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PREFACE

Darjeeling Tea Research Centre has been established in 1977 at Kurseong including an experimental farm of 21.6 hectares. The centre besides catering to the advisory requirement of Darjeeling tea gardens has developed technical know-how on various aspects of tea cultivation. The four main Divisions of research are Farm Management (Botany and Agronomy). Soil Science, Bio-chemistry and Plant Protection. The Centre has *inter alia* a Library, Miniature Manufacturing unit and an Agro-meteorological Observatory.

SIGNIFICANT ACHIEVEMENTS

The notable accomplishments are summarised below.

★ The performance of eight popular clones out of thirty clones released for Darjeeling gardens was evaluated. The comparative performance had indicated superiority of the clone Bannockburn 157 for large scale commercial cultivation. Other clones which could be used in order of priority are P312, T78 and T383.

★ Since distinct clonal variations were noticed, the relationship between growth parameters and their quantitative analysis at an early stage of growth of popular tea clones has been established.

★ Tea plants in Darjeeling takes as much as 7-8 years to come into full bearing. Evaluation of different methods of training of young plants have been done and pegging was found as most advantageous in bringing up young plants.

★ Replanting is almost universally considered a necessary but it is rather conservative in Darjeeling. The traditional method of replanting tea by manual uprooting of old tea bushes is expensive and promotes soil erosion. This research centre has formulated recommendations as an alternative to the traditional method which would preserve the top soil and involve less expense.

★ Experiments with binodal cuttings have shown their superiority in terms of better growth over single node cuttings.

★ Standardised the frequency of plucking in respect of yield and quality

★ A soil-fertility status viz., N, P & K, map of Darjeeling tea growing soils have been published.

★ The positive effect of foliar spray of Zinc on yield has been established.

★ Effect of six different sources of sulphur fertilizer has been examined and their efficacy in rectifying the deficiency of this mineral has also been established.

★ Potassium ion potential and the quantity - intensity relationship as affected by organic matter and exchangeable aluminium ions has been studied.

★ X-ray diffraction studies of the soils of quality and non-quality sections of Darjeeling tea gardens have been made. The genesis of the soils of this area has also been outlined on the basis of a detailed morphological, physico-chemical and mineralogical analysis.

★ Bioefficacy of different neem products in controlling certain pests of tea has been tested.

COLLABORATIVE RESEARCH

This Research Centre is recognised as a centre of Ph. D. work by North Bengal University and Kalyani University.

ADVISORY SERVICE

The Advisory Services are rendered from this Centre and it acted as an efficient channel for transmitting new findings to the fields. The scientists made several advisory visits to different tea estates of the Darjeeling hills.

VISITORS

Important visitors to the Research Centre include

I. Shri R. Krishna Kumar, Chairman, Tata Tea Ltd.

II. Shri Y. K. Daga, Director, Long View Tea Co. Ltd.

III. Shri S. Rahaman, President, Assam Branch of Indian Tea Association

IV. High Powered Govt. of Iran Delegation

V. Team of German Buyers' and renowned journalists of Germany.

FARM MANAGEMENT DIVISION

1.1 PRODUCTION AND SALE :

Total production of green leaves was 24,326 kg and was sold to Castleton Tea Estate at a price of Rs. 3,77,053.00.

1.2 PRUNING :

The following pruning schedule was followed.

(i)	Light pruning	–	4.01 hectare.
(ii)	Deep/Medium skiff	–	5.88 "
(iii)	Light/Levelling of skiff	–	5.35 "
(iv)	Untouched –	–	3.24 "
	Total	–	18.48 hectare.

1.3 MANURES AND FERTILISERS :

The following composition and dose of fertilisers were applied.

(i) Mature teas – N : P : K : : 120 : 45 : 120

(ii) Young teas – N : P : K : : 60 : 30 : 60

1.4 WEED CONTROL :

Glyphosate, paraquat and 2,4–D were applied at recommended doses and the control of weeds was satisfactory. Weed were also controlled manually during rainy season.

1.5 METEOROLOGY :

Monthly data on various meteorological parameters recorded during the year are presented in Table – 1.

1.6 RESEARCH PROJECTS :

1.6.1 DETERMINATION OF SUITABLE PRUNING CYCLE OF OLD CHINARY TEA BUSHES OF KURSEONG (DTRC/FM/17).

The experiment was initiated in the year of 1994. The yield data recorded during the year 1996 showed non-significant difference among the different treatment combinations. All the treatments were unpruned in 1996 season. (Table– 2).

TABLE – 1: METEOROGICAL OBSERVATIONS

Months	Air Temperature °C		Soil Temperature °C						Vapour Pressure mm of Mercury		Relative Humidity %		Total Rainfall mm	Wind Velocity km hr $^{-1}$	Evaporation mm day $^{-1}$
			5cm		10cm		20cm								
	Max	Min	6.39	13.39	6.39	13.39	6.39	13.39	6.39	13.39	6.39	13.39			
April '96	22.9	15.8	18.2	28.0	17.9	27.3	21.2	10.1	10.3	12.2	64.5	59.5	57.2	5.7	4.7
May	20.6	16.1	19.3	23.6	19.9	23.2	20.9	21.5	14.9	15.7	93.0	78.0	178.6	5.2	3.8
June	–	–	20.3	27.2	21.5	25.4	22.5	23.6	–	–	–	–	748.6	6.3	7.2
July	–	–	20.8	25.1	21.0	24.5	21.9	23.4	–	–	–	–	1007.3	4.7	7.4
August	24.5	18.4	21.2	23.4	21.0	23.5	22.0	22.5	17.3	17.9	100.0	92.0	1006.3	4.9	6.8
September	21.7	17.9	20.6	22.0	20.9	22.3	21.4	22.1	15.9	17.1	84.0	84.0	610.7	4.6	3.9
October	18.7	15.4	17.2	18.9	17.2	19.0	19.3	18.5	13.9	15.8	92.0	94.0	157.6	5.3	8.3
November	16.5	11.7	12.2	15.8	12.3	15.5	14.2	15.0	11.2	13.7	91.0	98.0	00	3.8	1.8
December	13.9	8.7	11.2	13.9	12.4	14.0	12.8	13.0	9.8	11.3	85.0	89.0	00	5.8	1.5
January '97	13.0	6.5	9.8	14.8	10.0	14.5	13.5	13.9	7.9	9.1	85.0	88.0	7.2	3.8	2.1
February	12.5	8.9	9.7	15.8	10.5	12.5	12.2	12.5	7.9	9.4	90.0	95.0	13.5	4.8	2.3
March	17.5	12.5	13.5	30.0	14.2	18.5	17.5	18.5	9.1	10.3	94.0	94.0	89.5	4.5	2.9

(DTRC – 1240 m.m.s.l., 26° 55' N, 88° 12' E)

TABLE – 2 : EFFECT OF PRUNING CYCLES AND TIME OF PRUNING (Yield of Made Tea kg ha^{-1} during 1996)

Pruning Cycle	Pruning 95-96	Time of Light Pruning 1994-95			Total	Mean	Result
		Sep	Nov	Dec			
3 YEARS	LOS	814.66	851.66	889.00	2555.32	851.77	N.S.
4 YEARS	LOS	772.00	973.33	978.66	2723.99	908.00	
5 YEARS	LOS	746.33	819.00	969.00	2533.33	844.44	
TOTAL		**2331.99**	**2643.99**	**2836.99**	**7812.62**	–	
MEAN		**777.33**	**881.33**	**945.55**	–	–	

1.6.2 EFFECT OF NUTRIENT MANAGEMENT ON STOMATAL BEHAVIOUR AND GROWTH OF YOUNG TEA PLANTS (DTRC/FM/22).

The details of the experiment are as follows.

Location	–	–	Experimental Farm, DTRC.
Clone	–	–	T78
Year of planting		–	1993
Design	–	–	R B D
Replication		–	3
Plants per plot		–	30
No. of treatments		–	9
No. of plots		–	27

Treatments :

T1	=	Control
T2	=	Organic manure (FYM)
T3	=	FYM + Urea + Rock Phos + MOP
T4	=	120 : 45 : 80 kg/ha/NPK basal through Urea, Rock Phos & Mop
T5	=	120 : 45 : 80 kg/ha/NPK basal through Amm. Sulph., Rock Phos & MOP
T6	=	120 : 45 : 80 kg/ha/NPK basal through CAN, Rock Phos & MOP
T7	=	90 : 22.5 & 40 kg/ha/NPK (2 splits through Urea, 30 : 22.5 & 40 kg/ha/NPK Rock Phos & MOP).

T8 = 90 : 22.5 & 40 kg/ha/NPK (2 splits through Amm. sulph., 30 : 22.5 & 40 kg/ha/NPK Rock Phos & MOP).

T9 = 90 : 22.5 & 40 kg/ha/NPK (2 splits through CAN, ROCK PHOS 30 : 22.5 & 40 kg/ha/NPK & MOP).

The experiment was started in the year 1996. Net photosynthesis, stomatal conductance, stomatal resistance, intercellular CO2 and transpiration was measured by Portable Photosynthesis System (LI – 6200). Girth was measured with the help of slide callipers. On the basis of preliminary trend highest net photosynthesis rate during the month of August, October, December '96 and February '97 was recorded in the treatment where 120 : 45 : 80 kg N : P : K/ha (basal) was applied through CAN : Rock Phos : MOP followed by 120 : 45 : 80 kg N : P : K/ha (basal) applied through Amm. Sulph. : Rock Phos : MOP, 90 : 22.5 : 40 and 30 : 22.5 : 40 kg NPK/ha (split) and 120 : 45 : 80 kg NPK/ha (basal) through Urea : Rock Phos : MOP and so on.

The highest girth has been recorded under T6 and T8 wherein 120 : 45 : 80 kg NPK/ha have been applied through CAN : Rock Phos : MOP and 90 : 22.5 : 40 and 30 : 22.5 : 40 kg NPK/ha (split) through Amm. Sulph : Rock Phos : MOP. Stomtal conductance was high during the month of August and October, '96 while it was lowest during Feb, 1997 (Table – 3).

1.6.3. DIURNAL VARIATIONS OF PHYSIOLOGICAL PARAMETERS

The data has been recorded on 29th September, 1996 on plants of clone T78. Reading has been taken only in the second leaf at two hour intervals from 6 A. M. to 6 P. M. (Table – 4).

TABLE – 3 : STANDARDISATION OF LEAF FOR RECORDING OF PHYSIOLOGICAL PARAMETERS (MEAN)

Treatment	Net Photosynthesis (μ mol $m^{-2}s^{-1}$)				Intercellular CO_2 Concentration (ppm)				Stomatal Resistance ($s\ cm^{-1}$)				Stomatal Conductance ($s\ cm^{-1}$)			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
T1	5.641	9.488	5.948	6.009	202.9	237.3	252.1	175.6	5.704	1.332	2.894	5.386	.2157	.5987	.3939	.1655
T2	9.099	11.444	7.388	7.610	212.2	246.9	231.8	197.4	2.274	1.400	2.225	3.860	.4565	.7155	.4506	.2611
T3	7.736	10.995	10.385	8.050	218.0	241.9	205.1	196.7	1.896	1.480	2.260	3.853	.4806	.6812	.4714	.2669
T4	7.701	9.807	10.003	10.199	176.7	250.4	231.5	186.0	3.551	1.689	2.133	3.209	.2838	.6238	.4909	.3219
T5	10.472	11.015	9.301	8.745	208.3	253.2	207.8	174.9	1.838	1.403	2.529	4.066	.5596	.7227	.4013	.2476
T6	11.119	11.873	10.621	10.203	215.2	260.3	219.5	190.7	1.642	1.446	1.988	3.159	.6346	.8900	.5149	.3201
T7	5.651	11.010	8.348	9.243	205.5	251.4	217.4	197.9	3.523	1.518	2.812	3.117	.4890	.6780	.3745	.3216
T8	9.576	9.995	6.986	8.803	211.4	295.8	247.5	213.0	1.980	2.306	2.661	3.875	.5089	.7703	.4111	.2695
T9	6.963	10.323	9.954	9.282	209.9	270.1	221.6	181.5	1.867	1.366	2.269	3.531	.5496	.7523	.4723	.2870

A = MONTH OF AUGUST '96 B = MONTH OF OCTOBER '96
C = MONTH OF DECEMBER '96 D = MONTH OF FEBRUARY '97

Treatment	Transpiration ($mol\ m^{-2}s^{-1}$)				Girth (cm)				Leaf Temp (°C)				Leaf Area (sq cm)			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
T1	.0044	.0041	.0021	.0018	3.0	3.2	3.5	3.8	37.4	20.8	18.2	25.6	–	27.87	28.85	–
T2	.0074	.0039	.0028	.0027	2.9	3.3	3.7	4.0	36.5	21.5	19.6	25.9	–	31.75	33.61	–
T3	.0078	.0032	.0033	.0029	2.8	3.4	3.6	3.8	36.3	19.7	21.9	26.7	–	35.40	36.08	–
T4	.0055	.0029	.0031	.0030	2.8	3.5	3.7	3.9	37.6	20.2	19.1	25.2	–	34.83	35.81	–
T5	.0077	.0035	.0027	.0026	2.9	3.5	3.9	4.1	35.4	19.6	20.9	26.2	–	29.92	30.58	–
T6	.0084	.0037	.0032	.0030	3.2	3.6	3.8	4.2	35.0	20.3	19.7	25.4	–	35.91	34.49	–
T7	.0063	.0032	.0025	.0032	2.9	3.3	3.7	3.8	36.7	19.8	20.9	26.2	–	31.86	32.85	–
T8	.0077	.0037	.0025	.0027	3.3	3.5	3.6	4.2	35.9	20.0	19.9	25.4	–	32.35	33.04	–
T9	.0083	.0035	.0032	.0030	2.8	3.5	3.7	4.0	36.9	20.7	21.8	26.4	–	34.5	35.17	–

TABLE – 4 : DIURNAL VARIATIONS OF PHYSIOLOGICAL PARAMETERS (SEPTEMBER, 1996)

Time (hr)	Leaf Temp (°C)			Photosynthesis (u molm^{-2}s^{-1})			Intercellular CO_2 CONC (ppm)			Stomatal Conductance (cm s^{-1})			Transpiration (molm^{-2}s^{-1})		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
06.00	13.9	14.0	14.2	0.083	0.798	0.682	366.7	365.4	423.3	.3473	.4036	.2932	.0011	.0013	.0009
08.00	24.7	24.6	24.9	8.372	10.490	10.180	253.4	254.2	226.0	.6009	.8076	.7058	.0040	.0054	.0048
10.00	30.5	31.2	30.4	9.585	10.780	10.038	213.9	205.7	212.8	.7527	.8352	.8662	.0049	.0047	.0048
12.00	24.0	23.9	24.1	9.506	8.413	7.439	265.6	268.8	278.6	.7145	.7472	.7612	.0038	.0043	.0042
14.00	22.8	22.6	22.5	6.342	4.640	4.720	317.6	304.0	306.4	.6351	.6354	.7152	.0036	.0038	.0038
16.00	22.7	22.6	22.5	4.100	3.560	4.050	288.5	310.1	298.2	.5545	.5218	.5498	.0030	.0028	.0031
18.00	20.5	20.5	21.0	.6628	.5460	.3858	440.1	360.8	358.5	.3455	.3388	.2453	.0017	.0018	.0014

SOIL SCIENCE DIVISION

2.1 **SOIL TESTING** – Tea estate soils have been tested and recommendation offered as per requirement. During the year under report 1782 tea estate soil samples, 10 organic manure, 3 compost, 19 fertilisers and 9 water samples were tested for the following parameters. In all 6571 estimations have been carried out.

Sl. No.	Parameters	No. of samples analysed
1.	pH	1782
2.	Organic Carbon	1535
3.	Mineralisable Nitrogen	212
4.	Available phosphate	1167
5.	Available potash	1538
6.	Available sulphur	198
7.	Cation Exchange capacity	44
8.	Organic manures	10
9.	Compost	3
10.	Fertilisers	19
11.	Water samples (analysed for pH, electrical conductivity, carbonates, bicarbonates, sulphates, phosphates, nitrates)	9 (63 estimations)
	Total Estimations :	**6571**

The name of Tea Estates whose soil, organic manures, compost, fertilisers and water samples has been analysed are :

Darjeeling tea gardens – Mundakoti, Pussimping, Ringtong and Hope town, Rohni, Chamong, Margaret's Hope, Singbuli, Dilaram, Nurbong, Sivitar, Castleton, Happy Valley, Ambootia, Tukvar, Saicon and Makaibari.

Doars and Terai tea gardens – Toonbari, Samsing, Doolong, Atal, Fagu, Mission Hill, Rajani, P.K.Pal (small tea grower), Parurbala, Patkapara, Bhatkhawa, Dalgaon, Rahimpur and Ranichera.

Sikkim tea garden – Temi

Assam tea garden – Mornai

2.2. RESEARCH PROJECTS

2.2.1. EFFICACY OF SPLIT AND BASAL APPLICATIONS OF ORGANIC AND INORGANIC FERTILISERS IN THE OPTIMISATION OF YIELD AND QUALITY OF MATURE DARJEELING TEA. (DTRC/S/7).

A field experiment was initiated during 1993 to ascertain the efficacy of split and basal application on yield and quality of Darjeeling tea. Soil samples were collected before and 15 days after application of fertiliser from both top and sub soil. The

results of 1996 revealed that the treatment of single basal dose of CAN : Rock Phos : MOP @ 120 : 45 : 80kg/ha of N, P, K yielded maximum (Table – 5A).

In the plots treated with phosphatic and potash fertilizers with doses of nitrogen (Urea) kept constant at 120kg N/ha did not show any significant difference in yield of made tea with different doses of phosphate and potash (treatments) applied in a single basal dose (Table – 5B).

TABLE – 5A : EFFICACY OF SPLIT AND BASAL APPLICATION OF ORGANIC AND INORGANIC FERTILISERS IN RESPECT OF MADE TEA YIELD.

Treatments	Dose of Fertiliser	Made tea kg/ha (1996)
T1	Control – – –	287.667
T2	Paraskhol @ 2M.T/ha – – –	361.667
T3	Paraskhol @ 1M.T/ha + 60 : 22.5 : 40kg NPK/ha –	375.333
T4	120 : 45 : 80kg NPK/ha Urea, DAP, MOP – –	416.00
T5	120 : 45 : 80kg NPK/ha $(NH_4)_2SO_4$, DAP, RP, MOP –	407.333
T6	120 : 45 : 80kg NPK/ha CAN, PAP, MOP – –	448.00
T7	90 : 22.5 : 40 and 30 : 22.5 : 40kg/NPK/ha split Urea, DAP, RP –	383.667
T8	90 : 22.5 : 40 and 30 : 22.5 : 40kg/NPK/ha split Amm. Sulph, DAP, RP	378.333
T9	90 : 22.5 : 40 and 30 : 22.5 : 40kg/NPK/ha CAN, DAP, RP–343.667	
T10	120 : 45 : 80kg NPK/ha Urea, RP, MOP – –	358.333
T11	120 : 45 : 80kg NPK/ha Amm. Sulph, RP, MOP– 414.333	
T12	120 : 45 : 80kg NPK/ha CAN, RP, MOP – –	364.666
T13	90 : 22.5 : 40 and 30 : 22.5 : 40kg NPK/ha split Urea, RP, MOP	390.00
T14	90 : 22.5 : 40 and 30 : 22.5 : 40kg NPK/ha Amm. Sulph, RP, MOP	386.333
T15	90 : 22.5 : 40 and 30 : 22.5 : 40kg NPK/ha CAN, RP, MOP392.667	
	C. D. at 5% –	55.43

a) LP – done in Nov - Dec '95
b) Single basal dose applied in the month of May only.
c) 2 split doses applied in the month of May and September.

TABLE – 5B : EFFECT OF DIFFERENT DOSES OF PHOSPHATIC AND POTASHIC FERTILISERS ON MADE TEA YIELD.

Treatments	Dose of Fertiliser	Made tea kg/ha (1996)
T1	Control – –	287.667
T2	120 : 45 : 80kg NPK/ha Urea, RP, MOP –	381.000
T3	120 : 45 : 100kg NPK/ha Urea, RP, MOP –	335.000
T4	120 : 45 : 120kg NPK/ha Urea, RP, MOP –	350.000
T5	120 : 30 : 80kg NPK/ha Urea, RP, MOP –	360.333
T6	120 : 30 : 100kg NPK/ha Urea, RP, MOP –	362.000
T7	120 : 30 : 120kg NPK/ha Urea, RP, MOP –	372.000
T8	120 : 20 : 80kg NPK/ha Urea, RP, MOP –	357.667
T9	120 : 20 : 100kg NPK/ha Urea, RP, MOP –	363.333
T10	120 : 20 : 120kg NPK/ha Urea, RP, MOP –	362.667

a) LP – done in Nov - Dec '95
b) Fertiliser applied in the month of May only.

BIOCHEMISTRY

3. RESEARCH PROJECT

3.1 STUDIES ON BIOCHEMICAL COMPOSITION OF CLONES RELEASED FOR DARJEELING TEA INDUSTRY (DTRC/BIO/6).

During 1996 season crude lipids of clones were estimated gravimetrically. Data revealed that quality clones contained less crude lipids than non-quality clones (Table – 6).

Tetraterpenoids were also studied qualitatively in a few clones. T.L.C. studies revealed the presence of new compounds which might have some bearing on Darjeeling tea flavour. Further studies possibly can confirm presence of new compounds.

3.2 INFLUENCE OF PRUNING ON CHEMICAL COMPOSITION OF AROMA PRECURSORS OF DARJEELING FLAVOURY TEAS (DTRC/BIO/7).

An experiment to study the effect of pruning cycle on chemical composition and aroma precursors of Darjeeling teas (DTRC/Bio/7) was started during 1996. Data indicated that total polyphenol content declined in pruned bushes. Shoot component studies for chlorophyll 'a' and 'b' are in progress (Table – 7).

3.3 DEGRADATION OF POLYPHENOLS AND CHLOROPHYLLS DURING MANUFACTURING OF DARJEELING FLAVOURY AND NON-FLAVOURY TEA (DTRC/BIO/8)

An experiment was started in 1996 to study the degradation of polyphenols and chlorophylls during manufacture of tea in Darjeeling. Pattern of polyphenol and chlorophyll degradation during various stages of tea manufacture and behaviour of these compounds in flavoury and non-flavoury teas will be covered in the studies. A loss of 20% polyphenolic content during withering was observed. Withering was done at 28/cfm air circulation.

TABLE – 6 : COMPOSITION OF CRUDE LIPIDS IN QUALITY & NON-QUALITY CLONES (%)

Sl. No.	Clone	1st flush	Rain flush	Remarks
1.	AV2 (Q)	4.20	5.13	Q. Quality
2.	P312 (Q)	4.36	5.28	NQ. Non-Quality
3.	T78	5.02	6.19	
4.	T135 (N Q)	6.35	8.72	
5.	TS 378 (N Q)	5.83	7.56	

TABLE – 7 : TOTAL POLYPHENOLS IN PRUNED & UNPRUNED TEAS

Sl. No.	Treatment	1st flush	Rain flush	Remarks
1.	HP	24.18	22.10	HP – Heavy pruned
2.	LP	23.52	21.62	LP – Light pruned
3.	LOS	26.26	24.26	LOS – Level of skiff

PLANT PROTECTION

4. RESEARCH PROJECTS.

4.1 EFFECT OF NEEM PRODUCTS IN CONTROLLING TEA PEST AND ITS EFFECT ON QUALITY (DTRC/PP/7).

Effect of various neem basal insecticides – Nethrin, Neem oil, Neemazal and Neemgold in control of various pests was studied. The results are given in table 13 – 18.

Thrips : There was no thrips infestation in Jan. – Feb,. It started built up in March and reached peak in June. Population dropped in July and again built up in August and dropped in Sept. and again went up in October. It started declining from Nov.

Jassids : There was no infestation in January–March. Population started increasing in April and reached high levels in June, showed drop in July and again went up in August. There was drop in September followed by an increase in October. Population declined from November again.

Tea Mosquito : There was no infestation from January to May. It started in June and reached peak in August. Infestation persisted till November and thereafter it declined.

Flushworm : There was no infestation from January to May. It started in June and peaked in October. Thereafter it declined.

Leaf Roller : Leaf roller was active only during May–July. Peak infestation was in June.

Redspider Mite : Red spider infestation started in May and peaked in June. It dropped in July. There was no activity from August onwards.

4.2 POPULATION DYNAMICS OF SOME TEA PESTS INFESTING CHINARY BUSHES (DTRC/PP/8).

Monthly variation in the population of common pests was studied from April, 1996 to March, 1997. Results are given in Table – 19.

4.3 EFFECT OF ORGANIC, INORGANIC FERTILIZERS AND GREEN MANURE CROP ON THE OPTIMIZATION OF YIELD AS WELL AS PEST MANAGEMENT (DTRC/PP/10).

The data presented in Table–8 revealed that highest yield was obtained from treatment no. 9 (120 : 45 : 80kg NPK/ha) i.e. 1571kg/ha followed by treatment No. 8 (90 : 45 : 80kg/ha NPK/ha) i.e. 1517kg/ha. All the treatments proved significantly superior over control in respect of yield. Moreover in respect of pest population, recorded after application of fertilisers at monthly interval, highest

TABLE – 8 : EFFECT OF ORGANIC, INORGANIC FERTILISERS AND GREEN MANURE CROPS ON THE YIELD

Treatments	Dose	Yield kg/ha (made tea)	Mean population * No. of Aphids, Jassids/ quadrate 30x30cm	Thrips/10 buds
T1	Control –	629.666	10.58	15.66
T2	Crotolaria –	1086.333	9.32	16.58
T3	Crotolaria + 80 : 30 : 53kg NPK/ha	1235.333	12.30	17.83
T4	Neem cake @ 1mt/ha –	1177.333	5.73	10.75
T5	Neem cake 0.5mt + 80 : 30 : 53kg NPK/ha	1292.666	8.23	14.58
T6	Vermicompost (Biogold) 1mt/ha –	1371.000	11.08	17.58
T7	F. Y. M. –	1198.000	11.17	17.50
T8	90 : 45 : 80kg NPK/ha –	1517.333	14.00	22.00
T9	120 : 45 : 80kg NPK/ha –	1571.666	15.12	22.58
T10	150 : 45 : 80kg NPK/ha –	1331.000	15.33	23.83
T11	Mushroom compost @ 1MT/ha –	995.00	11.98	17.75
	C. D. at 5% –	326.449	2.17	2.40

* Mean population of insects recorded at monthly intervals.

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T4	Neem cake @ 1mt/ha –	1177.333	5.73	10.75
T5	Neem cake 0.5mt + 80 : 30 : 53kg NPK/ha	1292.666	8.23	14.58
T6	Vermicompost (Biogold) 1mt/ha –	1371.000	11.08	17.58
T7	F. Y. M. –	1198.000	11.17	17.50
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T10	150 : 45 : 80kg NPK/ha –	1331.000	15.33	23.83
T11	Mushroom compost @ 1MT/ha –	995.00	11.98	17.75
	C. D. at 5% –	326.449	2.17	2.40

* Mean population of insects recorded at monthly intervals.

TABLE – 9 : BIO-EFFICACY OF ORGANIC PESTICIDES AGAINST TEA PESTS

Treatments	No. of Aphids/Quadrate (30X30cm)					No. of Jassids/Quadrate (30X30cm)					No. of Thrips/15 Buds (30X30cm)					Made Tea Yield kg/ha
	Before spray	3DAS	5DAS	7DAS	12DAS	Before spray	3DAS	5DAS	7DAS	12DAS	Before spray	3DAS	5DAS	7DAS	12DAS	
Control	28.6	65.46	66.00	67.73	30.80	2.33	8.07	7.93	10.86	9.06	23.00	40.00	42.00	38.00	35.33	472
Pestoneem @ 0.25%	30.6	21.06	20.50	5.93	10.13	2.20	2.07	2.93	3.33	2.46	25.66	17.00	15.00	19.33	22.00	664
------"------ @ 0.5%	29.8	17.80	17.06	5.00	12.00	3.06	1.60	2.53	3.13	3.73	26.00	16.67	13.67	15.33	19.66	729
Neemolin @ 0.33%	34.00	21.53	20.40	12.20	12.26	3.00	2.46	2.26	3.33	2.93	22.00	20.00	18.33	20.33	20.66	644
------"------ @ 0.5%	22.33	14.40	14.20	6.40	7.46	2.06	1.80	3.06	4.20	2.53	24.33	18.33	10.66	19.33	19.66	728
Margosom @ 0.25%	22.53	22.86	19.60	11.26	11.87	2.40	2.27	2.67	7.20	2.80	21.66	20.67	19.00	25.66	26.33	624
------"------ @ 0.5%	29.20	19.93	16.06	6.66	7.27	1.80	1.73	2.13	2.40	2.33	25.66	17.00	16.33	19.66	20.00	653
Allitin @ 0.25%	22.46	13.13	13.60	5.66	6.06	2.13	2.00	3.06	5.73	2.40	21.66	20.33	16.33	16.33	20.33	695
------"------ @ 0.5%	31.53	11.86	10.47	4.53	1.66	2.20	1.93	2.53	4.66	2.86	24.66	17.67	14.00	14.66	19.00	754
Nuvacron @ 0.25%	30.66	0.00	0.00	0.26	0.60	2.46	0.06	0.00	0.06	0.33	21.00	0.33	0.00	3.33	7.33	961
Margo Econeem @ 0.25%	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
C. D. at 5%	N. S.	35.84	13.26	10.86	6.14	N. S.	1.26	1.38	4.84	4.84	N. S.	9.20	7.75	7.64	8.70	117

– = Not recorded.

DAS = Days After Spray.

TABLE – 10 : ANTIFEEDANT PROPERTIES OF SOME PLANT EXTRACTS AGAINST BUNCH CATERPILLAR *(Andraca bipunctata)* ON TEA

Name of Plant	Concentration %	Area Consumed sq. cm.	% area protection due to treatment over control	Preference index
Control	–	63.30	–	–
Artimisia vulgaris	1.0	8.17	87.19	0.22
Artimisia vulgaris	0.5	22.36	63.86	0.53
Artimisia vulgaris	0.25	30.27	52.33	0.64
Urtica dioica	1.0	11.99	81.12	0.31
Urtica dioica	0.5	18.43	70.65	0.45
Urtica dioica	0.25	24.33	60.93	0.55
Polygonum runcinetum	1.0	8.46	86.01	0.23
Polygonum runcinetum	0.5	23.85	61.95	0.54
Polygonum runcinetum	0.25	35.77	41.98	0.71
Eupatorium glandulosum	1.0	14.05	77.52	0.35
Eupatorium glandulosum	0.5	23.56	61.85	0.54
Eupatorium glandulosum	0.25	37.44	39.85	0.74
C. D. at 5%	–	9.69	15.29	0.15

TABLE – 11A : BEFORE INCIDENCE VISUAL % INFESTATION

Treatments		Before spray	Ist spray		IInd spray		IIIrd spray	
			7DAS	14DAS	7DAS	14DAS	7DAS	14DAS
Delan (Dithianon 75% WP)	@ 0.1%	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.66 (1.00)	4.33 (2.18)	5.00 (2.34)
...".....	@ 0.15%	1.66 (1.25)	4.00 (1.84)	1.66 (1.25)	1.66 (1.25)	1.00 (1.10)	3.66 (2.03)	4.33 (2.18)
...".....	@ 0.2%	1.66 (1.25)	2.66 (1.64)	0.16 (1.81)	0.33 (0.88)	0.66 (1.05)	2.33 (1.54)	3.33 (1.93)
Baycor (Bitertanol 25% WP)	@ 0.05%	0.00 (0.71)	0.00 (0.71)	0.50 (0.98)	1.66 (1.39)	3.66 (2.01)	5.00 (2.28)	6.66 (2.64)
Calixin (Tridemorph 80%)	@ 0.25%	0.00 (0.71)	0.33 (0.88)	2.00 (1.47)	3.00(1.86)	3.33(1.93)	4.33(2.23)	6.00(2.48)
Control		0.00 (0.71)	1.00 (1.17)	3.00 (1.81)	7.66 (2.83)	15.00 (3.90)	15.66 (4.00)	18.33 (4.27)
	C. D. at 5%	N. S.	N. S.	N. S.	0.89	1.24	1.19	0.96

Figures in parenthesis are square root transformed data.

DAS – Days After Spray

TABLE – 11B : BEFORE INCIDENCE NO. OF BLISTER SPOTS/10 LEAVES

Treatments		Before spray	Ist spray		IInd spray		IIIrd spray	
			7DAS	14DAS	7DAS	14DAS	7DAS	14DAS
Delan (Dithianon 75% WP)	@ 0.1%	0.00 (0.71)	0.00 (0.71)	0.33 (0.88)	0.00 (0.71)	0.33 (0.88)	4.33 (2.15)	7.33 (2.79)
...".....	@ 0.15%	2.33 (1.39)	2.00 (1.47)	2.66 (1.44)	2.33 (1.49)	2.00 (1.32)	5.66 (2.48)	6.33 (2.60)
...".....	@ 0.2%	3.00 (1.50)	1.66 (1.44)	0.33 (0.88)	0.66 (1.00)	0.66 (1.00)	3.33 (1.77)	6.33 (2.61)
Baycor (Bitertanol 25% WP)	@ 0.05%	0.66 (1.05)	0.33 (0.88)	1.66 (1.39)	3.33 (1.93)	4.00 (2.12)	3.00 (2.12)	8.00 (2.90)
Calixin (Tridemorph 80%)	@ 0.25%	0.33 (0.88)	1.00 (1.17)	3.00 (1.86)	4.00 (2.10)	4.33 (2.16)	5.33 (2.42)	7.00 (2.69)
Control		0.00 (0.71)	6.33 (2.53)	9.33 (3.13)	14.00 (3.78)	21.66 (4.70)	16.00 (4.06)	23.33 (4.86)
	C. D. at 5%	N. S.	N. S.	0.97	0.98	1.00	1.06	0.81

Figures in parenthesis are square root transformed data.

DAS – Days After Spray

TABLE – 12A : EFFECT OF DIFFERENT CHEMICALS IN CONTROL OF BLISTER BLIGHT (after incidence visual % infestation)

Treatments		Before spray	Ist spray		IInd spray	
			7DAS	14DAS	7DAS	14DAS
Delan (Dithianon 75% WP)	@ 0.1%	15.00 (3.90)	7.66 (2.83)	9.33 (3.13)	5.00 (2.32)	3.66 (2.03)
..... do	@ 0.15%	15.00 (3.90)	6.66 (2.64)	9.33 (3.13)	4.33 (2.19)	1.33 (1.34)
..... do	@ 0.2%	12.66 (3.47)	5.00 (2.34)	6.66 (2.64)	2.33 (1.68)	0.00 (0.71)
Baycor (Bitertanol 25% WP)	@ 0.05%	12.66 (3.41)	6.66 (2.67)	8.33 (2.94)	6.66 (2.64)	5.66 (2.46)
Calixin (Tridemorph 80%)	@ 0.25%	21.66 (4.70)	7.66 (2.83)	10.33 (3.26)	9.33 (3.13)	7.66 (2.83)
Control		15.00 (3.94)	17.66 (4.26)	20.00 (4.53)	25.00 (5.03)	26.66 (5.21)
	C. D. at 5%	N. S.	0.74	0.78	0.54	0.49

Figures in parenthesis are square root transformed data.
DAS – Days After Spray

TABLE – 12B : AFTER INCIDENCE NO. OF BLISTER SPOTS/10 LEAVES

Treatments		Before spray	Ist spray		IInd spray	
			7DAS	14DAS	7DAS	14DAS
Delan (Dithianon 75% WP)	@ 0.1%	14.66 (3.88)	4.33 (2.18)	9.00 (3.06)	6.33 (2.60)	3.66 (2.04)
..... do	@ 0.15%	13.00 (3.65)	2.66 (1.76)	7.66 (2.85)	4.33 (2.19)	2.00 (1.56)
..... do	@ 0.2%	17.00 (4.18)	3.33 (1.94)	6.66 (2.67)	2.00 (1.58)	0.33 (0.88)
Baycor (Bitertanol 25% WP)	@ 0.05%	14.33 (3.85)	3.00 (2.34)	8.66 (3.01)	11.66 (3.48)	10.00 (3.24)
Calixin (Tridemorph 80%)	@ 0.25%	22.33 (4.66)	7.66 (2.84)	9.00 (3.08)	12.66 (3.60)	13.33 (3.71)
Control		14.66 (3.89)	16.33 (4.10)	21.00 (4.64)	24.33 (3.95)	27.33 (5.26)
	C. D. at 5%	N. S.	0.64	0.58	0.63	0.51

Figures in parenthesis are square root transformed data.
DAS – Days After Spray

TABLE – 13 : THRIPS

Treatments	July (14/7)		August (7/8)		September (20/9)		October (4/10)	
	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.
Bioneem @ 500ml/acre	22	20	6	5	14	12	33	23
Nethrin @ 200ml/acre	10	9	4	2	9	7	16	11
Neem-oil @ 1% + Teepol @ 2%	18	16	5	3	17	13	30	19
Neemgold @ 500ml/acre	25	21	7	6	17	16	31	19
Neemazal @ 200ml/acre	15	13	6	5	13	9	21	17
Nuvacron @ 1 : 400	8	1	3	2	8	3	12	4
CONTROL 40	40	33	9	7	24	21	46	41
Total	**138**	**113**	**40**	**30**	**102**	**81**	**189**	**134**

Date of spray is given against each month

Table no. 13, population of Thrips in 0.054 sq. m., 24 hrs. and 48 hrs. after spraying.

TABLE – 14 : JASSIDS

Treatments	July (14/7)		August (7/8)		September (20/9)		October (4/10)	
	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.
Bioneem @ 500ml/acre	12	7	5	3	8	7	23	16
Nethrin @ 200ml/acre	6	5	3	1	8	6	18	10
Neem-oil @ 1% + Teepol @ 2%	11	7	4	3	9	7	18	9
Neemgold @ 500ml/acre	20	17	5	4	11	10	22	13
Neemazal @ 200ml/acre	15	10	3	3	10	8	20	14
Nuvacron @ 1 : 400	2	0	1	0	5	3	7	3
CONTROL 40	20	20	7	6	14	13	35	33
Total	**86**	**66**	**28**	**20**	**65**	**54**	**143**	**98**

Date of spray is given against each month

Table no. 14, population of Jassid in 0.054 sq. m., 24 hrs. and 48 hrs. after spraying.

TABLE – 15 : TEA MUSQUITO BUGS

Treatments	July (14/7)		August (7/8)		September (20/9)		October (4/10)	
	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.
Bioneem @ 500ml/acre	20	19	9	6	17	11	30	23
Nethrin @ 200ml/acre	11	7	6	3	9	5	18	12
Neem-oil @ 1% + Teepol @ 2%	21	15	6	5	12	10	27	20
Neemgold @ 500ml/acre	22	20	10	7	15	13	31	25
Neemazal @ 200ml/acre	17	14	7	5	10	9	25	14
Nuvacron @ 1 : 400	6	3	5	2	8	3	13	5
CONTROL 40	25	22	10	8	25	24	45	37
Total	**122**	**100**	**53**	**36**	**96**	**75**	**189**	**135**

Date of spray is given against each month

Table no. 15, population of T. M. in 0.054 sq. m., 24 hrs. and 48 hrs. after spraying.

TABLE – 16 : LEAF ROLLER

Treatments	July (14/7)		August (7/8)		September (20/9)		October (4/10)	
	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.
Bioneem @ 500ml/acre	–	–	3	2	7	5	7	5
Nethrin @ 200ml/acre	–	–	2	1	5	3	11	6
Neem-oil @ 1% + Teepol @ 2%	–	–	1	1	7	6	9	6
Neemgold @ 500ml/acre	–	–	–	–	11	10	7	7
Neemazal @ 200ml/acre	–	–	2	2	8	3	11	9
Nuvacron @ 1 : 400	–	–	0	0	2	0	3	1
CONTROL 40	–	–	3	3	9	7	17	14
Total	**–**	**–**	**11**	**9**	**49**	**34**	**65**	**48**

Date of spray is given against each month

Table no. 16, population of Leaf Roller in 0.054 sq. m., 24 hrs. and 48 hrs. after spraying.

TABLE – 17 : FLUSH WORM

Treatments		July (14/7)		August (7/8)		September (20/9)		October (4/10)	
		24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.
Bioneem	@ 500ml/acre	–	–	4	3	9	7	8	5
Nethrin	@ 200ml/acre	–	–	1	0	11	9	10	6
Neem-oil @ 1% +	Teepol @ 2%	–	–	2	2	10	6	10	6
Neemgold	@ 500ml/acre	–	–	2	2	10	8	11	9
Neemazal	@ 200ml/acre	–	–	2	1	9	5	12	7
Nuvacron	@ 1 : 400	–	–	0	0	5	1	3	1
CONTROL	40	–	–	7	5	10	9	16	15
Total		–	–	**18**	**13**	**64**	**45**	**70**	**49**

Date of spray is given against each month

Table no. 17, population of Flush worm in 0.054 sq. m., 24 hrs. and 48 hrs. after spraying.

TABLE – 18 : RED SPIDER MITE

Treatments		July (14/7)		August (7/8)		September (20/9)		October (4/10)	
		24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.	24hrs.	48hrs.
Bioneem	@ 500ml/acre	9	7	–	–	–	–	–	–
Nethrin	@ 200ml/acre	6	3	–	–	–	–	–	–
Neemoil @ 1% +	Teepol @ 2%	8	5	–	–	–	–	–	–
Neemgold	@ 500ml/acre	8	7	–	–	–	–	–	–
Neemazal	@ 200ml/acre	11	9	–	–	–	–	–	–
Nuvacron	@ 1 : 400	2	1	–	–	–	–	–	–
CONTROL	40	17	16	–	–	–	–	–	–
Total		**61**	**48**	–	–	–	–	–	–

Date of spray is given against each month

Table no. 18, population of Red Spider Mite in 0.054 sq. m., 24 hrs. and 48 hrs. after spraying.

number of sucking insects per quadrate (30x30cm) in case of Aphids and Jassids and per 10 buds in case of thrips were recorded in treatment No. 10 (150 : 45 : 80kg NPK/ha) while lowest number was recorded in treatment No. 4 (Neem cake 1MT/ha). On the basis of data available it appears that higher dose of nitrogen increases the infestation of sucking pests as compared to lower dose of nitrogen as well as organic manures.

4.4 BIO-EFFICACY AND RESIDUE STUDY OF SOME COMMON TEA PESTICIDES (DTRC/PP/11).

This experiment was initiated with the following objectives –

(i) To assess the residue levels in made tea at different intervals.

(ii) To ascertain the safe waiting period in respect of residues present on made tea during dry and wet season.

It was observed that the rate of degradation of pesticides was higher during the wet season as compared to dry season. Residue studies were undertaken during dry (pre-monsoon) and wet (monsoon) season. The data reveals that most of the chemicals which has been studied had residues well below MRL after 7 days of spray in made tea. The only exception was Dicofol during dry season.

4.5 BIO-EFFICACY AND PHYTOTOXICITY OF ORGANIC PESTICIDES ON TEA PESTS (DTRC/PP/12).

The experiment was initiated with the following objectives –

(i) To study the bio-efficacy of organic insecticides against specific pests in comparison with conventional pesticides (Nuvacron).

(ii) To evaluate organic pesticides in respect of yield and pest control.

The details of experiment are as follows –

Location	–	–	DTRC Farm
Design	–	–	R. B. D.
Replication	–	–	3
No. of treatment	–		11
Total no. of plots	–		33
Plot size	–	–	35 sq. m.

The data presented in Table – 9 reveal that among all the treatments Nuvacron @ 0.25% concentration proved best in respect of pest control as well as yield. Among the organic pesticides performance of Allitin @ 0.5% was found best followed by Margosom and Neemolin at 0.5% for aphid control. All organic pesticides are at par against thrips and jassids. No phytotoxic effect has been observed at the applied dose.

4.6 BIO–EFFICACY OF CERTAIN WEED EXTRACTS AGAINST TEA PESTS (DTRC/PP/13).

This experiment could not be started during 1996 due to non-availability of

TABLE – 19 : MONTHLY POPULATION OF DIFFERENT INSECTS IN 30X30CM QUADRATE (TOTAL NUMBER 75 OBSERVATIONS) DURING APRIL, '96 – MARCH, '97

Month	Thrips	Jassid	Tea Mosquito Bug	Flushworm	Leaf roller	Red spider mite
April	44	33	–	–	–	–
May	102	82	–	–	–	71
June	214	112	26	12	–	166
July	92	36	60	8	–	28
August	174	114	194	27	17	–
September	91	63	72	33	30	–
October	143	87	89	50	44	–
November	94	49	60	4	8	–
December	19	13	16	–	–	–
January	–	–	–	–	–	–
February	–	–	–	–	–	–
March	12	–	–	–	–	–

extractor. It will be started in 1997. In the mean time antifeedant properties of these extracts has been studied against bunch caterpillar (*Andraca bipunctata*) under laboratory conditions.

The data presented in Table – 10 reveal that there is significant variation in the leaf area consumed by the bunch caterpillar among different concentrations of plant extracts due to their antifeedant properties. Among all the plant extracts *Artimisia vulgaris* at 1.0% concentration proved best and was closely followed by *Polygonum runcinatum*, *Urtica dioica* and *Eupatorium glandulosum* in respect of leaf area consumed.

4.7 EFFICACY OF DIFFERENT FUNGICIDES AGAINST BLISTER BLIGHT (DTRC/PP/14).

The details of the experiment are as follows –

Location	–	–	DTRC Farm
Design	–	–	R. B. D.
Replication	–	–	3
No. of treatment	–		6
Total no. of plots	–		18

The experiment was initiated in the year of 1996. Prophylactic and palliative spraying was done.

The data presented in Table – 11A & B show that under prophylactic control measures the incidence of disease was lowest in the plots treated with Delan (Dithianon 75% WP) @ 0.2% concentration closely followed by Delan @ 0.15%, Delan @ 0.1%, Calixin @ 0.25% and Baycor @ 0.05%. All the treatments were significantly superior over control.

The data presented in Table – 12A & B show that under palliative spraying Delan (Dithianon) @ 0.2% proved best, followed by Delan @ 0.15%, Delan @ 0.1%, Baycor @ 0.05% and Calixin @ 0.25% in respect of disease control.

B. EELWORM ANALYSIS

16 soil samples received from tea estates were tested for eelworm count.

DISEASE IDENTIFICATION

Disease plant specimens were received from various tea gardens for identification and advice. The plant parts were examined and necessary control measures were suggested. The diseases found were Carry root rot, Black rot and Branch cankar.

1. *Meloidogyne incognita*
2. *Meloidogyne javanica*
3. *Meloidogyne hapla*
4. *Haplolaimus sp.*
5. *Pratylenchus sp.*

NURSERY AND DEVELOPMENT

About 80,000 cuttings of Darjeeling clones were planted for supply to the plantation as well as establishing mother bush. 3,000 UPSAI realeased clonal cuttings were procured from UPASI along with some Bi-clonal seeds.

Centre's own mother bush (Nucleus) plot has been well established, which has started generating cuttings for the centre's own nursery.

About 2,000 clonal plants were supplied during the year to different tea gardens and still more plants are available in the centre's nursery.

5.1 **RESEARCH WORK :** Work on mortality of cuttings is in progress. Preliminary study has shown the following factors responsible for the damage.

a) Effect of fungus – fusarium sp.
b) Moisture level – high percentage.
c) Scorching due to sun.

2. Effect of different shade materials is in progress.

Studies on mortality of cuttings are in progress. Preliminary studies have shown the following factors responsible for mortality.

a) Fusarium infection.
b) Excessive moisutre in beds.
c) Sunscorch.

Studies are also in progress on the use of different materials for use as shade in nursery.

3. Comparative study of bi-nodal and single-node cuttings.

Binodal cuttings has shown better growth in respect of root and shoot development as well as frame formation. It has also shown early sprout of roots and shoots. The plants are also ready for planting in the field much earlier than the single node cuttings/plants (See photograph on cover page).

LIBRARY

During the year 700 books has been acquisitioned.

7 foreign journals has been received which are as follows :

1) Tropical Agriculture.
2) Soil Science Society of America Journal.
3) Field Crop Research.
4) Journal of the Science of Food and Agriculture.
5) Tea International.
6) Experimental Agriculture.
7) Journal of Agriculture Food Chemistry.

6 Indian journals has been received which are as follows :

1) Indian Journal of Agronomy.
2) Pestology.
3) Indian Phytopathology.
4) Journal of Entomological Research.
5) Indian Journal of Entomology.
6) Journal of Plantation Crops.

SCIENTIFIC AND SUPPORTING PERSONNEL AT DTRC

N. Ghosh Hajra, M.Sc., Ph.D.	:	Project Manager

SOIL SCIENCE

R. Saha, M.Sc (Ag), Ph.D	:	Junior Soil Scientist
Ms. S. Rai	:	Laboratory Assistant

BIOCHEMISTRY

N. Kumar, M.Sc.	:	Senior Scientific Assistant
R. Rai, B.Sc.	:	Junior Scientific Assistant
T. Choudhury, B.Sc.	:	Laboratory Assistant

FARM MANAGEMENT (BOTANY AND AGRONOMY)

R. Kumar, M.Sc. (Ag)	:	Junior Scientific Assistant

NURSERY AND DEVELOPMENT

P. Chhetri, M.Sc.	:	Inspector (Development)

PLANT PROTECTION

M. Singh, M.Sc. (Ag)	:	Senior Scientific Assistant
J. S. Bisen, M.Sc. (Ag)	:	Junior Scientific Assistant

The total staff of the centre is seventeen which includes 2 scientific and 3 scientific assistants and 7 administrative personnel.

APPENDIX

Serial No.	Name of the Division	Project Code No.	Title of the Project	Remarks
1.	Farm Management (Botany & Agronomy)	DTRC/FM/16	Effect of Environmental Factors on the Physiological and Biochemical Attributes in Tea.	Ongoing
		DTRC/FM/17	Determination of suitable pruning cycle of old chinary Tea Bushes of Kurseong.	"
		DTRC/FM/19	Effect of Nutrient Management on Stomatal Behaviour and Growth of Young Tea Plants.	"
		DTRC/FM/20	Effect of various Micronutrients in Optimising Yield and Quality of Darjeeling Tea.	
		DTRC/FM/7	Performance of certain Tea Clones in Kurseong.	Concluded
		DTRC/FM/8	Comparison of Methods of Replanting old Tea Bushes.	"
		DTRC/FM/9	Evaluation of Herbicides for Weed control in Darjeeling Tea.	"
		DTRC/FM/10	Training of Young Tea in Darjeeling.	"
		DTRC/FM/11	Effect of Plucking Interval on Crop Yield and Flavour of Made Tea.	"
		DTRC/FM/12	Growth Analysis of Five clones under Kurseong condition.	"
2.	Soil Scierce	DTRC/S/3	Phosphate Fixation studies in Darjeeling Tea Soils.	Ongoing
		DTRC/S/8	Effect of Organic and Inorganic Forms of Fertilisers on Long Term Yield and Soil Fertility.	"
		DTRC/S/9	Effect of Different Levels of Nitrogen (Basal and split) on the Long Term Yield and Soil Fertility.	"
		DTRC/S/1	Effect of Different Doses of Urea and Potash Fertilisers on Yield of Darjeeling Tea.	Concluded
		DTRC/S/2	Effect of Foliar Application of Zinc on Tea in Darjeeling.	"
		DTRC/S/4A	Tea Soils of Darjeeling - Morphology, Classificaton, Mineralogy and Genesis.	"
		DTRC/S/4B	NPK Soil Fertility Status Map of Darjeeling Tea Growing soils.	"
		DTRC/S/5	Studies on Potassium Ion potential and Quantity-Intensity (Q/I) relationships of some Acidic Tea Growing soils of Darjeeling.	"
		DTRC/S/6	Sulphur in Darjeeling Tea Soils-Deficiencies and Remedies.	"
		DTRC/S/7	Phosphorus and Potassium fertilisers in optimisation of Yield and Quality of Darjeeling Tea.	"

3.	Plant Protection	DTRC/PP/7	Effect of neem products in controling of tea pests and its effects on quality.	Ongoing
		DTRC/PP/8	Population dynamics of some tea pests infesting chinary bushes.	"
		DTRC/PP/9	Effect of inorganic, organic fertilisers and green manure crops in the optimisation of yield as well as pest management.	"
		DTRC/PP/12	Bioefficacy, phytotoxicity and compatibility of organic pesticides against tea pests.	Ongoing
		DTRC/PP/13	Bioefficacy of certain plant extracts against sucking pests of tea.	"
		DTRC/PP/14	Efficacy of certain fungicides against blister blight of tea.	"
		DTRC/PP/2	Effect of neemoil, neemcake and neem seed kernel powder in controlling tea pests.	Ongoing
		DTRC/PP/4	Infectivity of *Bacillus thuringiensis* var *kurustaki* against bunch caterpillar.	"
		DTRC/PP/5	Bioefficacy of neem products in controlling certain pests of tea.	"
		DTRC/PP/10	Testing of Delfin (*Bacillus thuringiensis* var. *Kurustaki* serotype 3a, 3b) against flush worm (*Cydia leucostoma*) in young tea in Darjeeling.	"
		DTRC/PP/11	Studies on the residue and persistence of Monocrotophos, Malathion, Quinalphos, Fenvalerate, Dimethoate and Dicofol in made Tea of Darjeeling.	Paper under preparation
4.	Biochemistry	DTRC/Bio/2	Studies of biochemical parameters of clones of tea grown in the Darjeeling hills- Assessment of fermentation periods.	Ongoing
		DTRC/Bio/7	Influence of pruning on chemical composition of aroma precursors of Darjeeling flavoury teas.	"
		DTRC/Bio/8	Degradation of polyphenols and chlorophyll during manufacture of Darjeeling flavoury and nonflavoury teas.	"
		DTRC/Bio/9	Isolation, Identification and characteristion of B Glucosidose in Darjeeling flavoury teas.	"
		DTRC/Bio/1	Darjeeling teas in perspective of ISO specification 3720	Concluded
		DTRC/Bio/4	Determination of clonal compatibility in relation to improvement of flavour and quality of Darjeeling clones.	"
		DTRC/Bio/5	Effect of copper and zinc on the chemical compostion and quality of Darjeeling teas.	"
		DTRC/Bio/6	Effect of plucking intervals on the flavour and quality of Darjeeling teas.	"

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		DTRC/PP/4	Infectivity of *Bacillus thuringiensis* var *kurustaki* against bunch caterpillar.	"
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