

TRIPURA

WEATHER AND ITS FORECASTING

The total rainfall received during 2009-10 is 2478.8 mm (Table 1). About 70% rainfall was received during the monsoon period (June to September), 8% as a post monsoon shower (October to December) and 19% rainfall in summer season (April and May). The total rainy days were 114 days. The maximum rainfall (506.8mm) in a month was recorded in July with 19 rainy days. However, August showed the presence of the highest number of rainy days (21) with 313.3 mm rainfall. Maximum and minimum air temperature were found to vary from 27.4 to 33.7⁰C and 9.2 to 25.4⁰C, respectively. May is the hottest and January is the coolest month of the year. The temperature difference between maximum and minimum was from 3.8 to 15.2⁰C. The temperature difference was recorded highest during January and lowest during April. Soil temperature was recorded from 5 and 20cm depths both in morning and evening. Soil temperature showed an increasing trend along with the depth. Relative humidity in the morning varied from 60 to 91 percent but in the afternoon 49 to 77 percent. The months from June to September showed the highest relative humidity. Humidity in the evening during winter season recorded lowest. Average monthly wind velocity was found to vary from 1.5 to 8.2 km per hour. During summer and monsoon wind speed were observed to have high wind velocity. Monthly average Sunshine hour, on an average underwent a variation from 3.5 to 7.4 hours per day. As usual, winter and summer are more sunny than monsoon. Wind in most of the times remains Westerly except few months during monsoon and winter. During post monsoon season and winter wind direction in the afternoon remains North Westerly. In order to disseminate the weather information including its forecast for minimizing the weather losses in agriculture, the Integrated Agromet Advisory Services of ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra and Indian Meteorological Department, Meteorological Centre, Agartala have jointly started a SMS service for farmers of the state. The Hon'ble Chief Minister of the State Shri Manik Sarkar has inaugurated the service on 30th January 2010 in a Farmers' Meet at the centre. Farmers may get the location specific weather forecast five days in advance. Presently, the forecast is updated twice in a week and will be available at district level. Farmers may type FC<location syntax><ddmmyy> going into "Text Message" leaving no blank and send to 9436949600. The syntax for West Tripura is WST, South Tripura SOU, North Tripura NOR and Dhalai DLI. The location specific real weather information may also be stored into the system through mobile network from different registered users. The data sent, will automatically be stored into the system memory and a brief weather information will automatically be generated and loaded into the web page (tsu.trp.nic.in/agromet). Alarm for severe weather, possible outbreak of pest and insect attacks will automatically be generated and disseminated to the registered farmers. This is as designed by the National Informatics Centre, Govt of India, Agartala. The system is such designed that the same may be used for providing block level weather information without much change.

Table 1. Meteorological data of Lembucherra during 2009 - 10

Month	Rain (mm)	Rainy Days	Evap (mm)	Temperature		Wind Speed (kmph)	Wind Direction		Sun shine (Hr)	Relative Humidity (%)		Soil Temperature (°C)					
				Max °C	Min °C		Morn	Even		Morn	Even	Morning			Evening		
												5 cm	10 cm	20 cm	5 cm	10 cm	20 cm
Apr	70.4	4	155.7	27.4	23.6	6.6	W	W	7.4	82	60	27.8	29.0	29.9	38.9	36.7	34.1
May	399.3	15	128.3	33.7	24.4	5.9	W	W	6.4	82	67	26.6	27.6	28.6	36.2	33.5	32.3
Jun	477.7	20	119.2	33.5	25.2	6.4	SW	W	5.4	85	71	26.9	27.8	28.8	35.4	33.8	32.1
Jul	506.8	19	125.2	32.3	25.4	8.2	W	W	5.2	87	75	26.7	27.7	28.6	34.6	32.9	31.5
Aug	313.3	21	101.6	32.3	25.3	5.5	SW	W	3.5	89	77	26.8	27.7	28.6	33.4	32.4	30.8
Sep	431.0	20	101.3	32.6	25.1	3.8	SW	W	5.1	91	74	27.0	27.8	28.7	33.6	32.7	30.9
Oct	186.6	10	117.9	31.4	22.4	2.2	W	W	6.5	77	74	25.1	26.0	27.0	33.3	32.3	31.1
Nov	18.0	1	120.9	29.5	18.1	1.7	W	NW	6.8	72	67	21.7	22.8	23.9	32.6	31.2	29.7
Dec	0.0	0	103.8	25.6	12.9	1.5	W	NW	1.9	72	66	16.7	17.8	19.2	27.6	33.4	23.3
Jan	0.0	0	98.6	24.4	9.2	2.1	W	NW	5.6	60	63	15.6	16.6	17.5	25.4	23.4	21.0
Feb	0.0	0	120.3	28.9	13.8	2.6	SW	NW	6.0	73	49	18.4	19.7	20.9	32.2	29.5	26.7
Mar	75.7	4	160.1	34.0	21.4	5.1	W	NW	6.3	75	58	24.7	25.8	27.1	38.9	36.5	32.7

RICE

Rice improvement programme

Three lines were nominated to All India Coordinated Rice Improvement Project trials. Details of the lines are given in table 2..

Table 2. Performance of rice lines under AICRP

Trial	Designation	Cross	Days to 50% flower	Grain type	Local trial yield (kg/ha)
IVT IM	TRC-05-8-4-42-8-3-7 (TRC-2005-1)	PYZUM x BPT 5204	103	MS	5970
IVT IM	TRC-05-8-41-3-9-2-5 (TRC 2005-2)	PYZUM x BPT 5204	107	MS	66125
IVT IME	TRC-05-2-6-4-39-3-6 (TRC-2005-3)	JAGANNATH X JAYA	93	LS	6015

TRC 2005 -3 was promoted to AVT 1 on the basis of its performance and yield superiority over the checks.

Hybridization and selection

Further 9 lines were made ready for nominations to AICRIP in 2010 from developed lines at the centre and INGER nurseries conducted by us as they performed better in station trial as well as in PVS. The detail of new lines made ready for nominations are as below.

Maintenance and purification of germplasm

Local landraces, upland and lowland varieties from Tripura were raised in *kharif* season for maintenance and purification.

Rice Improvement AICRP programmes

5 trials in *kharif* 2009 and one trial in *boro* 2008-09 were conducted at this centre. Due to non availability of paddy lands at the centre all trials except boro 2008-09 were conducted on farmers' plot.

Initial varietal trial irrigated midium early

Sixty four entries including checks were evaluated. Yield of the entries ranged from 7601 kg/ha to 3065 kg/ha. Top 5 entries are listed below.

Table 3. Performance of rice lines under IVT (irrigated medium early)

IET No.	Plant ht (cm)	panicle / sq. m.	Grain yield (kg/ ha)
21576	110	374.6	7601
21564	125	380.3	7442
21581	116	373.6	7163
21567	125	368.3	6852
21586	95	362.3	6711

Advance varietal trial 1- irrigated medium

Forty nine entries were evaluated. Yields ranged from 7221 kg/ha to 3132 kg. Top 5 entries are listed below.

Table 4. Performance of rice lines under AVT (irrigated medium)

IET No.	Plant ht (cm)	panicle / sq. m.	Grain yield (kg/ ha)
20931	118	390	7221
20114	121	259	6584
20735	124	373	6434
20904	108	318	6350
20881	111	463	6294

Initial Varietal Trial Irrigated Medium

Sixty four entries were evaluated. Yields in the trial ranged from 8394 kg/ha to 2624 kg/ha. Top 5 entries are listed below.

Table 5. Performance of rice lines under IVT (medium)

IET No.	Plant Ht (cm)	panicle / sq. m.	Grain yield (kg/ ha)
21531	140	355.3	8394
21511	122	405	8230
21536	126	329.6	8165
21512	126	449.3	8111
21538	119	483.3	7304

Aromatic short grain observational nursery 2009

Twenty one entries were evaluated in the nursery. Yields ranged from 4170 kg/ha to 1615 kg/ha. Top 5 entries are as below.

Table 6. Performance of top 5 aromatic rice entries under observational trials

IET No.	Plant Ht (cm)	panicle / sq. m.	Grain yield (kg/ ha)
21276	106	336	4170
21261	114	455	4077
21265	156	306	3990
21272	124	373	3844
21263	134	383	3837

Initial varietal trial aromatic short grain

Sixteen Aromatic Short Grain entries were evaluated. Yields ranged from 3087 kg/ha to 1877 kg/ha. Only one entry IET 19713 could surpass the checks. Top 5 yielders are as below.

Table 7. Performance of rice lines under IVT (aromatic short grain)

IET No.	Plant Ht (cm)	panicle / sq. m.	Grain yield (kg/ ha)
19713	152	396	3087
Kalanamak (check)	161	361	3065
Badshabhog (check)	153	281	3025
Kali Khasa	176	354	2996
21050	165	284	2462

Initial varietal trial boro 2008-09

Fourteen entries were evaluated in boro season. Yield levels in the trial ranged from 8177 kg/ha to 4480 kg/ha. Top 5 entries are as below.

Table 8. Performance of top 5 rice lines under IVT boro

IET No.	Yield (kg/ha)	Plant ht (cm)	Days to flower	Panicles/ sq. m.
21255	8177	125	113	341
21258	7543	115	106	412
21252	7263	102	109	422
21254	6963	119	110	342
IR -64	6803	102	116	355

IRRI – INDIA UPLAND SHUTTLE BREEDING NETWORK PROJECT**AYT 80-100 RNFHF (control)**

- 72 Entries were tried under Alpha Lattice design
- A seed rate of 60 kg / ha with a row spacing of 20 cm has been used
- Direct Seeding with a fertilizer dose of 60:30:30 kg/ha was adapted.

NB. Major drought spells was Oct 11 to till harvest with only 2 rainy days on 17 Oct. and 16 Nov.

AYT 80-100 RNFHF (control)**Table 9. Summary statistics for measured traits for AVT 80-100 RNFHF (control)**

Variate	Minimum	Maximum	Mean	Std. dev.	CV
Days to 50% flower	56	83	68.4	7.0	3.19
Plant Height	85	155	124.3	10.5	6.95
Yield (kg / ha)	754.5	3988.5	2276.4	817.2	30.6
Lodging (%)	0	100	50.2	35.4	
Days to Harvest	98	111.5	104.1	2.4	
No. of Panicles / Plant	4.5	14	9.4	2.2	

Table 10. Performance of top 5 rice entries AVT 80-100 RNFHF (control)

Entries	DTF	PH (cm)	GY (kg/ha)	Lodging (%)	Days to Harvest	Pan /plant
RR 509-6-B-2	74	137.5	3988.5	5	105.5	10
IR 83868-B-B-258-CRA-3-1	77	135	3922.6	50	103.5	9
RR 222-1	67	130	3909.2	62.5	104.5	13.5
BAU 446-06	61.5	131.5	3616.9	100	102	11
RR 451-2821-2-1	67	134	3573.8	75	104.5	9



Fig 1. Dr. Arvind Kumar, Sr. Scientist, Drought Breeding, IRRI, Philippines visiting URSBN and DBN trials at the centre.

Table 11. Performance of top 5 entries under AYT 80-100 RNFLF (stress)

Entries	DTF	PH (cm)	GY (kg/ha)	Lodging (%)	Days to Harvest	Pan /plant
RR 616-B-2-54-1	64	127.5	2427.03	50	92	5.5
IR 83871-B-B-239-CRA-5-1	64	92.5	2258.87	45	96.5	5
RR 451-2821-2-1	60	112.5	2204.33	95	100	5.5
IR 84898-B-171-CRA-43-1	65	132.5	2136.15	90	91	9
RR 616-B-2-66-4	65	105	2022.53	0	102	7.5

Observational Yield Trial (stress)

- Experimental Design: Alpha Lattice
- Number of Entries: 117
- Rate of Seeding: 60 kg / ha
- Space between rows: 20 cm
- Method of Establishment: Direct Seeded
- Fertilizer Application: 20:10:10

Table 12. Summary statistics for measured traits of Observational Yield Trial (OYT - Stress).

Variate	Minimum	Maximum	Mean	Std. dev.
Days to 50% flower	52	77	67.2	5.5
Plant Height	85	142	115.4	10.7
Yield (kg / ha)	170	2810	1222.5	629.4
Lodging (%)	0	95	10.5	22.2
Days to Harvest	88	104.5	98.1	3.9
No. of Panicles / Plant	3.5	13	7.0	1.7

Table 13. Performance of top 5 entries under Observational Yield Trial (Stress).

Entries	DTF	PH (cm)	GY (kg/ha)	Lodging (%)	Days to Harvest	Panicle /plant
IR 82589-B-B-2-2	66	115.5	2810	0	97	9.5
IR 82589-B-B-147-2	67	109	2720	0	98	6.5
IR 82589-B-B-7-3	71	112.5	2600	0	99	6.5
IR 82590-B-B-102-4	72	114	2600	0	101	6
IR 82589-B-B-84-3	67.5	115	2360	0	98	8.5

Drought donors (STRESS)

- Experimental Design: Alpha Lattice
- Number of Entries: 24
- Rate of Seeding: 60 kg / ha
- Space between rows: 20 cm
- Method of Establishment: Direct Seeded
- Fertilizer Application: 20:10:10

Table 14. Summary statistics for measured traits under drought donors (Stress).

Variate	Minimum	Maximum	Mean	Std. dev.	CV
Days to 50% flower	53	71.3	63	4	3.53
Plant Height	79.3	172.3	109.8	19.5	7.99
Yield (kg / ha)	333.4	1733.7	984.5	498.6	42.47
Lodging (%)	40	100	80.8	17.1	
Days to Harvest	89	98	94.3	2.1	
No. of Panicles / sq. m.	534	151.3	380.2	106.6	

Table 15. Performance of top 5 donors under drought donors (Stress)

Entries	DTF	PH (cm)	GY (kg/ha)	Lodging (%)	Days to Harvest	Pan /plant
RR 345-2	65.0	107.0	2022.6	40.0	98.0	242.7
RR 366-5	63.0	80.0	1955.9	73.3	94.3	442.3
VANDANA	63.0	107.3	1733.7	95.0	93.0	534.0
DDR 105	65.0	146.7	1622.5	76.7	94.7	337.7
DULAR	65.7	83.0	1600.3	63.3	94.7	509.0

Drought donors (Control)

- Experimental Design: Alpha Lattice
- Number of Entries: 24
- Rate of Seeding: 60 kg / ha
- Space between rows: 20 cm
- Method of Establishment: Direct Seeded
- Fertilizer Application: 60:30:30

Table 16. Performance of top 5 donors under drought donors (Control).

Entries	DTF	PH (cm)	GY (kg/ha)	Lodging (%)	Days to Harvest	Pan /plant
RR 348-6	57.0	93.5	3214.0	0.0	98.0	12.5
ANNADA	65.5	100.0	3070.6	0.0	100.5	11.0
RR 345-2	58.0	136.5	3007.3	32.5	101.0	13.0
SALUMPIKIT	79.0	157.5	2737.2	12.5	105.0	9.0
ANJALI	56.5	125.0	2670.5	50.0	99.0	11.0

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Table 17. Performance of top 5 entries under AYT 100-120 (control)

ENTRIES	DTF	PHT	GY KG/HA
IR 79913-B-399-B-2	73	145	4360
IR 78875-207-B-1-B	75	137	4346
IR 84894-B-143-CRA-17-1	70	152	4149
IR 78908-105-B-2-B	71	152	3919
NDR 1045-2	73	128	3742

Table 18. Top 5 entries under AYT 100 -120 reproductive stress

ENTRIES	DTF	PHT	GY KG/HA
IR 80013-B-141-4-1	66	107	2889
IR 84899-B-185-CRA-5-1	68	82	2690
IR 81063-B-94-U-3-2	65	109	2678
IR 81044-B-112-U-4-2	70	114	2678
IR 78875-207-B-1-B	60	107	2645

Table 19. AYT 100 -120 RNFSS

ENTRIES	DTF	PHT	GY KG/HA
IR 79970-B-47-1	71	126	3930
IR 78908-105-B-2-B	71	138	3614
IR 80013-B-141-4-1	75	130	3602
NDR 1119	73	123	3485
IR 70215-70-CPA-3-4-1-3	72	1777	3427

Table 20. Advance yield trial greater than 120 days (control)

ENTRIES	DTF	PHT	GY KG/HA
IR 78875-207-B-B-13-14	74	138	5653
IR 80461-B-7-1	68	112	5606
IR 75417-R-R-R-R-267-3	72	162	4508
CB 5754	72	134	4168
IR 78908-140-B-1-B-B	67	150	4034

Table 21. Advance yield trial greater than 120 Days (Reproductive stress)

ENTRIES	DTF	PHT	GY KG/HA
CB 5755	75	110	2884
IR 78875-207-B-B-13-14	75	121	2643
IR 80508-B-194-2-B	73	122	2599
IR 84882-B-121-CRA-3-1	75	101	2555
NDR 1135	72	127	2527

Table 22. Advance yield trial greater than 120 days (Rainfed severe stress)

ENTRIES	DTF	PHT	GY KG/HA
IR 78875-207-B-B-13-14	74	121	3211
NDR 1135	72	121	2669
IR 77080-B-34-3	72	117	2562
SAMBHA MAHSURI	92	97	2442
IR 80508-B-194-2-B	70	123	2293

Table 23. IR64 isogenic lines (Control)

ENTRIES	DTF	PHT	GY KG/HA
IR 77298-14-1-2-1	66	124	4824
IR 77298-14-1-2-15	72	129	4772
IR 77298-14-1-2-10	66	124	4707
IR 77298-14-1-2-19	69	115	4353
IR 77298-14-1-2-13	66	125	4281

Table 24. IR64 isogenic lines (Reproductive stress)

ENTRIES	DTF	PHT	GY KG/HA
IR 77298-14-1-2-15	76	94	2124
ADAY SEL	74	161	2063
IR 77298-14-1-2-1	71	93	1898
IR 77298-12-7-25	70	91	1735
IR 77298-14-1-2-19	69	85	1664



Fig 2. Dr. Casiana Vera Cruz, Sr. Plant Pathologist, IRRI, Philippines and Dr. M. Varier, Principal Scientist CRURRS, Hazaribag, visiting the URSBN and DBN trials at the centre.



Fig 3. Dr. N. P. Singh, Joint Director, Tripura Centre appreciating a bumper crop of *Jhum* rice at Baramura while visiting along with Dr. Arvind Kumar, Sr. Scientist, IRRI.

RICE DISEASE

Influence of host resistance on the incidence of sheath blight disease in Tripura

Varietal response to the disease was studied both in field and in potted plants with artificial inoculation. The field plots were inoculated during cloudy- rainy days at growth stage 3 (IRRI,96) with *Rhizoctonia solani* inoculum grown on rice grain medium supplemented with calcium carbonate (10%) and calcium sulphate (30%) @ 50g/plot (4m X5m). The disease was scored in 0-9 scale at growth stage 7-8. None of the genotypes showed high level of resistance, although, the disease was comparatively less in the genotypes like, NDR-97, Garomaloti, Bati, Aduma, 540177, IC 526713, IC, 540249, IC 540179, IC 540237, RCPL 1-115, RCPL 1-114, RCPL 1-46, RCPL 1-116, Bhalum-1 and Bhalum-2. The host resistance study was done to further confirm the resistance against sheath blight disease of the host genotypes under controlled condition giving same amount of inoculum and environment. The potted plants were replicated thrice. Each pot contained five plants and each plant was inoculated with one inoculum of 5mm diameter PDA block. The inoculum was inserted below a healthy sheath. Number of spots developed per pot with five plants and the size of spot (length) were measured on 7th day after inoculation. The results indicated that the spot size in Aduma was minimum (2.63cm) which followed by IC 540275 (3.10cm), NDR-97 (3.17cm), Garomalati (3.20cm) and Bhalum-1 (3.27cm), respectively, although in all cases number of spots were more or less similar. Further, except IC 540275, all the aforementioned varieties showed considerable degree of resistance both under field and controlled conditions.

Efficacy of biocontrol agent in minimizing sheath blight disease in rice

This study was done in two steps. Under *in vivo* condition, field evaluation of different biocontrol agents collecting from markets and soils were done with the rice variety TRC-27-251. The results indicated those different strains of *Trichoderma viride*, *Trichoderma sp.* and *Pseudomonas fluorescens* collecting from different locations, *Gliocladium virens* and *Trichoderma harzianum* + *Trichoderma viride* mixture showed different effects in minimizing the disease. In most cases their effects are negligible except *Pseudomonas fluorescens* – a product of Amit Biotech (trade name Guard) where along with disease

minimization yield was increased. Under *in vitro* conditions, in all ten biocontrol agents, viz. *Trichoderma viride* (Guard, Amit biotech, Howrah), *T. sp.*, (Jay Biotech, Kolkata), *T. viride* (Nagaland, personal collection), *T. sp.* (ICAR, Tripura, personal collection), *T. viride* (Meghalaya, personal collection), *T. viride* (Carbogurd, Dr. Rajan Laboratories, Chennai), *Pseudomonas fluorescens* (Sedoj, Jay Biotech, Kolkata), *Pseudomonas fluorescens* (Rakshak, Amit biotech, Howrah), *Bacillus subtilis* (Fighter, Dr. Rajan Laboratories, Chennai) and *Gliocladium virens* (Assam, personal collection) were grown on nutrient medium. The cell free extract after 14 days growth were mixed at the rate of 100µl and 500µl with the 20 ml of sterilized stab medium and inoculated with a 5mm diameter inoculum of the causal fungus of sheath blight disease. The radial growth of the pathogen was measured after 72 h of incubation. The results revealed that cell free extract of both *T. viride* (Amit) and *P. fluorescens* (Amit) were effective to minimize the mycelial growth (Fig 4).

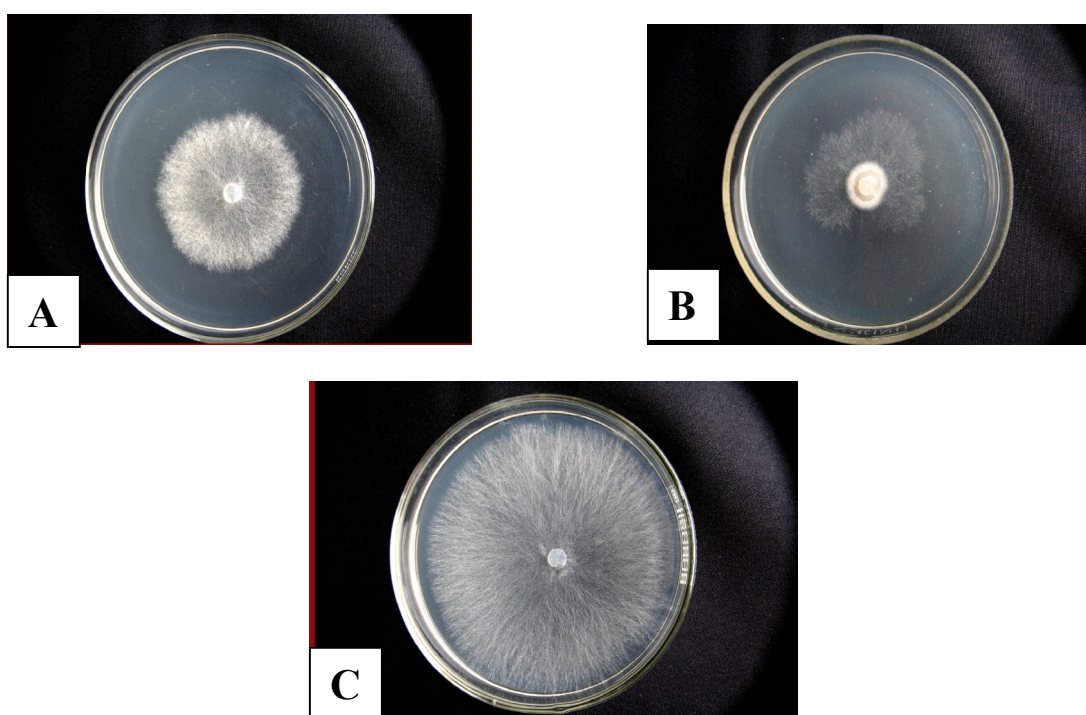


Fig. 4. Effect of cell free extract of biocontrol agents on the growth of *Rhizoctonia solani* A. *Trichoderma viride* (Amit) 100µl, B. *Pseudomonas fluorescens* (Amit) 500 µl C. Control

Evaluation of fungicides to control sheath blight disease in rice

This experiment was conducted both *in vivo* (field evaluation) and *in vitro*. Seven fungicides, viz., Carbendazim 0.05%, Chlorothalonil (0.2%), Mancozeb, 0.2%, Benomyl (0.1%), Tricyclazole (0.1%), Hexaconazole (0.025%) and Propiconazole 0.025%, were tested in field which was inoculated by sheath blight pathogen spreading inoculum of *Rhizoctonia solani* grown on rice grain medium supplemented with calcium carbonate (10%) and calcium sulphate (30%) @ 50g/plot (4m X 5m) during cloudy- rainy days at growth stage 3. The disease was scored in 0-9 scale at growth stage 7-8. Under field condition all the fungicides except mancozeb and tricyclazole were effective to minimize the disease. However, both propiconazole and hexaconazole showed toxic effects to the plant by decreasing plant's height. For *in vitro* study, bioassay of fungicides was conducted

in Petri plate to determine the efficacy of fungicides for controlling sheath blight pathogen of rice. Blotting paper of 3 cm diameter was dipped in different fungicide solutions and inoculated PDA medium by 2cm diameter inoculum in petri plate. Incubation was done for 72 hrs at $28 \pm 1^{\circ}\text{C}$. The inhibition zone and characteristics of mycelial growth were noted. The results (Fig. 5) revealed that the systemic fungicides, carbendazim, hexaconazole and propiconazole as well as contact fungicide, chlorothalonil, were effective to control the pathogen, although in later case zone of inhibition was not measurable but killing of mycelia in contact with filter paper was clearly visible.

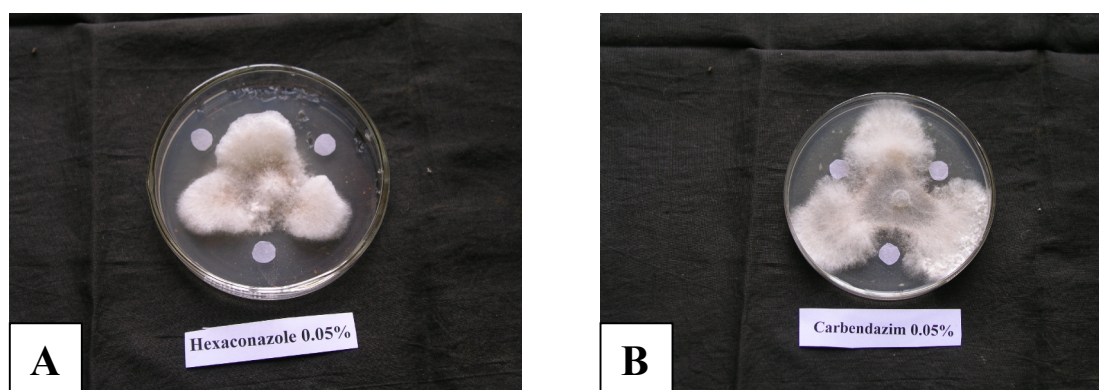


Fig. 5 Bioassay of fungicides to control sheath blight pathogen of rice. A. Hexaconazole 0.05% showing inhibition of mycelial growth; B. Carbendazim 0.05% showing inhibition of mycelial growth

FRONT LINE DEMONSTRATIONS ON RICE

In boro 2008-09, 231 FLDs including 54 in Hybrid rice were conducted at 14 locations. FLDs included HYV – Naveen, Hybrids - Arize 6444 and Arize 6219 and package technology (SRI or ICM).

In kharif 2009 226 FLDs were conducted on TRC 2005 -1, Naveen, Durga, Varshadhan and MTU 1010. In 2009-10 boro 634 FLDs including 84 in collaboration with Divyodaya Krishi Vigyan Kendra, Chebri, West Tripura were conducted on TRC 2005-1, Chandan, MTU 1010. During this season first time demonstrations were held on 8 row self propelled mechanical paddy transplanter in Khowai sub division in collaboration with KVK, Chebri (Fig 6).



Fig 6. Different stages of demonstrations with paddy transplanter conducted with KVK, Cherai, West Tripura.

MAIZE

Sheath blight disease incidence was studied in 52 genotypes during kharif crop season 2009. The disease was found to affect all the genotypes studied. Its intensity was more while the crop grown later. The genotypes like DMR-102 and DMR-108 showed resistant with disease score 1.9 & 1.7 in 1-5 scale, respectively (Table 25).

Table 25. Sheath blight disease incidence in maize genotypes

Date of sowing	Number of genotypes	Range of disease score in 1-5 scale on 60 DAS	Resistant (R) / Susceptible (S)/ Remarks
18.4.09	17	1.2-2.2	Not clear due to low disease incidence
28.4.09	9	1.8-2.4	Not clear due to low disease incidence
12.5.09	26	1.7-4.0	DMR-102 (R); DMR- 108 (R)

PULSES

Varietal improvement

TRCP - 8 (Field pea, *Pisum sativum* L.) IC 583364 recommended for Uttarakhand hills, Jammu and Kashmir and North Eastern states of India by CVRC was submitted to Central Sub Committee on Crop Standards Notification and Release of Varieties. The proposal was accepted in the meeting held on 25th January 2010. The salient features of the variety is given below.

Salient features of “TRCP-8”

- TRCP - 8 was developed from the cross “T- 163 x DMR 7” at ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra – 799 210, Tripura .
- TRCP – 8 ranked 1st on the basis of yield of 4 year testing (1396 kg/ha)
- The proposed strain TRCP - 8 has shown significant yield superiority of 70.56% over the check HUDP - 15 and 32.84 % over DMR – 7, 24% over Rachana and 22. 55 % over IPFD 1-10 Average superiority at 4, 20, 20, and 16 locations, respectively) during 2005-06 to 2008-09.
- TRCP - 8 ranked first at 6 locations and top in first non-significant group at 11 locations out of 20 locations tested in NHZ.
- TRCP – 8 exhibited multi-location disease resistance to Powdery Mildew and Rust, which are very important diseases of field pea in NHZ.
- TRCP – 8 exhibited tolerance to pod borer and stem fly.
- TRCP – 8 exhibited good tolerance to *M. incognita* and *M. javanica* at different locations.
- It has Medium bold seed size (18.94), spherical and cream coloured seed
- TRCP - 8 (1973 kg / ha) has shown better response to lower dose fertilizer application of 20: 20: 20 kg NPK/ha as compared to check varieties and qualified varieties. At recommended doses of fertilizer also TRCP – 8 out yielded check varieties and qualified varieties at Lembucherra.
- TRCP - 8 also performed much better (2023kg / ha) than the check varieties and qualified varieties under late sown condition.



Fig 7. Release of TRCP -8 by His Excellency Governor of Tripura, Dr. D. Y. Patil, during Spring / Summer Pulses Group Meet 2010 held at Pragna Bhavan, Agartala on 27th January 2010.

Table 26. Plant Description of TRCP -8 (Field pea (*Pisum sativum* L.))

Growth habit	Tall and vigorous
Leaf: Simple or compound	Simple
Leaf: Leaflets	Present
Leaf: Axil colour	Green
Stem: Colour	Light green
Stem: Anthocyanin colouration	Absent
Foliage Colour	Green
Flower: Standard petal Colour	white
Pod: Number / Axil	Double
Pod: Curvature	Absent
Pod: Shape of distal part	Blunt
Pod: Intensity of Green Colour	Green
Plant: Height	Long
Seed	Straw white
Seed: Shape	Spherical
Seed: Surface	Smooth
Seed: Cotyledon colour	Creamy
Seed: Weight of 1000 seeds	Medium
Seed: Testa mottling	Absent
Agronomic traits	
Days to 50% flowering	97 (49 – 168) days
Days to maturity	140 (87 – 207) days
Plant height (cm)	98 (47 – 161) cm
100 seed weight	18.94 (15.7 – 24.2)
Protein percentage	19.86
Disease and Pest Reaction	Resistant to Powdery mildew and rust. Tolerant to pod borer and stem fly. Tolerant to <i>M. incognita</i> and <i>M. javanica</i> at different locations.

Another Variety **TRCP -9** developed from cross “**DMR 7 x T- 163**” also qualified for VIC proposal in 2009. However, its proposal was not submitted to CVRC due to the fact TRCP – 8 and TRCP – 9 both qualified for VIC proposal in the same year. Proposal will be submitted to SVRC for release of TRCP – 9. Performance of TRCP – 9 in AICRP trials is given below.

Table 27. Performance of TRCP-9 in AICRP trials over 3 years : Zone: NHZ

	Year of Testing (No. of Trials)	Qualifying variety (TRCP-9)	Check & Qualifying Varieties			
			Pant P 86 (QV)	Rachana (Tall Check)	DMR 7 (Tall Check)	IPFD 1-10 (Dwarf check)
Mean yield (kg/ha) Zonal	2006-07 (5)	1177	1064	865	873	854
	2007-08 (6)	842	844	623	659	753
	2008-09 (5)	1202	1058	1039	1067	1080
Mean		1074	989	842	866	896

AICRP MULLaRP

Urdbean AVT2 kharif 2009 : 5 entries were evaluated.

Table 28. Performance of top 5 entries under AVT kharif.

Urdbean AVT2 kharif 2009	
Entry	Yield (KG / HA)
KU-203	1181.6
KU-201	1105.0
KU-202	975.4
KU-205	826.6
KU-204	722.3

Urdbean IVT kharif 20009: 14 entries were evaluated.

Table 29. Performance of top 5 entries of urdbean IVT kharif

Urdbean IVT kharif 20009	
Entry	Yield (KG / HA)
KU-260	1222.9
KU-279	1211.8
KU-265	1164.3
KU-268	1143.9
KU-252	1095.1

Mungbean IVT kharif 2009: 24 entries were evaluated.

Table 30. Performance of top 5 entries of mungbean IVT kharif.

Mungbean IVT 2009-10	
Entry	Yield (KG / HA)
KM-09-159	1781.6
KM-09-152	1605.1
KM-09-155	1595.2
KM-09-165	1377.9
KM-09-172	1372.9

Special trial Urdbean 2009-10: 11 entries were evaluated.

Table 31. Performance of entries of urdbean special trial.

Special trial Urdbean 2009-10	
Entry	Yield (KG / HA)
WBU-108	1314.9
KU-963	1138.4
MASH-1008	1087.7
PU-40	1008.7
LBS-752	992.7
TU-942	980.9
MASH-114	968.0
LBG-20	966.1
UTTARA	940.2
PU-31	932.2
SEKHAR-1	802.5

Mungbean Special Trial kharif 2009: 18 entries were evaluated.

Table 32. Performance of entries of mungbean under special trial -kharif

Entry	Yield (KG / HA)
IPM-0723	1874.8
IPM-99-125	1735.3
OUM-11-5	1419.2
PUSA -9531	1280.3
RMG-492	1179.1
KM-2241	1148.2
PUSA-9072	1143.9
Pusa Vishal	1137.1
COGG -912	1081.6
SAMRAT	1043.3
IPM-02-17	1042.7
PUSA RATNA	1025.4
TM-962	1019.2
PANT M 4	996.4
TARM-1	950.1
HUM-1	888.3
PANT M 5	749.4
SML-668	453.7

Mungbean AVT 1 kharif 2009-10: 13 entries were evaluated.

Table 33. Performance of top 5 entries of mungbean under AVT 1 kharif

Mungbean AVT 1 kharif 2009-10	
Entry	Yield (KG / HA)
KM-09-106	1582.5
KM-09-112	1107.4
KM-09-108	1020.2
KM-09-101	960.2
KM-09-102	867.4

Table 34. Status of Breeding Outcomes in Different Crops at Tripura Centre

Crop	No. of genotypes developed	No. of genotypes nominated to AICRP	No. of genotypes identified / promoted by AICRP for satisfactory performance in one or more state	No. of genotypes sent to CVRC and SVRC	No. of varieties released by CVRC or SVRC
Rice	155	7	TRC- 87-251 ranked 1st in AICRIP IVT VE TP 2006-07. TRC -87-251 & TRC 87-251-1 were listed as promising for different states by AICRIP 2007-08. TRC -2005-3 promoted to AVT 1 in 2009	Proposal for TRC -87-251 is prepared for submission to SVRC	
Maize	13	3	TRM -5-OY promoted to AET 1		
Fieldpea	230	2	TRCP – 8 and TRCP – 9 both qualified for VIC proposal in 2009	TRCP – 8 released by CVRC	Proposal for TRCP – 9 for submission to SVRC is made ready
Greengram	678	2	--	--	--
Blackgram	6	--	--	--	--
Toria	4	1	TRC-T-1-1-5-1 (TCN-06-19A) secured first position in IVT (Rainfed) Zone V in 2007-2008.		
Yellow Sorson	14	--	--	--	--
Sesame	4	--	--	--	--

FRONT LINE DEMONSTRATIONS IN PULSES SPRING / SUMMER 2009

During Spring / Summer 2009 a total of 127 FLDs were conducted on mungbean and urdbean. HUM -12 and PU – 31 were varieties of mungbean and urdbean, respectively, used for the FLDs. The demonstrations were conducted to test the effect of Sulfur application and urea spray. Sulfur @ 20 kg/ ha was applied in both mungbean and urdbean. Two sprays of urea just before flowering, followed by another spray after 10 days were applied on mungbean variety HUM -12. Based on the average yield advantage of the FLDs it was found that Sulfur application @ 20 kg/ha resulted

in **9.5** percent yield gain for HUM -12. However, for urdbean PU 31 the yield gain was only **5.4** percent. prays of 2% urea could increase the yield in HUM – 12 by **6.3** percent

kharif 2009

In kharif 2009 139 FLDs were conducted by us. Eighty one FLDs were conducted on Blackgram and 58 FLDs were conducted on Greengram. In Black gram for FLD plots variety PU -31 Truthfully Labeled seed produced by us was given with standard package technology; whereas, for check plots farmers used local seed and own practice. In greengram HUM – 16 Truthfully Labeled seed produced by us was given along with standard package of practices for FLD plots, whereas, for check plots farmer's seed of local Sona Mung and farmer's practice was followed. FLDs were conducted at 10 locations viz. Bagabasa, Bagma, Barabhaia, Koroiamura, South Bagma, West Kufilong and Mirza in South Tripura and batapura in West Tripura under Khowai sub division. Blackgram FLDs recorded an yield advantage of 18.9 per cent and Greengram FLDs recorded an average yield advantage of 15.8 per cent

Rabi 2009-10

In total 136 Front Line Demonstrations on Field pea , Rajmash and Lentil were conducted during rabi 2008-09.

OILSEEDS

GROUNDNUT

Evaluation of recently released cultivars of groundnut in acid soil

Fourteen varieties, viz., ICGS-76, GG-2, GG-13, TG 37A, FeESG-10, FeESG-8, K-134, GG-6, SB XI, GG-11, Kaushal, GG-4, GG-2, GG-8 were grown and NPK (40:60:50) in combination with cowdung (5 t/ha) were applied. As depicted in Table 35, it is evident that the no. of pod, pod and seed weight in groundnut underwent a variation from 5.11 to 20.55, 3.99 to 23.77 and 2.99 to 17.66 g / plant respectively. The variety ICGS-76 and GG-13 showed the highest 100 seed weight (56.6 g) and the variety SBXI and GG-4 the lowest 100 seed weight (33.3 g). Shelling per cent varied from 42.03(Kaushal) to 57.50 (GG-11).The variety GG-13 could produce the highest pod yield (2.88 t/ha) and the lowest pod yield (0.43 t/ha) was produced by FeESG-8.Haulm yield varied from 0.55 to 1.86 t/ha, the highest and lowest being recorded in Kaushal and FeESG -10, respectively.

Table 35. Productivity parameters of groundnut varieties

Groundnut variety	No.of pod/Plant	Pod weight (g/plant)	Seed weight (g/Plant)	Plant weight (g/Plant)	100 seed weight (g)	Shelling %	Productivity (t/ha)	
							Pod	Haulm
ICGS-76	16.10	23.77	17.66	18.77	56.6	49.99	1.08	1.25
GG-2	11.33	13.66	9.99	16.88	50.0	50.00	1.85	1.51
GG-13	10.88	14.77	10.10	28.21	56.6	49.99	2.88	1.71
TG 37A	18.99	22.77	15.66	14.44	40.0	50.06	1.62	1.41
FeESG-10	12.85	11.22	7.88	13.88	40.0	45.45	0.50	0.55
FeESG-8	5.11	3.99	2.99	12.44	53.3	53.36	0.43	0.64
K-134	11.32	8.88	6.77	13.33	50.0	50.00	0.80	1.12
GG-6	20.44	15.66	12.33	23.77	36.6	47.41	1.31	1.50
SB XI	20.55	15.22	10.99	28.99	33.3	49.20	1.33	1.62
GG-11	11.66	21.22	14.55	36.99	53.3	57.50	2.35	1.16

Kaushal	13.66	19.22	13.88	26.66	43.3	42.03	1.86	1.86
GG-4	16.77	16.77	12.44	20.88	33.3	55.71	0.98	1.21
GG-2	14.99	12.11	9.21	15.44	43.3	53.33	1.41	0.94
GG-8	14.33	16.32	13.66	23.33	40.0	46.29	1.43	1.18
SE (±)	1.17	1.28	1.04	2.05	2.4	2.53	0.12	0.11
CD (5% level)	1.81	1.89	1.70	2.39	8.1	2.66	0.57	0.55

Seven recently released cultivars were given trial during Kharif crop season for their performances under acid soil in NEH Region (Table 36). The results revealed that leaf spot disease was comparatively low in GG-20 and ICGS-76 with disease scores 2.87 and 4.1 in 1-9 scale. However, the latter one was more prone to rust. The varieties like, FeESG-10 and FeESG-8 showed high leaf spot disease incidence (disease score: 6.33 – 6.70) although the former one was resistant to rust with 1.9 disease score. The rest of the varieties were intermediate in disease reaction. As regards the yield was concerned, both GG-20 and ICGS-76 gave higher yield during the season.

Table 36. Performances of released cultivars of groundnut during Kharif and Rabi seasons

Variety	Disease score in 1-9 scale		Yield/plot (5 sq.m.) (kg)
	Leaf spot	Rust	
FeESG-8	6.70	3.40	1.300
FeESG-10	6.33	1.90	1.050
GG-5	5.23	2.00	0.750
GG-7	4.47	1.80	1.350
GG-11	5.37	1.76	0.500
GG-20	2.87	1.80	1.820
ICGS-76	4.10	3.57	1.627

Yield performance of groundnut in various intercropping options

Groundnut (var. GG-7, FeESG-10, FeESG-8) was grown in intercropping (2:2) with Rice, Sesamum, and Mung (Fig 8). The NPK dose applied was 40:60:50 kg/ha in combination with cowdung (5 t/ha). Treatment combinations are T1- Sesamum sole crop, T2- Mung sole crop, T3- Rice sole crop, T4-Groundnut (GG-7) sole crop, T5- Groundnut (FeESG-8) sole crop, T6- Groundnut (FeESG-10) sole crop, T7- Groundnut (GG-7) + Rice, T8 - Groundnut (FeESG-8) + Rice, T9- Groundnut (FeESG-10) + Rice, T10- Groundnut (GG-7) + Sesamum, T11- Groundnut (FeESG-8) + Sesamum, T12- Groundnut



Fig. 8 Groundnut in intercropping with rice/ sesame/ mung

(FeESG-10) + Sesamum, T13- Groundnut (GG-7) + Mung, T14- Groundnut (FeESG-8) + Mung, T15- Groundnut (FeESG-10) + Mung. The productivity result indicated that FeESG-10 in combination with Rice could produce the highest yield (1.57 t/ha) followed by the combination with GG-7 and Mung (0.97 t/ha).

Identification of confectionary/ large seeded groundnut varieties

A total 10 nos. of confectionary /large seeded groundnut varieties viz., GG-20, HNG-10, ICGS 76, BAU 13, TPG 41, GG-7 Somnath, NRCGCS 148, and NRCGCS 268 AND NRCGCS 281 were grown in RBD design with 3 replications. NPK (40:60:50) in combination with 5t cowdung/ha was applied. The result indicated that the groundnut variety BAU 13 showed the highest pod, seed and plant weight followed by the variety HNG 10.

Nutrition of bold seeded groundnut in acid soils

The experiment on nutrition of groundnut (var. GG 7) was carried out with the treatment, viz., T1- control, T2 –P50, T3- K100 , T4 –Lime (2.5 t/ha),T5-P50 + Lime, T6- P50 + K100 +Lime, T7- P50 + K100 +Lime +13 Kg Boric acid /ha , T8-P50 + K 100 + Lime + 10 t cowdung /ha. The productivity parameters indicated that the treatment T8 after the application of phosphate (50 kg P₂O₅ /ha), Potash (100 K₂O /ha), Lime (2.5 t/ha) and cowdung (10 t/ha) could produce the highest pod yield of 1.12 t /ha with 14.66 no.of pod and 19.55 g pod weight /Plant.

Evaluation of germplasm and advanced breeding lines of groundnut

Screening of groundnut germplasm against the soil acidic condition was carried out with 66 nos of germplasm. Various vegetative growth parameters of 66 nos of groundnut after 35 days of sowing were recorded and root length varied from 8.17 to 22.06 cm/plant, shoot length, 12.56 to 40.20 cm/plant, no.of secondary root, 10 to 43.16, no.of nodule, 5.66 to 110.66, nodule weight, 0.34 to 0.004 g/plant, root weight, 0.14 to 19.02 g/plant and shoot weight, 4.40 to 29.47 g/plant. Similar nature of variability in groundnut under soil acidic condition was recorded at 65 days after sowing. There was a wide variation in no. of pod from 2.33 to 17.66, pod weight from 2.66 to 22.0 g/plant, seed weight from 1.0 to 15.33 g/plant and plant weight from 2.66 to 36.66 g/plant in groundnut at harvesting. The decline in vegetative/production parameters at 35 and 65 days after sowing and at harvesting could indicate that the variety of groundnut is sensitive under soil acidity but the increase in vegetative/production parameters indicate the presence of tolerance behavior of groundnut under soil acidity.

The groundnut germplasms were evaluated for their disease reaction under natural conditions of Tripura. The diseases, like leaf spot, rust, wilt/stem rot diseases were found during kharif crop season. During this year leaf spot disease was appeared in all the genotypes of core collection. However, the leaf spot disease incidence was low, showing resistant with 2- -3 disease score in 1-9 scale, both under fertilized and unfertilized condition in the genotypes like, NRCG 955, NRCG 12297, NRCG 12487, NRCG 12291, NRCG 12393, NRCG 12968 and NRCG 11985. Rust was more in the genotypes like NRCG 12879, NRCG 2190, NRCG 11197, and NRCG 11656. The genotypes, like, NRCG 11811, NRCG 10572, NRCG 11450, NRCG 12264, NRCG 11126 and NRCG 12700, were more affected by wilt disease than others.

FIELD PEA

Four released varieties, viz. TRCP-8, Rachna, IPFDI-10 and DMR-7, of field pea were studied for their disease reaction under field condition during Ravi crop season, 2009-2010. The blight disease was found as predominant during the season. Among the varieties, the disease was highest with mean disease score 5.11 in 0-9 scale in DMR-7 while least with disease score 1.83 in IPFDI-10.

VEGETABLES

TOMATO

Management of leaf curl disease of tomato under field condition

Influence of host resistance on the incidence leaf curl disease of tomato

Fifteen genotypes including 3 hybrids were given trial in rows with earlier detected susceptible variety, BT-1, as infective row at every 4th row. Three replicates were kept in all cases, except BT-1. The disease was studied after 45 and 55 days of transplantation. It was found that all the tested genotypes were more tolerant than BT-1. However, the disease was least hybrid, Trishul, and variety, Tura Local with 23.33% disease on 55da after transplantation (Table 37). The disease was considerably less in the hybrid, Al rounder, and varieties, BT-10, H-24, BT-117-5-3-1, Type-1 and Hisar Arun (Sel-7). Considering the yield, the hybrids, Trishul and Al rounder, were better than all the varieties. Further, the disease showed different symptoms, i.e. leaf curl with mosaic appearance in presence of other viral attacks.

Table 37. Influence of host resistance on the incidence of leaf curl disease of tomato

Genotypes	Leaf curl disease incidence at different growth stages (%)		Number of fruits/ 10 plants	Yield (kg)/ 10 plants
	45 day after transplantation	55 days after transplantation		
BT-1	60 (\pm 17.89)	80 (\pm 16.73)	542 (\pm 103)	15.4 (\pm 2.92)
S-22	40 (\pm 30.00)	60 (\pm 34.64)	363 (\pm 51)	18.3 (\pm 5.13)
BT-10	23.33 (\pm 25.17)	36.67 (\pm 11.55)	279 (\pm 65)	18.37 (\pm 5.97)
Trishul	23.33 (\pm 20.82)	23.33 (\pm 20.82)	536 (\pm 40)	25.08 (\pm 2.85)
H-24	30 (\pm 10.00)	36.67 (\pm 11.55)	769 (\pm 457)	22.27 (\pm 9.02)
Alrounder	36.67 (\pm 5.77)	36.67 (\pm 5.77)	610 (\pm 278)	25.00 (\pm 8.43)
Sel-1	46.67 (\pm 20.82)	50 (\pm 26.46)	372 (\pm 91)	19.45 (\pm 7.81)
BT-117-5-3-1	26.67 (\pm 15.27)	33.33 (\pm 20.82)	516 (\pm 108)	20.17 (\pm 4.19)
CKVT-17	33.33 (\pm 15.27)	73.33 (\pm 30.55)	672 (\pm 300)	22.2 (\pm 8.21)
S. Local	30 (\pm 20.00)	40 (\pm 10.00)	1041 (\pm 571)	17.77 (\pm 11.21)
Type-1	30 (\pm 17.32)	33.33 (\pm 11.55)	495 (\pm 46)	14.58 (\pm 3.29)
A. Abha	20 (\pm 17.32)	40 (\pm 10.00)	635 (\pm 141)	20.12 (\pm 3.02)
T. Local	13.33 (\pm 15.27)	23.33 (\pm 5.77)	1148 (\pm 191)	19.72 (\pm 3.73)
H.Arun	20 (\pm 17.32)	36.67 (\pm 25.17)	543 (\pm 170)	21.25 (\pm 7.02)
Hybrid608	40 (\pm 26.46)	50 (\pm 30.00)	289 (\pm 53)	11.01 (\pm 1.40)

* Figures in parentheses are standard deviation.

Effect of biopesticides for the control of leaf curl disease in tomato

The experiment was carried out with BT-1 tomato variety. Commercial neem oil (0.1%), neem leaf extract (10%), neem twig extract (10%) and control (without spray) were used as spray in 2 \times 2.5m plot. The biopesticides were sprayed at 10 days interval for 4 times and disease was studied on 45 and 55 days after transplantation. The results

presented in Table 38 indicated that none of the material was effective in minimizing the disease considerably, although, fruit yield increment was observed best while neem leaf extract was used.

Table 38. Effect of biopesticides for the control of leaf curl disease in tomato

Biopesticide	Leaf curl disease incidence at different growth stages (%)		Number of fruits/plot	Yield (kg)/ plot
	45 day after transplantation	55 days after transplantation		
Neem oil	50.55 (\pm 9.18)	97.22 (\pm 4.81)	759 (\pm 100)	20.57 (\pm 0.48)
Neem leaf extract	54.54 (\pm 7.87)	100 (\pm 0.00)	937 (\pm 375)	26.32 (\pm 7.36)
Neem twig extract	55.55 (\pm 4.81)	94.45 (\pm 4.81)	732 (\pm 153)	21.17 (\pm 5.80)
Control (without spray)	61.87 (\pm 32.47)	100 (\pm 0.00)	483 (\pm 156)	16.07 (\pm 7.96)

* Figures in parentheses are standard deviation.

Effect of chemical pesticides for the control of leaf curl disease in tomato

The experiment was carried out with BT-1 tomato variety. Seven pesticides, viz. Carbofuran (1g/plant, soil application), Monochrotophos (0.1%, spray), Malathion (0.1%, spray), Dimethoate (0.1%, spray), Imidachloprid (0.1%, spray), Chloropyriphos + Cypermethrin mixture (0.1%, spray), Carbosulfan (0.1%, spray), were applied at 10 days interval for four times. The data recorded in Table 39 indicated that disease intensity at later stage was less in almost all pesticide applied plot, except, Cypermethrin + chloropyriphos applied one. The fruit yield was also increased in the pesticide applied plot. Monochrotophos and Imidachloprid were seemed to be the most effective in controlling the vector pest, *Bemisia tabaci*.

Table 39. Effect of chemical pesticides for the control of leaf curl disease in tomato

Chemical pesticide	Leaf curl disease incidence at different growth stages (%)		Number of fruits/plot	Yield (kg)/ plot
	45 day after transplantation	55 days after transplantation		
Carbofuran	45.2 (\pm 16.08)	54.04 (\pm 7.44)	598 (\pm 219)	13.5 (\pm 2.69)
Monochrotophos	31.31 (\pm 3.50)	34.09 (\pm 7.23)	624 (\pm 49)	16.03 (\pm 2.34)
Malathion	33.33 (\pm 10.49)	41.16 (\pm 4.57)	644 (\pm 210)	15.37 (\pm 4.11)
Dimethoate	31.56 (\pm 13.17)	52.78 (\pm 12.73)	551 (\pm 83)	14.78 (\pm 1.60)
Imidachloprid	23.99 (\pm 19.23)	38.89 (\pm 4.81)	808 (\pm 76)	19.47 (\pm 3.74)
Cypermethrin + Chloropyriphos	39.65 (\pm 23.43)	61.11 (\pm 24.06)	360 (\pm 67)	11.0 (\pm 2.28)
Carbosulfan	32.32 (\pm 4.63)	47.22 (\pm 6.61)	562 (\pm 29)	14.71 (\pm 1.74)
Control	38.89 (\pm 17.34)	70.44 (\pm 3.27)	398 (\pm 154)	10.48 (\pm 3.95)

* Figures in parentheses are standard deviation.

MUSHROOM

Improvement of summer mushroom cultivation

Evaluation of different races of paddy straw mushroom

Different strains, VV-02, VV-06, VV-07, VV-08, VV-09, VV-10 and VV-11, of paddy straw mushroom (*Volvariella volvacea*) were cultivated during the favourable seasons. In each case cube bed was prepared with 3kg paddy straw. The results showed that VV-02, VV-06 & VV-08 were more productive than the others.

Performances of different species of oyster mushroom

The experiment was conducted with *Pleurotus sajor-caju*, *P. florida* and *P. flabellatus* during the favourable period. All the three species produced more or less same yield (Table 40) but the number of days required for fruit body production in *P. sajor-caju* was least, while, that was highest in *P. flabellatus*.

Table 40. Performances of different species of oyster mushroom on rice straw

Mushroom species	Date of spawning	Days required for fruit body	Yield (g)/ kg substrate
<i>Pleurotus sajor-caju</i>	15.12.2009	20	569.17
<i>Pleurotus florida</i>	15.12.2009	24	547.50
<i>Pleurotus flabellatus</i>	15.12.2009	27	633.33

Effects of different inorganic and organic amendments in mushroom bed for fruit body production of oyster mushroom

Rice straw treated with 5% and 10% solutions of CaCO_3 and lime had no beneficial effect in yield of oyster mushroom. In another experiment, the organic amendments like *Kuro* (commercial rice bran) and *Bhushi* (commercial wheat bran) were mixed with the rice straw substrate after disinfection. The results showed detrimental effect of both the materials.

JATROPHA

Four types of trials, viz., progeny trial, agrisilviculture trial, package of practices and multi national trial were undertaken under National Network Programme on Jatropha.

i. Identifying suitable jatropha progeny for Tripura

Eighteen (18) seed sources were planted on 9th May' 06 and growth characteristics estimated upto November '09. Jatropha planted from seed samples of Udaipur (South Tripura) showed the maximum diameter of 10.48 cm with 14.00 primary branches and 27.00 secondary branches. The lowest basal diameter (7.45 cm) was noted in Jatropha planted from Khowai (West Tripura) With 8 nos of primary branches and 9 nos of secondary branches. Jatropha from UAS (Dharwad) showed the maximum no. of primary brances (25 nos) and Mohanpur (West Tripura) showed the maximum no. of secondary branches (29 nos). Leaf curl disease was noticed in Jatropha and the per cent occurrence varied from 13 to 88 with maximum in Jatropha from Udaipur (South Tripura) and lowest in Jatropha (Madhya Pradesh). Male/female ratio is a matter of great concern in jatropha plantation. Male /Female ratio underwent a variation from 15.28 to 49.05 with fruit yield from 297 to 1952.78 g/plant. Seed yield was variable from 155.33 to 617 g/plant with the shelling percent from 42.51 to 55.05. 1st flowering was recorded in the month of April '09. After 3rd of plantation, Jatropha from Dimapara (South Garo Hills) showed the maximum fruit yield (1.952 kg/tree) with 31.63 % recovery and Jatropha from Madhya Pradesh showed the lowest production of fruit yield (0.297 kg/tree) with 52.16 % recovery. Out of the progeny material from Tripura, Jatropha from Mohanpur (West Tripura) showed the maximum production of fruit (0.9 kg/ tree) with 37.94 % recovery. There was an increment of the purning on the secondary branches of Jatropha. Jatropha from Dimapara (south Garo Hills) showed the maximum no of secondary branches (21-36) thus indicating the maximum fruit/seed yield after 3 years of planting.

ii. Jatropha based agrisilviculture

In the agri silviculture trial planted in May' 06 in spacing of 4 x 3 m, growth characteristics were recorded. In the agri-silviculture trial, 3 crops, viz., okra (var. hybrid 152), cowpea (var. YB -8) and rice (TRC-87-251) were grown. Jatropha from Mendipathar (East Garo Hills) had the maximum basal diameter of 12.50 cm with 36 no of secondary branches. Fruit yield was also maximum (1183 g/plant) in Jatropha from Mendipathar (East Garo Hills). Male /Female ratio was variable from 19.24 to 28.88. Disease (leaf curl) occurrence varied from 20 to 55.6 %. In the interspaces of jatropha from Ri bhoi (Mawahati), there was maximum production of okra (4500 kg/ha). Cowpea showed the maximum production (7650 kg/ha) in the interspaces of jatropha from East Garo Hills (Medipathar). Rice also showed the maximum production of 1890 kg/ha in the interspaces of jatropha from Dimapara (South Garo Hill).

iii. Package of practice for jatropha

In the package of practices trial with the fertilizer dose of 26 g urea, 100 g SSP, 16 g MOP and 1 kg cowdung, growth characteristics were estimated. Basal diameter was maximum (11.3 cm) in jatropha from East Garo Hill (Mendipathar) and lowest (7.25 cm) in Jatropha from Madhya Pradesh. The occurrence of leaf curl disease in Jatropha was comparatively low in the experiment under package of practices. Fruit yield in Jatropha from Udiapur (Rajasthan) was 538 g /tree with 51.9 % recovery.

iv. National provenance trial on jatropha

A National trial with the following materials, viz. LBJJ-23 (Ranchi), NDJC-1 (Faizabad), TFRI -07 (Jabalpur), JIP-12-520621 (Jammu), JJ2 (Jabalpur), Panth JCP-1 (Uttarakhand) 7), JCP-2 (Uttarakhand), PDKVNOV -19 (Akola) was laid out in 2008. Jatropha planted from seed samples of LBJJ-23 showed the maximum basal diameter of 5.74 cm with 1.55 primary branches and height of 1.28 m. The lowest basal diameter (4.32 cm) was noted in Jatropha planted from Panth-JCP-1 with 1 no of primary branches and height of 0.89 m. Jatropha from PDKVNOV -19 (Akola) showed the highest occurrence of leaf curl disease (63 %) and the lowest occurrence (3.01 %) was noted in jatropha from TFRI-07 (Jabalpur). After 3 years of Jatropha planting, jatropha from South Garo Hills (Dimapara) in Meghalaya could produce 1952.78 g fruit /plant and 617.77 g seed/plant with 31 % seed recovery. After 3 years of Jatropha planting, jatropha from Mohanpur (West Tripura) could produce 900.33 g fruit /plant and 341.66 g seed/plant with 37 % seed recovery.

v. Propagation of jatropha through stem cutting

Stem cutting collected from different places of Tripura were planted in 2007 in ICAR Research farm. Male /Female ratio of the materials varied from 12.60 to 102 with fruit yield from 23 to 258.33 g/plant.

Vi. Jatropha in undulated uplands

It was indicated that the fruit yield of the jatropha planted in undulated terrains underwent a variation from 48.00 to 510.00 g/plant. Jatropha from North Tripura (Dharmanagar) showed the highest production of jatropha (510 g /tree). Hybrid Napier was grown as fodder in the interspaces of jatropha in the hilly terrain and productivity of green fodder was 50 t /ha.

Table 41. Performance of jatropha in undulated upland after 3 years.

Position of Uplands	Jatropha		Male flower (Nos)	Female flower (Nos)	Male/ female ratio	Fruit yield (g/plant)	Seed yield (g/plant)
1 st	West	Tripura	3013.00	167.4	17.99	450.00	150
	(Mohanpur)						
2 nd	South	Tripura	606.5	73.5	8.25	219.00	73.00
	(Udaypur)						
2 nd	North	Tripura	404.16	16.16	25.00	48.00	17.66
	(Dharmanagar)						
2 nd	Rajasthan (Udaipur)		229.16	31.16	7.35	275.00	112.00
4 th	North	Tripura	3063.8	170.2	18.02	510.00	270
	(Dharmanagar)						
4 th	East Garo Hills		2278.00	126.55	18.00	378.00	126
	(Meghalaya)						
4 th	Rajasthan (Udaipur)		1036.16	60.33	17.17	280.00	60.00
	Mean		1518.68	92.18	15.96	308.57	115.52

Use of leguminous tree leaf for crop nutrition

To investigate the effect of tree leaf sources from hedge plantation (viz., *Gliricidia maculata*, *Indigofera tinctoria*, *Tephrosia candida* and *Crotalaria tetragona*), green leaf (10 t/ha) with 50 % before sowing of the crop and 50 % as leaf mulch were applied in the crops grown in the terrace. The results indicated that the productivity of upland rice (var. NDR -97) in the terrace land after the application of tree leaf was found to be raised from 1.50 to 2.12 t/ha, 1.72 to 1.90 t/ha and 1.12 to 2.15 t/ha over fertilizer after the application of *Indigofera*, *Tephrosia* and *Gliricidia* green leaf, respectively. With the application of tree leaf, viz., *Tephrosia* and *Gliricidia*, seed yield of sesamum (var. B-67) though showed a decline from 0.89 to 0.75 t/ha and 0.64 to 0.57 t/ha as compared to fertilizer alone but the haulm yield was raised from 2.74 to 2.86 t/ha and 2.29 to 2.52 t/ha, respectively. The application of tree leaf, viz., *Indigofera* and *Gliricidia* could produce a rise in bhindi (var. okra 152) from 1.70 to 3.79 t/ha and 1.34 to 1.61 t/ha but *Tephrosia* leaf could show a concomitant decline in bhindi from 3.13 to 2.16 t/ha over fertilizer application. In mustard (var. TRC -1-1-5-1), tree leaf manuring could produce a rise in seed yield from 0.26 to 0.51 t/ha, 0.93 to 0.96 t/ha and 0.50 to 0.84 t/ha over the fertilizer application and the maximum rise in the productivity was noted after the application of *Indigofera*. The application of *Gliricidia* leaf @10 t/ha could produce a rise in radish (var. Ivory white) from 53.13 to 58.89 t/ha over fertilizer while two other leaf sources (*Indigofera*/*Tephrosia*) could have the radish productivity less than the fertilizer application. In carrot (var. king kuroda), the application of green tree leaf @ 10 t/ha alone could have carrot productivity from 7.50 to 13.75 t/ha, though 20.8 % increase in carrot productivity over fertilizer was noted after the application of *Tephrosia* leaf. An experiment was also conducted with organic manuring, viz., cowdung (2 t/ha), cowdung (5 t/ha), cowdung (10 t/ha), Biofertilizer + 5 t cowdung/ha, Biofertilizer + 10 t cowdung/ha in upland rice (var. TRC-87-261) and mung (var. Ratna) alone and their intercrops. Biofertilizer applied was rhizobium, PSB and Azotobacter inoculated @100 g/kg seed. The application of organic manuring was found to raise the rice equivalent yield of mung as sole crop from 2.90 to

3.68 t/ha. But the combination of rice + mung (1:1) could produce rice equivalent of 2.92 and 3.84 t/ha after the application of cowdung (5 t/ha) and Biofertilizer + 5 t cowdung/ha, respectively thus indicating an increase of 13.6 to 21.5 % over the sole crop of mung. On the other hand, the combination of mung and rice (2:2) showed the reduction in rice equivalent yield as compared to the sole crop of mung. An experiment was conducted with treatments [T1 - Fertilizer (20:60:40), T2– Cowdung (10 t/ha), T3– Fertilizer + Cowdung, T4- ½ fertilizer + cowdung and T5– ½ fertilizer + cowdung + PSB + rhizobium] in field pea (var. TRC –P8) and the productivity of the crop was presented below. Pod yield was found to be increased from 1.88 to 3.69 tha and the corresponding rise I seed and hulm yield was from 1.34 to 2.68 t/ha and 3.60 to 4.74 t/ha.

Soil health card

Soil samples (0-15 cm) were collected from 31 farmers' club in South Tripura during the period under report. It was observed that soil pH varied from 3.02 to 6.92 thus indicating the change in soil acidity from strongly acidic to mild acidic. Organic carbon, nitrogen and phosphorus underwent a variation from very low to very high in status. Availability of potassium was found to be low. Calcium availability was also varying from low to high. There was a wide variation in sulphur from low to high with 58.42% coefficient of variation. Among the micronutrients, soils are having a high concentration of Fe (critical limit 4.5 mg/kg), some soils are low in Mn availability but majority of soils are containing high Mn content (critical limit 2.0 mg/kg). Both Cu and Zn varied from 0.16-5.86 mg/kg and 0.33-8.30 mg/kg, respectively thus indicating deficiency (critical limit 0.6 mg/kg for Zn and 0.2 mg/kg for Cu) in some soils and abundant supply in most of the soils (Table 42).

Table 42. Average soil test report of farmers' club in South Tripura

Parameter	Range	Mean	S.D	C.V (%)
pH	3.02-6.92	4.97	0.49	9.85
Organic carbon (%)	0.1-1.86	0.62	0.29	46.77
Nitrogen (kg/ha)	8.12-578.31	199.44	35.94	18.02
Phosphorus (kg/ha)	0.37-120.37	11.13	9.51	85.54
Potassium (kg/ha)	1.66-97.50	15.76	5.39	34.20
Calcium {c mole (p ⁺)/kg}	0.04-44.25	1.97	0.91	46.19
Sulphur (kg/ha)	0.12-571.25	67.99	39.72	58.42
Iron (mg/kg)	9.10-35.61	26.41	3.94	14.91
Mn (mg/kg)	0.88-22.80	12.17	5.43	44.61
Cu(mg/kg)	0.16-5.86	1.73	0.53	30.63
Zn(mg/kg)	0.33-8.30	2.04	0.72	35.29

AGROFORESTRY

In the arboretum maintained at Tripura Centre, there are 12 tree species, viz., *Acacia auriculiformis*, *Morus alba*, *Leucaena leucocephala*, *Dalbergia sisoo*, *Gliricidia maculata*, *Azadirachta indica*, *Michelia champaca*, *Eucalyptus hybrid*, *Tectona grandis*, *Gmelina arborea*, *Samania saman*, *Albizia lebbeck*. Various crops were grown in association with forest tree species and their productivity in Horti-Silvi systems were presented in Table 43 and 44.

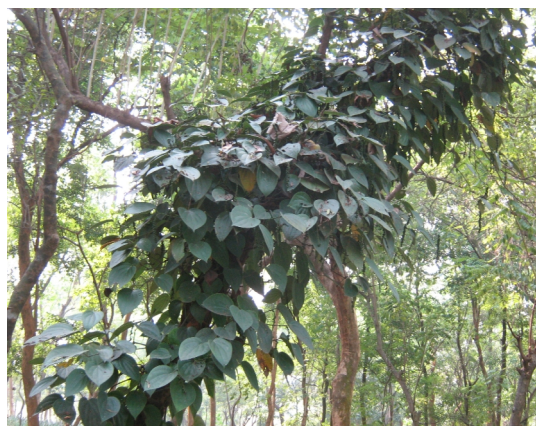
Table 43. Productivity of pineapple

Forest trees	Fruit weight (g)	Fruit yield (t/ ha)
<i>Leucaena leucocephala</i>	890	14.85
<i>Dalbergia sisoo</i>	820	7.03
<i>Eucalyptus hybrid</i>	743	12.69
<i>Azadirachta indica</i>	815	10.82
<i>Tectona grandis</i>	657	12.42
<i>Albizia lebbbeck</i>	760	10.04
<i>Samania saman</i>	816	15.21
<i>Morus alba</i>	790	10.98
<i>Gmelina arborea</i>	705	11.11
<i>Michelia champaca</i>	620	5.58
Mean	762	11.07

Table 44. Productivity of Dioscorea alata

Forest trees	Productivity (kg/ plant)	Productivity (t/ ha)
<i>Leucaena leucocephala</i>	2.39	10.18
<i>Azadirachta indica</i>	3.22	6.36
<i>Albizia lebbbeck</i>	1.08	4.55
<i>Samania saman</i>	2.58	5.69
<i>Morus alba</i>	2.34	8.68
<i>Michelia champaca</i>	1.28	5.13
Mean	2.15	6.77

Black pepper was grown in a 3- tier system with *Azadirachta indica* and *Michelia champaca* and the average productivity of 1.25 kg/plant was obtained.

**Fig 9. Dioscorea + Forest Tree****Fig 10. Black pepper + Forest Tree**

The programme of agroforestry was also undertaken in 1.7 ha of farmer's land with a no. of forest trees and rubber plantation. Out of the total area of 1.7 ha under this project, the area under pineapple was 1.04 ha and an area of 0.40 ha was planted with Kew variety of pineapple. The remaining area under pineapple was Queen variety of pineapple. An attempt has been made to develop agroforestry based land use system with pineapple and dioscorea planted in 1225 m² and 223 m² of land, respectively. Pineapple planted through sucker in the plot would require 18 months to come to the flowering stage. Due to late planting of turmeric, rhizome was not harvested and the produce would be ready for harvesting soon. The productivity of okra in association with rubber varied from 6.45 to 7.5 q/ha and green leaf of patchouli collected from the area under the shade of arecanut

was 13.54 q/ha with the production of 3.33 q/ha dry leaf having a market value of Rs 4333/-.

FARMING SYSTEM RESEARCH

A number of crop combinations were undertaken under farming system research with the aim to make the cropping intensity 300 %. An attempt has been made to combine different crops under farming system research. Some promising combinations have been documented in Table 45.

Table 45. Some promising combinations

Crop sequence	Variety	Unit area	Productivity (t/ ha)	Cost of cultivation (Rs/unit area)	Gross return (Rs/unit area)	Net return (Rs/unit area)	B : C ratio
Banana	Sabri	384 m ²	1.77	1080/-	6400/-	5320/-	5.93
Green gram - Broccoli	HUM 12 Everest	180 m ²	1.19 21.1	2470/-	8675/-	6250/-	3.51
Duck- fish culture	Khaki Cambell Composite fish	326 m ²	6503 nos egg 3.02 t fish/ ha	3370/-	9552/-	6182/-	2.83
Broom grass	Local	108 m ²	14,444 bundles (9.38 t/ha)	620/-	1560/-	940/-	2.52
Ridge gourd- bitter gourd- bottle gourd	Local	190 m ²	1.05 0.95 14.11	2800/-	5740/-	2940/-	2.05
Cowpea- Maize- Cabbage/ Cauliflower	Kashi kanchan TRM 5-BC78/ Snowheart	472 m ²	3.6 4.87 26.2 28.8	10,276/-	18,288/-	8004/-	1.77
Green gram- Potato	Hum 12 TPS (II/67)	80 m ²	1.56 17.0	1190/-	1985/-	795/-	1.67



Fig 11. Sloppy land utilization through Banana + Gamahar (*Gmelina arborea*)



Fig 12. Potato crops under farming

ANIMAL SCIENCES

DAIRY CATTLE

A small herd of crossbred cattle (23 number including calf) was maintained at the livestock farm. The animals were fed on green fodder available, straw and concentrate mixture. The animals were vaccinated timely against FMD, HS and BQ as well as

dewormed at 6 months interval for adult and 3 months interval for calf. A revenue of Rs. 1,30,687 was collected from the sell of milk during 2009- 10. The cow dung was used for making compost which was used for fodder cultivation and also supplied to other division. Research work on enhancing fertility in cattle using biotechniques has been undertaken.

PIGS

The crossbed (Hampshire X Local) pigs were maintained at this centre. Two pairs of local 'Mali' pigs have been introduced from the State Farm of ARD, Govt. of Tripura. A pilot study on productive and reproductive traits of 'Mali' pigs has been undertaken. The pig farm offered a service to provide crossbred piglets to the farmers for backyard pig farming.



Fig 13. Mali pig of Tripura

GOAT

Phenotypic characterization for variation in kidding size in Black Bengal goats

The objective of the study was to generate some phenotypic descriptors for determining the kidding size during pregnancy in Black Bengal goats. Two-stage stratified random sample survey based monthly phenotypic data on 383 pregnant Black Bengal goats were recorded during 5 months of pregnancy period and one set of observation after kidding in 23 villages of 3 districts of Tripura viz., West Tripura, South Tripura and Dhalai. A complete time-series data on 383 goats were analyzed using one-way Analysis of Variance (ANOVA) considering observed kidding size as the only source of variation to investigate if linear type quantitative phenotypic traits influenced the kidding size of prolific Black Bengal goats. Duncan test was applied to compare pair wise mean difference probabilities. The mean comparison through one-way analysis of variance has detected significant differences among most of the linear body measurements (such as head rump length, body length, wither height, croup height, heart girth, punch girth, pelvic triangle area etc.) in Black Bengal goats during different months of pregnancy. Out of 383 does, 60.83 % of does gave birth of twin kids followed by 30.81 % birth of single kid. The incidence of triplet births was 8.36 % with a prolificacy of 177.54%, averaging 1.78 kids per doe. Among the selected goats under study, 68.40% goats were black in hair coat colour and 43.10% goats with black hair color were recorded to give twin birth, though such association was not significant ($p > 0.05$). The goats with bigger ear as well as longer neck showed the tendency to give birth of more kids. The ear length ranged between 12.14 and 12.87 cm. and neck length was recorded to be between 21.59 and 24.94 cm.

The stepwise discriminant function analysis was done to recognize the most probable descriptors. Based on stepwise discriminant analysis, curved head- rump length and distance between tuber major bones were found to be good indicators for higher

kidding size starting from 3rd month of pregnancy, while heart girth and punch girth were good indicators during 4th and 5th months of pregnancy. The fitted linear trend or simple regression lines for descriptors indicated that udder height (from ground) decreased significantly due to advancement in pregnancy (months) for kidding size 3. Chest height (from ground) was found to decrease significantly due to advancement in pregnancy (months) for kidding size 2.

Determination of ovulation rate in cyclic Black Bengal goats using both ultrasonographic (USG) examination as well as laparotomy operation

To investigate the ovulation rate in cyclic Black Bengal goats under National Fund for Basic and Strategic Research in Agriculture (NFBSRA) project, 9 goats were subjected to transrectal ultrasonography (USG) examination at standing position on 10th day of estrous cycle, using 7.5 MHz linear transducer with B-mode. The USG observations were confirmed through laparotomy operation on the same day for counting corpus lutea (CL) in ovaries *in vivo* condition. Out of 9 goats, 33.33 % of cyclic goats showed single ovulation which was taken place in right ovary in all cases. The incidence of two ovulations was recorded in 22.22% of goats, while 44.45% of cyclic goats exhibited three or more than three ovulations during the estrous cycle. Both USG examination and laparotomy operation indicated multiple ovulations in Black Bengal goats were common.

Prediction of kidding size based on plasma follicle stimulating hormone (FSH) and luteinizing hormone (LH) profiles during growing period and peri-pubertal stage in female Black Bengal goats

The female kids born at Goat Farm of ICAR Research Complex, Tripura Centre, Lembucherra were subjected to the weekly blood sampling schedule from the day 1 age upto the day of confirmation of conception by USG, covering the growing stage and peripubertal period. Estrus was checked with vasectomized (teaser) buck. The plasma samples harvested from the collected blood samples were utilized for the estimation of FSH and LH following enzyme immunoassay (EIA) technique. The time period was assigned to day in relation to the day of conception. The FSH and LH data was normalized considering the day of conception as '0' day and the data generated before the conception was utilized for statistical analysis. Based on the record of kidding size, the goats were categorized in three groups, viz. single, twin and triplet kidding size groups. Plasma LH concentrations in goats under the triplet kidding size group were higher ($p < 0.05$) as compared to twin kidding size group during the growing period and peripubertal stage. Similarly, plasma LH concentrations in goats under the twin kidding size group were higher ($p < 0.05$) than the goats under single kidding size group. However, plasma FSH concentrations in goats among three different groups did not differ ($p > 0.05$) during the growing stage and peripubertal period. The present investigation was further extended to more number of animals.

Plasma progesterone and estrone sulphate concentrations during pregnancy period and prediction of fetal number in Black Bengal goats

The investigation was made on 16 Black Bengal pregnant goats. Blood sampling was started from the day of breeding and collected at monthly interval during the pregnancy period and completed by collecting blood sample after one month of parturition. Pregnancy diagnosis was made using transabdominal USG scanning on day 60 of pregnancy. The number of single, twin and triplet pregnancies was seven, seven and two, respectively. The USG observation was also confirmed by recording the number of kid(s) after parturition. The blood samples were centrifuged ($2500 \times g$ for 10min at 4°C) and the plasma separated and utilized for the estimation of progesterone and estrone sulphate using enzyme immuno assay. Plasma progesterone values in goats with triplet pregnancies were significantly higher as compared to those with twin pregnancies (15.53 ± 2.11 ng/ml vs. 26.16 ± 4.33 ng/ml; $p < 0.05$) as well as single pregnancies (9.50 ± 1.19 ng/ml vs. 26.16 ± 4.33 ng/ml; $p < 0.01$). Plasma progesterone concentrations in goats carrying twin fetuses were also higher ($p < 0.05$) than that of carrying single fetus. Plasma estrone sulphate concentration, an indicator of endocrine activity of the fetoplacental unit which secretes significant amounts of progesterone (in addition to functional corpora lutea) for the maintenance of pregnancy, did not differ ($p > 0.05$) between does with single and multiple fetuses. Plasma estrone sulphate concentration started to increase to a level between 500- 1000 pg/ ml and the concentration reached at the level of 1500- 2000 pg/ ml between 2nd and 4th month of pregnancy. After parturition, plasma estrone sulphate concentration declined to a very low level. The results indicated that the determination of plasma estrone sulphate might be useful for pregnancy diagnosis in goats. However, its concentration might not be helpful for the prediction of number of fetuses during pregnancy in goats. Plasma progesterone concentration might be a predictive tool for the determination of kidding size in goats during pregnancy. The present finding warranted further investigation on more number of animals.

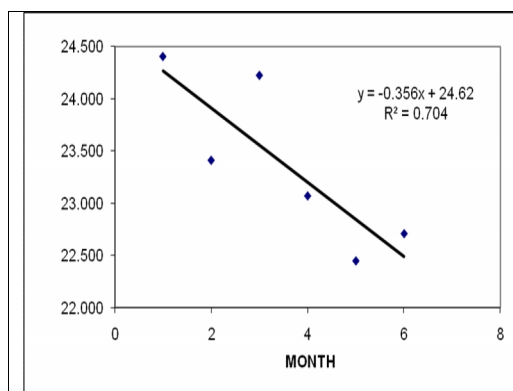


Fig 14. Regression line for 'Udder height (from ground)' for kidding size 3

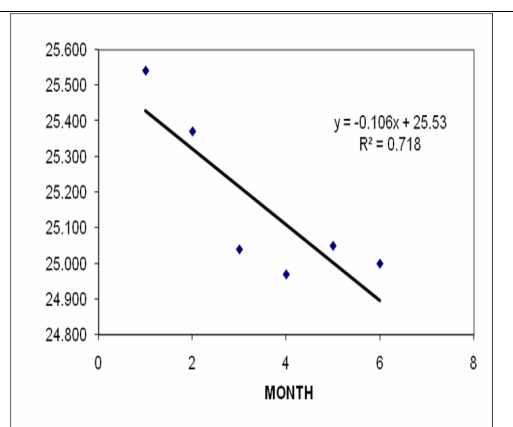


Fig 15. Regression line for 'Chest height (from ground)' for kidding size 2



Fig 16. USG image showing two CLs in left ovary of goat on 10th day of the estrous cycle

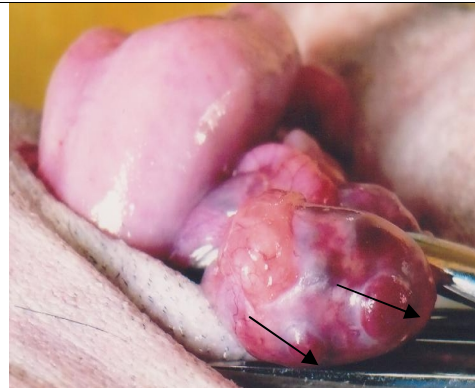


Fig 17. Arrow indicating two CLs in left ovary of goat on 10th day of the estrous cycle

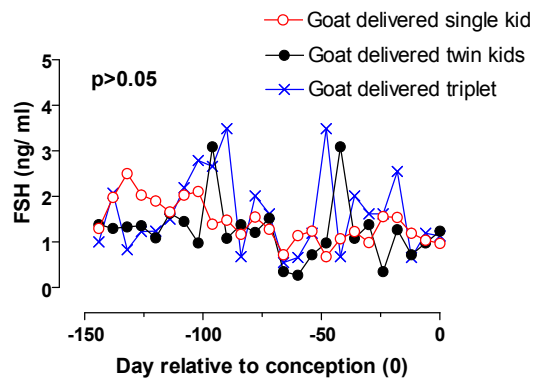


Fig 18. Plasma FSH profiles during growing period and peripubertal stage in female Black Bengal goats

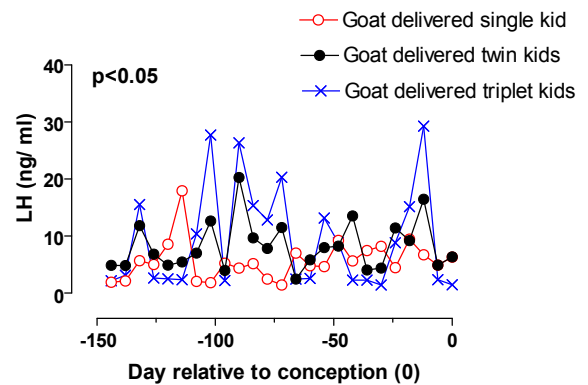


Fig 19. Plasma LH profiles during growing period and peripubertal stage in female Black Bengal goats

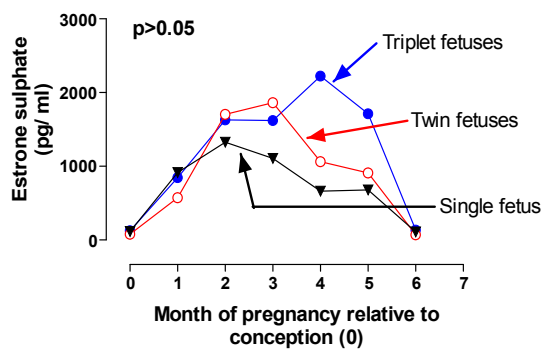


Fig 20. Plasma estrone sulphate concentrations in pregnant does carrying single, twin and triplet fetuses

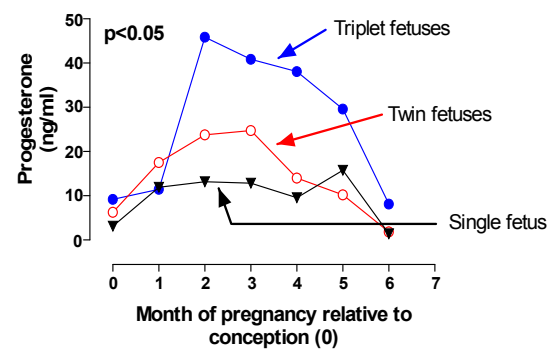


Fig 21. Plasma progesterone concentrations in pregnant does carrying single, twin and triplet fetuses

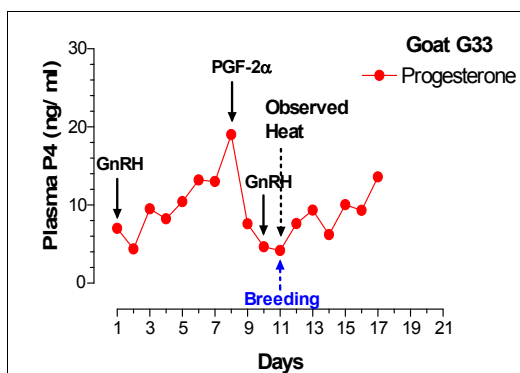


Fig 22. Plasma progesterone profiles in goat treated with ovsynch protocol



Fig 23. Buck in the Black Bengal goat flock for induction of estrus in she goats

Validation of timed and controlled breeding program in goats

The aim of the study was to validate the timed and controlled breeding program in goats for eliminating the unplanned breeding performed by the stray bucks within the flock of Black Bengal goats in the villages. Seven (7) female cyclic goats aged 18.29 ± 2.90 months with body weight of 11.77 ± 0.92 were selected randomly from the goat farm of ICAR, Tripura Centre and subjected to GnRH-PGF_{2α}-GnRH treatment (ovsynch) on day 0, 7 and 9, respectively, irrespective of the stage of estrous cycle and thereafter, the goats were allowed for breeding by the buck on day 10. Another fifteen (15) non-cyclic female goats aged 16.87 ± 2.20 months with body weight of 13.77 ± 0.88 were selected randomly and kept with buck in a separate paddock. The animals were served as control animals. The moment when the buck mounted on the female goat was considered as estrus. Daily blood samples were collected from the experimental goats. The plasma samples harvested from the collected blood samples were utilized for the estimation of progesterone. Plasma progesterone concentration was used as an indicator of ovulation. All 7 goats treated with ovsynch showed heat symptoms. Behaviorally, the does sought out the buck and displayed tail wagging, bleating, restlessness, frequent urination and clear thin discharge from the vagina. The time from the end of treatment protocol (ovsynch) till the occurrence of heat was 1.71 ± 0.47 day. In case of control goats, 11 out of 15 goats showed heat symptoms after 8.36 ± 1.63 days of introduction of buck in the flock. Synchronization of ovulation and timed breeding program following ovsynch resulted higher conception rate (85.71%) in treated goats when compared with standard reproductive management in control goats (73.3%). The plasma progesterone concentrations indicated the presence of the functional CL in pregnant goats. Synchronization of ovulation would allow more control in breeding program of goats and eliminate the dependence on estrus detection before breeding. This ovsynch program could provide an effective way to manage reproduction in goats and thus reduce the chance of conventional breeding practices.

POULTRY

Rural poultry production

A total of 6,200 nos. of good chicks of different varieties / lines of poultry were supplied to the farmers of different villages of Tripura under AICRP on Poultry Breeding Programme. Out of the 6,200 chicks, 2,749 chicks of Gramapriya were supplied to the

farmers of Barjala (Bishalgarh), Mandavi (ARDD), NAIP (Dhalai dist.), Baghma, MogpusKurni, Jubutara, Bishramganj, Lembucherra, Sambhurampara, Khamparpara, Kobrapara and Holy Cross School, Agartala; 416 chicks of GD cross to the KVK Chebri, Kobrapara, Barkhatal and Bishalgarh; 678 chicks of DG cross to KVK Chebri and farmers of Kagamchikobra, Gandhigram, Khamparpara, Barjala, Bishramganj, Siphaipara, Damdamia, Agartala, Kamalghat, Jampai, Baganthakurpara and Lembucherra; 452 chicks of FG cross to the KVK Chebri and farmers of Baghma, Bishramganj and Matripally (Agartala). 1905 chicks of coloured broiler were also supplied to the farmers of Barjala, Baghma, Mogpuskurni and Holy Cross School, Agartala.

Performance of Deshi black ♂ (DM) × Gramapriya ♀ (GF) cross

The mean performance of body weights of DG cross were measured from 2 to 20 weeks and then at 40 weeks of age in both the sexes at farm and field. The mean body weights at 20 weeks of age were: 1.635 ± 0.011 , 1.107 ± 0.024 and 1.324 ± 0.025 kg., respectively in male, female and overall mean at the ICAR Lembucherra farm and the corresponding body weights at KVK, Chebri farm were: 2100 g. and 1700 g., respectively in male and female and the overall mean at farmer's field was 1000 g. The mean body weights at the farm were quite high in comparison to field. The mean body weights of DG cross were similar to CARI Nirbheek and CARI Shyama variety tested at this centre. However, the higher mean body weights were observed in Gramapriya, Vanaraja and Giriraja at this centre being the cross of broiler line. The average feed consumption between 19-20 weeks of age was: 91.60 g., 93.30 g. and 92.50 g. per bird, respectively, in male, female and pooled mean. The feed consumption between 19-20 weeks of age was lowest than all the stocks evaluated at this centre being the lower body weight of the birds. The age at first egg was 145 days, 133 days and 160 days, respectively at the ICAR Lembucherra farm, KVK, Chebri farm and field level. The age at first egg is lower at the farm than field. The egg weight at 40 weeks of age was: 54.25 ± 0.44 g. The egg production upto 40 weeks of age was: 51.78 eggs at the ICAR Lembucherra farm, 42 eggs at KVK, Chebri farm and 37 eggs at field level. The egg production at 40 weeks of age was higher than other stocks evaluated at this centre except Gramapriya. The percent chick mortality from 0-8 wks, 9-20 and 21-40 wks. of age were: 2.49 %, 4.11 % and 3.68 %, respectively.

Performance of Gramapriya ♂ (GM) × Deshi black ♀ (DF) cross

The mean performance of different traits of GD cross was measured at different intervals in both the sexes. The mean body weights at 20 weeks of age were: 1.349 ± 0.020 , 1.089 ± 0.018 and 1.214 ± 0.017 kg., respectively in male, female and overall mean at the ICAR Lembucherra farm and the corresponding body weights at KVK, Chebri farm were: 2050 g. and 1700 g., respectively in male and female and the overall mean at farmer's field was 1100 g. The mean body weights of GD cross was comparable with CARI Nirbheek and CARI Shyama but lower than Gramapriya, Vanaraja and Giriraja. The average feed consumption between 19-20 weeks of age was: 92.50 g., 94.20 g. and 93.30 g. per bird, respectively, in male, female and pooled mean. The feed consumption between 19-20 weeks of age was lower than all the stocks evaluated at this centre being the lower body weight of the birds. The age at first egg was 152 days, 126 days and 160 days, respectively at the ICAR Lembucherra farm, KVK, Chebri farm and at farmer's field. The egg weight at 40 weeks of age was: 55.73 ± 0.54 g. The egg production upto 40 weeks of age was:

57.11 eggs, 47 eggs and 40 eggs, respectively at the ICAR Lembucherra farm, KVK, Chebri farm and at farmer's field. The egg production at 40 weeks of age was higher than other stocks and cross evaluated at this centre except Gramapriya. The percent chick mortality from 0-8 wks, 9-20 and 21-40 wks. of age were: 3.33%, 1.91 % and 2.25 %, respectively. The mortality was lower than other stocks tested at this centre.

Performance of Coloured broiler female line ♂ (FM) × Gramapriya ♀ (GF) cross

The mean performance of body weights of DG cross were measured from 2 to 20 weeks and then at 40 weeks of age in both the sexes at farm and field. The mean body weights at 20 weeks of age were: 1.748 ± 0.062 , 1.149 ± 0.037 and 1.337 ± 0.041 kg., respectively in male, female and overall mean at ICAR Lembucherra farm and the corresponding body weights at KVK, Chebri farm were: 3000 g. and 2100 g., respectively in male and female and the overall mean at farmer's field was 1900 g. The mean body weights of FG cross were higher than GD Cross, DG cross, CARI Nirbheek and CARI Shyama but lower than Gramapriya, Vanaraja and Giriraja. The average feed consumption between 19-20 weeks of age was: 151.0 g., 106.0 g. and 128.0 g. per bird, respectively, in male, female and pooled mean. The feed consumption between 19-20 weeks of age was higher than the above said two crosses evaluated at this centre. The age at first egg was 167 days, 125 days and 155 days, respectively at the ICAR Lembucherra farm, KVK, Chebri farm and at farmer's field. The egg weight at 40 weeks of age was: 59.42 ± 0.66 g. The egg production upto 40 weeks of age was: 32.73 eggs, 40 eggs and 30 eggs, at the ICAR Lembucherra farm, KVK, Chebri farm and at farmer's field. The egg production at 40 weeks of age was lower than the above said two crosses evaluated at this centre. The percent mortality from 0-8 wks, 9-20 and 21-40 wks. of age were 3.66 %, 7.60 % and 5.80%, respectively. Over all in terms of mortality and egg production, the performance of FG cross was poor than DG and GD cross. In terms of egg production, the GD cross performed better than other two crosses.

Performance of 1st Generation of Tripura Local Germplasm (Black)

783 chicks of first generation were hatched out and brooded in the battery brooder at the farm. The average percent fertility was estimated 85.05 %. The observed percent hatchability on total egg set and fertile egg set were; 64.34 % and 75.65 %, respectively, in sire and dam lines. The mean performance of body weights from 4-20 weeks have been estimated in both the sexes. The mean body weight at 12 weeks of age were; 650.63 ± 15.06 g., 505.11 ± 8.93 g. and 546.64 ± 8.31 g., respectively in male female and pooled mean and at 20 weeks of age were; 1278.12 ± 23.31 g., 1101.31 ± 18.47 g. and 1107.98 ± 17.81 g., respectively, in male female and pooled mean. The mean body weights at 20 weeks of age were slightly higher than the base generation. The age at first egg was 172 days, which is higher from base generation.

Performance of Coloured broiler Sire and Dam lines

The mean body weights of coloured broiler sire and dam lines were measured at 4, 5, 6 and 8 weeks of age in both the sexes at farm. The mean body weights at 5 weeks of age were: 1029.00 ± 27.28 , 962.97 ± 20.85 and 986.42 ± 16.28 g., respectively in case of male, female and pooled mean in sire line and the corresponding body weights at 5 weeks of age in case of dam line were: 853.43 ± 24.83 , 734.42 ± 16.68 and 792.16 ± 15.87 g., respectively. The mean body weights in sire line were higher in all the age groups in

comparison to dam line, since the sire line was developed for higher body weights. The age at first egg was observed 146 and 147 days, respectively in sire and dam lines. The egg weight at 40 weeks of age was 64.78 ± 0.49 g. and 64.54 ± 0.57 g., respectively in sire and dam lines. The egg weight in sire and dam lines were not significantly different. The percent mortality during brooding and growing period was: 24.69 and 19.81 %, respectively in sire line and 20.41 and 10.39 %, respectively in dam line. The percent mortality was significantly higher than all the other stocks except Gramapriya Parent stock evaluated at this centre. The main cause of mortality was due to infection of lymphoid leukosis. The broiler parent lines were maintained to evolve new variety (ies) of poultry, by crossing these lines with local indigenous germplasm, which would be suitable for rural poultry production.

Genetic improvement of growth and production traits of japanese quail in agro-climatic conditions of Tripura

Selective breeding was followed for the genetic improvement of two lines of Japanese quail viz. white and coloured quail line. The base populations were established after random mating in the parent populations. The evaluation of performance of second generation was continued. The overall mean performance of body weights of the progeny of coloured quail line at 3, 4 and 5 weeks of age were: 117.49 ± 1.33 , 153.35 ± 1.46 and 186.38 ± 1.62 gms., respectively and the corresponding body weights in Control line were: 112.62 ± 0.98 , 144.61 ± 1.08 and 171.27 ± 1.39 gms., respectively. Moreover, the overall mean performance of body weights of the progeny of white quail line at 3, 4 and 5 weeks of age were: 109.09 ± 0.99 , 145.84 ± 1.14 and 177.44 ± 1.24 gms., respectively and the corresponding body weights in Control line were: 102.98 ± 1.97 , 131.68 ± 1.95 and 162.79 ± 2.14 gms., respectively. The weight gain in coloured and white quail lines from 3-5 weeks of age were: 68.89 ± 0.46 and 68.35 ± 0.31 gms., respectively and the corresponding weight gain in control lines were: 58.65 ± 1.10 and 59.80 ± 0.42 gms., respectively.

NATIONAL AGRICULTURAL INNOVATION PROGRAMME (Component III, SRLS)

Food security through enhancement of productivity and production of rice in Dhalai of Tripura

Under this project 378 farmers were covered under demonstrations on HYV and Package technology during 2009-10. The demonstrations recorded an average yield advantage of 31.3 per cent (732.5 kg / ha). Though the yield advantage gone down in comparison to 2008-09 (which was mainly due to non application of fertilizer due to non availability), such advantage over the district average of rice productivity was highly significant and indicated the possibility of jump in rice production with adoption of proper HYV and package technology. Performance of the demonstrations is presented in Table 46 & 47.

Table 46. Performance of the demonstrations on rice in Dhalai

Variety Introduced	Naveen, BPT 5204, Pusa – 44, TRC 2005-1 & TRC -87-251		
Cluster	No. of farmers covered	Inputs provided	Area covered (ha)
Maracherra	300 (0.16 ha each)	Seed and pesticides	48
Balaram	78 (0.16 ha each)		12.48

Table 47. Yield advantage of rice demonstrations at selected clusters over the district average

Cluster	Yield advantage (%)	Yield advantage (kg/ha)	Average over the clusters
Maracherra	39.1	915	31.3 % 732.5 kg/ ha
Balaram	29.3	685	
Average productivity of rice in Dhalai :			2335 kg / ha



Fig 24. Training cum Seed Distribution at Balaram on 9 July 2009

Mushroom cultivation

Mushroom cultivation at Balaram and Maracherra villages was introduced by giving training and demonstration. The spawn and other requisite materials were either supplied from this centre or supplied by purchasing from state Government laboratories. Eight low-cost mushroom houses were prepared in the houses of progressive and interested farmers and 2 more progressive farmers have been selected for shed construction. Considerable number of farmers learned the techniques and produced mushroom for the first time in their houses. The farmers earned money from selling of fresh mushroom @ Rs.80/- per kg in the local markets. During the months of May and June (2008) mushroom cultivation was first introduced at Balaram and Maracherra areas of Dhalai district giving *in situ* training and demonstration at the farmers' houses. In all six SHGs (Abachanga, Khabaksha, Sharda, Pohor, Bokri Bodol and Loknath) and fifty beneficiaries were pertained training two times one each on mushroom cultivation with chemical disinfection and that with hot water treatment. The farmers successfully learned the techniques. The process of mushroom cultivation is still going on and several training programmes have been organized during the year 2009- 10 to popularize the practice. In 97 farmers of Balaram cultivated mushroom during the period starting from June, 2009 to January, 2010 (Table 48). They used 732 mushroom spawns (each 150g) and produced 495.8 kg of fresh mushroom. There expenditure was calculated as Rs. 8784/- @ Rs. 12 for a poly bag filling. The farmers sold their produce @ Rs. 80/- per kg fresh mushroom to the local markets and earned Rs. 36784/-, which resulted Rs. 28000/- as net profit.

Table 48 Mushroom production and profit observed in Balaram village, Dhalai

Period/Month	No. of Farmers	No. Spawn bag used (150g each)	Total expenditure (Rs.)	Production of mushroom (Kg)	Amount received on selling (Rs.)	Profit (Rs.)
June-July,2009	10	80	960	52.7	4216	3256
August 2009	10	100	1200	60	4800	3600
September, 2009	8	80	960	51	5952	4080
October, 2009	20	100	1200	64	5120	3920
November, 2009	9	72	864	44.6	3568	2704
December, 2009	25	150	1800	93	7440	5640
January, 2010	15	150	1800	94.5	7560	5760
Total	97	732	8784	459.8	36784	28000

In 77 farmers of Maracherra cultivated mushroom during the period starting from June, 2009 to January, 2010 (Table 49). They used 710 mushroom spawns (each 150g) and produced 425 kg of fresh mushroom. Their expenditure was calculated as Rs. 8520- @ Rs. 12 for a poly bag filling. The farmers sold their produce @ Rs. 80/- per kg fresh mushroom to the local markets and earned Rs. 34000/-, which resulted Rs. 25480/- as net profit. Eight mushroom sheds along with tank for substrate soaking, disinfection unit and racks for keeping mushroom beds have been prepared at Balaram (Five) and Maracherra (Three). Two more are under construction at Maracherra. Training and demonstration on mushroom cultivation on four days at 8 locations have been conducted.

Table 49. Mushroom production and profit observed in Maracherra Village, Dhalai

Period/Month	No. of Farmers	No. Spawn bag used (150g each)	Total expenditure (Rs.)	Production of mushroom (Kg)	Amount received on selling (Rs.)	Profit (Rs.)
June-July,2009	15	100	1200	60	4800	3600
August, 2009	12	120	1440	62	4960	3520
September-October, 2008	10	110	1320	64	5120	3800
November-December, 08	25	200	2400	122	9760	7360
January	15	180	2160	117	9360	7200
Total	77	710	8520	425	34000	25480

Goat rearing

The aim of the study was to educate and support the farmers for better animal husbandry and management of local natural resources to improve rural livelihood and secure foods for few more days utilizing goat resource in resource limited area. The activities were undertaken on goat husbandry which was a common and traditional livelihood option in the locality. The actions included imparting trainings on state of art management, delivery of technical know-how on goat housing, making available of good female and male goats and organizing deworming-cum-treatment camps. Based on the land holdings, goat rearing patterns and other factors, 68 families in Balaram and 23 families in Murracherra were supported to construct a total of 91 goat houses using bamboo and other

local materials. A total of 182 female Black Bengal goats were provided to 91 farmer men and women. The family based micro-survey indicated that an unit of two female goats could provide food security for about 45 days. Farmers showed keen interest for making goat house utilizing low-cost local materials and rearing goat with more care to fetch more income.

Eight deworming-cum-treatment camps were organized for treating 461 goats including kids at different points of Balaram and Murracherra under NAIP program. Animals were administered orally with deworming medicines. A number of veterinary medicines like liver extract, vitamins tonic, mineral mixture etc. were given to the farmers for administering orally the pregnant animals and weak growing animals. A total of 163 farmers were participated in the program.

Backyard poultry

The day old chicks of Gramapriya were procured from the Division of Poultry Science of the ICAR Tripura Centre. The day old chicks were brooded upto 6 weeks of age at the ICAR Tripura Centre farm. During the period, the chicks were fed prepared starter ration and vaccinated to control deadly viral diseases (RD (F₁ strain); IBD (MB strain); RD (R₂B). The beneficiary farmers were selected on 12th Nov., 2009 from Balram village of Dhalai Dist. On 13th Nov., 2009 in the presence of Panchyat Samiti members, 455 chicks of Gramapriya of 6 weeks of age were distributed to 38 beneficiary farmers of Balram village of Dhalai Dist. During the period, on 10th April, 2009 training on scientific poultry farming was imparted to 87 farmers of Maracherra village. Training was also imparted to 80 farmers of Balram village on 21st August, 2009. Along with training a fruitful discussion was held with the farmers of both the locations about their problems at field level and solutions were suggested.

IMPORTANT EVENTS

Workshop on black Bengal goat

A State level workshop on 'Conservation and Utilization of Black Bengal Goat Resource for Rural Livelihood' was organized on 10th June 2009 at ICAR Research Complex, Tripura Centre, Lembucherra, West Tripura. Thirty eight officers of Animal Resource Development, Rural Development Department and Tripura Tribal Areas Autonomous District Council from four districts of Tripura state participated in the workshop.

Workshop on rural poultry production

A state level workshop on "Rural Poultry Production" was organised by Division of Poultry Science, ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra, Tripura West on 3rd November, 2009.

Spring / Summer Pulses Group Meet 2010 & Symposium on "Food Legumes for Nutritional Security in NEH Region"

ICAR Research Complex for NEH Region, Tripura Centre, hosted the Spring / Summer Pulses Group meet 2010 during 27-28th January 2010 at Agartala.

Simultaneously, regional symposium on " Food Legumes for Nutritional Security in NEH Region" was also organized. His Excellency Governor of Tripura, Dr. D. Y. Patil, graced the occasion as the Honourable Guest. Dr. Swapan Kr. Datta, Deputy Director General (Crop Sciences), ICAR, New Delhi, presided over the function.

Farmers' meet-2010

Farmers Meet 2010 was held on 30th January, 2010 in the campus of ICAR Research Complex for NEH Region, Tripura Centre. The Chief Guest was Shri Manik Sarkar, Hon'ble Chief Minister, Govt. of Tripura and the event was attended by many dignitaries such as Shri Haricharan Sarkar, Hon'ble Member, Tripura Legislative Assembly, Dr. A.K. Singh, Deputy Director General (NRM), ICAR, New Delhi, Mr. K. V. Satyanarayan, Principal Secretary, Govt. of Tripura and Dr. S.V. Ngachan, Director, ICAR, Meghalaya. All Directors of Department of Agriculture, Animal Husbandry, Horticulture and Soil Conservation, Govt. of Tripura were also present in the meeting.

Poster painting competition on climate and environment

A Poster Painting Competition among the School Children of Class I to XII was organised on 23rd January 2010 at ICAR Research Complex for NEH Region, Tripura Centre as a part of awareness campaign of Integrated Agromet Advisory Services.

Participatory rice variety selection day

Under the Bill and Melinda Gates Foundation (BMGF) project “**Stress Tolerant Rice for Poor Farmers in Africa and South Asia**” Participatory Rice Variety Selection was conducted at Magpuskarini, South Tripura on 3rd December, 2009, 9.00 AM onwards. The PVS was followed by organization of “Participatory Rice Variety Selection Day and Kharif Rice Day “. PVS conducted at this location was the Mother Trial comprised of 23 entries drawn from line developed at ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra, different INGER nurseries conducted by us in 2008, Sambha Mahasuri *sub1* and IR 64 *sub1*.



Fig 25. Hon'ble Minister for Agriculture of Tripura, Shri Aghore Debbarma visiting the Participatory Varietal Selection site at Magpuskarini and overlooking the activity, which was first of its kind in Tripura.

Hybrid Rice Day 2009

Even after a decade of release of first set of hybrids in India the area under hybrid rice has reached only about 1.0 million hectares. The rate of adoption is much slower than expected. Considering the lack of adequate initiative and effort for popularization of this innovative hybrid rice technology, ICAR Research Complex for NEH Region, Tripura Centre has taken up the initiative to demonstrate the potential of Hybrid rice in Tripura in collaboration with Bayer BioSciences. In boro 2008-09 Demonstrations were taken up in South Tripura District in places Bagma, Bagabasa, Koroiamura, Magpuskarini and Mirza. Apart from this as part of our regular activity of Front Line Demonstrations, large number of FLDs were also conducted on HYV + ICM, HYV + SRI, Field experiments on ICM vs SRI and replicated yield trial on 5 hybrids. To mark the success of the demonstrations “Hybrid Rice Day” was celebrated on 20 May 2009. Principal Secretary of Agriculture, Govt. of Tripura, Shri Shushil Kumar visited the demonstration plots and graced the occasion as chief guest. Director of Agriculture and other senior officers from Dept. of Agriculture were also present during visit and the function at Mirza.



Fig 26. Principal Secretary of Agriculture, Govt. of Tripura visiting Hybrid rice demonstration plots in South Tripura



Fig 27.. Organized Hybrid Rice Day at Mirza, South Tripura to mark the success of the Hybrid rice demonstrations.

PUBLICATIONS

Research papers

- Biswas, S. and Singh, N. P. 2009. Evaluation of alternate substrates for milky mushroom. J. Mycol. Pl. Pathol. 39 (2): 355-357.
- Biswas, S. and Singh, N.P. 2009. Determination of seasons and substrates for paddy straw mushroom cultivation in Tripura. Mushroom Research, 17 (2) 75-78.
- Malik, S., Singh, N. P. and Ngachan, S. V. 2009. Study of the different economic traits of CARI Shyama in field and farm conditions of Tripura. Indian Journal of Poultry Science. 44:296-300.
- Singh, N.P., Daschoudhuri, D. and Biswas, S. 2009. Crop calendar with the use of meteorological data in Tripura. Journal of Agrometeorology 11 (2): 183-187

Abstracts

- Biswas, S., Singh, N.P., Datta, M. and Singh, A.L. 2009. Evaluation of groundnut genotypes against leaf spot disease in Tripura. 5th International Conference on Plant Pathology in the Globalized Era. November 10-13, 2009, Indian Phytopathological Society, IARI, New Delhi, Abs. 415 (S-8).

- Biswas, C.K., Haldar, A., Pan, S. and Mazumdar, D. 2010. 'Influence of season of conception and parity on variation in kidding size and some physical attributes in Black Bengal goat', published in Compendium of National Seminar on 'Stress management in small ruminant production and product processing', held on January 29-31, 2010 at Jaipur, India, organized by Indian Society for Sheep and Goat Production and Utilization. pp. 83.
- Doiphode, A., Das, A., Pan, S., Haldar, A., Mitra, A., 2010. 'Molecular characterization and localization of DGF-9 gene in the ovarian follicles of Black Bengal breed of goat', published in Book of Abstracts of 3rd Congress of the Asia Pacific Initiative on Reproduction (ASPIRE 2010), held on April 9-11, 2010 at Bangkok, Thailand. pp. 82.
- Haldar, A., Paul, R., Pal, S. and Singh, N. P. 2010. 'Withdrawal of mother milk and its effect on growth, survivability and hormone profiles in Black Bengal goats', published in Compendium of National Seminar on 'Stress management in small ruminant production and product processing', held on January 29-31, 2010 at Jaipur, India, organized by Indian Society for Sheep and Goat Production and Utilization. pp. 73.
- Malik, S. and Singh, N. P. 2009. Evaluation of Local Indigenous Germplasm (Black) of Tripura. Proceedings of XXVI Annual Conference and National Symposium of Indian Poultry Science Association, Bombay Veterinary College, Mumbai, from 22 to 24 Oct., 2009.
- Malik, S. and Singh, N. P. 2010. Performance of D08 (PDP) variety in agroclimatic conditions of Tripura. Proceedings of State level Seminar on Agricultural Development: Changing Scenario of Tripura, organized by Economic Science Society of Tripura and IGNOU Regional Centre, Agartala from 9 – 10 Jan., 2010.

Popular articles

- Biswas, S., Singh, N.P. 2009. Mushroom Chash. Gnan Bichitra. 33 (4): 24-26.

Book chapters

- Biswas, S. 2007. Mushroom cultivation. In Water Shed Management (eds, Singh, N.P., Daschudhari, Datta, M. and Chakraborty, K.S.) ICAR Research Complex for NEH Region Tripura Centre, Lembucherra & IGNOU Regional Centre, Agartala, Tripura, pp132-138.
- Haldar, A., Paul R., and Singh, N. P. 2010. 'Importance and scope of animal husbandry in watershed' book chapter, published in Watershed Management, ed. By Singh et al., ICAR Research Complex for NEH Region, Tripura and IGNOU Regional Centre, Tripura, pp. 157-166.

Scientific/Technical folders

- Development of Agroforestry based farming system models for sustainable land management in Dhalai district of Tripura (both in English & Bengali)
- Mushroomer rakambhed o thader chash padathi (in Bengali)
- Gramapriya: An Efficient layer for the backyard poultry farming (in English)
- Maize Production Technology for Tripura (both in English & Bengali)
- Production Technology for Sesame (Til) in Tripura (in English)

Seminar/ symposium/ meeting/workshop/ training etc. attended by the scientists

Dr. N. P. Singh, Joint Director

- ☆ Annual Group Meet of Rice organized by Directorate of Rice Research at Hyderabad, Andhra Pradesh during 10-11th May, 2009.

- ☆ All India Coordinated Research Group Meet on Pigeonpea and MULLaRP at University of Agricultural Sciences, Dharwad, Karnataka during 25-27th May, 2009.
- ☆ All India Coordinated Research Group Meet on Niger and Sesame at Birsa Agricultural University, Ranchi, Jharkhand during 28-30th May, 2009.
- ☆ Conference of Agri-Export Zones-Policy Interventions Needed for Implementation in North East organized by Confederation of Indian Industry (CII) at Pragna Bhavan, Agartala on 5th June, 2009.
- ☆ One day workshop on “Conservation and Utilization of Black Bengal Goat Resource for Rural Livelihood” under the National Fund for Basic & Strategic Research in Agricultural Sciences Project at ICAR Research Complex for NEH Region, Tripura Centre on 10th June, 2009.
- ☆ The training programme as Guest of Honour in Integrated Pest Management (IPM) for pesticide dealers at Agartala, Tripura on 14th June, 2009.
- ☆ Interface Meeting in the Department of Agriculture, Horticulture and Soil Conservation, Govt. of Tripura on 24th June, 2009.
- ☆ Review Meeting of Department of Agriculture, Govt. of Tripura at Kailashahar, North Tripura on 25th June, 2009.
- ☆ National Symposium organised by College of Agriculture, KAU, Vellyani, Trivandrum during 28-30th June, 2009.
- ☆ AICRP Meet on Poultry at Birsa Agricultural University, Kanke, Ranchi during 2nd -5th October, 2009.
- ☆ AICRP Meet on Tuber Crops at OUAT, Bhubaneswar, Orissa during 8-12th October, 2009.
- ☆ Regional Committee Meeting at Gangtok, Sikkim during 20-26th October, 2009.
- ☆ Attended the “Technology Week” programme at KVK, Birchandra Manu, South Tripura on 27th October, 2009.
- ☆ Workshop on Rural Poultry Production organized by AICRP on Poultry, ICAR, Tripura Centre on 3rd November, 2009.
- ☆ Review Committee Meeting organized by Department of Horticulture Society, Agartala, Tripura on 7th November, 2009.
- ☆ Government Body Meeting of Tripura Rubber Mission at the Office of the Chief Secretary, Agartala, Tripura on 17th November, 2009.

Dr. M. Datta, Principal Scientist (Soil Science)

- Conference on Agri-Export Zones- Policy Interventions needed for Implementation in North-East organized by Confederation of Indian Industry at Agartala on 5th June, 2009.
- Training programme in Integrated Pest Management (IPM) for pesticide dealer and Delivered a talk on IPM and malnutritional problems in rice, organized by IGNOU, Agartala on 14th June 2009.
- ☆ Attended a workshop on “Recent advances in production and post harvest technology of Banana” organized by the Directorate of Horticulture & Soil conservation, Department of Agriculture during 21-24th October’09 at Nagicheria, Tripura.
 - State Level Nodal Agency (SLNA) meeting for watershed implementation programme, organized by the Department of Agriculture, Govt. of Tripura on 23rd October’09.
 - Attended the training programme and delivered a talk on watershed management for sustainable development organized by Krishi Vigyan Kendra, ICAR Research Complex at Birchahdramanu, on 28th October’09.
 - Expert group meeting to develop Entrepreneurship programme in Integrated Nutrient Management in Agri-Horticulture, organized by Indira Gandhi National Open University on 04th November, 2009 at New Delhi.

Attended meeting on Mission Mode Approach in Tilla Land Cultivation , organized by Tripura State Council of Science and Technology at Agartala on 28th November,2009.

3rd Annual Review Meeting (ARM) of Integrated Agromet Advisory Services (IAAS) organized by India Meteorological Department at Indian Institute of Technology, Roorkee during 10-12th December,2009.

Platinum Jubilee Celebration of Indian Society of Soil Science and presented a research paper on “Green tree leaf as a source of manure in augmenting crop production and soil fertility in Tripura” at New Delhi on 22-25th December, 2009.

- ☆ Attended a State level seminar on Agricultural Development Changing scenario of Tripura and presented research paper on Soil Health Card and Jatropha, organized by Economic Science Society of Tripura (ESSOT) and Indira Gandhi National Open University at Agartala during 9-10th January, 2010.
- ☆ State Credit Seminar, organized by NABARD, Tripura Unit at Agartala on the 11th February, 2010.
- ☆ Video conferencing meeting with IMD, Pune on SMS Service for Weather forecast and agro-advisory, organized by National Information Centre at Agartala on 8th March 2010.
- ☆ SLNA meeting on rainfed farming, organized by Department of Agriculture, Govt. of Tripura on 12th March, 2010.

Lecture delivered

- ☆ Delivered a talk on water requirement of field crops of Junior Engineers, organized by Department of Agriculture, Govt. of Tripura on 15th March, 2010.
- ☆ Delivered a talk on “Production practices of Major Kharif Crops in Tripura” in the Training programme for officers of Kissan call Centres under Directorate of Extension, Ministry of Agriculture, Govt. of India, organized by College of Fisheries, Central Agricultural University, on 20th May, 2009 at Lembucherra, West Tripura.

Dr. S. Biswas, Sr. Scientist (Plant Pathology)

Conference on, “Agri Export Zones – Policy interventions needed for implementation in the North East” organized by Confederation of Indian Industry on 5th June, 2009 at Pragna Bhawan, Agartala, Tripura.

One day workshop on “Conservation and Utilization of Black Bengal Goat Resource for Rural Livelihood” under the National Fund for Basic & Strategic Research in Agricultural Sciences Project at ICAR Research Complex for NEH Region, Tripura Centre on 10th June, 2009.

Special meeting with DOS officials and Principal Secretary of Agriculture, Govt. of Tripura on the progress and chalked out programmes of research works at ICAR Tripura Centre on 24th June, 2009

special Board Meeting of Tripura State Pollution Control Board on 25th June, 2009 at TSPCB, Gorkhabasti, Agartala

- ☆ Interface meeting at College of Fisheries, CAU, Lembucherra, Tripura on dated July 17, 2009
- ☆ SRC meeting, ICAR Research Complex for NEH Region, Umiam, during 28-29th July, 2009
- ☆ Fish Farmers, Meet 2009, organized by North East Society for Fisheries and Aquaculture (India) at College of Fisheries, Lembucherra on 11th September, 2009.
- ☆ workshop on “Recent advances in production and post harvest technology of banana” organized by Horticulture Research Complex, Nagicherra in Collaboration with NRC banana, Tiruchirapalli, Tamilnadu on 21st October, 2009.

- ☆ workshop on Rural Poultry Production, Organized by ICAR Research Complex for NEH Region, Tripura Centre on 3rd November, 2009
- ☆ 5th International conference on Plant Pathology in the Globalized Era, during 10-13th November, 2009 at IPS, IARI, New Delhi.
- State level poster painting competition, as a member of organizing committee, organized by ICAR Research Complex for NEH Region, Tripura Centre at Msic Hall, Agartala on January 23, 2010.
- ☆ Spring/ Summer Pulses Group Meet and Regional Symposium on 'Food Legumes for Nutritional security in NEH Region', as a member of organizing committee, organized by ICAR Research Complex for NEH Region, Tripura Centre at Pragna Bhavan, Agartala on January 27-28, 2010.
- ☆ 'Farmers Meet', as a member of organizing committee, organized by ICAR Research Complex for NEH Region, Tripura Centre at Pragna Bhavan, Agartala on January 27-28, 2010.

Lecture delivered

Delivered an invite lecture on Topic, "Introduction to fungi, bacteria and viruses etc and general principles of IPM of Paddy" on 14th June, 2009 in the Training programme in Integrated Pest Management (IPM) for Pesticides dealer" organized by IGNOU, Agartala at Training Hall, T. Sameti, UGTC, Lembucherra

Given Training on Mushroom Cultivation in NSS Special Camping Programme on Community Development through the Participation of Rural Youth at Senapati Para, Mohanpur block, Tripura on 9th June, 2009, organized by College of Fisheries NSS Unit, CAU, Lembucherra, Tripura.

Dr. A. Haldar, Sr. Scientist

- ☆ 'World Environment Day- 2009' at College of Fisheries, Lembucherra, West Tripura on 5th June 2009.
- ☆ seminar on 'Threat of pandemic flu- role of veterinarian', organized by Tripura Veterinary Doctors' Association at the Assam Rifles Auditorium, Agartala, West Tripura on 8th August 2009.
- ☆ Second meeting of Scientific Advisory Committee of KVK, South Tripura at Birchandra Manu, South Tripura on 28th August 2009.
- ☆ Fish Farmers' Meet 2009 at College of Fisheries, Lembucherra, West Tripura on 11th September 2009.
- ☆ Seminar on 'DNA Bar code of life' at College of Fisheries, Lembucherra, West Tripura on 4th December 2009.
- ☆ National Seminar on 'Stress management in small ruminants production and product processing', organized by Indian Society for Sheep and Goat Production and Utilization (ISSGPU), at Jaipur on 29th to 31st January 2010.
- ☆ Attended FAO sponsored two days workshop on 'Strengthening of cross-border emergency preparedness and response mechanism for HPAI' organized by ARD Deptt, Govt. of Tripura, at Pragna Bhavan, Agartala on 18th and 19th February 2010.
- ☆ National CME on Immunology, Organized by Indian Immunology Society at Agartala Govt. Medical College, Agartala, Tripura on 5th and 6th March 2010.
- ☆ Attended and delivered lecture in one day block level training program on 'Prevention & control of animal diseases', organized by ARD Deptt, Govt. of Tripura at Salema, Dhalai on 12th March 2010.

Lecture delivered

- ☆ Lectures delivered on ‘Pig and goat management practices’ for the officers of Kissan Call Centre, Tripura at College of Fisheries, Lembucherrra, West Tripura on 15th September 2009.
- ☆ Attended and delivered lecture in the two days district level training program on ‘Prevention & control of different animal diseases’, organized by ARD Deptt, Govt. of Tripura at Udaipur, South Tripura on 5th and 6th March 2010.

Dr. S. Malik, Sr. Scientist (Poultry Science)

National Workshop on “Synthesis of experiences in promotion of backyard poultry” held at PDP, Hyderabad from 9-10th July, 2009.

XXVII Scientist meet of AICRP on Poultry Breeding and presented Annual report (2008-09) of AICRP on Poultry Breeding, Agaratala Centre held at BAU, Ranchi from 3rd -4th October, 2009.

XXVI Annual Conference and National Symposium of Poultry Science Association and presented abstract paper entitled “Evaluation of Local Indigenous Germplasm (Black) of Tripura” at Bombay Veterinary College, Parel, Mumbai from 22nd – 24th October, 2009.

Distinguished visitors

- Dr. S. A. H. Abidi, Former Member (AS), ASRB, CM-II, Sector-B, Aliganj, Lucknow-226020 visited on 15th April, 2009.
- Prof. K. Pradhan, Ex. Vice Chancellor, C24/HIG, HB Coloney, Baramunda, Bhubaneswar-751003 visited on 15th April, 2009.
- Mr. S.S. Chaturvedi, IGP, TSR, Agartala, Tripura visited on 2nd June, 2009.
- Mr. Sushil Kumar, Commissioner & Secretary, Govt. of Tripura, Agartala visited on 24th June, 2009.
- Shri S.K.Mishra, IPS, IG BSF, Tripura Frontier, Salbagan, Agartala, Tripura visited on 22nd August, 2009.
- Dr. Casiana M.Vera Crag, International Rice Research Institute (IRRI), Philippine visited on 13th October, 2009.
- Dr.M.M.Mustaffa, Director, National Research Centre for Banana, Trichy, Tamil Nadu visited on 22nd October, 2009.
- Shri B.L.Saha, Deputy Speaker, Tripura Legislative Assembly, Agartala visited on 3rd November, 2009.
- Shri Kishan Singh, DGM, NABARD, Agartala visited on 1st December, 2009.
- Dr. Akali Sana, Director, Central Institute of Horticulture, Govt. of India, Medziphema, Nagaland visited on 12th January, 2010.
- Shri Krishna Jindal, G.M, NABARD, Regional Office Tripura, Palace Compound, Agartala visited on 14th January, 2010.
- Dr. D. M. Hegde, Director, Directorate of Oil Seeds Research, Rajendranagar, Hyderabad-500030, Andhra Pradesh visited on 26th January, 2010.
- Dr. N. GopalKrishnan, Project Coordinator (Cotton) & Head, CICR RS, Coimbatore-641003, Tamil Nadu visited on 26th January, 2010.
- Dr. A. K. Singh, DDG (NRM), ICAR, Krishi Bhavan, New Delhi-110014 visited on 26th January, 2010.
- Prof. S. K. Datta, DDG (Crop Science), ICAR, Krishi Bhavan, New Delhi-110014 visited on 26th January, 2010.
- Dr. B. B. Singh, Project Coordinator MULLaRP, IIPR, Kanpur visited on 26th January, 2010.
- Dr. S. V. Nagchan, Director, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya visited during 26th -30th January. 2010.
- Dr. V. D. Patil, ADG (O & P), ICAR, Krishi Bhavan, New Delhi visited on 28th January, 2010.