Assam Company Chemical Usage Report

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Pest scenario in Assam

The situation in Assam due to multiple factors like climatic change due to the global warming phenomena has upset the seasonal weather conditions and rainfall patterns, leading to higher prevalence and persistence of pests especially in Upper Assam, where most of the Assam Company gardens are located. The general scenario in Assam has seen an unprecedented pest activity, impelling the use of chemicals to control the attacks which are on the increase year on year.

The above scenario combined with the situation of Assam Company gardens where there has been an absence of good agricultural practices over many years, inputs not being provided in time, incorrect usage of chemicals in previous years and the older age profile of the tea bushes, have had the added effect of reducing the vigour and immunity of our tea bushes, thereby leading to a reduction of crop over the years.

Chemical usage of the Company

Assam Company as a policy follows only PPC approved chemical usage as per the illustrations given below.

Pesticide is a broad term, which includes insecticides, acaricides (miticides), fungicides, weedicides (herbicides), nematocides, rodenticides and molluscicides. These pesticides are used for the control of insects, mites, fungal diseases, weeds, nematodes, rodents (rat, mice) and molluses (snails) respectively.

Appropriate pesticides with correct and timely application arrests the loss of crop by killing the pests that invade and destroy the crop. Therefore, before application of pesticides a thorough knowledge is required to make the operation cost effective. Plant protection chemicals are costly, but the benefits derived due to the control of pests are greater in relation to cost when applied correctly. However, with the changing climatic conditions it has been observed that there has been a mutation of the pests and a change in their life cycles, for which the pesticides have had limited efficacy. In addition, the rainfall post application nullifies the efficacy requiring repeat spraying.

Points to be considered prior to spraying pesticides to get effective control of pests:

a) Compatibility tables of pesticides to be followed. Two coloured compatibility tables from two research stations, one from UPASI (Annexure 1) and the other is from TRA (Annexure 2) are attached.

b) Names of the insecticides, acaricides, fungicides with their mode of action and dose per hectare are to be given due consideration.

c) Location of some of the common pests in the canopy of the tea bushes, i.e. the targeted area

d) Selection of effective pesticides to get significant efficacy

e) Resistance management of pesticides to pests

f) Residue management (MRL) of pesticides

g) Different aspects of spraying spray fluid of pesticides

b) Names of the pesticides, Fungicides mentioned in the Compatibility table of UPASI, their dose per ha & Mode of action:

	Pesticides	Sub-group	Acaricide/Insecticide/Fungicide	Dose/ha	Mode of action	PPC: Y or N	PHI
01	Acephate 75 SP	organophosphate	Insecticide	1000 ml	C cum S	N	
02	Bifenthrin 8 SC	Pyrethroid	Insecticide cum Acaricide	750 ml	C	Y	**5**
03	C O C	Copper	Fungicide	1.25 lit	C	Y	
04	L-Cyhalothrin5 EC	Pyrethroid	Insecticide	250 ml	C	N	
05	Cypermethrin 25 EC	-do-	-do-	125 ml	C	N	
06	DAP		Nutrient	1% (4 kg /ha)			
07	Deltamethrin 2.8 EC	Pyrethroid	Insecticide	250 ml	C	Y	**10**
08	Dicofol 18.5 EC	Unc Dicofol	Acaricide	1.25 lit	C	Y	16
09	Ethion 50 EC	organophosphate	-do-	1.25 lit	C	Y	10
10	Fenazaquin 10 EC	METI acaricides	-do-	1.oo lit	C	Y	12
11	Fenitrothion		?		?	Not included	

12	Fenpropathrin 30 EC	Pyrethroid	Insecticide cum Acaricide	310 ml	C	Y	8
13	Fenpyeoximate 5 EC	METI acaricides	Acaricide	500 ml	C & O	Y	
14	Hexaconazole 5 SC	Conazole	Fungicide	500 ml		Y	12
15	Hexythiazox 5.45 EC	Hexythiazox	Acaricide	500 ml	O & C	Y	12
16	Imidacloprid 17.8 SL	Necotinoid	Insecticide	150 ml	S cum C	N	
17	Microsul 72.8%	Sulphur	Acaricide	1.00 lit	C	Y	
18	Monocrotophos 36 SL	Organophosphate	Insecticide	1.25 lit	C cum S	N	
19	Parafffinic oil	NA					
20	Phosalone 35 EC	Organophosphate	Insecticide	1.25 lit	C	Y	
21	Profenofos 50 EC	-do-	Insecticide cum acaricide	500 ml		N	
22	Propargite 57 EC	Propergite	Acaricide	1.00 lit	C	Y	20
23	Propiconazole 25 EC	Conazole	Fungicide	500 ml	S cum C	Y	14
24	Quinalphos 25 EC	Organophosphate	Insecticide	1.25 lit	C	Y	20
25	Spiromesifen 22.9 SC	Tetronic acid	Acaricide	500 ml	C	Y	14
26	Thiamethoxam 25 WG	Neonicotinoids	Insecticide	100 g	S cum C	Y	10
27	Urea + MOP		Nutrient	1% each(8 kg/ha)			
28	Zn. Sulphate		Nutrient	1 % (4 kg /ha)			

Other PPC approved chemicals (not mentioned in the Compatibility table of UPASI but some are mentioned in TRA Compatibility table):

PPC approved pesticides	C.Table, TRA	Acaricide cum Insecticide	Dose/ ha	Mode of action	PHI
Sulphur 80 WP	Serial No. 09	Acaricide	2.5 kg	C	10
Sulphur 40 WP		-do-	2.0 kg	C	10
Sulphur 52 SC		-do-		C	10
Cyflumetofen 20 SC		-do-	1.00 lit		
Etoxazole 10 EC		-do-	350 ml		
Flufenzine 20 SC					
Azadirachtin 1 EC		Acaricide cum Insecticide		C	
Azadirachtin 5 EC	Serial No. 11	-do-		C	
Clothianidin 50 WDG	Serial No. 12	Insecticide	100 g	C cum S	14-21
Thiacloprid 21.7 SC	Serial No. 16	Insecticide	375 ml	C cum S	7-14

Emamectin benzoate		Insecticide	200 g	C cum SP	7
Flubendiamide			125 ml	C cum SP	30-40
Thiamethoxam 12.6% + L-Cyhalothrin 9.5%		Insecticide	200 ml	S cum SP	
Carbendazim 12% + Mancozeb 63% WP	Serial No. 18	Fungicide	1.25 kg		
Hexaconazole 4%+ Zineb 68% WP		-do-	750 g		

C: Contact, C cum SP: Contact cum Stomach Poison,

Mode of action (C = Contact, S= Systemic, O = Ovicide,) N= Not approved by PPC, Y = Approved by PPC, PHI= Pre-harvest interval in days

c) Location of the tea pests

Major tea pests with their site of attack and the period of occurrence (source : TRA)

Pests	**Site of infestation**	**Peak Period of occurrence**
Sucking mites	**Sap feeders (Mites)**	
Red Spider	Upper surface of the maintenance foliage	Jan-June/Sept-Nov
Purple mite	Upper and lower surface of mature & old leaves	Feb-April/Oct-Nov
Pink mite	Lower surface of young leaves	Mar-Jun/Oct-Nov
Scarlet	Lower surface of mature leaves and young stems	Feb-Jun/Oct-Nov
Sucking insects	**Sap feeders (insects)**	
Jassid (Green fly)	Young leaves, tender stems,	Feb - July
Aphids	Buds, tender stems, young leaves	Jan - April
Thrips	Unopened and partly opened buds, young leaves	Jan - July
Helopelties	Young leaves, buds, tender stems	Feb - November
Defoliators	**Chewing insect pests**	
Flush worm	Buds	Jan - May

Red slug caterpillars	Under surface of matured leaves, bark of stems	Feb-April/Jun - Sept
Looper caterpillar	Young leaves/mature leaves/entire foliage	March - October
Bunch caterpillar	Mature leaves/entire foliage of the bushes in patches	March-December
Nettle Grubs/Jellygrubs	Mature leaves and young leaves also	Throughout the year
Subterranean	**Soil borne pests**	
Cockchafer grub	Collar region of young tea	
Termite	Live and dead wood of tea bushes	
Nematodes	Roots of tea seedlings	March - August

Difference between sucking mite pests and sucking insect pests

Both mites and sucking insect pests damage our tea crop by sucking the cell sap through their sucking type of mouth parts. The differences in body structure between mites and sucking insect pests are as follows:

Mites	**Insects**
4 pairs of legs	3 pairs of legs
Body two segmented	Body three segmented
No wings	Wings presents (4 orders without wings, 25 orders winged
Antennae present or absent	Antennae present and characteristic to each group
No scale	Scales present
Mostly minute	Macroscopic

Efficacy of acaricides on different stages of growth of Red spider mite (Source: PPC, Tea Board, August 2017, Ver.9, P 20)

Pesticide sub-Group	**Acaricide**	**Dose/ha**	**Egg**	**Nymph**	**Adult**
Propergite	Propergite 57 EC	1 lit	*	**	***
METI acaricides	Fenazaquin 10 EC	1 lit	**	**	**
	Fenpyroximate 5 EC	500 ml	*	**	***
Pyrethroid	Fenpropathrin 30 EC	310 ml	-	-	***
Hexythiazox	Hexythiazox 5.45 EC	500 ml	***	-	-

Tetronic acid	Spiromesifen 240 SC	500 ml	***	***	**
Pyrethroid	Bifenthrin 8 S C	750 ml			
Sulphur	Sulphur formulation 80WP	2.5 kg			***
Etoxazole	Etoxazole 10 EC		-	-	***
Benzole acetonitrile	Cyflumetofen 20 EC		NA	NA	NA

d) Selection of Pesticides:

Thiamethoxam and Bifenthrin alone at TRA recommended dosages and in combination with 2% MOP against Helopeltis showed better control of Helopelties (it will be more effective when low volume sprayers are used).

Insecticides for helopeltis control (Source : PPC, Aug 2017, Ver. 9 **) :**

For Spraying during rain free period	Dose/ha	**For spraying in intermittent rains**	Dose/ha
Thiamethoxam 25WG	125 g	Deltamethrin 2.8 EC	250 ml
Quinalphos 25 EC	1.25 lit	Fenpropathrin 30 EC	310 ml
Thiaclorpid 240 SC	500 ml	Bifenthrin 8 SC	
Clorothanidin 50 WDG	100 g		
Not in PPC			
Fifronil 5% (not in PPC)	750 ml		
Yoro (effective for thrips) (not in PPC)	100 g		

Insecticides for different stages of looper control

Insecticides	**different stages**	**200 lit. of water**	***PHI in days**
Quinalphos (sub-group: Organophosphate)	1st instar	500 ml	20
Phosalone 35 EC (-do-)	1st instar	500 ml	-
Deltamethrin 10 EC (sub-group: Pyrathroid)	1st & 2nd instar	100 ml	10
Bifenthrin 8% SC (-do-)	1st,2nd ,3rd instar	300 ml	5
Dipal8L(Bt.Sumitomo)+Bifenthrin 8 SC*	**1st,2nd,3rd 4th instar**	**400 ml +125 ml**	
EmamectinBenzoate 5%	3rd ,4th ,5th instars	80 g	7

Flubendiamide 20% WG (sub-group: Diamides)	3rd,4th , 5th instars	50 g	30-40
Hand collection of the caterpillars should be continued for 3rd, 4th 5th instars			

(*PHI = Pre-harvest intervals),

Dipal 8L + Bifenthrin 8 SC :*** this cocktail was found to be very effective against 3rd , 4th & 5th instars By Tocklai (Ref: Tocklai News, Vol.23, Jan-June 2015)**

Name of pesticides having duel properties

Acaricides with insecticidal properties	**Dose/ha**	**Insecticidal properties**
Spiromesifen (Oberon) Ovicide	500 ml/ha	Mild
Ethion(least toxic)	1.25 lit/ha	Mild
Insecticides with acaricidal properties		**Acaricidal properties**
Phasalone (Zolone)	1.25 lit/ha	strong
Bifenthrin	500 ml/ha	strong
Fenpropathrin	310 ml/ha	mild
Azadirachtin 5%	1: 1500	strong

e) Resistance management of pesticides to pests

1. The objective of successful Pesticide Resistance Management (PRM) is to prevent or delay the evolution of resistance of pesticides to a pest. To get season long sustainable resistance management through the use of alternation, sequences or rotation of insecticides or acaricides from **different chemical sub-groups should be adapted**. One should change the sub-group to avoid or delay the resistance of pesticides to the targeted pests.
2. Spraying of the chemicals from the same sub-group one after another should be avoided for the management of pest resistance to the targeted pests. A list of sub-groups and the technical name of the pesticides are given below:

Acaricides, Insecticides, Fungicides				MRL (PPM)			PHI
Pesticides	**Pesticide Sub-group**	**Technical name of pesticides**	**Targeted pest**	**EU**	**Japan**	**FSSAI**	
Acaricides (for mites)	Unc Dicofol	Dicofol 18.5 EC	Red spider, Pink, Purple, Scarlet	20	3	5.0	
	Organophosphate	Ethion 50 EC	-do-	3	0.3	5.0	

	METI Acaricides	Fenpyroximate 5 EC	-do-	0.1	10	0.2 Black tea	
	-do-	Fenazaquin 10 EC	-do-	10	-	3.0	
	Hexythiazox	Hexythiazox 5.45 EC	-do-	4	-	-	
	Propergite	Propergite 57 EC	-do-	0.05	5	10	
	Etoxazole	Etoxazole 10 EC	-do-				
	Benzoyl acetonitrile	Cyflumetofen 20 EC	-do-				
	Sulphur	Sulphur 80 WP	Red spider				
	Sulphur	Sulphur 80 WG	-do-				
	Sulphur	Sulphur 72.8 w/v	-do-				
	Sulphur	Sulphur 40 SC	-do-				
	Tetronic acid	Spiromesiforn 240 SC	-do-	50	30		
	Azadirachtin	Azadirachtin 50,000 ppm	Insecticide cum acaricide				
	-do-	Azadirachtin 10,000 ppm	-do-				
Insecticides	Avermectins	**Emamactin Benzoate 5 SC**	Caterpillar pest		0.02		7
	Carbamate	Carbofuran 3 G	Nematicide				
	Cartap hydrochloride	Cartap hydrochloride 50 SP	Sucking Pest				
	Diamides	**Flubendiamide 20 WG**	Looper caterpillar	0.02			30-40
	Insect Growth regulator	Diflubenzuron 25 WP	-do-				
	Necotinoid	Acetamiprid 20 SP	Sucking pest				
		Clothianidin 50 WDG	-do-	0.7	50	0.1	
		Imidaclorpid 17.8 SL	-do-				
		Thiamethoxam 25 WG	-do-	20	20		
		Thiacloprid 21.7 SC	-do-	10	30		
	Organophosphorus	Acephate 75 SP	-do-				
		Chlorpyriphos 20 EC	-do-				
		Dimethoate 30 EC	-do- & mites				
		Oxydemeton-methyl 25 EC	Sucking pest				
		Monocrotophos 36 SL	-do-				
		Phorate 10 G	-do-				
		Phosalone 35 EC	-do-	0.05	2		
		Profenophos 50 EC	Insecticide cum acaricide				
		Quinalphos 25 EC	Sucking insect & caterpillars	0.1	0.1	0.01	20
	Pyrethroid	Alphamethrin 10 EC	Sucking pest				

		Bifenthrin 8 SC	Red spider, sucking pests	5	25		5
		Bifenthrin 10 EC	Sucking insect, Termite,Caterpillars				
		Cypermethrin 25 EC	Sucking & Chewing pest				
		Deltamethrin 2.8 EC	-do-	5	10		10
		Deltamethrin 10.8 EC	-do-				
		Ethofenprox 10 EC	Sucking pest				
		Fenpropathrin 30 EC	Red spider & sucking pest	2	25		
		Fenvelarate 20 EC					
		Lamda cyhalothrin 5 EC	Sucking pest				
	Phenylpyrazoles	Fifronil 5 EC	Sucking pest				
		Fifronil 80 WG	Termite				
Fungicides	Copper	Copper oxychloride 50 WP	Red rust, Black rot, Blister	0.05	0.05		
		Copper hydroxide 77 WP	-do-				
	Conazole (Triazole)	Hexaconazole 5 EC	Black rot, Blister, Fusarium,			0.02	
		Propiconazole 25 EC	Fusarium, Black rot,			0.01	
		Trideomorph 80 EC	Blister blight				
	Carbamate	Carbendazim 50 WP	Fusarium			0.5	
	Amide	Carboxin 75 WP	Black rot				

Example : **Suppose Ethion has been sprayed from Organophosphate sub-group. Second round should be sprayed with Fenpyroximate which is in METI Acaricide sub-group**. **Changing sub-groups of pesticides will help to delay the resistance of pesticides to pests.**

Points to note:

a) One Insecticide and one acaricide may be mixed if there is a mixed infestation. Generally, they remain compatible (consult compatibility tables).

b) But when target sites are different, mixing of pesticide(s) with nutrients will not be economical. It will be a wastage even if they are compatible. Suppose a growth promoter with an acaricide is mixed to control the red spider infestation and to promote growth. In this

case the red spider remains on the upper side of the leaves and the target site of growth promoter is the under surface of the leaves. So one target will be missed.

c) Two insecticides or two acaricides or two fungicides should **not be** mixed. Purpose of mixing must have a valid reason and compatibility should be from authentic source (s).
d) Growth promoters or nutrients should not be mixed with pesticides or fungicides if compatibility is not known. Priority should be given to pest control.

f) Residue management to made tea:

a) The search and destroy method should be adopted. Flagging of the infested/infected patches should be undertaken prior to spot spraying of pesticides.
b) Pesticides should be sprayed following black plucking
c) Pesticides should be used having high MRL (**Maximum Residue Limit**)
d) Blanket spraying should be avoided as much as possible
e) The infested/infected patches should also be isolated by lopping the side branches of the tea bushes prior to spraying pesticides
f) Efforts should be made to undertake spot spraying.
g) A safe interval between spraying of pesticides and plucking should be maintained
h) Two rounds must be sprayed by **changing pesticide sub-group** following black plucking to get effective control.
i) In case of **blanket spraying** where the size of the section is more than 5 ha it should be plucked in 2-3 days to keep the **MRL** below the recommended level
j) Normally 17 per cent of the total tea area under plucking is plucked in any one single day in case of 7 days (17 x 6 = 102) plucking rounds and this invariably results in the simultaneous plucking of pesticides sprayed and unsprayed leaves, which are then bulked and manufactured. This dilutes the chances of carryover of residues from pesticides sprayed section to manufactured tea (Banerjee 1993).

The following spreading and sticking agents should be mixed with the pesticides:

Name	**Marketing Company**	**Dose in 200 lit of spray fluid**
Silwet Gold	Chemtura Chemicals India Pvt Ltd	60 ml
Spreadmix	E.I.D Parry India Ltd	50 ml

Dhanuvit	Dhanuka Agritech Ltd	200 g
Indtron AE	Indofil Chemical Co	250 g (for weedicide)

g) Different aspects of spraying pesticides:

1. Spraying of pesticides should be undertaken following black plucking to get effective control. But hard plucking should be avoided in February-March.
2. Pesticide should be prepared first in a small bucket and then gradually poured into a 200 lit. drum adding water to make it a homogeneous fluid.
3. Spraying of pesticides should be undertaken in early morning or late afternoon hours.
4. Power sprayers can be used for helopeltis control from April to October.
5. Power sprayer should not be used during the dry period and poorly shaded or shadeless sections and also in very low and very high sections as these fine droplets will dry up before reaching the target due to inadequate humidity.
6. In case of high volume sprayers nozzles having discharge rate of 700 ml/ minute should be used so that spraying task can be completed in the normal working hours otherwise operators will misuse the spray fluid by tampering the hole of the nozzle.
7. After preparation of spray fluid it should be used **within 4 hours as after 4 hrs** efficacy of spray fluid starts deteriorating (c).
8. Ph of water used for preparation of spray fluid should be between 6 and 8. Calcium content should not exceed 20 ppm and iron content should be less than 2 ppm and it should be free from clay particles **(PPC, 2017).** Water should be tested from an authentic laboratory.
9. During cropping season **spot spraying** of acaricides (for the control of Red spider) should be undertaken following flagging.
10. Two rounds of pesticides application must be made at an interval of 7-10 days in case of Red spider and helopeltis following black plucking and **removing protruding stems.**
11. Spraying of pesticide should be undertaken as soon as pest infestation is noticed.
12. In case of lopper caterpillars two rounds of insecticides must be sprayed at an interval of 7-9 days. Hand collection must be continued irrespective of spraying insecticides. Afternoon hour is the ideal time for spraying insecticide for controlling Looper and Red slug.
13. Shade tree trunks should be sprayed with any recommended insecticide at 15 days intervals using high tree sprayers to destroy moths and eggs of looper caterpillar.
14. Spraying of pesticides should be undertaken in early morning or late afternoon hours in case of helopeltis and other sucking pests.
15. In winter, amount of water accumulated as dew drops on tea leaves can be as high as **700-900 liters of water per hectare (Phukan 2001)**. Under this condition the spray fluid will be further diluted. Similar condition may occur after a heavy rainfall during monsoon period also. Therefore, spraying should be done after the dew or rain droplets on tea leaves get evaporated.

16. It was noticed that re-infestation of pests starts from unsprayed patches. Therefore, each operator should carry a flag which he should place when he finishes spray fluid in the spraying machine so that he can resume spraying from the flagged spot.
17. Directional method of spraying should be undertaken to avoid non-spraying of bushes which usually take place in case of swinging method of spraying.
18. Ambient temperature higher than 35^0 C reduces the efficiency of EC formulations. Therefore, spraying between 10 am and 3 pm should be avoided.
19. Dry chemicals are turned into paste with little water and then added to water in the tank slowly.
20. When using more than one chemical they are to be added to the water one at a time. Stirring should be continued when each is mixed with water (Planters' Handbook 1996, p 69).

Nozzles generally used in High Volume sprayers for spraying insecticides & acaricides

Nozzle Code	**Angle of discharge**	**Liquid presssure**	**Discharge rate at 40 psi (3 kg/sq.cm)**	**Time to discharge 200 lit of spray fluid**
NMD/S	80^0	3 kg/ sq. cm	450 ml/min	7 hrs 40 min
HCN/PB	80^0	3 kg/sq.cm	450 ml/min	7 hrs 40 min
HCN/PC	100^0	3 kg/sq cm	700 ml/min	**5 hrs 16 min(preferred)**
HCN/PD	100^0	3 kg/ sq cm	900 ml/min	4 hrs 10 min

HCN = Hollow Cone Nozzle, NMD/S= Duro mist spray nozzle

Annexure 1

Enclosed : Colored compatibility tables of UPASI and TRA (Tocklai)

Compatibility Table: TRF, UPASI:

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
		Acephate	Bifenthrin	C O C	L-Cyhalothrin	Cypermethrin	DAP	Deltamethrin	Dicofol	Ethion	Fenazaquin	Fenitrothion	Fenpropathrin	Fenpyeoximate	Hexaconazole	Hexythiazox	Imidacloprid	Microsul	Monocrotopho	Parafffinic oil	Phosalone	Profenofos	Propargite	Propiconazole	Quinalphos	Spiromessifen	Thiamethoxam	Urea + MOP	Zn. sulphate
1	Acephate	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
2	Bifenthrin	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
3	C O C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	X	X	C	C	C	C	C	C	C	C	C	X	C	C
4	L-Cyhalothrin	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
5	Cypermethrin	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	X	C
6	DAP	C	C	X	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	X
7	Deltamethrin	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	X	C
8	Dicofol	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
9	Ethion	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
10	Fenazaquin	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
11	Fenitrothion	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12	Fenpropathrin	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
13	Fenpyeoximate	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
14	Hexaconazole	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C	C
15	Hexythiazox	C	C	X	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C	C

16	Imidacloprid	C	C	X	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C
17	Microsul	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C	C
18	Monocrotopho	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C	C
19	Parafffinic oil	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C	C
20	Phosalone	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C	C
21	Profenofos	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C	C
22	Propargite	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C	C
23	Propiconazole	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C	C
24	Quinalphos	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C	C
25	Spiromessifen	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C	C
26	Thiamethoxam	C	C	X	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	0	C	C	C
27	Urea + MOP	c	c	c	c	x	c	x	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	0	c	c
28	Zn. sulphate	c	c	c	c	c	x	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	0	c
		C = COMPATIBLE									X = INCOMPATIBLE																			

Annexure 2

Tocklai Tea Research Institute: TRA: Cinnamara, Jorhat-8

Physical Compatibility chart for Tea Agrochemical (Following Petroff 2008)

Agrochemicals	Bifenthrin 8 SC	Dicofol 18.5 EC	Ethion 50 EC	Fenpropathrin 30 EC	Fenazaquin 10 Ec	Fenpyroximate 5 EC/SC	Hexythiazox 5.45 EC	Propargite 57 EC	Sulphur 80 WG	Spiromesifen 240 SC	Azadirachtin 5 EC	Clothianidin 50 WDG	Deltamethrin 2.8 EC	Phosalone 35 EC	Quinalphos 25 EC	Thiacloprid 21.7 SC	Thiomethoxam 25 WG	Carbendazim + Mancozeb	Propiconazole 25 EC	COC	Urea	Zinc	MOP	Boron
Bifenthrin 8 SC	-	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
Dicofol 18.5 EC	F	-	F	F	F	F	F	F	F	F	F	F	F	F	?	?	F	I	F	F	F	F	F	I
Ethion 50 EC	F	F	-	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
Fenpropathrin 30 EC	F	F	F	-	F	F	F	F	F	F	F	F	F	I	F	F	F	F	F	F	F	F	F	F
Fenazaquin 10 EC	F	F	F	F	F	F	?	F	F	F	?	F	?	F	F	F	F	F	F	F	F	F	?	F	F
Fenpyroximate 5 EC/SC	F	F	F	F	F	-	F	F	F	F	F	F	F	F	?	F	F	I	F	F	F	F	F	F
Hexythiazox 5.45 EC	F	F	F	F	?	F	-	?	F	?	F	F	F	F	F	?	F	F	F	F	F	F	F	F
Propargite 57 EC	F	F	F	F	F	?	?	-	F	?	F	F	?	I	F	F	F	I	F	F	F	F	F	F
Sulphur 80 WG	F	F	F	F	F	F	F	F	-	F	F	F	F	F	?	?	?	F	F	F	F	F	F	F
Spiromesifen 240 SC	?	F	F	F	F	F	?	?	F	-	I	F	F	I	?	?	F	I	I	I	?	?	?	F
Azadirachtin 5 EC	F	F	F	F	?	F	F	F	F	I	-	F	F	I	F	I	F	I	F	F	F	?	F	I
Clothianidin 50 WDG	F	F	F	F	F	F	F	F	F	F	F	-	F	?	F	F	F	I	F	F	F	I	F	F
Deltamethrin 2.8 EC	F	F	F	F	?	F	F	I	F	F	F	F	-	F	F	F	F	F	?	F	F	F	F	F
Phosalone 35 EC	F	F	F	I	F	F	F	I	F	F	I	?	F	-	I	I	I	I	F	I	F	F	F	I
Quinalphos 25 EC	F	F	F	F	F	?	F	F	F	I	F	F	F	I	-	F	F	F	I	F	F	F	F	F
Thiacloprid 21.7 SC	F	F	F	F	F	F	F	F	F	?	I	F	F	I	F	-	F	F	F	F	F	F	F	F
Thiomethoxam 25 WG	F	F	F	F	F	F	F	F	F	F	F	F	F	I	F	F	-	F	F	F	F	F	F	F
Carbendazim + Mancozeb	F	I	F	F	F	F	F	I	F	I	I	I	F	I	F	F	F	-	F	F	F	F	F	I
Propiconazole 25 EC	F	F	F	F	F	F	F	F	F	I	F	F	?	F	I	F	F	F	-	F	F	F	F	F
COC	F	F	F	F	F	F	F	F	F	I	F	F	F	I	F	F	F	F	F	-	F	F	F	F
Urea	F	F	F	F	F	F	F	F	F	?	F	F	F	F	F	F	F	F	F	F	-	F	F	F
Zinc	F	F	F	F	?	F	F	F	F	?	?	I	F	F	F	F	F	F	F	F	F	-	I	F
MOP	F	F	F	F	F	F	F	F	F	?	F	F	F	F	F	F	F	F	F	F	F	I	-	F
Boron	F	I	F	F	F	F	F	F	F	F	I	F	F	I	F	F	F	I	F	F	F	F	F	-
		F= compatible						I =Incompatible						? = Compatibility in doubt										

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