An Ecological Study of Sugar Cane, with special reference to Moisture Content and Nitrate Fluctuations in the Soil during part of the Growing and Fallow Period.

GENERAL AND INTRODUCTION:-

The relation of a plant to its environment is of fundamental importance, the study of which embraces many kindred sciences. Here we are dealing with many factors, most of which are complicated yet closely related: thus the internal metabolism and physiology of the plant goes hand-in-hand with the structure and chemical composition of the soil in which it grows: both these are variables, fluctuating with external conditions such as rainfall, temperature, sunshine, etc.

The study of soil types (with special reference to mechanical and chemical composition) and the specific flora growing upon them may be of interest to the casual ecologist but is of little fundamental importance: the plotting-out of 'plant associations' as has been followed by Brenchley in England and Bews in South Africa may be termed an ecological study but is of no help to the general agriculturist: in the following work we have attempted to take a more comprehensive view than this and to study the more subtle relationships between plant and soil: for such a study continuous observations are essential.

The entomologist and mycologist are at last turning their attention to this important side of the question and their maxim in combating practically every pest and disease is 'study the needs of the growing plant and ameliorate soil conditions to meet that need'. Nowell (23) lays special stress on this 'need' and calls it the 'predisposing factor' to disease. It is here that the crop ecologist with his comprehensive view comes to the aid of the agriculturist: to quote a few cases. Wardlaw(30) points out that possibly the only way of combating Panama Disease is to improve the methods of tillage and cultivation around the growing banana: it is a well

known fact that Fusarium cubense types are present in practically every soil whether cropped with or without bananas but it is only on those soils where little attention is given to tillage and the improvement of soil conditions that the disease becomes virulent and the production of bananas rendered uneconomic: the incidence of 'wilt' in coconuts is coupled with overcrowding and lack of available nutrients, 'die-back' in cocoa, with absence of sufficient wind breaks, 'pod rot and canker' in cocoa with excessive shading: attacks from the Steirastoma beetle (cocoa) is connected with exposure to excessive wind; thrip damage with bad drainage and exposure: innumerable cases could be mentioned.

Coming nearer home to our own problem we will consider the incidence of froghopper blight (Tomaspis saccharina) on sugar cane: work by Hardy (14) and his co-workers have shown that damage done by this pest is most acute in those areas where there is a shortage of available lime in the soil: in this case soil acidity or shortage of available CaCo3 is the predisposing factor to froghopper attack. Such an observation is of fundamental importance from an economic point of view, and the correlation would never have been made from the pure analyses of the soil in the laboratory without the accompanying field observations. This question of lime deficiency leads up to the problem under review in this dissertation: it is a generally accepted fact that nitrification goes on best in a slightly alkaline medium of fair moisture content (more will be said on this subject later). Can we correlate the nitrate content of a soil or better still its 'nitrifying power' with the incidence of or freedom from this pest? How is the lime content and nitrate content of the soil related? Does it mean that in an alkaline soil soluble calcium salts are absorbed and these so affect the internal physiology of the plant that it becomes more resistant to attack or does it mean that with a high lime content nitrification is more rapid, absorption of nitrates more rapid with a consequent building up of a richer and more resistant protoplasm? This last speculation is beyond the sphere of this present work and can only be approached

by the plant physiologist. Follett-Smith (10) working along the lines laid down by C. H. Wright (31) measured the readily-available nutrients, potential nutrients and rates of supply of various good and bad cane soils and was in practically every case able to correlate high yields and absence from blight with high values for each of these factors (and vice-versa). Here again we find ourselves faced with a 'predisposing factor'.