MINOR ELEMENT NUTRITION OF THE TEA BUSH IN CEYLON

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Tea provided one of the early examples of a deficiency disease occurring in plants. In 1929–1931 tea planted in Nyasaland was devastated by a disease known as "Tea Yellows". This was shown by H. H. Storey and R. Leach to be due to a deficiency of the element sulphur. These two workers had the great satisfaction of finding a spectacular cure for a disease which had been described by an eminent authority as "unquestionably one of the most serious diseases to which the tea bush is liable".

The importance of mineral elements other than nitrogen, phosphorus and potash to the full health of plants has been accentuated by progressive studies on plant nutrition. Some plants require considerable amounts of calcium, magnesium, iron and manganese and sulphur in addition to the three major elements nitrogen, phosphorus and potash.

In recent years it has been found that the most minute traces of other elements such as boron, cobalt, copper and molybdenum are also essential for the normal growth of a number of crops.

Where more or less complete deficiencies of nutrients occur, some crisis is usually precipitated and attention is thereby drawn to the condition. In other cases where the essential elements are present in the soil but are unavailable, or are in amounts inadequate for full health and vigour, the effects are insidious and most difficult to recognise. The investigations described in this article are, therefore, of considerable importance.

The nitrogen, phosphate and potassium requirements of the tea bush are reasonably well known and Eden[1] has described in detail the crop response consequent upon different levels of application of the three nutrients mentioned. The manurial experiments conducted to date have enabled a rational manurial policy to be recommended and it is only in the case of very high yielding fields that there is somewhat of a gap in the knowledge of the nutrient requirements.

However, plants in general require many more elements than the nitrogen, phosphorus, potassium trio to enable them to grow satisfactorily. Bond[2] reviewed the role of minor nutrients in plant life and drew attention to some of the more common diseases which had been shown to be attributable to shortages of nutrient elements.

Since that date (1941) very many more cases of diseases or lack of optimum production due to minor nutrient deficiencies have been identified, and nearly every crop plant has been involved in one area or another. Quite recently Evans[3], working in Trinidad, showed that cacao, growing on what has been for many years the most highly productive soil in the island, gave visual responses to the application of iron, manganese and copper compounds to the leaves. The soil type in question, Montserrat clay loam, had been regarded as approaching the ideal soil for cacao, but this view may need modification in view of the recent findings.

Tea in Ceylon is not known to suffer from any minor nutrient deficiency although within the last few years symptoms believed to be associated with a deficiency of the macronutrient potassium have become apparent.

The cause of this apparent potassium deficiency is probably to be found in the cessation of potash manuring during the war and immediate post-war years coupled with relatively high levels of crop removal during that period. Similar symptoms can be observed on the plots on St. Coombs which have received no potash manures for over 20 years. The fact that no specific minor nutrient deficiency symptoms have yet been found on Ceylon tea does not necessarily mean that minor nutrient shortages do not exist.

There are a few estates where, in spite of quite high applications of nitrogen, phosphates and potash, no crop response has been obtained. In one such area the tea is well grown and appears to be healthy, but the yield per acre is very disappointing being only some 500 lbs. made tea per acre per annum where from the appearance of the tea twice that yield might reasonably be expected. In this area the application of cattle manure at the rate of 6–8 tons per acre has given remarkable increases in yield whilst more than the equivalent amount of nutrients given as inorganic fertilizers has been without effect.

The soil in question is a fine sandy loam of considerable depth, low in clay and organic matter (1%) and very freely drained. It tends to dry out rather rapidly in the dry weather. However, it is difficult to believe that the small amount of organic matter supplied by an application of from 6–8 tons per acre of cattle manure can have had a material effect on the waterholding capacity of the soil or on the structure of the soil.

The possibility that the cattle manure supplied a minor nutrient which was previously lacking in the soil and which was not contained in the inorganic manure mixture (which gave no crop response at all) was considered and an experiment laid down to test this possibility.

The experiment consisted of ten plots each containing three hundred bushes. Five plots chosen at random were treated and five plots remained untreated as controls. The minor nutrient mixture containing all known essential elements was applied to the foliage of the bushes as a spray at weekly intervals for the 5 week period before tipping. The whole applicational part of the experiment was carried out in dry weather.

Tipping weights were recorded and the weights of flush removed at nine day intervals for a period of four months after tipping were also taken. There was no response whatsoever which could be attributed to the treatment. This experiment was repeated on three other sites, the relevant details of which are given below. In no case was any response obtained.

Site 2—This site was in the Uva Province and the soil is derived from a quartzite outcrop. The soil is gravelly and freely drained with a good humic topsoil of some 10" depth. A manurial experiment, involving the three nutrients, nitrogen, phosphorus and potassium has shown that shortage of potash is one of the limiting factors to production on this soil type. The field on which the minor nutrient experiment was carried out had been adequately fertilized with nitrogen, phosphates and potash.

Site 3—This site was on St. Coombs Estate Field No. 3 where the soil is dark red brown clay of good structure. The black humic topsoil extends to a depth of 9"–12" and the soil is of free draining character due to good sub-soil structure.

Site 4—This was located on a low-country estate. The soil is a red, medium clay loam, sandy in patches. The soil is freely drained although there is a tendency to iron pan formation at depths varying from 2 to 4 feet. On the plots which were used this iron pan formation was very little in evidence.

The possibility that the nutrients applied to the bushes in the form of a spray were not absorbed into the leaves cannot be ignored, but since it has been shown by Lamb[4] that the copper ion can be absorbed into the tea leaf when sprayed onto the leaf surface, the possibility of the non-absorption of the applied nutrient appears to be remote.

It may be concluded, therefore, that for the present, minor element deficiencies are unlikely to be of importance in limiting yields in the main tea growing areas of Ceylon.

With the current replanting of certain areas with high yielding clonal material the position will need constant review since a high yield means a greater drain on the soil nutrients and consequently a danger of earlier exhaustion of the soil reserves.

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