

Introduction

1.0 INTRODUCTION

India, the second largest popular country, mostly depends on agriculture for living. The population explosion has created a tremendous pressure on agriculture. The use of agricultural land for various industrial purposes reduces the area of crop production. Most of the Indian agricultural lands are deprived of some of the essential nutrients for growth and development of crop plants (Chandrasekar *et al.*, 2005).

Fertilizers are the sources of the plant nutrients that can be added to soil to supply its natural fertility. They are intended to supply plant needs directly rather than indirectly through modification of such properties as soil pH and structure. There is usually a dramatic improvement in both quantity and quality of plant growth when appropriate fertilizers are added. The change from an agrarian society and a subsistence type of agriculture to a modern mechanized society is accompanied by a marked increase in the use of fertilizers (Aziz, 2007).

Green revolution technologies involving greater use of synthetic agrochemicals such as fertilizers and pesticides with adoption of nutrient responsive, high yielding varieties of crops have boosted the production output per hectare in most cases. However, this increase in production has slowed down and in some cases there are indications of decline in productivity and production (Ramesh *et al.*, 2005).

The synthetic fertilizers are harmful for soil and aerial environment, because the inorganic fertilizers mainly contain major nutrients NPK in large quantities and are neglecting the use of organic manures and biofertilizers and hence have paved the way for deterioration of soil health and in turn ill-effects on plants, human beings and livestock. Most of the soil applied fertilizers (nitrogenous), leach down below the root zone or into the groundwater, which pollute the groundwater causing diseases mainly, "Methemoglobinemia" (Choudhry, 2005). Thus the green revolution has threatened the fragile ecosystem.

Organic farming is not a destination to reach, but it is a journey to a mission. It is one among the ways to maintain the soil health. Organic farming conserves soil fertility and soil erosion through implementation of appropriate conservation principles. Organic farming leads to live in harmony with nature. To make organic farming successful, it is essential that ecofriendly technologies, which can maintain soil health and increase the agricultural productivity, have to be developed and made available to the farmers.

Organic farming is a method of farming which avoids or largely excludes the use of harmful chemicals such as chemical fertilizers, pesticides and herbicides and use of natural resources such as organic matter, minerals and microbes to maintain the environment clean, ecological balance and to provide stability to the production level without polluting soil, water and air. Organic farming system rely on large scale application of animal wastes or FYM, compost, crop rotation, crop residues, green manure, vermicompost, biofertilizers, biopesticides and biological control (Kannan *et al.*, 2005).

Nutrients contained in organic manures are released slowly and are stored for a longer time in the soil, thereby ensuring a long residual effect. Improvement of environmental conditions and public health as well as the need to reduce the costs of fertilizing crops are also important reasons for advocating increased use of organic materials. Application of organic manures also improves the soil microbial properties (Ayoola and Makinde, 2007).

Complementary use of organic manures and mineral fertilizers has proved to be a sound soil fertility management strategy in many countries of the world. High and sustained crop yield could be obtained with judicious and balanced NPK fertilization combined with organic matter amendments (Bayu *et al.*, 2006).

In recent years, biofertilizers have emerged as a promising component of integrating nutrient supply system in agriculture. Our whole system of agriculture depends in many important ways, on microbial activities and there appears to be a

tremendous potential for making use of microorganisms in increasing crop production. Microbiological fertilizers are an important part of environment friendly sustainable agricultural practices (Shehata and Khawas, 2003).

Biofertilizers are the formulation of living microorganism, which are able to fix atmospheric nitrogen in the available form for plants either by living freely in the soil or being associated symbiotically with plants. Biofertilizers are inputs containing microorganism which are capable of mobilizing nutritive elements from nonusable form to usable form through biological processes (Shaheen *et al.*, 2007).

Azospirillum form different types of association in diverse vegetable species. Initially it was believed that they were found only at the rhizosphere, but later on they were isolated from the soil and also contain endophytic strains, which are capable to colonize inside the plant, supplying the nitrogen with more efficiency (Fischer *et al.*, 2003). The inoculation can cause increase in dry weight, accumulation of total nitrogen, the grain yield, weight of the grains, germination rate of the seeds and changes in the duration of the plant growth stages (Santa *et al.*, 2004).

Phosphate solubilising bacteria (PSB), has the capacity to solubilize and mineralize the residual or fixed phosphorus, increase the availability of phosphorus in the soil, produce the growth substances like IAA and GA and thus increase the overall phosphorus use efficiency (Jat and Ahlawat, 2004). In addition, microorganisms involved in phosphate solubilization as well as better scavenging of soluble phosphate can enhance plant growth by increasing the efficiency of biological nitrogen fixation, enhancing the availability of other trace elements such as Fe, Zn, etc., and by production of plant growth promoting substances (Gyaneshwar *et al.*, 2002). Combination of both *Azospirillum* and phosphobacterium has been named as *Azophos* (Premalatha *et al.*, 2005).

Vermicomposts are finely-divided mature peat-like materials with a high porosity, aeration, drainage and water-holding capacity and microbial activity which are stabilized by interaction between earthworms and microorganisms in a non-thermophilic process.

Vermicompost contain most nutrients in plant available form such as nitrates, phosphates and exchangeable calcium and soluble potassium. Vermicompost have large particulate surface areas that provide many micro sites for microbial activity and for the strong retention of nutrients. They are rich in microbial populations and diversity, particularly fungi, bacteria and actinomycetes. Its consistency promote biological activity which can cause plants to germinate, flower and grow and yield better than in commercial container media, independent of nutrient availability (Arancon *et al.*, 2004).

Chilli (*Capsicum annuum* L.) is an important spice crop in India occupying about 0.81 m ha⁻¹ (Raj and Christopher, 2008). An annual plant, chilli comes in a wide variety of shapes, sizes, colors and in different degrees of pungency. The medium pungent sannam and the mildly pungent mundu chillies are internationally recognized as the finest in quality products and are also available as powder and oleoresins. Indian chilli is exported to many countries, notably USA. The hot flavor of chillies is due to the presence of a group of seven closely related compounds called capsaicinoids, but capsaicin (8-methyl-N-vanillyl-6-nonenamide) and dihydrocapsaicin are responsible for approximately 90% of the pungency. Chillies as a natural product have been a subject of study in pharmaceuticals, food industry etc., (Mathur *et al.*, 2000).

Hence a study has been undertaken to evaluate the individual and combined effect of *Azophos*, vermicompost and triple-17 on the growth and yield of green chilli (Gundu variety) by determining the biometric observations (root length, shoot length, fresh weight, dry weight, moisture content and number of leaves) and biochemical parameters like chlorophyll, carotenoids, carbohydrates, phenols, proteins, nitrogen, phosphorus and potassium levels.