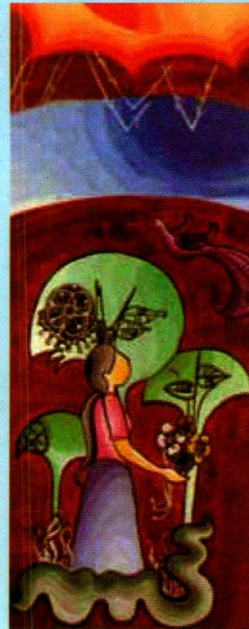


Protect the Ozone Layer

secure our future

A terrestrial life without the provision of sun rays is far from reality. But like in many other situations, there comes with these most beneficial rays, some radiation that can also be very harmful to the life that they are trying to sustain. These rays comprise of both high-energy; gamma rays, X rays and Ultra Violet (UV) rays and the low-energy; Infra Red (IR) rays. What is visible to the human eye lies in-between these two extremes.

UV rays can have deleterious effects on all living beings and plants on earth. The nature has taken care of this in its own intrinsic way so as to provide protection to all living things by way of a filter. This



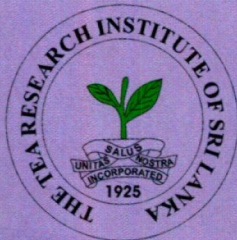
natural filter is called the 'Ozone Layer', and is made up of naturally occurring, Ozone gas. Ozone molecule is a combination of three Oxygen (O) atoms.

Activity of Ozone Layer

UV rays are of three types; UV-A, UV-B and UV-C. The first type is relatively of low energy and does not mean much harm to any life form. But, the other two types, UV-B and UV-C are capable of causing much harm to all living beings. How these two UV rays are trapped by the Ozone layer is illustrated thus;

Oxygen molecules in the stratosphere, upon exposure to UV-C rays are broken down to oxygen atoms. These oxygen atoms immediately react with oxygen molecules (two Oxygen atoms), to form Ozone molecules (three Oxygen atoms). UV-B rays react with these ozone

contd .. Page 2



National Program for Phasing-out Methyl Bromide Use from the Tea Industry has Succeeded

The project was carried out by the Tea Research Institute of Sri Lanka to phase-out the use of Methyl Bromide in tea industry was funded by the UNDP through National Ozone Unit of the Ministry of Environment and Natural Resources. Introduction and popularization of alternatives for Methyl Bromide to replace its use from tea nurseries through training, information delivery and skill development programs for those who were involved in the tea industry is main outcome of this project.

Dr. Sumathipala, Director of NOU won the Montreal Protocol Implementers Award 2008

Dr. W.L. Sumathipala, the Director of the National Ozone Unit of the Ministry of Environment and Natural Resources of Sri Lanka and his team received the *Montreal Protocol Implementers Award*, awarded by the United States Environmental Protection Agency (EPA), for their dedicated efforts, leadership and innovative approaches on Montreal Protocol activities, on the occasion of the 20th Anniversary of the Montreal Protocol.

Use of MeBr in the tea industry

There are three harmful nematode species identified, occurring in the Sri Lankan tea nurseries, all of which could be effectively controlled chemically, through fumigation. For this purpose, the Tea Research Institute of Sri Lanka has experimented with a number of chemical compounds. Among them are, the mixture of Di-chloro-propane (DBCP) and Di-chloro-propene (DD), Ethylene Bromide, Methyl Demeton Sulphoxide, Methyl Bromide, Dazomet, etc.

In 1940s, for the fumigation of tea nursery soils; DD or Shell-DD and Ethylene Bromide were used. But later on, Ethylene Bromide has been withdrawn upon finding that it could yield to phytotoxicities in plants.

In 1960s, TRI has made the nursery soil fumigation a compulsory activity. And in 1971, MeBr was recommended by the TRI in place of Shell DD, as the former was observed to be the most efficient fumigant.

In 1980, Dazomet, a fine granular powder was introduced by the TRI, which upon contact with water, is capable of releasing the fumigant, Methyl Isothiocyanate (MITC). Dazomet did not become as popular as MeBr, as the use of the latter was both less cumbersome and less time consuming. But due to the numerous efforts by the TRI in educating the grower about the damaging effects of MeBr on the environment, the reliance on MeBr could be brought to an end.

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Protect Ozone Layer ...

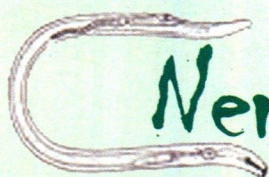
molecules to break them down again to an oxygen molecule and an oxygen atom each. This is a continuous process, which helps keeping the balance between the Oxygen and Ozone in the stratosphere. Most importantly, this process absorbs the extra energy contained in the UV-B and UV-C radiations of sunshine, which can otherwise have harmful effects on all beings living on earth's surface.

Causes for the disruption

It is several years since some scientists have found that some of the gasses released by man, during numerous actions performed by him, can be harmful to the ozone molecules of the stratosphere. Most serious among them are, the Chloro-Floro Carbons (CFCs). This is a group of chemicals that have been in common usage in our day-to-day lives for sometime now. Some of their uses are found commonly; in domestic refrigeration, in the manufacture of cosmetics, paints and pesticides. There are a number of chemicals that belong to this group, while Methyl Bromide (MeBr) has been widely used as a potent pesticide. MeBr (CH_3Br) can act as a good insecticide, soil nematicide and a fungicide as well. MeBr has become very popular in the control of nematodes in the soil, particularly at the initial stages of nursery itself. This had been proved to be very successful in the control of very damaging root diseases like red root (*Poria*), and has been used in its control until two decades ago.

Impact of CFCs including MeBr on Ozone layer

As the gaseous MeBr that is released at the earth's surface does not react with other gasses in the atmosphere, it gradually reaches the stratosphere. Here, upon exposure to the UV rays, MeBr molecules are broken down to release Bromine (Br) atoms. These Br atoms are highly energised and therefore, readily react with Ozone (O_3) to produce Bromine Monoxide (BrO). BrO is an unstable molecule and is broken down to form an Oxygen (O_2) molecule and a Br atom, again. This process of destroying O_3 in the presence of MeBr continues in the stratosphere, while releasing more and more O_2 . According to scientific estimates one atom of Br can destroy about a million molecules of O_3 . This invariably leads to the gradual thinning of the Ozone layer.



Nematodes

Prevention is better than controlling



The First report of Eel Worms (Nematodes), as they were known then, as a pest capable of causing damage to the tea plant dates back to 1928. This microscopic pest parasitizes the host plant while living inside roots, interfering with the water and food translocation systems of the host plant, thus debilitating its overall growth.

With the knowledge on nematodes expanding, three species that were capable of inflicting significant damages were identified from among hundreds of species that were soil dwelling. They are namely, *Pratylenchus loosi*, *Radopholus similis* and *Moloidogyne brevicauda*.

According to estimates by Dr Gnanapragasam, the losses attributed to nematodes in Sri Lankan tea, ranged from 4 – 40%. Dissemination of nematodes into tea fields mainly takes place through the improperly managed tea nurseries.

Different tea cultivars respond to damage by nematodes differently. Some cultivars do not support or sustain growth of nematodes within them and therefore are considered resistant to nematodes. Some cultivars while allowing nematode growth within the roots, do not suffer any appreciable losses and are therefore, considered tolerant. A third category of cultivars do not support or sustain any nematode growth within them and are considered immune. However, so far no tea cultivar has been found totally immune to nematode attacks.

It is now known that Guatemala (*Tripsacum laxum*) and Mana (*Cymbopogon confertiflorus*) grasses host *R. similis* and therefore, when resorting to rehabilitate lands prior to planting tea, it is important to incorporate the recommended nematicides to the soil (in the planting hole). Similarly, grasses like African Love grass (*Eragrostis curvula*), Vetiver (*Vetivaria zizanoides*) are other two common plant species found in tea plantations, capable of reducing nematode infestations.

Once a field is infested with nematodes, it is never easy to totally eradicate them. If the field consists of susceptible tea cultivars, the spread of infestation and the resultant damage will be very high. Therefore, it always pays to prevent introduction of nematodes anew into the field and their damages, rather than waiting till it happens to take measures to control them. Integrated approaches pay dividends in this regard.

First and foremost, serious attention must be paid in the tea nurseries, in which the soil medium must be free of any nematode infestations. This can be achieved by

proper fumigation, following TRI recommended measures. Properly treated nursery soil once filled into bags should be arranged in beds that have been fumigated. Having started the nursery correct, does not mean the end of the story. Watering, which is a routine activity, has to be undertaken with utmost care, because nematodes can find their way through to tea nursery bags with the irrigation water, unless adequate care is exercised. To achieve this, TRI has recommended the use of water only through sedimentation tanks or from fairly deep wells that do not allow surface running contaminated water in.

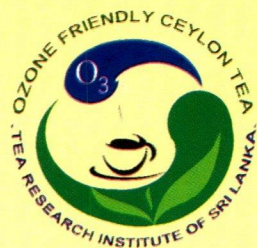
As the second most important step, only recommended grass species must be employed in a given area in rehabilitating lands prior to replanting tea. Avoid using Guatemala grass to rehabilitate soil in areas prone to *R. similis*, particularly in the low and mid countries. However, since the common species of nematode, *P. loosi* found in the upcountry is not influenced by Guatemala grass, it is safe to use them in the rehabilitation of soils, there.

As the next precautionary step, properly nurtured nursery plants must be introduced into planting holes in the field, which are treated with the recommended doses of nematicides.

Tea Research Institute has identified a series of plants that promote nematode populations that can be harmful to tea. Among them are, economic crops like coconut, arecanut, pepper, banana, anthurium, some grasses and weed species. Therefore, it is advisable to avoid any of these known alternative host species in and around tea fields, providing breeding grounds for the harmful nematodes. Anyone desirous of raising an inter-crop must seek prior advice from the respective scientists of the TRI in order to avoid any cross-contaminations.

In spite of an infestation by nematodes, any healthy tea cultivation, which has received all other good agricultural practices and therefore showing a good vigour, can always take care to minimise the potential ill effects.

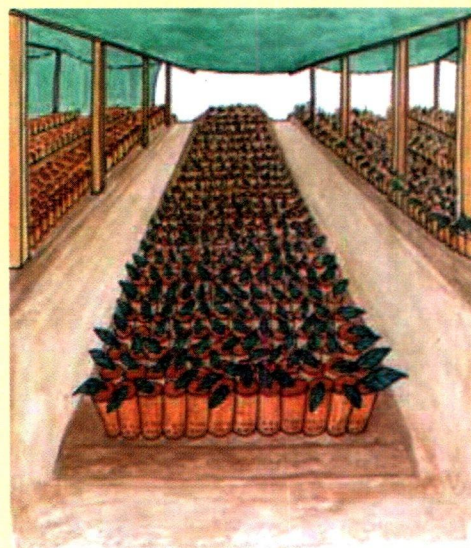
However, it is very well to bear in mind that any infestation in a tea plantation, whether big or small, is bound to cause harm. Similarly, it should also be remembered that eradication of nematodes from a field once infested, is also equally difficult. That is why the emphasis, that prevention of nematodes from entry into the field is always of paramount importance, rather than allowing them in and then attempting their control.



Phasing-out of the use of MeBr in Tea industry

The United Nations Development Program (UNDP) launched a project for funding activities in the developing countries to innovate and evaluate the alternatives for MeBr, to safeguard the depletion of Ozone layer. The project for introducing of alternatives to MeBr, in order to phase-out its uses in the Tea industry became eligible for financial support from a multilateral fund in 1995. Under the above fund, Tea Research Institute of Sri Lanka received two projects; one to find out the alternatives to phase-out the use of MeBr in tea nurseries and the other to disseminate new technologies generated, to tea growers in both corporate sector and the tea small holdings sector.

The first project was successfully completed in March 2003 and the current project, which is the second phase was initiated in August 2007.



Technology dissemination for phasing-out MeBr

After the introduction of economical and practically feasible alternatives for MeBr, now it is going to be increasingly important to implement an appropriate strategy for the technology transfer, dissemination and their adoption for sustainable application, in both corporate and small holding sectors in tea industry.

Tea Research Institute was tasked to undertake this project as it is in constant contact with plantation managements and tea small-holders providing regular advice on pest control and other agronomic issues in tea cultivation. TRI is equally well-informed of the relevant pest infestations in tea fields in various tea growing regions and the need to implement

alternatives in order to phase-out methyl bromide use in tea. The institute also has an effective, responsive and proactive extension and outreach programs to provide the technologies, research findings to tea growers

Financial part of the project was coordinated by the National Ozone Unit (NOU) of the Environment Ministry and the United Nations Development Program (UNDP) local office, while the technical activities were coordinated and conducted by the team of Extension staff of the Advisory and Extension and Nematology staff of the Tea Research Institute of Sri Lanka.

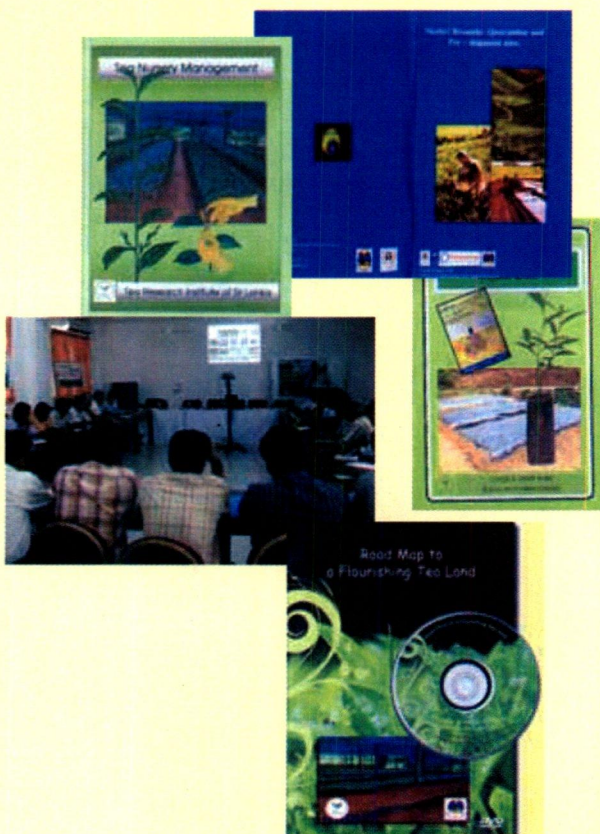
Objectives of the Project

The main objective of the project is to disseminate technologies developed by the Tea Research Institute of Sri Lanka to facilitate tea growers by adopting effective, practical and economically feasible alternatives to MeBr in preparing for its phase-out from the tea industry in Sri Lanka.

The specific objectives are:

- To train the trainers in tea industry to disseminate the alternatives technologies introduced to phase-out the use of MeBr.
- To make tea growers in both corporate sector and small holdings sector aware the need of phasing out the use of MeBr in Sri Lanka.
- To establish nursery demonstration sites on the use of alternatives for MeBr in tea that can be visited by the tea growers.

- To monitor and evaluate the overall sustainability of the adoption of alternatives and to establish a scientific monitoring system to control nematodes in tea nurseries.
- To develop a planting material certification system and policy initiatives to produce nematode free, healthy and vigorous tea plants.
- To make general public aware the phase-out of MeBr from the tea sector and producing tea, following ozone layer friendly techniques.
- To produce teaching and outreach materials to use in the technology dissemination and awareness activities.



Main Activities of the Project

1. Training of Trainers (TOT) Programs
2. Awareness programs for tea smallholders, commercial tea nursery owners, management of corporate tea sector and field staff on new technologies of nursery management
3. Establishment of demonstration sites
4. Development of legislative and regulatory procedures for certification of commercial nurseries
5. Public awareness activities
6. Production of outreach materials (posters, sticker and digital hoardings) to make the general public aware on the phasing-out of MeBr and on producing the “Ozone Friendly Ceylon tea”
7. Establishment of a nematode management and monitoring procedure
8. Production of training and extension materials
9. DVD film in Sinhala and English on “Sterilization of Soil used in Tea Nurseries”
10. Training manual on tea nursery management and other publications for the use of Trainers in tea cultivation.

TOT Programs conducted under the MeBr/TOT Project

1. Training of Advisory and Extension staff of TRI on new nursery techniques: 23rd August 2007 at the auditorium of Tea Research Institute, Talawakelle.
2. Training of Regional manager, Assistant Regional Managers and Extension Officers of the Kandy RM region of the TSHDA, on 10th March 2008 at the Ratnasiri Wickremanayake Training Centre, Uduwela, Kandy.
3. Training of Regional manager, Assistant Regional Managers and Extension Officers of the Nuwara Eliya RM Region of the TSHDA on 11th March 2008 at the Ratnasiri Wickremanayake Training Centre, Uduwela, Kandy.
4. Training of Regional manager, Assistant Regional Managers and Extension Officers of Bandarawela RM Region of the TSHDA on 17 & 18 of March 2008 at the THSDA Training Centre at Bandarawela RM Office.
5. Training of Regional manager, Assistant Regional Managers and Extension Officers of Ratnapura RM Region of the TSHDA on 19th & 20th of March 2008 at the auditorium of TRI, Ratnapura.
6. Training of Regional manager, Assistant Regional Managers and Extension Officers of Kegalle and Kalutara RM Regions of the TSHDA on 24th & 25th of March 2008 at the auditorium of TRI, Ratnapura.
7. Training of Regional manager, Assistant Regional Managers and Extension Officers of Matara RM Region of the TSHDA on 3rd of April 2008 at the auditorium of Wakwella Management Training Centre.
8. Training of Regional manager, Assistant Regional Managers and Extension Officers of Galle RM Region of the TSHDA on 4th of April 2008 at the auditorium of Wakwella Management Training Centre.
9. Workshop and the evaluation of TOT programs conducted on new nursery techniques on 12 May 2007, at the auditorium of Tea Research Institute, Talawakelle.

Food
the



The Project on Phasing-out of the use of MeBr in tea industry organized several activities to make stakeholders aware on alternatives for MeBr. These programmes had a very good response both from corporate sector and smallholder sector.

Few activities captured on our camera are shown here.



Footprints of Success



Nursery Soil Fumigation

Importance of Fumigating tea Nursery Soils

Nematodes, once introduced in a field and when the plants become infested, there is very little one can do to reduce the damages inflicted upon the crop, and even if available it will be at an exorbitant cost. Therefore, the importance of preventing nematode infestations, starting from where it matters, that is at the nursery, cannot be overemphasised.

These nematodes can be transmitted into a field through planting material, soil, animals, agricultural implements and water that runs through such lands. Once introduced, their long term establishment and rate of spread will depend upon the type of soil, environmental and other relevant factors. It has now been established that these three nematode species can be encountered in all tea growing districts at variable intensities.

Symptoms of Nematode infestations

When the nematodes are established in a tea root system, causing damage; the leaves will turn pale yellow, producing plenty of flowers and fruits as it advances into the infestation. 'Spread' of the bush slows down along with the height, thus reflecting on an overall and gradual debilitation in growth. However, it is well to note that such similar symptoms can also be brought about by long term ill drained soil conditions, prolonged droughty conditions and due to imbalanced nutritional status or due to any other limitation that would yield to weakening of the feeder roots. In order to establish the cause of the problem it is advisable to seek assistance of the Tea Research Institute (TRI).

Control of Nematodes in Tea Nurseries

Infested tea plants can be the main source of dissemination of nematodes into a tea field, afresh. They can spread nematode infestations into new fields of a given estate or to a totally new area of a region where nematodes were not found hitherto.

Therefore, it becomes incumbent upon all tea growers present and future, to prevent any and all avenues of nematode infestations, because once introduced, getting rid of them is no easy task. This makes it mandatory to treat the nursery soils and nursery beds out of nematodes.

There are several methods available at our disposal for the control of nematodes. Amongst them, chemical fumigation is found to be the most efficient, considering the threat it poses.

In the tea nursery system, soil fumigation can ensure free from nematodes and more importantly, healthy and vigorous plants that are going to establish well and faster in the field.

How to fumigate

Soil fumigant is a chemical compound or a mixture of them that are capable of releasing a toxic gas that kills all the soil dwelling organisms.

A successful fumigation involves two important aspects. The first is that the nematodes should be active at the time of treatment. The second, at the end of fumigation the treated soil should not have any traces of the chemical by way of residues that may harm the subsequent crop.

TRI recommend Dazomet 98% (Basamid) at the rate of 250 g per cube of soil or the Metham Sodium (Metham) at the rate of 800 ml per cube of soil for fumigating nursery soil.

Use of fumigants is not considered to pause any threat by way of residues, in made tea as the gap between treatment and the first processing of made tea is too far apart.

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Soil Solarization for Nematode Control

The use of thermo-therapy or heat treatment as a means of killing phytophagous nematodes is a well established technology. Studies have shown that the exposure of soils to temperatures even below 45° can be lethal to nematodes if happened over long periods.

Sun's short wave (0.2 – 80 μm) and long wave (4 – 80 μm) radiations providing the source of energy for solarization. Normal transparent polythene that we use day to day, allows sun's radiation in the range of 0.4 – 36 μ to penetrate. Use of black colour polythene tends to absorb part of the energy of sun's radiation. For this reason, use of more efficient transparent type polythene is encouraged for this purpose, in tea nurseries.

Use of polythene minimises, the loss of heat through direct convection currents and by way of water vapour. The water vapour that deposits in a film on the underside of the polythene prevents the escape of long wavelength heat radiation, thus simulating the green house effect. This provides additional heat under the cover, making the process more efficient.

How do we solarize the soil?

Transparent polythene of 500 gauge is recommended for soil solarization. Under dry weather condition the solarization process normally takes about 2 months, taking progressively longer time periods if there are interruptions to the incident sunlight. Therefore, it will be necessary to initiate the steps of collection of soil and filling of bags ahead of soil solarization proper, by about 2 – 4 months.

Nursery beds should be located in a place, guaranteed of plenty of sunshine, devoid of large trees or buildings. A bed should be approximately 3 ft wide and of any convenient length. There should be provision for a drain right round, to take away any excess water. Nursery bags of 9 in x 5 in (lay flat) are filled with sieved/processed soil and stacked on the beds.

Water the nursery bags well in order to moist the soils in the bags. This is important for two reasons. Firstly, when the nematodes in wet soils become active, they are more sensitive to heat. Secondly, since the soil is a

week conductor of heat, the wetness around soil particles (thin film of water) makes it improve the conductance of heat, significantly.

A few soil-filled nursery bags must be laid on top of the stacked bags, as shown in the diagram, in order to provide for a space of a few inches between the top of the nursery bags and the polythene sheet above them. The edges of the polythene sheet should be properly secured on all four sides of the bed. Nursery beds thus covered should be exposed to direct sunlight over a period of six weeks, if the duration of sunlight is not less than 5 hours per day. For any day that receives less than 5 hours of sunshine, an additional day should be allowed.

Efficiency of Soil Solarization

It may not be possible to use this technology in all tea-growing districts, mainly due to limitations imposed by the sunshine hours, which do not meet with the stipulated minimum of 5 per day. Accordingly, this qualifies the Badulla District in its entirety, except for the Haputale region. This method can also be employed in the control of nematodes in Balangoda and Rakwana regions of the Ratnapura District and in Urubokka region of the Matara District.

If and when above conditions are fulfilled, solarization can bring about a temperature of 50°C on the surface of the heap, while this will achieve a temperature in the range of 35 - 40°C at a depth of 7 – 15 cm depth. Further down, at a depth of 30 cm, the increase in temperature can be from 1 – 2°C more than the ambient temperature of the locality. Since the overall height of the nursery bag does not exceed 22 cm, this level of rise in temperature is considered to be adequate for the satisfactory control of nematodes inside nursery bags. It has been observed that a temperature of 30°C is needed to kill nematodes in the soil.

Soil solarization can be carried out even prior to filling nursery bags. In this situation, the soil is heaped up to a uniform height of 20 – 25 cm and then cover with the polythene sheet, while maintaining an air cavity

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Sampling of Tea Nurseries for Nematode Analysis

In order to prevent spread of nematode infestations in the field, it is imperative to diagnose their presence in the first place. Collection of soil and root samples, in the nursery must be essentially undertaken by an individual who has the required knowledge or under such someone's supervision.

- Select a minimum of five plants, for each 1000 plant-bed of nursery, at random.
- Select five adjacent beds of same cultivar and of same age, of above dimensions.
- Remove the plants from the bags and sever the feeder roots into a polythene bag.
- Cover the separated out roots with a little soil, to prevent any desiccation.
- Label the bags appropriately, indicating the Estate name, Location of nursery/ Division, Tea cultivar, Bed number and the Age.

Nursery Soil Fumigation is compulsory

It is now mandatory to fumigate nursery soils of all the tea growing regions.

Only the root samples are collected from the nurseries. The cuttings inserted in the nursery bags take about 6 months to develop a reasonable root system. Therefore, sampling in the nurseries should be aimed for this time around. One sample should comprise at least 10 grams of roots. In order to realise this, the following procedure could be adopted;

Irrigation Water

If there are nematode infested fields in the Estate, any water flowing through such fields could contaminate water to spread nematodes to other fields and nurseries. It is of best interest to construct 'Sedimentation Tanks' or 'Fairly Deep Wells' to provide irrigation water, free from nematode contaminations.

Forwarding of samples to the TRI

It is very important not to expose the polythene bags containing samples (root or soil) to direct sunlight or any other heat source, which could increase temperature inside bags.

It is also very important that all these samples are sent to the TRI, within the first 24 hours from collection, as delays could cause death of nematodes thus leading to erroneous results.

To assure more accurate recommendations, include a note indicating the field history.

Where to send the samples

These samples can be sent to Talawakelle, Ratnapura, Hantana, Deniyaya and Kottawa stations of the TRI on a prearranged date. To obtain a date, a letter should be addressed to the Head, Entomology Division, Tea Research Institute, Talawakelle or in the alternative, the respective Officers-in-Charge of the Ratnapura, Hantana, Deniyaya and Kottawa regional Centres. It is also important to remember that in any of these stations only 10 samples can be handled on any working day.

Head Office at Talawakelle	051 2222601	Low country Centre, Ratnapura	045 2228851
Mid country regional Centre, Hantana	081 2218832	Galle Regional Centre, Kottawa	060 2903259
Deniyaya Regional Centre, Deniyaya	041 2273941		

Please note

Water samples and the soils that are intended for nurseries are not accepted by the TRI for nematode analysis.

Basamid granules and Metham Sodium are the present recommendations as fumigants for nematode control in tea. These chemicals are highly poisonous to the human and other animals. Therefore, careful handling of these fumigants is essential.

Points to remember

The active ingredients of Basamid and Metham Sodium are toxic to all forms of plant life and therefore should be kept away from them.

Any traces of the fumigant remained un-escaped in nursery soil can be harmful to the inserted tea cuttings. Therefore, it is very important to ensure that the soil is totally free of any traces of the chemical. This can be asserted by exposing the treated soil to some germinating seedlings (*i.e.* mustard, lettuce).

Storage and Disposal of the fumigant

- Store the fumigant/s in well-ventilated, dry room.
- Ensure that the place is not humid and the temperatures do not exceed 50°C.
- Store the fumigant/s always in its/their original containers tightly closed.
- Avoid storing with human or animal feed, seeds and fertilizer.
- Do not litter the water sources, cultivable lands and human habitats with empty containers.
- Empty containers should be destroyed preventing any reuse.

First-aid

If the chemical has come in contact with the eyes, wash them thoroughly with running water at least for 15 minutes. Consult a Physician, if pain persists.

Any contacts with the skin should be washed with clean water and soap. If there is any uncomfortable feeling, consult a Physician.

Any accidental swallows occurred, make the patient to drink two glasses of clean water to induce vomiting. Take the patient to a Physician, immediately.

If the gas is inhaled, take the patient to a well ventilated place with clean air. Provide artificial respiration if necessary. Take the patient to a Physician, immediately.

Rate of Application

follow the guidelines/ recommendations of TRI

Warning !!

- Keep the chemical out of reach of children.
- Do not allow this product (both granular and gaseous forms) to come in contact with food, eyes, skin or clothes. Avoid any inhalation of the gas.
- Clean the body with plenty of water after using of fumigant.
- Refrain from chewing betel or smoking, during the use of the chemical.
- Wear protective gear during the fumigation *i.e.* overall, hand gloves, goggles, boots, *etc.*
- Wash all the clothing and the protective gear after using
- Clean all the utensils that are used in fumigation.
- Do not allow the chemical to contaminate water source.

Soil Solarization

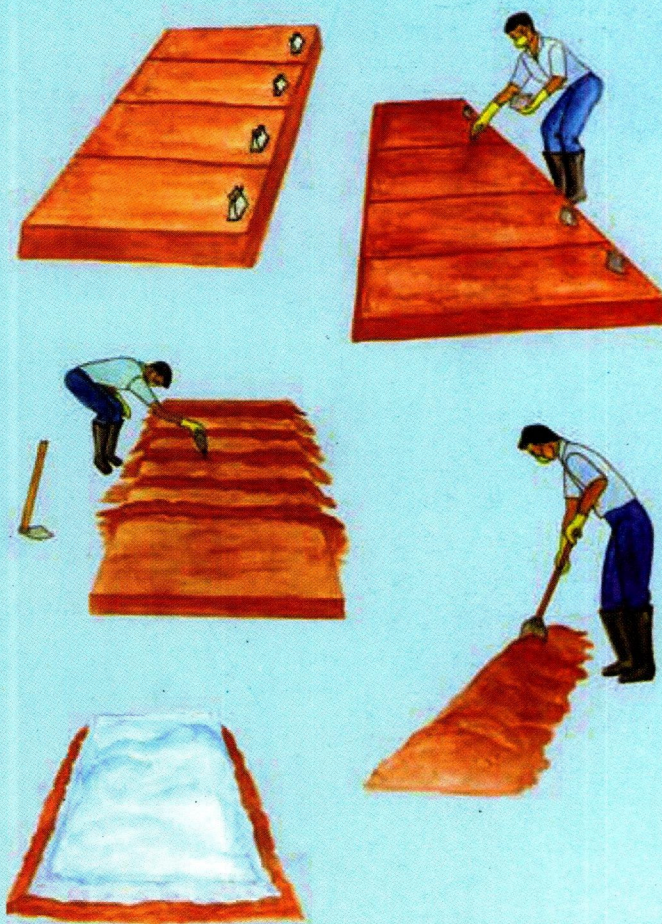
immediately above the soil with the use of several soil filled nursery bags, placed on top of the soil heap. In preparing soil for solarization, the soil heap should be kept moist with the provision of water from overhead, using a watering can or any other mechanism. There is no necessity to provide any water during the process of solarization.

Importance of soil solarization

Soil solarisation does not rely on any chemical and therefore, is very environmentally friendly. Because of the simplicity of the process, it is easy to adopt without incurring heavy expenditure. The feature most important in solarization is the correct determination of solar radiation hours and adjust the duration of solarization accordingly.

Fumigation of Soil

- Moisten the sieved soil adequately 2 weeks prior to the commencement of fumigation
- Fumigate the nursery beds 2 weeks prior to the fumigating of soil
- Prepare the soil heap into a rectangular shape at a height of 15 – 20 cm (6 – 8 in) and then spread Basamid on the soil uniformly or sprinkle the Metham Sodium on the heap uniformly
- Mix the soil well using a mamoty and make soil heap into a convenient dimension (rectangle),
- Moisten the heap using a watering can and cover the soil heap with 500-gauge polythene sheet and keep it undisturbed for 7 days,
- Remove the polythene on the 8th day and mix the soil heap thoroughly using a mamoty on the 9th day,
- Mix the soil heap on the 12th day again and the final mixing has to be done on the 15th day and use the soil for filling bags on the 22nd day.
- Introduce tea cuttings into bags/soil on the 29th day



Fumigation of nursery beds

Nursery beds that have been in use before are bound to harbour nematodes both in soil and in root fragments. Therefore, it is necessary to fumigate nursery beds at least two weeks prior to the stacking nursery bags.

- Treat the nursery bed with Basamid, uniformly by sprinkling at the rate of 10 g per square meter.
- Dibble the chemical in, using a hand fork,
- Beds can be used for stacking nursery bags two weeks later.

TRI UPDATE



Tea Research Institute of Sri Lanka
Talawakelle,
Sri Lanka