



# Plant Archives

Journal homepage: <http://www.plantarchives.org>DOI Url : <https://doi.org/10.51470/PLANTARCHIVES.2025.v25.no.2.041>

## EFFECT OF ORGANIC MANURES AND INORGANIC FERTILIZERS ON GROWTH, YIELD AND QUALITY ATTRIBUTES OF PEA

Rahul Kumar\*, Shweta Soni, Sunil Kumar, Abhinav Yadav, Archana Upadhyay, Sudhir Pal and Pradip Kumar

Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India.

\*Corresponding author E-mail : [rahul200gzp@gmail.com](mailto:rahul200gzp@gmail.com)

(Date of Receiving-02-06-2025; Date of Acceptance-10-08-2025)

### ABSTRACT

An experiment was conducted to examine the response of four different organic manures viz. farmyard manure, Vermicompost, NPK as a source of nitrogen with or without chemical fertilizers, in a randomized block design with three replications during the rabi season of the year 2022. The results revealed that, the significantly highest plant height at 30 (19.76,20.01,19.55cm), 60 (43.25,45.13,44.69 cm) and 90 (61.24,62.00,63.40 cm) DAS was recorded with T<sub>9</sub> (50% NPK (15:40:30)+50% Vermicompost @ 1.5 t ha<sup>-1</sup>+50% FYM @ 2.5 t ha<sup>-1</sup>) during the year 2022 and in pooled analysis, respectively. The highest protein content (22.20,21.95 and 22.54%) was recorded in T<sub>9</sub>. The significantly maximum yield attributes i.e. no. of pods per plant (18.26,14.60 and 12.80 ) yield of pods per plot (7.06,6.99 and 7.3 kg), and yield of pods per hectare (117q,115 q and 110q) was recorded with T<sub>9</sub> during the year 2022 and in pooled analysis respectively.

**Key words :** Growth, Yield, NPK, Vermicompost, FYM.

### Introduction

Vegetables are an important protective food and highly beneficial for the maintenance of health and prevention of diseases. They contain valuable food ingredients which can be successfully utilized to build up and repair the body. Vegetables play a vital role in crop diversification, employment generation and socio-economic upliftment of the farming society. After green revolution, our country has made a tremendous progress in vegetable production. India is now, the second largest producer of vegetables in the world with a total production of 191.77 million metric tonnes from 10.35 million hectares area and a productivity of 14.9 tonnes per hectare (NHB Database, 2019-20). Vegetable provides carbohydrate, protein, fat, vitamins, minerals and water along with roughages which are the essential constituents of balanced diet. According to recommendation given by Indian Council of Medical Research (ICMR) a grown-up man with vegetarian or non-vegetarian food habit should consume 300 g vegetable per day, which includes 125 g leafy vegetables, 100 g of root vegetables and 75 g

of other vegetables. In addition to their role in nutrition, vegetables increase attractiveness and palatability of a diet by providing sensory appeal through their variety of colour and flavour. Garden pea (*Pisum sativum* L. var. *hortens*; 2n=14) is one of the most important leguminous vegetable grown for their delicious, nutritious seeds throughout the world and India ranks 1st in the production of pea. It belongs to the family Fabaceae and sub family papilionaceae. The ancestor of cultivated pea is *Pisum elatius*. Peas are grown on 4.20 lakh ha in India, producing 40.06 lakh MT at a productivity of 9.50 t/ha (Dutta *et al.*, 2021). In a 100g serving of edible pea, there are 7.2 g of digestible protein, 0.1 g of fat, 0.8 g of minerals (calcium 20 mg, magnesium 34 mg, carbohydrate 15.8 mg, vitamin - C 9 mg, phosphorus 139 mg, copper 0.23 mg, and sulphur 95 mg) and 15.8 g of carbohydrates (Sepehya *et al.*, 2015). As a fresh vegetable or as a frozen food, fresh seed and pea pods are available. As a human food source, dry seeds are utilized as pulse. Green vegetable pea pods are recommended for use in cooking because they are highly nutritious and can be utilized as

cattle feed. Peas are one of the most sustainable vegetables grown in India. As a nitrogen fixing legume, its value as a plant that enhances soil fertility has long been recognized. It improves the Soil fertility due to biological nitrogen fixation combined with symbiotic rhizobia prevailing in nodules and also leaves residual nitrogen of about 50-60kg/ha (Negi *et al.*, 2006). The nitrogen content of the soil is one of the most important factors that influence the growth and yield potential of many different vegetable crops. Many investigations were carried out to see if nitrogen application would have beneficial effects on growth, yield and quality in peas. The mulch also helps improve soil health and provide quality fodder for cattle.

### Materials and Methods

An investigation was carried out at Vegetable research farm of Banda University of Agriculture and Technology, Banda, U.P., India. The University is geographically located at 24° 53'- 25° 55' N latitudes and 80° 07'- 81° 34' E longitudes. The present investigation was conducted during Rabi (October-February) season of 2021 at Vegetable Research Farm of College of Horticulture, Banda University of Agriculture and Technology, Banda. The two different organic manures viz.; farmyard manure, vermicompost, as a source of nitrogen with or without chemical fertilizers like nitrogen, phosphorus and potassium were tested during the rabi season of the year 2021. The experiment was laid out in a Randomized Block Design with nine treatments were employed and replicated thrice. The treatments involved in the study were 09 in numbers i.e.  $T_1$  = NPK (30:80:60),  $T_2$  = Farmyard manure @ 5 t ha<sup>-1</sup>,  $T_3$  = Vermicompost @ 3 t ha<sup>-1</sup>,  $T_4$  = 50% NPK (15:40:30) + 50% FYM @ 2.5 t ha<sup>-1</sup>,  $T_5$  = 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 t ha<sup>-1</sup>,  $T_6$  = 50% FYM @ 2.5 t ha<sup>-1</sup> + 50% Vermicompost @ 1.5 t ha<sup>-1</sup>,  $T_7$  = 50% NPK (15:40:30) + 100% FYM @ 5 t ha<sup>-1</sup>,  $T_8$  = 50% NPK (15:40:30) + 100% Vermicompost @ 3 t ha<sup>-1</sup>,  $T_9$  = 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 t ha<sup>-1</sup> + 50% FYM @ 2.5 t ha<sup>-1</sup> and they were applied with an objective to study the effect of organic and inorganic nutrients on growth, yield, quality and economics of garden pea.

### Physiochemical Properties of soil

| S. no. | Particulars       | Value Obtained               |
|--------|-------------------|------------------------------|
| 1.     | pH                | 7.5                          |
| 2.     | EC                | 0.55(dsm <sup>-1</sup> )     |
| 3.     | Organic carbon(%) | 0.65 %                       |
| 4.     | Potassium         | 265 kg ha <sup>-1</sup>      |
| 5.     | Sulphur           | 7.3 mg kg <sup>-1</sup> soil |
| 6.     | Phosphorus        | 15.51 kg h <sup>-1</sup>     |

### Methodology of growth parameters

**Plant height (cm) :** The height of the plant was measured from the ground level to the maximum apical bud (top most leaf) with the help of meter scale from the 5 tagged plants in each treatment and replications at 30, 60 and 90 days after sowing and average plant height was expressed in centimeter.

**Leaf area (cm<sup>2</sup>) :** Five compound leaves from each plant were randomly selected and length and width were measured with the help of meter scale from the 5 tagged plants at 30, 60 and 90 days and calculated the leaf area by multiplying leaf length and width and expressed in cm<sup>2</sup>.

$$\text{Leaf area} = \text{Leaf length} \times \text{Leaf width}$$

**Days of first flowering :** The number of days taken to first flowering was recorded from the date of sowing to the date when first flower of the plant flowered for each plot and the mean value was expressed as number of days required to first flowering.

**Days to 50% flowering :** The number of days taken to 50 per cent flowering was recorded from the date of sowing to the date when 50 percent of the plants flowered for each plot and the mean value was expressed as number of days required for 50 % flowering.

**Pod length (cm) :** Fresh and healthy five pods were selected in each tagged plant after harvesting and the pod length was measured by using measuring scale. The mean value was calculated and expressed in centimeter.

**Width of pod (cm) :** Fresh and healthy five pods which were selected for measuring pod width which was measured at the center of the fruit by using vernier calliper. The mean value was calculated and expressed in centimeter (cm).

### Methodology of yield parameters

**Days of first harvesting :** Number of days was counted from sowing date up to the first picking of pods in each treatment.

**Number of seeds pod<sup>-1</sup> :** At the time of picking, five pods were randomly selected from each plot and total seeds were counted to record the average number of seeds pod<sup>-1</sup>.

**Number of pods plant<sup>-1</sup> :** The total number of fresh pods harvested from the tagged plants was counted and an average value was recorded and expressed as number of pods plant<sup>-1</sup>.

**Pod yield plant<sup>-1</sup> (g) :** The weight of green pods was recorded for each picking in each plant to determine the total pod yield plant<sup>-1</sup>.

**Pod yield plot<sup>-1</sup> (kg) :** The weight of green pods was recorded for each picking in each plot to determine the total pod yield plot<sup>-1</sup> and measured in kilogram.

**Pod yield quintal hectare<sup>-1</sup> :** The pod yield per plot (kg) was converted into q ha<sup>-1</sup> for each plot.

### Methodology of quality parameters

**Total soluble solids (°Brix) :** Each plot's selected pods were crushed to create a homogenised sample and the juice was extracted using a grinder. A few droplets of juice were poured on the prism's surface of hand refractometer. The hinged section was replaced after that, the refractometer was placed in front of the sun. At room temperature, the reading was taken by rotating the eyepiece (A.O.A.C., 1970).

### Protein content

**Protein estimation (Lowery method) :** Protein content in sample was estimated by Lowery method given by Lowery *et al.* (1951).

## Results and Discussion

### Growth parameters

Application of organic and inorganic nutrients had positive increased in growth attributes of the plants, in term of plant height. The significantly maximum plant height was obtained at 30, 60 and 90 DAS (27.10, 52.53 and 64.76 cm, respectively) in T<sub>8</sub> which might be due to the combined effect of organic and inorganic nutrient sources. The Vermicompost improve the soil physiochemical and biological condition, water holding capacity, increase aggregation and microbial activity resulted increase moisture availability, nutrient mineralization which increases N, P and K availability and uptake by plant. The more nitrogen in plant increase cell division, cell elongation, carbohydrate and highest green surface area which intercept more light energy consequences increases photosynthesis ultimately increase plant height. Plant height was significantly greater for all the treatments than those for the control. Gopinath *et al.* (2011) also reported that organic manures, poultry manure 5 tonnes/ha + biofertilizers being at par with combined application of organic manures (T<sub>4</sub>) and Vermicompost 7.5 tonnes/ha+ biofertilizers gave significantly higher plant height compared to farmyard manure 20 tonnes/ha + biofertilizers. Similar Findings were observed by Kumar *et al.* (2014) and Yadav *et al.* (2018) in Pea. The increase in growth such as plant height may be due to the application of Vermicompost which facilitates quick and greater availability of plant nutrients and thus provides a better environment for root growth and proliferation. Vermicompost also creates a more

adsorptive surface for uptake of nutrients (Patil *et al.*, 2010).

The data as regards the leaf area was observed at 30, 60 and 90 DAS influenced by different treatments of organic and inorganic nutrients. The maximum leaf area (8.76, 8.60 and 8.93 cm<sup>2</sup> respectively) recorded in T<sub>8</sub> whereas, the minimum leaf area was observed at 30, 60 and 90 DAS (6.57, 6.71 and 6.84 cm<sup>2</sup>) in T<sub>1</sub> control.

Similar results were also reported by Kumar *et al.* (2014) and Yadav *et al.* (2018) in pea. The (vermicompost-10 t/ha + NPK) treatment exhibited the maximum nodule formation. A comparative study of the present findings led to the conclusion that sowing of pea with the application of Vermicompost @ 10 t/ha and NPK @ 25:60:50 kg/ha was found most effective to best growth of pea. Achakzai (2012) reported that maximum leaf length (6.94) was recorded with application of 100 kg N ha<sup>-1</sup> as well as similar result were found by Gupta *et al.* (2017). Bharadwaj *et al.* (2021) observed that the growth attributes with application of (Vermicompost @ 2.5 t ha<sup>-1</sup> + ½ dose of NPK through chemical fertilizer) showed maximum leaf area in pea. Yadav *et al.* (2019) found that the growth attributes of cowpea viz. leaf area and leaf area index (LAI) was found highest in treatment involving the combined application of FYM + Vermicompost + Rhizobium + PSB culture. The combined effect of organic and inorganic nutrients in days taken to first flowering was found non-significant. However, the earliest flowering (35 days) was reported in T<sub>8</sub> and the late flowering (38 days) was observed under the control (T<sub>1</sub>). The combination of organic manures like Vermicompost along with NPK decreases number of nodes at which first flowering appear. NPK and Vermicompost together with organic manures reduce the number of nodes at which the first flowers develop. This treatment's early bloom emergence may be related to the sufficient availability of micro and macronutrients. According to Gupta *et al.* (2017) and Mishra *et al.* (2014), the earlier flowering is induced by the increased absorption of nutrients and availability to the growing bud. Bharadwaj *et al.* (2021) it has been noted that using organic liquid manures reduces the time needed for first flowering and first plucking. Because it was the closest sink and the timing was ideal for fruit production and blooming, the potassium application may have boosted carbohydrate building and their remobilization in the plant's reproductive system. These findings collaborate the results of Vimala and Natrajan (2000), Singh and Singh (2002), Datt *et al.* (2003), Yadav and Luthra (2005) in pea. The pod length (9.32 cm) was found to be maximum with T<sub>9</sub> whereas, the minimum pod length (8.61cm) was observed in T<sub>1</sub>

control. Significantly result was found on pod length by the application of nitrogen, phosphorus and potassium. Enhance the pod length was influenced by the vegetative growth. The enhance in metabolic activities and accumulation of carbohydrates gives better vegetative growth due to the availability of nutrients which leads to manufacture of food materials which are then translocate to the developing fruit and ultimately led to increase the length of pod. The plants treated with different combinations of NPK and NADEP compost results in to higher length of pods. Similar results were reported by Nadeem *et al.* (2002) and Sharma *et al.* (2011). Jaipaul *et al.* (2011) and Singh *et al.* (2015) also identify the efficient tillage practices and organic nitrogen sources for achieving higher productivity, profitability and energy use efficiency of vegetable pea (*Pisum sativum* L.). Pooled data of two years showed that among the tillage practices, significantly higher values of growth attributes viz. pod length (8.3 cm) was recorded.

The significantly maximum pod width (4.18 cm) was recorded with treatments  $T_9$  and minimum pod width was recorded with  $T_1$  (Control) (1.97 cm). Adequate nutrient promotes vigorous growth of the plant which ultimately increase the width of pod as well as seed which confirms the observation of Waseem *et al.* (2008). The experiment's high yield and growth rates for the FYM and FYM + Vc treatments are consistent with those reported by Sankhyan *et al.* (2001) and Kumaran (2001). The results of Yadav and Vijayakumari (2003) were found to be consistent with the maximum overall growth record from the vermicompost treatment and admixed with FYM. The N:P:K treatments had the greatest biomass measurements for the entire plant. The highest biomass obtained may have resulted from the high nitrogen content of inorganic fertilizers that were added during the plant's vegetative phase.

### Yield parameter

Number of pods plant<sup>-1</sup> was found maximum (18.26) with the application of  $T_9$  while minimum number of pods plant<sup>-1</sup> (8.66) was recorded at  $T_1$  (Control). Performance was poor due to the less availability of nutrients resulting in lesser number of pods plant<sup>-1</sup>. The increase in number of pods plant<sup>-1</sup> in  $T_9$  might be attributed due to availability of sufficient amount of nutrients from manures, NPK and Vermicompost which also improved soil health and water holding capacity of soil. Lalito *et al.* (2018) revealed that the number of pods per plants showed significant difference among the treatments and find that the highest number of pods is in treatment  $T_7$  i.e. NPK + FYM + Vermi-compost). Similar result was also reported by

Prabhakar *et al.* (2011), Dubey *et al.* (2012) and Mishra *et al.* (2014) in table pea. The maximum nutrient uptake along with good vegetative growth and translocation of photosynthates might be the reason of higher number of pods per plant. Application of NPK and FYM might have provided micro and macro nutrients along with growth promoting substances to the crop, which in turn could have increased the number of pods per plant.

Significantly maximum number of seeds pod<sup>-1</sup> was recorded with  $T_9$  (8.66), while the control plants were found to be minimum number of seeds pod<sup>-1</sup> 7.06 with  $T_1$  Control. Yadav *et al.* (2018) were found that there was increase number of pods plant<sup>-1</sup> with the application of DAP @150kg ha<sup>-1</sup> in comparison to DAP @ 100kg ha<sup>-1</sup>. More numbers of pods and pod characters resemble to be associated with more number of branches plant<sup>-1</sup>. Increased phosphorus availability at higher DAP rates may also be a significant contributing factor because phosphorus encourages blooms and helps seeds to develop. Additionally, P is important for root growth, energy conversion, and metabolic process of plant. This led to increased phosphate translocation in the direction of sink development. Similar finding were also reported by Vijayavardhan (1999). A higher number of pods may result from the greatest nutrient intake, strong vegetative growth and transfer of photosynthates each plant. Application of the organic therapies and Panchagavya and FYM may have offered micro and macronutrients and chemicals that promote growth of crop, which could have led to a rise in the number of pods plant<sup>-1</sup>. Similar results were reported by Ram *et al.* (2021). The highest number of seeds plant<sup>-1</sup> (14.33) was obtained with treatment  $T_7$  (½ RDN + enriched vermicompost @ 2.5 tonnes hectare<sup>-1</sup>), whereas the lowest number of seeds plant (9.33) was obtained with treatment  $T_1$  (Control) by Lalito *et al.* (2018).

Significantly maximum pod yield plant<sup>-1</sup> was recorded with  $T_9$  (54g) while the 34g minimum pod yield plant<sup>-1</sup> were recorded in  $T_1$  NPK (30:80:60) Control. The reason for such results may be adequate and balanced supply of integrated application of organic sources with chemical fertilizers. Plants received large amount of nutrients throughout their growth period and nourished properly which enhanced cropping period and ultimately yield of plant. These findings led support to the observations of Vimala and Natrajan (2000) and Singh *et al.* (2015) in garden pea. Accordance to Jaipaul *et al.* (2011), the improvement of yield attributes and the advantageous impact of combined use of organic and inorganic nutrients influencing the physical, chemical and microbiological properties of soil may be cause of the increase in garden

**Table 1 :** Effect of N P K, FYM and Vermicompost on Plant height (cm) and leaf area (cm<sup>2</sup>) per plant of garden pea.

| Notation       | Treatments                                                                                            | Plant height (cm) |        |       | Leaf area (cm <sup>2</sup> ) |       |       |
|----------------|-------------------------------------------------------------------------------------------------------|-------------------|--------|-------|------------------------------|-------|-------|
|                |                                                                                                       | 30 DAS            | 60 DAS | 90DAS | 30DAS                        | 60DAS | 90DAS |
| T <sub>1</sub> | NPK (30:80:60) Control                                                                                | 15.26             | 33.20  | 52.73 | 6.57                         | 6.71  | 6.84  |
| T <sub>2</sub> | FYM @ 5Ton ha <sup>-1</sup>                                                                           | 19.90             | 33.20  | 57.40 | 7.49                         | 7.38  | 7.19  |
| T <sub>3</sub> | Vermicompost @ 3Ton ha <sup>-1</sup>                                                                  | 23.9              | 45.56  | 59.66 | 7.55                         | 7.68  | 7.28  |
| T <sub>4</sub> | 50% NPK (15:40:30) + 50% FYM @ 2.5 Ton ha <sup>-1</sup>                                               | 18.8              | 46.40  | 61.83 | 6.70                         | 6.76  | 6.97  |
| T <sub>5</sub> | 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                                      | 20.86             | 46.36  | 60.96 | 6.77                         | 6.93  | 7.21  |
| T <sub>6</sub> | 50% FYM @ 2.5 Ton ha <sup>-1</sup> + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                      | 21.26             | 43.13  | 59.80 | 7.53                         | 7.51  | 7.57  |
| T <sub>7</sub> | 50% NPK (15:40:30) + 100% FYM @ 5 Ton ha <sup>-1</sup>                                                | 21.30             | 48.06  | 62.53 | 8.21                         | 7.76  | 7.99  |
| T <sub>8</sub> | 50% NPK (15:40:30) + 100% Vermicompost @ 3 Ton ha <sup>-1</sup>                                       | 27.10             | 52.53  | 64.76 | 8.76                         | 8.60  | 8.93  |
| T <sub>9</sub> | 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup> + 50% FYM @ 2.5 Ton ha <sup>-1</sup> | 19.76             | 45.13  | 63.40 | 7.36                         | 7.81  | 7.78  |
| CD             |                                                                                                       | 2.47              | 7.09   | 6.70  | 0.96                         | 1.03  | 0.60  |
| SEm±           |                                                                                                       | 0.81              | 2.34   | 2.21  | 0.32                         | 0.34  | 0.20  |
| CV             |                                                                                                       | 6.78              | 9.06   | 6.36  | 7.45                         | 7.93  | 4.60  |

**Table 2 :** Effect of N P K, FYM and Vermicompost on first flowering, Pod length and Pod width per plant of garden pea.

| Notation       | Treatments                                                                                            | Days of first flowering | Pod length | Pod width |
|----------------|-------------------------------------------------------------------------------------------------------|-------------------------|------------|-----------|
| T <sub>1</sub> | NPK (30:80:60) Control                                                                                | 38                      | 8.61       | 1.97      |
| T <sub>2</sub> | FYM @ 5Ton ha <sup>-1</sup>                                                                           | 37.33                   | 9.04       | 2.63      |
| T <sub>3</sub> | Vermicompost @ 3Ton ha <sup>-1</sup>                                                                  | 35.33                   | 8.92       | 2.92      |
| T <sub>4</sub> | 50% NPK (15:40:30) + 50% FYM @ 2.5 Ton ha <sup>-1</sup>                                               | 35.66                   | 9.20       | 3.13      |
| T <sub>5</sub> | 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                                      | 35                      | 8.86       | 2.76      |
| T <sub>6</sub> | 50% FYM @ 2.5 Ton ha <sup>-1</sup> + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                      | 35.33                   | 9.00       | 2.85      |
| T <sub>7</sub> | 50% NPK (15:40:30) + 100% FYM @ 5 Ton ha <sup>-1</sup>                                                | 36                      | 9.02       | 3.00      |
| T <sub>8</sub> | 50% NPK (15:40:30) + 100 % Vermicompost @ 3Ton ha <sup>-1</sup>                                       | 35                      | 8.99       | 3.20      |
| T <sub>9</sub> | 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup> + 50% FYM @ 2.5 Ton ha <sup>-1</sup> | 36                      | 9.32       | 4.18      |
| CD             |                                                                                                       | N/S                     | 0.3        | 0.34      |
| SEm±           |                                                                                                       | 0.67                    | 0.1        | 0.11      |
| CV             |                                                                                                       | 3.27                    | 1.94       | 6.53      |

pea seed yield because of the application of organic and inorganic nutrients alone or in combination. Due to the delayed nutrient deterioration and combined effects of vermicompost and farmyard manure, this may be the case release schedule from FYM and improved mineralization,

increased prevalence of advantageous organisms, hormones that promote growth and vermicompost enzymes. Banik *et al.* (2006) resulting in sufficient and balanced the provision of nutrients during the development phase allowed the plants to absorb enough photosynthesis,

**Table 3 :** Effect of N P K, FYM and Vermicompost on Number of pods plant<sup>-1</sup>, Number of seeds pod<sup>-1</sup> of garden pea.

| Notation       | Treatments                                                                                            | Number of pods plant <sup>-1</sup> | Number of seeds pod <sup>-1</sup> |
|----------------|-------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------|
| T <sub>1</sub> | NPK (30:80:60) Control                                                                                | 8.66                               | 7.06                              |
| T <sub>2</sub> | FYM @ 5Ton ha <sup>-1</sup>                                                                           | 12.66                              | 8.20                              |
| T <sub>3</sub> | Vermicompost @ 3 Ton ha <sup>-1</sup>                                                                 | 11.66                              | 7.93                              |
| T <sub>4</sub> | 50% NPK (15:40:30) + 50% FYM @ 2.5 Ton ha <sup>-1</sup>                                               | 14.06                              | 7.73                              |
| T <sub>5</sub> | 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                                      | 13.33                              | 8.13                              |
| T <sub>6</sub> | 50% FYM @ 2.5 Ton ha <sup>-1</sup> + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                      | 14.4                               | 7.86                              |
| T <sub>7</sub> | 50% NPK (15:40:30) + 100% FYM @ 5 Ton ha <sup>-1</sup>                                                | 12.8                               | 7.66                              |
| T <sub>8</sub> | 50% NPK (15:40:30) + 100 % Vermicompost @ 3 Ton ha <sup>-1</sup>                                      | 14.6                               | 8.33                              |
| T <sub>9</sub> | 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup> + 50% FYM @ 2.5 Ton ha <sup>-1</sup> | 18.26                              | 8.66                              |
| CD             |                                                                                                       | 1.83                               | 0.85                              |
| SEm±           |                                                                                                       | 0.6                                | 0.28                              |
| CV             |                                                                                                       | 7.85                               | 6.12                              |

**Table 4 :** Effect of N P K, FYM and Vermicompost on Pod yield plant<sup>-1</sup>(g), Pod yield plot<sup>-1</sup> (kg) and Pod yield (q ha<sup>-1</sup>) of garden pea.

| Notation       | Treatments                                                                                             | Pod yield plant <sup>-1</sup> (g) | Pod yield plot <sup>-1</sup> (kg) | Pod yield (q ha <sup>-1</sup> ) |
|----------------|--------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------|---------------------------------|
| T <sub>1</sub> | NPK (30:80:60) Control                                                                                 | 34                                | 4.51                              | 75.27                           |
| T <sub>2</sub> | FYM @ 5 Ton ha <sup>-1</sup>                                                                           | 40.33                             | 5.36                              | 89.38                           |
| T <sub>3</sub> | Vermicompost @ 3 Ton ha <sup>-1</sup>                                                                  | 42                                | 5.58                              | 92.99                           |
| T <sub>4</sub> | 50% NPK (15:40:30) + 50% FYM @ 2.5 Ton ha <sup>-1</sup>                                                | 44                                | 5.84                              | 97.44                           |
| T <sub>5</sub> | 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                                       | 45                                | 5.98                              | 99.66                           |
| T <sub>6</sub> | 50% FYM @ 2.5 Ton ha <sup>-1</sup> + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                       | 46.33                             | 6.15                              | 102.6                           |
| T <sub>7</sub> | 50% NPK (15:40:30) + 100% FYM @ 5 Ton ha <sup>-1</sup>                                                 | 48.33                             | 6.42                              | 107.05                          |
| T <sub>8</sub> | 50% NPK (15:40:30) + 100 % Vermicompost @ 3Ton ha <sup>-1</sup>                                        | 50.66                             | 6.73                              | 112.27                          |
| T <sub>9</sub> | 50 % NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup> + 50% FYM @ 2.5 Ton ha <sup>-1</sup> | 54                                | 7.06                              | 117.77                          |
| CD             |                                                                                                        | 1.8                               | 0.2                               | 3.48                            |
| SEm±           |                                                                                                        | 0.59                              | 0.06                              | 1.15                            |
| CV             |                                                                                                        | 2.29                              | 2.01                              | 2.01                            |

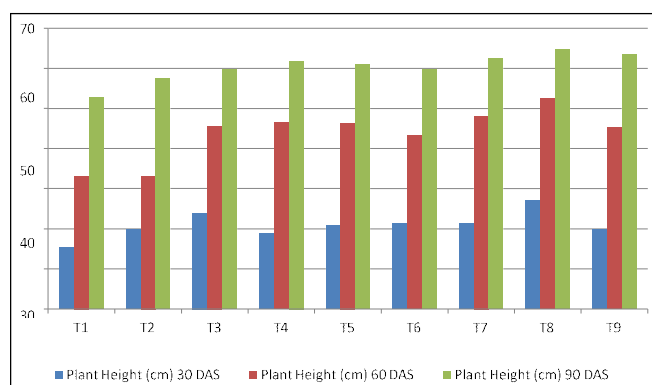
which raised the level of dried materials are moved to the sink, which produces increased yields.

Application of organic and inorganic nutrients had positive increased in yield attributes of the plants, in term of pod yield plot<sup>-1</sup>. The significantly maximum pod yield plot<sup>-1</sup> was obtained 7.06 kg with T<sub>9</sub> while the minimum pod yield plot<sup>-1</sup> were recorded 4.51 kg with T<sub>1</sub> Control. Higher nutrient availability, solubilization effects due to the addition were cited as the cause of the increased pod yield in pea. Using more organic manures and inorganic fertilizer the bodily processes resulting in the accumulation

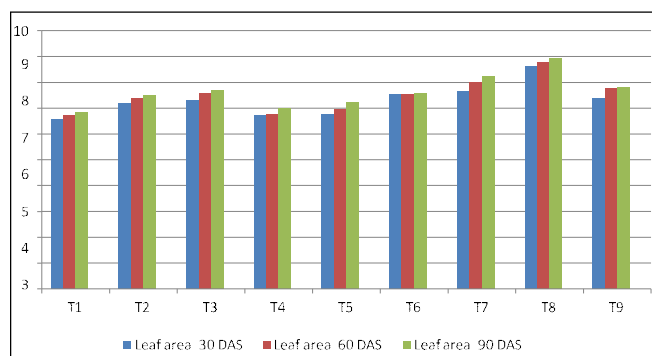
of sufficient food resources are declining and getting better with regard to same outcomes were also recorded for the developing pods by Musinguzi *et al.* (2010). Similar results were found by Attar *et al.* (2013) and Pawar *et al.* (2017) revealed that highest weight of pod (7.3, 7.0 and 7.1 kg), maximum yield of pods plot<sup>-1</sup> (5.3, 5.1 and 5.2 kg) was recorded with (Recommended dose of N as Poultry Manure + P and K + PSB) during the year 2012, 2013 and in pooled analysis, respectively.

Among the entire treatments maximum pod yield (117.77q ha<sup>-1</sup>) was found with T<sub>9</sub> the control plants had





**Fig. 1 :** Effect of organic and inorganic nutrients on plant height (cm) of garden pea.

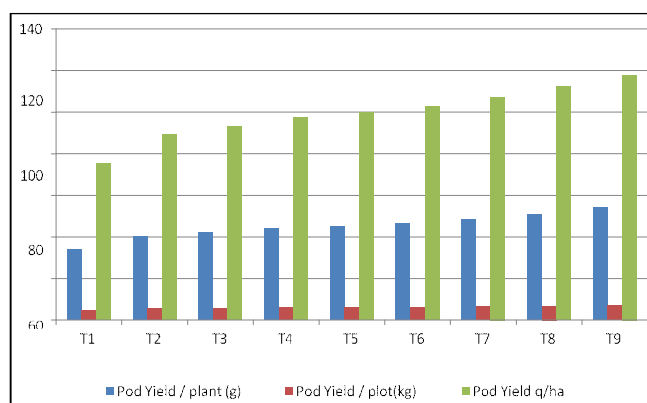


**Fig. 2 :** Effect of organic and inorganic nutrients on leaf area (cm<sup>2</sup>) of garden pea.

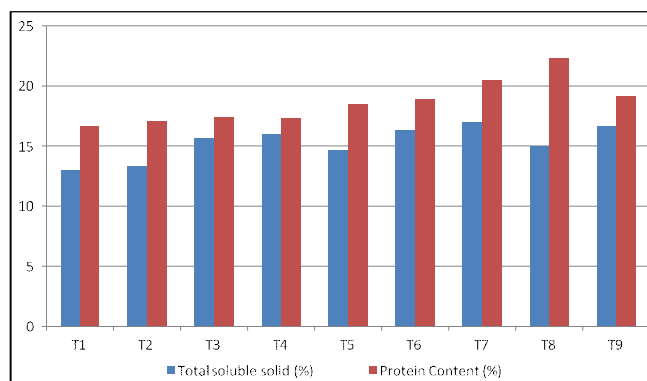
minimum pod yield (75.27q ha<sup>-1</sup>) during investigation. According to the experiment's findings, the soil's improved physicochemical properties may be the cause of the highest crop productivity in the Vermicompost, farmyard manure (FYM) and vermicompost + FYM treatments. These treatments can also be used as resources for maximum crop productivity with a higher economic return than those chemical fertilizers. This observation was determined by Veerabhadraiah *et al.* (2006). The increase in yield is the result of the soil's physical and biological qualities getting better, as well as the addition of extra nutrients through organic manures. The fact that these nutrients are significant components of nucleotides, proteins, chlorophyll, and enzymes and are involved in numerous metabolic processes that directly affect plants' vegetative and reproductive phases may also be the cause of the rise. These results are in accordance with the finding of Sofi *et al.* (2006) and Meena *et al.* (2007). Pawar *et al.* (2017) revealed that, yield of pods ha<sup>-1</sup> (137.9 q) was recorded with (Recommended dose of N as Poultry Manure +P and K+PSB) in garden pea.

#### Quality parameter

The total soluble solids were recorded after harvesting influenced by application of different combinations of organic and inorganic nutrients has been recorded highest



**Fig. 3 :** Effect of organic and inorganic nutrients on pod yield of garden pea.



**Fig. 4 :** Effect of organic and inorganic nutrients on TSS and protein content of garden pea.

with T<sub>7</sub> (17°brix) and minimum with T<sub>1</sub> NPK (30:80:60) Control (13°brix). Vimala and Natarajan (2000) and Gul *et al.* (2006) reported that the TSS content in pea was significantly higher in treatments with Vermicompost in addition to nitrogen and phosphorus at Udhagamandalam. Quality with a combination of N 120 kg, P 80 kg, Rhizobium 2 kg and phospho-bacteria 2 kg ha<sup>-1</sup> was found optimum. The application of different fertilizer doses had a significant effect on TSS. Maximum TSS value was recorded in the plots with 100% recommended NPK dose, which was at par with those applied with 75 per cent recommended NPK fertilizer dose reported by Sepehya *et al.* (2015).

In terms of the protein content of garden peas, the application of organic and inorganic fertilizers resulted in an improvement in the quality features of the plants. The maximum protein content was observed in treatment T<sub>8</sub> 22.31 during the year of investigation. The lowest content of protein in green pods however recorded in control plants (16.61%). On the other hand, additional organics play a crucial role in protein synthesis by improving the availability of N and S through mineralization which helps in formation of sulphur containing amino acids. Similar findings have been reported by Kumar *et al.* (2011).

**Table 5 :** Effect of N P K, FYM and Vermicompost on Total soluble solid (%) and Protein content (%) of garden pea.

| Notation       | Treatments                                                                                            | Total soluble solid (%) | Protein content (%) |
|----------------|-------------------------------------------------------------------------------------------------------|-------------------------|---------------------|
| T <sub>1</sub> | NPK (30:80:60) Control                                                                                | 13                      | 16.61               |
| T <sub>2</sub> | FYM @ 5Ton ha <sup>-1</sup>                                                                           | 13.33                   | 17.06               |
| T <sub>3</sub> | Vermicompost @ 3Ton ha <sup>-1</sup>                                                                  | 15.66                   | 17.38               |
| T <sub>4</sub> | 50% NPK (15:40:30) + 50% FYM @ 2.5 Ton ha <sup>-1</sup>                                               | 16                      | 17.33               |
| T <sub>5</sub> | 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                                      | 14.66                   | 18.5                |
| T <sub>6</sub> | 50% FYM @ 2.5 Ton ha <sup>-1</sup> + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup>                      | 16.33                   | 18.9                |
| T <sub>7</sub> | 50% NPK (15:40:30) + 100% FYM @ 5 Ton ha <sup>-1</sup>                                                | 17                      | 20.46               |
| T <sub>8</sub> | 50% NPK (15:40:30) + 100 % Vermicompost @ 3 Ton ha <sup>-1</sup>                                      | 15                      | 22.31               |
| T <sub>9</sub> | 50% NPK (15:40:30) + 50% Vermicompost @ 1.5 Ton ha <sup>-1</sup> + 50% FYM @ 2.5 Ton ha <sup>-1</sup> | 16.66                   | 19.15               |
| CD             |                                                                                                       | 1.29                    | 0.53                |
| SEm±           |                                                                                                       | 0.42                    | 0.17                |
| CV             |                                                                                                       | 4.85                    | 1.64                |

Fouda (2016) and Vikrant *et al.* (2005) reported that the application of 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> along with basal dose of 20 kg N ha<sup>-1</sup> significantly increased the protein content in grains of cowpea as compared to 20 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> and no phosphorus (control). Similar result was observed by Mankar *et al.* (2020) that quality aspects like protein, the use of Poultry manures @ 0.75 t ha<sup>-1</sup> + Vermicompost @ 0.75 t/ha + Neemcake @ 0.5 t ha<sup>-1</sup> + Mustard cake @ 0.25 t/ha gave better results in comparison to remaining treatments.

## References

- Achakzai, A.K.K. (2012). Effect of various levels of nitrogen fertilizer on some vegetative growth attributes of pea (*Pisum sativum* L.) cultivars. *Pak. J. Bot.*, **44**(2), 655-659.
- Association of Official Analytical Chemists (AOAC). *Official Methods of Analysis*. 10th Edition, Washington D.C., 1970, pp. 154-170.
- Attar, A.V., Patil B.T., Bhalekar M.N. and Shinde K.G. (2013). Effect of spacing and fertilizer levels on growth, yield and quality of garden pea (*Pisum sativum* L.) cv. Phule Priya. *Bioinfolet*, **10**(4B), 1240-1242.
- Banik, P., Ghosal P.K., Sasmal T.K., Bhattacharya S., Sarkar B.K. and Bagchi D.K. (2006). Effect of organic and inorganic nutrients for soil quality conservation and yield of rainfed lowland rice in sub-tropical plateau region. *J. Agron. Crop Sci.*, **192**, 331-343.
- Bhardwaj, A.K., Rajwar D., Yadav R.K., Chaudhari S.K. and Sharma D.K. (2021). Nitrogen availability and use efficiency in wheat crop as influenced by the organic-input quality under major integrated nutrient management systems. *Front. Plant Sci.*, **12**, 752.
- Chauhan, H.S., Joshi S.C. and Rana D.K. (2010). Response of vermicompost on growth and yield of pea (*Pisum sativum* L.) cv. Arkel. *Nature and Science*, **8**(4), 18-21.
- Datt, N., Sharma R.P. and Sharma G.D. (2003). Effect of supplementary use of farmyard manure along with chemical fertilizers on productivity and nutrient uptake by vegetable pea (*Pisum sativum* var. *arvense*) and build up of soil fertility in Lahaul valley of Himachal Pradesh. *Indian J. Agricult. Sci.*, **73**(5), 266-268.
- Dubey, D.K., Singh S.S., Verma R.S. and Singh P.K. (2012). Integrated nutrient management in garden pea (*Pisum sativum* var. *hortense*). *HortFlora Research Spectrum*, **1**(3), 244-247.
- Dutta, A.K. and Majee S.K. (2021). Performance of organically grown garden pea varieties in the south Chhotanagpur plateau of eastern India. *J. Appl. Hortic.*, **23**(1), 78-83.
- Fouda, K. (2016). Effect of Bio and Organic Fertilization on Chemical Constituents of Pea Plants and availability of NPK. *J. Soil Sci. Agricult. Engg.*, **7**(9), 693-698.
- Gopinath, K.A. and Mina B.L. (2011). Effect of organic manures on agronomic and economic performance of garden pea (*Pisum sativum*) and on soil properties. *Indian J. Agricult. Sci.*, **81**(3), 236.
- Gul, N.I., Jilani M.S. and Wasim K. (2006). Effect of split application of nitrogen levels on the quality and quality parameters of pea (*Pisum sativum* L.). *Int. J. Agricult. Biol.*, **8**(2), 226-230.
- Gupta, S., Singh D.P., Kasera S. and Maurya S.K. (2017). Effect of integrated nutrient management on growth and yield attributes of table pea (*Pisum sativum* L.) cv. AP-3. *Int. J. Chem. Stud.*, **5**(6), 906-908.
- Jaipaul, S.S., Dixit A.K. and Sharma A.K. (2011). Growth and yield of capsicum (*Capsicum annum*) and garden pea (*Pisum sativum*) as influenced by organic manures and biofertilizers. *Indian J. Agricult. Sci.*, **81**(7), 637-642.
- Kumar, J. (2011). Effect of phosphorus and Rhizobium inoculation on the growth, nodulation and yield of garden pea (*Pisum*



- sativum* L.) cv. "Mattar Ageta6". *Leg. Res.-An Int. J.*, **34**(1), 20.
- Kumar, R., Deka B.C., Kumawat N. and Ngachan S.V. (2014). Effect of integrated nutrition, biofertilizers and zinc application on production potential and profitability of garden pea (*Pisum sativum* L.) in Eastern Himalaya, India. *Leg. Res.-An Int. J.*, **37**(6), 614-620.
- Kumaran, S. (2001) Response of groundnut to organic manure, fertilizer levels, split application of phosphorus and gypsum application under irrigated condition. *Res. Crops*, **2**(2), 156-158.
- Lalito, C., Bhandari S., Sharma V. and Yadav S.K. (2018). Effect of different organic and inorganic nitrogenous fertilizers on growth, yield and soil properties of pea (*Pisum sativum* L.). *J. Pharmacog. Phytochem.*, **7**(4), 2114-2118.
- Lowry, O.H., Rosebrough N.J., Farr A.L. and Randall R.J. (1951). Protein measurement with the Folin phenol reagent. *J Biol Chem.*, **193**(1), 265-275.
- Mankar, A., Kumar C., Karuna K., Solankey S.S., Singh V.K. and Singh R. (2020). Response of different organic sources on growth, yield and quality of garden pea (*Pisum sativum* L. var. *hortense*) cv. Kashi Uday. *IJCS*, **8**(1), 1878-1882.
- Meena, R.N., Singh Y., Singh S.P., Singh P. and Singh K. (2007). Effect of sources and level of organic manures on yield, quality and economics of garden pea (*Pisum sativum* L.) in eastern Uttar Pradesh. *Veg. Sci.*, **34**(1), 60-63.
- Mishra, N., Mahapatra P., Mohanty S. and Pradhan M. (2014). Effect of soil amelioration, inorganic, organic and bio-fertilizer application on yield, quality and economics of snow pea (*Pisum sativum* L. var. *macrocarpon*). *J. Crop and Weed*, **10**(1), 48-52.
- Musinquzi, P., Tenya J.S. and Bekunda M.A. (2010). Strategic nutrient management of field pea in South-Western Uganda. *Afr. J. Food, Agric., Nutr. Develop.*, **10**(6), 2695-2706.16.
- Nadeem, N.M., Irfan J. Khan, Nabi, G., Muhammad N. and Badshah N. (2002). Influence of various levels of nitrogen and phosphorus on growth and yield of chilli (*Capsicum annum* L.). *Asian J. Pl Sci.*, **1**, 599-601.
- Negi, S., Singh R.V. and Dwivedi O.K. (2006). Effect of biofertilizers, nutrient sources and lime on growth and yield of garden pea. *Leg. Res.-An Int. J.*, **29**(4), 282-285.
- Patil, C. R., & Alagawadi, A. R. (2010). Microbial inoculants for sustainable legume production. Microbes for legume improvement, 515-536.
- Pawar, Y., Varma L.R., Verma P., Joshi H.N., More S.G. and Dabhi J.S. (2017). Influences of integrated use of organic and inorganic sources of nutrients on growth, flowering and yield of garden pea (*Pisum sativum* L.) cv. Bonneville. *Leg. Res.-An Int. J.*, **40**(1), 117-124.
- Prabhakar, M., Hebbar S.S. and Nair A.K. (2011). Growth and yield of French bean (*Phaseolus vulgaris* L.) under organic farming. *J. Appl. Horticult.*, **13**(1), 72-73.
- Ram, L., Jha A.K., Patel S.K., Kumar A. and Kumar A. (2021). Response of vermicompost and levels of nitrogen on growth, yield and yield attributes in pea (*Pisum sativum* L.) rhizosphere.
- Sankhyan, N.K., Bharat Bhushan and Sharma P.K. (2001). Effect of phosphorus, mulch and farm yard manure on soil moisture and productivity of maize in mid hills of Himachal Pradesh. *Res. Crops*, **2**(2), 116-119.
- Sepehya, S., Bhardwaj S.K. and Dhiman S. (2015). Quality attributes of garden pea (*Pisum sativum* L.) as influenced by integrated nutrient management under mid hill conditions. *J. Krishi Vigyan*, **3**(2), 78-83.
- Sharma, U. and Chauhan J.K. (2011). Influences of integrated use of inorganic and organic sources of nutrients on growth and production of pea. *J. Farm Sci.*, **1**(1), 14-18.
- Singh, K.P. and Bahadur A. (2015). *Vegetable production and improvement*. 1st edn. Kalyani Publishers, New Delhi. Pp. 299-300.
- Singh, S.P. and Singh B. (2002). Effect of Rhizobium inoculation and phosphorus application on growth and yield of pea (*Pisum sativum* L.) cv. Bonneville. *Bioved*, **13**, 69-72.
- Sofi, A.H., Singh A.K., Ahmed N., Narayan S. and Mofti Shahnaz (2006). Effect of organic manures and inorganic fertilizers on maturity growth, yield and economics of garden pea cv Azad P-1. *Environ. Ecol.*, **245 Special 3A**, 857-859.
- Veerabhadraiah, T.N., Chamegowda and Badrinath T.C. (2006). Cosequences of organic and inorganic sources of nutrients on physico-chemical properties of soil under French bean land use cover. *The 18th World Congress of Soil Science* 163-20.
- Vijayvardhan, V. (1999). Studies on levels of substitution of chemical fertilizers by organic manures in clusterbean (*Cyamopsis tetragonoloba* (L.) Taub.) cv. Pusa naubahar in middle Gujarat climatic conditions. AAU, Anand.
- Vikrant, Singh H., Malik C.V.S. and Singh B.P. (2005). Grain yield and protein content of cowpea as influenced by farm yard manures and phosphorus application. *Indian J. Pulses Res.*, **18**(2), 250-251.
- Vimla, B. and Natrajan S. (2000). Effect of nitrogen, phosphorus and biofertilizers on pod characters, yield and quality in pea (*Pisum sativum* L. spp. *hortense*). *South Indian Horticulture*, **48**, 60-63.
- Waseem, K., Kamran A.M. and Jilani M.S. (2002). Effect of different levels of nitrogen on the growth and yield of Cucumber (*Cucumis sativus* L.). *J. Agric. Res.*, 259-266.
- Yadav, A.K., Naleeni R. and Dashrath S. (2019). Effect of organic manures and biofertilizers on growth and yield parameters of cowpea (*Vigna unguiculata* (L.) Walp.). *J. Pharmacog. Phytochem.*, **8**(2), 271-274.
- Yadav, D.D., Kumar Y., Balaji R. and Pandey A.K. (2018). Efficacy of organic manures and bio fertilizers on growth and productivity of dwarf pea (*Pisum sativum* L.). *J Pharm Phytochem.*, **7**, 3823-3826.
- Yadav, H. and Vijayakumari B. (2003). Influence of vermicompost with organic and inorganic manures on biometric and yield parameters of chilli [*Capsicum annum* (L.) var. Plri]. *Crop Res.*, **25**(2), 236- 243.
- Yadav, V.S. and Luthra J.P. (2005). Effect of organic manures at different levels of phosphorus on yield and economics of vegetable pea. *Udyanika (J. Horticult. Sci.)*, **11**(2), 120-122.