

## Original Research Article

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## Effect of Organic Manures and Biofertilizers on Soil Microbial Population in Amaranth (*Amaranthus blitum*)

M. Ammaan\*, A. Akila, M. Muthukrishnan, M.A. Nivedhaa, A. Rahul, B. Rishi, S.P. Sowmya, S. Sumithra, Suraparaju Deepthi and M. Theradimani

College of Agricultural Technology, Theni, Tamil Nadu, India

\*Corresponding author

### ABSTRACT

*Amaranthus blitum*, commonly called purple amaranth or Guernsey pigweed, is an annual plant species in an economically important plant family Amaranthaceae. Fluid extracts are used for throat and mouth ulcers, and due to its astringency, it is recommended for diarrhoea and dysentery. The demand for organic produce is increasing every year and by taking the advantage of rising green consumerism, India can acquire enviable position in the world. With these in view, an investigation on the studies on the performance of organic manures and bio fertilizers on *Amaranthus (Amaranthus blitum)* was carried out at Orchard in the College of Agricultural Technology, Theni during 2018-19. The experiment was laid out in Randomized Block Design (RBD) with seven treatments in three replications. T1 (FYM @ 25t/ha +Azospirillum@ 2Kg/ha), T2 (FYM @ 25t/ha+ *Trichoderma viride* @ 2Kg/ha), T3(FYM @ 25t/ha+*Pseudomonas fluorescens* @ 2Kg/ha), T4 (Vermicompost @ 15t/ha+Azospirillum @ 2Kg/ha),T5 (Vermicompost @ 15t/ha+*Trichoderma viride* @ 2Kg/ha), T6 (Vermicompost @ 15t/ha+*Pseudomonas fluorescens* @ 2Kg/ha), T7 (Control- NPK 100:50:50 Kg/ha) Phylloquinone, the most common form of the vitamin, is directly involved in photosynthesis. Increased in photosynthetic activity and soil microbial population (bacteria, fungi and actinomycetes) was noticed in T6 after completion and their count was estimated as  $16.6 \times 10^5$  CFU/g,  $12.6 \times 10^4$  CFU/g and  $11.4 \times 10^3$  CFU/g respectively. The increase may be due to the combined effect of organic manures and biofertilizers on amaranthus.

#### Keywords

Amaranthus,  
Organic manures,  
Farmyard manures,  
Vermicompost,  
Biofertilizers

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### Introduction

*Amaranthus blitum* is a vigorous, annual plant producing erect to prostrate stems 60 - 90cm long. The stems can be simple or branched, sometimes radiating from base and forming mats. The edible leaves and seeds are sometimes gathered from the wild and used

locally. The plant, especially the form *Amaranthus blitum*, is often allowed to grow as a weed and is occasionally cultivated as a vegetable (Ken Fern, 2014).

Leaves - raw or cooked as spinach. The leaves contain about 3.88% protein, 1.1% fat, 9.38% carbohydrate, 3.2% ash, 323mg Ca, 8.3mg Fe,

they are very rich in Vitamins A & C, rich in vitamin B1. The leaves are used as a potherb in order to remove poison from the system. Used as a cereal substitute in cakes, porridge etc. Very small, about 1.2mm in diameter, but it is easy to harvest and very nutritious. The seed can be cooked whole, and becomes very gelatinous like this, but it is rather difficult to crush all of the small seeds in the mouth and thus some of the seed will pass right through the digestive system without being assimilated. An edible dye is obtained from the seed capsules. A fluid extract of the plant is used as an astringent internally in the treatment of ulcerated mouths and throats, externally as a wash for ulcers and sores. The juice of the roots is used externally to relieve headaches. The plant has a folk reputation for being effective in the treatment of tumours and warts (Duke and Ayensu, 1985).

### **Materials and Methods**

A field experiment was carried out at The Orchard, College of agricultural technology, Theni during 2018-19 in Randomized Block Design which was replicated thrice to study the effect of organic manures and biofertilizers on amaranthus. The treatment details were T1 (FYM @ 25t/ha +Azospirillum@ 2Kg/ha), T2 (FYM @ 25t/ha+ *Trichoderma viride* @ 2Kg/ha), T3(FYM @ 25t/ha+*Pseudomonas fluorescens* @ 2Kg/ha), T4 (Vermicompost @ 15t/ha+Azospirillum @ 2Kg/ha),T5 (Vermicompost @ 15t/ha+*Trichoderma viride* @ 2Kg/ha), T6 (Vermicompost @ 15t/ha+*Pseudomonas fluorescens* @ 2Kg/ha), T7 (Control- NPK 100:50:50 Kg/ha).

### **Estimation of total microbial population**

Ten grams of rhizosphere soil sample was transferred to 90 ml of sterile distilled water to get 10-1 dilution. After thoroughly mixing it, one ml of this dilution was transferred to 9

ml water blank to get 10-2 dilution. Likewise, sample was diluted serially with 9 ml water blanks till appropriate dilution was obtained (Parkinson *et al.*, 1971) (Fig. 1 and Table 1).

### **Bacteria (x 10<sup>6</sup> CFU g<sup>-1</sup> soil)**

The total bacterial population was enumerated by plating one ml of 10<sup>-6</sup> dilution in sterile petri plates using Soil Extract Agar medium. The bacterial colonies appearing on the plates after 48 h of incubation at 30 ±1°C were counted and expressed in colony forming units (CFU) per g dry weight of the soil.

### **Fungi (x 10<sup>3</sup> CFU g<sup>-1</sup> soil)**

For the enumeration of fungal population, one ml of 10<sup>-3</sup> dilution of the soil sample was plated in sterile plate with Rose Bengal Agar medium. After 72 h of incubation, the fungal colonies were counted and expressed in CFU per g dry weight of soil.

### **Actinomycetes (x 10<sup>4</sup> CFU g<sup>-1</sup> soil)**

The total actinomycetes population was enumerated by plating 1 ml of 10<sup>-4</sup> dilution with Ken Knights Agar medium. The powdery colonies of actinomycetes appearing after 5 days were counted and expressed in CFU per g dry weight of soil.

## **Results and Discussion**

### **Total fungal counts**

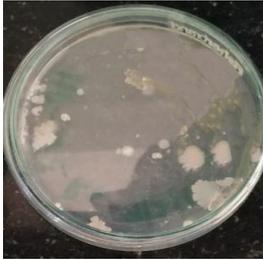
The initial fungal counts (TBC) of the soil sample was found to be 12.6 x 10<sup>4</sup> colony forming units (CFU) per gram of soil. Organic amendments were applied and the final microbial count was recorded. The value was 13.3 x 10<sup>4</sup> colony forming units (CFU) per gram of soil. An increase in the count was observed.

**Table.1** Effect of organic manures and biofertilizers on soil microbial population (Bacteria, Fungi, Actinomycetes) at initial and final stage

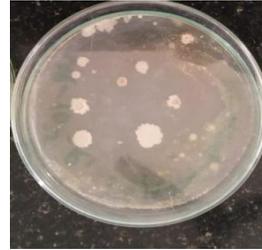
Treatments	Bacteria ( $\times 10^6$ CFU/g of soil)	Fungi ( $\times 10^3$ CFU/g of soil)	Actinomycetes ( $\times 10^4$ CFU/g of soil)
<b>Initial population</b>	16.6	12.6	11.4
<b>Final stage</b>			
<b>T1</b>	21.5	25.9	24.1
<b>T2</b>	33.4	32.1	41.8
<b>T3</b>	38.5	42.4	55.7
<b>T4</b>	46.2	52.4	59.7
<b>T5</b>	68.3	63.8	65.3
<b>T6</b>	85.8	81.3	83.5
<b>T7</b>	19.25	20.1	18.7
<b>SED</b>	<b>0.8282</b>	<b>0.8909</b>	<b>1.5838</b>
<b>CD (0.05%)</b>	<b>1.8045</b>	<b>1.9412</b>	<b>3.4509</b>

**Fig.1**

**Soil microbial population at initial stage**  
Bacteria (T6)



**Soil microbial population at final stage**



Fungi (T6)



Actinomycetes (T6)



Similar report was stated by Ammaan and Subramanian (2017). The mean total fungal count (TFC) of the soil sample was  $12.95 \times 10^4$  colony forming units (CFU) per gram of soil.

### **Total bacterial counts**

The initial bacterial counts (TBC) of the soil sample were found to be  $16.6 \times 10^5$  colony forming units (CFU) per gram of soil. Organic amendments were applied and the final microbial count was recorded. The value was  $17 \times 10^5$  colony forming units (CFU) per gram of soil. An increase in the count was observed. Similar report was stated by Ammaan and Subramanian (2017). The mean total bacterial counts (TBC) of the soil sample was  $16.8 \times 10^5$  colony forming units (CFU) per gram of soil.

### **Total actinomycetes counts**

The initial actinomycetes counts (TAC) of the soil sample were found to be  $11.4 \times 10^3$  colony forming units (CFU) per gram of soil. Organic amendments were applied and the final microbial count was recorded. The value was  $12 \times 10^3$  colony forming units (CFU) per gram of soil. An increase in the count was observed. Similar report was stated by Ammaan and Subramanian (2017). The mean total actinomycetes count (TAC) of the soil sample was  $12.95 \times 10^3$  colony forming units (CFU) per gram of soil.

Vermicompost is rich in both macronutrients and micronutrients besides having many plant growth promoting substances, humus forming microbes and nitrogen fixers. Improvement in enzymatic and microbial activities has been reported due to vermicompost, which helps in improvement of soil fertility. Vermicompost application also brings about increased biological activities in the soil and thus encourages the microbial population. It

increases the availability of nutrients to the *Amaranthus blitum* due to the presence of high humus content. Vermicompost incorporation significantly increased the dehydrogenase and hydrolase activities in soil. FYM increased available N, P, K and Organic carbon content increased by 32 per cent due to application of vermicompost at 5 t /ha over the control. Available potassium status in the soil was significantly higher in the treatment receiving vermicompost. *Pseudomonas* rapidly utilizes seed and root exudates and colonizes and multiplies in the rhizosphere and spermosphere environments. In the plant rhizosphere, it produces a wide spectrum of bioactive metabolites, that is, antibiotics, siderophores, volatiles, and growth-promoting substances competes aggressively with other microorganisms; and adapts to environmental stresses. *Pseudomonas* can provide some additional phosphorus to amaranthus of about 15 kg/ha (Mark S. Coyne and Robert Mikkelsen).

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