Annals of Plant and Soil Research 17 (2): 221-223 (2015)
Short Communcation

SOIL MICROBIAL POPULATION AT DIFFERENT GROWTH STAGES UNDER ORGANIC COTTON CULTIVATION

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Received: November, 2014: Revised accepted: April, 2015

Cotton (*Gossypium* spp.) popularly known as "the white gold" is an important commercial fibre crop grown under diverse agro-climatic conditions around the world. It provides fibre, a raw material for textile industry along with cotton seed and plays a vital role in economy of the country. Textile industry is supposed to be a number one enterprise, which consumes nearly 70 % of total fibre produced (Itnal, 2004).The addition of organic matter in the soil improves fertility status. Organic manures have potential for improving soil and water conservation and sustaining soil productivity and enhancing crop yield. (Palaniappan and Annadurai, 1999). Halemani *et al.* (2004) reported significantly highest population of bacteria (76.66 x 10^6 cfu g^{-1} soil), fungi (40.22 x 10^4 cfu g^{-1} soil) and actinomycetes (54.77 x 10^3 cfu g^{-1} soil) with application of FYM alone @ 10 ton ha^{-1} followed by FYM @ 5 ton + cotton stalk residues 2.5 ton per ha and @ 5 ton + vermicompost. However, less attention has been given an organic manuring requirement of the crops under rainfed condition and these aspects needs prime attention through investigation of performance of organic manures along with use of biofertilizers to improve soil quality and yield of cotton.

The field experiment was carried out at Cotton Research Unit (CRU), Cotton Research Station (CRS), Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The soils of the experimental area was medium deep black, clay loam in texture and moderately alkaline in reaction. The soils had pH 8.15 electrical conductivity 0.20 d Sm^{-1} 3.7 g kg^{-1} organic carbon, available N, P and K 220, 22.8, 364 kg ha^{-1} respectively. Akola is situated in sub tropical region between 22^0 42' N latitude and 77 ^{0} 02 'E longitudes. The altitude of the place is 304.42 m above mean sea level. The climate of Akola is semi arid and characterized by three distinct season *viz.*, hot and dry summer from March to May, warm humid rainy season from June to October and mild cold winter from November to February. Average annual precipitation on the basis of last fifteen years is 515.8 mm. The experiment was laid out in randomized block design with eight treatments (Table 1) each replicated thrice. Variety of cotton was taken AKA-8. Gross plot Size was 4.8 x 5.4 Sq mt and Net 3.6 x 4.8 Sq mt. Seed rate of cotton was taken 10 kg ha^{-1}. Method of sowing was adopted as a dibbling method.Four organic sources of nutrients were used for the "Organic cotton experimentation" out of which two viz., FYM and vermicompost are well decomposed organic manures, castor cake was bulky organic manure and sunhemp was used for in-situ green manuring. The soil samples of 0-20 cm depth were collected at flowering and boll bursting stage for microbial count. Soil microbial count was determined by serial dilution plate technique. In this technique one gram of soil sample was taken under aseptic condition in 10 ml sterile test tube and added 9 ml distilled water, shaked thoroughly. Then 1 ml suspension transferred in a 7 test tube and added 9 ml distilled water in it. Shake the test tube well and diluted 7 times with distilled water to get desired level of 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}, 10^{-7} dilution. After dilution transferred 1ml of suspension in petridish in particular media for specific growth of microorganisms. The results indicated that in general, the highest microbial population was recorded at the flowering stage as compared to boll bursting stage (Table 1).

Bacterial population

Data (Table 1) indicated that the bacterial population at flowering and boll bursting stage ranged from 34.00 x 10^6 cfu g^{-1} soil to 103.66 x 10^6 cfu g^{-1} soil and 16.33 x 10^6 cfu g^{-1} soil to 45.33 x 10^6 cfu g^{-1} soil, respectively. Among the various treatments, significantly highest bacterial population (103.66 x 10^6 cfu g^{-1} soil) at flowering stage and 45.33 x 10^6 cfu g^{-1} soil at boll bursting stage was recorded with 10 t FYM ha^{-1}. The increment in the bacterial population at both the critical stages of cotton under study was estimated as increased in the doses of vermicompost and FYM. Chandramohan *et al.* (2002) observed that the population of fungi, actinomycetes and bacteria were higher during vegetative and flowering stage as compare to harvest stage. They also reported significantly higher microbial population in sunhemp + vermicompost followed by sunhemp + poultry manur.

Table 1: Effect of organic sources on microbial population in Vertisols under cotton

Treatment	Bacterial population (cfu 10^6 g^{-1})		Fungal population (cfu 10^4 g^{-1})		Actinomycetes population (cfu 10^5 g^{-1})	
	At flowering stage	At boll bursting stage	At flowering stage	At boll bursting stage	At flowering stage	At boll bursting stage
T_1- FYM @ 5 t ha^{-1}	66.00	37.00	59.33	27.66	29.00	11.33
T_2- Vermicompost @ 2.5 t ha^{-1}	51.33	30.33	54.33	16.33	24.00	11.66
T_3- FYM @10 t ha^{-1}	103.66	45.33	85.00	49.00	42.66	21.00
T_4- Vermicompost @ 5 t ha^{-1}	83.33	40.00	58.33	23.66	32.33	14.00
T_5- Insitu green manuring with sunhemp	84.33	39.33	59.66	45.33	37.66	18.00
T_6- Castor cake @ 500 kg ha^{-1}	85.33	38.00	52.00	44.00	33.33	18.66
T_7- FYM (source of 15 kg P_2O_5) + green manuring with sunhemp	71.33	29.00	49.33	43.66	32.66	15.00
T_8- Absolute Control	34.00	16.33	32.33	14.33	22.33	11.00
SE (m)±	3.36	1.62	2.63	2.43	2.16	0.91
CD (P=0.05)	9.99	4.82	7.80	7.22	6.41	2.69

Significantly lowest bacterial population at flowering stage (34.00 x 10^6 cfu g^{-1} soil) and at boll bursting stage (16.33 x 10^6 cfu g^{-1}soil) were estimated in the absolute control. Increment in the bacterial population due to increments in doses of organic sources might be the fact that organic material ats as food for bacteria and as the quantity of food increased there was increased in their colonization for their energy requirement.

Fungal population

The result indicated that the fungal population at flowering and boll bursting stage ranged from 32.33 x 10^4 cfu g^{-1} soil to 85.00 x 10^4 cfu g^{-1} soil and 14.33 x 10^4 cfu g^{-1} soil to 49.00 x 10^4 cfu g^{-1} soil respectively. Similar trend was reported by Patil (1999) who observed that microbial population decreased markedly from grand growth stage to harvesting stage. The maximum fungal population was observed at all stages of crop growth in treatment receiving 10 t FYM ha^{-1} (at flowering stage 85.00 x 10^4 cfu g^{-1} soil and 49.00 x 10^4 cfu g^{-1} soil at boll bursting) and was higher at flowering stage. It might be due to addition of organic matter into the soil. The lowest fungal population was found in control (32.33 x 10^4 cfu g^{-1} soil at flowering and 14.33 x 10^4 cfu g^{-1} soil at boll bursting). At boll bursting stage statistically higher (49.00 x 10^4 cfu g^{-1} soil) fungal population was recorded which was at par with insitu green manuring with sunhemp and castor cake and FYM + green manuring treatments. However, lowest fungal population i.e. 14.33 x 10^4 cfu g^{-1} soil was recorded in the absolute control. Tripathi *et al.* (1980) reported that the green manuring treatments in general, increased population in total fungi and total bacteria. Halemani *et al.* (2004) reported significantly highest population of bacteria, fungi and actinomycetes with application of FYM alone @ 10 t ha^{-1} followed by FYM @ 5 t + cotton stalk residues 2.5 t ha^{-1} and @ 5 t + vermicompost.

Actinomycetes population

The data (Table 1) indicate that the actinomycetes population at flowering and boll bursting stage ranged from 22.33 x 10^5 cfu g^{-1} soil to 42.66 x 10^5 cfu g^{-1} soil and 11.00 x 10^5 cfu g^{-1} soil to 21.00 x 10^5 cfu g^{-1} soil, respectively. The highest actinomycetes population at flowering stage 42.66 x 10^5 cfu g^{-1} soil and 21.00 x 10^5 cfu g^{-1} soil at boll bursting was recorded 10 t FYM ha^{-1} and it was statistically at par with insitu green manuring with sunhemp at flowering stage and castor cake @ 500 kg ha^{-1}. However, the lowest values 22.33 x 10^5 cfu g^{-1} soils at flowering stage and 11.00 x 10^5 cfu g^{-1} soil at boll bursting stage were recorded in absolute control. These results are in agreement with the finding of Naidu *et al.* (1999) and Singh *et al.* (2007) who reported that soil microbial population enhanced due to application of organic amendments in comparison to absolute control. Organic sources had significantly influenced on bacteria, fungi and actinomycetes population in the rhizosphere of cotton. The microbial population was highest at flowering stage and it was reduced with the age of crop.

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