www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 794-797

www.thepharmajournal.com
Received: 02-08-2023
Accepted: 08-09-2023

Shweta Gupta
Research Scholar, Department of Agronomy, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Narendra Singh
Professor, Department of Agronomy, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Aniket H Kalhapure
Assistant Professor, Department of Agronomy, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Jagannath Pathak
Professor, Department of Soil Science and Agricultural Chemistry, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Anchal Singh
Research Scholar, Department of Agronomy, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Ankur Tripathi
Research Scholar, Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Ayodhya, Uttar Pradesh, India

Corresponding Author:
Shweta Gupta
Research Scholar, Department of Agronomy, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Effect of foliar supplementation and nutrient management on soil properties of chickpea crop

Shweta Gupta, Narendra Singh, Aniket H Kalhapure, Jagannath Pathak, Anchal Singh and Ankur Tripathi

Abstract
An experiment was conducted at the College Research Farm, Banda University of Agriculture and Technology, Banda, during the rabi seasons of 2021-22 and 2022-23. This study aimed to assess how applying fertilizers through foliar and basal methods would impact the soil characteristics of chickpea cultivation. The soil at the experimental site was characterized as having a clay loam texture, low levels of organic carbon and available nitrogen, and moderate levels of available phosphorus and potash. The experiment was conducted in split plot design with three main factors in main plot with six level of each in sub-plot treatment. Total combinations of treatment were eighteen and each treatment was replicated at three time. The main plot consisted of the foliar supplementation namely, no spray, NPK during flowering, NPK + Zinc + Salicylic Acid during flowering. Further each main plot had divided in to six sub-plots held six nutrient management practices. Results exhibited that among the treatments NPK + Zinc + Salicylic acid during flowering + 100% RDF + Vermicompost @ 2.5 t/ha found superior in terms of soil properties of chickpea.

Keywords: Foliar supplementation, nutrient management, soil, chickpea crop

Introduction
Pulses refer to the consumable seeds produced by plants. They develop within pods and exhibit a wide range of shapes, sizes, and colors. Pulses serve as an excellent plant-based protein source, making them indispensable in vegetarian and vegan diets. They are also abundant in dietary fiber, essential vitamins (like B vitamins), and vital minerals (such as iron, magnesium, and potassium). With their low fat content, especially saturated fat, they promote heart health by reducing the risk of heart disease. The high fiber content aids digestion, stabilizes blood sugar levels, and fosters a sense of fullness, which supports weight management

Chickpea are a nutritional powerhouse, serving as an excellent source of plant-based protein. They are also abundant in dietary fiber, vitamins (especially B vitamins such as folate), and essential minerals like iron, magnesium, and potassium. Incorporating chickpeas into your diet can be a boon for heart health due to their low saturated fat content and high fiber levels, which help in reducing cholesterol levels. Furthermore, their fiber content aids digestion and can assist individuals in managing their blood sugar levels, rendering them a suitable choice for those with diabetes. Chickpeas are also rich in antioxidants that combat oxidative stress and inflammation. Chickpeas are remarkably versatile in culinary applications, finding their way into an array of dishes such as hummus, falafel, soups, stews, salads, and curries. India holds the distinction of being the world's largest consumer of chickpeas. India is the largest producer of chickpea in the world and it solely contributes nearly 50% of the Indian pulse production. During 2021-22, chickpea production of India was 13.75 million tonnes from an acreage of 10.91 million ha. with a productivity of 12.6 q./ha (DES 2023, MOAF&W, GoI) [1]. Major chickpea growing states are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Bihar, Karnataka, Gujarat, Himachal Pradesh, Haryana and Punjab. In U.P. area, production and productivity of chickpea is 5.73 lakh hectare; 87.09 lakh tonnes and 1236 kg/ha, respectively (Annual Report, DES, DA&FW, 2021-22). Vermicomposting is a biochemically driven process that expedites the breakdown of organic materials. It stands out for its efficiency and safety when contrasted with conventional composting techniques, primarily because it involves the organic matter passing through the digestive systems of earthworms. FYM is an abbreviation for "Farm Yard Manure," which designates organic materials like animal excrement and decomposing plant matter employed as a natural fertilizer to boost soil

fertility and enhance crop development in agriculture. FYM is prized for its nutrient-rich composition and organic content, making it a valuable asset for enhancing soil condition and fostering robust plant growth. NPK 19:19:19 is a soluble fertilizer that contains a well-balanced combination of the primary nutrients nitrogen (N), phosphorus (P), and potassium (K) in an ideal proportion. This fertilizer effectively provides these essential nutrients to plants through either foliar spraying or fertigation, precisely at the times when they require them the most, thereby minimizing any unnecessary loss or waste. Zinc plays a crucial role in numerous metabolic processes, including carbohydrate metabolism, protein production, gene regulation, the metabolism of auxin (a growth regulator), pollen development, the upkeep of biological membranes, defense against photo-oxidative harm and heat stress, and the body's ability to resist infections caused by pathogens. Salicylic acid is a naturally occurring plant hormone that holds a prominent position in the realm of plant physiology. It belongs to the phenolic acid category and is characterized by its ring structure connected to hydroxyl and carboxyl groups. Therefore, an experiment was conducted to find out the suitable dose of foliar and basal application of fertilizers on soil properties of chickpea.

Materials and Methods

The experiment was conducted during *rabi* season of 2021-22 and 2022-23 at College Research Farm, Banda University of Agriculture & Technology, Banda situated at Central plateaus & Hill Region of agro climatic zone VIII in split plot design with three replications. The experiment consisted of 16 treatment combinations *viz*. No spray + 100% RDF, No spray + 75% RDF, No spray + 100% RDF + Vermicompost @ 2.5 t/ha, No spray + 75% RDF + Vermicompost @ 2.5 t/ha, No spray + 100% RDF + FYM @ 5.00 t/ha, No spray + 75% RDF + FYM @ 5.00 t/ha, NPK spray during flowering initiation + 100% RDF, NPK spray during flowering initiation + 75% RDF, NPK spray during flowering initiation + 100% RDF + Vermicompost @ 2.5 t/ha, NPK spray during flowering initiation + 75% RDF + Vermicompost @ 2.5 t/ha, NPK spray during flowering initiation + 100% RDF + FYM @ 5.00 t/ha, NPK spray during flowering initiation + 75% RDF + FYM @ 5.00 t/ha, NPK + Zinc + Salicylic acid during flowering initiation + 100% RDF, NPK + Zinc + Salicylic acid during flowering initiation + 75% RDF, NPK + Zinc + Salicylic acid during flowering initiation + 100% RDF + Vermicompost @ 2.5 t/ha, NPK + Zinc + Salicylic acid during flowering initiation + 75% RDF + Vermicompost @ 2.5 t/ha, NPK + Zinc + Salicylic acid during flowering initiation + 100% RDF + FYM @ 5.00 t/ha, NPK + Zinc + Salicylic acid during flowering initiation + 75% RDF + FYM @ 5.00 t/ha. The soil at the experimental site was characterized as having a clay loam texture, low levels of organic carbon and available nitrogen, and moderate levels of available phosphorus and potash. During the investigation, the test crop chosen was the 'JG-12 (Jawahar Gram)' cultivar of chickpeas. "Chickpea seeds were planted using a seed drill at a rate of 80 kg/ha, and all fertilizers were administered according to the specified treatments at the time of sowing. Nitrogen and phosphorus were provided through the use of di ammonium.

Doses: RDF – N-20 kg/ha, P-50 kg/ha, K-20 kg/ha, NPK (19:19:19)- 2%, Zinc- 500 ppm, Salicylic Acid- 150 ppm

Results and Discussion

Soil pH

Data is presented in table no 1. Related to chemical properties of soil shows that pH of soil varies from 7.38 to 7.63 and was more or less similar to initial values. pH of soil was not significantly affected both in main and sub plot treatments. (Table 1). In general, the effect of integrated application of foliar supplementation and nutrient management on pH of soil was more effective than the sole application of these. Maximum reduction (7.38) in pH was recorded in treatments namely NPK + Zinc + Salicylic acid spray, No Spray in main plot and (7.36) recorded with 100% RDF + Vermicompost @ 2.5 t/ha, 75% RDF + Vermicompost @ 2.5 t/ha and 100% RDF + FYM @ 5 t/ha in sub plot. In 2003 [2], Gawai identified that the primary cause of a decrease in soil pH is the result of organic manure decomposition by microorganisms.

Table 1: Effect of foliar supplementation and nutrient management on soil pH, electrical conductivity and organic carbon of post-harvest of soil.

Treatment	pH		EC(dSm^{-1})		Organic carbon (%)	
Foliar supplementation	**2021-22**	**2022-23**	**2021-22**	**2022-23**	**2021-22**	**2022-23**
No Spray	7.63	7.38	0.17	0.18	0.44	0.46
NPK spray	7.51	7.40	0.17	0.18	0.46	0.47
NPK + Zinc + Salicylic acid spray	7.50	7.38	0.17	0.17	0.46	0.47
S.Em±	0.13	0.13	0.00	0.0	0.01	0.01
CD(P=0.05)	NS	NS	NS	NS	NS	NS
Nutrient Management						
100% RDF	7.57	7.37	0.17	0.18	0.45	0.46
75% RDF	7.65	7.44	0.17	0.18	0.45	0.46
100% RDF + Vermicompost @ 2.5 t/ha	7.45	7.36	0.17	0.18	0.47	0.48
75% RDF + Vermicompost @ 2.5 t/ha	7.52	7.36	0.17	0.18	0.45	0.46
100% RDF + FYM @ 5.00 t/ha	7.49	7.36	0.16	0.18	0.46	0.47
75% RDF + FYM @ 5.00 t/ha	7.58	7.42	0.16	0.18	0.45	0.46
S.Em±	0.11	0.15	0.00	0.0	0.01	0.01
CD(P=0.05)	NS	NS	NS	NS	NS	NS
Initial value	7.85		0.17		0.41	

Table 2: Effect of foliar supplementation and nutrient management on porosity, bulk density, particle density of post-harvest of soil.

Treatment	Porosity (%)		Bulk density (Mg m^{-3})		Particle density (Mg m^{-3})	
Foliar supplementation	**2021-22**	**2022-23**	**2021-22**	**2022-23**	**2021-22**	**2022-23**
No Spray	49.46	49.53	1.32	1.32	2.68	2.65
NPK spray	49.49	49.57	1.32	1.31	2.66	2.65
NPK + Zinc + Salicylic acid spray	49.52	49.61	1.31	1.31	2.64	2.64
S.Em±	0.9	0.8	0.02	0.02	0.05	0.04
CD(P=0.05)	NS	NS	NS	NS	NS	NS
Nutrient Management						
100% RDF	49.48	49.56	1.31	1.33	2.67	2.65
75% RDF	49.49	49.55	1.32	1.31	2.69	2.67
100% RDF + Vermicompost @ 2.5 t/ha	49.51	49.59	1.31	1.30	2.64	2.62
75% RDF + Vermicompost @ 2.5 t/ha	49.49	49.57	1.32	1.31	2.67	2.64
100% RDF + FYM @ 5.00 t/ha	49.50	49.58	1.31	1.31	2.65	2.62
75% RDF + FYM @ 5.00 t/ha	49.49	49.57	1.32	1.32	2.66	2.67
S.Em±	1.1	1.0	0.03	0.02	0.06	0.05
CD(P=0.05)	NS	NS	NS	NS	NS	NS
Initial Value	49.29		1.33		2.67	

Electrical conductivity

The data showed that the soil's electrical conductivity increases in the chickpea field compared to the initial value of 0.17 dS m^{-1} (Table 1). EC of soil was not significantly affected both in main and sub plot treatments. (Table 1). In general, the effect of integrated application of foliar supplementation and nutrient management on EC of soil was more effective than the sole application of these. After chickpea harvest, it ranged from 0.16 to 0.17 dS m^{-1} in first year and 0.17 to 0.18 dS m^{-1} in second year. Lower values between 0.16 and 0.18 dS m^{-1} were observed in treatment with NPK + Zinc + Salicylic acid spray in both years. The lowest electrical conductivity was noted in the 100% RDF + FYM @ 5.00 t/ha and 75% RDF + FYM @ 5.00 t/ha 0.16 dS m^{-1} in first year in sub plot treatments.

Organic Carbon

The data showed that the soil's organic carbon increases in the chickpea field compared to the initial value of 0.41% (Table 1). OC of soil was not significantly affected both in main and sub plot treatments. (Table 1). In general, the effect of integrated application of foliar supplementation and nutrient management on OC of soil was more effective than the sole application of these. Higher values 0.46% to 0.47% were observed in treatments with NPK + Zinc + Salicylic acid spray, NPK spray in both years in main plot treatments and Higher values 0.47 to 0.48% was observed in treatments with 100% RDF + Vermicompost @ 2.5 t/ha and 0.46% to 0.47% was observed with treatment 100% RDF + FYM @ 5.00 t/ha in both years in sub plot treatments. The utilization of organic fertilizers alone or in conjunction with chemical fertilizers has proven effective in enhancing the accumulation of organic carbon in the soil. This observation is consistent with the findings of Sharma and Subehia (2003) [6], who documented higher levels of soil organic carbon when employing integrated approaches that combine organic and inorganic inputs.

Bulk density

The data showed that the soil's bulk density decreases in the chickpea field compared to the initial value of 1.33 Mg m^{-3} (Table 2). BD of soil was not significantly affected both in main and sub plot treatments. (Table 2). In general, the effect of integrated application of foliar supplementation and nutrient management on BD of soil was more effective than the sole application of these. Maximum reduction (1.31 Mg m^{-3}) in BD was recorded in treatments namely NPK + Zinc + Salicylic acid spray in main plot and (1.30 Mg m^{-3}) recoded with 100% RDF + Vermicompost @ 2.5 t/ha, 75% RDF + Vermicompost @ 2.5 t/ha and 100% RDF + FYM @ 5 t/ha in sub plot. Santhey *et al.* (1999) [5] similarly observed a decrease in soil bulk density as a consequence of incorporating organic manure in an integrated nutrient management (INM) experiment.

Particle density

The data showed that the soil's particle density decreases in the chickpea field compared to the initial value of 2.67 Mg m^{-3} (Table 2). PD of soil was not significantly affected both in main and sub plot treatments. (Table 2). In general, the effect of integrated application of foliar supplementation and nutrient management on PD of soil was more effective than the sole application of these. Maximum reduction (2.64 Mg m^{-3}) in PD was recorded in treatments namely NPK + Zinc + Salicylic acid spray in main plot and (2.62 Mg m^{-3}) recoded with 100% RDF + Vermicompost @ 2.5 t/ha, 75% RDF + Vermicompost @ 2.5 t/ha and 100% RDF + FYM @ 5 t/ha in sub plot.

Porosity

The data showed that the porosity of soil increases in the chickpea field compared to the initial value of 49.29% (Table 2). Porosity of soil was not significantly affected both in main and sub plot treatments. (Table 2). In general, the effect of integrated application of foliar supplementation and nutrient management on Porosity of soil was more effective than the sole application of these. Maximum increases (49.61%) in Porosity was recorded in treatments namely NPK + Zinc + Salicylic acid spray in main plot and (49.59%) recoded with 100% RDF + Vermicompost @ 2.5 t/ha, 75% RDF + Vermicompost @ 2.5 t/ha and 100% RDF + FYM @ 5 t/ha in sub plot.

Conclusion

It is concluded that various levels of foliar supplementation and nutrient management applied in the experiment and found that treatment combination NPK + Zinc + Salicylic acid spray + 100% RDF + Vermicompost @ 2.5 t/ha was found best response related to soil parameters viz. pH, EC, Organic Carbon, BD, PD and Porosity among all the treatment combinations.

References

1. DES, MOAF&W. Directorate of economics and statistics. Crop production statistics information system, Ministry of Agriculture & Farmers Welfare, India; c2023.
2. Gaur PM, Tripathi S, Gowda CLL, Ranga Rao GV, Sharma Pande HCS, Sharma M. Chickpea Seed Production Manual. India: International Crops Research Institute for the Semi-Arid Tropics. Patancheru Andhra Pradesh. 2010;502(323):1-28.
3. Gawai PP. Effect of integrated nutrient management system in sorghum-chickpea cropping sequence. M.P.K.V., Rahuri (M.S.); c2003. p. 80-167.
4. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. United States Department of Agriculture Circular no. 939. Washington DC: USDA; c1954.
5. Santhy P, Velusamy MS, Murryappan V, Selvi D. Effect of inorganic fertilizers and fertilizer manure combination on soil physico-chemical properties and dynamics of microbial biomass in an inceptisol. J of Indian Soc. of Soil Sci. 1999;37(3):379-382.
6. Sharma SP, Subehia SK. Effects of twenty-five years of fertilizer use on maize and wheat yields and quality of an acidic soil in the western Himalayas. Experimental Agric. 2003;39:55-63.
7. Subbaih BV, Asija GL. A rapid procedure for determination of available nitrogen in soil. Current Science. 1956;25:259-260.