www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(5): 2481-2485

www.thepharmajournal.com
Received: 16-02-2022
Accepted: 31-03-2022

Shivani Jolly
PG Scholar, Department of Soil Science and Agricultural Chemistry, Lovely Professional University, Phagwara, Punjab, India

Harmohan Singh Yadav
Assistant Professor, Department of Soil Science and Agricultural Chemistry, Lovely Professional University, Phagwara, Punjab, India

Vikas Sharma
Assistant Professor, Department of Soil Science and Agricultural Chemistry, Lovely Professional University, Phagwara, Punjab, India

Corresponding Author:
Shivani Jolly
PG Scholar, Department of Soil Science and Agricultural Chemistry, Lovely Professional University, Phagwara, Punjab, India

Response of integrated nutrient management (INM) on growth and yield parameters of Pea (*Pisum sativum*) crop

Shivani Jolly, Harmohan Singh Yadav and Vikas Sharma

Abstract
A field experiment was conducted at Research Farm, Lovely Professional University, Jalandhar (Phagwara) during rabi season of November (2021) to March (2022) to investigate the response of Integrated Nutrient Management (INM) on growth and yield parameters of Pea crop with seven treatments i.e T_1 (Control), T_2 (100% NPK), T_3 (125% NPK), T_4 (75% NPK without vermicompost), T_5 (75% NPK with vermicompost 2 t ha^{-1}), T_6 (50% NPK without vermicompost),T_7 (50% NPK with vermicompost 2 t ha^{-1}) in four replications. The result revealed that the growth parameters such as plant height, number of leaves, number of pods, number of grains, fresh weight and dry weight, yield of seeds were found to be highest under treatment T_3 (125% NPK) followed by treatment T_5 (75% NPK with vermicompost 2 t ha^{-1}). The application of NPK through inorganic source as ell as vermicompost will significantly enhanced yield attributes at all level of fertilizer. The overall result revealed that the integrated application of organic and inorganic source (Vermicompost) will surely help farmers the getting more yield of pea crop. Application of organic source of fertilizer (vermicompost) along with deficit dose of chemical fertilizer (75% of NPK) will reduce consumption of chemical fertilizer (upto 25%), which will not harm the health of soil for growing pea crop.

Keywords: Integrated nutrient management (INM), vermicompost, crop yield, npk and pea crop

Introduction
Pea (*Pisum sativum*) is one of the critical vegetables that is grown globally and ranks among the top 10 vegetable crops in the world. Pea is typically utilized in human weight loss throughout the world and it is rich in protein (21-25%), vitamin A and Ca, phosphorous and has high levels of amino acids, lysin and trypophan (Bhat *et al*., 2013). It maintains soil fertility through biological nitrogen fixation in association with symbiotic rhizobium prevalent in root nodules and thus plays a vital role in fostering sustainable agriculture (Negi *et al.* 2006). Its own requirement of nitrogen, peas are known to leave behind residual nitrogen in soil 50-60 kg/ha (Kanwar *et al* 1990) [1]. In this way increasing soil nitrogen level that will be used up by next growing crop. Chemical fertilizers are needed to get better crop yields but their overuse is harmful for the environment and their cost cannot make economic and profitable agricultural products (Bobade *et al.*, 1992) [2]. The annual consumption of N: P: K during year 2015-16 was 173.7: 69.7: 24 Lakh Tonne in India (Sharma *et al*., 2019) [10]. The maximum amount of chemical fertilizer import from other countries. The increased use of chemicals under intensive cultivation has not only contaminated the ground and surface water but has also disturbed the harmony existing among the soil plant and microbial population (Bahadur *et al*. 2006) [3]. So there is need to make a judicious balance of organic and inorganic fertilizers. In India, it is mainly grown as winter vegetable in the plains of North India and as summer vegetable in the hills. It is generally used as fresh vegetable and in the form of canned, processed or dehydrated. Pea occupies an area of 0.408 million hectares with the production of 3.74 million tonnes in India (Anonymous, 2012). It is cultivated in Punjab to indicate data for Punjab. It is largely cultivated to indicate data related to Jalandhar. The average yield of pea is 70-80 q (green pods) per hectare with a shelling percentage of 30-35 (Fageria *et al.*, 2003). About 93-99 per cent of the total phosphorus is insoluble and hence directly not available to plants. Only about a quarter of water soluble phosphate is taken up by plants in the season of the application and the remaining is converted into insoluble (unavailable) forms (Verma, 1993). Inoculation of P solubilizing microorganisms (PSB) in the rhizosphere of crop and soil increases the availability of P from insoluble sources of phosphate, desorption of fixed

phosphates and also increases the efficiency of phosphatic fertilizers (Gaur, 1991). The inoculated phosphate solubilizing bacteria secrete acidic substances and solubilize unavailable soil phosphorus and make available to plants. Vermicompost is a source of N, P, K and micronutrients. Besides containing a good proportion of exchangeable Ca, Mg, Na, etc., it adds organic carbon to the soil and helps to release the nutrients slowly. Some of the secretions of worms and the associated microbes act as growth promoters. It is also rich in growth hormones, vitamins and acts as powerful biocide against diseases and nematodes besides improving physical condition of soil. Poor nutrient economy of light textured soils necessitates the need for supplementing fertilizer with organic manures.

Materials and Methods

Study Area

The field experiment was conducted during rabi season 2021-2022 at Research farm of Lovely Professional University, Jalandhar, Phagwara adjoining the department of Soil Science and Agriculture Chemistry situated at 31.25°N latitude and 75.70°E longitude and at an altitude of 105.5 m above sea level, to study the response of Integrated Nutrient Management on growth and yield of Pea (*Pisum Sativum*). An average annual rainfall is 816 mm, mostly received during monsoon season (June to September). The rainfall trend shows a continuous decrement in average annual rainfall in India (Sharma, 2020) [11]. The study area is characterized by sub humid climate. The soil type was sandy loam. The maximum temperature goes as high as 32.2 °C during summer and minimum as low as 6 °C during winter months. The soil of experimental field was sandy loam with low in available nitrogen (256.72kg ha-1), low in available phosphorus (26.7760 kg ha-1) and medium in available potassium (96.0672kg ha-1). The pH and E.C. were 8.75 and 0.273 dsm-1 respectively.

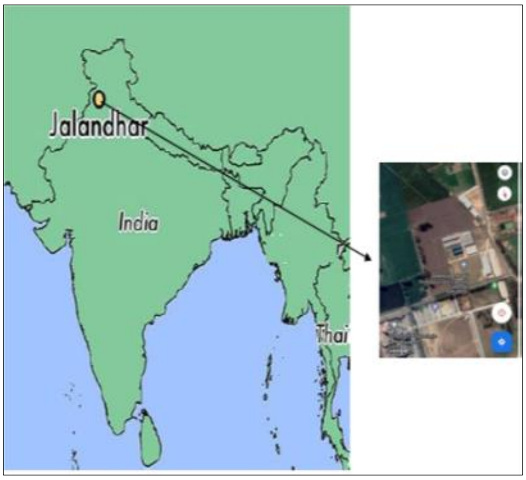

Plate 1: Location of study area

Experimental details

The experiment was laid out in a randomized block design with seven treatments and four replications viz. T_1 (Control), T_2 (100% NPK), T_3(125% NPK), T_4(75% NPK without vermicompost), T_5(75% NPK with vermicompost 2t ha^{-1}), T_6(50% NPK without vermicompost), T_7 (50% NPK with vermicompost 2t ha^{-1}). The plot size for each treatment is 2×2 m. Nitrogen, phosphorous and Potassium were applied as per treatment, half dose of nitrogen, full dose of phosphorous and potassium were applied at time of sowing and rest dose of nitrogen in two equal split one at 45 and 2nd at 60 days after sowing. Vermicompost were applied before 15 days of sowing.

Method of sowing and fertigation scheduling

Pea seeds were directly sown on 1st of December 2021 with the plant spacing 15cm and row spacing of 50 cm on all treatments with four replications. In this study @250 q ha^{-1} was applied during land preparation. Recommended dose of Fertilizer (RDF) N:P:K, 20:60:40 kg ha-1 were supplied as per respective treatments.

Crop observation

The plant height of selected plants for each treatment was recorded at 30 days interval and at harvest in all replication. The total weight of pea was recorded at the time of each harvesting for each treatment in all replications and then average weight of fruit was calculated. The lengths of pea were recorded at the time of each harvesting for each treatment in all replications and then average length of pea was carried out. The yield of pea seeds per plot (kg) was weighed separately at the time of each harvesting for each treatment in all replications and then it was converted in to total yield of pea per hectare (t ha^{-1}).

Procedure for calculation of EC, pH and NPK in soil

In order to evaluate the physico-chemical properties, soil samples from 0-15 cm depth were taken from different random spots of the experimental field prior to layout and representative composite sample was prepared by mixing and processing of all soil samples together. The homogeneous composite soil sample was subjected to mechanical, physical and chemical analysis. The soil p H was determined with the help of glass electrode pH meter in 1:2.5 soil water suspensions as described by Jackson (1973). The electrical conductivity (EC) was determined with the help of conductivity bridge using 1:2.5 soil water suspension as described by Jackson (1973). Organic carbon (OC) was determined following Walkley and Black's rapid titration method as advocated by Jackson (1973). The available nitrogen (N) content in the soil sample was determined by alkaline permanganate method as described by Subbiah and Asija (1956). The available phosphorus (P) content in the soil sample was determined by Olsen's method (Olsen *et al.*, 1954). The available potassium (K) content in the soil sample was determined by flame photo meter by the method as described by Jackson (1973).

Results and Discussion

Effect of different treatment on plant height

The data obtained in relation to plant height are presented in Table 1. It is evident from the table that plant height at 30, 45 and 60 days after sowing, maximum plant height was recorded with treatment T_3 followed by remaining treatments in decreasing order as T_4> T_2> T_6>T_5> T_1. It indicates that application of NPK and vermicompost in combination significantly increased the plant height as compared to control. Plant height was maximum at treatment T_3 because of that application of vermicompost enhances the organic matter. In this treatment which increases the microbial activity for more nitrogen fixation from atmosphere. Further, all the treatments increased the plant height when compared with control. All the treatments containing NPK and vermicompost play a significant role in increment of plant height. The maximum plant height was recorded in case of treatment T_3 (59cm) and minimum in treatment T_1 (38cm).The results corroborated the finding of Kumar and Singh (2010) [7].

Table 1: Effect of NPK and vermicompost application on number of plant height plant-1 of pea crop

Treatments	Days after sowing (DAS)		
	30	**60**	**90**
T_1(Control)	7.83	18	26.85
T_2(100% NPK)	9.6	21.75	29.55
T_3(125% NPK)	10.95	23.82	31.85
T_4(75% NPK without vermicompost)	10.4	22.1	31.05
T_5(75% NPK with vermicompost 2t ha^{-1})	10.87	23.9	32
T_6(50% NPK without vermicompost)	10	21.78	29.93
T_7(50% NPK with vermicompost 2t ha^{-1})	10.28	22.5	30.83
SEM (±)	0.106	0.337	0.264
CD	0.318	1.009	0.791

Effect of different treatment on number of leaves

The results pertaining to influence of integrated use of NPK, vermicompost on number of leaves measured at 30, 45 and 60 DAS is presented in Table 2. Application of 125% NPK significantly increased number of leaves as compared to other treatments. Results showed that incorporation of organic manures and biofertilizers could be reduced the chemical fertilizers upto 25%. It was also found that integration of organic manures and chemical fertilizers significantly increased number of leaves over chemical fertilizers alone. Effect of verious treatment on number of leaves could be arranged in order to T_3 (48.7) >T_5 (47.9) > T_2> T_4 > T_7> T_6 > T_1 under respective treatments. Similar results also reported by Singh *et al.* (2009).

Effect of different treatment on Number of Pods per plant

The effect of treatments on number of pod/plant were recorded and presented in Table 3. The results showed favourable response to application of NPK and vermicompost Maximum number pods were recorded in treatment T_3 (24.5) followed by other treatment T_5 (21.91). It indicated that integration of organic manures, biofertilizers and chemical fertilizers significantly increased number of pod per plants over chemical fertilizers alone. Treatment T_3 registered significantly superior as compared to all the other treatments. The increased yield with NPK and FYM application might be due to increased availability absorption and translocation of nutrient under NPK and FYM treated plots Rajkhowa *et al.*

Table 2: Effect of NPK and vermicompost application on number of leaves jplant-1 of pea crop

Treatments	Days after sowing (DAS)		
	30	**60**	**Maturity**
T_1(Control)	19.45	36.9	20.58
T_2(100% NPK)	23.65	45.5	24.31
T_3(125% NPK)	25.45	48.7	26.75
T_4 (75% NPK without vermicompost)	21.95	43.3	23.55
T_5 (75% NPK with vermicompost 2t ha^{-1})	24.9	47.9	26.14
T_6 (50% NPK without vermicompost)	20.85	39.5	22.25
T_7 (50% NPK with vermicompost 2t ha^{-1})	22.54	43.1	24.25
SEM (±)	0.279	0.603	0.387
CD	0.836	1.807	1.159

Effect of different treatment Number of grains per plant

The effect of treatments on number of grains/plant were recorded and presented in Table 3. In this view number pods were recorded in treatment T_3 (9.5) followed by treatment T_5 (9.3). Results indicated that integration of organic manures, vermicompost and chemical fertilizers significantly enhanced number of grains per plants due to more availability of nitrogen and other nutrient in plant root zone. Treatment T3 registered significantly superior as compared to all the other treatments.

Table 3: Effect of integrated use of NPK, FYM, bio-fertilizer and vermicompost on the root nodules, number grain per pod, grain yield and stover on pea crop.

Treatments	No of pods/plant	No of grains/plant	Dry weight
T_1(Control)	14.35	6.5	7.0
T_2(100% NPK)	23.2	8.5	8.4
T_3(125% NPK)	26.2	9.5	9.5
T_4(75% NPK without vermicompost)	21.85	8.4	8.7
T_5(75% NPK with vermicompost 2t ha^{-1})	25.5	9.3	9.3
T_6(50% NPK without vermicompost)	20.6	7.3	8.5
T_7(50% NPK with vermicompost 2t ha^{-1})	24.95	8	7.8
SEM (±)	1.257	0.087	0.889
CD	3.765	0.262	N/A

Effect of different treatment on soil properties

The effect of treatments on soil properties were recorded and presented in Table 4. The soil p H was determined with the help of glass electrode pH meter in 1:2.5 soil water suspension as described by Jackson (1973). The results showed favourable response to application of N,P,K and vermicompost. Maximum p H content upto 8.44 was noted in treatment T_3 (125% N,P,K) over control. Application of urea as a source of nitrogen (N) over the years has resulted in acidification of soils while lime application increased the pH to 6.2 in the surface soil and 6.0 in subsurface soil. The electrical conductivity (EC) was determined with the help of conductivity bridge using 1:2.5 soil water suspension as described by Jackson (1973). The maximum EC content upto 0.327 as noted in treatment T_3 (125% N,P,K) followed by treatment T_5 then treatment T_2. Organic carbon (OC) was determined following Walkley and Black's rapid titration method as advocated by Jackson (1973). Maximum OC content upto 0.486 was noted in treatment T_3(125% N,P,K) followed by treatment T_5 then treatment T_4. The surface soils contained higher amount of organic carbon in comparison to the subsurface soils.

The available potassium (K) content in the soil sample was determined by flame photo meter by the method as described by Jackson (1973). Maximum k content upto 166.008 was noted in treatment T_3(125% N,P,K) followed by treatment T_5 then treatment T_2. The exchangeable K content in the subsurface soils was less in comparison to the surface layers in all the treatments. The available phosphorus (P) content in the soil sample was determined by Olsen's method (Olsen *et al*., 1954). The phosphorus content upto 106.003 was noted in treatment T_3 followed by treatment T_5 then treatment T_2. Lime application also markedly increased the available P status of the soil due to decrease in exchangeable acidity and increase in mineralization of organic phosphates (Kumar and Verma 1997). The available nitrogen (N) content in the soil sample was determined by alkaline permanganate method as described by Subbiah and Asija (1956). Maximum nitrogen content upto 196.203 was noted in treatment T_3 followed by treatment T_5 then treatment T_2. The leaching losses of N under very high rainfall conditions and its application schedule not synchronizing with the crop requirement might be responsible for such a drastic decline in available N contents.

Table 4: Effect of INM-Effect of integrated use of NPK and vermicompost on the soil physico-chemical properties on pea crop.

Treatments	p H	EC	OC	K	P	N
T_1(Control)	8.11	0.24	0.40	149.1	24.4	175.2
T_2(100% NPK)	8.22	0.32	0.45	158.7	76.8	187.6
T_3(125% NPK)	8.44	0.32	0.48	166.0	106.0	196.2
T_4(75% NPK without vermicompost)	8.29	0.27	0.43	155.5	68.0	184.7
T_5(75% NPK with vermicompost 2t ha^{-1})	8.37	0.32	0.48	163.5	95.9	193.3
T_6(50% NPK without vermicompost)	8.21	0.25	0.42	148.7	59.0	180.0
T_7(50% NPK with vermicompost 2t ha^{-1})	8.27	0.30	0.46	152.2	48.4	181.5
SE(m)	0.03	0.001	0.001	0.5	0.7	0.6
CD	0.01	0.002	0.001	1.5	2.3	2.0


Plate 2: General view of the experimental field

Summary and Conclusion

The present study indicates that the application of NPK along with vermicompost significantly affected the growth. Yield contributing parameters and available NPK status of soil. It was found that integrated use of NPK and Vermicompost showed superiority over chemical fertilizer alone. It can also reduce application of chemical fertilizer in order to improve physicochemical environment of soil which support the pea crop for better plant growth and crop yield.

References

1. Kanwar JS. Punjab Veg. Grower. 1990;25:12-15.
2. Bobade KP, Kolte SO, Patil BG. Affectivity of cyanobacterial technology for transplanted rice, Phykos.

1992;31:33-35.
3. Bahadur A, Singh J, Singh KP, Upadhyay AK, Rai M. Effect of organic amendments and biofertilizers on growth, yield and quality attributes of Chinese cabbage (*Brassica pekinensis*). Indian Journal of Agricultural Sciences. 2006;76:596-598
4. Anonymous. Economic Survey of India, Ministry of Finance (Economic Division) GOI, New Delhi, 2009, pp. 17-22.
5. Raju MS, Varma SC. Response of mungbean (Vigna radiata) to *Rhizobium* inoculation in relation to fertilizer nitrogen. Legume Research. 1984;7:73-76.
6. Gaind S, Gaur AC. Role of PSB in crop productivity and enriched organic manure. Rai, M.M. and Verma, J.N. (Eds.): 134. (In) National Seminaron Organic Farming held during 28-29th at College of Agriculture, Indore, 1992.
7. Kumar V, Singh AP. Long term effect of green manuring and FYM on yield and soil, fertility status in rice-wheat cropping system. Indian Society of Soil Science. 2010;6:409-412.
8. Prativa KC, Bhattarai BP. Effect of integrated nutrient management on the growth, yield and soil nutrient status in tomato. Nepal Journal of Science and technology. 2011;12:23-28.
9. Rajkhowa DS, Gogoi AK, Kandali R, Rajkhowa KM. Effect of vermicompost on green-gram nutrition. Indian society of Soil Science. 2000;48:207-208.
10. Sharma V, Singh PK, Yadav KK, Lakhawat SS, Bhakar SR. Effects of chemical fertilizer scheduling on performance of okra (*Abelmoschus esculentus* L.) crop under soil moisture sensor based automated drip and conventional drip irrigation system. International Journal of Chemical Studies. 2019;7(4):3189-3191.
11. Sharma V. Impact Climate Change on Crop Water Requirement of Different Orchard Crops for Agro-Climatic Condition of Udaipur, Rajasthan. Indian Journal of Ecology. 2020;47(1): 12-16.
12. Walkaley A, Black AI. Soil Sci. Old Piper, C.S. Soil and plant analysis, Nans Publisher, Bombay. 1934;37:29-38.