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Influence of integrated nutrient management through organic sources on growth attributes of chickpea (*Cicer arietinum* L.)

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Abstract
The field experiment on "Influence of integrated nutrient management through organic sources on growth attributes of chickpea (*Cicer arietinum* L.)" was carried out at Karguan Ji Agriculture Farm, Bundelkhand University, Jhansi (UP) during Rabi Season of 2018-19 in *Randomized Block Design* (RBD) comprises with three replications and nine treatments. In the experiment, source of applied organic manure & opted variety were farm yard manure, poultry manure, vermin-compost and JG-14 respectively. The pooled data revealed that growth attributes i.e. No. of secondary branches per plant was found significantly maximum in treatment T_0 (RDF-Chemical) at 30 & 60 DAS and treatment T_8 with supplemented dose of **(**1/3FYM + 1/3VC + 1/3PM) + PSB at 90 DAS. Significantly maximum fresh & dry shoot & root weight (g.) plant^{-1} were recorded maximum in treatment T_0 (RDF-Chemical) at 90 DAS. No. of nodules plant^{-1} was found significant with different days and found maximum in T_2 with (100% through vermin-compost) at 30 DAS, T_1 with (100% through FYM) at 60DAS and T_8 with (1/3FYM + 1/3VC + 1/3PM) + PSB at 90 DAS. Therefore based on present study it can be concluded that application of (1/3 dose of Farmyard manure + 1/3 dose of Vermicompost + 1/3 dose of Poultry manure) + Phosphorus solubilizing bacteria is best suited for obtaining better growth development after application of RDF through chemical.

Keywords: Integrated nutrient management, PSB, RDF, FYM and chickpea

Introduction
Pulses are **mostly** produced, consumed, and imported in India. It is thought to consume 26 MT of pulses annually Sahu *et al*. (2019) [12]. Chickpea (*Cicer arietinum* L.) belongs to a Leguminosae or Fabaceae family. It is commonly known as Bengal gram in English and Black chana in Hindi. It is an annual *rabi* crop. The ripened seeds of chickpea are consumed in the form of processed foods which are boiled, roasted, fried, steamed, and sprouted. It is also used as a 'dal' or as flour (besan), fresh green seeds are also consumed as green vegetable. It is also used for preparing a variety of snacks, sweets. A significant source of protein, carbs, dietary fibre and minerals like iron, zinc and folate (folic acid), chickpeas are also a good source of protein. For vegans and vegetarians, it is also an excellent source of plant-based protein (Singh *et al*., 2020) [14]. Pulse production ranged from 25.75 MT in 2020-21 to 23.02 MT in 2019-20 to about 23.40 MT in 2018-19. Chickpea and pigeon pea are the primary producers of pulses in India. Chickpea make up over 46% (10.56 million tonnes) of the entire crop, whereas pigeon peas make up 18% (4.15 million tonnes) Singh *et al*. (2021) [15]. In especially in South Asia and the Mediterranean region, chickpea is a significant cash crop for smallholder farmers. It helps sustain rural livelihoods and is a significant source of income for farmers (Gummadov *et al*., 2016) [3]. Its cultivation maintains soil fertility through biological nitrogen fixation in association with symbiotic rhizobium prevalent in its root nodules and thus play a vital role in fostering sustainable agriculture (Negi *et al*., 2006) [9]. Vermi-compost is a rich source of nutrients and organic matter, which can help to improve soil structure, water retention, and nutrient availability. Vermi-compost can also help to suppress soil-borne diseases and improve plant growth and yield (Singh *et al*., 2019) [16].

It increases the growth and development, dry matter production and yield of crops even under dry land conditions. Nitrogen is important for vegetative growth, phosphorus is important for root development and fruiting, and potassium is important for overall plant health and disease resistance Tahir *et al*. (2019) [17]. Nitrogen plays an important role in synthesis of chlorophyll, amino acids and other organic compounds which add to the building units of proteins in the plant system. The photosynthesis action of the plants and their ability to use available nutrients increases by nitrogen application. Phosphorus is one of the most important major nutrient elements required for proper growth and yield of legumes. Ryan *et al*. (2012) [11] has clearly demonstrated the significance of phosphorus for all animals and plant life on the earth. But Imbalance use of chemical fertilizer; cause severe contamination of toxic pollutants in the crop foliage as well as soil health and other natural resources, which imparts toxic effect on human & animal health, soil fauna and other water bodies. Problems that arose after the green revolution, which are currently threatening the sustainability of Indian agriculture as a whole and raising serious concerns about national food security, include stagnation or even decline in production and productivity growth rates of major crops, deterioration of soil fertility, declining factor productivity, and low production diversity. Intensive cropping, along with uneven nutritional supplementation, has resulted in a soil deficit of key important nutrients. Balanced plant nutrition has an important role in increasing production, and using organic nutrition sources may be an option. Keeping all the above concerns in mind, the present study entitled "Influence of integrated nutrient management through organic sources on growth attributes of chickpea (*Cicer arietinum* L.)" was carried out during *rabi* season of 2018-2019 at the Agricultural Research Farm of the Institute of Agricultural Sciences, Bundelkhand University, Jhansi, Uttar Pradesh.

Materials and Methods

Experiment was carried out at Organic farming block, Agriculture Research Farm, Karguan Ji Agriculture Farm Jhansi behind BU campus in foot hills of Kamashin Mata Temple. Geographically, the Karguaji Farm of Bundelkhand University, Jhansi is situated at Latitude: 25027'31' N. Longitude: 78o34'47' E. The latitude level of Bundelkhand University Jhansi plains is about 285 m. above mean sea level. Plains of Jhansi lies in Agro Climatic Zone-VIII: Central Plateau and Hills region; agro climatic sub-zone Bundelkhand (Uttar Pradesh). Total rainfall received during crop growing period was 15.6 mm. and the maximum temperature of 39 °C was recorded in the month of April whereas the min. temp. Of 60 °C was observed in the January. Generally during the period of investigation, the mean max. and min. weekly bright sunshine duration were recorded 9.8 hrs to 4.4 hrs day^{-1}, respectively and the evapo-transpiration data obtained from weather bureau pan evaporimeter showed that the average ET during the period of experiment varied from 0.9-5.1 mm/day. The soil of experimental field was a yellowish, light-colored variety of red soil is found across UP Bundelkhand and it also called parua (A category of red soil) with slightly alkaline in reaction (pH 7.7). The experiment was laid out in randomized block design with three replications and 9 treatments as; RDF (Chemical), 100% through FYM, 100% through vermi-compost, 100% through poultry manure, (50% through FYM + 50% through vermin-compost), (50% through FYM + 50% through poultry manure0, (50% through vermin compost + 50% through Poultry manure), (1/3 FYM + 1/3 vermi-compost + 1/3 poultry manure), (1/3 FYM + 1/3 vermi-compost + 1/3 poultry manure) + PSB. Field was prepared and sown the chickpea variety 'JG-14' using seed rate @ 80 kg.ha^{-1} with standard spacing 30*10 cm^2 along with recommended package of practices. The fertilizer dose were applied as per treatment through FYM, Vermi-compost, Poultry manure to meet the recommended need of 30kg N, 60kg P_2O_5 and 60 kg K_2O full dose was applied at the time of sowing. Requirement of water on the basis of moisture in soil and crop requirement of water, one light irrigation were applied at the time of field preparation and after two consecutive light irrigation, first 25 DAS and second was applied at the time of flowering 60 DAS. Others practices *viz*. weeding, interculture and insect-pest and disease management measures were applied as need based. PSB (*Phosphate Solubilizing Bacteria*) culture was purchased from district agriculture department and chickpea seeds were treated @ 2g kg^{-1} before sowing as per treatment combination. The observation recorded during the course of investigation were tabulated and analyzed statistically by "O.P. States" to draw a valid conclusion. The data were analyzed as per standard procedure for "Analysis of Variance" (ANOVA) as directed by Gomez (1988) [2].

Results and Discussion

Number of primary branches per plant

The data based on the parameter Primary branches was no significant with different days as depicted in Table-1. Non-significantly at 30 DAS maximum no. of primary branches was proliferated (2.55) with supplemented dose of 100% through FYM opted in plot T_1 as compared to other treatments; which was at par with T_0 (2.22) enriched with (RDF - Chemical) and (2.1) with T_5 (50% through FYM + 50% through PM). While minimum number of branches per plant (1.8) were obtained in T_3 (100% through Poultry Manure) as presented in Table-1. The data recorded on number of branches, at 60 DAS, showed non-significant effect on proliferation of branches of chick pea plant. Among all the tested formulations of organic sources, higher number of branches per plant (2.8) were recorded in T_0 (RDF through chemical sources) as compared to other treatment formulations which was at par with T_1(2.56) enriched with (100% through FYM) and (2.56) with T_8 ((1/3FYM + 1/3 VC + 1/3 PM) + PSB) while minimum number of branches per plant (2.0) were counted in formulations of (50% through Vermi-compost and 50% through Poultry manure) opted in plot T_6 and as presented in Table-1. Final data recorded on flourishing of branches per plant of chickpea at 90 DAS was also found statistically non-significant, maximum no. of primary branches was proliferated (3.22) with supplemented dose of (1/3Farm Yard Manure + 1/3 Vermoicompost + 1/3 Poultry Manure) + Phosphorus Solublizing Bacteria, opted in plot T_8 which was at par with (3.1) in T_3 (100% through Poultry Manure) & (3.1) with T_8 (1/3FYM + 1/3 VC + 1/3 PM) + PSB).While minimum number of branches per plant (2.45) with T_2 (100% through VC). In general, the data showed that T_0 recorded relatively higher no. of branches at 60 DAS except 30 & 90 DAS than the other treatments. It was may be due to growth of plant by using inorganic source of fertilizer, which helps in readily availability of nutrient availability. While at 30 & 90 DAS; formulation of organic source of manure *viz.* FYM, vermi-compost and Poultry manure were also found better over it use with PSB for obtaining higher no. of primary branches. It may be due to slow release of nutrient by the well decomposed FYM integration with vermin-compost & poultry manure and impart favorable conditions for microbial activities over the growth period of crop and seed treated with PSB leads the mobilization of phosphorus,

which enhance better absorption of nutrients, resulted higher no. of primary branches.

Number of secondary branches per plant

The data based on the parameter Secondary branches was significant with different days as depicted in Table-1. Significantly maximum no. of secondary branches was proliferated (29.2) with supplemented dose of RDF (Chemical) opted in plot T_0 as compared to other treatments at 30 DAS. Followed the best next treatment was recorded (28.22) with T_1 (100% through FYM) and (26.44) with T_7 (1/3FYM + 1/3 VC + 1/3 PM) While minimum number of secondary branches per plant (18.3) were obtained in T_3 (100% through Poultry Manure) as presented in Table-1. The data recorded on number of secondary branches, at 60 DAS, showed significant effect on proliferation of secondary branches of chick pea plant. Among all the tested formulations of organic sources, higher number of secondary branches per plant (67.7) were recorded in T_0 (RDF through chemical sources) as compared to other treatment formulations. Followed by the best next treatment was recorded (61.2) with T_5 (50% through FYM + 50% through PM) and (59.4) with T_7 (1/3FYM + 1/3 VC + 1/3 PM) while minimum number of branches per plant (40.5) were counted in formulations of (100% through Poultry Manure) opted in plot T_3, as presented in Table-1. Final data recorded on flourishing of secondary branches per plant of chickpea at 90 DAS was also found statistically significant, maximum no. of secondary branches was proliferated (98.3) with supplemented dose of (1/3 Farm Yard Manure + 1/3 Vermoicompost + 1/3 Poultry Manure) + Phosphorus Solublizing Bacteria, opted in plot T_8. Similarly, next best treatment was recorded (94.4) with T_0 (RDF - Chemical) & (84.1) with T_7 (1/3FYM + 1/3 VC + 1/3 PM). While minimum number of branches per plant (74.5) with T_2 (100% through VC). Results revealed that lateral branches were higher under T_0 when (RDF was applied through chemical sources control) as compared to other treatment at 30, 60 DAS and T_8 with integrated dose of organic manures (1/3FYM + 1/3VC + 1/3PM) + PSB at 90 DAS. Generally. It becomes may be due to growth of plant by using the inorganic sources of nutrients, becomes readily available as well as photosynthesis of the plant (Nawale *et al*., 2009) [8]. In contrast, organic manures were slow-acting and released nutrients to plants gradually. This was because organic manures needed to be broken down by soil microbes before they could be absorbed by plant roots. Organic manures also typically contained lower levels of nutrients than inorganic fertilizers.

Table 1: Influence of Integrated Nutrient Management sources on number of branches & secondary branches per plant of gram under organic conditions.

Treatments	Treatment Formulation	Number of primary branches per plant			Number of secondary branches per plant		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T_0	RDF (Chemical)	2.22	2.78	3.00	29.22	67.77	94.44
T_1	100% through FYM	2.55	2.56	2.89	28.22	54.11	79.22
T_2	100% through VC	1.89	2.00	2.45	19.44	47.89	74.55
T_3	100% through Poultry Manure	1.78	2.11	3.11	18.33	40.55	75.33
T_4	50% through FYM+50% through VC	1.78	2.11	2.78	20.55	48.44	77.66
T_5	50% through FYM+ 50% through PM	2.11	2.45	3.00	24.66	61.22	77.22
T_6	50% through VC+50% through PM	2.11	2.00	2.67	19.44	43.22	81.55
T_7	1/3FYM+1/3 VC+1/3 PM	2.11	2.44	2.78	26.44	59.44	84.10
T_8	(1/3FYM+1/3VC+1/3 PM) + PSB	2.0	2.56	3.22	22.77	58.33	98.33
S.Em±		0.21	0.24	0.24	0.87	1.6	1.75
CD at 5%		NS	NS	NS	2.62	4.8	5.29

Fresh weight of shoot per plant

The data based on the parameter Fresh shoot weight was significant with different days except at 30 DAS as depicted in Table-2. Non-significantly at 30 DAS maximum fresh shoot weight was recorded (4.51 g) with supplemented dose of (50% through FYM + 50% through PM) opted in plot T_5 as compared to other treatments. Followed by the best next treatment was recorded (4.4 g) with T_2 (100% through VC) and (4.2 g) with T_0 (RDF (Chemical)) While minimum fresh shoot weight (2.9 g) were obtained in T_6 (50% through VC + 50% through PM) as presented in Table-2 The data recorded on fresh shoot weight, at 60 DAS, showed significant effect on fresh shoot weight of chick pea plant. Among all the tested formulation of organic sources, maximum fresh shoot weight (29.7 g) were recorded in T_8 (1/3FYM + 1/3 VC + 1/3 PM) + PSB as compared to other treatment formulations. Followed by the best next treatment was recorded (14.3 g) with T_1 (100% through FYM) and (12 g) with T_6 (50% through VC + 50% through PM) while minimum fresh shoot weight (7.1 g) were obtained with the supplemented dose (100% through VC) opted in plot T_2 as presented in Table-2. Final data recorded on fresh shoot weight of chickpea at 90 DAS was also found statistically significant, maximum fresh shoot weight was recorded (104.4 g) with supplemented dose of (RDF -Chemical), opted in plot T_0. Similarly, next best treatment was recorded (77.6 g) with T_7 (1/3FYM + 1/3 VC + 1/3 PM) & (69.2 g) with T_5 (50% through FYM + 50% through PM). While minimum fresh shoot weight (43 g) were recorded in T_2 (100% through VC). Maximum fresh weight of shoot of chickpea was obtained when RDF applied through chemical fertilizer (25:60:30 kg ha^{-1} NPK), It may be due to instant supply of essential nutrient to the plant. These findings are similar to the results of Khan and Qureshi, 2001 [4]; Mishra *et al*. 2002 [6]; Noor *et al*. 2003 [10].

Fresh weight of root per plant

The data based on the parameter Fresh root weight was non-significant with different days except at 90 DAS as depicted in Table-2. Non-significantly, maximum fresh root weight was recorded (0.43 g) with supplemented dose of (RDF - Chemical) opted in plot T_0 and (1.5 g) were recorded in T_1 enriched with (100% through FYM) at 30 & 60 DAS respectively as compared to other treatments. While minimum fresh root weight (0.23 g) & (1 g) were obtained in T_4 enriched with (50% through FYM + 50% through VC) at 30 & 60 DAS respectively. Final data recorded on fresh root weight of chickpea at 90 DAS was found statistically significant, maximum fresh root weight was recorded (4.5 g) with supplemented dose of (RDF - Chemical), opted in plot T_0. Similarly, the next best treatment was recorded

(3.2 g) with T_8 (1/3FYM+1/3 VC+1/3 PM) + PSB & (3 g) with T_7 (1/3FYM+1/3 VC+1/3 PM). While minimum fresh root weight was recorded (2.1 g) with T_2 (100% through VC). In general, the data showed that T_0 recorded relatively higher fresh root weight at 30, 60 and 90 DAS than the other treatments. It may be due to optimum dose nutrients could readily be made available through chemical fertilizer (RDF).

Table 2: Influence of Integrated Nutrient Management on fresh shoot & root weight (gm.) per plant of gram under organic condition.

Treatments	Treatment combination	Fresh shoot weight			Fresh root weight		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T_0	RDF (Chemical)	4.19	10.81	104.44	0.433	1.297	4.51
T_1	100% through FYM	3.26	14.33	62.44	0.327	1.513	2.98
T_2	100% through VC	4.44	7.14	43.00	0.323	1.437	2.09
T_3	100% through Poultry Manure	3.17	11.82	46.11	0.300	1.380	2.21
T_4	50% through FYM + 50% through VC	3.11	8.23	53.78	0.230	1.053	3.00
T_5	50% through FYM + 50% through PM	4.51	10.58	69.22	0.323	1.260	2.88
T_6	50% through VC + 50% through PM	2.97	12.07	46.11	0.273	1.197	2.32
T_7	1/3FYM + 1/3 VC + 1/3 PM	3.65	10.54	77.56	0.260	1.073	3.02
T_8	(1/3FYM + 1/3 VC + 1/3 PM) + PSB	3.52	29.71	59.44	0.360	1.170	3.20
S.Em±		0.48	0.83	2.08	0.072	0.161	0.29
CD at 5%		NS	2.5	6.30	NS	NS	0.90

Dry weight of shoot per plant

The data based on the parameter; dry shoot weight was non-significant with different days except at 90 DAS as depicted in Table-3. Non-significantly at 30 DAS maximum dry shoot weight was recorded (1.64 g) with supplemented dose of (50% through FYM + 50% through VC) opted in plot T_4 as compared to other treatments; which was at par with (1.04 g) opted in T_2 (100% through VC) and (1.02 g) with T_5 (50% through FYM + 50% through PM); while minimum fresh shoot weight (0.68 g) were obtained in T_6 (50% through VC + 50% through PM) as presented in Table-3. The data recorded on dry shoot weight, at 60 DAS, showed non-significant effect on fresh root weight of chick pea plant. Among all the tested formulation of organic sources, maximum fresh shoot weight (2.98 g) were recorded in T_1 (100% through FYM) as compared to other treatment; which was at par with (2.47 g) opted in T_1 (RDF Chemical) and (2.43 g) with T_3 (100% through Poultry Manure) while minimum dry root weight (1.67 g) were obtained with the supplemented dose (100% through VC) opted in plot T_2 and as presented in Table-3. Final data recorded on dry shoot weight of chickpea at 90 DAS was found statistically significant, maximum dry root weight was recorded (22.30 g) with supplemented dose of (RDF - Chemical), opted in plot T_0. Similarly, next best treatment was recorded (15.74 g) with T_7 (1/3FYM + 1/3 VC + 1/3 PM) & (13.53 g) with T_5 (1/3FYM + 1/3 VC + 1/3 PM). While minimum dry root weight was recorded (2.1 g) with T_3 (100% through Poultry Manure). In general, maximum dry shoot weight of chickpea was obtained in T_0 (chemical control) at 30, 60 and 90 DAS than the other treatments. It was may be due to growth of plant by using the inorganic sources of fertilizer, which helps to instant supply of major nutrients from soil to the plant. Significantly, maximum dry shoot weight of chickpea was obtained in T_0 (chemical control) at 90 DAS than the other treatments. It was may be due to growth of plant by using the inorganic sources of fertilizer, which helps to instant supply of major nutrients from soil to the plant.

Dry weight of root per plant

The pooled data based on the parameter; dry weight of root per plant were found non-significant at 30 & 60 DAS expect at 90 DAS. Non-significantly, maximum dry root weight (0.273 g) & (0.427 g) were found in T_0 enriched with RDF (Chemical) as compare to other treatments respectively at 30 & 60 DAS; which were at par with T_8 (0.219 g) &T_2 (0.197 g) at 30 DAS and T_1 (0.397 g) & T_5 (0.367 g) at 60 DAS respectively. The data recorded at 90 DAS, revealed that significantly maximum dry root weight (2.593 g) was recorded in T_0 enriched with RDF Chemical as compare to other treatments. Followed by the next best treatment was recorded in T_4 (1.567 g) & T_7 (1.423 g) respectively; while minimum dry root weight was recorded in T_3 (0.960 g) as depicted in Table 3. In final observation, at 30, 60 and 90 days after sowing the maximum dry root weight of chickpea was recorded under control treatment (T_0). It may be due to direct application of nitrogenous fertilizer which increases the vegetative root growth. These findings are similar to the results of Muddukumar, 2007 [7]; Singh and Prasad (2008) [13] and Chauhan *et al*. (2010) [1].

Table 3: Influence of Integrated Nutrient Management on Dry shoot & root weight (gm.) per plant of gram under organic condition.

Treatments	Treatment combination	Dry shoot weight			Dry root weight		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T_0	RDF (Chemical)	0.86	2.47	22.30	0.273	0.427	2.593
T_1	100% through FYM	0.77	2.98	12.67	0.176	0.397	1.173
T_2	100% through VC	1.04	1.67	9.99	0.197	0.360	1.210
T_3	100% through Poultry Manure	0.80	2.43	9.42	0.169	0.350	0.960
T_4	50% through FYM + 50% through VC	1.64	1.83	11.31	0.169	0.260	1.567
T_5	50% through FYM + 50% through PM	1.02	2.40	13.53	0.182	0.367	1.270
T_6	50% through VC + 50% through PM	0.68	2.53	10.18	0.159	0.327	1.387
T_7	1/3FYM + 1/3 VC + 1/3 PM	0.90	2.29	15.74	0.173	0.277	1.423
T_8	(1/3FYM + 1/3 VC + 1/3 PM) + PSB	0.86	2.19	11.18	0.219	0.360	1.400
S.Em±		0.39	0.50	1.01	0.045	0.058	0.209
CD at 5%		NS	NS	3.07	NS	NS	0.633

Number of nodules per plant

The pooled data based on parameter; Number of nodules per plant, indicated that Number of nodules per plant were found significant with different days as depicted in Fig. 1. Significantly, maximum no. of nodules were recorded (8.99) enriched with 100% through vermi-compost, opted in treatment T_2, which was at par with (8.56) T_1 & T_1 (8.56). Followed by the best next treatment was recorded (7.33) with T_8 and (6.55) with T_3 respectively. While minimum no. of nodules (4.55) was recorded in treatment T_6. The data recorded at 60 DAS, significantly maximum no. of nodules (25.67) were found in T_1 enriched with 100% through FYM. Similarly, the best nest treatment was recorded (22.11) with T_8 and (21.11) with T_8 respectively. While minimum no. of nodules (15.00) was recorded in treatment T_6. The final data recorded at 90 DAS, significantly maximum no. of nodules (29.48) were found in T_8 enriched with (1/3FYM + 1/3 VC + 1/3 PM) + PSB. Which was at par with (28.81) T_3 & T_0 (27.63). Similarly, the best nest treatment was recorded (27.15) with T_7 and (21.15) with T_6 respectively. While minimum no. of nodules (20.03) was recorded in treatment T_4. In legume crops, root nodule played significantly very vital role in architecting the growth and health of plant at above ground by converting nitrogen to their other form environment and supplying to the plant. Chickpea being a legume and health wearing along with more number of nodules on lateral roots and hairs; it is comparatively known to fix more nitrogen in soil during their cultivation. This finding is closely related to Mahto and Yadav (2005) [5].

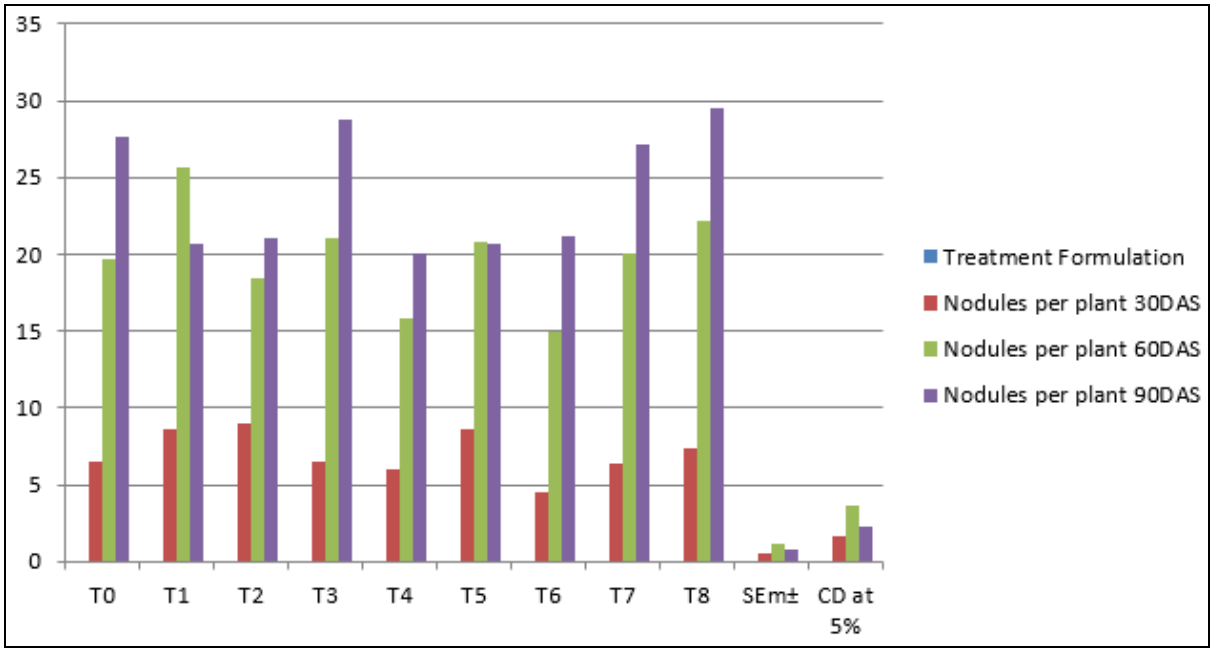

Fig 1: Effect of Integrated Nutrient Management on nos. of nodule per plant of gram under organic condition.

Conclusion

Based on the result of present investigation; it can be conclude that Integrated dose of organic source of manure; 1/3 FYM + 1/3 vermi-compost + 1/3 Poultry manure were proved better over it use with Phosphorus Solubilizing Bacteria for obtaining; Higher No. of Primary & Secondary branches and Maximum No. of Nodules over the use of 100% nutrient application through chemical. This formulation were also proved to be better for obtaining maximum fresh & dry weight of shoot and root of crop after the application of RDF through 100% chemically.

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