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ZS Kimi
Research Scholar,
Department of Soil Science and Agricultural Chemistry, Formerly-Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Arun Alfred David
Associate Professor,
Department of Soil Science and Agricultural Chemistry, Formerly-Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Tarence Thomas
Professor,
Department of Soil Science and Agricultural Chemistry, Formerly-Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Narendra Swaroop
Associate Professor,
Department of Soil Science and Agricultural Chemistry, Formerly-Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Amreen Hassan
Assistant Professor, Department of Soil Science and Agricultural Chemistry, Formerly-Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Corresponding Author:
ZS Kimi
Research Scholar, Department of Soil Science and Agricultural Chemistry, Formerly-Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Response of Integrated Nutrient Management on Soil Health, Yield Attributes and Yield of Pea (*Pisum sativum* L.)

ZS Kimi, Arun Alfred David, Tarence Thomas, Narendra Swaroop and Amreen Hassan

Abstract
The study was planned to see the response of integrated nutrient management on soil health, yield attributes and yield of pea (*Pisum sativum* L.) which comprised the combination of inorganic fertilizers (*viz*., Nitrogen, Phosphorus, Potassium and Zinc), bio-fertilizers (*viz*., Rhizobium+PSB) and organic manures (Farm Yard Manures). The results revealed that,100 % Rhizobium+PSB, inorganic fertilizers and FYM performed better regarding number of pods plant^{-1} (20.25), test weight (193), fresh weight (56.19g), dry weight (23.88g), pod yield (25.09 q ha^{-1}), seed yield (25.09 q ha^{-1}) and soil parameters. Combined inoculation of bio-fertilizers along with 100% FYM and inorganic fertilizers proved most effective for producing higher seed yield (25.09 q ha^{-1}) as compared to control (18.15 q ha^{-1}). The results clearly show that conjunctive use of organic manure and inorganic fertilizers along with bio-fertilizers resulted in higher productivity of field pea.

Keywords: INM, Field Pea, Soil properties, Yield attributes, Yield and Pea

1. Introduction
Among the pulse crops, field pea is one of the most important grain legumes and commonly used in human diet throughout the world and is rich in protein, carbohydrates, Vitamin A and C, Calcium, phosphorous and has high levels of amino acids lysine and tryptophane. Its cultivation maintains soil fertility through biological nitrogen fixation in association with symbiotic rhizobium prevalent in its root nodules and plays a vital role in focusing sustainable agriculture. Chemical fertilizers are needed to get good crop yields, but their abuse can be very harmful for the environment and their cost cannot make economic agriculture products. Under intensive cultivation, increased use of chemical has contaminated the ground water and also disturbed the harmony existing among the soil, plant and microbial population. Bio-fertilizers on the other hand are cost-effective and renewable source plant nutrients to supplement partly chemical fertilizers. Bio-fertilizers play a vital role for improving soil fertility by fixing atmospheric nitrogen both symbiotically with plant roots and asymbiotically; solubilize insoluble soil phosphates and produces plant growth substances in the soil. Integrated nutrient management, which entails the maintenance of soil fertility to an optimum level for crop productivity to obtain the maximum benefit from all possible sources of plant nutrient-organic as well as inorganic in an integrated manner in an essential step to address the twin concerns of nutrient excess and nutrient depletion. Thus, integrated approach of nutrient supply by chemical fertilizers along with bio-fertilizers is gaining importance, as this system not only reduces the excessive use of inorganic fertilizers, but also sustains the crop productivity by improving soil health besides being an environment-friendly approach. It is ultimately viable to achieve such a target through wise application of integrated nutrient management (INM) approach, which is known as balanced mixture of organic, inorganic and bioorganic microorganisms in combinations in different practices Janssen, (1993). Integration of inorganic fertilizers and bio fertilizers resulted in better growth, yield and nutrient uptake in field pea. This study was aimed to evaluate the response of integrated application of bio-fertilizers and inorganic fertilizers on field pea in terms of yield and its attributes.

Materials and Methods
The present investigation was carried out with field pea variety DS: 2020 during the Rabi seasons of 2020-21 in the research area of Department of Soil Science & Agriculture

Chemistry, Naini, SHUATS, Prayagraj. Before sowing the crop, composite soil samples representing the whole field and after harvest plot wise samples were collected for determining the nutrient status. The organic carbon, E.C, pH, available Nitrogen, Phosphorus, Potassium and Zinc were analysed as per the method described in table 1. The experimental soils were taken from a depth of 0-15cm for analysing the physical and chemical properties of the soil. The experiment was comprised of nine treatment combination *viz*., T_1- Farmers' practice, T_2- FYM+R+PSB 50%, T_3- FYM+R+PSB 100%, T_4- NPKZ 50%, T_5- NPKZ+FYM+R+PSB 50%, T_6- NPKZ 50% + FYM+R+PSB 100%, T_7- NPKZ 100%, T_8- NPKZ 100% + FYM+R+PSB 50%, T_9- NPKZ+ FYM+R+PSB 100%. All the recommended cultural practices were done regularly during crop growth. The treatments were replicated three times and the experimental data were analysed statistically in Factorial Randomized Block Design (RBD). The plot size for each treatment was 2.0m x 1.0m the plant protection measures were taken up as and when required along with intercultural operations. The bio-fertilizers, Rhizobium+ PSB were used as seed treatment @50ml kg^{-1} seed while 20kgN, 60kg DAP, 50kg MOP, 7.4 kg ha^{-1} used as recommended dose of inorganic fertilizer. FYM were used @5t ha^{-1}. The field pea crop was analysed in various treatments for key characters i.e. number of pods $plant^{-1}$, test weight (1000 seeds), pod yield and seed yield by randomly selecting three tagged plants from each plot and averaged. The seed yield was recorded on whole plot basis and calculated as quintal per hectare (q ha^{-1}).

Table 1: Physical analysis of soil at pre-experiment stage

Particulars	Result			Method employed(Year)
Bulk Density (Mg m^{-3})	1.39			Methuval *et al*. (1992) [11]
Particle Density (Mg m^{-3})	2.50			Methuval *et al*. (1992) [11]
Pore space (%)	43.32			Methuval *et al*. (1992) [11]
Water Holding capacity (%)	48.13			Methuval *et al*. (1992) [11]
Soil Colour	Dry- Light Yellow		Wet- Olive Brown	Albert Henry Munsell, (1994)
Soil Texture	Sand 55	Silt 25	Clay 20	Bouyoucos, (1927) [2]

Table 2: Chemical analysis of soil at pre-experiment stage

Particluars	Result	Scientist name(Year)
pH (1:2)	7.6	Jackson, (1958)
EC (dS m^{-1} at 25°C)	0.2	Wilcox, (1950) [21]
Organic Carbon (%)	0.42	Walkley and Black's (1947) [20]
Available N (kg ha^{-1})	253.72	Subbiah and Asija, (1956) [17]
Available P (kg ha^{-1})	23.6	Olsen *et al*., (1954) [15]
Available K (kg ha^{-1})	216.2	Toth and Prince, (1949) [18]
Available Zn (kg ha^{-1})	2.05	Shawn and Dean, (1952)

Result and Discussion

Physical and Chemical analysis of the experimental soil

The experimental soil was sandy loam in texture with white yellowish brown colour in dry conditions and olive brown colour in wet conditions, particle density (2.68 Mg m^{-3}) and bulk density (1.21 Mg m^{-3}) was highest in T_1, pore space (56.36%) highest in T_8 as compared to the pre experiment stage the bulk density of the soil decreased with loosening the soil through tillage and through the incorporation of the crop residue. Similar findings were also reported by Mukesh Kumar, (2021).

The effect of INM on soil pH, E.C, and organic carbon (%) of post-harvest soil of (7.13, 0.38 and 0.61) was recorded in T_9 and minimum of (7.45, 0.34 and 0.47) was recorded in T_1 table 3. The increase in organic carbon (%) may be due to increase in plant growth, which in turn increased the plant residues into the soil. Similar results were reported by Quddus *et al*., (2018) [19]. The available NPK and Zn of post-harvest of soil (250.57, 27.91, 258.03, 190.15, respectively) was recorded in T_9 and minimum was recorded in T_1 (241.31, 22.67 241.92, 72.23) respectively. Improvement of Nitrogen status after the crop harvests may be due to the addition of INM which increased the availability of nutrients from the native as well as applied fertilizers. Similar results were also reported by Weldu and Habtegriel *et al.* (2013).

Table 3: Effect of integrated nutrient (INM) treatments on Soil Parameters

Treatments	Particle Density (Mg m^{-3})	Bulk Density (Mg m^{-3})	Pore Space (%)	Soil pH (1:2)	EC (dS m^{-1})	OC (%)	Nitrogen (kg ha^{-1})	Phosphorous (kg ha^{-1})	Potassium (kg ha^{-1})	Zinc (mg ha^{-1})
T_1	2.68	1.21	51.52	7.45	0.34	0.47	241.31	22.67	241.92	76.23
T_2	2.62	1.19	54.20	7.36	0.35	0.51	242.55	24.89	245.09	135.6
T_3	2.66	1.12	53.22	7.25	0.36	0.57	244.73	26.32	252.97	156.43
T_4	2.67	1.21	52.56	7.43	0.37	0.48	243.62	23.51	243.97	86.45
T_5	2.57	1.17	54.71	7.31	0.37	0.53	246.63	25.59	248.33	142.33
T_6	2.63	1.19	53.67	7.15	0.37	0.60	248.53	26.89	256.11	173.29
T_7	2.65	1.20	53.64	7.40	0.38	0.49	245.03	24.52	244.52	95.55
T_8	2.54	1.16	56.36	7.27	0.37	0.54	247.31	26.87	248.89	147.32
T_9	2.57	1.18	55.98	7.13	0.38	0.61	250.57	27.91	258.03	190.15
SEm.(±)	0.398	0.336	0.273	0.345	0.159	0.002	0.402	0.116	0.663	0.031
C.D-5%	0.845	0.712	0.579	0.731	0.336	0.004	0.853	0.247	1.406	0.066

The findings of the investigation table 4 revealed that, the maximum increase in yield parameters like number of pods $plant^{-1}$ (20.25), 1000 seeds test weight (193), fresh weight (56.19g), dry weight (23.88g), pod yield (25.09) and seed yield (25.09) were attained in T_9 followed by T_6. However, the lowest mean values of yield attributing parameters like number of pods/plant (12.30), 1000 seeds test weight (180.33), dry weight (14.36g), pod yield (18.15) and seed yield (18.15) were recorded in T_1 (farmers' practice) and fresh weight (3.12g) in T_7. Similar findings were reported by

Dashadi *et al*., (2013) [3], Achakzai (2012), Ashraf *et al*., (2011) [1]. The pod yield of field pea in T_9 (25.09) significantly increased over T_6, T_3, T_8, T_5, T_2, T_7, T_4 and T_1, respectively. This might be due to application of Zinc, FYM and bio-fertilizers, which help in translocation of photosynthesis resulting in better pod formation as well as seeds. These result supported the findings of Erman *et al*., (2009) [5], Datt *et al*., (2013) [4]. Organic and inorganic combination of nutrient supply may be synergistic as organic source improve soil physical and biological environment which in turn increase the availability of nutrients from inorganic source. Further microbial activity brings about the transformation of insoluble inorganic nutrients to available forms which are easily taken up by the plants. The increase in seed yield is due to the cumulative effect of increased growth and yield attributes. The increase in pod yield might be due to the effect of bio-fertilizer inoculations. It is well known that PSB produce vitamin and IAA, GA like growth substances. These growth factors in combination with better nutritional condition have played a significant role for increasing the seed yield of field pea.

Table 4: Effects of INM treatments on yield attributes and yield of pea

Treatment	Number of pods plant^{-1}	1000 seed (test weight)	Fresh Weight (g)	Dry weight (g)	Pod yield (q ha^{-1})	Seed yield (q h^{-1})
T_1: Control	12.30	180.33	36.12	14.36	18.15	18.15
T_2	15.87	184.00	40.26	18.20	20.57	19.27
T_3	18.35	189.00	48.35	21.60	22.07	19.80
T_4	13.74	181.33	36.28	15.85	19.27	20.57
T_5	16.20	185.00	42.15	19.40	20.97	20.97
T_6	19.68	191.00	55.02	27.55	23.37	21.60
T_7	14.85	182.67	3.12	16.35	19.80	22.07
T_8	17.30	187.67	46.08	20.50	21.60	23.37
T_9	20.25	193.00	56.19	23.88	25.09	25.09
S.Em. (±)	0.559	0.559	0.247	0.370	0.559	
C.D- 5%	1.185	1.185	0.524	0.784	1.185	

Conclusion

It is concluded that, combined application of, 60 kg DAP, 50 kg MOP, 7.4 Zinc kg ha^{-1} and FYM @100% with bio fertilizers is an optimum nutrient combination for enhancing pod yield, other yield attributes and probability of field pea as compared to the rest of INM treatment combinations.

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References

1. Ashraf MI, Pervez MA, Amjad M, Ahmad R, Ayub M. Qualitative and quantitative response of pea (Pisum sativum L.) cultivars to judicious applications of irrigation with phosphorous and potassium. Pak J. life soc. Sci 2011;9(2):159-164.
2. Bouyoucos GJ. The hydrometer as a new method for the mechanical analysis of soils. Soil Science 1927;23:343-353.
3. Dashadi M, Hossein A, Radjabi R, Babanejad T. Investigation of effect different rates phosphorus and Zinc fertilzers on two cultivars Lentil Gachsaran and flip 92-12L in irrigation complement condition. International Journal of Agriculture and Crop Sciences IJACS/2013/5-1/1-5 2013
4. Datt *et al*., 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 2013
5. Erman M, Ari E, Togay Y, Cig F. Response of Field pea (*Pisum sativum sp*. arvense L.) to Rhizobium Inoculation and Nitrogen Application in Eastern Anotolia. Journal of Animal and Veterinary Advances 2009;8(4):612-616.
6. Fisher RA, Yates F. Statistical tables for biological, Agricultural and medical Research, Congress Group Limited, London 1957.
7. Jackson ML. Soil Chemical Analysis, Prentice Hall of India Private Limited, New Delhi 1973.
8. Jailpaul S, Dixit A, Sharma AK. Growth and Yield of Capsicum (Capsicum annum) and field pea (*Pisum sativum*) as influenced by organic manures and bio fertilizers, Indian Journal of Agriculture Science 2011;81(7):637-642.
9. Kumara A, Singh ON, Kumar R. Effect of integrated nutrient management on growth, seed yield and economics of pea (*Pisum sativum*) and fertility changes. J. Food Leg 2012;25:121-124.
10. Lindsay WL, Norvell WA. Development of a DTPA Soil Test for Zinc, Iron, Manganese and Copper. Soil Science Society of America Journal 1978;42(3):421-428.
11. Methuvel P, Udayasoorian C, Natesan R, Ramaswami PR. Introduction to Soil Analysis, Tamil Nadu Agricultural University, Coimbatore 1992.
12. Mishra A, Prasad K, Rai G. Effects of bio-fertilizers inoculation on growth and yield of dwarf field pea (*Pisum sativum* L.) in conjunction with different doses of chemical fertilizers. Journal of Agronomy 2010;9(4):163-168.
13. Mishra N, Mahapatra P, Mohanty S, Pradhan M. Effect of soil amelioration, inorganic, organic and bio-fertilizers application on yield, quality and economics of snow pea (*Pisum sativum*) 1. Var. macrocarpon). Journal of Crop and weed 2014;10(1):48-52.
14. Nasreen S, Farid ATM. Influence of different nutrients on growth and yield of field pea (*Pisum sativum*), Indian

Journal of Agronomy 2003;48:206-209.
15. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. U.S. Department of Agriculture Circulars 1954;939:1-9.
16. Pandey AK, Gopinath KA, Bhattacharya R, Hooda KS, Sushil SN, Kundu S *et al*. Effect of source and rate of organic manures on yield attributes, pod yield and economics of garden pea grown under organic farming system, Indian Journal of Agriculture Science 2006;76(4):230-234
17. Subbiah BV, Asija GL. A rapid procedure for the determination of available nitrogen in soil, Current Science 1956;25:259-260.
18. Toth SJ, Prince AL. Estimation of Cation exchange capacity and exchangeable Ca, K and NA content of soil by flame photometer technique. Soil Science 1949;67:439-445.
19. Quddus MA, Hossain MA, Naser HM, Anwar B, Aktar S, Nazimuddin M. Effect of Zinc and Boron application on productivity, quality and nutrient uptake of field pea (*Pisum sativum* L.) grown in calcareous soils, Journal of Agriculture science and Practice (JASP) 2018;3(6):132-143.
20. Walkley A, Black IA. Critical examination of rapid method for determining organic carbon in soils, effect of variance in digestion conditions and of inorganic soil constituents. *Soil Science* 1947, 632-251.
21. Wilcox LV. Electrical conductivity. American water works Association Journal 1950;42:775-776.