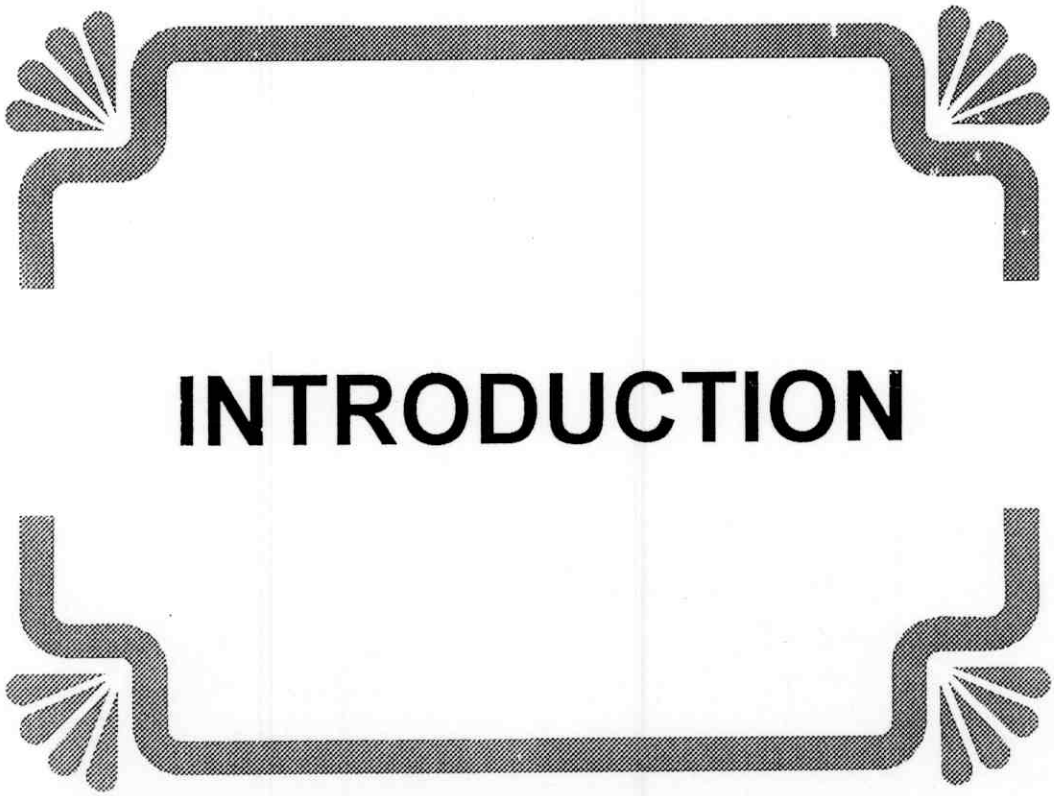

INTRODUCTION

1. INTRODUCTION

Wastes have been produced by mankind since ancient nomadic tribes settled into village and started utilization fire and cultivating lands. The concept of community-wide systematic collection, treatment, and disposal of solid wastes and wastewater, however, did not appear until the late 19th century. Since then, land application has been a common practice for disposal of municipal wastes, especially waste water and residues resulting from treatment of wastewater **(Jewell and Seebrook, 1979; Change and Diaz, 1994).**

Land application would be ideal for sludge disposal if it was not potentially hazardous trace elements and toxic organic pollutants because this practice could be mutually beneficial for the municipalities and the farmer. However, the agricultural land provides a reliable outlet for the sludge to be assimilate, the N, P, and organic matter added into the soil creates favorable agronomic conditions for plant growth.

Also, the chemical improvement of these soils arises, among other things, as a result of the release of available macro and micro-nutrients from the added organic residue through the microbial decomposition.

Some heavy metals such as Pb and Cd present in sewage sludge are toxic to plants, since they interfere with the work of some enzymes and may cause lethal effect on the embryos and metabolic process. Also, there could be a delay in seed germination and root growth **(Achtnich, 1980).**

The rhizosphere is that portion of the soil under the direct influence of the roots of higher plants where as the rhizosphere encompasses the root surface and is adhering soil. The soil microbes in the vicinity of the growing roots are stimulated by the provision of a surface upon which to grow as well as the contained in leachates, sloughed cells and decaying roots. Microbial colonies develop unevenly along the root surface with maximal development occurring where all prerequisites for growth are met. Therefore, occurrence of microbial colonies are a good indicator of carbon and energy source leakage from the root.

Application of sewage sludge in the rational rates of sewage sludge did not disturb soil microbiological processes. In the soil-plant system, the rhizosphere effect seemed to be more important for microbial growth than the direct application of sewage sludge. Repeated sludge applications at correct rates progressively improved soil biological properties, especially on poor sandy soils. In the field, microbial biomass increased with applications of sludge stabilized by composting. However, heavy sludge applications can depress mineralization, particularly in soils of low clay content and may also unfavourably affect other microbial processes such as ammonification and dinitrogen fixation, the extent of the effect depending on soil properties **(Coppola et al., 1986).**

Therefore, the objectives of the current investigation were to: (i) investigate the effect of sewage sludge application on soil macro- micronutrient and heavy metal contents in rhizosphere (ii) to monitor the uptake of micronutrients and

heavy metals by plants grown on soil treated with sewage sludge, and (iii) evaluate the effect of sewage sludge application on rhizosphere biological activity, nitrogen fixation and the pathogenic bacteria in ecosystem.