MAGNESIUM AND MANGANESE DEFICIENCIES IN THE NUTRITION OF THE TEA BUSH

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In an article in the preceding issue of the *Tea Quarterly*[1] mention was made of the need to consider the part played by less commonly considered nutrients in the growth of tea. The subject was deliberately left vague as at the time of publication work on certain nutrients was still in the early stages. Results concerning magnesium and manganese deficiencies in tea have now been obtained which are of sufficient interest and value to be published in the *Tea Quarterly*. More detailed scientific accounts will be published when the work is co mpleted.

While at Long Ashton Research Station the author had experience in a department which specialised in the diagnosis of nutrient imbalance in plants by means of 'visual foliar symptoms'. The basis of this method relies on the assumption that if a plant is suffering from an acute deficiency, or sometimes an excess, of one particular nutrient then the leaf shows a discolouration or deformity, or both, which is characteristic for that nutrient and for no other. Such symptoms, when they are known to be fool-proof, can be very simple aids to our investigations of the health of crop plants, but they are in the nature of an ultimatum since they show that the plant has been suffering for some time previously and is now reaching the stage of decline.

It must be obvious that a variety of causes can give rise to most peculiar deviations from the normal colour, size, shape and texture of a plant leaf or shoot. Climatic conditions and pests and diseases can be complicating factors, and there seems to be a tendency for many tea bushes to show odd branches with bright yellow or white blotches slapped haphazard on the leaves, or with a very sharply defined yellow rim round the leaf. These are almost certainly not nutritional or pathogenic, whatever their cause may be. A nutritional symptom follows a symmetrical pattern, often within a framework imposed by the leaf veins, which is the type shown by magnesium and manganese deficiencies in tea.

A more serious consideration is, whether a particular symptom is really characteristic for a deficiency of one nutrient only. With some crops, *e.g.* cereals and grasses, it is difficult to distinguish the various symptoms. With others, *e.g.* apple, citrus, avocado and probably cocoa, the individual symptoms are excellent guides to nutritional disorders. It now seems that tea can be classed as a good indicator plant.

Sulphur and potassium deficiency symptoms in tea have been thoroughly proved. Sulphur in Nyasaland many years ago, and potassium more recently in Java[2] and again in Ceylon.[3] In addition to the two symptoms recorded in this article the writer has observed another, very distinct, yellow pattern on the young tea shoots which have greened up when sprayed with an iron sulphate solution. Iron nutrition of plants is a rather complex subject and all that can be said of this symptom is that it represents a form of iron deficiency in the leaf, since there is no other information in the literature on tea to act as a guide.

Before describing the symptoms for magnesium and manganese it is of practical importance to digress on the use of foliage spraying as a means of correcting nutritional disorders in tea. Many plants are capable of absorbing nutrients which are

sprayed on to their leaves in a suitable form. The method is rapid in effect, economical in amount of nutrient required and often the only practicable way of curing certain deficiencies. It is not recommended to try to substitute foliage spraying for the normal manurial programme. As a further word or two of warning, get scientific advice on the compounds to use, and always use a wetting agent. The two deficiences to be described were diagnosed by the symptom shown on the leaf and confirmed by the improvement in leaf colour and growth following sprays containing the respective deficient nutrient.

Magnesium Deficiency.—Bushes in an area where growth was thin in spite of adequate general manuring were seen to have a discolouration on the older leaves which resembled that on Camellia varieties which the author had seen in a well known magnesium deficient area in the United Kingdom.

Apart from poor growth the main points of note were the dullness and brittleness of the old leaves with, in some bushes, a pronounced folding upwards along the mid-rib. The leaves were not much reduced in size. The colour was pale and without the dark bluish green seen in a healthy leaf.

The most characteristic symptom, however, was a diffuse yellowish brown to coffee coloured mottling which appeared as a vague mosaic between the main veins and towards the centre of the leaf. Individual bushes vary in details, but the general similarity of the symptom is apparent. The brown areas have never been seen to reach either the mid-rib or the leaf edge, or to cross one of the main veins.

It is not proposed to give chemical analyses at this stage, as there are connections with certain conditions in the soil and it has not been possible to begin these further analyses at the present. Magnesium analyses on the leaves of bushes used for diagnosis do, however, confirm that the symptoms described are those of magnesium deficiency.

The only other reference in the literature on this subject is from Java [2] where symptoms were induced in sand culture experiments, and a curiously casual mention made of low magnesium on certain estates. Whether the low magnesium caused serious effects in the field is not clear.

So far two widely separated areas have been found with severe magnesium symptoms associated with poor growth in the tea, and in a third area, where magnesium deficiency was detected and cured in citrus trees, suspected symptoms have been seen in the nearby tea.

For a more practicable control there are convenient magnesium containing manures, magnesium sulphate being very soluble and dolomitic limestone very slowly soluble. Trials with these have been started but the results will not be available for a little while. The sprays used in the above work were 2 per cent. magnesium sulphate, with a wetting agent.

Manganese Deficiency.—Again, the deficiency was diagnosed by the resemblance of a yellow pattern to that shown by certain other plants deficient in manganese, and again confirmed by the recovery after spraying, this time with manganese sulphate, and by chemical analysis of the leaf. In this case, however, it is the first instance of manganese deficiency recorded for tea under any circumstances.

In contrast to magnesium deficiency, the yellow pattern occurs on both young and old leaf, which remains dark green and glossy, except for bright greenish yellow 'tongues' between the main veins and in severe cases a narrow yellow band at the leaf edge. The yellow areas have a jig-saw outline and are fairly sharply defined.

Flush on these isolated bushes had slowed down markedly, and the leaves were small, dark and hard.

The cause of the deficiency was the burning of weeds on paths on a certain estate, with the result that the bushes nearest to the fires had a very heavy dose of an alkaline ash. The pH of the soil had been raised above 6.0, and this had been sufficient to render the manganese in the soil unavailable to the tea bush. This is a well known phenomenon in many crops, and the level to which the pH must be raised before the manganese is locked up depends rather on the amount of manganese in the soil. A pH above 6.0 will not, therefore, necessarily mean the tea bush is deficient in manganese.

In this instance it was suspected that the soil might be rather lower in manganese than are many of our tea soils, as the pH had only to be raised to 6.1 for a bush to be severely affected by the shortage of manganese. Again, soil analyses are not yet available, but preliminary leaf analyses show that the surrounding healthy bushes had much less manganese than bushes from several other estates. The possibility that their growth might benefit by addition of manganese is being investigated.

Apart from the possible practical implications there is an important point to note with regard to the confirmation by foliage spraying. This is a case where foliage spraying is the only practicable remedy, since the lowering of soil pH is an extremely difficult task and the addition of manganese salts to an 'alkaline' soil would only result in that manganese being locked up also. Manganese sulphate at 0.2 per cent. strength, plus a wetting agent, restored good growth and colour after only one spraying.

It is not inferred that the treatment of a few bushes is a practical necessity, but the possibility of other soils being low in manganese to the point of depressing bush growth should not be ignored.

This article has been written at an early stage in the work partly to emphasise the ideas of deficiency symptoms and the importance of lesser known nutrients, which are essential for healthy growth, and partly to induce planters to keep an eye open for unusual leaf colours. It is not possible for the writer to make an extensive estate survey, and the fact that several interesting, and sometimes important, indications of nutritional disorders have already been found on the few estates so far visited suggests that more of these deficiencies may easily be lurking in 'problem patches'.

We should welcome samples of leaves or shoots which look peculiar, but they should be sent in damp packing as such leaves often decay far more quickly than normal leaves.

It is unfortunate that inclusion of colour plates has been delayed, for technical reasons, as written descripton is very inadequate for deficiency symptoms. We hope to be able to remedy the omission shortly, and possibly to include illustrations of other deficiencies.

References

(1) Lamb, J. and Tolhurst, J. A. H.—*Tea Quarterly*, 1954, XXV., Pt. III, p. 51.

(2) de Haan, I.—Archief Voor de Theecultuur, 1941, XV., No. 1, p. 1.

(3) Portsmouth, G. B.—*Tea Quarterly*, 1953, XXIV., Pt. IV., p. 79.