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Influence of different combinations of neem cake and poultry manure on growth, yield and economics of greengram (*Vigna radiata* L.)

Surendra Singh Gurjar, Amreen Hasan, Arun Alfred David, Tarence Thomas, Iska Srinath Reddy and Pinky Yadav

Abstract
A field experiment was carried out at Department of Soil Science and Agricultural Chemistry Research Farm SHUATS, Prayagraj during *Kharif* season of 2021-2022 to assess the Influence of Different Combinations of Neem Cake and Poultry Manure on Growth, Yield and Economics of Greengram. The experiment was laid out in Randomized Block Design with 9 treatment combinations of neem cake and poultry manure (NC @ 0% + PM @ 0%, NC @ 0% + PM @ 50%, NC @ 0% + PM @ 100%, NC @ 50% + PM @ 0%, NC @ 50% + PM @ 50%, NC @ 50% + PM @ 100%, NC @ 100% + PM @ 0%, NC @ 100% + PM @ 50% and NC @ 100% + PM @ 100%) with 3 replications respectively. Application of (NC @ 100% + PM @ 100%) (T_9) attained the maximum plant height as 11.2 cm, 25.3 cm, 38.9 cm and 48.2 cm at 15, 30, 45 and at harvest stage, respectively. Data also revealed that application of treatment T_9 (NC @ 100% + PM @ 100%) recorded the highest number of branches plant^{-1} (3.9 and 7.4 at 30 DAS and 60 DAS, respectively), number of nodules plant^{-1} (46.1), dry weight of nodules per plant (81.30 mg plant^{-1}), plant population (13.1 mrl^{-1}), number of pods per plant (19.40), number of seeds per pod (8.77), highest test weight (32.58 gm), seed yield of 1357.6 kg ha^{-1} and maximum haulm yield 2375.7 kg ha^{-1}. Furthermore, economics of different treatment, the maximum gross returns (₹ 103519.07 ha^{-1}), net returns (₹ 70439.07 ha^{-1}) and B:C ratio (3.13) was recorded under treatment T_9 (NC @ 100% + PM @ 100%) for Greengram.

Keywords: Neem cake (NC), poultry manure (PM), recommended dose of fertilizer (RDF), at the rate of (@), per metre row length (mrl)

1. Introduction

Pulses continue to be an important ingredient of human diet, especially for the large vegetarian population in the country. In the era of Green Revolution with major focus on staple food like rice and wheat, pulses were regulated to the marginal lands with least inputs. This, coupled with the increasing population, resulted in reducing per capita availability of pulses to the masses. It is also known as grain legumes, are next to cereals in terms of agricultural importance and have been considered best options for diversification and intensification of agriculture across the globe because of their intrinsic values such as nitrogen fixing ability (15-35 kg N ha^{-1}), high protein content and ability to thrive well in less endowed environment (Kumar *et al*. 2018) [16].

Despite of being such an important crop, the average productivity of greengram in the state is quite low compared to its production potential which is a matter of serious concern. The present production of pulses in the country hovers around 19 million tonnes, which falls short of the present domestic requirement of around 21 million tonnes. This shortfall in pulses is mainly due to near stagnation in production during the decade (1999-2009) on account of poor spread of improved varieties and technologies, abrupt climatic changes, complex disease-pest syndrome, emergence of new biotypes and races of key pests and pathogens, and declining total factor productivity (IIPR, Kanpur). In order to narrow down the demand supply gap, the country resorts to import pulses to the tune of 2-3 million tonnes every year. In order to ensure self-sufficiency, the pulse requirement in the country is projected at 39 million tonnes by the year 2050 which necessitates an annual growth rate of 2.2 percent. It is grown on about 3.70 million hectares with annual production of 1.57 million tons. India is the largest producer of green gram and account for 54 percent of the world production and covers 65 percent of the world acreage. It's output accounts for about 10-12 percent of total pulse production in the country. Pulses occupies 28.78 million ha. area and contributes 25.46 million tonnes in pulse production with productivity of 8.88 q/ha in the country (Ministry of Agriculture, and Farmers Welfare, 2021). Indian farmers covered 30.84 lakh ha under pulses in which around 16.10 lakh ha was covered in mungbean. The state of Rajasthan (18.30 lakh ha), Maharashtra (3.28 lakh ha), Karnataka (2.89 lakh ha), Odisha (1.63 lakh ha) and Telangana (0.70 lakh ha) are major producer of mungbean in India (Directorate Economics and Statistics, GOI, 2019-20).

Green gram (*Vigna radiata* L.), also known as mung, moong and green gram, is one of the most ancient and extensively grown leguminous crops of India. It is believed to be originated from India and mainly grown in East Asia, Southeast Asia and the Indian subcontinent in arid and semi-arid region. It is important short duration grain legume crop with wide adaptability, low input requirement and has the ability to improve soil fertility by fixing atmospheric nitrogen well suited to small holder production under adverse climatic conditions (Vijayalakshmi and Bhattacharya, 2006) [28]. It is grown in almost all parts of the country, stands third after chickpea and pigeon pea among pulses.

In India, mungbean is grown in three different seasons *viz*., *Kharif*, *Rabi* and Summer (*Zaid*). It can be cultivated on deep, well drained loams in the alluvial tract in the north as well as on the red and black soil of peninsular and southern India. This is one of the main legume crops in the tropic and sub-tropics for its rich nutritional components and short growing season (Jaiwal *et al*. 2001) [13]. The seeds have high (28%) protein that is easily digestible, are easy to cook and lack flatulence factors in contrast to other legumes. Mungbean is a rich source of protein (14.6-33.0 g/100 g) and iron (5.9-7.6 mg/100 g) (Dahiya *et al*. 2015) [7]. It contains 1-3 percent fat, 50.4 percent carbohydrates, 3.5-4.5 percent fibers, 56.7 percent carbohydrates and 4.5-5.5 percent ash, while calcium and phosphorus are 132 and 367 mg per 100 grams of seed, respectively (Frauque *et al*. 2000) [8]. It also contains 75 mg calcium, 8.5 mg iron and 49 mg β-carotene per 100 g of a split dal. The foliage and stem are also a good source of fodder for livestock as well as a green manure (Sengupta, 2018) [22].

It is highly responsive to nutrients. Nutrient application is essentially required to improve growth and yield of greengram. FYM, vermicompost and poultry manure not only increase organic carbon status of the soils but also increase the soil water holding capacity, flocculation of soil and availability of all micro and macro nutrients, thus improve the soil and crop production. Since, helps in enhancing the activity of microorganism in soils which further enhance solubility of nutrients and their consequent availability, plants are known to be altered by microorganism by reducing soil pH at micro sites, chelating action of organic acids produced by them (Chhonkar, 2002) [5].

This is one of the popular short duration grain legumes in India and occupies third place after the chickpea and pigeon pea. Besides being a rich source of protein, it maintains soil fertility through biological nitrogen fixation and thus plays a vital role in sustainable agriculture. It fixes 63-342 kg N ha^{-1} per season in soil by biological nitrogen fixation. There exists a vast gap between potential productivity and actual productivity of green gram being realized at present. Apart from other agronomical management practices, imbalanced plant nutrition is the major constraint to higher productivity of the crop. Green gram being a leguminous crop requires adequate amount of phosphorus as well as apart from other nutrients these are directly involved in growth and development of plant. Under the present-day context, energy crisis and hike in fertilizer cost have necessitated to think of cost-effective organic sources of nutrients so as to maintain soil fertility, productivity and health for attaining sustainable crop production. In this context there is an urgent need to develop and evolve economic and sustainable technologies and practices on alternative/ organic sources of plant nutrients such as organic manures to reduce the dependency on synthetic sources of plant nutrients. Organic nutrient sources such as animal manures, compost, vermicompost, green manures and bio fertilizers add organic matter to the soil, improve the soil properties, conserve the nutrients in soil and enhance the soil microbial activity and diversity thereby improving soil quality and fertility and ecosystem sustainability. This expense can be minimized by use of organic manures *viz*., poultry manure, neem cake, farm yard manure, vermicompost, organic cakes and bio fertilizers. Organic manures and bio fertilizers have been reported to be beneficial in augmenting the yield of grain legumes. Proper fertilization is essential to improve the productivity of green gram. Nutrient balance is the key component to increase the crop yields. Excess and imbalanced use of nutrients has caused nutrient mining from the soil, deteriorated crop productivity and ultimately soil health environment. Organic manures provide a good substrate for the growth of microorganisms and maintain a favourable nutrient supply environment and improve soil physical-chemical properties (Amruta *et al*. 2015) [1]. Organic manures improve soil structure, increase organic matter content, promotes nutrient mobilization, increase water holding capacity of the soil, promotes formation of soil aggregates, suppresses certain plant diseases and soil borne pathogens and encourage the growth of beneficial microorganisms (Chen, 2006). Replenishment of these nutrients through organic and combination with neem cake and inorganic fertilizers has a direct impact on soil health environment and crop productivity. In India, poultry farming is increasing. In India, poultry farming is the main component of Integrated Farming System (IFS), and neem trees are widely spreaded throughout India, especially in northern states like Uttar Pradesh and Rajasthan. Neem cake and poultry manure both can play a very important role in enhancing farmers income while maintaining the production sustainability. Poultry manure and neem cake supplies all the major macro and micro plant nutrients, and improve the physical and chemical properties of soil. Neem cake act as a nitrogen inhibitor, and also reduces soil based pathogens and nematodes, and works as a natural pest controller. The poultry manure is relatively a cheap source of both macro nutrients (N, P, K, Ca, Mg, S) and micronutrients (Cu, Fe, Mn, B) and can increase soil carbon and N content, soil porosity and enhance soil microbial activity. As poultry waste contains a high concentration of nutrients, addition of small quantity of it in an integrated nutrient management system could meet the shortage of FYM to some extent.

2. Material and Methods

The experiment was undertaken on the Soil Science and Agricultural Chemistry Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj with greengram (var. Narendra Moong 1) as test crop during *Kharif* season 2021-22.

2.1. Experimental site
The experiment was conducted at Research Farm of Soil Science and Agricultural Chemistry at Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. The area situated on the south of Prayagraj on the right side of the river Yamuna on the South of Rewa Road at a distance of about 6 Km from Prayagraj city. It is situated at 25º24'46.14" N latitude, 81º50'49.95" E longitude and 98 m above the mean sea level.

2.2. Climate condition in the experimental area
The area of Prayagraj district comes under subtropical belt in the South east of Uttar Pradesh, which experience extremely hot summer and cold winter. The maximum temperature of the location reaches up to 46 °C – 48 °C and seldom falls as low as 4 °C -5 °C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100 mm annually. It has a sub- tropical and semi- arid climate with rain mostly during July- September.

Treatment Combinations

Treatment	Treatment combinations
T_1	NC @ 0% + PM @ 0%
T_2	NC @ 0% + PM @ 50%
T_3	NC @ 0% + PM @ 100%
T_4	NC @ 50% + PM @ 0%
T_5	NC @ 50% + PM @ 50%
T_6	NC @ 50% + PM @100%
T_7	NC @ 100% + PM @ 0%
T_8	NC @ 100% + PM @ 50%
T_9	NC @ 100% + PM @ 100%

Details of Layout

Design	:	RBD
Replication	:	03
Number of treatments	:	09
Plot size	:	2.0 m^2
Total number of plots	:	09x03=27
Total length of area	:	22.3m
Total width of plots	:	8.8m
Main irrigation channel	:	1.0 m
Sub irrigation channel	:	0.5m
Width of bund	:	0.3m
Gross cultivated area	:	196.24 m^2
Net cultivated area	:	108 m^2
Crop	:	Green gram
Variety	:	Narendra Moong 1
Row to row distance	:	30.0 cm
Plant to plant distance	:	10.0 cm

2.3 Details of observations recorded
2.3.1 Growth studies
Five plants were selected randomly from individual plot and labeled with tags for recording non-destructive observations throughout the crop period.

(A). Plant height (cm)
Height of crop plants under different treatments recorded at 15, 30, 45 DAS and at harvest stage. For these three plants randomly selected from each plot and tagged for observation to be recorded. Height of plants in cm recorded from ground level up to the base of the last fully opened leaf of the main shoot.

(B). Number of branches per plant
Number of branches per plant in three tagged plants from each plot was counted and average number of branches per plant was calculated at 30 DAS and 60 DAS.

(C) Number of nodules per plant and Dry weight of nodules (mg plant^{-1})
The number of nodules and dry weight of root nodules per plant were recorded at flowering. The five randomly selected plants are uprooted carefully to avoid unwanted shattering of root nodule from each treatment. The nodules of per plant^{-1} counted and then oven dried at constant temperature to record the nodules dry weight with help of electronic weight balance.

(D) Plant population (no. of plants m^{-1} row)
Plant population counted the plant in one-meter area with help of one-meter scale at 30 DAS and at harvest stage.

2.3.2 Yield attributes and yield
(A). Number of pods plant^{-1}
The total number of developed pods plant^{-1} was recorded from five tagged plants at harvest and mean was calculated for each plot and recorded separately.

(B). Number of seed pod^{-1}
Number of seeds pod^{-1} was counted at harvest from five pods of previously selected plants and the mean value was calculated and recorded for each treatment.

(C). Test weight (g)
Five seed samples of 1000 seeds were drawn from net plot yield of each treatment and 1000 seeds weight was recorded and mean was expressed in grams.

(D). Grain yield (kg ha^{-1})
Seed yield obtained from each net plot including the tagged plants was sun dried and recorded treatment wise and expressed as kg ha^{-1}.

(E). Straw yield (kg ha^{-1})
Straw yield was calculated by subtracting seed yield from respective biological yield of each plot and expressed as kg ha^{-1}.

2.3.3 Economics
(A). Gross returns
The gross returns (₹ ha^{-1}) occurred due to different treatments in the present study were worked out by considering market prices of economic product, by product and crop residues during the experimental year.

(B). Net returns
In order to evaluate the effectiveness of different treatment and ascertain the most remunerative treatment, total expenses incurred on cultural operations from preparatory tillage to harvesting including additional treatment cost for each treatment were computed and subtracted from the respective gross income taking prevailing market prices of the commodities. Thus, the net return was calculated by subtracting the total cost of cultivation from gross returns and expressed as (₹ ha^{-1}).
Net return (₹ ha^{-1}) = Gross returns (₹ ha^{-1}) – Cost of total input (₹ ha^{-1})

(C). B: C ratio

In order to evaluate the benefit accrued from the treatments applied, the economics of different treatments were worked out as follows in terms of net return (₹ ha^{-1}) and Benefit: Cost (B: C ratio) so that most remunerative treatment could be recommended. This was calculated on treatment yield basis and prevailing market rates of inputs and outputs.

$$\text{B: C ratio} = \frac{\text{Net Returns}}{\text{Cost of cultivation}}$$

2.3.4 Statistical analysis

The data recorded during the course of investigation will subjected to statistical analysis by analysis of variance (ANOVA) technique. The significant and non-significant of treatment effect was judged with the help of 'F' (variance ratio) table (Fisher 1950) [9].

3. Result and Discussion

3.1. Plant height (cm)

It is clear from the data presented in Table 1 and Fig. 1 that all the treatments significantly increased the plant height of greengram at different stages of growth in comparison to control during the year of investigation except 15 DAS. Results showed that application of (NC @ 100% + PM @ 100%) (T_9) attained the maximum plant height as 11.2 cm, 25.3 cm, 38.9 cm and 48.2 cm at 15, 30, 45 and at harvest stage, respectively, followed by the treatment T_6 (NC @ 50% + PM @ 100%) (10.9 cm, 20.6 cm, 34.4 cm and 44.4 cm) at 15, 30, 45 DAS and at harvest stage, respectively which was the next superior and equally effective treatment. Among the various treatments, control plot recorded the minimum plant height to the tune 9.0 cm, 14.7 cm, 22.0 cm and 30.0 cm at 15, 30, 45 and at harvest stage, respectively. This may be attributed primarily to the beneficial effect of fertility on overall physical condition of the soil. The reason for better growth and development in the above treatment might be due to increased availability of nitrogen and phosphorus to the plant initially through fertilizers, microbial inoculants then through poultry manure and neem cake in the cropping season. Thus, the improvement in soil environment resulted in encouraged proliferation of plant roots, which helped to draw more water and nutrients from larger area and deeper layers and thus owing to higher availability of nutrients, synthesis of more carbohydrates and their translocation to different plant parts resulted in increased vegetative growth including the reproductive structures. The significant increase of plant height also might be due to the internodes elongation and the vigorous shoot growth, results related to plant height was observed by Jadhav *et al.* (2017) [12]. These results corroborate with the finding of Kumawat *et al*. (2010) [18], and Choudhary and Yadav (2011) [6] in greengram.

3.2. Number of Branches Plant^{-1}

It is evident from data presented in Table 1 and Fig. 2 showed that the application of T_9 (NC @ 100% + PM @ 100%) recorded the highest number of branches $plant^{-1}$ at 30 DAS (3.9) and 60 DAS in greengram (7.4), which was significantly superior to other treatments. Minimum number of branches $plant^{-1}$ was recorded under control (6.7). Poultry manure and neem cake increases the number of branches may be due to adequate supply of macro and micro nutrients which enhanced the vegetative growth of plant. Similar results were reported by Biswas *et al*. (2014) [3], Masih *et al*. (2020) [9].

3.3. Number of nodules plant^{-1}

It is obvious from the data presented in Table 1 and Fig. 3 showed that number of nodules $plant^{-1}$ of greengram was significantly improved by the application of treatments. Results revealed that application of treatment T_9 (NC @ 100% + PM @ 100%) attained the maximum number of nodules $plant^{-1}$ of greengram (46.1) among all the treatments, followed by the treatment T_6 (NC @ 50% + PM @ 100%) (45.7) which was the next superior and equally effective treatment in respect to number of nodules $plant^{-1}$ of greengram. The increase in nodulation due to application of neem cake, poultry manure and rhizobium enhances the activity of rhizobia and increase the formation of root nodule and there by helps in fixing more of atmospheric nitrogen in root. So, increase in number of nodules was also observed. It might also be due to availability of nutrients to the crop which increased number of nodules $plant^{-1}$. Similar results were reported by Gajendra *et al*. 2016 [10].

3.4. Dry weight of nodules (mg plant^{-1})

Results (Table 1 and Fig. 4) showed that treatment T_9 (NC @ 100% + PM @ 1 00%) attained the maximum dry weight of nodules of 81.30 mg $plant^{-1}$, among all the treatments while, while minimum dry weight of nodules found in control plot (59.7 mg $plant^{-1}$). The higher nitrogen and phosphorus content was increased the availability throughout the growth period and reproductive period of greengram leading to increase the number of cell and size resultant profound vegetative growth in terms of plant height, dry matter accumulation, nodule count and their fresh weight was observed Gajendra *et al*. (2016) [10].

3.5. Plant population (per meter row length)

A perusal of data (Table 1 and Fig. 5) showed that plant stand per meter row length recorded at 30 DAS in greengram did significantly influenced and at harvest stage results revealed that application of treatment T_9 (NC @ 100% + PM @ 100%) attained the maximum plant population in greengram (13.1 mrl^{-1}) while plant population was found minimum in control (10.0 mrl^{-1}). It obviously reflects the fact from these data that the sowing of greengram was done properly, uniformly in each treatment combination using healthy and viable seeds to maintain the better germination, emergence and crop stand per unit area. Thus, the crop stand remained almost uniformly sufficient in all the combined treatments and found significant at harvest stage. Similar result was also reported by Nama *et al*. (2021) [20].

3.6. Number of pods plant^{-1}

It is evident from the data (Table 2) and diagrammatic representation (Fig 6) that highest number of pods per plant (19.40) recorded with the treatment T_9 (NC @ 100% + PM @ 100%) at harvest. Minimum number of pods per plant (12.03) recorded with the control plot at harvest. It might also be due to availability of nutrients to the crop which increased number of pods $plant^{-1}$. This might have significantly increased the number of pods $plant^{-1}$. Similar results were also reported by Venkatesh and Basu (2011) [27] for number of pods, when nutrients applied at the initial stages, might have been effectively absorbed and Trans located to the pods resulting in more number of pods $plant^{-1}$.

3.7. Number of seed pod^{-1}

Results (Table 2 and Fig. 7) showed that treatment T_9 (NC @ 100% + PM @ 100%) attained the maximum number of seeds per pod (8.77). It increased the number of seeds per pod to the tune of 40.77 percent higher over control. Minimum number of seeds per pod (6.23) recorded with the control plot at harvest. Similar results were also reported by Sitaram *et al*. (2013) [24] and Todawat (2017) [25].

3.8. Test weight (gm.)

It is evident from data presented in Table 2 showed that the application of T_9 (NC @ 100% + PM @ 100%) recorded the highest test weight (32.58 gm.) in greengram, which was significantly superior to other treatments. Minimum test weight in greengram was recorded under control (31.16 gm.). The test weight was found non-significant due to different level application of poultry manure and neem cake and similar results were confirmed by Kachhave *et al*. (2009) [14], Sheikh *et al*. (2012) [23].

3.9. Seed yield (kg ha^{-1})

Results indicated (Table 2 and Fig. 8) that application of T_9 (NC @100% + PM @ 100%) produced the maximum seed yield of 1357.6 kg ha^{-1} which was statistically superior over rest of the treatments. It registered remarkable increase in seed yield to the extent of 49.70% over control. Treatment T_6 (NC @ 50% + PM @ 100%) registered remarkable produced in seed yield of 1127.6 kg ha^{-1} which was the next superior and equally effective treatment in respect to seed yield while, control recorded the minimum seed yield of 551.3 kg ha^{-1}. The increased vegetative growth might have increased the synthesis of carbohydrates, which ultimately promoted yield. The increased growth in terms of plant height, dry matter accumulation and number of branches per plant might also provide better sites for pod formation and grain development. As a result, almost all yield attributes and yield characters of crop resulted into significant improvement due to application of poultry manure and neem cake in combination. This in turn would have improved assimilation of nutrients and thus seed yield. Similar results were also reported by Yadav *et al*. 2019 [29], and Khandelwal *et al*. 2012 [15] in greengram.

3.10. Haulm yield (kg ha^{-1})

A critical examination of the data presented in Table 2 and Fig. 9 revealed that haulm yield of greengram was also influenced in same manner due to different treatments as in the seed yield. Results revealed that application of T_9 (NC @ 100% + PM @ 100%) produced the maximum haulm yield (2375.7 kg ha^{-1}). The significant increase in haulm yield due to 100% neem cake along with 50% poultry manure or balanced fertilization could be ascribed to their direct influence on straw production by virtue of increased photosynthetic efficiency. Similar results were also reported by Usman *et al*. (2014) [26], Seerat *et al*. (2019) [21] and Kumar *et al*. (2020) [17].

3.11. Economics

Economics of all treatments were calculated according to expenditure incurred from the land preparation till harvesting of the crop.

(A). Net returns (₹ha^{-1})

It is obvious from the data (Table 2 and Fig. 10) that net returns from greengram influenced to a great extent by different treatments during the year of experimentation. Among the various treatments, treatment T_9 (NC @ 100% + PM @ 100%) provided the highest net return of ₹70439.07 ha^{-1}, that excelled rest of the treatments. It provided additional net returns of ₹46371.86 ha^{-1}, over control. However, the control plot treatment showed lowest net returns of ₹24067.21 ha^{-1}.

(B). B: C ratio

All the treatments evaluated for different combination of neem cake and poultry manure in greengram were calculated and noted to have significantly enhanced the B: C ratio over control (Table 2 & Fig. 11). The highest mean B: C ratio of 3.13 was recorded with the application of T_9 (NC @ 100% + PM @ 100%). Application of T_6 (NC @ 50% + PM @ 100%) was noted to be the next better and equally effective treatment, gives 3.06 B: C ratio. T_9 enhanced the B: C ratio by 34.33 percent, over control.

Table 1: Influence of different combination of neem cake and poultry manure on plant height, number of branches, number of nodules, dry weight of nodules and plant population at different stages of Greengram

Treatments	15 DAS	30 DAS	45 DAS	At harvest	Number of branches		Number of nodules	Dry weight of nodules (mg plant^{-1})	Plant Population (mrl^{-1})	
					30 DAS	60 DAS			30 DAS	At Harvest
T_1	9.0	14.7	22.0	30.0	3.0	6.7	40.7	59.7	10.9	10.0
T_2	9.3	17.3	24.7	32.0	3.2	6.8	42.4	61.9	11.1	10.5
T_3	10.1	18.2	26.4	35.4	3.8	7.0	43.9	70.0	12.7	10.7
T_4	9.2	16.4	23.3	31.3	3.1	6.8	41.7	61.5	10.6	10.2
T_5	10.2	19.4	29.7	39.7	3.6	7.1	44.8	71.4	12.8	10.8
T_6	10.9	20.6	34.4	44.4	3.8	7.3	45.7	78.7	13.2	11.8
T_7	10.0	17.5	24.7	34.7	3.3	6.9	42.9	69.1	12.3	10.6
T_8	10.8	19.4	30.7	41.4	3.7	7.2	45.2	78.0	13.0	11.8
T_9	11.2	25.3	38.9	48.2	3.9	7.4	46.1	81.3	13.6	13.1
S.Em (±)	0.53	1.01	1.28	1.11	0.32	0.04	0.78	3.99	0.66	0.62
C.D. at 5%	1.60	3.03	3.83	3.34	0.96	0.13	2.34	11.97	1.99	1.82
F-Test	NS	S	S	S	NS	S	S	S	S	S

Table 2: Influence of different combination of neem cake and poultry manure on Pods plant-1, Seeds pod-1, Test weight (g), Grain Yield (Kg ha-1), Haulm Yield (Kg ha-1), Cost of Cultivation, Gross return, Net return and B: C ratio of Greengram

Treatments	Pods plant-1	Seeds pod-1	Test weight (g)	Grain Yield (kg ha-1)	Haulm Yield (kg ha-1)	Cost of cultivation (₹)	Gross return (₹)	Net return (₹)	B:C ratio
T_1	12.03	6.23	31.16	551.3	1020.2	18080.00	42147.21	24067.21	2.33
T_2	13.98	7.06	32.03	855.0	1533.3	20580.00	62596.22	42016.22	3.04
T_3	15.77	7.16	32.31	962.4	1721.5	23080.00	69639.04	46559.04	3.02
T_4	13.93	7.02	31.84	804.7	1479.0	23080.00	61500.90	38420.90	2.66
T_5	15.80	7.19	32.33	994.3	1762.9	25580.00	75860.61	50280.61	2.97
T_6	17.68	7.98	32.51	1127.6	1986.0	28080.00	86007.08	57927.08	3.06
T_7	14.01	7.10	32.29	875.0	1566.0	28080.00	66790.43	38710.43	2.38
T_8	17.20	7.93	32.42	1081.4	1916.3	30580.00	82503.30	51923.30	2.70
T_9	19.40	8.77	32.58	1357.6	2375.7	33080.00	103519.07	70439.07	3.13
S.Em (±)	0.55	0.26	1.14	36.23	65.33	-	2691.01	2691.01	0.11
C.D. at 5%	1.66	0.77	3.42	108.61	195.87	-	2691.01	2691.01	0.34
F-Test	S	S	NS	S	S	-	S	S	S

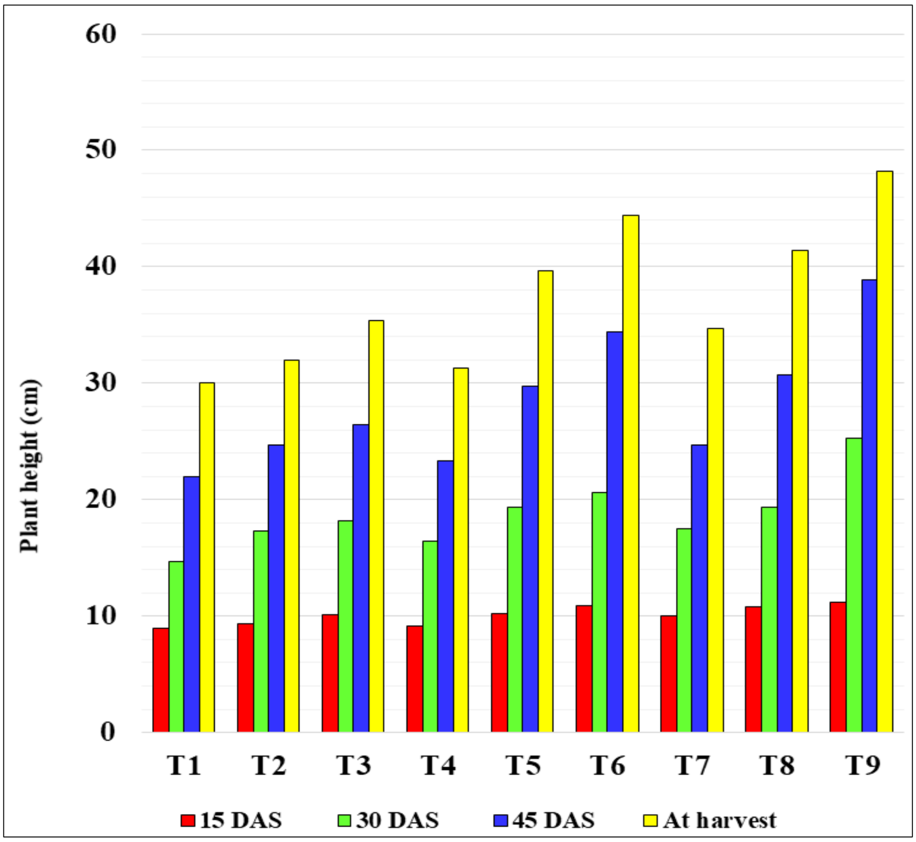

Fig 1: Influence of different combination of neem cake and poultry manure on plant height at different stages of Greengram

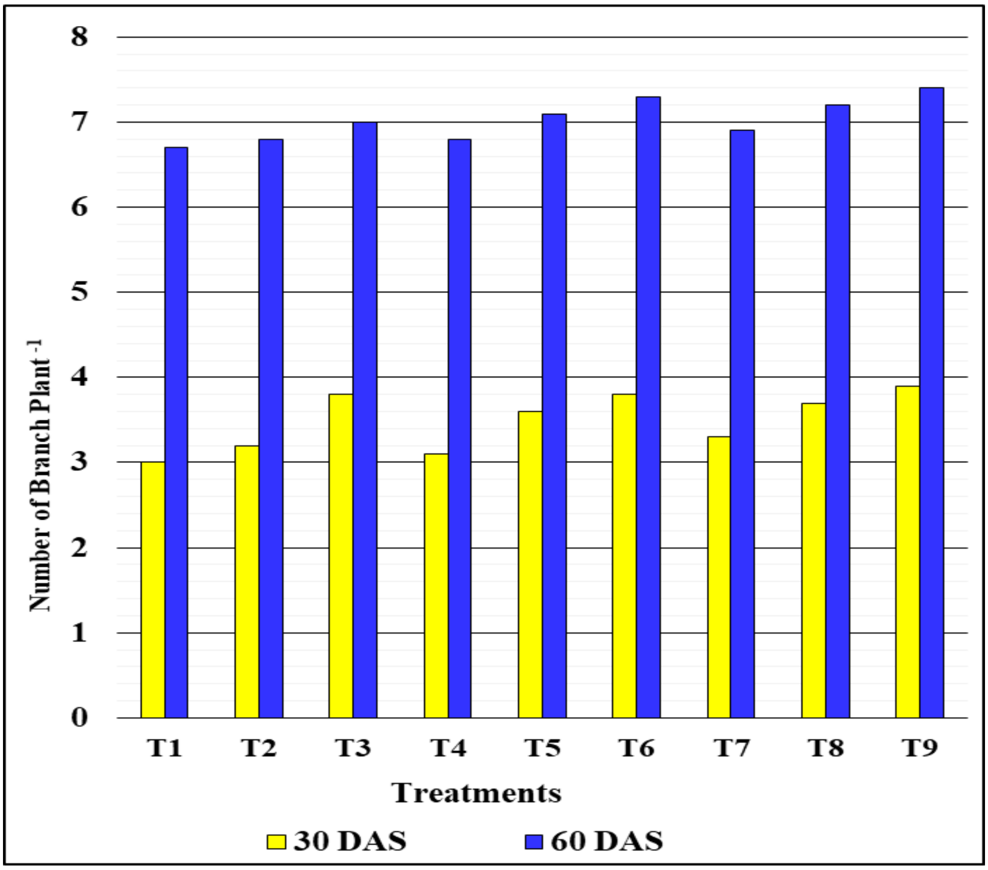

Fig 2: Influence of different combination of neem cake and poultry manure on number of branch plant^{-1}at different stages of Greengram

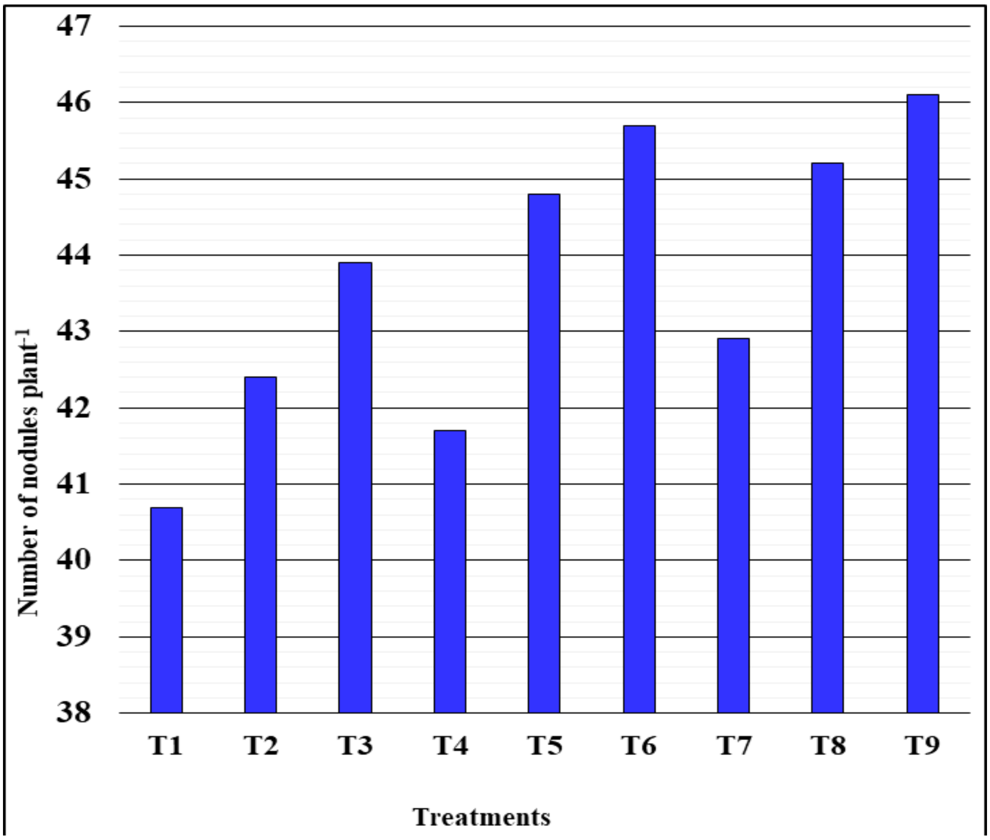

Fig 3: Influence of different combination of neem cake and poultry manure on number of nodules plant^{-1} of Greengram

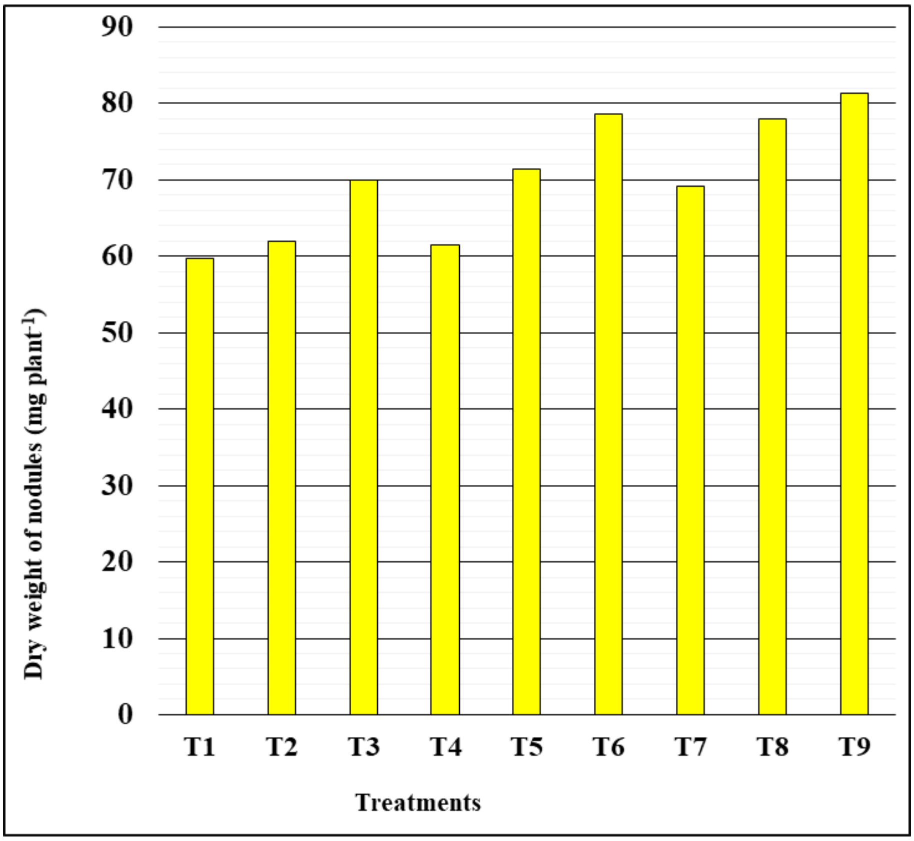

Fig 4: Influence of different combination of neem cake and poultry manure on dry weight of nodules of Greengram

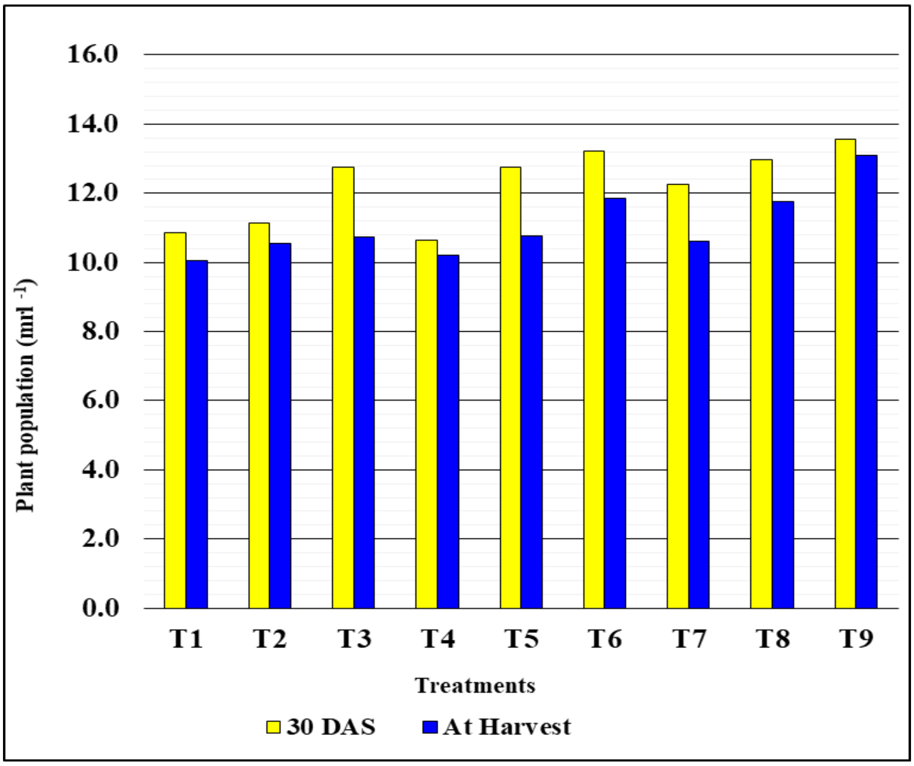

Fig 5: Influence of different combination of neem cake and poultry manure on plant population at different successive stage of Greengram

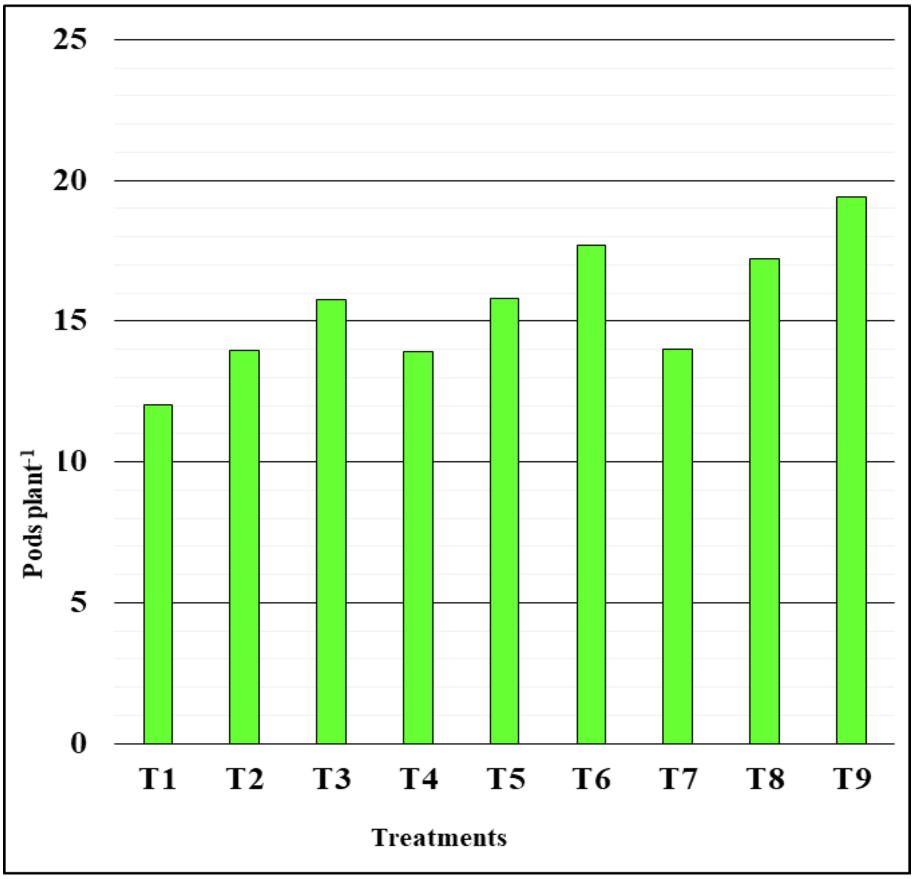

Fig 6: Influence of different combination of neem cake and poultry manure on Pods plant^{-1} at different successive stage of Greengram

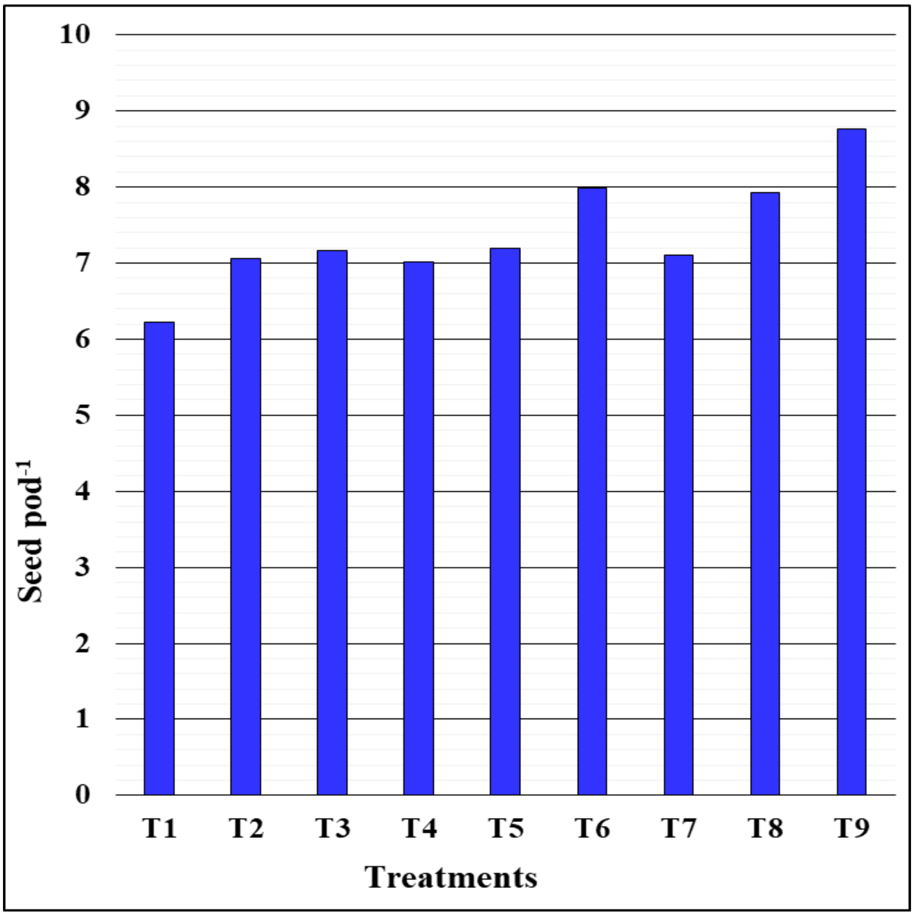

Fig 7: Influence of different combination of neem cake and poultry manure on Seeds pod^{-1} of Greengram

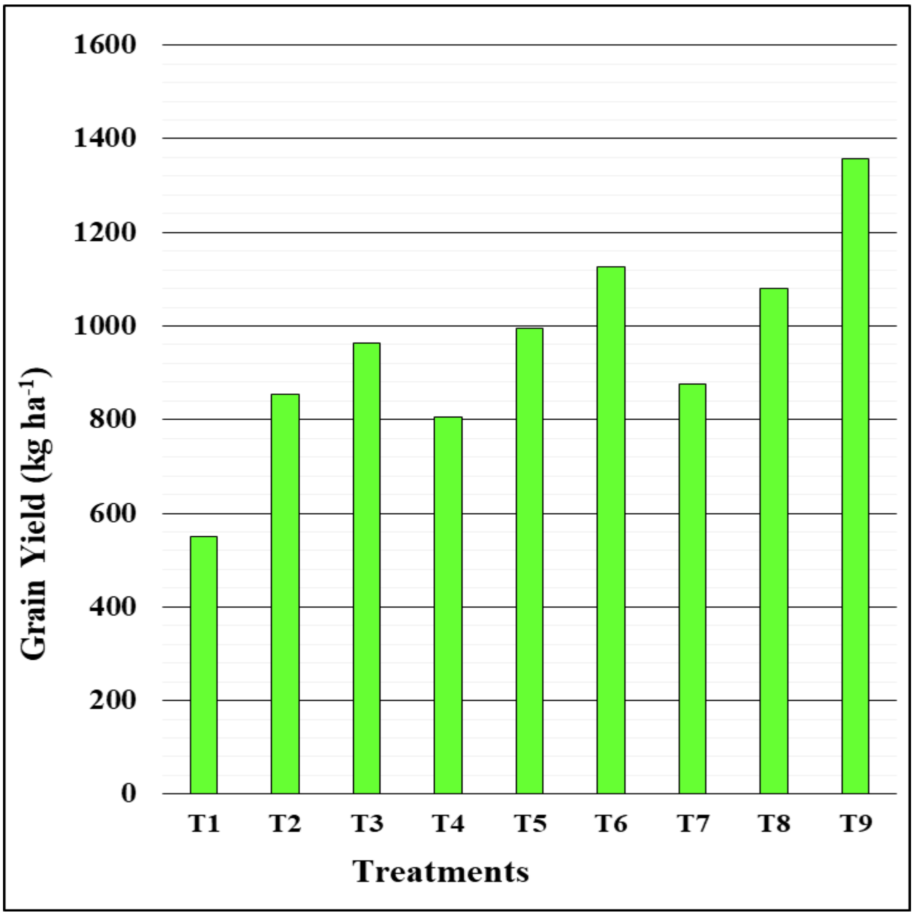

Fig 8: Influence of different combination of neem cake and poultry manure on grain yield (Kg ha^{-1}) of Greengram

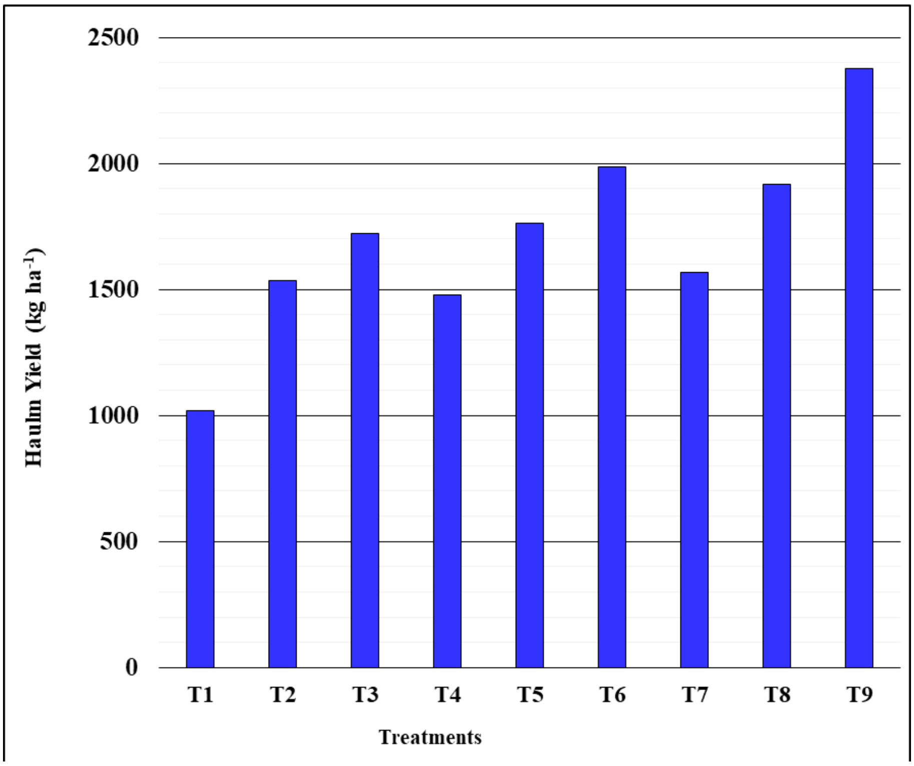

Fig 9: Influence of different combination of neem cake and poultry manure on haulm yield (Kg ha^{-1}) of Greengram

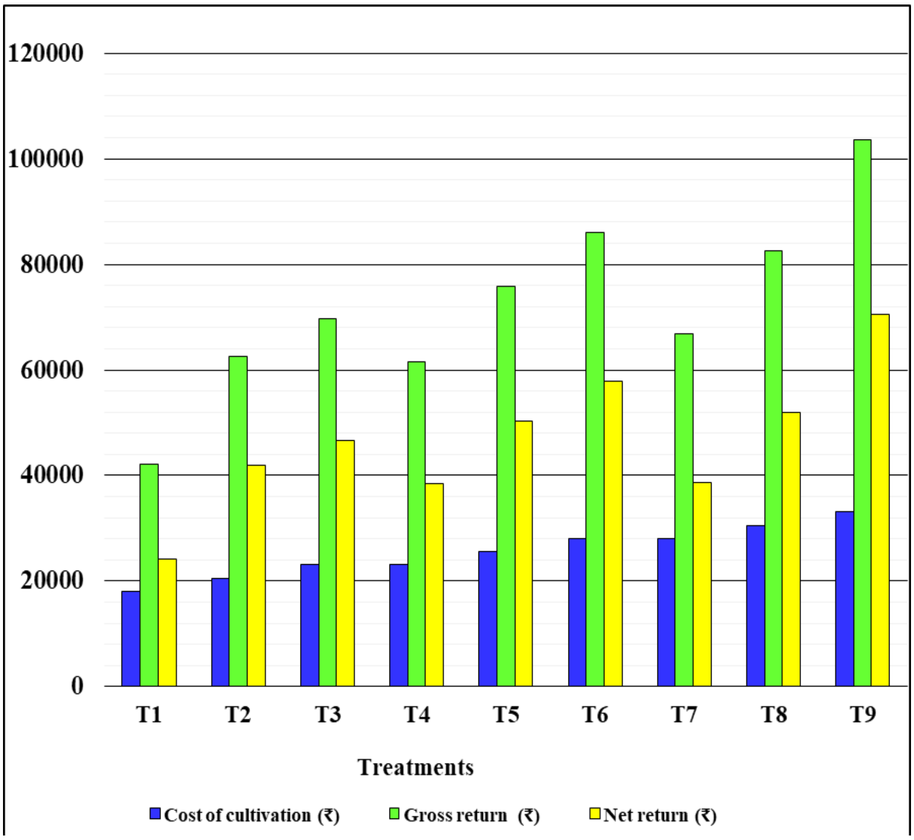

Fig 10: Influence of different combination of neem cake and poultry manure on cost of cultivation, gross return and net return of Greengram

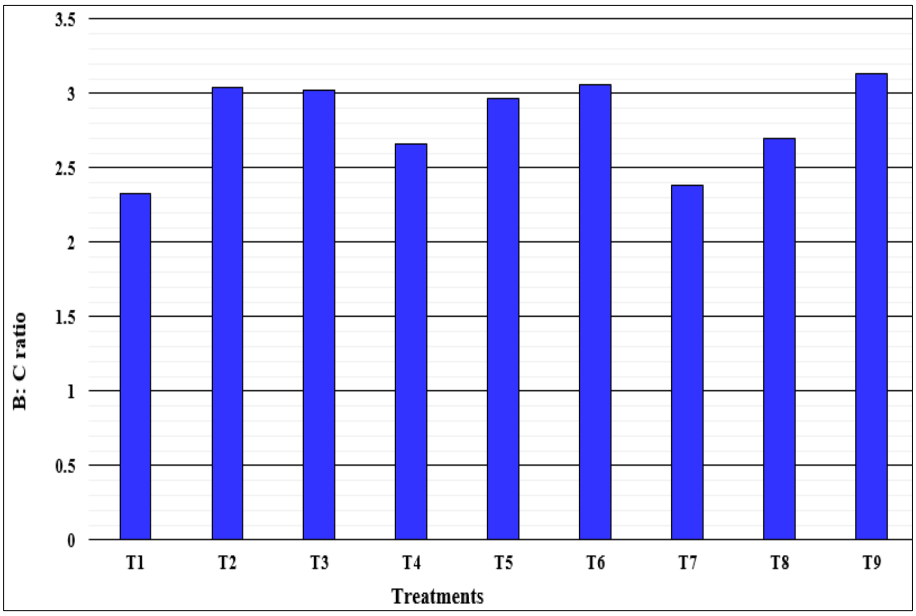

Fig 11: Influence of different combination of neem cake and poultry manure on B: C ratio of Greengram

4. Conclusion

Based on the results of experimentation, it may be concluded that in greengram crop. Amongst all the treatments, application of T_9 (NC @ 100% +PM @ 100%) provided the significantly highest vegetative growth as well as yield attributes and yield and showed positive effect on net return up to ₹70439.07 ha^{-1} with B: C ratio of 3.13. Therefore, it is suggested that application of Neem cake @ 100% + Poultry manure @ 100% found most suitable dose for greengram to obtain higher yield.

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