International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 1048-1052

Received: 01-05-2019
Accepted: 03-06-2019

Tirupati Meti
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Raichur, UAS, Raichur, Karnataka, India

MA Bellakki
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Kalaburagi, UAS, Raichur, Karnataka, India

Anand Naik
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Kalaburagi, UAS, Raichur, Karnataka, India

Correspondence
Anand Naik
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Kalaburagi, UAS, Raichur, Karnataka, India

A study on effect of nutrient management practices through organic and in-organic sources on growth parameters of chickpea in Karnataka state

Tirupati Meti, MA Bellakki and Anand Naik

Abstract
A field experiment was conducted at Krishi Vignana Kendra, Kalaburagi, University of Agricultural Sciences, Raichur during *rabi* 2015-16. To study the "Nutrient management in chickpea (*Cicer arietinum* L.) in black soil under rainfed situation". The results on growth parameters revealed that, Plant height, dry matter production and number of root nodules per plant at 40 DAS and 60 DAS were significantly higher with application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha at all the growth stages of chickpea. Significantly lower number of root nodules per plant was noticed in RDF treatment. The results supports that, integrated nutrient management through organic and in-organic nutrients plays a major role in maintaining soil health due to build up of soil organic matter, beneficial microbes, enzymes, besides improving soil physical and chemical properties.

Keywords: Plant height, dry matter production, number of branches, root nodules

Introduction
Agriculture is one of the oldest and most prospective professions of human civilization whose prosperity depends on soil organic matter status. The Green revolution technologies involving greater use of synthetic agrochemicals such as fertilizers and pesticides with adoption of nutrient- responsive, high- yielding varieties of crops from mid 1960's onwards no doubtely boosted the food grain production but also the soil system appeared to show signs of exhaustion after two to three decades, thus reflecting decline in the overall productivity per unit area of most of the crops. Inspite of using modern technologies, the yield did not show the same upward trend and it continued ever today itself. Among the various factors affecting the growth and yield of crops, nutrient management plays a vital role. In crop production, chemical fertilizers are the major source of nutrients, but escalating cost, coupled with increasing demand of chemical fertilizers and depleting soil health necessitates the safe and efficient use of organics in crop production, which is gaining much popularity. It helps to enhance and maintain soil organic carbon status for sustained crop yield. According to Katyal (2000) [1], India with the second largest human population which is sustained seventh largest geographical area in the world with tropical and sub-tropical climate with highest number of livestock, offers a great potential for organic matter availability. However, under arable production systems, organic manures suffer from the drawback of slow release of nutrients, which may cause significant reduction in crop yield and net farm income. This could be overcome by use of judicious combination of organic manures. Combined application of green manures, crop residues and composts along with liquid manures mainly jeevamrutha, panchagavya, bio-digester solution, beejamrutha, biogas spent slurry and vermiwash, *etc.* in a more synchronized system can release the nutrients as per the need of crop to sustain higher productivity (Kanwar *et al.*, 2006) [2].

In North Eastern Dry Zone of Karnataka, chickpea is one of the important rainfed crop grown during *rabi* season. This crop requires low input requirement particularly with response to nutrients. The yield level of this crop is not stable and potential yield is yet to be achieved. The yield decline is mainly due to low soil fertility status. There is a need to stabilize the yield. The crop yield can be maintained on sustainable manner on long run under organic system. Hence, the present investigation was carried out to study the integrated effect of organic and inorganic sources of nutrient on growth chickpea.

Materials and methods

A field experiment was conducted at Krishi Vignana Kendra, Kalaburagi, University of Agricultural Sciences, Raichur, conducted during *rabi* 2015-16. To study the "Nutrient management in chickpea (*Cicer arietinum* L.) in black soil under rainfed situation". The experiment consisted of eleven treatments comprised of RDF alone, in combination of FYM @ 5 t ha^{-1} with (50%, 75%, 100% RDF and Jeevamrutha), vermicompost @ 2.5 t ha^{-1} with (50%, 75%, and 100% RDF and Jeevamrutha), FYM @ 5 t ha^{-1} + vermicompost @ 2.5 t ha^{-1} + Jeevamrutha and RDF + Jeevamrutha. The trial was laid out in randomized complete block design with three replications.

Results and Discussions

Results

The results obtained from the study carried out on the nutrient management in chickpea (*Cicer arietinum* L.) in black soil under rainfed situation in North Eastern Dry Zone of Karnataka (Zone-2). The observations on growth parameters such as Plant height; Number of branches per plant, Dry matter accumulation in plant and Number of root nodules per plant is in four sub-heads on chickpea were collected at different crop growth stages and findings pertaining to these parameters are presented in the Table 1 to 4 respectively.

Plant height

The data pertaining to plant height of chickpea at different stages of crop growth revealed that due to various treatments in the experimentation have significantly influenced the plant height of chickpea at 30 DAS, 60 DAS and at harvest. (Table 1). At 30 DAS, significantly higher plant height was recorded with application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha (26.70 cm) as compared to all other treatments. Significantly lower plant height was recorded with RDF (25.25 cm) which inturn was on par with rest of the treatments. At 60 DAS, treatment with application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha recorded significantly higher plant height (40.93 cm) and was on par with VC @ 2.5 t ha^{-1} + 100% RDF (40.43 cm) and VC @ 2.5 t ha^{-1} + Jeevamrutha (40.37 cm). Treatment supplemented with only RDF recorded lower plant height (37.13 cm) and was on par with treatments supplied with FYM @ 5 t ha^{-1} + 50% RDF, RDF + Jeevamrutha, VC @ 2.5 t ha^{-1} + 50% RDF, FYM @ 5 t ha^{-1} + 75% RDF, VC @ 2.5 t ha^{-1} + 75% RDF, FYM @ 5 t ha^{-1} + Jeevamrutha, along with FYM @ 5 t ha^{-1} + 100% RDF.

At harvest, significantly higher plant height was recorded with application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha (44.68 cm) and was on par with VC @ 2.5 t ha^{-1} + 100% RDF (44.43 cm). The next best treatments were application of VC @ 2.5 t ha^{-1} + Jeevamrutha (44.08 cm) and FYM @ 5 t ha^{-1} + Jeevamrutha (43.97 cm) along with FYM @ 5 t ha^{-1} + 100% RDF which were on par with each other. Significantly lower plant height was recorded with RDF (42.01 cm).

Table 1: Plant height at different growth stages of chickpea as influenced by nutrient management practices.

Treatment details	Plant height (cm)		
	30 DAS	60 DAS	At Harvest
T_1: RDF(10:25:0 N:P_2O_5:K_2O kg ha^{-1})	25.25	37.43	42.01
T_2: FYM @ 5 t ha^{-1} + 50% RDF	25.81	37.50	42.04
T_3: FYM @ 5 t ha^{-1} + 75% RDF	26.03	37.30	42.80
T_4: FYM @ 5 t ha^{-1} + 100% RDF	26.39	39.70	43.32
T_5: FYM @ 5 t ha^{-1} + Jeevamrutha	26.59	39.97	43.97
T_6: VC @ 2.5 t ha^{-1} + 50% RDF	26.00	39.19	42.68
T_7: VC @ 2.5 t ha^{-1} + 75% RDF	26.34	39.61	42.89
T_8: VC @ 2.5 t ha^{-1} + 100% RDF	27.01	40.43	44.43
T_9: VC @ 2.5 t ha^{-1} + Jeevamrutha	26.61	40.37	44.08
T_{10}: RDF + Jeevamrutha	25.95	38.00	42.26
T_{11}: FYM @ 5t ha^{-1} + VC @ 2.5t ha^{-1} + Jeevamrutha	26.70	40.93	44.68
S.Em ±	0.26	0.72	0.49
CD (0.05)	0.76	2.14	1.44

RDF: Recommended Dose of Fertilizer, **FYM:** Farm Yard Manure, **VC:** Vermicompost.

Number of branches per plant

Number of branches per plant differed significantly due to different organic nutrient management systems at 30 and 60 DAS and at harvest (Table 2). The results revealed that, At 30 DAS, FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha recorded significantly higher number of branches per plant (4.83) and on par with the treatments receiving VC @ 2.5 t ha^{-1} + 100% RDF (4.80), VC @ 2.5 t ha^{-1} + Jeevamrutha (4.80), FYM @ 5 t ha^{-1} + Jeevamrutha (4.73), FYM @ 5 t ha^{-1} + 100% RDF (4.67), VC @ 2.5 t ha^{-1} + 75% RDF (4.60), FYM @ 5 t ha^{-1} + 75% RDF (4.37), VC @ 2.5 t ha^{-1} + 50% RDF (4.30) and RDF + Jeevamrutha (4.33) along with FYM @ 5 t ha^{-1} + 50% RDF(4.20). Significantly lower number of branches per plant was recorded with RDF alone (4.13). On the other hand, at 60 DAS, treatment with application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha recorded significantly higher number of branches per plant (6.80) and was on par with VC @ 2.5 t ha^{-1} + 100% RDF (6.67), VC @ 2.5 t ha^{-1} + Jeevamrutha (6.60) and FYM @ 5 t ha^{-1} + Jeevamrutha (6.60). Significantly lower number of branches per plant was recorded with RDF treatment (6.13) which inturn was on par with treatments supplemented with FYM @ 5 t ha^{-1} + 50% RDF (6.20), RDF + Jeevamrutha (6.33), VC @ 2.5 t ha^{-1} + 50% RDF (6.33), FYM @ 5 t ha^{-1} + 75% RDF (6.40) and VC @ 2.5 t ha^{-1} + 75% RDF (6.40) in combination with FYM @ 5 t ha^{-1} + 100% RDF (6.47). However, during harvest, significantly higher number of branches per plant was recorded with FYM @ 5 t ha-1 + VC @ 2.5 t ha-1 + Jeevamrutha (8.40) and was on par with VC @ 2.5 t ha-1 + 100% RDF (8.33), VC @ 2.5 t ha-1 + Jeevamrutha (8.27), FYM @ 5 t ha-1 + Jeevamrutha (8.20) and VC @ 2.5 t ha-1 + 75% RDF (8.13). Treatment received RDF (7.87) resulted in significantly lower number of branches per plant and was found on par with rest of the treatments.

Table 2: Number of branches per plant at different growth stages of chickpea as influenced by nutrient management practices.

Treatment details	No. of branches per plant		
	30 DAS	60 DAS	At Harvest
T_1: RDF(10:25:0 N:P_2O_5:K_2O kg ha^{-1})	4.13	6.13	7.87
T_2: FYM @ 5 t ha^{-1} + 50% RDF	4.20	6.20	7.93
T_3: FYM @ 5 t ha^{-1} + 75% RDF	4.37	6.40	8.07
T_4: FYM @ 5 t ha^{-1} + 100% RDF	4.67	6.47	8.20
T_5: FYM @ 5 t ha^{-1} + Jeevamrutha	4.73	6.60	8.20
T_6: VC @ 2.5 t ha^{-1} + 50% RDF	4.33	6.33	8.00
T_7: VC @ 2.5 t ha^{-1} + 75% RDF	4.60	6.40	8.13
T_8: VC @ 2.5 t ha^{-1} + 100% RDF	4.80	6.67	8.33
T_9: VC @ 2.5 t ha^{-1} + Jeevamrutha	4.80	6.60	8.27
T_{10}: RDF + Jeevamrutha	4.33	6.33	7.93
T_{11}: FYM @ 5t ha^{-1} + VC @ 2.5t ha^{-1} + Jeevamrutha	4.83	6.80	8.40
S.Em ±	0.16	0.13	0.10
CD (0.05)	0.47	0.38	0.29

RDF: Recommended Dose of Fertilizer, **FYM:** Farm Yard Manure, **VC:** Vermicompost.

Dry matter accumulation in plant

The findings related to Dry matter production differed significantly due to nutrient management practices at all the crop growth stages (table 3 and Fig 1). It showed that, at 30 DAS, significantly higher dry matter production per plant was recorded with application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha (1.36 g $plant^{-1}$) when compare to all other treatments. The next best treatments were VC @ 2.5 t ha^{-1} + 100% RDF (1.32 g $plant^{-1}$), FYM @ 5 t ha^{-1} + Jeevamrutha (1.31 g $plant^{-1}$), VC @ 2.5 t ha^{-1} + Jeevamrutha (1.29 g $plant^{-1}$), FYM @ 5 t ha^{-1} + 100% RDF (1.22 g $plant^{-1}$) and VC @ 2.5 t ha^{-1} + 75% RDF (1.16 g $plant^{-1}$). Significantly lower dry matter production per plant was observed in control i,e RDF (0.94 g $plant^{-1}$) which inturn on par with the treatments supplemented with FYM @ 5 t ha^{-1} + 50% RDF (1.01 g $plant^{-1}$), RDF + Jeevamrutha (1.06 g $plant^{-1}$), VC @ 2.5 t ha^{-1} + 50% RDF (1.10 g $plant^{-1}$), FYM @ 5 t ha^{-1} + 75% RDF (1.12 g $plant^{-1}$).

Similarly at 60 DAS, application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha recorded significantly higher dry matter production (10.20 g $plant^{-1}$) and was on par with VC @ 2.5 t ha^{-1} + 100% RDF (9.78 g $plant^{-1}$) and VC @ 2.5 t ha^{-1} + Jeevamrutha (9.70 g $plant^{-1}$). Significantly lower dry matter production was recorded in RDF (7.28 g $plant^{-1}$) when compared to all other treatments. Further, during the harvest period, the FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha recorded significantly higher dry matter production per plant (28.9 g $plant^{-1}$) and was found on par with VC @ 2.5 t ha^{-1} + 100% RDF (28.60 g $plant^{-1}$) and VC @ 2.5 t ha^{-1} + Jeevamrutha (28.50 g $plant^{-1}$). The next best treatments were with FYM @ 5 t ha^{-1} + Jeevamrutha (28.40 g $plant^{-1}$) and FYM @ 5 t ha^{-1} + 100% RDF (27.9 g $plant^{-1}$). The treatment RDF showed significantly lower dry matter production per plant (26.20 g $plant^{-1}$) over rest of the treatments except FYM @ 5 t ha^{-1} + 50% RDF (26.5 g $plant^{-1}$).

Table 3: Dry matter accumulation in crop at different growth stages of chickpea as influenced by nutrient management practices.

Treatment details	Dry matter production (g $plant^{-1}$)		
	30 DAS	60 DAS	At Harvest
T_1: RDF(10:25:0 N:P_2O_5:K_2O kg ha^{-1})	0.94	7.28	26.2
T_2: FYM @ 5 t ha^{-1} + 50% RDF	1.01	7.35	26.5
T_3: FYM @ 5 t ha^{-1} + 75% RDF	1.12	7.95	27.0
T_4: FYM @ 5 t ha^{-1} + 100% RDF	1.22	9.11	27.9
T_5: FYM @ 5 t ha^{-1} + Jeevamrutha	1.31	9.38	28.4
T_6: VC @ 2.5 t ha^{-1} + 50% RDF	1.10	7.61	26.9
T_7: VC @ 2.5 t ha^{-1} + 75% RDF	1.16	8.45	27.4
T_8: VC @ 2.5 t ha^{-1} + 100% RDF	1.32	9.78	28.6
T_9: VC @ 2.5 t ha^{-1} + Jeevamrutha	1.29	9.70	28.5
T_{10}: RDF + Jeevamrutha	1.06	7.43	26.7
T_{11}: FYM @ 5t ha^{-1} + VC @ 2.5t ha^{-1} + Jeevamrutha	1.36	10.20	28.9
S.Em ±	0.06	0.58	0.60
CD (0.05)	0.17	1.70	1.78

RDF: Recommended Dose of Fertilizer, **FYM:** Farm Yard Manure, **VC:** Vermicompost.

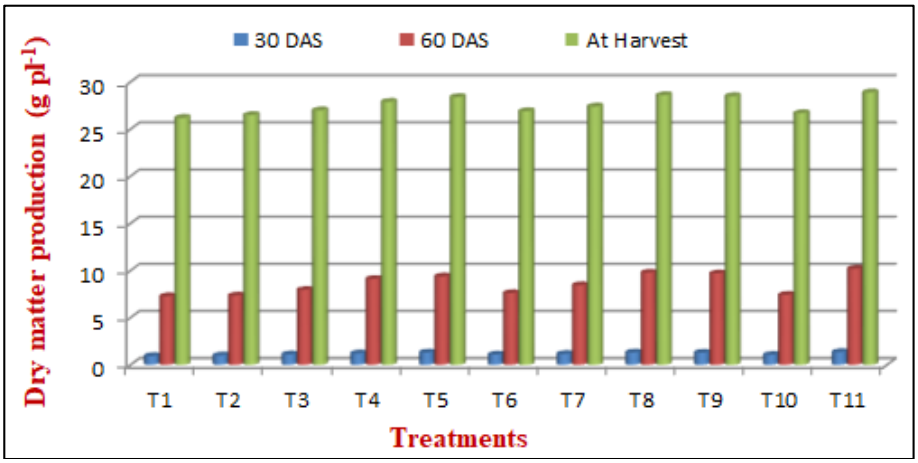

Fig 1: Dry matter accumulation in crop at different growth stages of chickpea as influenced by nutrient management practices.

Number of root nodules per plant

The findings on number of root nodules per plant differed significantly due to nutrient management practices at 40 and 60 DAS. At 40 DAS (Table 4 and Fig 2), significantly higher number of root nodules per plant were noticed with treatment received FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha (14.93) compared to all other treatments, and on par with VC @ 2.5 t ha^{-1} + 100% RDF (14.80), VC @ 2.5 t ha^{-1} + Jeevamrutha (14.53), FYM @ 5 t ha^{-1} + Jeevamrutha (14.27), FYM @ 5 t ha^{-1} + 100% RDF (14.20), VC @ 2.5 t ha^{-1} + 75% RDF (14.2) treatments, FYM @ 5 t ha^{-1} + 75% RDF (14.00). Significantly lower number of root nodules per plant were recorded with RDF (12.87) which inturn was on par with FYM @ 5 t ha^{-1} + 50% RDF (13.60) and RDF + Jeevamrutha (13.80). Conversely, at 60 DAS, application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha (18.0), and on par with the treatments like VC @ 2.5 t ha^{-1} + 100% RDF (17.87), VC @ 2.5 t ha^{-1} + Jeevamrutha (17.60) and FYM @ 5 t ha^{-1} + Jeevamrutha (17.47) recorded significantly higher number of root nodules per plant over FYM @ 5 t ha^{-1} + 50% RDF (16.73), RDF(10:25:0) + Jeevamrutha (16.80), RDF + Jeevamrutha (16.80), VC @ 2.5 t ha^{-1} + 50% RDF (17.07), FYM @ 5 t ha^{-1} + 75% RDF (17.20), VC @ 2.5 t ha^{-1} + 75% RDF (17.27), and FYM @ 5 t ha^{-1} + 100% RDF (17.43). Treatment supplemented with only RDF recorded significantly lower number of root nodules per plant (16.67).

Table 4: Number of root nodules per plant at different growth stages of chickpea as influenced by nutrient management practices.

Treatment details	No. of root nodules per plant	
	40 DAS	60 DAS
T_1: RDF(10:25:0 N:P_2O_5:K_2O kg ha^{-1})	12.87	16.67
T_2: FYM @ 5 t ha^{-1} + 50% RDF	13.60	16.73
T_3: FYM @ 5 t ha^{-1} + 75% RDF	14.00	17.20
T_4: FYM @ 5 t ha^{-1} + 100% RDF	14.20	17.43
T_5: FYM @ 5 t ha^{-1} + Jeevamrutha	14.27	17.47
T_6: VC @ 2.5 t ha^{-1} + 50% RDF	13.93	17.07
T_7: VC @ 2.5 t ha^{-1} + 75% RDF	14.20	17.27
T_8: VC @ 2.5 t ha^{-1} + 100% RDF	14.80	17.87
T_9: VC @ 2.5 t ha^{-1} + Jeevamrutha	14.53	17.60
T_{10}: RDF(10:25:0) + Jeevamrutha	13.80	16.80
T_{11}: FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha	14.93	18.00
S.Em ±	0.31	0.19
CD (0.05)	0.90	0.57

RDF: Recommended Dose of Fertilizer, **FYM:** Farm Yard Manure, **VC:** Vermicompost.

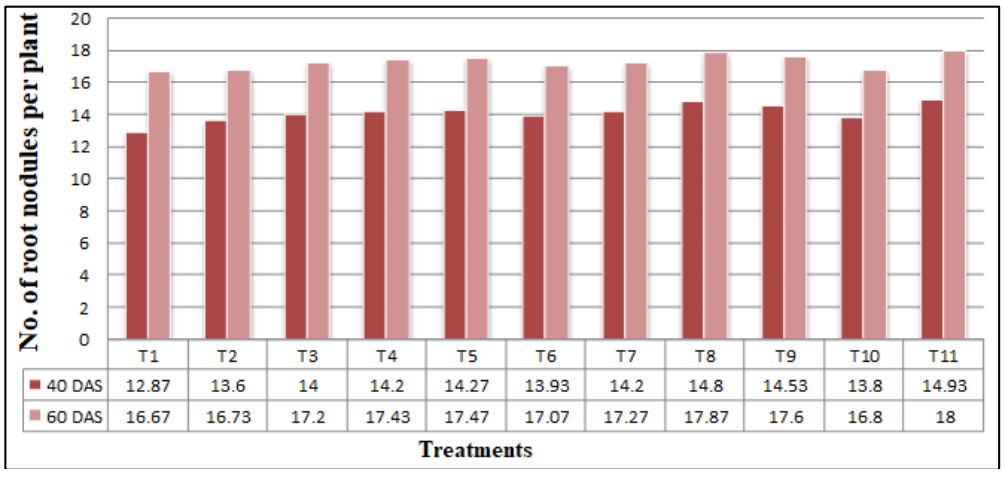

Fig 2: Number of root nodules per plant at different growth stages of chickpea as influenced by nutrient management practices.

Discussions

The data obtained by conducting the experiment revealed that the application of sources of organic and inorganic as per different treatments had significant influence on plant height, number of branches, total dry matter production and number of root nodules per plant at different stages of crop growth are presented in above Tables. At harvest, significantly highest plant height and number of branches plant^{-1} were recorded in T_{11} treatment which received application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha. However, lowest plant height and number of branches plant^{-1} were recorded in T_1 (RDF alone). It might be due to application of organic manures in combination with inorganic fertilizers to the soil, resulted in increased the availability of nutrients considerably which intern improvement in growth parameters. These findings are in accordance with the results of Babalad 1999 who had observed increased plant height, number of trifoliate leaves plant^{-1} and number of branches plant^{-1} in soybean due to application of organic manure and inorganic fertilizers. Similar results were reported by Sharma and Dixit 1987.

Plant was differed significantly at different growth stages (30, 60 DAS and at harvest) of chickpea. Plant height was significantly higher with application of FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha at all the growth stages of chickpea. Whereas, significantly lower plant height was recorded with application of RDF (control). Number of branches per plant was differed significantly at different growth stages (30, 60 DAS and at harvest) of chickpea, significantly higher branches in the treatment receiving FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha. Whereas, significantly lower number of branches per plant was recorded with the application of RDF (control). Further, the growth parameter such as Dry matter accumulation per plant in different parts of chickpea were significantly influenced by nutrient management at all stages of crop growth. Significantly lower dry matter production per plant was noticed in application of RDF (control). Further, Number of root nodules per plant at 40 DAS and 60 DAS was significantly higher in treatment FYM @ 5 t ha^{-1} + VC @ 2.5 t ha^{-1} + Jeevamrutha. Significantly lower number of root nodules per plant was noticed in RDF treatment. Similar results were reported by Ramesh (2007) [5].

Conclusions

From the results of the present study, it can be concluded that there was significant response of nutrient management on chickpea crop through combined application of organic manures along with liquid organic *viz.*, jeevamrutha. Application of FYM along with vermicompost and jeevamrutha could be the best nutrient combination for enhancing the growth, yield, nutrient uptake, availability and microbial biomass of chickpea because of slow release of nutrients at all the stages of crop growth, which has profound influence in mobilizing the nutrients from unavailable to available form and also reduces the loss of nutrients through leaching and volatilization.

References

1. Katyal JC. Organic matter maintenance: Mainstay of soil quality, Journal of the Indian Society of Soil Science. 2000; 48(4):704-716.
2. Kanwar KS, Paliyal Manjinder Kaur Bedi. Integrated management of green manure, compost and nitrogen fertilizer in a rice-wheat cropping sequence, Crop Research. 2006: 31(3):196-200.
3. Babald HB. Integrated nutrient management for sustainable production in soybean based cropping system. Ph.D. Thesis, University of agricultural science, Dharwad, 1999.
4. Sharma RA, Dixit BK. Effect of nutrient application on rainfed soybean, Journal of the Indian Society of Soil Science. 1987; 35:452-455.
5. Ramesh P. Organic Farming Research in Madhya Pradesh. Organic Farming in Rainfed Agriculture: Opportunities and Constraints, Central Research Institute for Dryland Agriculture, Hyderabad, 2007, 12-20.