



INFLUENCE OF LONG-TERM USE OF ORGANIC SOURCES ON SOIL FERTILITY AND NODULATION PATTERN OF RICE FALLOW BLACKGRAM

D.Kumari manimuthu veeral and R.Krishnamoorthy

Department of Agronomy, Annamalai University, Chidambaram-608002

Abstract

Field investigations were carried out in the farmers field, Cuddalore District of Tamilnadu, for 5 years to evaluate the influence of organic sources (FYM,vermicompost,daincha,pressmud) on nodulation pattern of rice fallow blackgram and biological properties of soil from 2017-18 to 2019-21. The results of the field experiment revealed that among the various organic sources evaluated, combined application of FYM @ 10 t ha⁻¹+ Bio fertilizers @2 kg ha⁻¹was highly suitable in terms of their ideal physico-chemical characteristics, the magnitude of nutrient contents and their availability and it was found to improve the microbial population of the soil and nodulation pattern of rice fallow blackgram in all the seasons. BF in combination with FYM/vermicompost/daincha gave better results than farmer's practice/control. Organic as well as integrated nutrient approaches enhance or maintain the biological properties of the soil.

Keywords; Organic nutrient management, rice fallow, biological properties

INTRODUCTION

Indian agriculture has shifted from traditional to intensive farming with extensive use of chemical fertilizers and pesticides, which in turn has made our soils largely non-productive. Indian soils are also becoming poor in organic matter and there is a growing concern for regular application of organic manures and recycling crop residues to sustain productivity. Thus, there is a need to apply organic manures as essential part of crop production to balanced plant nutrition for sustainable agriculture. The application of organic manures has numerous advantages, such as, improving soil physical property parameters, *i.e.*, water holding capacity, water movement, infiltration rate, bulk density, porosity, tilth, aeration, soil structure, aggregate stability (Saha *et al.*, 2010)

Use of organic manures may prove to be a viable option for sustaining the productivity of legumes and adds life to the soil (Vidyavathi *et al.*, 2011). Organic manures contain a very large population of bacteria, actinomycetes and fungi. Application of organic manure helps the microorganisms to build up better soil structure, N-fixation and phosphorus solubilization (Munendra Pal *et al.*, 2014). The proper use of biofertilizer in agro ecology could be a viable approach to increase crop yield and improve soil health. An ideal soil applied with various organic sources/manures and wastes should be persisted long enough to give an acceptable period of

nutrient supply for subsequent crops. Since organic manures are applied as basal, its impact on crop yield can be attributed largely to beneficial effects on soil properties, moisture retention, better nutrient availability, more favourable condition for root growth and supply of micronutrients in the subsequent crops rather than preceding crops (Tandon, 1972). Scientific information on the beneficial effects of organic manures in combination with biofertilizers are to be generated for effective utilization of these wastes in minimizing environmental pollution, safety disposal and in successful farming. The enhanced nutrient availability in the soil is generally characterized by coarse texture, poor organic carbon and favourable changes in physical and microbiological properties might be ascribed for the marked response. It may be owing to application of organic manures and its enrichment with *bio fertilizers* which supplied secondary and micronutrients along with major nutrients besides improving the soil condition, which enhanced the root proliferation and source to sink relationship.

Methodology

Field investigations were carried out in the farmers field, Cuddalore District of Tamilnadu, during Summer seasons of 2017-18 to 2020-21 on rice fallow blackgram to evaluate the influence of organic sources on nodulation pattern of rice fallow blackgram and biological properties of soil. The experiments were laid out in randomized block design and replicated thrice. The experiments consisted of eleven treatments *viz* FYM, vermicompost, daincha with or without bio fertilizers with an absolute control and farmers practice. The bunds and channels prepared for the first crop was not disturbed and the soils were loosen using a spade.

The bunds and channels were strengthened to prevent seepage. The total number of effective nodules plant⁻¹ was counted in the sample plant at harvest stage. The plots were irrigated and the plants were carefully uprooted using a spade with a radius of approximately 15 cm around the plant without damaging the root nodules. Adhered soil was gently washed with a stream of water and the roots were examined by floating in a tray of water. White and pink colored nodules were counted in each treatment plot. The number of effective nodules (which were showing pink colour on their cross section) was counted in the sample plants and expressed as effective nodules plant⁻¹.

Results

Number of effective nodules plant⁻¹

The results of the experiment to evaluate the influence of organic sources (FYM, vermicompost) on nodulation pattern of rice fallow blackgram and biological properties of soil revealed that combined application of vermicompost @ 2.5 t ha⁻¹ + bio fertilizers was highly suitable in terms of their ideal physico-chemical characteristics, the magnitude of nutrient contents and their availability and it was found to improve the microbial population of the soil and nodulation pattern in all the seasons. It resulted in the highest nodules number plant⁻¹ (43.00) and the lowest nodule number plant⁻¹ (17.40) were recorded under control.

Microbial Population

Among the various treatments application of FYM @ 10 t ha⁻¹ + Bio fertilizers @ 2 kg ha⁻¹ recorded the highest count of microbial population in all seasons. Due to application of vermicompost in low land rice, the activity of the beneficial microbes and colonization of micorhizae fungi increased, which play an important role in the mobilization of nutrients and thereby leading to better availability of nutrients facilitating uptake by plants. This was also supported by Yadav and Meena, 2014; Basal application of vermicompost @ 2.5 t ha⁻¹ + bio fertilizers significant residual effect for benefit of pod yield of succeeding black gram, which was refracted from beneficial effect vermicompost on nodulation and growth of black gram feeding to the enhanced N₂ fixation for its own growth and productivity and use of succeeding crop. Our finding confirm the results of Saha *et al.* 2010 as stated by combined application of organic nutrients enhanced the yield and yield attributes in rice fallow blackgram. Manure may be of plant or animal origin used to fertilize the land for improving the fertility and crop productivity. Bio fertilizers are commanding the popularity, as it is eco-

friendly and also the compounds found in it help to increase the N and P content in the soil. Uptake of N, P and K by black gram improved significantly due to the residual effect of organic manures and their combinations. This is minimal loss of N increase of organic sources that made N availability to the crop for a longer period.

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Table – 1 Long term effects of organic manures on soil fertility

Treatment details	microbial population (million / g of soil)			Number of effective nodules plant ⁻¹
	Bacteria	Fungi	Actinomyces	
T ₁ – Control	15.1	0.103	0.77	14.1
T ₂ – FYM @ 10 t ha ⁻¹	28.3	0.161	0.99	35.5
T ₃ – Vermicompost @ 5 t ha ⁻¹	35.1	0.162	1.32	52.5
T ₄ – Daincha @ 5 t ha ⁻¹	25.9	0.152	1.11	43.7
T ₅ – Pressmud @ 10 t ha ⁻¹	29.6	0.146	1.08	28.3
T ₆ – Bio fertilizers @ 2 kg ha ⁻¹	20.3	0.137	1.05	69.1
T ₇ – FYM @ 10 t ha ⁻¹ + Bio fertilizers @ 2 kg ha ⁻¹	47.7	0.69	1.64	84.5
T ₈ – Vermicompost @ 2.5 t ha ⁻¹ + Bio fertilizers @ 2 kg ha ⁻¹	38.2	0.19	1.56	78.4
T ₉ – Daincha @ 2.5 t ha ⁻¹ + Bio fertilizers @ 2 kg ha ⁻¹	36.7	0.16	1.43	61.4
T ₁₀ – Pressmud @ 10 t ha ⁻¹ + Bio fertilizers @ 2 kg ha ⁻¹	33.1	0.162	1.23	21.2
T ₁₁ – Farmers practice(FYM @ 12.5 t ha ⁻¹ + RDF)	19.4	0.124	0.81	62.5
SE _D	0.76	0.01	0.54	2.14
CD (P=0.05)	1.52	0.02	1.07	4.38

The present studies showed that organic manures combined with bio fertilizers increased nodule number and microbial population in the soil. The corresponding increase over control was 45 percentage. This is in accordance with the findings of Kumarimanimuthu Veeral, & Kalaimathi, 2017 that combined organic manures in the long term enhanced the nodule number per plant and microbial population in the soil.

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