EELWORMS

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The question may well be asked how serious and widespread is the damage attributed to meadow eelworm in Ceylon tea plantations. So far as our records show the pest is confined to the up-country districts where the crop over many thousands of acres is almost exclusively tea. The haphazard and light distribution of the eelworm, at the time tea was planted, has built up over many decades, on a very susceptible crop, and has extended considerably. In certain areas the damage caused by the pest is causing anxiety, while there is undoubted evidence that distribution over the tea districts is far more extensive today than it was 25 years ago.

The movement of the pest in soil is slow, but as tea has to remain with us, as a permanent and almost a monocultural crop, little can be done on infested estates to check the gradual spread from foci of infestation to surrounding bushes. Under these conditions what may be considered a mild pest today may assume serious proportions fifty years hence if cultural practices are not carefully maintained.

The possible nature of damage may be assessed from crop records over a field of 48 acres on an estate where infestation is both severe and widespread. Between 1921 and 1928 the average yield was approximately 1,200 pounds of made tea per acre. Between 1946 and 1953 the yield fell to below 300 pounds per acre. On another estate, in a different district, where infestation is also widespread, the yield over the whole estate fell from 800 pounds per acre in 1940 to just over 400 pounds in 1953.

Losses due to meadow eelworm attack may be assessed from counts of productive bushes on a heavily infested estate. Over an area of 225 acres a count of productive bushes, on plantings $3 \times 3\frac{1}{2}$ feet, averaged 1,300 bushes per acre. This count included bushes which carried even a few flush points and, therefore, includes a fair proportion of sick plants in the process of deterioration. An average yield of 300 pounds per acre is not surprising under such conditions.

The damage to tea caused by meadow eelworm attack is in the destruction of feeding roots with the resulting check in the absorption of plant nutrients. The bush gradually becomes unproductive and eventually fails to recover after the usual pruning.

An important field of eelworm research, in other countries, has been in the analyses of plant material, including stems and roots of certain plants for their mineral content. Significant increases or decreases of many of the essential elements including sodium, potassium, phosphorus, magnesium, copper etc., have been found as a result of eelworm attack. In many cases the deficiencies continued, even though these elements were supplied to the plant, but on elimination of the eelworm pest conditions returned to normal.

Control of damage caused by plant parasitic eelworms by heavy applications of organic matter has been established in a number of countries. Sugar beet may be grown successfully in soil heavily infested with the sugar beet eelworm if the area is heavily dunged before planting. Similar results have been observed for tea where heavy applications of bulk material caused a remarkable recovery of the plants in health and vigour. The soil has, therefore, to be kept rich in decaying organic matter if gradual deterioration to unproductiveness is to be avoided.

Little is known of the origins of the meadow eelworm though there are indications that the pest is fairly widely distributed in patna soils. The chief agent in the spread of the pest and in the setting up of new foci of infestation in tea is man. Plants

transferred to the field from an infested nursery would carry the pest with them and so distribute the eelworm over land which previously may have been free of the pest. For this reason I have repeatedly advised against the distribution of clonal material, as rooted plants, from one estate to another. Nurseries are the focal point at which control measures must be adopted. Fumigate the nursery beds before each planting and do the fumigation efficiently. Do not transport soil indiscriminately to your nursery. If soil has to be brought in from outside fumigate it before the nursery is planted. If your estate has no previous history of meadow eelworm infestation keep it clean by planting clean material. Do not import rooted plants from other estates.

What can we do to minimise the possible build up of parasitic eelworms on areas to be replanted and in new clearings?

From experiments conducted in my laboratory it has been proved beyond any reasonable doubt that the meadow eelworm is an obligate parasite. In other words the pest requires a living root of a susceptible plant in order to propagate its species. We have found that after starvation (that is withholding of living roots from the pests) for 18 weeks, 20 per cent. of the worms were still alive. However, as the period of starvation progressed the worm gradually lost its ability to enter roots and after 20 weeks starvation this ability was lost completely. The presence of decaying roots in the soil did not materially preserve the worm's ability to attack susceptible roots.

Before replanting, therefore, it is desirable to fallow infested land for as long as possible, taking the precaution of avoiding undue exposure of the soil to the elements by thatching with Guatemala or Mana loppings. The area should be clean weeded frequently to remove roots of living plants on which the eelworm may feed. This is, of course, counsel of perfection and over large areas is not easy. The odd weed must persist here and there to bring about the condition of haphazard and light distribution which probably prevailed at the original planting. The prevention of reinfection is also a major problem unless large areas are fallowed simultaneously. The possibility of reinfection from drainage water and other sources is also not easily controlled.

After a year of fallow the area should be planted up with Guatemala grass, *Desmodium gyroides*, *Crotalaria usaramoensis* or *Crotalaria anagyroides* which are not susceptible to meadow eelworm infestation. A period of two years should, therefore, lapse between uprooting of infested tea and replanting in order to eliminate the pest as far as possible from the area to be planted. Where meadow eelworm infested land has to be planted in tea do not plant *Tephrosia vogelii* until the two-year period is over, as it is a very susceptible crop.

The most important requirement, where the possibility of reinfection remains, is in the selection and propagation of eelworm tolerant material. Testing of tolerance is a long term project as many complex characters of soil conditions have to be contended with. For instance T.R.I. Clone 2024 established in a lightly infested nursery has grown excellently on transference to an area which was free of meadow eelworm. The plants are now just over 7 years old and, though the root system supports a large population of the pest, have produced a crop of 3,900 pounds of made tea per acre over a period of 12 months. However, attempts to establish the same clone from cuttings in heavily infested soil have failed, though cuttings from apparently tolerant bushes have grown remarkably well under the same conditions. On the other hand T.R.I. Clone 1294 which was established successfully in lightly infested soil grew excellently for 7 years and then succumbed in a few months' time. For the proving of tolerance it appears desirable to grow selected material under conditions of heavy infestation, from the cutting stage, for a period of many years before the final selection is made. Work on these lines has already commenced and over 100 selections are under test. Whether we can find clones which are resistant to both meadow eelworm and blister blight disease only time will show. Blister can be controlled by chemical means at an economic cost, but the control of eelworm pests chemically in a standing crop is still a nematologist's dream.