I. INTRODUCTION

The application of green manures to fields is a common practice in several countries including India, even though its importance is not always understood. Plants used as green manures include members of leguminosae and other families, whether woody or herbaceous species, yielding large quantities of green leaves and twigs. The role of green manures in the growth of crop plants has been a subject of much investigation and controversy since 16th century.

In the view of agronomists, green manure is the cheapest of all the sources available for the enrichment of soil to maintain or even to increase soil fertility. In the absence of other sources of organic matter, green manure is the best suitable alternative for incorporation into soil (Saxena, 1961).

Several people interpreted the importance of green manure in different ways. Joffe (1955) stated that the application of green manure either to raise the quantity of organic matter in soil above the field level or even to maintain it was doomed to failure. Others like Ambika Singh (1961) and Krishna Rao (1960) accepted the view that green manures impart beneficial effects on soil organic matter.

Increasing the organic matter content of soils in humid tropics and sub-tropics was found to be very difficult, but the green manuring was beneficial to succeeding crop as a result of release of nutrients on decomposition (Joffe, 1955). Green manures are considered to be of no use unless decomposed (Joffe, 1955).
As soon as green manure is turned under, micro-organisms attack and decompose it by breaking down its complex organic substances into simpler ones. During the process of decomposition, some of the substances are utilized by microorganisms for their cell synthesis, some other substances may be volatilized and the remaining substances are gradually transformed into humus which is much more stable and acts as a storehouse of nutrients (Sachsman, 1962).

The activities of soil microorganisms decomposing green manures are known to improve soil structure by mechanical binding of soil particles (Modell, 1942) and by increasing soil aggregation through the production of polysaccharides and other binding substances (Sachsman, 1938). There is, however, a recent report indicating that polysaccharides are easily degraded in soil and a few weeks after the addition of plant materials the net polysaccharides content may be less than that present at the time of addition (Martin, 1971).

Decomposition of organic matter in soil results in the formation of various types of organic substances such as free sugars (Gupta and Goward, 1963), organic acid derivatives (Fuller, 1947); organic acids (Wobley, 1961) and amino acids (Paul and Schmid, 1960). Casteel (1965) stated that the formation of organic acids in soil is very important, because they liberate phosphorus from insoluble materials like calcium and aluminium phosphates. The amino acids fluctuate very often in soil (Casteel, 1965). It has been proved in aseptic cultures, that a number of amino acids and aliphatic amines are directly assimilated by higher
plants. Virtanen and Linkola (1966) reported that 2 and 3 forms of aspartic and glutamic acids are assimilated by peas and clover and they said that aspartic acid, nitrate and amine are simultaneously assimilated by plants.

The occurrence of vitamins and growth factors in soil has also been investigated by several workers. Growth promoting substances termed as "auxinones" were detected by Lockridge (1933) in decomposing compost. Specific substances isolated from soil include thiamin (Sibly and Lockman, 1933) and riboflavin (Joppecker, 1948). Occurrence of B-group vitamins and 'terregen' factor were reported by various workers (West, 1933; Schmidt and Stanley, 1961; Koch and Kusmalski, 1950). Work done in Russia also supports the view that vitamins produced by soil microorganisms benefit crop plants (Krasilnikov, 1962). Ryle (1971) has cited reports of occurrence of plant growth hormones including indole-3-acetic acid in soil.

Usually very small amounts of organic and inorganic nutrients present in soil are sufficient to support the growth of plants. Under certain unfavourable conditions the production of organic substances may become sufficiently high so as to cause an inhibition of seed germination and subsequent growth of plants. Production of phytotoxic substances from decomposing plant residues has been reported by Patrick and Koch (1968), McCalla and Army (1961), Patrick, Tousson and Snyder (1963) and others. Toxic substances may be present in the plants which are added to soil (Evansri, 1949; Mayer and Poljakoff-Mayer, 1961), or produced by micro-organisms themselves (Brian, 1957).
There is very little information on the decomposition of green manures in soil under rain-fed field conditions, although their value in rice fields has been recognized. Prasad (1968) showed that bacterial activities reached a peak in 15-20 days following the addition of leguminous green manures to soil and maintaining the moisture levels at 25%, 50%, 70% and 100% of moisture holding capacity. Bacterial stimulation was greatest at moisture level approximating the field capacity (75% m.h.c.). Fungal population remained at an uniformly high level up to 30 days. They were stimulated to a greater extent at low moisture levels (25% and 50% m.h.c.). Levels of organic matter and nitrogen in treated soils were higher when compared with unamended soil even after 150 days of decomposition. Nitrification was favored at soil moisture level of 70% m.h.c. In green manure experiments, however, maximum values were reached at 100% m.h.c level in controls.

It is now proposed to investigate the effects of leguminous green manures on various types of organic compounds such as vitamins, amino acids, phenolic substances and carbohydrates in soils. It is also proposed to study the influence of soil moisture content on the above substances in green manure amended soils. It is expected that both beneficial as well as possible harmful effects of decomposing green manures in soil can be assessed to some extent by this study. Information may be obtained which would indicate the suitability of green manure application to rain-fed crops in tropical conditions.