Technical Session 5
Improving Realization: Non-use of Chemicals
Chairman Yukihiko Hara

Chapter 21

ECO-FRIENDLY MANAGEMENT OF TEA PLANTATONS TOWARDS SUSTAINABLITY

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Dr. Nalini Gnanapragasam has more than 33 years of research experience in tea agriculture. She was the Deputy Director In-charge of Research at the Tea Research Institute of Sri Lanka during the period 1990-1995 and also the Head of Nematology Division from 1980-1995. She holds a Master of Philosophy and a Ph.D. degree in the field of Insect Physiology. She had been pioneer in directing the environmentally friendly IPM strategies to manage plant parasitic nematode pests of tea and was also involved in management strategies to control selected insect pests using metabolic disrupters. In addition to her research activities she had followed an advanced training program in Agricultural Research Management conducted by USDA in Washington, U.S.A in 1992. At present she is working as a Tea Consultant to some of the plantation companies in Sri Lanka and is the Director of the tea consultancy firm, Crop Optima Limited.

INTRODUCTION

Environmental conservation and sustainable agriculture have become trendy subjects discussed at various forums by an increasing number of individuals, ranging from policy makers and professionals, to average laymen.

The consumption of forests, energy and land by humans is far outstripping the rate at which the Earth can replenish itself. According to recent studies conducted by a California research group, the impact by humans on the environment had inched higher from what was 70 percent of the earth's regenerative capacity in 1961, to the present level of a negative balance where it would take 1.2 years to regenerate what we consume in one year! As this rate of varacious consumption is increasing year by year, the group has warned that a failure to arrest this dangerous trend could lead the planet into "ecological bankruptcy".

We who are associated with the plantation industry have an obligation to conserve the sensitive lands we have exploited to our advantage, by halting the on-going degenerative processes and maintain these in a sustainable manner for the continued sustenance of generations to come.
The expanse of pioneer tea established as a mono-crop within the cleared primordial forests in Sri Lanka set in motion the erosion of the stable forest ecosystem to a destabilized one. With the further expansion into natural forests occupying the catchment areas of the crucial mountain terrain, the degree of destabilization increased further.

With the progress of time various 'improved' agricultural technologies had been introduced into the tea sector with the primary goal of increasing yield, with little if not hardly any

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concern to the impact of such technology on the fragile ecosystem. Many of these systems of cultivation have caused severe environmental imbalances, affecting growth and productivity of tea in several areas. These disturbances were mainly connected with the large-scale use of chemical fertilizers, which in turn caused excessive soil acidification and the consequent physical compaction. These changes in soil physical structure accelerated erosive surface run-off and loss of fertility through continued depletion of humus content. The indiscriminate and heavy use of pesticides have further compounded the problem of environmental instability, as a result of the ecological dislocations caused to the faunal and floral populations within the plantations.

Studies on environmental impact assessments have clearly demonstrated the negative aspects of the adoption of some of these "improved technologies". Following such understanding, there is at present a greater concern and emphasis for adopting eco-friendly agricultural practices, which would turn around tea cultivation to be one that would cause minimal damage to the environment and thus ensuring the progress towards sustainability. Such measures are geared to (a) grow the tea crop in a sustainable manner giving the utmost priority to environmental concerns, and (b) produce a clean end product that is acceptable to the growing numbers of health-conscious consumers and thereby become competitive, particularly in the context of a likely over-production scenario.

The above two concerns are inter-linked to the extent that the growing of tea in a sustainable manner does take into consideration the environmental issues and concerns that lead to the production of an end-product that qualifies well to be accepted by the health-conscious consumer. This is achieved by adopting the concept of "green farming", which is an environment-friendly sensible farming concept that has the minimal impact on the environment and ensures the system to be a sustainable one, while at the same time ensuring the production of a well made, clean, quality end-product that is in demand by the international trade.

CAUSE FOR CONCERN (THE PROBLEM)

Soil degradation and the associated fertility degeneration, along with the over-use of agro-chemicals have led to the emergence of a multitude of problems that have not only contributed to an escalation in the cost of production, but have had severe impacts on the environment to the extent of rendering tea cultivation to be a non-sustainable one. The problem gets compounded further when the end product itself is not in keeping with the expected standards and demands of the international trade, with the resultant decline in price, especially within the scenario of expanding global production.

Soil degradation through actual physical loss caused by excessive erosion and the consequent fertility degradation including loss of humus, along with chemical accumulation from artificial fertilizers and other agro-chemicals, have rendered significant extents of tea soils to become virtual sterile media that continue to be totally dependent on further chemical inputs. Many plantations had thus been forced to be on the "chemical treadmill" for the past several decades.

LAND MANAGEMENT

The volume of over 300 million kg of tea produced last year in Sri Lanka is the sum total of produce emanating from a wide range of tea extents. These include the fertile lands where tea could be cultivated in a sustainable manner to the very poor degraded ones on the steep and rocky terrain, that are no longer economically viable for tea growing. In such a scenario, the average cost of production is bound to be high. Marginalizing the poorer extents

and concentrating the available resources on the economically viable extents that would yet produce the same volume, overall costs are better managed. The uneconomic tea lands are being diversified to the much-needed fuel-wood plantings, the availability of which scarce resource is beginning to emerge into a crisis situation.

The challenge facing the tea scientists and the associated stakeholders is to reverse all such problems to the point of re-establishing the cultivation of tea to be an environmentally friendly and sustainable one that is economically viable and helps to consistently generate an end-product that commands the attention of the international trade that promotes tea as a health beverage. The reversal of such deleterious degradation has become possible through the adoption of sensible time-proven old agro-technology, including proper soil conservation measures by terracing, draining and the establishment of contour hedge-rows crops, and fertility improvement by mulching, composting and the re-cycling of prunings and the incorporation of green manure as well as refuse tea back to the soil.

The practice of establishing intermittent contour hedge rows of fast-growing mulch producing leguminous crops, such as *Calliandra calothyrsus*, *Flemingia congesta* and *Tithonia diversifolia* (sun flower), has proved very useful in aiding the build-up of live terraces and significantly improving the soil fertility as well; the hedge rows are lopped periodically and the lopping used as surface mulch within the inter-rows of tea between the hedges. This practice, which was first introduced on steep lands in the Philippine islands, is popularly referred to as SALT (Watson, 1990).

The implementation of this technology amongst the tea plantations in the sloping terrain of the mid and high elevations of Sri Lanka has proved very successful in soil conservation and fertility improvement on these tea lands. Successful implementation of this technology helps to do away with the otherwise required large numbers of lateral drains requiring expensive maintenance (Ekanayake, 1994, 1999), and with time leads to significant reduction on the dependence for additional fertilizer supplementation.

PEST & DISEASE MANAGEMENT

The greatest dislocations to the growing environment has been in the area of pest and disease management that came to be dependent almost entirely on a chemical approach involving the use of a wide array of chemical pesticides. During the pioneer years, when tea was grown with low-input traditional cultivation practices, with the total lack of agro-chemicals, the tea growing environment remained relatively undisturbed, when the majority of pests and diseases that are presently causing serious damage to tea were kept under natural control. However, with the further large-scale clearing of forests and the indiscriminate use of inorganic fertilizers and pesticides (more specifically from the mid-part of the last century), this scenario changed to one of a declined status of biodiversity, with the consequent build-up of pest species causing serious damage in many areas of the tea-growing countries.

Apart from the ecological disruptions caused by wide-scale use of pesticides, residue problems in the made tea has caused a grave global concern to establish the permissible maximum residue limits (M.R.L.s) of pesticides in tea, which should ideally remain much below the threshold level of physiological consequence to tea consumers.

During the past three decades the rapidly emerging global demand for environmental concern and food safety has led to the cautious adoption of a variety of sensible alternate pest and disease management strategies in Sri Lanka, thus paving the way for the

emergence of integrated pests and disease management systems that ensure the management of pests and diseases within acceptable damage threshold limits, rather than one aimed at almost total eradication.

Since the mid-1970s, the environment disrupting broad spectral long-persistent pesticides have all been totally banned in Sri Lanka. A greater emphasis is presently placed on various cultural practices that enable the tea plants to better tolerate pest damage as well as by harnessing plant-derived botanicals and short-persistent chemical pesticides that help to maintain pest populations below the damage threshold.

The adoption of such sensible strategies became possible only following the detailed studies of the host-pest interactions and relating these with the changing micro and macro-environments. Such knowledge also made it possible to establish damage threshold level for some of the important perennial pests such as shot-hole borer (Sivapalan and Delucchi, 1974) and pathogenic nematodes (Gnanapragasam and Manuelpillai, 1984; Gnanapragasam and Herath, 1989). The damage threshold levels established in other countries are also used in Sri Lanka, including the threshold for mites in India (Banerjee, 1977), and for tea looper and pink mites in China (Chen Xuefen and Kunshan, 1988). Supplementary pesticide treatments are adopted only when pest populations threaten to exceed such established threshold limits. Wherever chemical control measures are needed, proper timing by maintaining regular vigilance with early warning devices results in only spot treatments.

The environment-friendly strategies that are being adopted by us in developing an integrated strategy include (a) manipulating the growing environment and the microclimate to suit the quick build-up of natural predators and parasites and at the same time enable the environment is less conducive for the build-up of the target pests, and (b) harnessing selected botanicals and related bio-pesticides to supplement the natural pest management methods.

MANIPULATION OF THE ENVIRONMENT

Physical Management

A proper vigilance through regular field inspection is being maintained for the timely detection of any signs or symptoms of attack. The badly damaged and weakened tea bushes, which are not economical to maintain, and harbour significant pest population, are expected to be eliminated on time as these continue to serve as reservoirs for future pest build-up. Thereafter the resultant vacant areas are planted to healthy vigorously growing pest-tolerant cultivars that are suitable to the specific environment.

Alternate Hosts

In order to ensure that the specific growing environment is less conducive for the build-up of the particular pest/disease, care is taken to prevent the growing of any other crop species that would serve as alternate reservoir hosts to the target pest or disease.

Soil Environment

All recommended practices that enhance soil fertility, including forking of soil, incorporation of compost / vermi-compost / other organic matter and humic acids that help improve soil fertility, are recommended for meticulous adoption. Such improvement in soil fertility, besides strengthening the health and vigour of the target crop, enhance biodiversity and help the build-up of beneficial soil organisms that limit build-up of serious soil pests.

Use of Fertilizers

The balanced supply of plant nutrients maintains the host plants in a healthy and vigorous state, thus

enabling the latter to withstand pest damage to significant extents. Higher supplementation with potash fertilizer is known to enable the tea plants to better tolerate nematode damage (Gnanapragasam, 1982) as well as attack by SHB (Muraleedharan and Selvasundaram, 1996). Sri Lankan tea fields that are identified to be infested with nematodes and / or SHB are treated to high nitrogen/potash ratio of 1: 2.

Growing of Resistant /Tolerant Varieties

The growing of tea cultivars, which are naturally resistant or tolerant to the major pests and diseases, is one of the most effective means for managing pest /disease in tea. As a result of the continuous screening of different cultivars, this strategy has been effectively harnessed amongst the tea plantations of Sri Lanka against SHB (Calnaido, 1972; Danthanarayana, 1973; Thirugnanasuntharan and Jayachandran, 1989), live wood tea termites (Sivalpalan *et al*, 1980) and plant pathogenic nematodes (Hutchinson, 1960, Gnanapragasam, 1988).

Minimizing Predisposition to Pest Attack

Certain innocuous (secondary) pests attack a given plant species only when the potential host becomes weak, as a consequence of specific environmental stress such as poor soil conditions, improper and inadequate agronomic inputs, predisposition to attack by other serious pests and/or diseases, etc. A proper understanding of this phenomenon helps to avert serious pest incidence by adjusting specific cultural practices. The adoption of sanitary measures that have helped reduce the entry and attack of live wood tea termite, a very serious pest of tea in Sri Lanka, is one such example (Sivapalan and Senaratne, 1977, Sivapalan *et al*, 1977).

Harnessing Natural Forms of Control Methods

Methods of natural control successfully implemented in Sri Lanka include the use of 'trap' crops, soil amendments, harnessing botanicals, use of escape strategy and biological control.

Trap Crops

These crops having specific chemical substances that are toxic to the target pest species initially attract the pests to them, thus effectively serving as diversionary hosts, and thereafter kill the trapped pests. Examples of such successful crops used in Sri Lanka include *Targets* sp., *Arachis pintoi, Eragrostis curvula, Tithonia diversifolia, Wedeliya trilobata* and *Vetiveria zizanoides* that help control parasitic nematodes (Gnanapragasam, 1981, 1995, 1997). Another effective trap crop is *Gliricidia sepium*, the decaying lopped stumps of which help to attract the swarmers of live-wood tea termites and induce egg laying, and thereafter the accumulated toxic substances kill the hatching nymphs (Sivapalan, *et al*, 1977).

Soil Amendments

Soil incorporation of plant and animal refuse helps to induce physical, biological and chemical changes that further help to increase the population of natural enemies of given target pests and also help the plants to better tolerate pest attack. This environment-friendly means of control is being practiced in Sri Lanka to control parasitic nematodes. The main soil amendments recommended include tea waste (refuse tea), neem oil cake, coconut oil cake, poultry manure, castor oil cake (if available; Gnanapragasam, 1991) and use of decaying water hyacinth (*Eichornia crasipes*; Gnanapragasam, 1994).

Botanicals

These plant-derived chemicals are presently used in controlling certain economically important tea pests. One such most popular plant species is *Azadirechta indica* (the Neem tree) known to control pathogenic nematodes of tea (Sivapalan, 1980; Gnanapragasam, 1984, 1991), tea mites,

tea mosquito bugs and various caterpillar pests (Sudoi 1998; Udaiayan and Ramarathinem, 1994). The other popularly used ones include extracts from *Lantana* and *Adhathoda* used mainly in organically farmed areas (Stassen Bio Tea Project, personal communication; Maskeliya Plantation, personal communication).

Mating Disruption

Use of sex pheromones of tea tortrix dispersed at various strategic points within the tea field has shown promise to bring about mating disruption, with the consequent decline in tea tortrix outbreak. Though recommended, this practice is yet to be harnessed in the tea industry of Sri Lanka.

Escape Strategy

The shot-hole borer beetle pest of tea in Sri Lanka is attracted to the re-growing stems on a pruned tea bush, only during a particular stage of maturity. Having studied the migration pattern of the beetle within a given year, the pruning of tea bushes is timed in such a manner that the vulnerable stage of maturity of the main primary branches does not coincide with the peak migration time of beetles. Such an "escape strategy" has caused significant curtailment of damage to the fields recovering from pruning (Sivapalan, 1985).

Biological Control

There are several species of identified natural enemies, including a variety of predators, parasites and disease-causing micro-organisms that help in the regulation of a variety of tea pests in Sri Lanka. Examples of a few of these include *Macrocentrus homonae* parasitising tea Tortrix (Dadd, 1941), the braconid parasite, *Apanteles* sp of the Tea Looper caterpillar (Danthanarayana and Kathiravetpillai, 1969), the bacterial species, *Pasturia penetrans* parasitising pathogenic nematodes (Mohotti, 1998), and the entomopathogenic nematode (*Heterorhabditis* sp. and *Steinernerma* sp.) attacking live-wood tea termites (Danthanarayana and Vitarana, 1987, Amarasinghe and Hominick, 1993).

The above strategies are presently being well integrated towards a stable environment with minimal pest damage, thus re-entering the era of "green farming".

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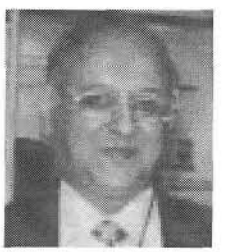
Chapter 22

AN EXPERIENCE OF REALITY OF NATURE – A PERCEPTION THROUGH REALIZATION

J. Patel*

Mr. Jayant Patel is a senior tea planter from Jalinga Tea Company. He has experienced reality of nature and would like to share with you his perception of natural cultivation without any artificials and its impact on the production and economics of tea growing in one of the most difficult tea groining areas viz. Cachar. The title of the paper appears to be very interesting.



THE CRISIS IN TEA PLANTAION

The present grim situation faced by the tea industry is a matter of concern for all. Poor exports, high production, low quality imports, poor marketing, high input costs, low price realization of our teas etc. are some of the reasons given for this. Change in any of the above factors would change the whole scenario and there would be no apparent crisis. For example, if Indian per capita tea consumption goes to 1 kg per annum, there would be apparent shortage of tea; this can be possible in a year or two if iced tea is strongly marketed.

One area we normally play down upon is the increasing consumption of fertilizers, pesticides and herbicides. This has made our soil inert and plants toxic. The ecosystem is almost lost. Today it is difficult to find dragonflies and earthworms in the tea estate. Pests are no longer area specific. Pests found earlier in Dooars only are now common in Assam and Darjeeling at a height of 5000 ft. With each new discovery of chemical molecule for pest control, we get new pests the following year. Yet we do not learn that we have not been able to eradicate any of these pests over the years. A newer version keeps coming: the rampant use of herbicides has eroded our soil.

Under the so-called modern, scientific farming method, we have been spraying poisonous chemicals on tea plants and the soil for several decades. What is more alarming is that we continue to do so even today and at the same time we are trying to promote tea as a health drink. Under this situation the entire tea industry is finding it extremely difficult to have an alternative and rational method that would ensure a safe, convenient and effective pathway to come out of the vicious web of chemical practices. When we sit back and try to think what we have been doing in farming and plantation, we realize that this is really not a scientific way of working with nature. But is there an alternate method that is cost effective and sustainable? The various forms of organic cultivation presently practiced try to eliminate the chemicals, but the steep increase in cost and reduction of crop for several years make them unviable. They then move to any certification agency for better price realization when exporting their products. Thus, unless a high price for the final product is assured, one cannot think of moving into that direction.

About three years ago, a research organization named Inhana Biotech approached us with a unique

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proposal. They had the technology that would allow us to stop the use of all chemicals

Without loss of crop and without increase in cost of *inputs*. The energized and poetized herbal extracts provided by them were to be sprayed on plants for sustaining growth and keeping the plants free of pests. These contained no fertilizers, micronutrients or growth promoters.

THEORY

The objectivity of the principle of Inhana Biotech is to return back the following two lost heritages of the plant kingdom.

a. Self-nourishment: Five basic elements (*pancha-mahabhutas*) soil, air, water, fire and space take care of nourishment till the time we humans do not interfere with these qualities; it performs without any problem. The individual element has its specific role in mechanism of nourishment like the earth element controls nutrition and structure formation, and the air element controls respiration etc.-
b. Self-protection – the self-defense mechanism is controlled by five different life forces or *prana shaktis*. These originate from the basic life force, i.e. solar energy. The life forces or *prana-shaktis* are actually vehicles of these basic elements and movement of nutrients is impossible without them. These life forces or *prana-shaktis* control specific functions like transpiration, respiration, photosynthesis etc.

Mr. P. Das Biswas of Inhana Biotech believes that the right method would be to feed the plant qualitatively from the soil and quantitatively from the atmosphere-, which is natural to its philosophy. The principle behind the technology is *sanjeevan* system, which means 'to add life'. Since it works on the principle of 'energy management' and activates five basic elements, it can be called 'energy element activation principle'. If there is any imbalance in sub-functions like structure formation, circulation, metabolism, respiration, nourishment etc., the whole system tries to protect it. All these processes, functions and sub-functions are interdependent and operate in an orchestral manner in nature. Any imbalance leads to the disease or pest manifestation or lack of nourishment.

PROJECT

In 2001 about 50 ha area from various sections was taken under the project. A portion of each section was kept as control and normal chemicals were used in those areas. It is important to note that in Jalinga, being a Cachar garden, the export potential is practically 'nil'. Thus abandoning chemical farming and moving towards rational farming was because the former looked unscientific. Further, the productivity is low along with low price realization. Termite problem is also very bad. Thus most people would consider any experiment of such kind suicidal. Experimental areas were sprayed with various Inhana solutions during the year. During this period, almost every month, Mr. Das Biswas had long discussions with the manager and assistants on the theory behind the principals so as to improve their understanding of the subject. The contradictions between present chemical farming and Inhana's rational farming were substantial. Some of these are given below:

- Under ideal or virgin condition the plants feed themselves. They take 95-96% of their nutrition from air and the balance 4-5% from soil. In other words, they take their food quantitatively from air and qualitatively from soil. Thus applying high doses of fertilizers to soil is wrong. Moreover the harmful affect of the chemicals on soil micro-organisms make their use unscientific.
- It is obvious that the current theory of putting back what has been taken out is incorrect. Thus, while moving away from chemical fertilizers, the theory of adding large quantity of organic matter

to compensate the N, P, K loss does not arise. What is needed is an environment to allow the soil to rejuvenate itself.

- Herbicides increase the salt concentration of the soil, thus making the condition in the soil less conducive for the plants to take nutrients. Thus application of herbicides first and then of fertilizers is incorrect. Moreover, weeds are not as harmful as made out by chemical farming. If necessary, sickling is a much better and an overall profitable method.
- Compost under Novcom method of Inhana was to be added in small quantity of 1-2 tons/ha, not 4-5 tons/ha as normally done in organic garden. The method allowed us to prepare the compost in 21 days against normal 90–120 days. This energized compost application was for giving ideal environment to the soil by increasing the activities of microbes and earthworms.

At the end of the year there was about 10% increase in crop in sections under Inhana project. Encouraged by this we were planning to increase the area to about 200 ha for 2002. At that time, Inhana gave a different proposal. While we will pay for 300 ha for their assistance, the entire garden of 600 ha will be taken under the project. We would apply chemicals wherever necessary, but the aim would be to minimize their use as much as possible. By that time the first dose of fertilizer had already arrived and its application had started. In absence of compost for the whole garden, some fertilizer had to be added. Pest control was done as much as possible with Inhana solution. Seeing the performance of 2002, in 2003 we went for reduction in all chemicals to 5% or less. 1500 tons of Novcom compost was made in Decermber 2002 – February 2003 to rejuvenate the soil. The results of crop and chemical consumptions are given below.

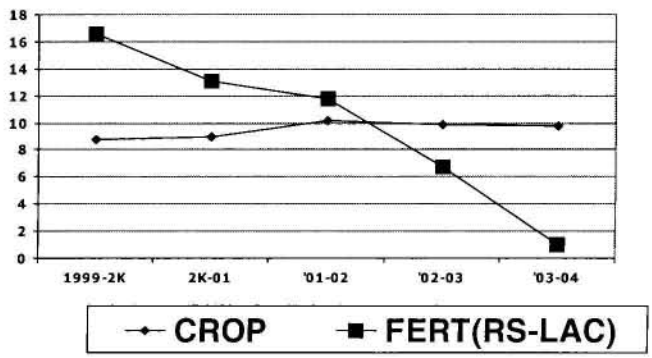
- Various solutions of Inhana Biotech used were Atermit, Samridhi, Organi-K, Organi-N, Jay Vijay, Novcom etc. While these are their standard products, in Jalinga 28 different solutions have been used for various purposes.
- Study conducted by Assam University showed amazingly better environment improvement and biodiversity at Jalinga Tea Estate compared to other conventional gardens.
- Samples of August and September teas tested for pesticide residue were found to have no detectable pesticide residues.

We have tried the rational farming in Gujarat on tobacco and bajra and got about 20% and 30% increase in yield respectively. Thus the system works for other crops also and not just tea.

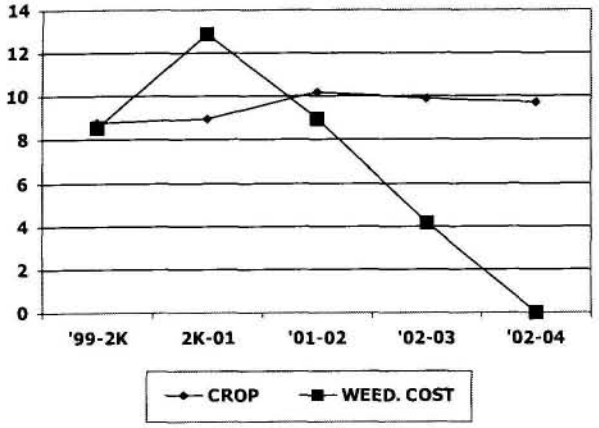
Annexure 1. Jalinga: Tea samples of September 2003

Sr. No.	Name of Pesticide	Residue content mg/Kg.	MRL (mg/Kg.)	Detection Limit (mg/Kg.)	Method of Analysis
1	2	3	4	5	6
A	**Organochlorine pesticides**				
1	DDT	BDL	--	0.01	GLC-ECD
2	Dicofol	BDL	--	0.01	GLC-ECD
3	Endosulfan (All Isomers)	BDL	--	0.01	GLC-ECD
B.	**Organophosphorus Pesticides**				
4	Chlorpyriphos	BDL	--	0.01	GLC-ECD
5	Ethion	BDL	--	0.01	GLC-ECD
6	Malathion	BDL	--	0.01	GLC-ECD
7	Profenophos	BDL	--	0.01	GLC-ECD
8	Monochrotophos	BDL	--	0.01	GLC-ECD
C.	**Synthetic Pyrethroids**				
9	Cypermethrin	BDL	--	0.01	GLC-ECD
10	COC	BDL	--	0.01	Spectrophotometric

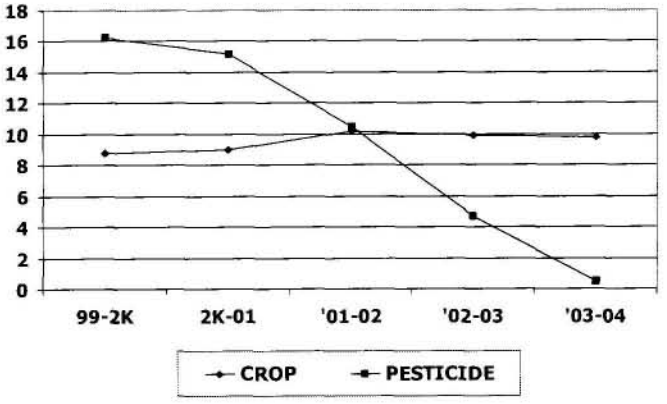
Annexure 2. Jalinga: Crop vs. fertilizer cost (Rs. lac)



Annexure 3. Jalinga: Crop vs. herbicide (Rs. lac)



Annexure 4. Jalinga: Crop vs. pesticide cost (Rs. lac)



Annexure 5. An integrated environmental assessment of W. Jalinga T. E. by Assam University

- Population densities of all the major groups of microorganisms were considerably higher in Jalinga when compared to those from conventional gardens.
- Phosphate solubilizing microorganisms also exhibited much higher densities in the soils of Jalinga when compared to those from conventional gardens.
- Dissolved oxygen and total alkalinity were higher in the water of the streams flowing through Jalinga, while nitrates and phosphates were lower, when compared to those in the streams of conventional gardens.
- The biological assessment studies of the streams revealed higher diversity of planktonic, periphytonic and benthic macroinvertebrate taxa in the Jalinga streams. The Rapid Bioassessment Protocol values were also higher in Jalinga streams.
- Bird diversity was decidedly higher in Jalinga Tea Estate, when compared to those in the conventional tea gardens.

Chapter 23

THE REALITY OF NATURE THROUGH ENERGY MANAGEMENT PRINCIPLES – AN IMPROVED REALISATION

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ABSTARCT

Tea can offer numerous value-added benefits to human health, if the various biochemical reactions take place in accordance with the nature's program and with the orderly presence of all properties. It is not possible to reach to the objectivity of exploiting these potentials from tea in chemical farming. Moreover, it is not difficult to understand that the poisons which are used to kill the insects must rebound to affect humans as well as both are the part of the same web of life. If we still might not be serious about ecosystem but definitely we would not like to have the numerous deadly toxins having serious repercussions into our own system to get the beneficial medicinal properties of tea. Chemical farming which started its journey with romantic beginning has already unmasked its ugly face forcing the agriculture into a perplex state. Moving towards natural methods is now obvious but no convenient, effective and economical alternative is available.

Those who earn their daily bread from agriculture first look for the confirmation about the viability of the alternative process, otherwise, awareness alone will not be able to stimulate them to change their present practice. Indian tea industry is now virtually knocking at every possible corners for its the revival. Hence, they also can't be truly involved with the consciousness of Bio-diversity or Environmental Sanitation unless any organic method is offered to them as economical, convenient and effective alternative. Nevertheless, this surely have to be projected as scientific to give the confidence to the people of tea industry that they are moving with a judicious and scientific system.

Organic farming has always been always projected as holistic approach. Since, we had inherited organic farming as a tradition, we were not aware of the science on which it is based. It is high time that we understood two facts - first, Chemical farming which has been believed as scientific is not true at all and second, true organic farming which follows nature's principle is always scientific. Rational Farming ® was developed by P. Das Biswas, the founder of Inhana Biotech to analytically interpret these two understandings. At the same time, Rational Farming is the only organic method which assures of no crop loss and no escalation in the cost of production (even in the extreme deactivated situation)- the two major threats not to move towards organic farming. It analytically explains the natural doctrine that 'Plants feed themselves' and it aims to return back the two lost heritage of the plant kingdom i.e. Sense of Self - Nourishment and Sense of Self-Protection.

Rational Farming® works with the complete package of organic solutions, developed first time in the globe, by Inhana Biotech. It functions with the principle of Element - Energy Activation Principle® deploying the role of 'Energy Management'.

Inhana Biotech believes that poison-free food is the legitimate right of all. Rational Farming® aims to fulfil that mission and take towards that beautiful organic whole where nature is available with its all potentials. There, modern science will also find it convenient to utilise the numerous hidden and unexploited plants potential for the human benefit.

Note : Full manuscript of the paper was not received - Editors

Chapter 9

DARJEELING TEA QUALITY IN RELATION TO ENVIRONMENT MANAGEMENT

Hirak Ghosh
Chairman West Bengal Pollution Control Bureau.

Ladies & Gentleman:

I am thankful to Dr. Siddiqi for inviting me to this conference of experts of tea. My only claim to be here is that I am a drinker of good Darjeeling tea. Most of you know that the older generation of our grand parents was against drinking tea. As a matter of fact, there is a Bengali saying that drinking tea is like drinking poison, which is attributed to a famous scientist of Bengal. Perhaps the negative attitude of the general public to tea drinking can be attributed to the role of tea in colonial history. The British won Opium War against China in 1842, which gave them access to Chinese tea in exchange for Indian opium. Some people thought that like opium, tea was addictive and hence nothing good will come out of drinking tea. But all of you here know that tea contains antioxidants, which are health-promoting constituents.

Historically speaking, a proposal to tax tea by the British led to Boston Tea party, which ultimately won freedom for the British colonies in America. At the same time this incident also resulted in replacement of tea with coffee in American cuisine. Till recently tea was not popular in the USA. Now M/S Starbucks are promoting high quality Darjeeling as *Tea-late* and masala chai in speciality shops.

During my tours of duty to Darjeeling, I came across a lot of misuse of agricultural chemicals that leave behind harmful residues, which militates against the health giving properties of tea. I am told that some quality conscious Darjeeling tea estates buy their organic manure from as far away as Bangalore. I see no reason why locally made compost from the town waste cannot be utilized which will have additional advantage of waste disposal. I have come across growing heaps of garbage with increasing population. Its disposal in the cities is a major problem and composting units like the one operating at Dhapa and other major cities are not efficiently run. The scientists here must identify improved technology of composting including microbes that break down biodegradable garbage efficiently. I suggest that a scheme of composting this garbage should be drawn up so that under-utilized capacity of city composing units can be harnessed to generate a large quantity of good quality compost to meet the requirement of the local tea industry. This compost from local garbage can be utilized to enhance the quality of organically grown tea, which is free from harmful residues and will fetch higher prices in the discerning markets abroad.