



## A Survey on IPM Adoption In Darjeeling Organic Tea Plantation

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### ABSTRACT

A questionnaire based survey was carried out on IPM adoption rate in organic tea plantation in Darjeeling covering 15% of total area. It was observed that 26% of tea estates adopted MCPA (microbial pest control agents). No predator of parasite released against biocontrol of pest population reported. Mean compost application estimated to be 2MT/ha and in-house production hindered by non-availability of green matters. Very few estates have production facility. Biofertilizer use such as VAM, *Azotobacter*, *Rhizobium* and *Azospirillum* are not reported. There is an urgent need for raising awareness on IPM benefits, research and training in relation to organic tea in Darjeeling.

### INTRODUCTION

IPM concept as generally perceived has originated as a viable alternative to mitigate the ill effect of agro-pesticides on man and environment (Carson, 1962; Barfield and Swisher, 1994). Integrated pest management has been identified as a viable alternative to prevent crop loss worldwide in developed and developing countries (Pimental and Peshin 2014). Later IPM has been recognized as socially, economically and environmentally viable technology for developing countries (NRI, 1992; Bajwa and Kogan 2003). Research on IPM in India was started in 1974–75 on two locations crops, rice and cotton, under Operational Research Projects (Swaminathan, 1975). Under this programme, location specific IPM technologies were developed in cotton and rice crops. Subsequently in mid 1980s the Government of India re-oriented its plant protection strategy. India became a member country of the FAO initiated Inter – Country Program in 1980, but IPM activities have been intensified only since 1993. The following benefits of IPM adoption were recorded. Krishna *et al* (2002) provided detail account of IPM adoption and economic and social benefits in relation to Indian agriculture.

### Background of Darjeeling Organic Tea:

Situated in the foot hills of Eastern Himalaya (Lat-26°31' to 27°43' N and Lon 87°59' to 88°53' E), Darjeeling tea Industry comprised of 87 Tea estates covering an area of 17800 ha. It produces about 8 m kg of highly priced, quality orthodox tea. Tukvar was the first tea estate in Darjeeling established in the year 1875. Darjeeling tea was conventionally managed. Green revolution had significant impact on Tea Industry in Darjeeling and improved agro techniques and planting materials were developed and recommended by Tocklai were implemented and resulted in

increased productivity(535 kg/ha). Darjeeling tea industry has undergone perceptible change in the following lines in the recent years.

1. Conversion from conventional to organic resulting in total withdrawal of agrochemicals in all most entire tea areas except few gardens.
2. Enactment of GI act for protection of Darjeeling tea.
3. Regulation of pesticides inputs by Tea Board of India by publication of Plant protection code.
4. Emergence of organic certifying bodies.
5. Decline of production and productivity due to conversion.
6. Promotion of IPM by Tea Board of India and other Tea Research Institutes. e.g TRA, UPASI .

Pests and diseases continue to cause significant losses to crop yield in tea, *Camellia sinensis* as high as 30percent (PPC-2017). Tocklai Tea Research Institute provides R & D aids to member Estates of NE India which includes Sikkim and Darjeeling Tea Industry.

In general, the losses in Indian agriculture during the post-green revolution era (Dhaliwal *et al.* 2004) have been increasing compared to losses during the pre-green revolution era and similar trends was prevalent in tea plantation. New pest emergence, pests resistance to applied pesticides and climate change has been largely attributed to the increased pest activity and as such pesticides consumption rate is rising. In NE India, tea pest survey was initiated during 1963 and total loss of crop was estimated to be 12.8 (Sen *et al* 1963)

**Table : 1 Crop loss in various crops in India**

<b>Crop</b>	<b>Pre-Green Revolution (early 1960s)</b>	<b>Post-Green Revolution (early 2000s)</b>
Cotton	18.0	50.0
Groundnut	5.0.	15,0
Other oilseeds	5.0	25.0
Pulses	5	15
Rice	10	25
Maize	5	25
Sorghum and Millet	3.5	30
Wheat	3	5
Sugar cane	10	20
Average	7.2	23.3
Tea	12.8	30 (ppc, 2016)

Adopted from Dhaliwal *et al* 2004).

Tea was cultivated by following conventional methods in Darjeeling in the initial years and agropesticides (Insecticides, acaricides, fungicides and weedicides) as high as 7.35 kg/ha were applied as per TRA recommendations (Barbora and Biswas 1996). Subsequently organic tea conversion has been carried out in Darjeeling phase wise under certification bodies accredited by

APEDA where IPM occupies an important place (Muralidharan and Selvasundaram 2001; PPC 2017). Certification bodies have requirements in regards to tea growing and input utilizations and planters need to adopt and implement in order to be eligible for certification. Benefits of certification and IPM outcome is not limited to producer but also to consumers, society and environment as well (NRI 1992). Although IPM packages has been published for Tea plantation in India (Muralidharan and Selvasundaram 2001; PPC 2017) there is no information regarding the extent of adoption of IPM in Tea in India. A programme under NTRF in house was undertaken to initiate survey on IPM adoption.

### Objective

The present work deals with a results of survey of IPM adoption in Darjeeling organic tea Plantation and its associated constraints along with suggested guidelines.

### Methodology

Questionnaire based proforma on IPM adoption were communicated to The Tea Estates and primary data received from the tea estates of Darjeeling were compiled and shown in table 1. There were four parts in the survey sheet 1. Area and Demographic 2. Pests and Diseases occurrence 3. Pests and Disease control under field condition 4. Biopesticides use trends. Besides visits were also paid to selected Estates to collect survey data duly filled in. Primary data so obtained were compiled and presented in Table 2.

### Results and Discussions

It was evident from the Table 2. that 15.85% of total area was covered in the survey. Top management is the sole authority for external communication and make all the decision of pests control in the field indicating top down approach of communication system. All estate engaged in agro practices in tea in line with recommendations by certifying bodies, IPM practices as per PPC 2016 and also Advisory services provided by officials of Tea Research Association. Cultural practices i.e hard plucking adopted in case of severe attack of sucking pests (helopeltis, thrips or jassids) and winter cultural practices during pruning time. Environmental, social and economic benefit of IPM and organic cultivation recognized by all the respondent. Plant Protection Code published by Tea Board India has been found to be useful source for knowledge on pests and disease.

It was evident from the Table 1 that ,29% of Tea Estate used microbial biopesticides for control of pests and disease. Among microbial pesticides, *Trichoderma* for pruning cut protection and *Metarhizium* for Termite control were used by 63 and 43 percent of surveyed Estates. Formulation of *Beauveria bassiana* were used by 36% of surveyed estates against *Helopeltis*. Both *Verticillium* and *Paecilomyces* formulations were used against Tea Red spider mite by 18% of surveyed tea estates. Neem formulations and Sticky traps were used by 9% of surveyed estates. No predator of parasite release against biocontrol of pest population reported. Pests monitoring through Economic Injury level (EIL) not found practically useful for destructive pests like Helopeltis and

Looper. Pests control success through IPM varies depending on elevation, type of prune and location. Biofertilizer use (Azotobacter, VAM, Azospirillum) has not been reported from surveyed Darjeeling Tea Estates. Organic Certifying bodies regulates agrochemical inputs and IMO certified products are permitted. Similarly Vermicompost and compost preparation found to be negligible and not wide spread. Very few estates have production facility. Social, environmental and economic impact of IPM are not well perceived by respondent. Training and demonstration of IPM under field condition is an urgent need. A comprehensive survey made by (Para *et al* 2014) found that there are many inherent constraints of IPM adoption in developing countries leading to poor adoption which is in conformity in our study.

**Table 2. Biopesticides and Biofertilizer Use Pattern**

In put Category	Use Pattern (Percent)	Target Pests	Rate of Application	Remarks
<b>BIOPESTICIDES</b>				
1. <i>Trichoderma</i> formulation	63	Prunning cut protection	800ml//ha-2kg/ha	Details of strain not known
2. <i>Metarhizium</i> formulation	45	Termite pests/White grub	800ml/ha	Details of strain not known
3. <i>Verticillium</i> formulation	18	Red spider mite	800ml/ha	Details of strain not known
4. <i>Paecilomyces</i> formulation	18	Red spider mite	800ml/ha	Details of strain not known
5.Beauveria formulation	36	Tea Mosquito Bug	800ml/ha	Details of strain not known
6.Botanicals(neem)NKAE	9	Sucking pests	2.5kg/ha	
7.Sticky trap	9	Sucking pests	30no/ha	Sticky trap is indiscriminate and traps beneficial insects too.
<b>Miscellaneous Biofertilizers :</b>				
1.Organic Manure	100	Soil application	2MT/ha	
2.Mulch	100	-	-	
3.Prunning litters	100	In situ		
4.Biofertilizers	9	Soil application		
5.Vermicompost	Not Reported			
6.VAM	Not Reported			

**CONCLUSION AND RECOMMENDATION**

- I. Survey response and adoption rate of IPM was very poor.
- II. Biopesticides like *Trichoderma* formulation find large scale use.
- III. Biofertilizers use not evident.
- IV. There is a lack of IPM research and Technical bulletin in relation to organic tea in Darjeeling.
- V. Lack of IPM training for grass root level workers in a tea estates.

**RECOMMENDATION**

- I. Urgent need for awareness generation among grass root level workers, and management personals on environmental, economic and social benefit of IPM .
- II. Urgent need for development of appropriate Biopesticides and Biofertilizer for organic tea plantation in Darjeeling.
- III. Promotion of IPM research e.g developing pest resistant tea cultivars, mass production of natural enemies.
- IV. Continuous effort on Training of IPM and preparation of technical bulletin for IPM teaching in Darjeeling organic tea in local language.

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