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**Om Prakash Pandey**
Department of Agricultural Chemistry & Soil Science, Udai Pratap Autonomous College, Varanasi, Uttar Pradesh, India

**Sanjay Kumar Shahi**
Department of Agricultural Chemistry & Soil Science, Udai Pratap Autonomous College, Varanasi, Uttar Pradesh, India

**Akhila Nand Dubey**
Departemnt of Soil Science & Agricultural Chemistry, Banaras Hindu University, Varanasi Uttar Pradesh, India

**Sunil Kumar Maurya**
Department of Agricultural Chemistry & Soil Science, Udai Pratap Autonomous College, Varanasi, Uttar Pradesh, India

**Correspondence**
**Akhila Nand Dubey**
Departemnt of Soil Science & Agricultural Chemistry, Banaras Hindu University, Varanasi Uttar Pradesh, India

# Effect of integrated nutrient management of growth and yield attributes of green gram (*Vigna radiata* L.)

**Om Prakash Pandey, Sanjay Kumar Shahi, Akhila Nand Dubey and Sunil Kumar Maurya**

**Abstract**
A field experiment was carried out at college farm of Udai Pratap College, Varanasi, Uttar Pradesh during 2015-16 to Effect of Integrated Nutrient Management on yield and productivity of Green gram crop with six treatments *i.e.* $T_1$ (Control), $T_2$ (100% NPK), $T_3$ (75% NPK +5t FYM $ha^{-1}$ + Biofertilizer (PSB+Rhizobium), $T_4$ (50% NPK+5t FYM $ha^{-1}$+ Bio-fertilizer), $T_5$ (10t FYM $ha^{-1}$ + Bio-fertilizer) and $T_6$ (10t Vermicompost $ha^{-1}$ + Bio-fertilizer). The plant growth parameters were taken at 30, 45 and 60 days after sowing. Plant height, no. of leaves & pod form, no. of branches, root nodules yield of grain and stoves were maximum found in $T_3$ followed by $T_4$ than $T_2$. The application of NPK through inorganic source with FYM and vermicompost significantly increased to yield attributes at all level of fertilizer. Thus integrated application of inorganic and organic source (Vermicompost + FYM) maximized yield of green gram.

**Keywords:** FYM, Vermicompost and Green gram crop

## Introduction
Green gram (*Vigna radiate* L.) is an important pulses crop in India. It is short duration legume crop grown mostly as a fallow crop in rotation with rice. Similar to the leguminous pulses, green gram, enriches soil nitrogen content. Green gram is also used as green manuring crop. Being a leguminous crop, it has the capacity to fix the 42 kg N ha-1 from atmospheric nitrogen. It also helps in preventing soil erosion being intensive crop rotation. Moong bean can be used as feed for cattle after harvesting the pods, green plant are uprooted or cut from ground level and chapped into small pieces and feed to the cattle. The husk of the seed can be soaked in water and used as cattle feeds. Green gram production of India is 1.51 million tons in 2014-15 (Sources GOI Department of Agricultural and Corporation 2014-15).
India is the world`s largest producer as well as consumer of green gram it produce about 1.5 to 2.0 million tonnes of moong from about 3 to 4 million hectares of area with an average productivity of 500 kg ha-1. Green gram output account for about 10 to 12% of total pulses production in the country. In India, the important states growing this crop with a total area of about 30 lakh hectares are Orissa, Madhya Pradesh, Gujarat, Rajasthan, U.P and Bihar. Its grains are used as dal, soup and feed for animals. Its used as fodder and fuel. It has highest nutritive and digestibility. Its grain contains 24.20% protein, 1.3%fat, 60.4%carbohydrate and also calcium phosphorous 118 and 340 mg per 100 g grain, respectively. The effect of N,P and K fertilizers with or without FYM, lime Sand B on yield, nutrient uptake and fertility status of soil available N, P, K and S. The highest grain yield of rice and pea was recorded in the treatment recieving,50%of recommended dose of NPK fertilizers along with application of 5tFYM+250kg lime+20kg S+1kg B/ha. Integrated use of FYM, lime, Sand B with 50% RDF increase considerably total NPK and Sup take by rice-pea cropping system. Application of lime @250kg/ha in furrow along with 5t FYM/ha and 50%RDF significantly improve the ph of soil after harvest of pea crop. INM enhanced OC and available NPK and S content in the soil (Singh *et al.*, 2011) [9]. Thakur *et al.* (2011) [10] were also reported that the application of recommended dose of N, P and K (20:80:20 kg/ha to soyabeen and 120:80:40kg/ha to wheat) with organic manure @15t FYM/ha resulted in 145% and 292% increase in soyabeen and wheat yield respectively over control use of FYM with 100% NPK substantially improved the orgnic C. The decline of K was of lower magnitude with 100% NPK+FYM (14.9%) and 150% NPK (20% treatment indicting to raise the level of K fertilizer application to meet demands of crops. Ali *et al.*, (2009) [1] reported that the application of OM significantly increased the rhizospheric microbial population (Bacteria, Fungi and Actinomycetes) and available soil N, P

and K in green gram. Application of FYM (10t/ha) proved significantly superior to drawled (15t/ha).Soil inoculation with phosphorus solublizer recorded significant increase in grain and straw yield of green gram. Increasing level of P up to 30 kg P2O5/ha significantly improve the grain and straw yield of green gram. Application of 30kgP2O5/ha could be designated as safe limit for maximum microbial build up in the green-gram.

The intercropping black gram with pigeonpea recorded higher value of organic carbon, available N, P, K content microbial population, dehydrogenase activity in soil and yield of pigeonpea and its equivalent application of 5.0t FYM/ha increase OC available N, P and K content biological properties of soil viz. microbial population and yield of component crops and pigeon pea equivalent over not application of FYM (Singh *et al.* 2007). There was build-up of available N in soil receiving 75% NPK along with FYM. a significant @5 t/ha over other treatment. The higher available N Content in the 75%. NPK+FYM.@5t/ha+ bio-fertilizer treatment may be due to optimal fertilizer input, three year conjoint used of 5t FYM/ha with 75% NPK significantly improved the organic carbon and available N, P & K Contents over the chemical fertilizer alone significantly higher grain yield of 5.36 t/ha & total N.P.K. uptake by rice with the application of 100% NPK & 10% FYM/ha as compared to grain yield of 4.46 t/ha (Chesti *et al*,. 2015) [2]. The information regarding the application of NPK, FYM and Vermi-compost in Indian Moong is very less and fragmentary, particularly for eastern region for Uttar Pradesh. Keeping the above fact in view, an attempt has been made to study the effect of integrated nutrient management on soil fertility status and productivity under the moong crop.

## Materials and Methods

The field experiment was conducted during Zaid season 2015-16 on research plot of Udai Pratap Autonomous College, Varanasi (U.P.) adjoining the department of Agricultural Chemistry and Soil Science. The soils of Varanasi formed on alluvial, deposited by river Ganga have predominance of Illite, quartz, feldspars and Illite minerals are partly inherited from micas which are predominant in the sand and silt fractions. The soil of experimental field was sandy loam with low in available nitrogen (256.72kg ha-1), low in available phosphorus (12.8 kg ha-1) and medium in available potassium (203.6kg ha-1). The pH and E.C. were 7.7 and 0.50 dsm-1 respectively. The experiment was laid out in a randomized block design with seven treatments and three replication viz. T1 (Control), T2 (50% NPKS), T3 (50% NPKS+10 t Vermicompost/ha), T4 (100% NPKS), T5 (100% NPKS+10 t Vermicompost /ha), T6 (150% NPKS) and T7 (200% NPKS). Nitrogen, phosphorous and Potassium were applied as per treatment, half dose of nitrogen, full dose of phosphorous and potassium were applied at time of sowing and rest dose of nitrogen in two equal split one at 45 and 2nd at 60 days after sowing. FYM and vermicompost were applied before 15 days of sowing. Seed treatment was done with PSB + Rhizobium (bio-fertilizer).

## Results and Discussion

### 1. Plant height

The data obtained in relation to plant height are presented in table 1. It is evident from the table that plant height at 30, 45 and 60 days after sowing. Maximum plant height was recorded with treatment $T_3$ followed by other treatments in decreasing order as $T_4$> $T_2$> $T_6$>$T_5$> $T_1$. Results revealed that application of NPK, FYM and bio-fertilizer in combination significantly increased the plant height as compared to control. Further, all the treatments increased the plant height when compared with control. All the treatments containing NPK, FYM and Bio-fertilizer play a significant role in increment of plant height when compared with control. The maximum plant height was recorded in case of treatment $T_3$ (59cm) and minimum was in the treatment $T_1$ (38cm).The results corroborated the finding of Kumar and Singh (2010) [3].

### 2. Number of leaves

The results pertaining to influence of integrated use of NPK, FYM, vermicompost and biofertilizers on number of leaves measured at 30, 45 and 60 DAS have been presented in table 2. Application of 75% NPK along with FYM and biofetlizers significantly increased number of leaves as compared to other treatments. Results showed that incorporation of organic manures and biofertilizers could be reduced the chemical fertilizers upto 25%. It was also found that integration of organic manures and chemical fertilizers significantly increased number of leaves over chemical fertilizers alone. Effect of verious treatment on number of leaves could be arranged in order to $T_3$>$T_4$>$T_2$>$T_6$>$T_5$>$T_1$ and values varied between 20.20 to 29.13, 19.27-27.67, 19.09-26.67, 18.17-26.00, 16.60-25.27 and 15.07-22.47 under respective treatments. Similar results also reported by Singh *et al.* (2009) [8].

### 3. Number of branches

The results pertaining to influence of integrated use of NPK, FYM. Vermicompost and biofertilizer on number of branches measured at 30, 45 and 60 DAS have been presented in table 5.Application of 75% along with FYM and biofertilizers significantly increased number of braches as compared to other treatments. Results showed that incorporation of organic manure and biofertilizer could be reduced the chemical fertilizer upto 25%. It was also found that integration of organic manure and chemical fertilizer significantly increased number of branches over chemical fertilizer alone. Effect of various treatments on number of branches could be arranged in order to $T_3$>$T_4$>$T_2$>$T_6$>$T_5$>$T_1$ and values varied between 5.80 to 10.27, 4.80 to 8.73, 4.77-8.20, 4.67-8.0, 4.13-7.80 and 3.60-7.13 under respective treatments. Effect of INM on the growth is reported by Prativa, K.C. and Bhattarai, B.P. (2011) [4].

### 4. Number of root nodules

The observation related to number of root nodules plant-1 was recorded at 45 DAS at presented in table6. Application of NPK, FYM and bio-fertilizer in combination significantly increased the number of nodules as compared to control. The maximum number of root-nodulesplant-1 were recorded in case of treatment T3 (14.37) followed by T4(13.13)> T2(12.77)>T6(12.67)>T5(12.17)>T1(11.50). The treatment T3 (14.37) was found to be significantly superior over all the treatments. Root characterization is reported by Singh *et al.* (2000) [6].

### 5. Number of pods plant$^{-1}$

The effect of treatments on number of pod plant-1 were recorded and presented in tables6. The results showed favourable response to application of NPK, FYM and Bio-fertilizer. Maximum number pods were recorded in treatment T3 (9.33) followed by other treatment T4 (9.00) > T2 (8.33) >

T6 (8.27) > T5 (7.13) > T1 (6.80). Results indicated that integration of organic manures, biofertilizers and chemical fertilizers significantly increased number of pod per plants over chemical fertilizers alone. Treatment T3 registered significantly superior as compared to all the other treatments. The increased yield with NPK and FYM application might be due to increased availability absorption and translocation of nutrient under NPK and FYM treated plots Rajkhowa *et al.* (2000) [5].

**6. Grain yield**

Results indicated that integration of organic and inorganic source of nutrients significantly increased grain yield as compared to chemical fertilizers alone. Effect of various treatments on grain yield could be arranged in order of T3>T4>T2>T6>T5>T1 and values were 1.08, 0.97, 0.63, 0.61, 0.54 and 0.44 Q ha-1respectively. Similar results were also reported by Kumar and Singh (2010) [3].

**7. Stover yield**

Application of 75% chemical fertilizer, FYM and biofertilizers significantly increased stover yield as compared to other treatments. Results indicated that organic source can substitute up to 25% chemical fertilizers. Addition of organic manures along with chemical fertilizers significantly increased stover yield over chemical fertilizers alone might be due to it provides favourable physico-chemical soil environment for microbes as well as plant.

**Summary and Conclusion**

Present experiment was conducted at the research plots of department of agriculture chemistry and soil science, Udai Pratap Autonomous College Varanasi with moong crop variety virat as test crop during zaid season (2015-16) to investigate the soil properties and performance of test crop as influence by addition of various levels of NPK, FYM bio-fertilizers and vermicompost. The treatments were composed of NPK, FYM bio-fertilizers and vermicompost. The treatment were $T_1$ (control), $T_2$ (100%NPK), $T_3$ (75% NPK+5t FYMha-1+bio-fertilizers (PSB+rhizobium), $T_4$ (50% NPK+5t FYMha-1+ Bio-fertilizer, $T_5$ (10t FYMha-1+ bio-fertilizer), $T_6$ (10tvermicompostha-1+bio-fertilizers). Randomized block design (RBD) with three replications. The important plant parameter such as plant height, grain and Stover yield were also measured under this experiment at different time interval have summarized below.

Higher plant height was recorded with $T_3$ (59cm) treatment as compared to other treatment at all growth stages. The effect of different doses of NPK + FYM + Bio-fertilizer on different growth stages of moong crop in order T3>T4>T2>T6>T5>T1. Higher number of branch (10.27), grain pod-1(9.33), root nodules/plant (14.34), Stover yield (12q/ha), and grain yield (1.08q/ha) were recorded under applied T3 (75%NPK+5t FYMha-1+ bio-fertilizer (PSB+Rhizobium)) plots. The present study thus conducted that the application of NPK, FYM and vermicompost in moong crop significantly affected the growth yield, and available NPKS status of soil was found to be best treatment regarding growth T3(75% NPK+5t FYMha-1+Bio-fertilizer).

It was found that integrated use of NPK, FYM Bio-fertilizer showed superiority over chemical fertilizer alone and reduced up to 25% chemical fertilizer application of organic form improved physicochemical environment of soil which support the productivity of crop in right way.

**Table 1:** Effect of NPK, FYM, bio-fertilizer and vermicompost application on plant height (cm) of green gram crop.

| Treatments | Days after sowing (DAS) | | |
|---|---|---|---|
| | 30 | 45 | 60 |
| $T_1$ (Control) | 24.80 | 37.00 | 38.0 |
| $T_2$ (100%NPK) | 33.33 | 49.0 | 51.13 |
| $T_3$ (75% NPK +5t FYMha$^{-1}$+Biofertilizer (PSB+ Rhizobium) | 36.93 | 55.87 | 59.0 |
| $T_4$ (50% NPK+5t FYMha-1+ Bio-fertilizer) | 34.53 | 51.20 | 52.33 |
| $T_5$ (10t FYMha-1+ Bio-fertilizer) | 26.93 | 47.07 | 47.80 |
| $T_6$ (10t VERMICOMPOSTha-1+ Bio-fertilizer) | 31.67 | 48.80 | 49.33 |
| SEm± | 1.703 | 2.324 | 2.188 |
| CD 5% | 5.366 | 7.324 | 6.894 |

DAS= Days after sowing

**Table 2:** Effect of NPK, FYM, bio-fertilizer and vermicompost application on number of leaves plant$^{-1}$of green gram crop.

| Treatments | Days after sowing (DAS) | | |
|---|---|---|---|
| | 30 | 45 | 60 |
| $T_1$ (Control) | 15.07 | 15.67 | 22.47 |
| $T_2$ (100%NPK) | 19.07 | 24.87 | 26.67 |
| $T_3$ (75% NPK +5t FYMha$^{-1}$+Biofertilizer (PSB+ Rhizobium) | 20.20 | 27.07 | 29.13 |
| $T_4$ (50% NPK+5t FYMha-1+ Bio-fertilizer) | 19.27 | 25.67 | 27.67 |
| $T_5$ (10t FYMha-1+ Bio-fertilizer) | 16.60 | 23.33 | 25.27 |
| $T_6$ (10t VERMICOMPOSTha-1+ Bio-fertilizer) | 18.13 | 24.40 | 26.00 |
| SEm± | 0.358 | 0.414 | 0.603 |
| CD 5% | 1.129 | 1.303 | 1.901 |

**Table 3:** Effect of integrated use of NPK, FYM, bio-fertilizer and vermicompost on number of branch per plant under green gram.

| Treatments | Days after sowing (DAS) | | |
|---|---|---|---|
| | 30 | 45 | 60 |
| $T_1$ (Control) | 3.60 | 6.87 | 7.13 |
| $T_2$ (100%NPK) | 4.77 | 7.73 | 8.20 |
| $T_3$ (75% NPK +5t FYMha$^{-1}$+Biofertilizer (PSB+ Rhizobium) | 5.80 | 8.67 | 10.27 |
| $T_4$ (50% NPK+5t FYMha-1+ Bio-fertilizer) | 4.80 | 8.13 | 8.73 |

| | | | |
|---|---|---|---|
| $T_5$ (10t FYMha-1+ Bio-fertilizer) | 4.13 | 7.33 | 7.80 |
| $T_6$ (10t VERMICOMPOSTha-1+ Bio-fertilizer) | 4.67 | 7.53 | 8.0 |
| SEm± | 0.163 | 0.152 | 0.279 |
| CD 5% | 0.514 | 0.477 | 0.880 |

**Table 4:** Effect of integrated use of NPK, FYM, bio-fertilizer and vermicompost on the root nodules, number grain per pod, grain yield and stover on green gram crop.

| Treatments | Root Nodules | No. Of Grain Per Pod | Grain Yield Q/Ha | Stover yield Q/ha |
|---|---|---|---|---|
| $T_1$ (Control) | 11.50 | 6.87 | 0.44 | 6.50 |
| $T_2$ (100%NPK) | 12.77 | 8.33 | 0.63 | 10.5 |
| $T_3$ (75% NPK +5t FYMha$^{-1}$+Biofertilizer (PSB+ Rhizobium) | 14.34 | 9.33 | 1.08 | 12.00 |
| $T_4$ (50% NPK+5t FYMha-1+ Biofertilizer) | 13.13 | 9.00 | 0.97 | 11.00 |
| $T_5$ (10t FYMha-1+ Bio-fertilizer) | 12.17 | 7.17 | 0.54 | 8.50 |
| $T_6$ (10t VERMICOMPOSTha-1+ Bio-fertilizer) | 12.67 | 8.27 | 0.61 | 9.00 |
| SEm± | 0.174 | 0.230 | 0.059 | 0.108 |
| CD 5% | 0.547 | 0.724 | 0.186 | 0.340 |

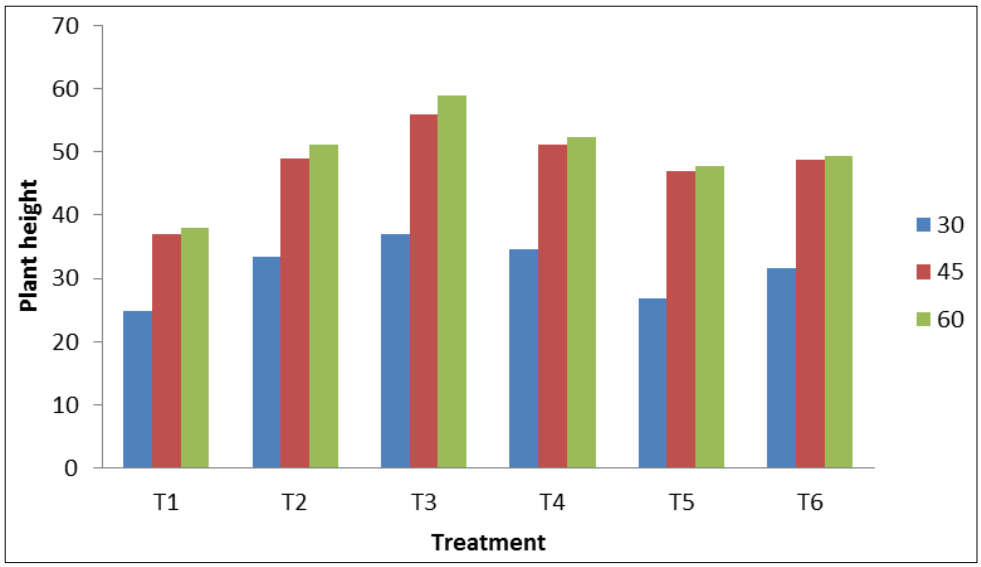


**Fig 1:** Effect of NPK, FYM, bio-fertilizer and vermicompost application on plant height (cm) of green gram crop

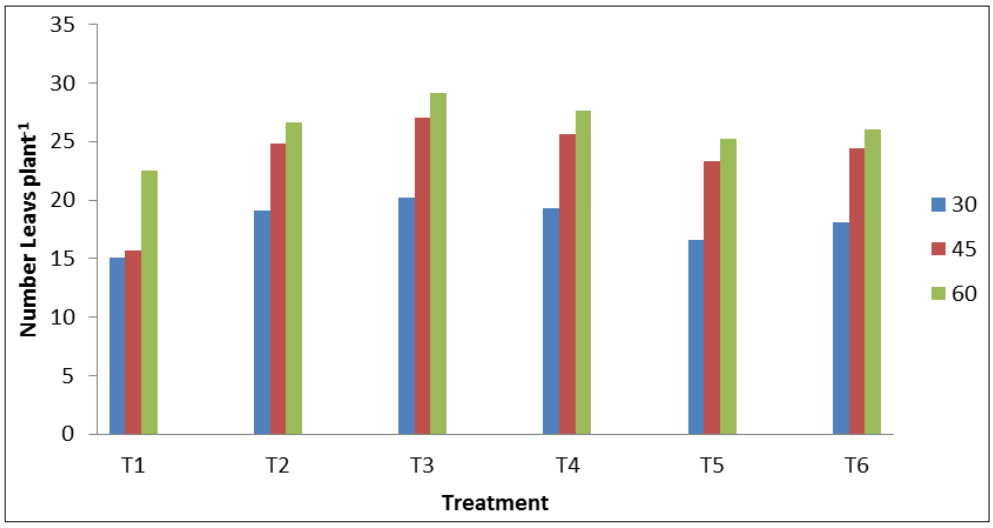


**Fig 2:** Effect of NPK, FYM, Bio-fertilizer and Vermicompost application on number of leaves plant$^{-1}$ green gram crop

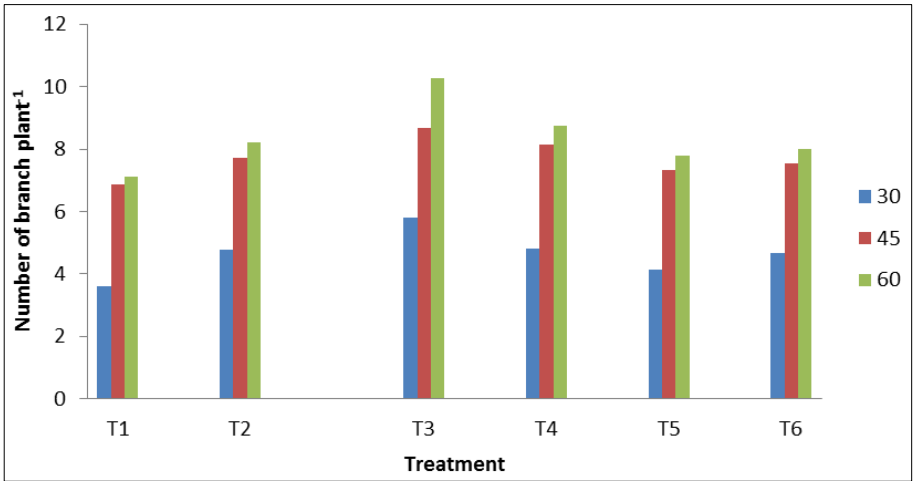


**Fig 3:** Effect of NPK, FYM, Bio-fertilizer and Vermicompost application on number of branching on green gram crop

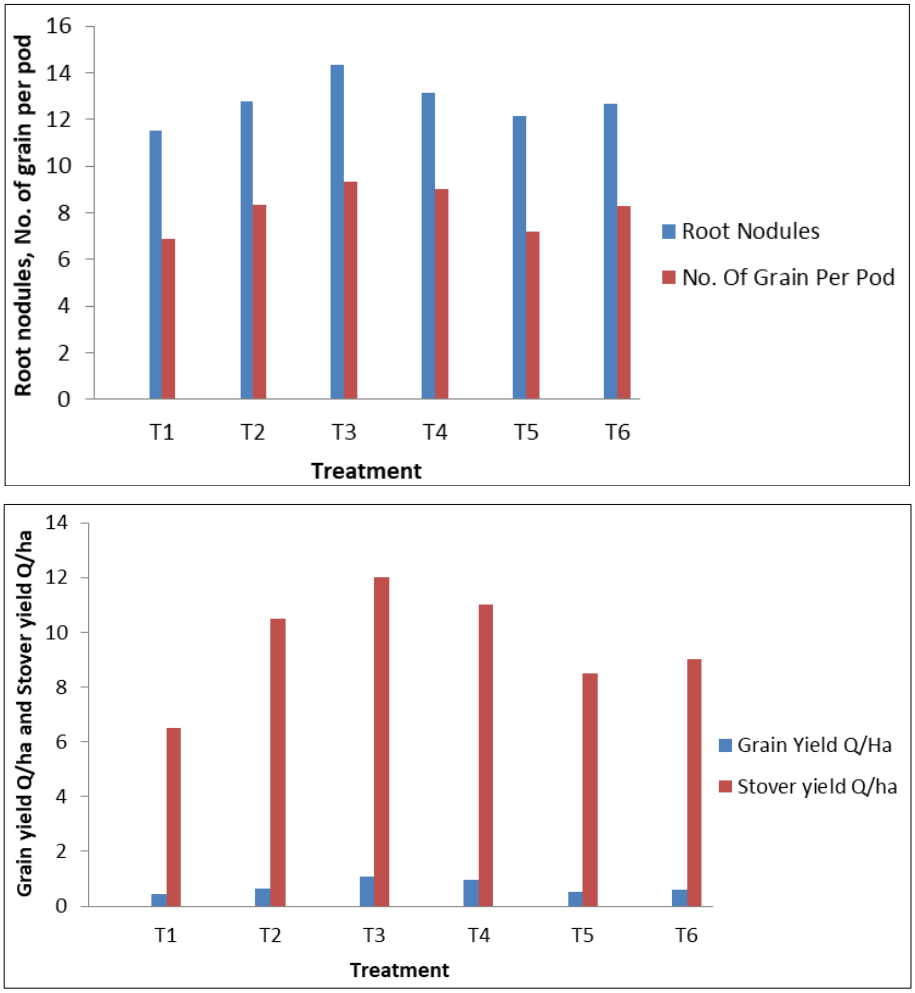


**Fig 4:** Effect of NPK, FYM, Bio-fertilizer and Vermicompost application on the root nodules, number grain per pod, grain yield and Stover on green gram crop

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