

SOME SYMPTOMS OF PLANT NUTRIENT DEFICIENCIES IN THE COFFEE TREE.

PRELIMINARY NOTE.

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The time-honoured method of ascertaining whether a soil is deficient in plant nutrients is chemical analysis. Where a mass of data has been accumulated from which can be deduced the relationship between the results of chemical analysis and the response to manuring, chemical analyses are of value but, in a new country, where no such data exist, the results of chemical analyses may be very misleading. Such a condition does exist in Kenya; often according to the analytical results there is an ample supply of potash yet there is a marked response to potash manuring.

Not only in new countries are chemical analyses of the soil being found unsatisfactory. In Europe, notably in Germany, methods have been evolved whereby the manurial requirements of soils are directly determined by the use of plants. These methods give very accurate results but are expensive in material and labour. Some quick method directly applicable to plants in the field is required. Such a method, chemical in character, has been elaborated in the United States and is applicable to the maize plant. Similar chemical methods are being elaborated at the Scott Agricultural Laboratories for application to the coffee plant.

Meanwhile a number of observations upon the leaves of coffee trees has led to the discovery of many symptoms indicating deficiencies in nutrition of the coffee tree. Work is being continued upon these symptoms and it is hoped eventually to be in a position to state definitely from an examination of a few trees what manurial treatment will be the most likely to have the greatest effect. A certain amount of data has been accumulated so far and forms the basis of this preliminary note.

The symptoms which can be definitely associated with certain deficiencies are varied and may be modified by an ample or deficient supply of other nutrients. Some are exceedingly difficult to describe adequately and really require demonstration for their proper appreciation.

The first symptom of a deficiency of nitrogen is a reduction in the size of the leaf, the texture of the leaves on the inside of the tree, those unable fully to perform photosynthesis, is rather harsh and the leaf is thin. This texture feel is not definite and is very easily confused with the feel caused by other deficiencies. The next symptom is a chlorosis in which the main lateral veins of the leaf first become

yellow; the chlorosis then extends to the blade of the leaf, but generally the veins are markedly more yellow than the interstitial tissue. The leaf too has a distinctly leathery feel. As chlorosis progresses the more mature leaves drop prematurely until the twig is completely defoliated after which it dies back from the tip. On fruiting twigs it will be found that collapse and "break down" of the beans occurs even in the young cherries.

Potash deficiencies manifest themselves in a whole series of symptoms. The first is a papery feel of the inner leaves of a coffee bush. The leaves may be thin when they have a feel reminiscent of a sheet of "foreign" note paper; when thick they feel like a sheet of good cartridge paper. It is interesting to note that in a group of trees infested with mealy bug contiguous to trees uninfested or only very slightly so, the inner leaves were very papery and thin while those on the uninfested trees were normal. Whether the trees were attacked by mealy bug because they were deficient in potash or the symptom of the potash deficiency was caused by the mealy bug attack is a point now receiving attention.

The next stage in the series of symptoms is the development of a puffy leaf. The leaf tissue between the main lateral veins rises into a ridge and the papery feel is more accentuated. With progressing potash deficiency the drip tip of the leaf becomes pinched at its base and tends to rise at right angles to the general plane of the leaf. This is followed by the abortion of the drip tip giving a leaf with a rounded point. A later stage appears to be the death of tissue along the edge of the leaf and a chlorotic condition.

The only symptom which can be correlated to a phosphate deficiency is a harsh feel to the surface of the leaf. This condition is neither easy to describe nor to detect. Perhaps the simplest way of describing it would be to say that the leaf lacks the velvety surface feel that the leaves on a tree receiving an adequate supply of phosphate possess. Here too as in all cases where leaf texture and feel are described the inner leaves are meant. In the outer leaves the products of photosynthesis completely mask the symptoms.

When the soil has an ample supply of lime leaves are found to be distinctly stiffer than those on trees growing on a soil at all deficient in lime. Such a condition is what would be expected in view of the effect of calcium upon the middle lamella. It is, however, much to be doubted if lack of rigidity in a leaf could be taken as a positive symptom of there being a lime deficiency.

There are several other distinct symptoms which have not yet been correlated with any one deficiency. The most marked of these is a chlorotic condition in which the leaf tissue is yellow while the veins, even to the small anastomosing vein, are green. The leaf has

a peculiar mosaic appearance. Study of these symptoms is being started while that of the symptoms described above is being extended.

There appears to be every reason to hope that during the course of the next few years our knowledge of the effect of the various common plant nutrients upon the leaves and general growth of the coffee tree will have so advanced that, by a study of a few trees upon a plantation it will be possible definitely to plan a manurial programme for the plantation.