IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Assessment of growth and yield attributes of Chickpea (*Cicer arietinum* L.) under Integrated Nutrient Management

Ashutosh Subhash Mane[1], Awaneesh Kumar[2*], Ritika Kumari[1], Harsh Vardhan Vimal[1], Rasika Gawande[1]

[1] Research Scholar, School of Agriculture, Uttaranchal University, Deharadun 248007, Uttarakhand, India.

[2] Assistant Professor, School of Agriculture, Uttaranchal University, Deharadun 248007, Uttarakhand, India.

ABSTRACT:

A field experiment was carried out during rabi season of 2021-2022 at Crop Research Center, Uttaranchal university, Dehradun to evaluate the result of organic and inorganic fertilizer application on productivity of chickpea in vertisol soil. The geography of trial field was uniform and levelled. The soil of experimental site was sandy clay loam in texture, moderately alkaline in reaction having pH 7.04 with chemical composition such as moderate in nitrogen (298 kg ha^{-1}) and phosphorous (12.15 kg ha^{-1}) and very low in available potassium (234 kg ha^{-1}). The experimental trial was performed in Randomized Block Design (RBD). The eight treatments were replicated thrice. The application of **25% RDF+25% Vermicompost + 25% Azotobacter +25%Rhizobium (T_8)** recorded higher growth, yield attributes and seed yield. After that, application of **75% RDF + 25% Rhizobium (T_4)** and **50% Rhizobium + 50% Vermicompost (T_6)** found considerably greater than over rest of the treatments.

KEYWORDS: Chickpea, RDF, Rhizobium, Azotobacter, Vermicompost

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is a main pulse crop grown and consumed all over the world. Chickpea are classified into two types namely, Desi and Kabuli. Desi Channa, (also known as microsperma,) have pink colored flowers and thick seed coat. The Kabuli Channa (also known as macrosperma) have white colored flowers and seeds with a ram's head shape, thin seed coat and smooth seed surface [2].

It is an excellent source of vitamins such as niacin, riboflavin, folate, thiamin, a precursor, β-carotene and the protein quality is considered to be healthier than other pulses. chickpea is nutritionally rich and important pulse crop, containing unsaturated fatty acids like linoleic and oleic acid. It can contain positive effects on some of the important human diseases like cardiovascular disease, type 2 diabetes, digestive diseases and some cancers. In India, chickpea is cultivated in an area of 10.56 million hectares with total production of nearly 11-12 million tonnes with productivity of 1063 kg/ha. whereas in Gujarat, chickpea is grown in an area of 0.29 million hectares producing 0.37 million tonnes with the around yield of 1250 kg/ha (Anonymous, 2018) [1].

It is fundamental to supply essential nutrient elements in proper amount to sustain soil health and soil fertility and also to boost the crop production. Excessive uses of fertilizer by farmers not only decrease the crop yield but also depreciate the quality of soil and water resource. For reducing the cost of cultivation there is a need of integrated use of Rhizobium and inorganic fertilizers. Treating the seed of chickpea with Rhizobium culture is low-cost technology for increasing the yield. Furthermore, environmental conditions such as pH, nutrient availability, temperature, herbicides and moisture have a significant effect on legume-Rhizobium symbiosis and its nitrogen fixation efficiency **(Singh *et al.*, 2008)**.

Keeping in view, the present research entitled '**Assessment of growth and yield attributes of Chickpea (*Cicer arietinum* L.) under Integrated Nutrient Management**' was undertaken to evaluate the effect of STCR based N, P and K application on productivity of chickpea.

MATERIALS AND METHODS:

An experiment was carried out during rabi season of 2021-2022 at Crop Research Center, Uttaranchal university, Dehradun to study the INM performance of chickpea (*Cicer arietinum* L.). The soil of experimental site was sandy clay loam in texture, black in colour with good drainage. Soil was moderate in available nitrogen (298.7 kg ha^{-1}), very low in available phosphorous (12.15 kg ha^{-1}) and very low in available potassium (235.4 kg ha^{-1}). The soil was moderately alkaline in reaction having pH 7.03. The experimental trial was conducted in Randomized Block Design. The eight treatments were replicated thrice. The treatments were **T_1: control, T_2 :100 % RDF (25:50:25), T_3 :75% RDF + 25% Vermicompost, T_4: 75% RDF + 25% Rhizobium, T_5: 50% Rhizobium + 25% RDF + 25% Vermicompost, T_6: 50% Rhizobium + 50% Vermicompost, T_7: 25% RDF + 50% Vermicompost + 25% Azotobacter, T_8: 25% RDF+25% Vermicompost + 25% Azotobacter +25% Rhizobium.** The gross and net plot size of each experimental unit was 14 m x 9 m and 3 m x 2 m, respectively. Sowing was done by dibbling method by using seed rate 60 kg ha^{-1}. The recommended dose of fertilizer was 25: 50:25 kg NPK ha^{-1}. Fertilizers was given as per treatments.

RESULT AND DISCUSSION:

Growth Attributes

Growth attributing characters like plant height (cm), number of branches and dry matter accumulation (g) $plant^{-1}$ were influenced significantly due to different treatments (Table 1). Maximum plant height chickpea was recorded with application of **25% RDF+25% Vermicompost + 25% Azotobacter +25% Rhizobium (T_8)** which was at par with the application of **75% RDF + 25% Rhizobium (T_4)** and **75% RDF + 25% Vermicompost (T_3)** and found significantly superior over rest of the treatments.

Maximum number of branches was recorded highest with application of **25% RDF+25% Vermicompost + 25% Azotobacter +25% Rhizobium (T_8)** which was at par with Application of **75% RDF + 25% Rhizobium(T_4) and 25% RDF + 50% Vermicompost + 25% Azotobacter (T_7)** and found superior over rest of the treatments. These might have resulted because of the role of N and P in plant which accelerated various metabolic processes which reflect in greater apical growth, cell elongation and shoot development along with vermicompost which provide supplementary nutrient and enhanced nutrient availability with balanced fertilizer. Also these treatments might have assist the applied nutrients capably according to the require of crop and enriched nutrients kept in soil which leading to better comfortable of nutrients by the crop. Similar results were observed by *Jadhav et al.* (2009) [5], Tripathi *et al.* (2013) [6], Kumar *et al*. (2015) [7], and Singh *et al.* (2018) [4].

Maximum total dry matter $plant^{-1}$ (g) of chickpea was recorded with application of **25% RDF+25% Vermicompost + 25% Azotobacter +25% Rhizobium (T_8)** which was at par with the application of **75% RDF + 25% Rhizobium(T_4)** and **25% RDF + 50% Vermicompost + 25% Azotobacter (T_7)** and found significantly superior over rest of the treatments. This might have happened because of superior accessibility of nutrients in soil which leads to better absorption of nutrient which improve photosynthesis and translocation assimilates. Similar findings were recorded by Singh *et al.* (2015) and Yadav *et al.* (2017) [8].

Yield Attributes

The yield attributing characters of gram viz., number of pods $plant^{-1}$, number of seeds $plant^{-1}$, weight of pods $plant^{-1}$ (g), seed yield $plant^{-1}$ (g) and seed yield (kg ha^{-1}) were found significant and superior in **25% RDF+25% Vermicompost + 25% Azotobacter +25% Rhizobium (T_8)** over rest of the treatments. Although, number of seeds pod^{-1} found abundantly in **75% RDF + 25% Rhizobium(T_4)** over the rest of treatments. These effect could be attributed due to better translocation of assimilate towards sink. Application of Rhizobium and Azotobacter with vermicompost and zinc sulphate improved the nutrient metabolism, biological activity and growth parameter which support vegetative branches and leads to increase in all yield attributes and final seed yield (kg ha^{-1}). Similar results were observed in findings of Jadhav et al. (2009) [5], Yadav *et al.* (2017) [8], Singh *et al.* (2018) [4] and Srivastav *et al.* (2019) [9].

Table.1 Effect of different treatments on growth attributing characters of Chickpea.

Treatment		Plant height (cm) at harvest	No. of branches at harvest	Dry matter (g) at harvest
T_1	CONTROL	42.9	7.9	16.18
T_2	100% RDF [25:50:25]	45.73	8.06	16.76
T_3	75% RDF + 25% Vermicompost	48.16	7.83	16.84
T_4	75% RDF + 25% Rhizobium	49.13	9.13	18.11
T_5	50% Rhizobium + 25% RDF + 25% Vermicompost	45.90	8.23	17.56
T_6	50% Rhizobium + 50% Vermicompost	46.90	8.43	17.83
T_7	25% RDF + 50% Vermicompost + 25% Azotobacter	47.86	8.86	18.03
T_8	25% RDF+25% Vermicompost + 25% Azotobacter +25% Rhizobium	51.00	10.33	19.13
SE		**1.111**	**0.216**	**0.034**

CD@5%	**1.846**	**0.813**	**0.322**
General Mean	**47.2**	**8.59**	**17.56**

Table.2 Effect of different treatments on yield attributing characters and yield of Chickpea

Treatment		**No of pods per plant**	**No of seeds per plant**	**No of seeds per pod**
T_1	**CONTROL**	34.70	34.50	1.05
T_2	**100% RDF [25:50:25]**	52.03	56.02	1.46
T_3	**75% RDF + 25% Vermicompost**	56.07	62.25	1.64
T_4	**75% RDF + 25% Rhizobium**	60.12	68.75	1.90
T_5	**50% Rhizobium + 25% RDF + 25% Vermicompost**	58.15	64.20	1.68
T_6	**50% Rhizobium + 50% Vermicompost**	42.40	66.48	1.75
T_7	**25% RDF + 50% Vermicompost + 25% Azotobacter**	59.17	61.32	1.63
T_8	**25% RDF+25% Vermicompost + 25% Azotobacter +25% Rhizobium**	64.02	74.23	1.86
SE		**1.005**	**2.32**	**0.098**
CD@5%		**NS**	**8.02**	**0.278**
General Mean		**53.33**	**60.96**	**1.61**

Table.3 Effect of different treatments on yield attributing characters and yield of Chickpea

Treatment		**Weight of pods per plant**	**Seed yield per plant**	**Seed index**
T_1	**CONTROL**	10.07	6.75	16.70
T_2	**100% RDF [25:50:25]**	12.05	8.25	17.00
T_3	**75% RDF + 25% Vermicompost**	13.45	8.05	17.20
T_4	**75% RDF + 25% Rhizobium**	14.27	9.75	19.05
T_5	**50% Rhizobium + 25% RDF + 25% Vermicompost**	13.20	8.56	18.65
T_6	**50% Rhizobium + 50% Vermicompost**	14.21	8.70	18.38
T_7	**25% RDF + 50% Vermicompost + 25% Azotobacter**	12.54	8.64	17.59
T_8	**25% RDF+25% Vermicompost + 25% Azotobacter +25% Rhizobium**	16.18	10.13	20.13
SE		**0.286**	**0.459**	**0.473**
CD@5%		**1.005**	**1.206**	**1.209**
General Mean		**13.24**	**8.60**	**17.46**

CONCLUSION:

From above result, it concluded that The application of **25% RDF+25% Vermicompost + 25% Azotobacter +25% Rhizobium (T_8)** recorded maximum growth, yield attributes and seed yield in chickpea production. After that, **75% RDF + 25% Rhizobium (T_4)** and **50% Rhizobium + 50% Vermicompost (T_6)** found as superior treatments.

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