THE TAPERING DISEASE OF COCONUTS

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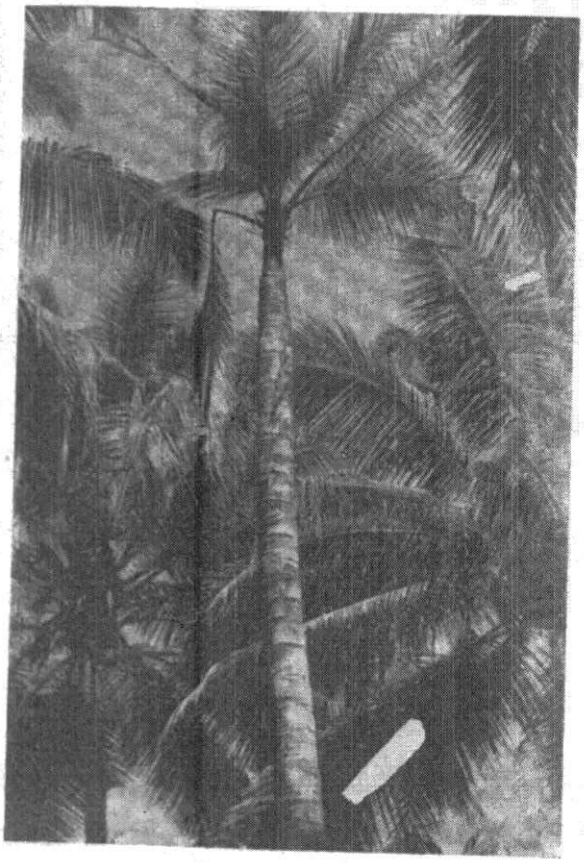
ATTENTION was recently drawn in the Ceylon Press to a new disease of coconuts which had made its appearance in the Seeduwa area of the Western Province and was said to be spreading towards Negombo. It has since been confirmed that this is the so-called tapering disease of coconuts, which was first recorded in Jamaica in 1903. This disease has been studied by various investigatiors in the West Indies, the Philippines, India and Ceylon, but so far the cause of the disease has not been found and it also seems to have been generally accepted that there is no remedy.



In Ceylon the policy on some estates has been to remove these tapering palms as soon as they become poor-yielders, without waiting for the disease to run its full course, and to replace them with selected high-grade seedlings, using plenty of goat-manure, husk ash and husks in the planting holes.

A recent inspection of one of these estates has revealed that this policy is giving satisfactory results; the mature "supplies," now 15 years old, are already giving fine crops and shewing no signs of the disease. The problem still remains because every year on this estate other palms continue to develop symptoms of the disease and have to be pulled down and replaced, and it has yet to be determined whether the supplies too will develop the disease when they grow older.

Sudden tapering or pencil-point disease of coconuts must not be confused with gradual tapering or slow starvation due to prolonged neglect

or to an unsuitable environment. Palms, bearing even as many as 100 nuts or more per palm, growing on a well-cultivated and regularly manured sandy loam and on an estate with an annual crop of over 6,000 nuts per acre, have suddenly been found to show the first symptoms of the disease, and for no apparent reason at all.

There are four distinct stages in the progress of the disease :—

First stage.—The crown of a healthy, good-yielding palm becomes unsymmetrical and untidy ; the upper leaves are green, instead of dark green, and the lower leaves yellowish-green with a yellowing or a rusting at the tips of the leaflets ; the sturdy grey trunk with its evenly spaced leaf-scars develops a black band just below the crown, but there is no obvious tapering.

Second stage.—The crown is now smaller because the new leaves, now being produced, are only three-quarter length ; daylight can be seen through the fronds because their leaflets are very narrow. The middle leaves are now yellowish green and two or three of the lower leaves yellowish red or else necrosed (rusty brown) and some may be broken. The hitherto uniformly sturdy trunk now develops an obvious tapering and shows a marked diminution in diameter just below the crown. Here too the leaf scars are now only about an inch apart (compared with the normal two inches) and the black band of discoloration is broader. Nuts are now small, long and less than ten in number. The ripe nuts usually contain [illegible]tter.

[illegible]ird stage.—The palm is now near its end. The crown, surmounting the pencil-pointed trunk, is now only half its original size and is sparse and untidy. The top fronds are now yellowish green, the middle leaves are yellow with necrosed brown tips, and the lower leaves still hang dry, brown, shrivelled and ragged ; its withered spathes may also still bear a useless nut or two.

Fourth stage.—Ultimately when only a few scraggy leaves remain, the crown collapses, and with the leaves all dead, may still hang on until it is finally blown off and drops to the ground. The bare pencil-pointed trunk will still stand until it too is finally brought down by the ravages of white ants.

A second-stage tapering palm, which was felled, showed the following features :—The growing point was very small and on analysis found to be exceptionally rich in potash ; the tapering portion of the stem was black, corrugated and about three feet in length ; the bole was hollow and rotten ; and the majority of the roots were dead. Extensive root destruction was found to be a feature of all these palms, and the tapering portion was soft and frequently bored by coconut beetle.

A remarkable feature of the disease is that an affected and dying palm is usually to be found next to a healthy, high-yielding palm, which remains unaffected by the close association. Furthe[illegible]ore, a careful survey of all the palms on one estate, carried out by the Soil Chemist has also shown that there is an erratic dispersal or scatter of affected palms. These two observations appear to indicate that tapering is not a communicable disease, nor is it due to an insect pest which would spread outwards in zones from centres of infection. This conclusion has been confirmed by repeated examinations of roots, leaves, and butt-ends sent to the Department of Agriculture for examination.

Palms suffering from tapering disease have been found under all conditions of environment,—on good soils and on bad soils ; where there is regular cultivation and manuring, and where there is long-standing neglect and heavy undergrowth ; close to the sea and also far inland ; close to houses and in a village market.

The extensive root destruction, which is an important feature of the disease could be attributed to a variety of physical causes, *e.g.*, the cracking of heavy clay soils, due to drought ; a cement-like hardening-up of certain soils due to the operation of white ants or to severe drought in the absence of adequate water-conservation measures ; a sudden rise in the water-table, due to flooding or neglected drainage, and conversely the drying up of exhausted soils during periods of very prolonged drought, without adequate new root development in the subsequent rains.

It is a significant observation that this crop has been growing on the same land for a very long period of time, and, in the case of 90% of the properties, little or nothing has been put back into the soil. The majority of owners have removed everything possible of commercial value from the land,—pasture grass, leaves, butt-ends, husks, shells and poonac. Finally, before replanting, even the trunks are taken away and sold to make rafters. All of these plant products contain essential plant food, and the continuous commercial cultivation of a permanent crop, without any crop rotation, requires that the supply of plant nutrients in the soil must be maintained either by the breakdown of the minerals in the soils or by the application of fertilisers and manures. This suggests the possibility that malnutrition, due to soil impoverishment, may be the cause of the tapering of coconut palms, and that tapering is the inability to make new wood and new roots owing to the lack of certain essential plant nutrients in the soil. The throttling effect of tapering would check the passage of food from the leaves to the roots and from the roots back to the leaves and so explain the progressive diminution in the size of the crown and the extensive root decay exhibited by all tapering palms.

Continuing this line of thought, it is necessary to consider what the plant requires for the development of trunk at the normal rate of about 2 feet per year, approximately equal to 70 lbs. of wood. According to Sampson, the leading authority on the coconut palm, magnesium is the leading mineral constituent of the woody tissue of the coconut palm, and in the case of the trunk the figures he gives are :—magnesia , 0·65%; lime, 0·27% ; potash, 0·21% and phosphoric acid, 0·55%.

Not only is magnesium present in the trunk, however, it is also an element of the chlorophyll molecule, the green pigment in the leaves, and so it follows naturally that a deficiency of magnesium in a soil would produce yellowing in the leaves.

In other plants, such a symptom of magnesium deficiency can be seen in the foliage. The salts of magnesium are very mobile and are distributed throughout the entire plant. If there is any deficiency, the younger parts of the plant grow on the older parts, and this provides a possible explanation for the yellowing and subsequent necrosis of the lower and older leaves of a tapering palm, while the younger leaves remain green. The yellowing of the leaves is not the only colour, which may develop; there may also be reddening if the magnesium deficiency is associated with phosphorous deficiency. Magnesium aids the movement of phosphorus within the plant and in consequence such deficiencies are related.

Healthy plants can only result when the essential plant nutrients are absorbed in the correct relative proportions and when certain trace elements about which little is at present known, are also present. The ratio between the three principal plant foods N.P.K. must be correct, otherwise deficiency conditions can be created. For instance, a faulty P/K ratio can reduce the nitrogen intake. In addition a cumulative deficiency of minor elements such as magnesium, lime, sodium, manganese, zinc, iron and molybdenum can develop over a long period of years and become significant.

A calculation has been made by the Acting Chemist of the quantities of major nutrients which are required from the soil each year by the coconut palm. This reveals that in the course of one year the plant removes 26 lbs. of nitrogen, 24 lbs. of potash, 20 lbs. of magnesia, 13 lbs. of lime, 8 lbs. of phosphorus and 4 lbs. of soda from each acre of land, bearing 60 palms with a crop of about 25 nuts each per annum. This is equivalent to 2 lbs. of ammonium sulphate, 1¾ lbs. of dolomite, 2 lbs. of muriate of potash, ½ lb. of saphos, and 2 ozs. salt per palm per annum.

In a good soil there is constant replacement of plant foods in the soil as mineral nutrients are taken up by plants. Recent investigations, however, have revealed that magnesium deficiency in crops may develop on acid sandy soils, which have been severely leached by tropical rains. Magnesium is a very soluble mineral and it can be easily washed out of the soil by warm rain water, containing carbonic acid absorbed from the atmosphere. It has also been stated that magnesium deficiency in soils can also be induced by the excessive application of potash fertilizers. If this is true, it would explain why attempts to improve an affected area by heavy addition of potash did not improve matters.

In fact, no check on the progress of the disease has resulted from the application of artificial fertilisers alone. It is claimed, however, that an affected palm may generally be saved by a heavy application of cattle manure, if the disease is spotted in good time before tapering has started to develop, *i.e.*, stage 1.

The following is the treatment accorded to such palms on what is perhaps the highest yielding estate in Ceylon, where it is a practice never to sell any husk, but return it all to the soil, and where the palms are regularly manured with an N.P.K. mixture :—Whenever a tapering palm is spotted it is at once treated with 1 lb. of potash and six or seven baskets of cattle manure applied in a half circle at the base of the palm. This is additional to the general mixture, so that the total application in that year amounts to 2 lbs. of sulphate of ammonia, 2 lbs. of muriate of potash, 3 lbs. of fish guano and 50 lbs. of cattle manure.

If the palm is caught in time, it is claimed that it can be saved, although it will not be as high yielding as it was before the onset of the disease. It is apparent, therefore, that this expensive treatment is only worthwhile for exceptionally good palms ; palms which are not so good are better replaced by selected seedlings as previously described.

The use of cattle manure as a remedy suggests that the presence of plant hormones (growth-promoting substances) now known to be present in the excreta of animals, may

encourage the development of new root growth in the dying root system of an affected palm. There is also the possibility that the existence of mineral elements other than N.P.K. in cattle manure may correct the existing deficiencies in the soil.

The problem is being systematically investigated by officers of the Department of Agriculture and of the Coconut Research Scheme, working in collaboration. As a first step, surveys of affected areas are being made and the conditions reported. Parts of a healthy plant are being analysed to ascertain what quantities of major and minor chemical elements the coconut palm requires from the soil, and, finally, soil and leaf samples from diseased palms have been sent to the United Kingdom for examination by specialists in the study of mineral deficiencies in soils.

Meanwhile some affected palms have been selected and given various treatments based on the theories outlined above, and the results will be published from time to time as the work progresses.