

# MAGNESIUM DEFICIENCY IN COCONUT PALMS

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## 1. INTRODUCTION

Magnesium has long been considered an element essential for plant growth. But only within about the last thirty years was it recognized as of any significance in practical fertiliser usage. The composition of fertiliser mixtures has been generally confined to nitrogen, phosphoric acid and potash on the assumption that these contained sufficient magnesium and other elements essential for plant growth as impurities. But with the increasing tendency towards the use of highly refined chemical fertilisers, the need for including magnesium in fertiliser programmes become apparent. Much of the work reported on this subject has been carried out on crops in the temperate regions.

The occurrence of magnesium deficiency in Ceylon soils was first reported in the early 1950's in connection with cocoa, guava, sorghum and maize grown on the lateritic soils of the wet zone and sandy soils of the dry zone. Subsequently, magnesium deficiency has been observed in our tea and rubber soils.

## 2. VISUAL DEFICIENCY SYMPTOMS

The manuring of coconut palms has been hitherto confined to the application of nitrogen, phosphoric acid and potash. Within the last decade an intense yellowing of mature leaves has been observed in coconut palms grown on the regularly manured but heavily leached lateritic soils of the high rainfall areas in the Western and Southern Provinces. Generally, the yellowing commences at the tips of leaflets on the lower end of mature fronds gradually spreading to upper parts of both leaflets and fronds. The midribs of leaflets and the petiole retain their original colour. In the early stages, a small margin of the leaflets on either side of the midribs remains green. As the yellowing advances there is a tendency for the leaflets to wither prematurely, beginning at the tips. Sometimes the yellowing is accompanied by a brown pin-head type of mottling. But it is uncertain whether the mottling is a further manifestation of the same problem or whether it is due to some other cause.

Oil and fibre plants are known to have a relatively high requirement of magnesium and therefore develop deficiency symptoms early. In Malaya and West Africa similar colorations in the leaves of oil palms (which belong to the same family as the coconut), have been cured by the application of magnesium fertilisers.

It has been reported that next to potash and nitrogen, magnesium ranks highest in the amounts of plant nutrients removed per acre of coconuts per annum. It seemed reasonable to anticipate, therefore, that the problem of yellowing in coconut palms described above was also associated with the magnesium deficiency. Conclusive evidence in support of this view has been obtained through our laboratory and field experiments carried out recently.

The visual symptoms described above are distinct from those associated with coconut scale — where generally yellowing of leaflets occurs in patches close to the petiole. They are also different to those associated with water-logging or general neglect — where foliar colorations are more towards a yellowish orange, and no green marginal effects are observed. However, their identification requires some experience, and it is best to eliminate the possibilities of coconut scale, water-logging or general neglect being the cause of foliar yellowing before rushing into concluding that they are due to magnesium deficiency. When in doubt, planters are advised to communicate with and send us some samples of fresh leaflets enclosed in a polythene bag.

### 3. EXPERIMENTAL RESULTS

Field and laboratory studies have been done on palms showing intense deficiency symptoms described above at Mattegoda Estate, Polgasowita and Walgama Estate, Pannipitiya.

FOLIAR SPRAYING of affected palms with 1-2 per cent solutions of magnesium sulphate brought about complete recovery in a few months — three months, in the case of young palms (about eight years old) and five months for adult palms. The sprayings were done fortnightly with a power sprayer. Each palm was sprayed with about three gallons solution so as to wet the foliage completely. The results were most encouraging, since it was feared that owing to the waxy nature of the coconut leaflet, the chances of foliar absorption of nutrients would be small. The response to foliar spraying was very much quicker than that achieved by soil applications of magnesium, where even after three years complete recovery in leaf colour was not obtained. However, the foliar spraying technique can only be considered to be of diagnostic value in its application to the coconut palm. It is not practicable to carry out routine large scale foliar spraying of adult palms.

SOIL ANALYSIS for exchangeable magnesium failed to show any difference between samples of soil taken from the same plantation from areas in which the palms were quite healthy and green, and areas in which the palms showed intense deficiency symptoms. Investigations are in progress on a new and simpler method of analysis which shows promise of being useful in diagnosing magnesium deficiency.

LEAF ANALYSIS of samples taken from the first and sixth fully opened fronds of healthy and affected palms have clearly shown that the samples from the latter trees have a lower content of magnesium (0.19 per cent Mg in healthy palms, and 0.06 per cent Mg in affected palms). No differences were obtained in their contents of nitrogen, potassium, phosphorus, calcium, iron and manganese.

FIELD TRIALS on soil applications of magnesium (both as magnesium sulphate and dolomitic limestone) along with the usual N.P.K. fertiliser mixture were commenced in 1957. Affected palms receiving magnesium gave a yield of about 50 nuts per palm in the year 1960-61, in contrast to a yield of 35 nuts from palms not receiving any magnesium. However, complete recovery of leaf colour in the affected palms which have been treated with magnesium fertilisers annually since 1957 has not been achieved yet. Healthy green palms on the same plantation receiving only N.P.K. fertilisers gave a yield of 70 nuts per palm for the year 1960-61. The field trials have also indicated that soluble magnesium sulphate acts quicker than the insoluble dolomite in bringing about improvements in leaf colour. Further, it is observed that affected palms receiving N.P.K. fertilisers only were in a worse condition than palms receiving no fertilisers at all.

Magnesium deficiency is known to be accentuated by the presence of excess acidity, ammonium, potassium and calcium salts. The acid leached, lateritic soils receiving regular dosages of refined N.P.K. fertiliser mixture (ammonium sulphate, muriate of potash and saphos phosphate) therefore present optimum conditions for the development of magnesium deficiency symptoms in coconut palms grown on them. Furthermore, in soils which have been subject to a long period of monoculture (continuous coconut cultivation extending to nearly a hundred years or even more in some areas) such deficiencies must arise sooner or later.

#### 4. REMEDIAL MEASURES

As a long term preventive measure against magnesium deficiency, it is recommended that all coconut lands in the high rainfall areas of the Southern and Western Provinces be treated with one and a half pounds crushed dolomite per adult palm annually in addition to the usual N.P.K. mixture. Young palms may be treated with half pound dolomite to start

with. Dolomite should not be mixed with inorganic fertiliser mixtures containing sulphate of ammonia. It should be applied separately, preferably a couple of weeks after application of the N.P.K. fertilisers. The method of surface application round the palm may be used.

Where mild deficiency symptoms are observed, the dolomite dosage should be increased to three pounds per adult palm, and one pound for young palms.

In the case of palms showing acute deficiency symptoms, the normal N.P.K. manuring should be suspended for one year and the palms treated with two and a half pounds magnesium sulphate (which can be obtained commercially as 'KIESERITE' containing 25 per cent MgO). This should be followed by a further dosage of two and half pounds six months later. After a further six months, the N.P.K. manuring must be resumed, and dolomite applied at the rate of three pounds per palm per annum. Young palms can be given half these dosages.

Dolomite is a magnesium containing limestone (18 per cent MgO) which occurs naturally in Ceylon. Although it may not be as quick acting as soluble magnesium sulphate, (or kieserite), dolomite is recommended because it is a considerably cheaper source of magnesium. For the initial treatment of acute deficiencies, kieserite may be replaced with dolomite (3½ lbs. half yearly) should the former be considered too expensive.

Dolomite contains a large proportion of calcium. It might be feared that this calcium would give rise to other complications. However, under the acid soils conditions for which dolomite applications are recommended, such a possibility is extremely remote.

As already stated, it should be noted that the response to soil applications of magnesium is slow and a period of at least three years may lapse before any beneficial effects are observed.

The above recommendations are tentative; and further notes will follow as more experimental data is obtained.