

## Influence of Organic Manures and Foliar Sprays on Soil Microbial Population, Crop Growth and Seed Yield of Green gram

ASHOK S SAJJAN\*

Department of Seed Science and Technology,  
University of Agricultural Sciences, Dharwad, Vijayapur, Karnataka - 586101, India  
\*assajjan@gmail.com

(Received : January 2018; Revised : April 2018; Accepted : April 2018)

**ABSTRACT:** The influence of organic manures on soil beneficial micro-organisms, crop growth and seed yield parameters of Green gram (*Vigna radiata*) were studied. The population load of fungi, bacteria and actinomycetes was affected significantly with different rates of organic manures at all the stages of crop growth. Increasing trend of soil microbial population viz., bacteria, fungi and actinomycetes was noticed at 50% flowering and further it declined at harvesting stage and higher crop growth parameters of plant height (66.33 cm), number of trifoliolate leaves (6.87), dry matter accumulation (11.15 g/plant) and higher yield attributing parameters like number of pods per plant (21.27), pod length (10.25 cm), number of seeds per pod (12.10) and seed yield per hectare (1263 kg/ha) was obtained in treatment combination of FYM 1/3+VC 1/3+GLM 1/3+ foliar spray of 3% panchagavya.

**Keywords:** Farm yard manure, Vermicompost, Glyricidia green leaf manure, Panchagavya, Growth, Seed yield, Green gram

The chemical use is hitting the sustainability in soil and decreasing its potency. Applying organic manure is the only solution to improve the soil organic carbon productivity in the future. The importance of organic manures in promoting soil health and better plant nutrition has started receiving much recognition in the world as a whole in recent years. In nature's laboratory there are a number of organisms (micro and macro) that have the ability to convert organic waste into valuable resources containing plant nutrients and organic matter which are critical for maintaining soil productivity. Several groups of micro-organisms have the potential to enhance growth and improve the health of crops. Microbial biomass is the total sum of all micro-organisms present in soil. The number and activity of these microbes exhibit variable responses to different agricultural management practices. One of the most beneficial crop management system is the incorporation of a leguminous green manure crops into soil [1]. Soil micro-biota provides essential benefits for the functioning of agro-ecosystems which are important for the long term sustainability of agriculture. They support essential soil processes and play a key role in maintaining the soil quality which is very much essential for crop productivity. Soil micro-

organism helps to create and maintain beneficial soil structure and decomposing crop residues so that valuable nutrients are released for plant growth and contribute to soil carbon storage by mixing organic materials with mineral soil. Moreover the unbalanced and continuous use of chemical fertilizers in intensive cropping system has lead to reduction in crop yield and also resulted in imbalance of nutrients in soil which has adverse effect on soil physico-chemical properties. Long term addition of organic materials to soil results in increased organic matter, crop productivity and soil biological activity.

Green gram (*Vigna radiata* L. Wilczek) is one of the most ancient and extensively grown leguminous crops in India. The total area covered under moong in India was 34.50 lakh hectares with a total production of 15.91 lakh tonnes. The coverage of area and its production was maximum in Rajasthan (32.76% & 30.61%) followed by Maharashtra (11.95% & 10.58%) of the total area and production. Karnataka ranked third in area (8.81%) and Tamil Nadu is on third position for production (7.63%). The highest yield was recorded by the state of Punjab (845 kg/ha) followed by Jharkhand (704 kg/ha) and Andhra Pradesh (696 kg/ha). The National yield average

was 461 kg/ha. The lowest yield observed in the state of Karnataka (227 kg/ha) followed by Chhatisgarh (326 kg/ha) and Odisha (327 kg/ha). Anonymous [2] reported continuous use of chemical fertilizers leads to reduction in the crop yield and resulted in imbalance of nutrients in the soil, which has adverse effects on soil health. Use of soil organic manures alone or in combination with liquid organic manures will help to improve physico-chemical properties of the soil and efficient utilization of applied organic manures for improving crop growth and seed yield. In view of this the present investigation was carried out to know the effect of organic manures and organic foliar sprays on soil microbial population, crop growth and seed yield of green gram.

## MATERIALS AND METHODS

A field experiment was conducted during 2016 at Bio-Organic farm, Main Agricultural Research Station, UAS, Dharwad, Karnataka, India. The soil of the experimental site was clayey in texture with bulk density of 1.27 g/cc, pH of 7.70, organic carbon of 0.55%. The soil is low in available N (211.40 kg/ha) and  $P_2O_5$  (27.34 kg/ha) and medium in available  $K_2O$  (346.19 kg/ha). The experiment was laid out in Randomized Complete Block Design with three replications. There were a total of 12 treatment combinations consisting of four soil amendments (S) such as  $S_1$ : RDF (25:50:00 kg N:  $P_2O_5$ :  $K_2O$ /ha) + FYM 5  $tha^{-1}$  (Control/ RPP),  $S_2$ : FYM 1/2+ Vermicompost (Equivalent to recommended dose of phosphorus of 50 kg/ha),  $S_3$ : FYM 1/3 + Vermicompost 1/3 + Neem cake 1/3 (Equivalent to recommended dose of phosphorus of 50 kg/ha),  $S_4$ : FYM 1/3 + Vermicompost 1/3 + Glyricidia green manure 1/3 (Equivalent to recommended dose of phosphorus of 50 kg/ha) and three organic foliar sprays (F) such as  $F_1$ : 3% Panchagavya,  $F_2$ : 10% Vermiwash and  $F_3$ : Water spray (Control).

The crop green gram variety DGGV-1 was sown with a spacing of 30 cm x 10 cm. The recommended dose of phosphorus for green gram was supplemented with different combinations of soil organic manures with equal proportions based on their P content. The required quantity of organic manures viz., Farm yard manure, vermicompost, Glyricidia green leaf manure and neem cake were applied uniformly as per the treatment combinations and incorporated into the soil three weeks before sowing. The recommended dose of fertilizers (RDF- 25 kg N + 50 kg  $P_2O_5$  + 0 kg  $K_2O$   $ha^{-1}$ )

was applied to the plots as per the treatment details in the form of urea, diammonium phosphate and muriate of potash. All the fertilizers were applied in a single dose at the time of sowing in furrows opened at 5 cm away and 5 cm deep in the soil as basal dose. The organic foliar sprays of 3% Panchagavya, 10% Vermiwash and water spray (absolute control) were sprayed at two times, one at initiation of flowering and another at fifteen days after flowering according to the treatment combinations.

The microbial population such as bacteria, fungi and actinomycetes were enumerated from the soil sample taken from the rhizosphere region of green gram field at different stages of the crop growth. The serial dilution and standard plate count method was used for the isolation of total bacteria, fungi and actinomycetes using nutrient agar, Rose Bengal agar and Krustose agar respectively. Soil sample from different treatments were collected separately in replication wise. Ten grams of soil was mixed in 90 ml sterilized water blank to give  $10^{-1}$  dilutions. Subsequent dilutions up to  $10^{-7}$  were made by transferring serially one ml of each dilution to nine ml sterilized water blanks. Three petriplates per dilution per sample of soil were used. One ml each of the dilutions into respective sets of petriplates was taken i.e.,  $10^{-7}$  for bacteria,  $10^{-4}$  for fungi and  $10^{-5}$  for actinomycetes. The plates were incubated at  $28 \pm 2^\circ C$  in an incubator for one week and the colony counts were recorded. The population was expressed as number of colony forming units (cfu) per gram dry weight of soil sample.

## RESULTS AND DISCUSSION

### Bacterial Population (colony forming units x $10^{-7}$ /g soil)

Among the soil amendments  $S_4$  (FYM 1/3 + Vermicompost 1/3 + Glyricidia green leaf manure 1/3) recorded more bacterial population of 70.33 and 44.22 cfu x  $10^{-7}$ /g soil at 50% flowering and at harvest respectively (Table 1). While significantly less bacterial population was noticed with RDF + FYM 5  $tha^{-1}$  ( $S_1$ ) 63.78 and 41.11 cfu x  $10^{-7}$ /g soil at both the stages respectively. This might be due to the addition of organic biomass to the soil which ultimately increases the microbial population load as organic materials decomposes in the soil which provides better carbon source for the rhizosphere population. Similar results were also reported by [3] in sesame.

**Table 1.** Effect of soil amendments and organic foliar sprays on microbial population of bacteria and fungi at 50% flowering and at harvest in green gram

Treatments Soil amendments (S)	Bacterial population (No. x 10 <sup>-7</sup> cfu/g of soil)		Fungal population (No. x 10 <sup>-4</sup> cfu/g of soil)	
	At 50% flowering	At harvest	At 50% flowering	At harvest
S <sub>1</sub>	63.78	41.11	31.44	16.56
S <sub>2</sub>	65.78	42.11	35.33	17.56
S <sub>3</sub>	67.11	42.67	35.78	18.11
S <sub>4</sub>	70.33	44.22	39.33	19.67
SEm(±)	0.31	0.22	0.44	0.27
CD (p=0.05)	0.92	0.65	1.29	0.79
Foliar sprays (F)				
F <sub>1</sub>	75.33	46.83	44.92	21.92
F <sub>2</sub>	66.58	42.33	35.83	17.50
F <sub>3</sub>	58.33	38.42	25.67	14.50
SEm(±)	0.27	0.19	0.38	0.23
CD (p=0.05)	0.80	0.56	1.12	0.68
SxF				
S <sub>1</sub> F <sub>1</sub>	72.33	45.33	40.67	19.67
S <sub>1</sub> F <sub>2</sub>	64.67	40.67	32.67	16.00
S <sub>1</sub> F <sub>3</sub>	54.33	37.33	21.00	14.00
S <sub>2</sub> F <sub>1</sub>	74.00	46.00	43.61	20.33
S <sub>2</sub> F <sub>2</sub>	66.33	42.33	37.00	18.00
S <sub>2</sub> F <sub>3</sub>	57.00	38.00	25.33	14.33
S <sub>3</sub> F <sub>1</sub>	76.00	47.33	46.00	22.30
S <sub>3</sub> F <sub>2</sub>	66.00	41.67	34.33	17.31
S <sub>3</sub> F <sub>3</sub>	59.33	39.00	27.00	14.67
S <sub>4</sub> F <sub>1</sub>	79.00	48.67	49.33	25.33
S <sub>4</sub> F <sub>2</sub>	69.33	44.67	39.33	18.67
S <sub>4</sub> F <sub>3</sub>	62.67	39.33	29.10	15.00
SEm(±)	0.54	0.38	0.76	0.47
CD (p=0.05)	1.59	1.12	2.23	1.36

The application of organic foliar spray of 3% panchagavya recorded highest bacterial population (75.33 and 46.83 cfu x 10<sup>-7</sup>/g soil) at 50% flowering and at harvest respectively when compared to control (water spray). This might be due to as the fermented organic manures like panchagavya also contain microbial load and plant growth promoting substances in addition to nutrients that help in improving the metabolic activities and microbial population load in the soil. These results are in line with the findings of [4] in chilli.

Among the interactions the soil amendments S<sub>4</sub>F<sub>1</sub> (FYM 1/3 + Vermicompost 1/3 + Glyricidia green leaf manure 1/3 + 3% panchagavya) showed more bacterial population (79.00 and 48.67 cfu x 10<sup>7</sup>/g soil) as compared to control (54.33 and 37.33 cfu x 10<sup>7</sup>/g soil) (RDF + FYM 5 t ha<sup>-1</sup> + water spray) at 50% flowering and harvest respectively. This might be due to cumulative effect of both organic manures leads to increased organic carbon

content of soil which acted as carbon and energy sources for microbes and fermented foliar organics results in quick build up of microflora and fauna and these results are in agreement with the findings of Ravusaheb [3] in sesame and Shwetha [5] in soybean.

#### Fungal Population (colony forming units x 10<sup>4</sup>/g soil)

Among the soil amendments S<sub>4</sub> (FYM 1/3 + Vermicompost 1/3 + Glyricidia green leaf manure 1/3) recorded significantly more fungal population of (39.33 and 19.67 cfu x 10<sup>4</sup>/g soil) at 50% flowering and at harvest respectively (Table 2). Significantly less fungal population was noticed with S<sub>1</sub> (31.44 and 16.56 cfu x 10<sup>4</sup>/g soil) (RDF + FYM 5 t ha<sup>-1</sup>). This might be due to decomposition of the organic soil amendments which provides organic carbon which is very much necessary for the microbial communities. These results are in confirmation with the findings of Swer *et. al.* [6] in French bean.

Organic foliar spray of 3% panchagavya recorded highest fungal population (44.92 and 21.92 cfu x 10<sup>4</sup>/g soil) as compared to water sprays (25.67 and 14.50 cfu x 10<sup>4</sup>/g soil) at 50% flowering and at harvest respectively. This might be due to biochemical activity of panchagavya to increase the soil fertility and plant nutrition [4].

Among the interactions the S<sub>4</sub>F<sub>1</sub> (FYM 1/3 + Vermicompost 1/3 + Glyricidia green leaf manure 1/3 + 3% panchagavya) (49.33 and 25.33 cfu x 10<sup>4</sup>/g soil) recorded highest fungal population when compared to RDF + FYM 5 t ha<sup>-1</sup> + water spray (21.00 and 14.00 cfu x 10<sup>4</sup>/g soil) at 50% flowering and at harvest respectively. This might be due to the combination of all essential plant nutrients and their availability is also more due to improved soil chemical and biological properties [7] and these results are in agreement with findings of Shwetha [5] in soybean and Ravusaheb [3] in sesame.

### Actinomycetes Population (colony forming units x 10<sup>5</sup>/g soil)

FYM 1/3 + Vermicompost 1/3 + Glyricidia green leaf manure 1/3 recorded more Actinomycetes population (66.78 and 47.89 cfu x 10<sup>5</sup>/g soil) at 50% flowering and at harvest respectively (Table 2) and lowest was observed at RDF + FYM 5 t ha<sup>-1</sup>. This might be due to addition of organic matter as well as the water soluble organic constituents of green leaf manures [8].

The foliar spray of 3% panchagavya showed highest actinomycetes population (71.42 and 50.92 cfu x 10<sup>5</sup>/g soil) as compared to control (53.33 and 41.17 cfu x 10<sup>5</sup>/g soil) at 50% flowering and at harvest respectively. This may be attributed to the fact that panchagavya in low concentration provide carbon source for increasing the population dynamics of actinomycetes.

**Table 2.** Effect of soil amendments and organic foliar sprays on microbial population of Actinomycetes at 50% flowering and harvest and plant height and number of trifoliolate leaves per plant at harvest in green gram

Treatments Soil amendments (S)	Actinomycetes (No. x 10 <sup>5</sup> cfu/g of soil)		Plant height (cm)	Number of trifoliolate leaves per plant
	At 50% flowering	At harvest		
S <sub>1</sub>	58.89	44.44	59.33	5.73
S <sub>2</sub>	62.89	45.89	60.50	5.93
S <sub>3</sub>	63.56	46.00	61.84	6.09
S <sub>4</sub>	66.78	47.89	63.40	6.38
SEm(±)	0.60	0.27	0.36	0.10
CD (p=0.05)	1.72	0.81	1.06	0.29
Foliar sprays (F)				
F <sub>1</sub>	71.42	50.92	63.29	6.37
F <sub>2</sub>	63.83	46.08	62.38	6.10
F <sub>3</sub>	53.33	41.17	58.29	5.63
SEm(±)	0.52	0.24	0.31	0.09
CD (p=0.05)	1.52	0.70	0.91	0.25
SxF				
S <sub>1</sub> F <sub>1</sub>	68.67	49.67	61.40	6.00
S <sub>1</sub> F <sub>2</sub>	60.33	44.00	61.10	5.80
S <sub>1</sub> F <sub>3</sub>	47.67	39.67	56.10	5.40
S <sub>2</sub> F <sub>1</sub>	70.33	50.00	62.30	6.20
S <sub>2</sub> F <sub>2</sub>	65.33	47.00	61.90	6.00
S <sub>2</sub> F <sub>3</sub>	53.00	40.67	57.31	5.60
S <sub>3</sub> F <sub>1</sub>	72.00	51.33	63.13	6.40
S <sub>3</sub> F <sub>2</sub>	62.67	45.00	62.60	6.20
S <sub>3</sub> F <sub>3</sub>	56.00	41.67	59.80	5.67
S <sub>4</sub> F <sub>1</sub>	74.67	52.67	66.33	6.87
S <sub>4</sub> F <sub>2</sub>	67.00	48.33	63.90	6.41
S <sub>4</sub> F <sub>3</sub>	58.67	42.67	59.97	5.87
SEm(±)	1.04	0.48	0.62	0.17
CD (p=0.05)	3.05	1.40	1.86	0.53

Among the interactions the FYM 1/3 + Vermicompost 1/3 + Glyricidia green leaf manure 1/3 + 3% panchagavya recorded highest Actinomycetes population (74.67 and 52.67 cfu x 10<sup>5</sup>/g soil) as compared to RDF + FYM 5 t ha<sup>-1</sup> + water spray (47.67 and 39.67 cfu x 10<sup>5</sup>/g soil, respectively)

All the rhizosphere microbial population differed significantly with their specific dilution factor. Soil amendments FYM (1/3) + VC (1/3) + GM (1/3) with organic foliar sprays of 3% panchagavya recorded significantly higher microbial population over (RDF + FYM 5 t ha<sup>-1</sup>). This highest microbial population load might be due to cumulative effect of both organic manures in increasing organic carbon content of soil which acted as carbon and energy sources for microbes and fermented organics in quick build up of microflora and fauna [9]. Whereas, RDF + FYM did not cause significant changes in the soil microbial biomass, growth and functioning of soil microbial biomass as the chemical

fertilizer might have an adverse effect on microbial activity. It was observed that the added chemical fertilizers resulted in a smothering effect on living organisms [10]. However, the treatments with organic foliar sprays noticed good improvement over water spray due to quick build up of microflora with the addition of organic sprays. Significantly lower microbial population was noticed with (RDF + FYM 5 t ha<sup>-1</sup>) which were because of lower microbial activity under inorganic treatment.

### Crop Growth Parameters

Application of Phosphorus equivalent to 100 per cent recommended dose through FYM 1/3 + vermicompost 1/3 + glyricidia green leaf manure 1/3 with equal proportion showed highest plant height (63.40cm), number of trifoliolate leaves (6.38) and dry matter accumulation (10.80g/plant) at harvest as compared to control (RDF+ FYM 5t/ha) (Table 2 & 3). The increased

**Table 3.** Effect of soil amendments and organic foliar sprays on seed yield attributing traits in green gram

Treatments Soil amendments (S)	Dry matter accumulation (g/plant) at harvest)	Number of pods per plant	Pod length (cm)	Seed yield per hectare (kg/ha)
S <sub>1</sub>	10.30	16.91	8.14	952
S <sub>2</sub>	10.47	17.40	8.90	1029
S <sub>3</sub>	10.55	17.64	9.04	1057
S <sub>4</sub>	10.80	18.99	9.38	1145
SEm(±)	0.02	0.17	0.06	6.87
CD (p=0.05)	0.06	0.51	0.17	20.15
Foliar sprays (F)				
F <sub>1</sub>	10.87	18.85	9.49	1135
F <sub>2</sub>	10.75	18.06	9.20	1084
F <sub>3</sub>	9.97	16.30	7.92	919
SEm(±)	0.02	0.15	0.05	5.95
CD (p=0.05)	0.05	0.44	0.15	17.45
SxF				
S <sub>1</sub> F <sub>1</sub>	10.56	17.54	8.70	1014
S <sub>1</sub> F <sub>2</sub>	10.49	17.40	8.50	1012
S <sub>1</sub> F <sub>3</sub>	9.85	15.80	7.23	831
S <sub>2</sub> F <sub>1</sub>	10.83	18.13	9.50	1094
S <sub>2</sub> F <sub>2</sub>	10.68	17.87	9.20	1064
S <sub>2</sub> F <sub>3</sub>	9.89	16.20	8.00	928
S <sub>3</sub> F <sub>1</sub>	10.93	18.47	9.50	1169
S <sub>3</sub> F <sub>2</sub>	10.77	18.13	9.40	1074
S <sub>3</sub> F <sub>3</sub>	9.96	16.33	8.23	926
S <sub>4</sub> F <sub>1</sub>	11.15	21.27	10.25	1263
S <sub>4</sub> F <sub>2</sub>	11.06	18.83	9.70	1185
S <sub>4</sub> F <sub>3</sub>	10.17	16.87	8.20	986
SEm(±)	0.03	0.30	0.10	11.90
CD (p=0.05)	0.10	0.88	0.30	34.90

plant growth parameters might be due to the improvement in soil physical condition for the plant growth along with increased availability of N, P and K especially in the treatment combination of FYM 1/3 + VC 1/3 + GLM 1/3. The addition of organic manures had significant positive effects on the soil physical and biological properties besides enhancing plant growth parameters [11].

Panchagavya @ 3% spray noticed highest plant height (63.29 cm), number of trifoliolate leaves (6.37) and dry matter accumulation (10.87 g /plant) at harvest as compared to water spray. This might ascribed to beneficial effect of panchagavya as an efficient plant growth stimulant that enhances the biological efficiency of crops. It is used to activate biological reactions in the soil and also protect the plants from disease incidence [12].

The combined soil application of FYM 1/3 + VC 1/3 + GLM 1/3 coupled with 3% panchagavya spray ( $S_4F_1$ ) recorded highest plant height (66.33 cm), number of trifoliolate leaves (6.87), total dry matter accumulation (11.15 g /plant) as compared to control  $S_1F_3$  (RDF + FYM 5 t/ha + water spray). This might be due to the growth enzymes present in panchagavya which favored rapid cell division and multiplication. The same view was obtained by application of enriched compost 1/3 + vermicompost 1/3 + glyricidia leaf manure 1/3 equivalent to 100% RDN and foliar spray of 3% panchagavya at flower initiation and 15 DAF as reported by (7) in chickpea. The increased plant biometrical parameters might be due to the better availability of nutrients from the application of soil amendments and organic foliar sprays and effective conversion of nutrients from these organic sources such as Fe, Mg and Zn available at the site of photosynthesis. The presence of coconut water in panchagavya contains kinetin along with other enzymes and might have increased the chlorophyll content of the leaves. Hence, this might have lead to higher leaf area production and capture more solar radiation resulting in higher photosynthesis and consequent improvement in all growth attributes. These results are in agreement with the findings of Somasundaram [13] in green gram, De Britto and Girija [14] in blackgram and green gram and Kumaravelu and Kadambian [15] in green gram.

### Seed Yield Parameters

When organics are applied, nutrients will be released slowly and nutrient losses will be minimized due to

increased absorption of nutrients as a result of increased cation exchange capacity with increased organic matter content. Thus, plant nutrients will be available for a long period in adequate quantity thereby, plant can absorb the required nutrients as per its demand resulting in better growth, development and yield components.

Application of FYM 1/3+ vermicompost 1/3+ glyricidia green leaf manure 1/3 in equal proportion to RDF recorded more number of pods/plant (18.99), pod length (9.38 cm) and seed yield per hectare (1145 kg/ha) over control RDF+FYM @ 5 t ha<sup>-1</sup> and all the other organic soil amendments (Table 3). The increased seed yield might be due to higher availability of nutrients to plants, besides increased water holding capacity and other physical properties which might have caused increased rate of infiltration and this might be also due to formation of more root nodules, vigorous root development, better nitrogen fixation and better development of plant growth leading to higher photosynthetic activity and translocation of photosynthates to the sink which in turn resulted in better development of yield attributes and finally higher seed yield. Similar results were also reported by Yadav and Vijayakumari [16] in chilli, Patil *et. al.* [17] in chickpea, Ravusaheb [3] in sesame and Shwetha [5] in soybean.

Foliar spraying of 3% panchagavya has showed more number of pods/plant (18.85), pod length (9.49 cm) and seed yield per hectare (1135 kg/ha) followed by 10% vermiwash as compared to water spray. This might be due to fact that cow dung in panchagavya act as a medium for the growth of beneficial microbes and cow urine provides nitrogen which is essential for crop growth [14].

Among the interactions, organic foliar sprays of 3% panchagavya with FYM 1/3 + Vermicompost 1/3 + Glyricidia green leaf manure 1/3 has showed higher number of pods/plant (21.27), pod length (10.25 cm) and seed yield per hectare (1263 kg/ha) over control  $S_1F_3$  (RDF + FYM 5 t ha<sup>-1</sup> + water spray). This might be due availability and optimum supply of nutrients to plants favorably influenced the flowering and seed formation which ultimately increased the pods/plant. Higher yield attributing characters in aforesaid treatments is a consequence of increased rate of photosynthesis coupled with efficient translocation of photosynthates from source (leaf and stem) to sink (pods) and it might be also due to significant improvement in the sink size (number of pods) could be due to increase in number of

branches per plant, which might have resulted in the development of more number of reproductive parts and thereby increases the sink size to obtain higher seed yield. These findings are in agreement with Patil *et al.* [17] in chickpea, Ravusaheb [3] in sesame and Shwetha [5] in soybean.

Soil application of P equivalent to 100 per cent recommended dose with FYM + vermicompost + glyricidia leaf manure and foliar spray of 3% panchagavya at flower initiation and 15 days after flowering improved the soil microbial population, crop growth and seed yield of green gram. This will also helps in accomplishing the nutrient demand of green gram through various organic nutrient sources and reduce the dependence to chemical fertilizers.

The regulated application of organics as a practice will energize the living micro-organisms of the soil involved in biochemical activity of importance to soil fertility and plant nutrition. The activity of microflora might have helped to improve the soil fertility through mineralization of organic sources and in turn increases the crop growth and yield parameters. The present work recorded higher microbial populations at 50% flowering and declined at harvest which might be due to this could be attributed due to the presence of flush of easily metabolizable compounds at the beginning and the crop was also under active growth phase releasing higher amounts of root exudates for supporting numerous and diverse microflora population in the early stage.

This study clearly brought out that application of organic manures combined with organic foliar spray play a crucial role in increasing the beneficial microbial population load and thereby increases the crop growth performance and seed yield and yield attributes.

## REFERENCES

1. TILAK, KV, AR SAXENA AND D NAVEEN (1995). Dynamics of microbes in Agricultural soil with different management practices. *Journal of Soil Biology and Ecology*, **15**(2): 117-126.
2. ANONYMOUS (2017). Annual Report 2016-17 published by Directorate of Pulses Development, government of India ,Ministry of agriculture and Farmers Welfare (Department of Agriculture, Cooperation & Farmers Welfare) New Delhi. pp: 35.
3. RAVUSAHEB, M (2008). Studies on nutrient management practices through organics in sesame (*Sesamum indicum* L.). *M. Sc (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka, India.
4. SREENIVASA MN, N NAGARAJ, SN BHAT, AND MM NEKAR (2010). Effect of organic liquid manures on growth, yield and quality of chilli. *Green farming*, **1**(3): 282-284.
5. SHWETHA BN (2008). Effect of nutrient management through the organics in soybean-wheat cropping system. *M. Sc (Agri.) Thesis*, Univ. Agric. Sci. Dharwad, Karnataka, India.
6. SWER H, MS DKHAR, AND H KAYANG (2011). Fungal population and diversity in organically amended agricultural soils of Meghalaya. *Indian Journal of Organic Systems*, **6**(2): 1-11.
7. MUDDUKUMAR CL (2007). Organic nutrient management and plant protection in chickpea production system. *M. Sc. (Agri.) Thesis*, Univ. Agric. Sci., Dharwad, Karnataka, India.
8. RAMALINGAM N AND S KANNAIYAN (2006). Impact of green manures and sulphur application on soil enzyme activity and grain yield of rice. *Mysore Journal of Agricultural Sciences*, **40**(1): 68-73.
9. YADAV AK AND SM MOWADE (2004). Organic manures and compost. In: Organic farming -A ray of hope for Indian farmer. pp: 129-144.
10. MANNA MC AND TK GANGULY (1997). Soil biological activity and yield of crops as influenced by compost and inorganic fertilizers under a cereal legume on a Typic Hapluster. *Journal of Soil Biology and Ecology*, **17**(2): 88-94.
11. THARMARAJ K, P GANESH, R SURESH KUMAR, A ANANDAN AND K KOLANJINATHAN (2011). A critical review on panchagavya-A boon plant growth. *International Journal of Pharmaceutical & Biological Archive*, **2**(6): 1611-1614.
12. NILEEMA S, GORE AND MN SREENIVASA (2011). Influence of liquid organic manures on growth, nutrient content and yield of tomato (*Lycopersicon esculentum* Mill.) in the sterilized soil. *Karnataka Journal of Agricultural Sciences*, **24**(2): 153-157.
13. SOMASUNDARAM E (2003). Evaluation of organic sources of nutrients and panchagavya spray on the growth and productivity of maize-sunflower-green gram system. *Ph.D. Thesis*, Tamil Nadu Agric. Univ., Coimbatore, Tamilnadu, India.
14. DE BRITTO JA AND SL GIRIJA (2006). Investigation on the effect of organic and inorganic farming methods on black gram and green gram. *Indian Journal of Agricultural Research*, **40**(3): 204-207.
15. KUMARAVELU G AND D KADAMBIAN (2009). Panchagavya and its effect on the growth of the green gram cultivar K-851. *International Journal of Plant Sciences*, **4**(2): 409-414.
16. YADAV H AND B VIJAYAKUMARI (2003). Influence of vermicompost with organic and inorganic manures on biometric and yield parameters of chilli (*Capsicum annum* L.). *Crop Research*, **25**(2): 236-243.
17. PATIL SV, SI HALIKATTI, SM HIREMATH, HB BABALAD, MN SREENIVASA, NS HESUR AND G SOMANAGOUDA (2012). Effect of organics on growth and yield of chickpea (*Cicer arietinum* L.) in vertisols. *Karnataka Journal of Agricultural Sciences*, **25**(3): 326-331.