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RESPONSE OF ORGANIC AND INORGANIC FERTILIZERS ON NUTRIENT CONTENT AND UPTAKE IN CHICKPEA (*CICER ARIETINUM* L.)

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Abstract

A field experiment was conducted at a research farm, Lovely Professional University, Phagwara, Punjab during *rabi* season 2017-18 on sandy loam soil. The trial consist of eight treatments *viz.,* T_1(Control), T_2(100% RDF), T_3(100% vermicompost), T_4(100% FYM), T_5(50% RDF + 50% vermicompost), T_6(50% vermicompost + 50% FYM), T_7(25% RDF + 25% FYM + 25% vermicompost) and T_8(50% RDF + 50% FYM + 50% vermicompost) and was replicated thrice in Randomized Block Design. The result of a present investigation revealed that the application of 50% + RDF + 50% FYM + 50% vermicompost shows highest values of nitrogen content (0.870%) and uptake (28.87 kg/plot), whereas the treatment with application of 25% RDF + 25% FYM + 25% vermicompost (T_7) showed the highest P content (0.08%) and uptake (2.77 kg/plot)and the treatment 100% FYM (T_4) shows the maximum percentage of K (1.860%) in plant as well as uptake (61.74 kg/plot)than the rest of treatment as well as control.

Key words : *Cicer arietinum* L., organic and inorganic fertilizers, pulses, production.

Introduction

Pulses in agriculture reported great role in Indian agriculture for sustainable production, improvement in soil health and environment safety. Not only India producing largest amount of pulses, but also largest number of consumer of pulses in the world and found that it is a cheaper source of protein to overcome malnutrition among human beings. Pulses contain high percentage of quality protein nearly three times as much as cereals (Bhosale *et al.*, 2017).

Chickpea meet the 60% nitrogen requirement through atmospheric nitrogen fixation and it has ability to fix up to 140-150 kg N per hector. Residual effect of chickpea crop adds the nitrogen for next crop and also left organic matter so that it maintains the soil health and fertility. Chickpea have deep root system so that it can show better performance under drought condition by using dipper level water for their growth and development. Chickpea adds protein (21.1%), carbohydrates (56.5%), fiber, unsaturated fatty acids and β- carotene in human diet. Chickpea contains high unsaturated fatty acids. Chickpea is an important pulse crop, which provides food for millions of people in the developing countries.

According to pulse production data chickpea (*Cicer arietinum* L.) is important food legume all over world. Globally chickpea area was 12.0 MH, production was 10.9 MT and productivity was 913 kg ha^{-1} during 2010. Chickpea mostly major pulse crop of tropical, sub- tropical and temperate regions of the world. After common bean (*Phaseolus vulgaris* L.) and field pea (*Pisum sativum* L.) chickpea is the third largest produced food legume globally. Chickpea is grown in more than 50 countries (89.7% area in Asia, 4.3% in Africa, 2.6% in Oceania, 2.9% in Americas and 0.4% in Europe). The chickpea seeds contain on average 23% protein, 64% total carbohydrates (47% starch, 6% soluble sugar), 5% fat, 6% crude fiber and 3% ash. High mineral content has been reported for phosphorus (340mg/100g), calcium (190mg/100g), magnesium (140mg/100g), iron (7mg/100g) and zinc (3mg/100g).

Pulses have ability to fix atmospheric nitrogen and

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adaptability to a wide range of agro-ecological situations and variable management practices. As per looking the demand of the crop, there is a possibility of raising the production per unit area by efficient and judicious use of nutrients. Vermicompost, DAP and zinc sulphate are potential nutrient sources, which enhances the macro and micro plant nutrients, growth enhancing substances such as auxins and gibberellins and number of beneficial microorganisms like nitrogen fixing, P-solubilizing and cellulose decomposing organism and also supplies most required nutrients like nitrogen and phosphorus (Hosseinzadeh *et al*., 2016). Over reliance on mineral nutrients result into soil degradation by deteriorate the chemical and physical properties of soil (Hepperly *et al*., 2009).

Organic manures is very good media for microorganisms growth and development also maintain the soil fertility status. It is that combination of organics and mineral fertilizers highly enhance the productivity of soil. Frequent use of inorganic fertilizer causes reduction in the crop yields and resulted in imbalance of nutrients in the soil, which has adverse effect on soil health. Combined use organic manures and alone application improve the soil physical, chemical and biological properties and proper utilization of applied fertilizers for improving seed yield and quality of crop (Patil *et al*., 2012).

Keeping all these things in view a research entitled "Response of organic and inorganic fertilizers on growth and yield attributes of chickpea (*Cicer arietinum* L.)" with the followingobjectives:

To study the effect of organic and inorganic fertilizer on nutrient content and uptake under differenttreatments.

To identify best combination of organic and mineralfertilizers.

Materials and Methods

The experiment was conducted at Lovely Professional University farm, Department of Agronomy, Lovely Professional University, Jalandhar (Punjab) during *rabi* season of 2017-18. This farm is situated at 31^0 22'31.81 North Latitude and 75^0 23'03.02 East longitude, with an average elevation and with a mean sea level of 252 m. The experimental site comes under sub-tropical type of weather situation with cool winters, hot summers and a distinct rainy period with yearly rainfall of 1919.5mm. The soil of experimental site was found to be sandy clay loam and the pH of the soil varied from 7.83 to 7.98. The details of eight treatments: T_1 (Control), T_2 (100% RDF), T_3(100% vermicompost), T_4(100% FYM), T_5(50% RDF + 50% vermicompost), T_6(50% vermicompost + 50% FYM), T_7(25% RDF + 25% FYM + 25% vermicompost) and T_8(50% RDF + 50% FYM + 50% vermicompost) and was replicated thrice in Randomized Block Design. A popular variety of chickpea PUSA-362 was selected for *rabi* season with a crop period 145-150 days. Sowing is done on ridges. The size of net plot was 16 $m^2$and total number of plot was 24. Seed is treated with *Rhizobium* @ 2.5gm for 1 kg seeds. Healthy and bold seeds of chickpea were dibbled into the soil at a spacing 30cm × 10cm. The crop was harvested when the plants shows physiological maturity. The crop was harvested 140 days after sowing. The plant samples were taken from each treatment after harvesting and dried for grinding and grinded sample were taken for analysis.

The initial physico-chemical properties ofsoil sample were analyzed *viz*., sand, silt and clay content, soil texture, soil pH, soil EC, organic carbon, available nitrogen, available phosphorus, available potassium (table 1). The content of total nitrogen, phosphorus and potassium content were analyzed after harvesting of crop. The standard methods were used for analysis. The statistical analysis were done by using Randomized Block Design suggested by Sukhatme and Panse (1967).

The uptake of N, P and K by fenugreek leaves, stem and root were computed separately on dry weight basis by using the following formula:

$$\text{Nutrient uptake (kg/ha)} = \frac{\text{Nutrient content (\%)} \times \text{Yield (kg/ha)}}{100}$$

Results and Discussion

Plant analysis

Total nitrogen

The total nitrogen content of chickpea are presented in table 2. The data revealed that a dose of 50% RDF + 50% FYM + 50% vermicompost (T_8) showed significantly maximum nitrogen content in plant (0.870%) as compared to control (0.560%) as well as other treatment.

Total phosphorus

The impact of organic as well as mineral fertilizers on per cent phosphorus content in plant found significant. The data given in table 2 indicated that among all the treatments the treatment with application of 50% RDF + 25% FYM + 25% vermicompost (T_7) was registered the highest P content in plant (0.083%), while control and 50% vermicompost + 50% FYM (T_6) recorded the lowest phosphorus content (0.057%), respectively.

Total potassium (K)

A perusal of the data in table 2 showed that among

Table 1 : Physiochemical properties of soil of experimental field.

Physiochemical properties	Content
Sand content (%)	72
Silt content (%)	13.3
Clay content (%)	14.7
Soil texture	Sandy loam
Soil pH	7.9
Soil Electrical Conductivity (ds/m)	0.5
Soil Organic carbon (%)	0.55
Available Nitrogen (Kg/ha)	210
Available Phosphorus (Kg/ha)	16.2
Available Potassium (Kg/ha)	230

the eight treatments, the maximum percentage of K (1.860%) in plant was recorded in treatment (T_4) *i.e.* 100% FYM, which were superior overcontrol treatment (1.653%).

Nutrient uptake

Nitrogen uptake (kg/plot)

A precise study of the data on nitrogen uptake by chickpea plant (table 3) revealed that the total uptake of N was maximum under the treatment 50% RDF + 50% FYM + 50% vermicompost (T8) (28.87 kg/plot) and the minimum in control (18.58 kg/plot).

Phosphorus uptake (kg/plot)

Among eight treatments the application of 25% RDF + 25% FYM + 25% vermicompost (T_7) showed the significant highest P uptake by the plant (2.77 kg/plot). This treatment is at par with treatments 100% vermicompost (T_3), 100% FYM (T_4), 50% RDF + 50% vermicompost (T_5) and 50% RDF + 50% FYM + 50% vermicompost (T_8) (table 3). The total uptake was minimum in control (1.88 kg/plot).

Potassium uptake (kg/plot)

The data illustrated in table 3 showed that the 100% FYM (T_4) recorded highest K uptake by plant (61.740 kg/plot). The next treatments in order of effectiveness were 100% RDF (T_2), 100% vermicompost (T_3), 50% RDF + 50% vermicompost (T_5), 50% vermicompost + 50% FYM (T_6), 25% RDF + 25% vermicompost + 25% FYM(T_7) and 50% RDF + 50% vermicompost + 50% FYM (T_8). While the lowest K uptake was obtained under control plot.

Total uptake of nitrogen, phosphorus and potassium was maximum under the treatment 50% RDF + 50% FYM + 50% vermicompost (T_8) (28.87 kg/plot) and the minimum in control. N-uptake and accumulated in shoot and seeds of chickpea were significantly increased as affected by the addition of organic manure and mineral fertilizer (Ismail *et al*., 2017).

Table 2 : Response of organic and inorganic fertilizers on per cent nitrogen, phosphorus and potassium content in plant of chickpea crop.

Treatments	N Content	P Content	K Content
T_1	0.56	0.05	1.65
T_2	0.65	0.06	1.78
T_3	0.73	0.07	1.77
T_4	0.69	0.08	1.86
T_5	0.74	0.07	1.74
T_6	0.77	0.05	1.75
T_7	0.77	0.08	1.77
T_8	0.87	0.06	1.85
C.D.	0.072	0.018	0.118
SE(m)	0.024	0.006	0.039
C.V. %	5.656	14.930	3.760

Table 3 : Response of organic and inorganic fertilizers on nutrient uptake (kg/plot) in chickpea after harvest.

Treatments	Nitrogen	Phosphorus	Potassium
T_1	18.58	1.88	54.87
T_2	21.68	2.10	59.08
T_3	24.23	2.32	58.75
T_4	22.90	2.65	61.74
T_5	24.78	2.43	57.97
T_6	25.67	1.88	58.31
T_7	25.55	2.77	58.86
T_8	28.87	2.21	61.40
C.D.	2.404	0.605	3.914
SE(m)	0.785	0.198	1.278
C.V. %	5.657	14.994	3.759

Conclusion

The overall results obtained from the present investigation facilitated to draw the following conclusions.

Organic and inorganic fertilizers played an important role on content of plant nutrient and uptake of nutrients in chickpea. The combination of 50% RDF + 50% FYM + 50% vermicompost recorded highest plant nutrient status as well as nutrient uptake in chickpea crop as compared to application of organic and mineral fertilizers alone as well as control.

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