | 1.249                              | 1.264    | 2.501                                  | 2.515    | 49.80          | 49.54    | 42.10                      | 39.80    |
| T <sub>9</sub> | NPK @ 100% + FYM @ 100% | 1.246                              | 1.263    | 2.497                                  | 2.512    | 52.22          | 50.89    | 43.31                      | 41.34    |
| F-Test         |                         | NS                                 | NS       | NS                                     | NS       | S              | S        | S                          | S        |
| S.Ed. (±)      |                         | -                                  | -        | -                                      | -        | 1.92           | 1.62     | 1.96                       | 2.66     |
| C.D. at 0.5%   |                         | -                                  | -        | -                                      | -        | 4.10           | 3.46     | 4.06                       | 5.52     |

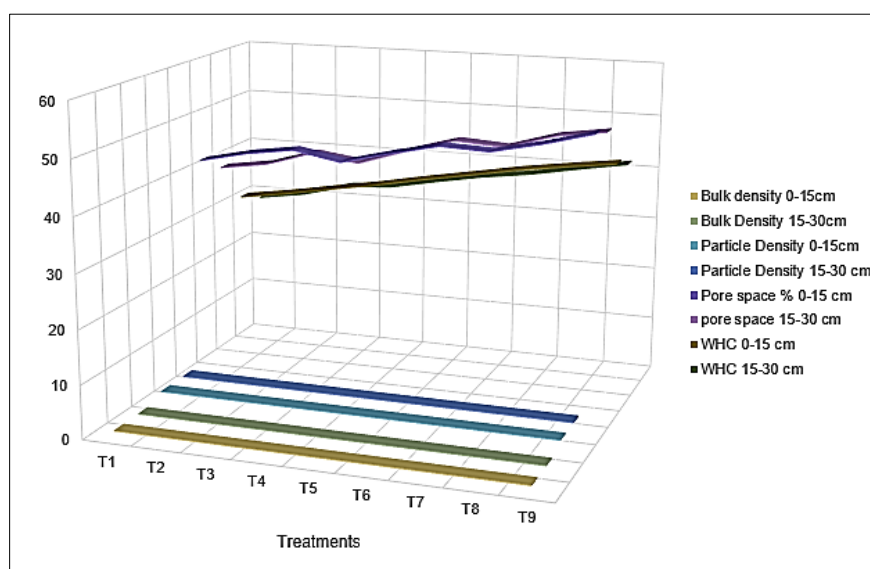
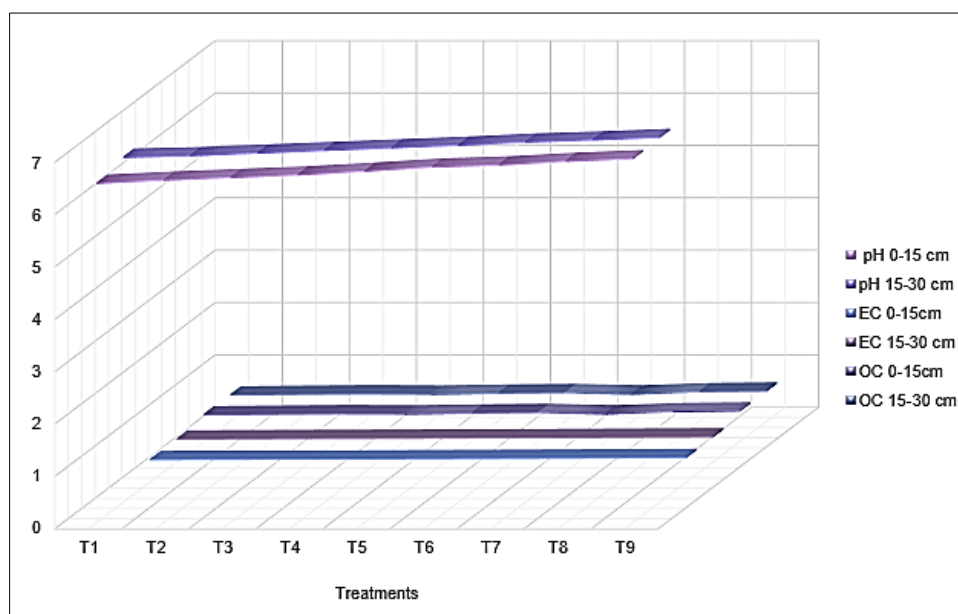


**Fig 1:** Effect of all treatments on bulk density (Mg m<sup>-3</sup>), Particle density (Mg m<sup>-3</sup>), Pore space (%) and Water holding capacity (%) of soil.

**Table 2:** Effect of NPK and FYM on pH, EC, Organic Carbon of soil at Harvest.

| Treatments     |                         | pH      |          | EC (dSm <sup>-1</sup> ) |          | Organic carbon (%) |          |
|----------------|-------------------------|---------|----------|-------------------------|----------|--------------------|----------|
|                |                         | 0-15 cm | 15-30 cm | 0-15 cm                 | 15-30 cm | 0-15 cm            | 15-30 cm |
| T <sub>1</sub> | Control                 | 6.48    | 6.59     | 0.429                   | 0.435    | 0.512              | 0.504    |
| T <sub>2</sub> | FYM @ 50%               | 6.54    | 6.62     | 0.432                   | 0.439    | 0.521              | 0.515    |
| T <sub>3</sub> | FYM @ 100%              | 6.59    | 6.67     | 0.436                   | 0.445    | 0.530              | 0.524    |
| T <sub>4</sub> | NPK @ 50%               | 6.64    | 6.72     | 0.440                   | 0.449    | 0.525              | 0.517    |
| T <sub>5</sub> | NPK @ 50% + FYM @ 50%   | 6.71    | 6.77     | 0.446                   | 0.454    | 0.545              | 0.538    |
| T <sub>6</sub> | NPK @ 50% + FYM @ 100%  | 6.79    | 6.82     | 0.451                   | 0.460    | 0.556              | 0.548    |
| T <sub>7</sub> | NPK @ 100%              | 6.83    | 6.88     | 0.457                   | 0.465    | 0.528              | 0.521    |
| T <sub>8</sub> | NPK @ 100% + FYM @ 50%  | 6.90    | 6.92     | 0.463                   | 0.471    | 0.573              | 0.567    |
| T <sub>9</sub> | NPK @ 100% + FYM @ 100% | 6.95    | 6.97     | 0.469                   | 0.476    | 0.585              | 0.578    |
|                | F-Test                  | S       | S        | S                       | S        | S                  | S        |
|                | S.Ed. (±)               | 0.03    | 0.03     | 0.015                   | 0.0015   | 0.002              | 0.002    |
|                | C.D. at 0.5%            | 0.07    | 0.06     | 0.423                   | 0.0033   | 0.004              | 0.005    |

**Fig 2:** Effect of NPK and FYM on pH, EC (dSm<sup>-1</sup>), and Organic carbon (%) of soil.**Table 3:** Effect of NPK and FYM on Available Nitrogen, phosphorus, potassium of soil at Harvest.

| Treatments     |                         | Available Nitrogen (kg/ha) |          | Available phosphorus (kg/ha) |          | Available Potassium (kg/ha) |          |
|----------------|-------------------------|----------------------------|----------|------------------------------|----------|-----------------------------|----------|
|                |                         | 0-15 cm                    | 15-30 cm | 0-15 cm                      | 15-30 cm | 0-15 cm                     | 15-30 cm |
| T <sub>1</sub> | Control                 | 252.15                     | 245.37   | 15.89                        | 14.32    | 190.23                      | 187.55   |
| T <sub>2</sub> | FYM @ 50%               | 261.47                     | 253.50   | 18.63                        | 16.20    | 193.41                      | 189.82   |
| T <sub>3</sub> | FYM @ 100%              | 270.71                     | 262.10   | 20.78                        | 18.40    | 196.58                      | 191.56   |
| T <sub>4</sub> | NPK @ 50%               | 277.63                     | 274.60   | 21.05                        | 18.85    | 199.08                      | 194.72   |
| T <sub>5</sub> | NPK @ 50% + FYM @ 50%   | 291.18                     | 282.86   | 23.52                        | 20.50    | 203.56                      | 197.80   |
| T <sub>6</sub> | NPK @ 50% + FYM @ 100%  | 303.10                     | 294.50   | 25.61                        | 22.15    | 208.78                      | 201.45   |
| T <sub>7</sub> | NPK @ 100%              | 308.93                     | 300.03   | 26.10                        | 23.10    | 213.81                      | 203.72   |
| T <sub>8</sub> | NPK @ 100% + FYM @ 50%  | 316.41                     | 306.73   | 28.50                        | 25.33    | 217.95                      | 208.65   |
| T <sub>9</sub> | NPK @ 100% + FYM @ 100% | 321.86                     | 315.60   | 30.20                        | 27.46    | 221.42                      | 211.67   |
|                | F-Test                  | S                          | S        | S                            | S        | S                           | S        |
|                | S.Ed. (±)               | 3.23                       | 0.28     | 1.50                         | 1.65     | 1.44                        | 1.92     |
|                | C.D. at 0.5%            | 6.87                       | 0.60     | 3.20                         | 3.52     | 3.07                        | 4.09     |

#### 4. Conclusion

The present investigation clearly demonstrated that integrated nutrient management significantly improved soil health, growth and yield of garden pea. Among all treatments, T<sub>9</sub> (100% RDF NPK + 100% FYM) proved superior by recording the highest values of soil fertility parameters, plant growth and pod yield. Therefore, application of 100% RDF NPK along with 100% FYM

may be recommended for sustainable and profitable cultivation of garden pea under alluvial soil conditions of Prayagraj.

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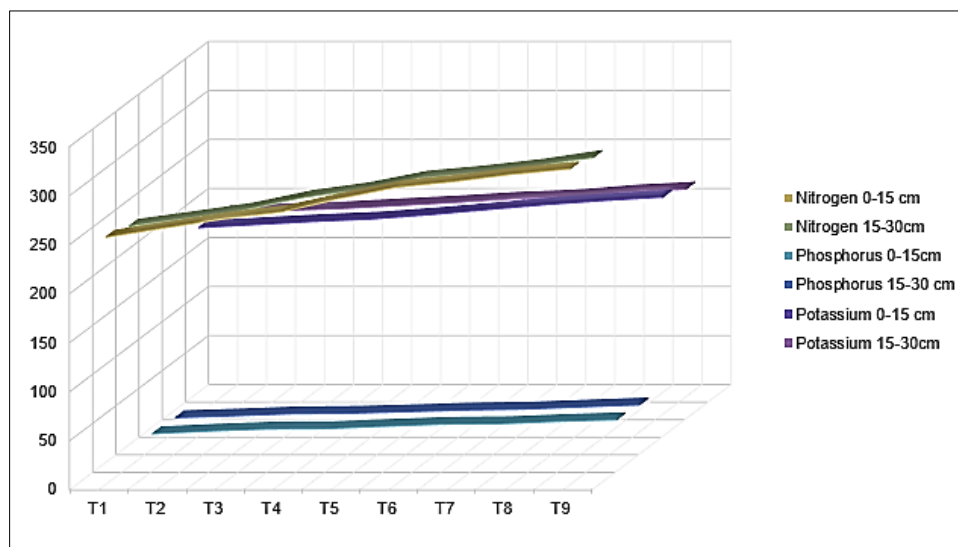


**Fig 3:** Effect of NPK and FYM on Available nitrogen (kg ha<sup>-1</sup>), Available phosphorus (kg ha<sup>-1</sup>), Available potassium (kg ha<sup>-1</sup>) in soil.

### Competing Interests

The authors declare that there are no conflicts of interest regarding the publication of this paper.

### References

- Bouyoucos GJ. The hydrometer as a new method for the mechanical analysis of soils. *Soil Science*. 1927;23(5):343-354.
- Bunker SP, Rathore MS, Singh V. Available macronutrient status and green pod yield of vegetable legumes as influenced by organic and inorganic inputs. *International Journal of Agronomy*. 2018;45-51.
- Chanu TR, Devi KM, Singh NB. Shifts in particle density and structural soil pore space under integrated nutrient matrices. *Journal of the Indian Society of Soil Science*. 2020;68(2):177-183.
- Chethan, Kumar S, Rani P. Organic matter build-up and vegetative response parameters in leguminous cropping sequences. *Indian Journal of Agricultural Research*. 2018;52(4):411-416.
- Das K, Sharma MK, Tiwari A. Dynamics of bulk density and electrical conductivity variations under combined chemical and organic fertilization. *Soil and Tillage Research*. 2020;198:104-111.
- Dhaliwal SS, Sadana US, Puri K. Nutritional profiling and digestible protein evaluation of cool-season vegetable legumes. *Food Nutrition Bulletin*. 2017;38(4):512-519.
- Government of India. *Agricultural Production and Productivity Statistics Handbook 2024-2025*. New Delhi: Ministry of Agriculture and Farmers Welfare; 2025.
- Jackson ML. *Soil Chemical Analysis*. New Delhi: Prentice Hall of India Pvt. Ltd.; 1973. p. 498.
- Kumar P, David AA, Thomas T, Reddy IS. Impact of integrated nutrient management on physico-chemical properties of soil in pea (*Pisum sativum* L.) var. GS 10. *International Journal of Plant and Soil Science*. 2022;34(20):521-526.
- Kumar J, Singh SK, Sanodiya LK. Chelate formatting capacities and soluble organic matrices in acidifying alluvial fields. *Soil Research Bulletin*. 2023;41(4):213-219.
- Muthuvel P, Udayasoorian C, Natesan R, Ramaswami PP. *Introduction to Soil Analysis*. Coimbatore: Tamil Nadu Agricultural University; 1992.
- Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of Available Phosphorus in Soils by Extraction with Sodium Bicarbonate. USDA Circular No. 939. Washington (DC): United States Department of Agriculture; 1954.
- Panday SC, Singh RD, Kumar A. Bulk density and macroporosity dynamics under long-term chemical and organic fertilizer inputs. *Geoderma Regional*. 2017;11:43-50.
- Fisher RA. *The Design of Experiments*. Edinburgh: Oliver and Boyd; 1935.
- Reta G, Worku W, Mohammed H. Phosphorus impacts on structural rooting depth and potassium drove crop quality indicators under harsh environmental conditions. *Legume Science*. 2021;3(2):94.
- Sharma N, Thakur KS. Effect of integrated nutrient management on soil properties and nutrient content in pea (*Pisum sativum* L.). *The Bioscan*. 2016;11(1):455-458.
- Singh M, Yadav BL, Sharma R. Pivotal roles of balanced nitrogen allocations in mitigating drought vulnerabilities and upgrading field yield. *Journal of Plant Nutrition Management*. 2015;18(1):52-59.
- Singh SB, Gaharwar S, Mishra A. Integrated nutrient management strategies and structural morpho-economic parameters of garden pea. *Progressive Horticulture*. 2021;53(1):88-94.
- Singhal V, Yadav PK, Central R. Botanical configurations, center of origin and seed bed requirements of annual cool-season legumes. *Horticultural Science Reviews*. 2021;29(2):114-122.
- Subbiah BV, Asija GL. A rapid procedure for the estimation of available nitrogen in soils. *Current Science*. 1956;25:259-260.
- Toppo S, Thomas T, Kurbah I. Available macroelement dynamics and structural soil indexes under combined neem cake and bio-fertilizer integrations. *Journal of Pharmacognosy and Phytochemistry*. 2017;6(5):2154-2158.
- Toth SJ, Prince AL. Estimation of cation-exchange capacity and exchangeable calcium, potassium, and sodium contents of soils by flame photometer techniques. *Soil Science*. 1949;67(6):439-445.
- Uddin MJ, Ahmed S, Rahman M. Essential macronutrient mechanics: Chlorophyll synthesis and stomata regulation via active potassium channels. *Plant Physiology Reports*. 2023;28(2):189-196.
- Verma GK, Singh RP, Kumar S. Nitrogen assimilation arrays, photosynthetic velocity and carbohydrate

- accumulation parameters in cool-season crops. *Photosynthetica*. 2019;57(4):990-997.
25. Wilcox LV. Electrical conductivity. *Journal of the American Water Works Association*. 1950;42(8):775-776.
26. Walkley A. A critical examination of a rapid method for determining organic carbon in soils: Effect of variations in digestion conditions and of inorganic soil constituents. *Soil Science*. 1947;63(4):251-264.
27. Yadav SS, Rani P, Chethan M. Structural stabilization of water retention metrics and structural chemical profiles in semi-arid zones. *Arid Soil Research and Rehabilitation*. 2018;32(2):145-152.
28. Yadav SK, Alluvial PJ, Central C. Soil Organic Carbon (SOC) dynamics and continuous production challenges under Ganga-Yamuna plains. *Alluvial Soil Research*. 2023;14(3):114-121.
29. Kimi ZS, Thomas T, Sangma MC. *Rhizobium* and phosphate-solubilising bacteria seed treatment optimizations and dry matter accumulation arrays in field pea. *Journal of Grain Legumes*. 2021;18(2):82-88.