

Impact of inorganic fertilizers and organic manures on soil health, growth and yield attributes of Pea (*Pisum sativum* L.) cv. Arkel

Theruovino Metha, Narendra Swaroop, Tarence Thomas

Department of Soil Science, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Deemed-to-be-University), Allahabad, Uttar Pradesh, India

Abstract

A field experiment was conducted during Rabi seasons of 2015-2016 to find out the Impact of Inorganic fertilizers and organic manures on soil health, growth and yield attributes of Pea (*Pisum sativum* L.) cv. Arkel at the research farm of Department of Soil Science, Sam Higginbottom Institute of Agriculture Technology and Sciences (Formerly- Allahabad Agriculture Institute) Deemed-to-be-University, Allahabad U.P., India. The experiment was laid out in a Randomized Block Design with three replications in sandy loam soil. During the experimentation, growth and yield characters were recorded. The lowest values related to all parameters were obtained in the control treatment. A comparative study of the findings led to the conclusion that sowing of Pea with the application of NPK @ 40:80:40 kg/ha and FYM @ 20t/ha was found most effective for best growth of Pea crop under Allahabad region of Uttar Pradesh State, India.

Keywords: Inorganic Fertilizers, Organic Manure, Growth, Yield, Economics and Garden Pea (*Pisum sativum* L.)

1. Introduction

Food is the primary necessity of life. It serves the physiological functions related to supply of energy, building and maintaining the cells and tissues and regularity of body processes. These needs are satisfied by the nutrients present in the food. Mainly, cereals and pulses are the basic vegetarian food source for Indian society.

Pea (*Pisum sativum* L.) is one of the most important vegetables in the world and ranks among the top 10 vegetable crop. Pea (*Pisum sativum* L.) derives from the Middle East and was first cultivated roughly 10,000 years ago (Mithen, 2003). It can be grown on many types of soil-light sandy loam, to clay soil. Pea needs well-drained soils. The fields should be prepared to get fine, firm and leveled beds for sowing. Well-drained soils, loose, friable and heavy soils are ideal. Pea does not thrive on acidic soils.

In India pea covers an area of 5.83 lakh hectares with a production of about 40 lakh tonnes. UP is the most Pea growing state; UP alone produces about 46% of total pea produced in India. According to National Horticulture Board Estimates, (NHB, 2013-14) ^[10]. Nutrient balance is the key component to increase crop yields. Providing of these nutrients through organics and combination with organics and inorganics has a direct impact on soil health and crop productivity (Datt *et al.* 2003) ^[2].

Inorganic fertilizer as like (nitrogen) is important for all crops. It increases growth and development of all living tissues and increases protein content in the pulses. It also increases utilization of phosphorus and potassium to an appreciable extent. Inorganic fertilizer (i.e. P) not only improves the growth, seed yield, nodulation and quality of legumes, but also increases the organic matter, nitrogen and P content in soils, have reported that yield of grains increases with the increasing levels of phosphorus. Phosphorus is the second most important plant nutrient that must be added to the soil to maintain plant

growth and sustain crop yield. Potassium enables crops to tolerate water stress, and bringing about improvement in crop yield and quality. Organic manure like FYM or compost is applied to enrich the soil fertility and provide plants with many macro and micro nutrients. Farm yard or compost manure seems to act directly for increasing the crop yields either by acceleration of respiratory process with increasing cell permeability and hormonal growth action or by combination of all these processes. It improves physical-chemical properties of soil such as aggregation, aeration, permeability, water holding capacity, slow release of nutrients, increase in cation exchange capacity, stimulation of soil flora and fauna etc.

2. Materials and Methods

The research work was carried out at the Soil Science Research Farm, Sam Higginbottom Institute of Agriculture Technology & Sciences Deemed-to-be University, Allahabad during Rabi Season of 2015-2016. Agroclimatically, Allahabad district represents the subtropical belt of the South East of Uttar Pradesh, and is endowed with extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46°C-48°C and seldom falls as low as 4°C -5°C. The relative humidity ranged between 20 to 94 percent. The average rainfall of this area is around 1100mm annually. The experiment was carried out in a Randomized Block Design (RBD) with three levels of inorganic fertilizer N, P, K (40, 80, 40 ha⁻¹) and organic manure FYM (20 t ha⁻¹), the treatments were replicated three times. Treatments were T₀ (Control), T₁ (N₀P₀K₀ ha⁻¹ + FYM₁₀ t ha⁻¹), T₂ (N₀P₀K₀ ha⁻¹ + FYM₂₀ t ha⁻¹), T₃ (N₂₀P₄₀K₂₀ ha⁻¹ + FYM₀ t ha⁻¹), T₄ (N₂₀P₄₀K₂₀ ha⁻¹ + FYM₁₀ t ha⁻¹) T₅ (N₂₀P₄₀K₂₀ ha⁻¹ + FYM₂₀ t ha⁻¹), T₆ (N₄₀P₈₀K₄₀ ha⁻¹ + FYM₀ t ha⁻¹), T₇ (N₄₀P₈₀K₄₀ ha⁻¹ + FYM₁₀ t ha⁻¹), T₈ (N₄₀P₈₀K₄₀ ha⁻¹ + FYM₂₀ t ha⁻¹). During the experimentation, growth and yield characters were recorded.

The source of inorganic nutrients was Urea, SSP, MOP and organic nutrient was FYM respectively.

3. Results and Discussions

i) Plant height (cm)

At 20DAS maximum plant height (9.73cm) was obtained at T₈ and a minimum of (7.93cm) at T₀ (Control). At 40DAS maximum plant height (40.40cm) was obtained at T₈ (N₄₀P₈₀K₄₀FYM₂₀) while the minimum was recorded at T₀ (Control). The plant height at 40DAS was found to be significant. At 60DAS maximum plant height (60.50cm) was recorded at T₈ (N₄₀P₈₀K₄₀FYM₂₀) and a minimum of (35.13cm) was found at T₀ (Control). Similar observations have been reported by Ilhe *et al.* (2007) [5], Erman *et al.* (2009) [4].

ii) Leaves per plant (no)

Number of leaves increased as the age of plant progressed. Increasing levels of NPK 40, 80, 40kg ha⁻¹ increased the no of leaves from 18.33, 32.67 and 60.33 in N₀P₀K₀FYM₀ treatment (control), to a maximum of 24.33, 44.33 and 82.33 in (N₄₀P₈₀K₄₀FYM₂₀) treatment receiving 40, 80 and 40kg ha⁻¹ NPK and 20t FYM/ha applied at 20, 40 and 60 DAS respectively. Similar results have also been reported by Ilhe. *et al.* (2007) [5].

iii) Branches per plant (no)

At 20, 40 and 60 DAS, the number of branches increased significantly with the increasing levels of NPK and FYM. The maximum number of branches recorded was 5.67, 8.33 and 13.33cm with treatment T₈ (N₄₀P₈₀K₄₀FYM₂₀) at 20, 40 and 60 DAS respectively, the minimum number of branches recorded was 4.00, 8.33 and 8.67 cm accordingly at T₀(control). Similar results were reported by Aga *et al.* (2004) [1], Kumar *et al.* (2004) [6].

iv) Pods per plant (no)

The data shows that there was a significant influence of different levels of NPK and FYM on the number of pods per plant. Treatment combination T₈ (N₄₀P₈₀K₄₀FYM₂₀) recorded maximum number of pods plant⁻¹ (19.00), followed by (18.33) with T₇ (N₄₀P₈₀K₄₀FYM₁₀), whereas, T₀ (control) recorded the minimum (10.33). Similar results have been reported by Sundara *et al.* (2004) and Erman *et al.* (2009) [12, 4].

v) Seeds per pods (no)

The maximum number of seeds pod⁻¹ (7.67) was recorded with treatment combination T₈ (N₄₀P₈₀K₄₀FYM₂₀) followed by (7.00) with T₇ (N₄₀P₈₀K₄₀FYM₁₀) whereas, T₀ (control) recorded a minimum (4.33). Similar results were also reported by Meena *et al.* (2010), Sundara *et al.* (2004), Prasad *et al.* (2005) [8, 4, 11].

vi) Length of pod (cm)

The longest pod (9.5cm) was obtained with treatment combination T₈ (N₄₀P₈₀K₄₀FYM₂₀), followed by (9.4cm) at T₇ (N₄₀P₈₀K₄₀FYM₁₀), and the minimum was (7.5cm) recorded at T₀ (Control). The plants treated with different combinations of NPK and FYM resulted into higher length of pods. Similar results were reported by Nadeem *et al.* (2003) and Prasad *et al.* (2005) [9, 11].

vii) Pod yield (q/ha)

The maximum pod yield (94.37) was recorded at T₈ (N₄₀P₈₀K₄₀FYM₂₀), while the minimum (75.17) was recorded at T₀ (Control). The maximum pod yield (94.37) at T₈ N₄₀P₈₀K₄₀FYM₂₀ was more significantly higher than the remaining treatment combinations. Pod yield gradually increased with increasing levels of NPK and FYM. Similar results were also reported by Datt *et al.* (2003); Ilhe *et al.* (2007) [2, 5].

Table 1: Impact of Inorganic fertilizers and organic manures on soil health, growth and yield attributes of Pea (*Pisum sativum* L.) cv. Arkel (60DAS)

Treatment Combination	Plant height (cm)	Leaves per plant(no)	Branches per plant(no)	Pods per plant(no)	Seeds per Pod(no)	Length of Pod (cm)	Pod yield (q/ha)	Cost Benefit Ratio (C:B)
T0	35.13	60.33	8.67	10.33	4.33	7.5	75.17	4.92
T1	40.53	67.33	9.00	13.33	4.67	8.1	75.20	5.23
T2	42.37	69.67	9.67	10.67	5.00	8.4	81.53	4.97
T3	48.77	74.67	10.00	14.33	5.00	8.2	80.60	5.77
T4	52.93	75.33	10.67	16.00	5.33	9.1	85.23	5.40
T5	49.60	73.33	12.67	17.33	6.33	9.5	92.50	5.20
T6	55.70	80.00	11.67	16.33	6.67	8.8	88.23	5.82
T7	55.80	77.67	13.00	18.33	7.00	9.4	90.33	5.266
T8	60.50	82.33	13.33	19.00	7.67	9.5	94.37	6.07
Mean	63.60	84.93	14.07	20.40	7.86	9.8	97.08	5.89
F-test	S	S	S	S	S	S	S	
S.Em(±)	3.569	3.979	1.017	0.901	0.430	0.619	3.835	
C.D. at 5%	7.566	8.435	2.156	1.910	0.912	0.292	8.129	

4. Conclusion

The combined application of NPK @ 40, 80 40kg ha⁻¹ + FYM @ 20 t ha⁻¹ gave the best results in terms of growth, pod yield and highest cost benefit ratio (Rs.1:6.07) of garden pea. Since the result is based on one year experiment, further trial is needed to authenticate the results.

5. Reference

- Aga FA, Singh JK, Singh DK, Peer FA. Effect of different levels of compost and phosphorous on growth and yield of pea (*Pisum sativum* L.) under rainfed condition. *Environmental and Ecology*. 2004. 22(2): 653-356. 5 ref.

2. Datt N, Sharma RP, Sharma GD. Effect of supplementary use of farmyard manure along with chemical fertilizers on productivity and nutrient uptake by vegetable pea (*Pisum sativum* var. *arvense*) and buildup of soil fertility in Lahaul valley of Himachal Pradesh. *Indian Journal of Agricultural Sciences* 2003. 73:266-268.
3. Erman M, Yildirim B, Togay B. Effect of phosphorus application and rhizobium inoculation on the yield, nodulation and nutrient uptake in field pea (*Pisum sativum* L.). *Journal of Animal and Veterinary Advances*, 2009. 8:2, 301-310.
4. Ilhe RS, Solanke AV, Dhumal SS, Ilhe BM, Kshirsagar, DB. Effect of organic manures and inorganic fertilizers on growth and yield of green pea (*Pisum sativum* L.). *Asian Journal of Soil Science*; 2007. 2:2, 153-155. 7 ref.
5. Kumar M, Sinha KK, Roy Sharma 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.
6. Mithen. *After the Ice: A Global Human History 20,000-5,000 BC*. Weidenfield and Nicholson, London. 2003.
7. Meena RN, Singh SP, Kalyan Singh. Effect of organic nitrogen nutrition on yield, quality, nutrient uptake and economics of rice (*oriza sativa*) – table pea (*Pisum sativum* var. *hortense*) – onion (*Allium cepa*) cropping sequence. *Indian Journal of Agricultural Sciences*. 2010. 80:11, 1003-100. 10 ref.
8. Nadeem Akhtar, Muhammad Amjad, Muhammad Akbar Anjum. Growth and Yield Response of Pea (*Pisum Sativum* L.) Crop to Phosphorus and Potassium Application. *Pak. J. Agri. Sci.*, 2003. 40(3-4).
9. NHB. Annual report, 2013-14, National Horticulture Board, Ministry of Agriculture, Government of India. 2013-14. 172-173
10. Prasad Kedar, Kumar Sanjay, Pyare JPS. Effect of FYM and biofertilizer in conjunction with inorganic fertilizer on growth, yield and profit of chickpea (*Cicer arietinum* L.). *Plant Archives*, 2005. 5(2): 609-612.
11. Sundara TH, Vyakaranahal BS, Shekhargouda M, Shashidhara SD, Hosamani RM. Influence of phosphorus and micronutrients on seed yield and quality of pea (*Pisumsativum* L.). 2004.