Root parameters and yield as influenced by different nutrient management treatments in organic blackgram

M Vinutha*[1], E. Somasundaram[2], S. Sanbagavalli[1], U. Sivakumar[3], K. Ganesan[4] and R. Sunitha[5]

1. Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

2. Director, Directorate of Agribusiness Development, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

3. Department of Agricultural Microbiology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

4. Department of Agricultural Entomology, Agricultural Research Station, Tamil Nadu Agricultural University, Bhavanisagar, Tamil Nadu, India

5. Department of Environmental Sciences, Nammazhvar Organic Farming Research Centre, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Abstract

A field study was conducted in wetlands, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore during 2022 to study the influence of different organic sprays and manures in blackgram. The treatments consisted of 4 organic manures in main plot and 5 foliar sprays in sub plot which was replicated thrice and laid out in split plot design. The manures were applied as basal and incorporated and sprays were given at first flowering and 10 days after spray. The results showed that among the manures, number of nodules plant^{-1}, fresh nodule weight (g), root length (cm) and root volume (cc) were higher in the vermicompost application and among the foliar sprays Panchagavya recorded higher root parameters. Higher yield was recorded in vermicompost @ 2.5 t ha^{-1} + Panchagavya spray @ 3% twice.

Keywords: *Organic farming, organic fertilizers, root, foliar spray and yield*

**Corresponding author: M Vinutha, E-mail: queenvinutha1@gmail.com*
Department of Agronomy, TNAU, Coimbatore, Tamil Nadu, India-641 003

Introduction

Modern day agricultural practices for the past 40 years, which holds the irrational use of chemical inputs have caused numerous hazards such as soil erosion, ground water level decline, soil salinization and desertification. The other effects from the pollution caused by the fertilizers include adverse affects on the environment and biodiversity which is ultimately decreasing food quality and increasing cultivation costs (Reddy, 2010). One of the ideal ways to maintain the sustainability and overcome the ill effects of the conventional systems is through organic farming as this practice enhances and supports the life system by improving the biological processes through utilization of non chemical and non genetic modified organisms (Avasthe *et al.,* 2016).

Indian population and Indian diet has immense significance for pulses consumption especially for their protein content. Among the pulses blackgram is one of the important pulse which contains protein (26%), fat (1.2%) along with carbohydrates (57%) and calcium and iron. It has the ability to fix atmospheric nitrogen through its nodules which ranges about 22 kg ha^{-1} and its adaptability to various cropping conditions (FAOSTAT, 2012). Though its hardy in nature, the productivity is not adequate as it is mostly grown in marginal and low fertile lands with less care (Divyavani *et al.*, 2020). Hence it is having need for improved growth conditions especially under organic conditions. Nutrient management under organic farming can be done through various organic fertilizers in the form of manures and foliar sprays. The available manures are being adapted by inputting various modifications in a way to supply required nutrients by various farmers (Uma and Sujathamma, 2015). Hence this study was proposed to improve the growth and productivity of blackgram under organic conditions.

Materials and methods

A field experiment was conducted in wetlands, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India to study the influence of different nutrient management techniques on organic blackgram. The experiment was laid out in split plot with three replications. Split plot design was used comprising of 4 levels of organic manures in main plot Viz., M_1- Farm Yard Manure (FYM) @ 12.5 t ha^{-1}, M_2- Vermicompost (VC) @ 2.5 t ha^{-1}, M_3- Enriched FYM @ 750 Kg ha^{-1} and M_4- Enriched VC @ 1 t ha^{-1}.and 5 levels of foliar spray of liquid manures in sub plot Viz., S_1- Panchagavya @ 3%, S_2- Fermented egg extract (FEE) @ 5%, S_3- Fermented fish extract (FFE) @ 5%, S_4- Farmers Effective Microbes (FEM) @ 5% and S_5- Jeevamruth @ 5% where, the manures were applied at basal and incorporated manually and all the sprays were sprayed at first flowering and 10 days after the 1st spray and comprising of 20 treatment combinations replicated thrice. The soil type was clay loam where the pH was 8.58 and EC was 0.37 dS m^{-1}. The mean maximum and minimum temperature were 33.6 and 22.2 ºC with the total rainfall of 49.4 mm. The root volume and length were collected during vegetative and physiological harvest stage. The root volume was measured by dipping roots in known volume of water and expressed a change in one milliliters as one cc. The nodule parameters were measured during vegetative and flowering stage after cleaning the roots thoroughly. The data was analyzed using agres software.

Results and discussion

The nodule number plant^{-1} (Table 1) at vegetative stage, among manures was significantly higher for the vermicompost @ 2.5 t ha^{-1} application and was significantly lower for FYM @ 12.5 t ha^{-1} application where the foliar sprays showed non significant difference. At flowering stage the main plots showed similar trend as that of vegetative stage and in sub plots the application of Panchagavya @ 3% spray showed significantly higher nodule number plant^{-1} and foliar spray of fermented egg extract and Jeevamruth @ 5% recorded significantly lower nodule number plant^{-1}. Fresh nodule weight plant^{-1} (g) (Table 1) showed that during vegetative stage, among the manures significant values were recorded in vermicompost @ 2.5 t ha^{-1} and foliar sprays recorded no significant difference. During flowering stage, the main plots showed similar trend to that of vegetative stage and sub plot recorded significantly higher root nodule weight with application of Panchagavya @ 3% spray and FEM @ 5% spray and significantly lower values were recorded in fermented egg extract and Jeevamruth @ 5% spray.

At vegetative stage, there was no significant difference in root length (cm) (Table 1) whereas during harvest in main plots application of vermicompost @ 2.5 t ha^{-1} and enriched FYM @ 750 kg ha^{-1} recorded maximum root length and application of enriched VC @ 1 t ha^{-1} and FYM @ 12.5 t ha^{-1} recorded minimum root length. In subplots Panchagavya @ 3% and FEM @ 5% have recorded higher root length and fermented egg extract and Jeevamruth @ 5% spray recorded lower root length. The root volume (cc) (Table 1) at vegetative stage, showed that among the manures, application of vermicompost @ 2.5 t ha^{-1} recorded significantly greater volume and application of FYM @ 12.5 t ha^{-1} recorded lower volume and there was no significant difference in sub plots. At harvest the application of vermicompost @ 2.5 t ha^{-1} and FYM @ 12.5 t ha^{-1} recorded significantly greater and lower volume. Similar trend as that of vegetative stage was observed and in sub plots application of Panchagavya @ 3%, fermented fish amino acid and FEM @ 5% recorded greater volume and fermented egg extract and Jeevamruth @ 5% recorded significantly lower root volume.

There was no interaction effect observed in any of the above treatments. Higher grain yield (Fig. 1) was recorded under the application of vermicompost @ 2.5 t ha^{-1} + Panchagavya @ 3% recorded significantly higher grain yield and treatments FYM @ 12.5 t ha^{-1} + fermented fish extract or Jeevamruth or fermented egg extract @ 5% recorded lower yields which were on par. Due to the improvement of soil physical properties such as increased organic carbon with increased organic matter, reduction in pH and EC, pore space and bulk density and improved biological activity with the addition of the vermicompost, there was better growth conditions for plants below soil which might have increased the root length and volume. These both parameters led to increase in the number of nodules and nodules weight. The additional effect might have been observed under the influence of the foliar spray of liquid manures leading to enhanced nutrient absorption and thus increase in the grain yield. Panchagavya contains beneficial microbial load, growth enhancing components and adequate nutrient availability required for plant development. Similar results have been observed by Kumar *et al*. (2011), Divyavani *et al.* (2020), Parthasarathi *et al.* (2008) and Niu *et al.* (2020).

Table 1: Effect of organic manures and foliar sprays on number of nodules plant^{-1}, fresh nodule weight (g), root length (cm) and root volume (cc)

Treatments	Number of nodules plant^{-1}		Fresh nodule weight plant^{-1} (g)		Root length (cm)		Root volume (cc)	
	VS	FS	VS	FS	VS	Harvest	VS	Harvest
Main plot								
M_1	19.6	41.0	0.019	0.048	13.6	25.0	0.37	0.76
M_2	49.7	60.3	0.042	0.082	14.9	34.3	2.49	4.14
M_3	36.3	51.0	0.033	0.070	14.6	31.3	1.21	2.73
M_4	27.5	46.5	0.024	0.058	14.3	28.6	0.64	1.36
CD= (p=0.05%)	**2.24**	**3.05**	**0.002**	**0.003**	**NS**	**1.47**	**0.06**	**0.15**
Sub plot								
S_1	33.5	49.8	0.030	0.067	14.5	32.5	1.20	2.43
S_2	32.5	40.3	0.031	0.063	14.2	27.4	1.16	2.07
S_3	33.8	49.5	0.029	0.063	14.4	29.6	1.19	2.23
S_4	33.6	51.6	0.029	0.065	14.3	31.0	1.20	2.37
S_5	33.1	47.3	0.030	0.065	14.2	28.3	1.14	2.14
CD= (p=0.05%)	**NS**	**NS**	**NS**	**NS**	**NS**	**1.82**	**NS**	**0.16**
MxS	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
SxM	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

*VS- vegetative stage & FS- Flowering stage

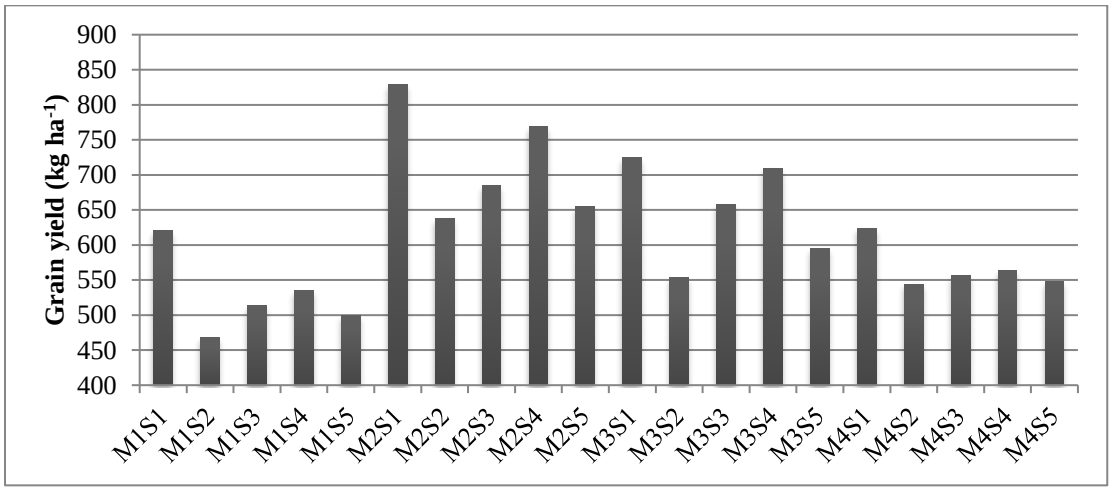

Fig. 1: Grain yield of organic blackgram as influenced by nutrient management treatments

Conclusion

It is concluded from the above that the application of vermicompost @ 2.5 t ha^{-1} as basal enhances the root and nodule development leading to better underground plant parameters. Foliar spray of Panchagavya @ 3% has resulted in better root and nodule parameters. The grain yield was also followed similar trend and the highest grain yield was observed in treatment vermicompost @ 2.5 t ha^{-1} + Panchagavya @ 3%. Therefore for higher productivity under organic conditions adoption of vermicompost @ 2.5 t ha^{-1} as basal + foliar spray of Panchagavya @ 3% twice is recommended.

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