

SOIL SAMPLES FROM ESTATES FOR ESTIMATION OF MEADOW NEMATODES

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Sufficient new experience has been obtained since the last note on this subject was published (Hutchinson, 1960) to make desirable a review of the usefulness of soil samples as a means of assessing Root-lesion or Meadow Nematode numbers, the method of taking these samples for best results, and the details of a new policy being adopted by the Colombo Companies that process these samples.

As indicated in the preceding article, only estates above 4,000 ft elevation need be routinely concerned about this pest, although there is always the possibility of occasional estates sustaining injury at as low an elevation as 2,600 ft—particularly in new clearings. Below 2,000 ft only the root-knot nematode in nurseries can give concern.

The following are ideas developed on the subject of soil sampling as a result of a three-day course of study and discussion at the Institute with representatives of the following companies: Messrs A. Baur & Co., Ltd., The Colombo Commercial Co., Ltd., and Messrs Fisons (Ceylon) Ltd.

Suggestions for Sampling.—Any area of tea soil, except areas of satisfactory growth, can justifiably be sampled. This includes declining areas of mature tea, new clearings that fail to establish properly, nursery sites, or areas in Guatemala grass where the period of rehabilitation might need to be extended in order to eliminate the nematodes.

The sample should be labelled to indicate the area sampled, otherwise appropriate advice cannot be given. A label, written with pencil or ball-point pen, and placed within the container, is recommended.

Soil should be sampled when suitably damp for planting. Dry or very wet samples cannot be processed satisfactorily, and when such samples are received in Colombo, the estate concerned would be notified and requested to send in a more suitable sample.

The sample is best forwarded in a tightly wrapped polythene bag, as it can, if necessary, be stored for some time in such a container without appreciable loss in the number of living nematodes.

The sample should be taken in the following manner. If a soil auger is available, the auger should be inserted approximately 6 inches deep into the soil with a twisting motion, and then removed with a firm pull. If a mammotie or alavangoe is used, the soil should be opened to expose a soil face, and a section of soil approximately 6 inches deep by 2 inches square should be removed. Sampling at a depth lower than 6 inches is not as likely to result in recovery of nematodes.

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When sampling, the centre area between two rows should be avoided. This is particularly important in new clearings, where roots may not have penetrated so far from the rows.

The number of soil cores to be taken depends upon the area involved. For one acre, 10 cores taken at random throughout the area are sufficient. These are broken up and carefully mixed in a large pan. From this soil mass, soil is selected in various places until the equivalent of a cigarette-tin full has been obtained. For areas ranging between 1 and 5 acres, 20 cores are taken, and a similar procedure is followed; one sample only being sent.

Areas larger than 5 acres are divided into 5-acre blocks, and then sampled accordingly. For nurseries less than 1 acre in area, each bed should be sampled, and a single sample drawn from the lot. For larger nurseries, one sample can be drawn from each acre. Nurseries not known to be infested should be sampled prior to each usage.

Samples taken in the manner described above will almost surely recover meadow nematode if it is present in any but trace numbers.

Where a large number of samples is received from an estate, with no indication as to what areas are represented, the Company concerned will write to request this information, and processing will have to be delayed until the information is received. Where several samples have been sent from an area of 5 acres or less, these will be composited by the technician for processing as a single sample. Where an estate requests that samples from all its fields be examined, the Company concerned will write to determine which fields are in fact experiencing a decline in yield, since it is not conceivable that an entire estate should suddenly be found to be declining. Samples will not be accepted from mature tea in the low country, as injury attributable to Meadow Nematode is most unlikely below 2,000 feet elevation. However, examination of nursery soil can be made if the Superintendent has evidence of root galling in nursery plants that indicates presence of the root-knot nematode.

Results will no longer be reported to estates in terms of the exact number of nematodes recovered. In the past, such reporting has led estates to check one Company against another, or against the Institute's technicians, and has served to confuse the question of whether or not the number of nematodes recovered is of importance. Based on considerable experience, the following scale of infestation will be reported:—

Light infestation	1-5	nematodes recovered per 100 gm soil		
Moderate ,,	6-25	,,	,,	,,
Heavy ,,	26-69	,,	,,	,,
Very heavy ,,	70 or more	,,	,,	,,

These designations can be applied in a rough way to indicate the extent of the problem, *i.e.* a light infestation would indicate that no problem exists at present, and a very heavy infestation would indicate that the nematodes were responsible for serious injury to the tea.

If only a light infestation is found in an area where mature tea is severely injured, several possibilities can be investigated. First, it should be determined whether or not the tea is infested with Shot-hole Borer, or has sustained injury due to Scarlet Mite, *i.e.* has had brownish or purplish foliage some 4-6 months earlier and is now defoliating. If neither of these pests are involved, and if the decline

cannot be traced to slab rock, poor drainage, or infrequent manuring, an additional sample should be taken in an area *immediately above* the affected area. If this proves to have few or no nematodes, another sample could be taken from the affected area in 4-6 month's time. If this sample also shows a light infestation, the primary difficulty does not lie with the nematode.

If a light infestation is found in a nursery site, however, the position is a very different one, since here the nematode can multiply rapidly on the roots of clonal plants. If a new nursery site cannot be obtained, additional precautions are advisable. Cuttings could be struck directly into polythene bags of fumigated soil kept on racks above the ground surface. Soil should be fumigated and later stored, while removed from contact with the ground, and the fumigant should be thoroughly dissipated from the soil before the cuttings are placed. Two or three months should be sufficient for this purpose if the soil is turned several times in the interim.

Nursery sites not known to be infested should be fumigated regularly before each usage (Hutchinson, 1960a) to assist in preventing establishment of the nematode. This practice cannot, however, guarantee freedom from nematodes, and therefore, in addition, it is recommended that nursery sites also be sampled before each usage, so that small numbers of nematodes can be detected and the additional precautions noted above may be taken. Because of the increasing importance of nursery practice in the control of this nematode, we are recommending a shift in emphasis from sampling mature tea to the sampling of nurseries.

In order to enable the technicians in Colombo to cope with an increased number of nursery samples, estates should refrain from sending samples from areas already known to be infested, since resampling will provide them with no new information, *i.e.* it is most unlikely that the nematodes will have died out in the interim. An exception to this rule is where an infested area is being rehabilitated when a sample could be taken after one year's rehabilitation, to determine whether or not further rehabilitation will be necessary to eliminate the nematode.

Estates are also kindly requested not to send samples from the same area to more than one company. Even where similar sampling is done over a marked area, where selection of final samples is done with care, and where counting of samples is carried out by trained persons, a considerable variation occurs. The results of an experiment which illustrates this are shown in Table 1, where 8 persons each took 10 cores of soil with an auger from a carefully marked one-acre area of clonal tea at St Coombs. Each person then carefully mixed the soil obtained, and from it selected two tins full of soil; each designated in Table 1 as "Sub-samples". Each of these sub-samples was separately processed, and counted twice; once by the person who took the sample, and once by his or her partner. Results show that variation in counting is not significant. Variation in sub-sampling is, however, highly significant, as is variation in sampling. If, for instance, sample No. 2 were submitted to Colombo, a count of "moderate infestation" would be returned. If, however, sample No. 8 were submitted, a count of "heavy infestation" would be returned. Moreover, the variation in this test is probably at a minimum. Sampling as it is now practiced on estates would certainly produce several times this amount of variation.

The answer to more accurate information from soil sampling is therefore not to send samples from the same area to two companies, but to sample the area more carefully.

All technicians in the Colombo companies process soil samples in a standard manner, and are fully competent to identify the nematodes of importance to tea.

They are anxious to be of maximum service to you, rather than to duplicate efforts. Counting nematodes under a microscope is tedious and time-consuming work. In addition, these technicians must examine soil for pH and mineral content, leaves for mineral content, plant specimens for identification or for pests and diseases, and must examine all these samples from other crops in addition to tea.

Since taking over most of the routine analysis for Meadow Nematode from the Nematology Division, their duties in this regard have approximately quadrupled. It is to assure that their time is used by the Industry to the best possible advantage that we have together composed this article.

References

- HUTCHINSON, M. T. (1960). Nematode samples from estates. *Tea Quart.* 31: 116-118.
- HUTCHINSON, M. T. (1960 a). Fumigating nurseries. *Tea Quart.* 31: 119-120.

TABLE 1.—*Variation encountered in the sampling of a one-acre area of clonal tea for meadow nematode*

Sample No.	SUB-SAMPLE			
	A		B	
	Count		Count	
	1	2	1	2
1	30	24	50	48
2	23	18	11	8
3	36	39	42	44
4	30	32	37	41
5	61	59	24	26
6	55	56	31	23
7	52	72	34	39
8	69	73	39	58

Standard Error

(No. of Nematodes)

Sampling	25	Significant (P < 0.01)
Sub-sampling	22	Significant (P < 0.01)
Counting	5	Not significant.