1. INTRODUCTION

Nitrogen is an essential and key element in improving crop productivity throughout the world. Although it is a major nutrient, limited water resources, low crop productivity in arid and semi-arid regions, and spiralling costs of fertilizers have discouraged the wide spread use of nitrogenous fertilizers. However it has attracted considerable attention of research workers both as a plant nutrient and as an environmental pollutant. Several reviews have appeared on the significance of nitrogen fixation (Jensen, 1965; Moore, 1966; Stewart, 1969; Mishustin, 1970; Becking, 1971; Dobereiner and Campelo, 1971; Knowles, 1977; Neyra and Dobereiner, 1977; Sethunathan et al., 1983; Boddey and Dobereiner, 1988).

Despite great abundance of molecular nitrogen in the atmosphere, the element is commonly deficient in agricultural soils thereby limiting agricultural productivity. As a result of the critical role of nitrogen and its low supply, the management of nitrogen resources is an important aspect of crop production. Also, under intensive cropping, substantial loss of
nitrogen can occur from the soil through processes such as denitrification, leaching, volatilization and erosion.

Although increasing nitrogen demand of the crop is mainly satisfied by the application of mineral fertilizers, biological nitrogen fixation, a process involving the reduction of atmospheric nitrogen to ammonia by microorganisms, which accounts for nearly 60% of the earth's newly-fixed nitrogen (Postgate, 1982), has assumed great importance in maintaining soil fertility status. Unless the molecular nitrogen is converted into a suitable form (ammonia) the plants cannot utilise the same. This activity of reduction of atmospheric nitrogen to ammonia, known as biological nitrogen fixation, is confined to microorganisms and in particular to prokaryotes. The nitrogen gain through non-symbiotic systems is low compared to symbiotic systems. Nevertheless, contribution by heterotrophic nitrogen fixers can be of considerable importance under conditions of high organic matter and moisture availability. Further recent investigations emphasize the significant contribution of diazotrophic bacteria like *Azospirillum* inoculated to foxtail millet (Cohen et al., 1980; Kapulnik et al., 1981).
Anantapur district of Andhra Pradesh receives a poor annual rain fall of 34.4 mm and a temperature of 31°9 C resulting in frequent droughts. Under these conditions foxtail millet, one of the short duration crops (75 to 90 days), is cultivated as a minor millet mixed crop. Recent data (1991-92) indicate that it is cultivated in 7,573 hectares during the kharif and rabi seasons and it is suitable for light black and red soils of Anantapur district. The recommended varieties for the local area (Anantapur district) are Chitra, Lepakshi - AK-132-1 and Prasad SIA-326, and the recommended level of nitrogenous fertilizer is 40 kg/ha (Anonymous, 1992).

Foxtail millet is chosen for the present study because it not only resists drought conditions but also withstands delayed monsoons and hence widely cultivated in the local area. The variety Lepakshi is selected for its higher yield and more area of cultivation compared to the other two varieties.

Isolation of diazotrophic bacteria from soil and rhizosphere using nitrogen free media with different carbon sources encourages the growth of different groups of bacteria. For example use of glucose or mannitol
leads to the frequent isolation of diazotrophs of Azotobacteriaceae, while use of malate leads to the isolation of Azospirillum sp. The experimental model used in the present study called the spermosphere model has two advantages viz., the seedling provides bacteria with root exudates, the actual carbon source they come across in the soil thus avoiding bias in the carbon source and the growing seedling uses up any nitrogen made available by the diazotrophs rendering the medium free from nitrogen and thus highly selective (Thomas-Bauzon et al., 1982). Hence this model was used in the present study to estimate nitrogen fixation by the diazotrophic bacteria isolated from the rhizosphere of foxtail millet.

Despite several studies on nitrogen fixation, information on the diazotrophs associated with the rhizosphere of foxtail millet is rather limited (Lakshmikumari et al., 1976; Lakshmi et al., 1977; Cohen et al., 1980; Nur et al., 1980; Kapulnik et al., 1981). Therefore, the present study emphasizes the following aspects of heterotrophic nitrogen fixation:

0 Isolation and estimation of the population of bacteria from the rhizosphere of foxtail millet.
Purification of the bacterial isolates.

Screening of the bacterial isolates for diazotrophs.

Estimation of nitrogen fixation by selected isolates of diazotrophic bacteria employing spermosphere model.