

Original Research Article

Effect of organic and inorganic fertilizers on plant growth and pod yield of cluster bean (*Cyamopsis tetragonoloba*) cv. MDU 1

ABSTRACT

An experiment was carried out in departmental field of Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during April to July 2021 on Cluster bean (*Cyamopsis tetragonoloba*) cv. MDU 1 to find out the best suitable combination of organic and inorganic fertilizers for better vegetative growth and yield of cluster bean. The experiment include organic manures like FYM, Poultry Manure, Vermicompost, Goat Manure which were combined in different percentages with reduced dosage of inorganic fertilizers i.e RDF. Twelve treatment combinations were made and replicated thrice in Randomized Block Design. Application of fertilizers and manures was done as per the treatment allocation. The experimental results revealed that treatment T₃-75%RDF 18.75:37.5:37.5kg NPK +25%vermicompost 1.25t (5.66) took the minimum number of days to germinate, while vegetative parameters like plant height were recorded maximum in treatment T₄-75% RDF 18.75:37.5:37.5 kg NPK+25% Poultry manure 1.25t during the first 30 DAS, later at 60 and 90 DAS treatment T₁₀-50%RDF 12.5:25:25kg NPK +25%FYM 2.5t+25%poultry manure 1.25t was recorded with maximum height (67.04 and 119.09 cm) and maximum no of branches (22.05), first flower bud formation was observed in treatment T₃ (33.44 DAS), and yield parameters such as pod yield per plant (265.95 g), total Pod yield (17.72 t/ha), were also recorded significantly maximum in treatment T₁₀.

Keywords: *clusters; pod; Farmyard manure; Vermicompost; Poultry manure; Goat manure; Inorganic fertilizers*

1. INTRODUCTION

Cluster bean (*Cyamopsis tetragonoloba* L. *taub*) belonging to the Fabaceae family also popularly known as guar having a chromosome number $2n=14$ is an important multipurpose and self pollinated crop, its center of origin is Tropical Africa. *Cyamopsis senegalensis* is an ancestor of present cultivating clusterbean. Guar is a rich source of protein with 3.2 g, carbohydrates-10.8 g, moisture – 81%, vitamin C, vitamin K and vitamin A, dietary fibre, folate iron and K (Aykroyed,1963). Traditionally guar is cultivating in western dry zones of Rajasthan, Haryana and Punjab. Rajasthan alone accounts for 72% of the cluster bean produced in the country (Suresh *et al.*,2022). Cluster bean is grown for different purposes like vegetable, Green fodder, manure and feed. It is also used in reclamation of saline and alkaline soils (Singh and Usha 2003).

Addition of chemical fertilizers to grow crops for better yield is an established fact but increasing cost of these fertilizers direct towards the combined use of organic manures and inorganic fertilizers which seems to be viable method to produce higher yield. organic manures like FYM containing 0.5%N,

0.2%P₂O₅, 0.5% K₂O improves the nutrient and water holding capacity of soil (Tadesse *et al.*, 2013). vermicompost with 0.5%N, 0.15%P₂O₅, 0.5% K₂O is a rich source of major and micro nutrients also improves the physical, chemical and biological properties of soil (Singh *et al.*, 2008), poultry manure with 3.03%N, 2.63% P₂O₅,1.4%K₂O is a best form for easy absorption by plant roots, it includes the organic amendment of the soil and helps in nutrient provision to crops (Warren *et al.*, 2006), goat manure with 3%N, 1%P₂O₅,2%K₂O is rich in nitrogen levels makes it an excellent soil conditioner also helps in improving soil texture and provides a rich environment for roots to grow (Onwu *et al.*, 2014). Recommended dose of fertilizers was 25:50:50 NPK as guar itself has the ability to fix nitrogen through the root nodules so external application of N was less.

When organic manures applied along with inorganic fertilizers, the organic manures feed the soil and plants where as inorganic fertilizers containing mineral salts help in quick absorption of nutrients by the plant roots. Overtimes, soil treated alone with the chemical fertilizers loose the organic matter and all other important microorganisms which in turn need increase dosage application of fertilizers to stimulate plant growth. Integrated use of organic manures and inorganic fertilizers avoids throwing soil into this kind of situation. Hence keeping all the above points in view an experiment was undertaken to study Effect of organic and inorganic fertilizers on plant growth and pod yield and to find out the best suitable combination.

2. MATERIAL AND METHODS

The present investigation on Effect of organic and inorganic fertilizers on plant growth and pod yield of cluster bean *Cyamopsis tetragonoloba* cv MDU-1 was conducted at Horticulture Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The University is about 7 km away from Prayagraj city and it is geographically situated at 25.5°N latitude, 81.08°E longitudes. The altitude of this location is about 98 meter above the mean sea level. Twelve different treatment combinations of both organic and inorganic fertilizers were made including control as recommended dose of fertilizer in randomized block design with three replications. At each hill two seeds were sown at a depth of one inch. The recommended dose of nutrients is 25:50:50 kg/ha. NPK was applied as per the requirement of treatments in the form of urea, SSP and MOP. Nitrogen was given in two equal split doses i.e one at the time of sowing as basal dose and second dose as top dressing at 30 Days after sowing, phosphorus and potassium was applied as basal dose. Organic manures like FYM, vermicompost, poultry manure, goat manure were given 25% and 50% of recommended dose to the plots as per the treatments allocation. These organic manures were readily available for soil application. The Observations for all the characters were recorded in six randomly selected plants of each treatment. Germination and Growth parameters like days to germinate, plant height @30,60,90 DAS, Number of primary and secondary branches,Days to first flower bud observation, yield parameters like Average pod Yield/plant(g), Total pod yield (t/ha) were recorded. The data collected during the course of investigation were subjected to statistical analysis by adopting appropriate method of analysis of variance as described by Fisher (1950).

3. RESULTS AND DISCUSSION

3.1 Effect on germination and growth parameters of cluster bean

As per the experimental results germination was significantly influenced by the application of 25% vermicompost along with 75% RDF (5.66) which was also observed with saritha *et al.*, 2013,this might be due to the improvement in soil properties and quick availability of nutrients. At 30 DAS maximum plant height was recorded with application of 75% RDF and 25% poultry manure (30.84 cm). Later at 60 and 90 DAS when organic fertilizers commence releasing of nutrients plant height (67.04 and 119.09 cm), no of branches(22.05) were observed maximum with application of 50% RDF along with 25% FYM and 25% poultry manure. Ample supply of macro and micro nutrients from both the FYM and poultry enhances the physico-chemical properties of soil which might have helped in increasing the absorption and transportation of nutrients towards the developing part of the plant resulted in better vegetative growth. The results are at par with T₄. Similar findings were observed with Bhathal *et al.*, (2016). Earliness in flower bud formation was noticed when treated with 25% RDF along with 75% poultry manure (33.44), nutrients combined with translocation of cytokinins might have favoured the plant in entering into reproductive phase, similar with the results of Yadav and Luthra (2005).

Table 1 : Effect of organic and inorganic fertilizers on germination and growth parameters

| Notation | Treatment | Days to germinate | Plant height(cm) | | | Flower bud formation |
|-----------------|-------------------------------|-------------------|------------------|--------|--------|----------------------|
| | | | 30 DAS | 60 DAS | 90 DAS | |
| T ₁ | 100%RDF (NPK @25:50:50 kg/ha) | 6.10 | 25.15 | 62.76 | 98.04 | 36.99 |
| T ₂ | 75% RDF + 25% FYM | 5.88 | 29.99 | 64.97 | 112.05 | 34.60 |
| T ₃ | 75% RDF+25% VC | 5.66 | 30.75 | 65.53 | 113.11 | 33.44 |
| T ₄ | 75 % RDF+25 % PM | 5.88 | 30.84 | 66.30 | 117.02 | 33.83 |
| T ₅ | 75 % RDF+25% GM | 6.05 | 29.48 | 64.78 | 107.18 | 35.33 |
| T ₆ | 50% RDF+ 50%FYM | 5.99 | 26.29 | 63.98 | 103.80 | 35.44 |
| T ₇ | 50%RDF+50%VC | 5.94 | 26.87 | 64.89 | 110.32 | 34.49 |
| T ₈ | 50%RDF+50%PM | 5.83 | 27.09 | 65.44 | 113.04 | 34.27 |
| T ₉ | 50% RDF+50 % GM | 5.94 | 26.07 | 63.89 | 101.01 | 35.49 |
| T ₁₀ | 50 % RDF+25% FYM+25% PM | 6.05 | 29.07 | 67.04 | 119.09 | 35.60 |
| T ₁₁ | 50% RDF+25% VC+25% GM | 6.60 | 28.61 | 65.86 | 115.03 | 35.99 |
| T ₁₂ | 25%FYM+25%VC+25 %PM+25%GM | 5.94 | 25.26 | 62.95 | 99.04 | 36.16 |
| F-test | | S | S | S | S | S |
| SE(d) | | 0.205 | 0.468 | 0.524 | 1.205 | 0.427 |
| C.D at 5% | | 0.429 | 0.977 | 1.094 | 2.516 | 0.891 |

FYM-Farmyard manure, VC-Vermicompost, PM-Poultry manure ,GM-Goat manure

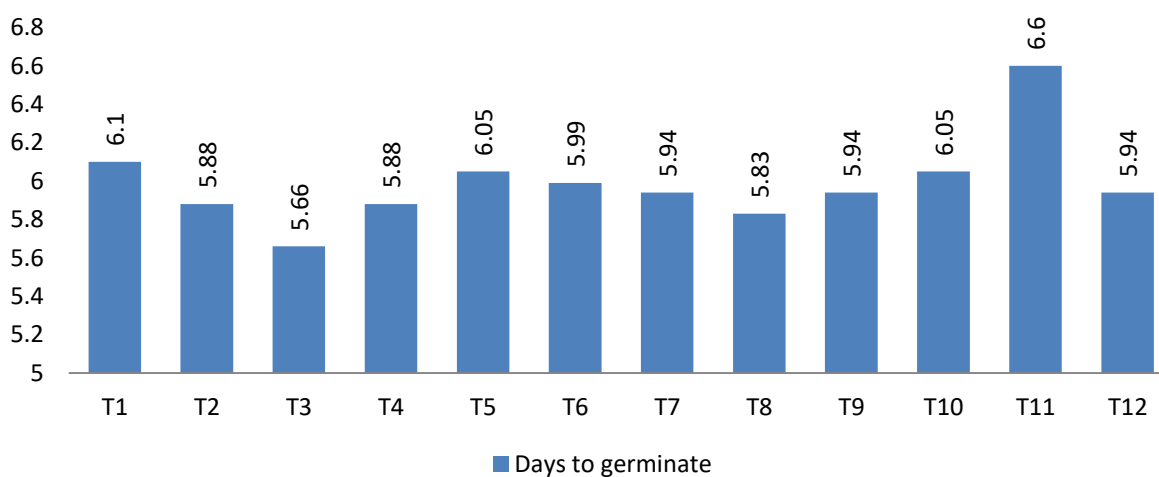


Fig 1: Effect of organic and inorganic fertilizers on germination of cluster bean

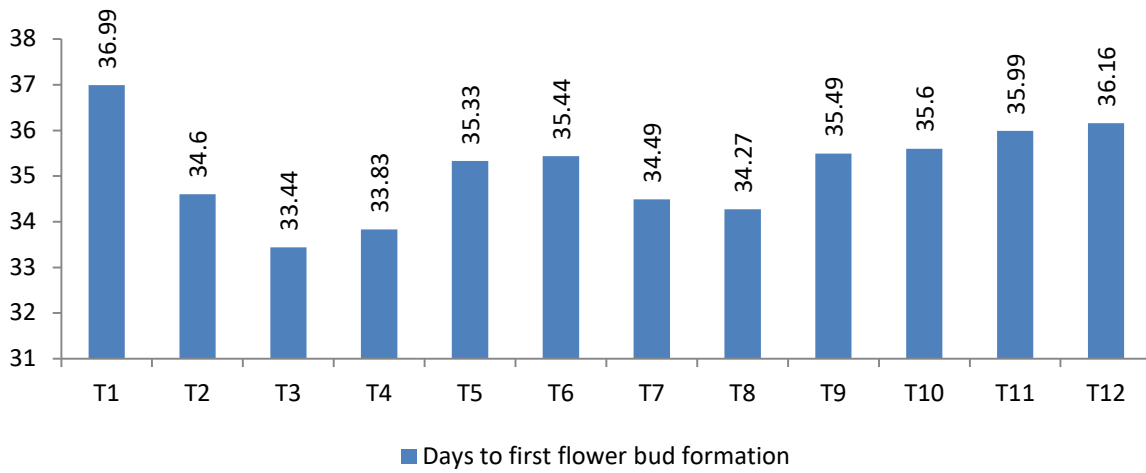


Fig 2: Effect of organic and inorganic fertilizers on days to first flower bud formation in cluster bean

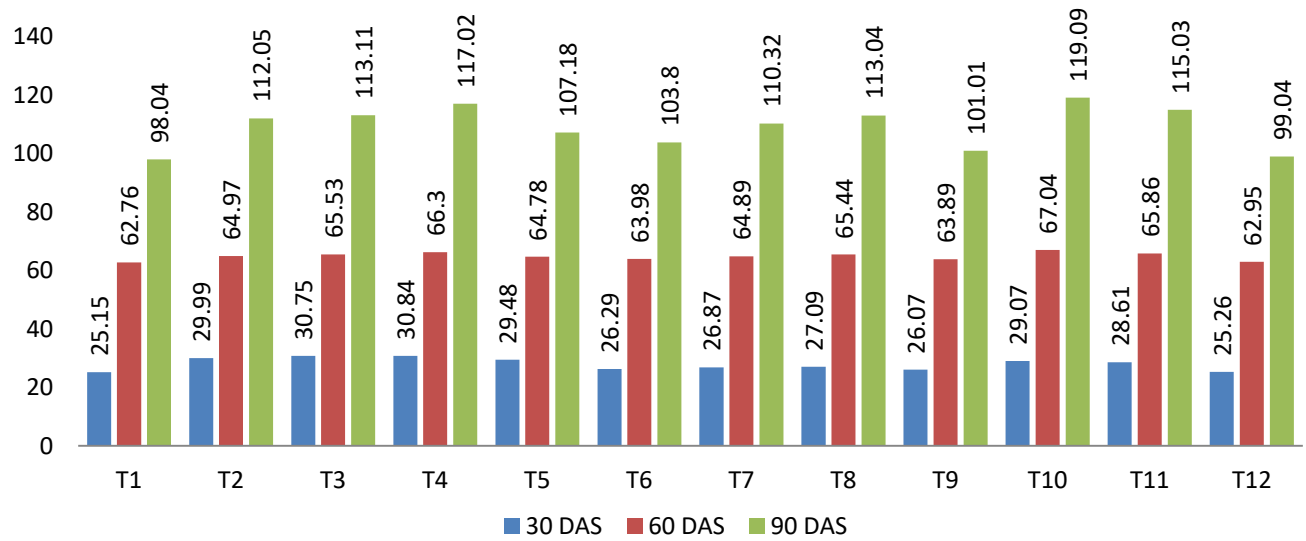


Fig 3: Effect of organic and inorganic fertilizers on plant height of cluster bean

3.2 Effect on yield parameters of cluster bean

It is quiet apparent from Table 2 that maximum no of clusters per plant (22.88), pods per cluster (8.29), Average pod yield (265.95 g/plant) and total pod yield (17.72 t/ha) was recorded maximum with combine application of 50% RDF along with 25% FYM and 25% poultry manure, it might be due to vigorous vegetative growth which hasten photosynthesis, production of photosynthates there by increasing the supply of carbohydrates to plants (Priyadarshini *et al.*, 2022). The beneficial effect of FYM and poultry might have helped in easily utilized form of plant nutrients during the crop growth period resulted in superior yields. The results also corroborates with Choudhary *et al.*, 2021. These observations are at par with T₁₁ (16.89 t/ha) and minimum yield was observed in T₁-100% NPK with inorganic fertilizers (10.38 t).

Table 2 : Effect of organic and inorganic fertilizers on yield parameters

| Notation | Treatments | No of branches | Clusters/ plant | Pods/ cluster | PodYield/ plant (g) | Total Yield (t/ha) |
|-----------------|---------------------------|----------------|-----------------|---------------|---------------------|--------------------|
| T ₁ | 100%RDF | 14.99 | 16.61 | 6.11 | 155.77 | 10.38 |
| T ₂ | 75% RDF + 25% FYM | 18.38 | 18.88 | 7.22 | 195.60 | 13.03 |
| T ₃ | 75% RDF+25% VC | 20.55 | 20.33 | 7.72 | 218.52 | 14.56 |
| T ₄ | 75 % RDF+25 % PM | 20.71 | 20.99 | 7.93 | 225.34 | 15.01 |
| T ₅ | 75 % RDF+25% GM | 17.49 | 18.66 | 6.91 | 192.72 | 12.84 |
| T ₆ | 50% RDF+ 50%FYM | 16.69 | 17.99 | 6.75 | 182.92 | 12.18 |
| T ₇ | 50%RDF+50%VC | 18.49 | 19.16 | 7.30 | 198.85 | 13.25 |
| T ₈ | 50%RDF+50%PM | 20.05 | 19.83 | 7.41 | 203.91 | 13.58 |
| T ₉ | 50% RDF+50 % GM | 16.60 | 17.94 | 6.55 | 167.96 | 11.19 |
| T ₁₀ | 50 % RDF+25% FYM+25% PM | 22.05 | 22.88 | 8.29 | 265.95 | 17.72 |
| T ₁₁ | 50% RDF+25% VC+25% GM | 21.16 | 21.83 | 8.06 | 253.55 | 16.89 |
| T ₁₂ | 25%FYM+25%VC+25% PM+25%GM | 15.16 | 17.88 | 6.33 | 166.43 | 11.09 |
| F-test | | S | S | S | S | S |
| SE(d) | | 0.705 | 0.454 | 0.249 | 11.95 | 0.798 |
| C.D at 5% | | 6.582 | 0.947 | 0.519 | 24.952 | 1.666 |

FYM-Farmyard manure, VC-Vermicompost, PM-Poultry manure ,GM-Goat manure

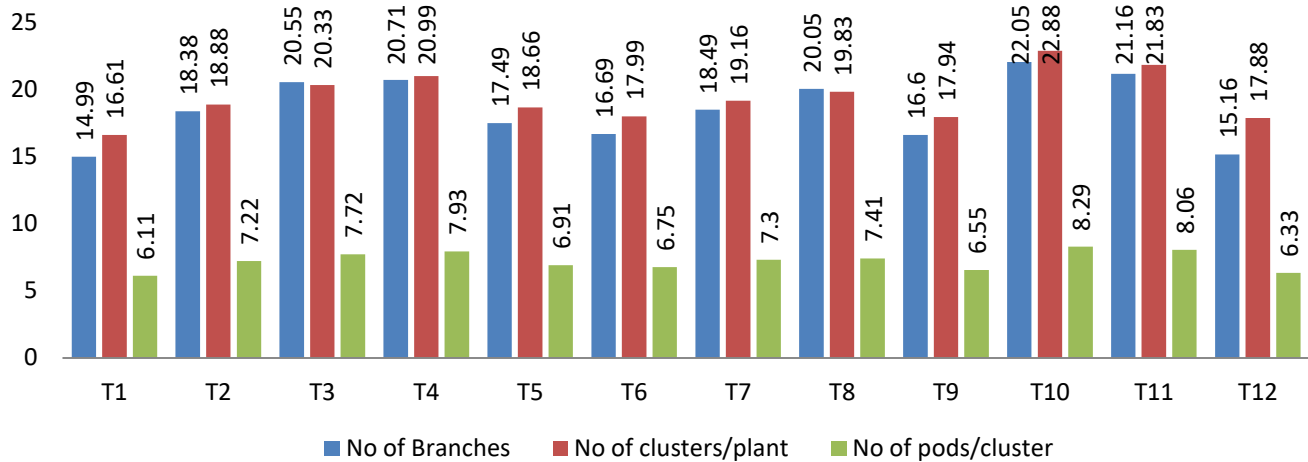


Fig 4: Effect of organic and inorganic fertilizers on No of branches, no of cluster/plant and no of pods/cluster of cluster bean

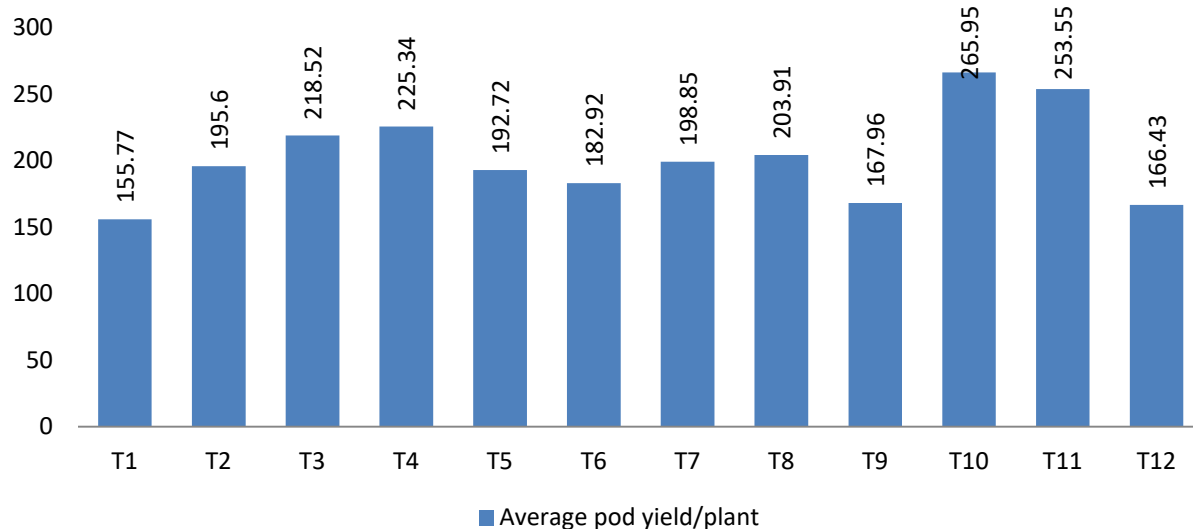


Fig 5: Effect of organic and inorganic fertilizers on Average pod yield/plant of cluster bean

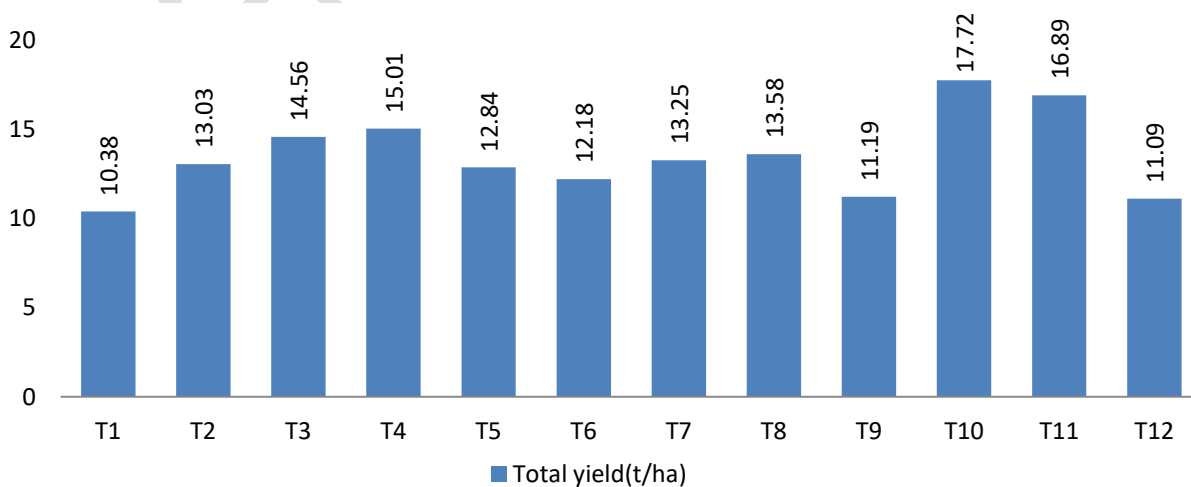


Fig 6: Effect of organic and inorganic fertilizers on Total yield of cluster bean

4. CONCLUSION

When inorganic fertilizers combined with organic manures, Fertilizers help in quick release of nutrients present in them to the plant where as organic fertilizers containing both micro and macro nutrients supplies nutrients to the plants along with soil, which helps in enhancing the fertility of soil by increasing microbial activity which inturn helps in better vegetative and reproductive growth of plant. In treatment T₁₀ RDF helped out in quick availability of nutrients at early stages of plant growth whereas Poultry and FYM which are readily available and easy for the plant to absorb compared to other organic manures resulted in maximum yield of 17.72 t/ha. While minimum yield was recorded with T₁ -100% RDF 10.38 t/ha compared to all other treatments.

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