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# Effect of integrated nutrient management on production, productivity and economics of chickpea (*Cicer arietinum* L) in central plain zone of U.P

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**Abstract**
A field experiment was conducted during Rabi, 2018-19 at Agricultural Research Farm of faculty of Agricultural Science and Allied industries Rama University, Mandhana, Kanpur (U.P.). The treatment comprised 8 integrated nutrient management practices *viz*., $T_1$- Control, $T_2$- Formers Practices (50 kg DAP/ha), $T_3$- RDF (20:60:20), $T_4$- FYM @ 10 t/ha, $T_5$- Vermicompost @ 5 t/ha, $T_6$- 75% RDF + FYM @ 2.5 t/ha+ Vermicompost @1.0 t/ha, $T_7$- 50% RDF + FYM @ 5 t/ha+ vermicompost @ 2.5 t/ha and $T_8$- 25% RDF + FYM @ 10t/ha + vermicompost @ 5 t/ha were tried in RBD (Randomized Block Design) with three replications. The results showed that the application of 75% RDF + FYM @ 2.5 t/ha + vermicompost @ 1.0 t/ha integrated nutrient management practices was recorded highest growth attributes *viz*., plant height, number of primary and secondary branches, dry matter production as well as yield attributes *viz*., number pod/plant (g), No. of seed/plant and test weight as compared to control plot. Variety KGD-1168 performed better and high yielded 30.67 q/ha, grain yield Rs. 1,00,506/ha net return against 11.92 q/ha grain Yield," Rs 19,307/ha net return with the application of 75% RDF + FYM @ 2.5 T/ha+ Vermicompost@1.0 t/ha. Over all on the basis of experimentation in applied of 75% RDF + FYM @ 2.5 t/ha + vermicompost @ 1.0 t/ha was higher received net return due to reason of higher production and productivity of chickpea with KGD- 1168 variety in central plain zone of Uttar Pradesh.

**Keywords:** Integrated nutrients management, FYM, vermicompost, economics, chickpea

## Introduction
Chickpea (*Cicer arietinum* L.) is the most important winter season (Rabi) grain legume in India, grown predominantly under rainfed conditions on residual moisture after harvest of *Kharif* crops its the third important pulse crop in the world after French bean (*Phasealus velgoris* L.) and field peas (*Pisum sativum* L.) with an acreage of 25.m/ha, production of 28. mt and productivity of 845 kg/ha. It is an important pulse Crop of the semi- arid tropics, particularly in the rainfed ecology of the Indian Subcontinent, the Mediterranean region, the West Asian and North African region, Eastern Africa and Latin America. In India, it is the premier food legume Crop Covering 9.85 m/ha area with a production of 11.90 mt and productivity of 1086 kg/ha. India is contributing highest share in area (73.30%) and production (88.90%) in the World (Anonymous, 2022). The important Chickpea growing states in India are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Andhra Pradesh and Karnataka. These states together contribute 107.37% of the production from 98.86% of area pulse are important source of dietary protein and have unique property of maintaining and restoring soil fertility, through biological nitrogen fixation by virtue of their deep root system and leaf fall. The medicinal value of chickpea is worth mentioning here also the leaves and seeds of the chickpea due to the presence of glandular secretions are commonly used as medicine.
This plant holds a good repute in "Ayurvedic and "Unani System of medicine and according to Ayurvedic method of treatment, chickpea leaves are sour, astringent to bowels and improve taste and appetite. Moreover, the leaves are used to Cure Chronic bronchitis and the seeds are considered as antibilious, used as tonic, stimulant and aphrodisiac properties, it is reoffered as Vajibhakshya in Sanskrit. Chickpea has also the property to act as hypocholestemic agent; germinating chickpea is believed to reduce the blood cholesterol level. The low yield of chickpea is also due to poor levels of nutrient management. The main soil quality and nutritional quality on a sustainable basis for the increasing population a judicious combination of both fertilizer and organic manure is most desirable, provide other agronomic practices are

optimized. Keeping, this in view, the present investigation was carried out to find out the effect of integrated nutrients practices on performance of chickpea.

## Materials and Methods

The experiment was conducted during Rabi Season of 2017-2018 at Research form of Faculty of Agriculture and Allied" Industries, Rama University, Mandhana, Kanpur (UP), which is situated in the alluvial tract of Indo-Gangetic plains in Central part of Uttar Pradesh between 25°26' to 26°58' North latitude and 79° 31' to 80$^{0}$' 34" East longitude at an elevation of 125.9 meters from the sea level. This region falls under agro-climatic zone V (Central Plain Zone) of Uttar Pradesh. The Seasonal rainfall of about 629.5 mm received mostly from second fortnight of June or first fortnight of July to mid-October with a few showers in Winter Season. The maximum and minimum temperature in the Rabi Season usually Occurs 35 °C and 10 °C, respectively. The Soil of the experimental field was originated farm alluvial deposits. The soil type and fertility status was determined mechanical and chemical by the any analysis of the soil. In Order to te ascertain physio-chemical properties of the experimental soil, primary soil samples were drawn randomly up to 15 cm depth from different spots of the entire experimental area. A representative soil sample was drawn from these samples, which was subjected to mechanical and chemical analysis to ascertain its physic- chemical properties. The experiment was, laid out in Randomized Block Design (RBD) along with three replications comprised of eight treatments combination *viz*; $T_1$- Control, $T_2$- Formers Practices (50 kg DAP/ha.), $T_3$- RDF (20:60:20), $T_4$- FYM @ 10 T/ha, $T_5$- Vermicompost @ 5t/ha, $T_6$- 75% RDF + FYM @ 2.5 T/ha+ Vermicompost @ 1.0 t/ha, $T_7$- 50% RDF + FYM @ 5 T/ha+ Vermicompost @ 2.5 t/ha and $T_8$- 25% RDF + FYM @ 10 t/ha + vermicompost @ 5 t/ha. KGD-1168 variety of chickpea is used. The Sowing of chickpea was done on October 25, 2017 at a row spacing of done behind 45 cm apart with depth 8-10 cm. Sowing of Crop was done behind country plough @ 100 kg seed per hectare. The experimental Crop was fertilized according to as per treatments. The first weeding was done at 30-35 days after sowing and second weeding at 70-72 days after sowing of the crop with the help of *Khurpi* to Control the weeds. The harvesting was done on the second week of April 01, 2018.

## Results and Discussion

### (a) Growth attributes

A perusal of data showed that plant stand/m$^2$ of chickpea recorded did not influence significantly due to varying various levels of organic and inorganic sources of nutrients. The plant population was recorded highest under the treatment of 75% RDF+FYM @ 2.5 t/ha+Vermicompost @ 1.0 t/ha and lowest in control treatment. A significantly increase in plant height was observed with the treatment of 75% RDF+FYM @ 2.5 t/ha+ Vermicompost @ 1.0 t/ha (35.0 m) as compared to all other treatments. The lowest plant height was recorded in control treatment (28.87 m) in present field experimentation. The highest number of primary and secondary branches were produced significantly with the application of 75% RDF+FYM @ 2.5 t/ha+ Vermicompost @ 1.0 t/ha (6.83 and 5.70) followed by RDF as (20kg N + 60 kg $P_2O_5$+20 kg$K_2O$/ha) (6.37 and 5.55), respectively. The lowest number of primary branches were produced in control plot (4.33 and 3.45), respectively. The dry matter accumulation (g/plant) was found highest with the application of 75% RDF+FYM@ 2.5 t/ha + Vermicompost @ 1.0 t/ha (29.72 gm/plant) followed by RDF as 20 kg N + 60 kg $P_2O_5$ + 20 Kg. $K_2O$/ha) and 50% RDF + FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha i.e. 28.43 and 26.53, respectively. These treatments were also significantly superior over rest of the treatments and at par with each other. The lowest dry matter accumulation was observed in control treatment (16.51 g/plant) during the study period. The increase in plant growth attributed to the increase availability of nutrients with the application of inorganic fertilizer, continuous supply of macro and micro nutrients from FYM and Vermicompost, which helped in acceleration of various metabolic processes *viz*., photosynthesis, energy transfer reaction and symbiotic biological N-fixation process. These results are in close agreement with the findings of Alam *et al*. (2009) [1].

### (b) Yield attributes

It is clear from the data given in table-2 indicated that number of pods/plant was influenced significantly by integrated nutrient management practices of chickpea. The number of pods/plant was produced maximum with the application of 75% RDF+FYM @ 2.5 t/ha+ Vermicompost @ 1.0t/.ha as compared to all other treatment.

The similar results the number of seed/plant and test weight of chickpea were recorded significantly higher with the application of 75% RDF+FYM @ 2.5 t/ha + Vermicompost @ 1.0 t/ha (16.40 and 14.45 g) which was also significantly superior over control and significantly at par with each other. The lowest number of seed/plant was in control treatments (12.47 and 9.97 g), respectively. Enhancement in yield attributes might be because of an ideas condition for soil micro flora with the application of FYM and Vermicompost and good tilth and their by better availability of nutrients and hence such response. The results are in close agreement with the findings of Tigga *et al*. (2004) [8], Tomar and Khajanji (2009) [9] and Wandil *et.al*. (2011) [11].

### (c) Yields

The seed yield (20.67 q/ha) was recorded significantly maximum with the application of 75% RDF + FYM @ 2.5 t/ha + Vermicompost @ 1.0 t/ha Application of RDF as 20:60:20 kg/ha NPK (19.27 q/ha) and 50% RDF+FYM @ 5.0 t/ha+ Vermicompost @ 2.5 t/ha (18.40 q/ha) which were significantly at par but showed significantly impact compared to remaining treatment, respectively. The application of 75% RDF+FYM @ 2.5 t/ha+ Vermicompost @ 1.0 t/ha increased the seed yield by a margin of 8.75 q/h (73.41%), 7.39 q/ha (55.65%), 1.40 q/ha (7.27%), 5.93 q/ha (40.23%), 6.22 q/ha (43.04%), 2.27q/ha (12.34%) and 3.63 q/ha (21.30%) than control, Farmers practices as 50 kg DAP/ha, RDF as 20:60:20 NPK/ha, FYM @ 10 t/ha, Vermicompost @ 5 t/ha, 50% RDF+FYM @ 2.5 t/ha + Vermicompost @ 2.5 t/ha and 25% RDF+FYM @ 10 t/ha + Vermicompost @ 5 t/ha, respectively. The straw and biological yield were noticed highest with the application of 75% RDF + FYM @ 2.5 t/ha + Vermicompost @ 1.0 t/ha (29.50 q/ha and 50.17 q/ha) followed by RDF as 20:60:20 kg NPK/ha (38.35 q/ha and 47.62 q/ha) and 50% RDF+FYM @ 5 t/ha + Vermicompost @ 2.5 t/ha (27.70 q/ha and 46.10 q/ha) as compared to rest treatment respectively. These treatments were also exhibited significantly at par with each other. Harvest index was not influenced significantly by different integrated nutrient

management practices of chickpea during observation period. The harvest index was noticed maximum (41.25%) with the application of 75% RDF + FYM @ 2.5 t/ha + Vermicompost @ 1.0 t/ha and lowest (35.63%) in control p lot in present field experimentation the increments in supply of essential elements through organic and inorganic sources, their availability, mobilization and influx into the plant tissues increased and thus, improved growth and yield components and finally the seed straw and biological yield of chickpea and as well as better availability of nutrients in the soil and source-sink relationship, resulting in higher production of photosynthetic and increased translocation and to reproductive parts and increased the harvest index. The results corroborated the findings of Thenua *et al*. (2010) [7] Chaturvedi *et al*. (2010) [3], Gajbhiye *et al*. (2011) [4].

**(d) Economics**

It is clear from the data given in Table-4 was indicate that gross return and net return in respect of chickpea crop was recorded economically more Rs. 123112/ha and Rs. 100506/ha with the application of 75% RDF+FYM @ 2.5t/ha + Vermi compost @ 1.0 t/ha compared to rest treatment, respectively during study period. The lowest value of growth return and net return was recorded with control plot of Rs. 71491 and Rs. 52184/ha respectively. Benefit cost ratio was higher 5.45 with the application of 75% RDF+FYM @ 2.5t/ha + Vermicompost @ 1.0 t/ha followed by 100% RDF 20:60:20 kg NPK/ha which was received (5.44) as compared to treatment of FYM @ 10 t/ha i.e. 3.18 followed with application of 25% RDF+FYM @ 10 t/ha + Vermicompost @ 5 t/ha (3.60) in present study. These results are inconformity to these of Verma *et al*. (2017).

**Table 1:** Performance of integrated nutrients management on growth attributes of chickpea.

| Treatments | Plant Population ($m^2$) | Plant Height (m) | Primary Branches (m) | Secondary Branches (m) | Dry Matter Accumulation (g/plant) |
|---|---|---|---|---|---|
| Control | 295.01 | 28.87 | 4.33 | 3.45 | 16.51 |
| Farmer Practice (50 Kg DAP/ha) | 301.71 | 29.73 | 4.47 | 3.91 | 18.62 |
| RDF (20 kg N+60kg $P_2O_5$+ 20 Kg $K_2$/ha) | 322.66 | 34.53 | 6.37 | 5.55 | 28.43 |
| FYM @ 10 t/ha | 312.38 | 31.93 | 5.21 | 4.70 | 20.54 |
| Vermicompost @ 5 t /ha | 309.12 | 31.40 | 4.71 | 4.23 | 19.57 |
| 75% RDF+FYM @ 2.5 t/ha+Vermi. @ 1.0 t/ha | 325.38 | 35.00 | 6.83 | 5.70 | 29.72 |
| 50% RDF+FYM @ 5 t/ha+Vermi. @ 2.5 t/ha | 321.15 | 33.80 | 6.23 | 5.80 | 26.53 |
| 25% RDF+FYMN @ 10 t/ha+Vermi. @ 5 t/ha | 316.39 | 32.80 | 5.76 | 4.71 | 25.28 |
| SE(d) | 7.16 | 1.17 | 0.20 | 0.11 | 1.25 |
| CD at 5% | NS | 3.56 | 0.60 | 0.33 | 3.78 |

**Table 2:** Performance of integrated nutrients management on yield attributes of chickpea.

| Treatment | Yield attributes | | |
|---|---|---|---|
| | Pod/ Plant | Seed/ Plant | Test weight(g) |
| Control | 41.38 | 12.47 | 9.97 |
| Farmer Practice (50 Kg DAP/ha) | 45.51 | 12.53 | 10.52 |
| RDF (20 kg N+60 kg $P_2O_5$+ 20 Kg $K_2$/ha) | 55.94 | 14.13 | 13.22 |
| FYM @ 10 t/ha | 49.88 | 12.93 | 11.55 |
| Vermicompost @ 5 t /ha | 48.02 | 12.70 | 11.04 |
| 75% RDF+FYM @ 2.5 t/ha+Vermi. @ 1.0 t/ha | 59.00 | 16.40 | 14.45 |
| 50% RDF+FYM @ 5 t/ha+Vermi. @ 2.5 t/ha | 53.42 | 13.93 | 12.43 |
| 25% RDF+FYMN @ 10 t/ha+Vermi. @ 5 t/ha | 49.51 | 13.47 | 12.2 |
| SE(d) | 1.27 | 0.75 | 0.76 |
| CD at 5% | 3.86 | 2.26 | 2.32 |

**Table 3:** Effect of integrated nutrients management on yields of chickpea

| Treatment | Seed yield (q/ha) | Straw yield (q/ha) | Biological yield (q/ha) | H. I. (%) |
|---|---|---|---|---|
| Control | 11.92 | 21.58 | 33.50 | 35.63 |
| Farmer Practice (50 Kg DAP/ha) | 13.28 | 22.46 | 35.74 | 37.08 |
| RDF (20 kg N+60 kg $P_2O_5$+ 20 Kg $K_2$/ha) | 19.27 | 28.35 | 47.62 | 40.48 |
| FYM @ 10 t/ha | 14.74 | 23.90 | 38.64 | 38.07 |
| Vermicompost @ 5 t /ha | 14.45 | 23.52 | 37.96 | 37.94 |
| 75% RDF+FYM @ 2.5 t/ha+Vermi. @ 1.0 t/ha | 20.67 | 29.50 | 50.17 | 41.25 |
| 50% RDF+FYM @ 5 t/ha+Vermi. @ 2.5 t/ha | 18.40 | 27.70 | 46.10 | 39.96 |
| 25% RDF+FYMN @ 10 t/ha+Vermi. @ 5t/ha | 17.04 | 25.84 | 42.89 | 39.78 |
| SE(d) | 1.06 | 1.32 | 1.57 | 2.22 |
| CD at 5% | 3.21 | 4.00 | 4.76 | NS |

**Table 4:** Performance of integrated nutrients management on economics of chickpea crops

| Treatment | Cost of Cultivation (Rs/ha) | Gross return (Rs./ha) | Net return (Rs./ha) | B:C ratio |
|---|---|---|---|---|
| Control | 19307 | 71491 | 52184 | 3.70 |
| Farmer Practice (50 Kg DAP/ha) | 20407 | 79495 | 59088 | 3.90 |
| RDF (20 kg N+60 kg $P_2O_5$+ 20 Kg $K_2$/ha) | 21106 | 114885 | 93779 | 5.44 |
| FYM @ 10 t/ha | 24307 | 88102 | 63795 | 3.62 |
| Vermicompost @ 5 t /ha | 22807 | 86378 | 63571 | 3.79 |
| 75% RDF+FYM @ 2.5 t/ha+Vermi. @ 1.0 t/ha | 22606 | 123112 | 100506 | 5.45 |
| 50% RDF+FYM @ 5 t/ha + Vermi. @ 2.5 t/ha | 24456 | 109767 | 85311 | 4.49 |
| 25% RDF+FYMN @ 10 t/ha+ Vermi. @ 5 t/ha | 28257 | 101694 | 73437 | 3.60 |

## Conclusion

Over all on the basis of experimentation in applied of 75% RDF + FYM @ 2.5 t/ha + vermicompost @ 1.0 t/ha integrated nutrient management practices was recorded highest growth and yield attributes, better and high yielded grain yield and net return received compared to control plot of Chickpea Variety KGD-1168 in Central Plain Zone of Uttar Pradesh.

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