
वार्षिक प्रतिवेदन
ANNUAL REPORT
2012-13
CENTRAL SERICULTURAL RESEARCH & TRAINING INSTITUTE

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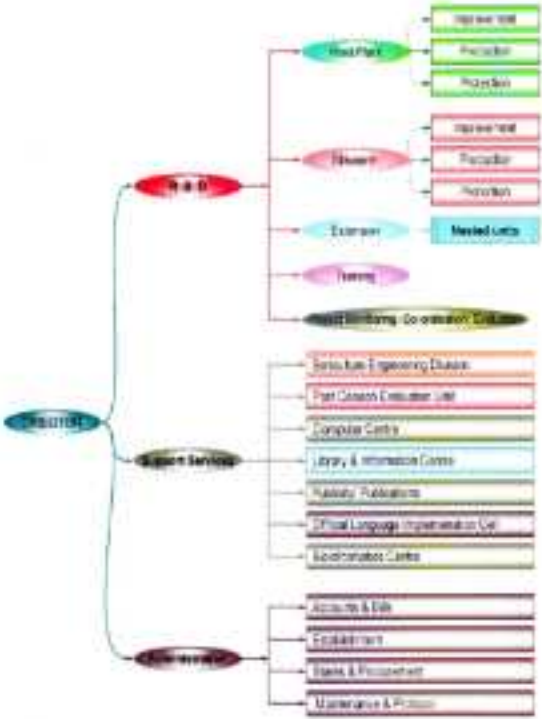
CSRTI, MYSORE - ORGANIZATION CHART



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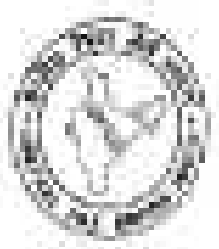

CENTRAL SERICULTURAL RESEARCH AND TRAINING INSTITUTE
(ISO 9001 : 2008 Certified)
Central Silk Board, Ministry of Textiles, Govt. of India, Mysuru-570 008

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FOREWORD

I am delighted to place before you the annual report of Central Sericultural Research and Training Institute, Mysuru for the year 2013-14. Established in April 1967 under the aegis of Central Silk Board, the Institute has been rendering yeoman service to the sericulturists through its R&D activities. Over the years, it has gained the status of a R&D Institute par excellence and has been serving as a springboard for scientific/technological extension and training activities in India, more so in the southern peninsula.

During the year, the Institute has adopted the Results Framework Documentation (RFD) and achieved the set targets. The Institute and its network units initiated 67 research projects/programmes of which eleven were funded by DBT/TSC. Out of these, 4 projects and 18 programmes were concluded.

Scientists under host plant division have come out with notable accomplishments by identifying the promising genotype Mo-1 for soil moisture conditions besides short listing six mulberry accessions which are resistant to root rot. A panel of diverse mulberry germplasm comprising of 100 accessions have been assembled through DNA profiling for sustainable conservation and enhanced utilization towards crop improvement. A package involving application of organic inputs and crop residue management has been developed which significantly improves soil with respect to physical, chemical and biological characters. The soil testing laboratories of the Institute as well as regional stations have analysed a total of 8014 soil samples of farmers from southern states and suitable recommendations have been given. Controlling the root rot up to 80% has been achieved by formulating a consortium of endophytic bio- control agents (EGAs). It is gratifying to note that for management of root knot pathogen, *Meloidogyne*, an eco friendly formulation has been developed.

Under Silkworm division, development of improved cross breeds (ICB) is one of the major tasks being pursued and during the year, two more ICBs, viz., NOW x CSR61 and L14 x CSR58, superior over the existing cross breed PM x CSR2 have been short-listed for further trials. Special emphasis has been made for popularization of the ICB, L14 x CSR2 with the potential to produce 3A-4A grade silk and over three lakh DFLs have been distributed and the results are encouraging. Further, a rectified rearing technology package developed for effective rearing of L14 x CSR2 crossbreed. Two hybrid combinations, 2G x 48 and 511 x G13 developed for sub-optimal conditions were found to be superior in terms of higher survival under on station trials. Molecular biology approaches for silkworm improvement has resulted in identification of two DNA markers associated with thermo-tolerance. For developing novel strategies for controlling pebrine disease, microsporidian genes controlling Ma/PTP enzyme have been identified which are being characterised. Databases pertaining to soil information, mulberry genome, important genes of mulberry, silk proteins, silkworm transcription factors were maintained and updated.

Use of eco-friendly measures for control of pests and diseases has been the major thrust of the Institute and biological control methods for the control of Pebrine, Flacherie, Muscardine and Grasserie were popularized through mass production and supply of over 50,000 parasitoids. The efficacy of individual mother moth examination in five successive generations in eliminating the newly reported microsporidian was successfully demonstrated.

A beginning has been made in the frontier areas like Nanotechnology through the use of Silver and MgO nano particles, which were found to be effective in suppressing flacherie disease in silkworm. With regard to development of value added products, studies were initiated on Cordyceps which is in great demand and sold at high cost due to its high pharmaceutical value. The results have shown the successful growth of three isolates of Cordyceps both *in vitro* and *in vivo* on silkworm pupae. Farmers' clinic for developing naturally coloured silk was continued during the year and protocols have been standardised through feeding silkworm larvae with dyes which produce cocoons of eight colours. Procedures have been standardised for preparation of fibroin fibre and silk sachets.

For reducing drudgery and operational costs, the engineering division has brought out a number of machines namely, high capacity leaf chopper, which can chop around 40 kg leaf per hour suitable for commercial chawki centers and cocoon harvester for plastic collapsible mountages and mechanised bed for late age silkworm rearing.

On the extension extension front, it is commendable that the Institute and its nested units conducted over 600 extension communication programmes reaching more than 30,000 stakeholders on improved technologies and management strategies. Further, a number of technologies like IVM, IPM, use of Hostels for mitigating nutritional deficiencies in mulberry, Manejo for management of root rot in mulberry, composting, intercropping, and mulberry tree plantation were effectively disseminated in the field. A workshop on *Development of Sericulture in Northern Karnataka* was conducted at Sagadoddi in which 1000 sericulturists participated actively. Rural Youth promotion through CPP was the major focus of the Institute under which a total of 177 clusters were identified and 172 cluster chairpersons and cluster development facilitators (CDF) were trained.

Under HRD programmes, a total of 4001 persons were trained under structured and need based programmes at the Institute and its nested units, besides 161 personnel under BAIS and two Mexican scientists in silkworm breeding at the Institute.

It is heartening that the Institute has secured second position and a rolling shield for outstanding performance in implementation of Official Language policy by the Central Silk Board and RSRS, Salem bagged the second prize under Rolling Shield Scheme of the Town Official Language Implementing Committee, Salem. I am happy to mention that for the first time, a technical workshop in Hindi was organised at the Institute.

On the publication front, a total of 211 publications including 54 research papers, 80 popular articles in the Journals of National and International repute, 182 other publicity materials including news reports, silk briefs, extension manuals, books/booklets and technical bulletins were published. Further, twenty papers were presented in workshops/conferences. The Institute has brought out three issues of *Indian Journal of Sericulture*, two issues of *Sericin*, one *Reshame Dhare* (Hindi) and one *Reshame Kalavi Kannada* in addition to the Annual Report.

I wish to acknowledge the pragmatic guidance extended by the learned Chairman and members of the PCC, RMC, RRMC and the former Director of the Institute, Dr. B.M.H. Qadri, his team of scientists and staff as well as the invaluable cooperation and support provided by the DoS at different states for achieving the set targets under R & D, training and Extension activities.

Dr. B.B. Bindroo
Director

1. ABOUT CSTRTI, MYSORE

The Central Sericultural Research & Training Institute, Mysore was established under the aegis of Central Silk Board, Ministry of Textiles, Govt. of India and started functioning at Mysore in the year 1951, after moving over the Sericulture Research Institute of erstwhile Mysore Government. It was dedicated to Mysore in the year 1961, with the necessary infrastructure and manpower. Hence it was renamed as – Central Sericultural Research & Training Institute (CSRTI), Mysore in the year 1962. This Institute as on date has completed 62 years of dedicated services for development of sericulture in the country and abroad.

Today, the Institute has the distinction of being the premier institution for conducting research per-taining to multi-disciplinary aspects and infrastructure. Over the decades, the Institute has grown in its stature, gained stature and more and more people. The Institute undertakes the more general or conventional R & D activities in order to the needs of the diverse sector of sericulture industry in Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra and Madhya Pradesh. Apart from such developmental infrastructure and training programmes, however it commenced on basic, the Institute has made a mark as a leading R & D institution on tropical sericulture in the country and the institute is well recognized as a centre for higher learning and advanced training in the discipline from its role in providing trained manpower not always basic but high professionals, both at domestic and international levels. So far, it has trained around 10,000 persons in different aspects of sericulture sciences and technology including 700 foreign nationals. Besides, on-training, research, training and consultancy activities, the institute also offers consultancy and advisory services to industrial and international agencies.

Vision

To be a model organization for promoting R & D activities in sericulture for rural development and upliftment, to develop generation of human resources with an interface with global trend with optimum utilization of resources and facilities.

Mission

- To improve the productivity and quality of raw cocoons ensuring fair return to cocoon growers.
- To promote eco-friendly, pro-poor and gender sensitive technologies for sericulture development.
- To facilitate low cost measures and strategies for overall improvement of socio-economic conditions of sericulturists.
- To enhance Human Resource Development and skill levels of sericulturists.
- To promote self-sustainable and viable silkworm breeding and seed production units.

Objectives

- To develop multivoltine and bivoltine hybrids suitable for different agro-climatic conditions.
- To undertake research and applied research in various disciplines relating to the development of appropriate technologies.
- To train young technical graduates and field level technicians periodically.

- To conduct short-term and long-term training programmes for farmers, extension personnel and scientists in the field of salinity and water management in agriculture
- To conduct demonstrations and trainings on salt tolerant crops and varieties
- To serve as a training centre for imparting knowledge about saline soil reclamation, crop production and technologies involved in CSSRI institute or collaboratively other agencies
- To coordinate with State Govts., voluntary organizations, NGOs, progressive farmers and other National Institutes for disseminating relevant and latest technologies

Organizational set-up

CSSRI, Karnal is the largest and most diversified institution engaged in activities R & D in the country, supported by about 300 scientists including Agriculture Engineers, Geologists and Economists who are working in close coordination for development of appropriate technologies and their transfer, both at the research institute and at the project sites spread over in the states of the Haryana, Punjab, Andhra Pradesh, Kerala, Maharashtra and Madhya Pradesh. The R & D activities and technology demonstrations are carried out at different locations under five major thrust areas viz. Reclamation, Soil-plant-water, Economics, Extension and Training. The thrust areas have been organized at the R & D activities of the Institute and it is in close touch with the support of Planning, Monitoring, Coordination and Evaluation Unit.

Extension Activities

To facilitate validation and effective transfer of necessary technologies developed in the field, the Institute has a close link system of operational research stations viz. Regional Saline Land Research Stations (RSLRS), Research Collaborative Centres (RCC) and Sub-Units (SU). The RSLRSs, located in major salt-affected areas of the country, have region specific objectives and action research. The technology trials are carried out in farmers' fields and adaptive research in the regional research stations besides providing training to farmers and extension staff. The RCCs and SUs are to meet the region or problem specific technology transfer in the identified areas and also provide all such logistical issues to support R&D. Maintaining active collaborations with regional Agricultural Universities, the Institute is coordinating online conferencing sessions in Karnataka, Andhra Pradesh and Tamil Nadu for effective transfer of technologies to farmers.

Training Centre

The Institute is recognized as a training centre by Government of India to conduct farmer oriented and in-service training programmes in the field of salinity and water management. It provides training in advanced technologies both at intermediate and national level. The Institute is also declared as University as Institute for conducting research in Agriculture, Technology and Environmental sciences including Ph.D. degree programmes in consultation with Panjab University, Chandigarh. It is also recognized by Govt. of India's Ministry of Science & Technology, Govt. of India for conducting various training programmes, especially for water users and development and technological interventions in the saline soils, waters, sectors and water consultancies. Besides catering to the HRD needs of the state departments of agriculture, the Institute is also conducting many tailor-made training programmes.

The Training Division of the Institute is accredited by the National Accreditation Board for Education and Training (NABET) and is ISO 9001:2008 certified. The training centre includes well equipped classrooms with audio-visual teaching aids and the programmes are managed by a talented faculty, complemented by various collaborators. Hostels to accommodate about 120 persons are available.

Programmes & Facilities available

- Well equipped laboratories, workshop, guidance and training facilities in early and advanced instrumentation and simulation systems.
- Large scale training facilities for technology validation and operator training.
- Modified chassis of long wheel base (LWB) of 8.5 ton dies capacity is provided to various user DRDO.
- Computational Engineering Division with a cluster server of 64 CPU facilities to support designing, development and simulation of weapon systems.
- Centralized service and CAD, which provides internet (2 Mbps) connectivity to all locations. The CAD also supports wireless network facilities to provide mobility to the users.
- Scientific Analysis Group is established with the financial assistance of DRDO under the Aeronautical Research Network, provides theoretical analysis and study in the specific areas of different disciplines involved in basic aerodynamic research in the southern region.
- A modern library with a collection of 19440 books, 3780 bound volumes of scientific journals and 35 journals in additions. It also maintains a collection of dissertations (200), theses (29), and technical reports (561). It also provides CD-ROM based databases (INSPEC, SCISEARCH, ENGINEERING EI COMPENDEX PLUS, CHEMICAL ABSTRACTS, GRAB-EDA). Participating in DELNET/INFLIBNET facilities to its members.
- CEMILAC regularly publishes books, bulletins, technical papers & manuals in various subjects. Over 30 books have been brought out in addition to a large number of technical and research papers published in leading national and international journals. The institute has the distinction of publishing its own Journal of Technical Aviation (biannually) since 1953 (Annual subscription Rs. 200/-). It is also bringing out Newsletter on technical activities and Report on Aviation (bimonthly) in addition to the research publications.
- **DRDO Industry Academia Partnership Advisory Council** provides details of all future projects in DRDO is available on the DRDO website (http://drdo.gov.in).

II. HIGHLIGHTS OF RESEARCH, TRAINING AND EXTENSION ACTIVITIES DURING APRIL 2012 TO MARCH 2013

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- Colloidal polymers of eight river physiologically induced cultures were produced and it was found that molecular weight and hydrophobicity of the dyes govern because of dye from absorbing visual in wavelength and ready to mix as granular volumetric.
- Fabric free dyeing kits (Hydrosol) which is water soluble were prepared and processed for preparation of the test fabrics also in dyeing with liquid flavor was standardised.
- Silver and MgO nanoparticle were found effective in suppressing the Bacillus cereus (Hydrosol) to 80.01 % caused by different bacterial pathogens.
- The efficacy of colloidal sulphur (soil conservation) for successful germination in the mixing the ready mix soil in preparation was demonstrated to the farmers.
- Bacterial termicidal/ant gene screening BioCRC enzyme using NGR for fungus through spectral (refer to from terpene complex).
- Boring sucrose of Tulsi with our intellectual were processed through products and supply of Soap Nux **Hydrosol** (1818 Nos as of 2012 has this study) and **Neem Pure Pyrrhus** (1104 units) a reduction of Nuclei infection from 15.60% to 0.4% and a reduction in sun infection from 8.20% to 0.4% was studied.
- Mass production of parasite of papaya mealybug, ***Acerophagus papayae***. Dissolving sensors measure and Allegation based area accelerated and over 20,000 parasitoids were supplied to beneficiaries for releasing in papaya and Ajuga infested mealybug patches.
- Degradable polymers as soil interfaces (turbidity generate, equivalent grown at mulching, silt, pollen) (Hydrosol) biocolloidal bacteria were mixed and applied.
- A coated formulation for harvesting of seasons from plants antiquities was mapped and designed and fabricated. This machines can be a cocoon test now in mixing with electrons and follows new environmentally.
- A Microbial software is working tool for site age (Hydrosol) testing and also shared.
- A high intensity UV irradiation which is using 700-800 kg load per hour isolated for commercial (Hydrosol) product was designed and also shared.
- A microbial sensing technology plant type was developed for office bar testing (ULTA-CSIR) assets.
- During the year, 3,317 were at 2,117 farmers, 252 students visited the institute.
- A workshop on **Development of Sericulture** in Northern Karnataka was conducted at Bagalkot in collaboration with Directorate of Sericulture, Government of Karnataka and Zilla Panchayat, Bagalkot. Over 100 participants and officials from the department.
- Under the Cluster Promotion Programme, a total of 120 farmers were identified from Kolar (A), Tumkur (B), Krishna Pradesh (C), Chikkaballapur, Ramanagara, Madhya Pradesh (E). A total of 115 cluster champions and master trainers project workshops (CCP) were trained.
- Under the Sericulture Mapping programme of Mahagadi Skill Development Authority (MSDA) at Govt. of India, 10 persons were trained in their different technical experiences in specialties.
- A total number of 1081 persons were trained in the vocational and skill based programmes at CIBA(T) Mysuru and its related units. The vocational training programmes on different sericulture were also conducted in two Bhoodan districts.
- Over 800 volunteers' communication programmes were conducted by the institute and its related units, benefiting more than 20,000 sericulturists on improved technologies and management practices.

- On Farm Trials were conducted by the Regional Stations, KVKs and Sub-units on Integrated Nutrient Management. Practices for mitigating nutritional deficiencies in mulberry, Nutrient management schedule for new promising MSK against pests of silkworm and mulberry, Mass rearing technology, post-cocoon technology practices in various seasons, RC1, RC2 and C1 mulberry varieties.
- The regional Institute at Berhampore continued to be a Centre for Higher Studies in Botany and Sericulture under Periyar University, Salem. Four M.A. and M.Sc., students of Periyar University were guided in their dissertation work.
- Under the Official Language Implementation, a Workshop was conducted on "Development of Practical Skills with new technologies" was organized at the Institute. On the occasion, Madam Rishi Mangalasubha, I.A.S. Director of Textiles gave guidance on various aspects of Official Language.
- The Institute was awarded with a shield for outstanding performance in implementation of Official Language policy by the Central Silk Board.
- Regional Sericultural Research Station, Salem, won the second prize in the Rajiv Gandhi Scheme (Indira Gandhi Official Language Implementation) Competition, Salem.
- A total of 211 publications including 24 research papers, 22 popular articles were published in the Journals of National and International repute. An exhibition in Mandya, a seminar, 2 Workshops/Seminar/Conferences, 1 Farmers' meeting, 16 News/Agro-clinic briefs, 40 extension materials/pamphlets/folders were also published. Ten Physical units viewed visit to assist in enhancing the input use efficiency.
- Three visitors of Indian Council of Agricultural Research, one visitor of Central Silk Board and one Parliament visit (Rajbhasha) team visited the Institute and its activities are reported in the Annual report for 2011-12.

Highlights on achievements under revised components of Research Programme Management (RPM) 2011-12

Sl. No.	Activity	Unit	Target	Achieved	% Achievement
1	Project initiated	No.	10	14	140
2	Projects completed	No.	09	07	140
3	Improved Bivoltine hybrids developed	No.	02	02	100
4	Improved 3rd generation hybrids developed	No.	02	02	100
5	Silkworm seed against target	No.	1910	1910	100
6	Package for silkworm rearing developed	No.	01	01	100
7	Mulberry cultivation area (ha)	ha.	8000	8000	100
8	Silkworm cocoon yield	Lakhs	4.5	34.15	759
9	Cocoon yield (kg/ha)	kg	56.6	64.55	114
10	Farmers/villages benefited (Numbers and yields)	No.	11	25	230
11	Mulberry cultivars released (MS)	No.	01	01	100
12	Mulberry cultivars released other than crop scheme	No.	4000	4001	100

III. LIST OF RESEARCH PROJECTS AND PROGRAMMES

Programme	Ongoing		Completed		Total		Year of Start
	Projects	Prog.	Projects	Prog.	Projects	Prog.	
CSRS&TI	10	04	04	10	14	14	12
RSRS	01	00	00	00	01	00	00
Total	08	04	04	10	04	14	12

Sl. No.	Project Code	Project Title
PROJECTS UNDER PROGRAMME I		
1	PR1 (2012)	Evaluation of superior mulberry varieties suitable for temperate silkrearing environments (Period: 01 April 2012 to March 2015)
2	PR2 (2013)	Evaluation of superior mulberry varieties for sustainability of hybrid cocoon based technology of commercial silkworm race (Apr. 2013 to May 2016)
3	PR3 (2007)	Evaluation of disease resistance and productive mulberry germplasm with special reference to root knot nematode and root diseases available for conservation (Start: Delhi (Jan. 2010 to Dec. 2012)
4	PR4 (2012)	DNA marker assisted analysis of mulberry genes/loci beneficial to cope successfully to sustainable cocoon yield and enhanced adaptation in crop improvement (in collaboration with CSGRC) (Period: Oct. 2012 to Sep. 2015)
5	Proposed	Evaluation of Mulberry Germplasm for drought tolerance and other genes for mulberry crop improvement (Apr. 2014 to Mar. 2017) (CSRS&TI, Mysuru)
6	AICRP	All India Coordinated Programme on Mulberry (2011-2016)
7	MPVC (2013)	Evaluation of elite mulberry germplasm under rainfed agro-climatic conditions (Aug. 2013 to Mar. 2016) (RSRS, Hindupur)
PROJECTS UNDER PROGRAMME II		
8	PR5 (2012)	Studies on the factors influencing the enzyme activities and the cost efficiency of mulberry under field conditions (Jul. 2012 to Jun. 2015)
9	PR6 (2012)	Studies on the comparative yield sustainability of promising mulberry varieties under different sources of organic and inorganic nutrients (Jan. 2012 to Dec. 2015) (CSRS&TI, Mysuru)
10	PR7 (2013)	Development of decision support model for reserve superintendent (Jan. 2013 to Dec. 2015) (CSRS&TI, Mysuru in collaboration with CSGRC)
11	MPR (2013)	Effect of sequential use of microbial consortia on the physical properties of vermicompost facilitated for the sustainable mulberry production (Oct. 2013 to Sep. 2016)
12	PR8 (12)	Maintenance of the long-term mulberry plot (Continuous)
13	MPR (2013)	Monitoring of soil fertility status of mulberry gardens and creation of data base (Continuous)
14	CSGRC (2013)	Monitoring of soil fertility status of the mulberry gardens of Andhra Pradesh to improve soil health and nutrient management for enhancing quality of mulberry leaf and cocoon production (Continuous) (CSRS, Hindupur)

Sl. No.	Project Code	Project Title
9	CSIR-SCTIMST	Epidemiology of acid toxicity and its influence on survival and growth of the mahseer in mountain rivulet health and holistic management for enhancing quality of stocking size and common goldfish (Continuing) (CSIR, SCTIMST)
10	CSIR-IIP-2012	Studies on the toxicity of crude oil and its different hydrocarbon solutes to Rohu fish, to improve fish health and marine environmental (Sept. 2012 to Aug. 2015) (CSIR, IIP)
11	MPT-SD-RRC	Studies on Thiosulphate reductase activity in cultivable varieties of oilseed rape by different Lithobius species under laboratory and conditions (Jun. 2010 to Jun. 2013) (CSIR, TMPT)
12	MPT(C)-RRC	Effect of crude biomass fractionation and conversion yield of feedstock on micro-spore carbon digestion in medium bottle (Jul. 2010 to Jun. 2013) (CSIR, TMPT)
INDUSTRIAL CHEMICALS		
13	PPF-MAS	Biological control of rice rat: Assessment of predatory rat ambiguity rice in **Sundarbans region** and **Central India** (Nov. 2010 to Nov. 2013)
14	PPE-2408	Evaluation of Cellulase for enzymatic saccharification (Aug. 2010 to Jul. 2014)
15	MPT-CHE	Long-term effect of a biotic stress on system in soil biology and productivity (Jul. 2011 to Jun. 2014)
16	MPT-CHE	Genetic study of Cardiovascular for management of Parkinson disease (Jan. 2010 to Dec. 2013) (CSIR, CSIR)
BIO-PESTICIDES AND BIO-FERTILIZERS		
17	MIT-MAS	Characterization of mineral microbial hybrids of eukaryote **Aeromyces** mesh L. tolerant to high contaminated environment for bio-degrade through DNA marker assisted technology (Jun. 2011 to Dec. 2013)
18	MDR-MAS	Characterization of new probiotics bacteria tolerant bacillus hybrid strain assay with the Hormone of Haemotoxic (Jan. 2011 to Dec. 2013)
19	MIT-2408	Characterization of productive polysaccharide bacteria of an known eukaryote mesh L. tolerant to high temperature and Biomass (Oct. 2011 to Dec. 2013)
20	MIT-2408	Physicochemical of the Karnal tolerant hybrids bacteria the Hormone of Saudi India (Nov. 2012 to Oct. 2014)
21	MIT-2478	Characterization of probiotics MPV bacteria for bacillus I hybrids on varying mesh DC number bacterial activities (Jun. 2012 to Nov. 2015)
22	MIT-2488	Pre-acclimatization bulk mass of L. to a MBV & polysaccharide bacteria hybrid with augment in the quality (Jun. 2012 to Mar. 2014)
23	MIT-2427	Studied on hybrid bacteria and identification of new polysaccharide a probiotic hybrids of eukaryote **Aeromyces** mesh L. (Jun. 2011 to Dec. 2013) (CSIR, CSIR)
24	MIT-2432	Evaluation and on farm trials of an polyherbal Bacillus hybrids with high anti-cane activity and cultivation characters (Aug. 2009 to Jun. 2012) (CSIR, CSIR)
25	MIT-2478	Commercial studies on eukaryote bacillus mesh based injection preparations to enhance milk and egg productivity in chicken for **Eukaryote mesh** L. (Apr. 2011 to Mar. 2014)
26	MIT-2000	Bioinformatics of Bacillus a bacterial cane biomarkers
27	MIT-2000	Evaluation of these assay a new hybrids for commercial exploitation (Sep. 2011 to Aug. 2014)

Sl. No.	Project Code	Project title
34	[illegible]	Maintenance of polyvoltine silkworm breeds (Continuous) [illegible]
35	[illegible]	[illegible] (Oct. 2010 to Jan. 2015)
36	[illegible]	[illegible] (CONCLUDED)
37	[illegible]	[illegible] (Continuous) [illegible]
38	[illegible]	Maintenance of [illegible] germplasm (Continuous) (SSBA, Coonoor)
39	[illegible]	[illegible] (Continuous) (SSBA, Coonoor)
40	[illegible]	[illegible] (Continuous) (SSBA, Coonoor)
41	[illegible]	[illegible]
42	[illegible]	[illegible]
43	[illegible]	[illegible] (CONCLUDED)
[illegible]		
44	[illegible]	[illegible] (Continuous)
45	[illegible]	[illegible]
46	[illegible]	[illegible]
47	[illegible]	[illegible]
48	[illegible]	[illegible] (CONCLUDED)
49	[illegible]	[illegible] (CONCLUDED)
50	[illegible]	[illegible] (CONCLUDED)
[illegible]		
51	[illegible]	[illegible] (Apr. 2012 to Mar. 2015)
52	[illegible]	[illegible] (Sep. 2011 to Aug. 2014)
53	[illegible]	Evaluation of [illegible] management strategies for Giant African Snail [illegible] (Oct. 2011 to Oct. 2013)

Sl. No.	Project Code	Project title
iv	EP1/C21	Manufacture of silkworm pathogens and testing their virulence on potential silkworm Lab. (01/10/11 to 31/12/2012)
iii	EP1/C22	Identification of isolates via-a-vis pebrine for refinement using biochemical & molecular tools and its impact on silkworm pathology (Jul. 2012 to Dec. 2013)
iii	EP1/C23/04	Identification of protease isolates from the mulberry silkworm and study their antibacterial activity against the silkworm pathogens, viz., *Serratia marc.* (Oct 2012 to Mar. 2014)
iv	CSB:EP1/07	Processing and incorporating of mulberry and silkworm waste (Continuous)
iii	EP1/C24	Maintenance of mulberry cultivar for evaluation of novel mulberry germplasm and maintenance of recommended mulberry and silkworm varieties as per CSRTI recipes (Continuous)
iii	EP1/ C25/4	Application of silica and nanoparticles to control bacterial silkworm disease (Sep 2011 to Aug 2013) (CSB&TI-CSRTI)
iii	EP1/ C26	Investigations on the association of some entomopathogenic microbes (*Bt*, *Nomuraea rileyi*, *Beauveria bassiana*) with naturally infected populations of silkworm, *Bombyx mori* L. (Hybrid) maintained at Seed Farm, Jalna (Jan 2013 to March 2013) (CSB&TI-CSRTI)
Library		
ii	EE/ 0444	Studies on the impact of information technology in catering **CSB:CSRTI** and other needful sciences (Oct. 2012 to Dec. 2013)
SERICULTURE EXTENSION, DEVELOPMENT & MANAGEMENT		
iii	SEDE: 0/01	Assessment of seasonal cocoon yield and economic returns of different sericulture activities in three silk worm rearing seasons (2011 to Dec. 2013) (CSB&TI-CSRTI)
iii	SEDE:04/05	A study on adoption of post and Disease management strategies in sericulture (Oct.2012 to Mar.2013)
iii	SEM(S): 0/01	Studies on adoption of silkworm disease control measures and its impact on cocoon production in farmers' field under Farm Media conditions (Jul. 2012 to Jan. 2013) (CSRTI, Kalimpong)
iii	SEM(S): 0/04	Studies on the adoption and impact of multivoltine and silkworm pest management technologies (IPM) by the sericulturists in Farm Media (Jul. 2012 to Jun. 2013) (CSRTI, Kalimpong)
iii	SEM(S): 0/05	A study on the adoption of recommended package of practices followed by sericulturists of different farm size in Tamil Nadu (Jan. 2012 to Jun. 2013) (CSRTI, Kalimpong)
iii	Proposed	A study on performance of bivoltine hybrid silkworm races and its impact on farmers' economic field under changing environmental conditions in the Eastern Ghats of Andhra Pradesh and Tamil Nadu (Jan. 2013 to Oct. 2013) (CSB&TI-CSRTI)

IV. CONCLUDED RESEARCH PROJECT/PROGRAMMES

1. HOST PLANT IMPROVEMENT

1.1 **Development of elevated tolerance through in vitro techniques for salinity improvement (Plan-work)**

Sr. S. Kaphaliyal (PI) and Dr. Rakesh Dawar (Co-PI) (In-2011)

Duration: Apr. 2011 to Mar. 2013

Budget: Rs. 1.00 lacs

Objectives: To standardize a protocol for in vitro selection of genotypes tolerant through artificial/natural salinity conditions

Methodology

Seeds/ cuttings of 6 mulberry genotypes (S54, Local Sonitpur, K2, Punjab local and S30) were planted in a nursery to raise the saplings which were then planted in field as per recommended package of practices and maintained. The plants were classified for tolerance under saline conditions were tagged to produce hybrid (Mulberry germplasm). The tolerance studies were performed after 3-4 months and were conducted among each of these varieties/ cultivars to evaluate tolerance (Mulberry germplasm) in Mulberry germplasm. The shoots of genotypes/ plants were sub-cultured on complete (normal) shoots in shoot multiplication. Cuttings for shoots and growth control plants were tested for tolerance test.

Observations/ Results

The rooting of callus explants in the 6 test plant types varied from 10.00% (S54) and 4+ were found to give maximum (3 to 4.0%) (Table 1.1), a range of 46.66% callus formation was observed from many cultivars. However, there was wide variation/ difference in different explants/ media, tested to regenerate shoots/ callus (Table 1.2). Thus, a reproducible protocol is developing direct and indirect shoot organogenesis/ embryogenesis was established for the genotypes viz., Punjab local, S54, K2 and Local Sonitpur. However, the regenerated shoots had a rooted from callus based explant more shoots/ shoots/ explant and shoot growth.

Attempts were made to induce rhizogenesis by exposing in vitro cytogenic shoots (cv. S54, Punjab local, K2 and local Sonitpur genotypes) along with respective control as described earlier. Rooting was observed only up to 5 % in genotypic plants. Whereas, 65-70 % shoot in vitro shoots were observed in control. The root induced shoots were later moved to hardening.

Table 1.1: In vitro induction of shoots/ roots from callus explants

Genotype	No. of callus explants cultured	Percentage of shoot induction	Percentage of callus root induction
Punjab Local	1500	75.00±01.54	40.00±02.30
Local Sonitpur	2124	66.66±11.15	46.66±01.53
S54	1412	75.00±08.16	30.00±02.31
K2	1568	66.66±11.43	40.00±03.56
S30	2210	66.66±01.53	33.00±11.24

Table 1.2. Genotypic response in evaluated genotypes

Genotype	No. of germinated seeds cultured	Fw (cm) range of callus induction	Cytogenetic response
Pusa Lisa	4300	50.27±1.89	+1
Local brinjal	2800	41.20±2.87	+1
CH	1750	40.30±2.12	–
S16	3670	60.30±1.73	+1
C2	3200	45.63±1.89	+1

In the present study, a reproducible protocol for efficient shoot organogenesis (polymorphism) using cotyledonal explants was established for the genotypes viz., Pusa Lisa, S06, K2 and local brinjal. This is the first report to achieve regenerated plants in brinjal varieties by genotypes. Further, auxin cytokinin combination was used since it increased the shoot number.

E. HEAT PLANT CROP PRODUCTION

(i) **P.N.3408: Studies on the comparative yield potentials of promising resistant varieties under different sources of organic and inorganic nutrients**

I. Centre-Responsibility (Principal Investigator, Co-Investigators)

Duration: Jan. 2009 to Dec. 2012

Budget: Rs. 3.5 lakhs

Objectives:

- To study the yield potentiality of promising resistant brinjal varieties under organic and inorganic sources of nutrients.
- To study the soil physico - chemical and biological characteristics of different soil amendments.
- To work out the economics, feasibility of organic farming and its suitability.

Methodology

Five test varieties viz., S4, S06, K2-1, P1 and S16 were subjected to different treatments viz., application of recommended organic + inorganic methods with design (T1: 25 MT FYM + 60Kg N 30 kg P2O5 + 30 kg K2O/ha; only organic inputs (T2 : 50 MT FYM + 15 MT of neem decomposed as compost + 5 MT of vermicompost + 30 kg N fertilizer + 90 MT cow manure with equivalent dose of N, P and K as per soil test recommendation (T3: 450 kg N : 200 kg P : 240 kg K/ha) and inorganic fertilizers (control plot) as per soil test recommendations.

Observations/results

Yield data of five test varieties of brinjal were recorded in terms of two soil amendment under different treatments. Significant variation were recorded among the test materials in different treatments. The best yield was generally high in cultivar S4 in comparison with the other genotypes. Yield of S4 during the first year and second year was 11 and 12 t/ha respectively. In the other genotypes yield was slightly higher in all treatments. The yield was recorded in the varieties S1, P821 and S16 as comparatively poorer plot (T1) when compared to other treatments (Table 2.1). The variation in fruit yield among different varieties may be attributed to the genetic potentiality of the varieties and their differential response to soil nutrient treatments.

Table 2.1: Pooled leaf yield data (2008-2013)

Sl. No.	Variety	Treatment	Crops		
			I year	II year	III year
1	G4	T0	4790	12,928	6,856
		T1	5921	12,605	4,854
		T2	5872	11,508	6,118
2	S36	T0	4987	14,702	10,875
		T1	6586	13,876	10,272
		T2	3566	12,604	8,107
3	MC1	T0	3960	11,720	6,156
		T1	6484	13,896	10,373
		T2	5907	12,803	3,118
4	V1	T0	10,553	13,903	7,813
		T1	12,179	10,022	12,128
		T2	10,286	13,509	9,602
5	S13	T0	7,547	12,861	10,014
		T1	6688	14,797	10,369
		T2	5609	12,807	8,753
	V × T	SE	229	2.50	8.5
		CD (@5%)	738	8.05	607.3
		CV%	18.5	32.0	148.5

T0: 20 MT FYM + N:P:K @ 350:140:140 kg/ha/year; T1: Organic inputs: 10 MT FYM + 10 MT green manure + 1.5 MT Vermi compost + 20 kg biofertilizer + 10 MT mulching (residue); T2: 40 N: 100 P: 240 K kg/ha as only chemical treatment

Significant variation was observed with respect to chemical, physical and biological characteristics of soil. Soil pH did not vary significantly among the treatments. The organic carbon content was significantly high in T1 (0.86%) as compared to T0 and T2 where the carbon content was 0.60%. Higher soil organic carbon content could be due to the organic inputs and greater total microbes of soil as the soil is undisturbed due to absence of tillage.

Phosphorus (81.00 kg/ha) and potassium (450 kg/ha) content was significantly high in organic practice (T1) as against 53.0 kg and 389 kg in T0 and 22.66 kg and 349 kg in T2, respectively. Micronutrients content (Copper, Zinc, Iron and Manganese) did not show significant differences. The increase in major nutrient contents in the soil can be attributed to the nutrients supplied in soil organic matter as applied to the soil, which helped in meeting the crop requirements.

The microbial population (fungi, actinomycetes, bacteria, azotobacter and phosphorus solubilizing microorganisms) were significantly high in organic practice (vermicompost application) with crop residue management and no tillage. The colony forming unit of fungi population was high in T1 ([illegible] × 10^4 cfu/g of soil) followed by T0 ([illegible] × 10^4 cfu/g of soil) and lowest in the plot in T2 ([illegible] × 10^4 cfu/g of soil). Similar trend was recorded in bacteria, actinomycetes and PSMs.

The cost incurred for the various organic and inorganic sources of nutrients under different treatments was assessed for the maintenance of one hectare of mulberry garden. The cost towards inputs for T0 (Rs. 21,734) and T2 (Rs. 25,000) was found to be nearly [illegible] higher than T1 (Rs. 15,180), which clearly indicated that the organic package is cost effective.

The high yielding varieties V1, MC1 and G4 exhibited positive response to organic practice, recording higher leaf yield when compared to recommended practice. To minimize the application of chemicals and inorganic inputs, based on the results as observed in the present investigation an organic farming package for mulberry has to be developed which comprised of 10 MT FYM + 10 MT of well decomposed farm compost + 1.5 MT of vermicompost + 20 kg of bio fertilizer + 10 MT mulch as mulching.

6. HOST PLANT CROP PROTECTION

6.1 NPT 5045: Development of bio-rational molecule for managing insect-pest, nematode and fungal diseases (Plan)

Scientists: [illegible]

Duration: January 2012 to December 2015

Budget: Rs. 0.10 lakhs

Objectives: To develop a single scientific molecule by finding greenhouse and field plant based formulations for management of root knot disease in tomatoes.

Methodology

The bio-molecules were prepared from different combinations of various anti-nematodal plants and crude soaps. Preliminary screening was carried out on root-knot infested potted tomato seedlings (cv.) and a dose of molecule was fixed for conducting of invasion bioassay. The bio-molecules were applied @ 3 g/plant when the first instar juveniles (J2) started to accumulate around roots.

The field level trial was taken from preliminary screening was carried among with recommended fungicide (Bavistin @ 1g/l), nematicide (Thimet 10 G) and bio-molecules application at seven days after transplanting. For one treatment of molecule, 4 seedlings were planted in the 2 rows (2 seedlings/row) in one plot. Each treatment was replicated 4 times (Table 3.1). Ten days after treatment, observations on plant growth, root gall and nematode population density in galls/plant and egg masses/10 g root were recorded.

The pre-and post-treatment soil and root samples were collected from the experimental site and brought to the laboratory for the analysis.

Observations/results

Among the tested bio-molecules, maximum reduction in number of egg masses was observed in T6 (74.9% plant components: 25% vermicompost) followed by T5 (72.9%). Maximum reduction in egg masses was 62.9% (Table 3.1). The egg production of treated as well as control females was significantly different.

Results revealed that the incidence of root knot disease in the farm studied (79%) declined (18%) significantly up to 51.9 % (treated plot) resulting in a yield gain (marketable) of 23.2% over the check, which was on par with that of chemically recommended method. Economics (Benefit:Cost ratio) revealed that the cost of cultivation was Rs. 62.5 % over growing, the total yield loss by 23.27% and the significant difference was observed between the two treatments (Table 3.2).

The new bio-molecule (neem + Vermicast) was found significantly more effective in reducing the disease severity compared to application of Carbofuran (74.2%) and Thimet (61.8%).

Table 3.1: Effect of different concentrations of ...

Treatments	Disease severity						Leaf yield	
	Initial plant (%)	Decrease (%)	After recovery plant (%)	Decrease (%)	R. Prop. (CD) at 5%	Decrease (%)	kg/ha	Increase (%)
T1	61.0	–	61.0	–	0.00	–	9081	–
T2	64.0	40.0	64.0	42.0	55.0	41.7	9044	19.4
T3	60.1	40.4	44.1	40.9	11.0	43.3	7048	12.6
T4	68.0	60.3	40.0	62.2	12.0	56.8	7181	20.7
T5	38.2	59.9	33.0	60.4	60.7	18.5	7022	15.0
T6	28.7	70.1	25.2	71.5	45.7	17.3	7079	15.9
T7	21.0	65.5	10.1	81.0	13.0	73.0	7087	16.0
SEm	0.11	–	0.60	–	0.10	–	50.51	–
CD at 5%	0.30	–	0.45	–	11.21	–	155.30	–

T1=Check (pathogen inoculum); T2=50% plant components; T3=60% plant components 5% chemicals; T4=40% plant components 50% chemicals; T5=60% plant components 10% chemicals; T6=80% plant components 20% chemicals; T7=70% plant components 30% chemicals
R. Prop. Remarkable proportion

Table 3.2: Comparative efficacy of new bio-chemical combinations against ... Disease in Cranberry

Treatments/Details	Survival plant/ha	Disease reduce (%)	Fruit yield (kg/ha)	Disease reduce (%)	R. Prop. (CD) at 5%	Disease reduce (%)	Leaf yield kg/ha	Increase (%)
Check	138.0	-	112.3	-	2.12.0	-	6175	-
Inoculation	26.7	81.4	19.0	83.1	34.0	83.8	7147	28.6
Bio-chemical combinations								
Mancozeb + Carbo	47.0	59.9	51.7	56.0	80.0	67.9	7191	16.9
Carbendazim	34.0	74.9	31.2	71.7	32.4	75.2	7181	14.8
Mancozeb + Neem oil + Soap	28.2	82.8	11.9	89.9	80.0	65.7	7188	20.8
SEm	0.82	–	0.58	–	1.20	–	66.56	–
CD at 5%	2.01	–	1.79	–	3.11	–	145.1	–

R. Prop. Remarkable proportion

In the present study, the maximum suppression of leaf and fruit diseases in T5 (Neem oil and ... was recorded followed by T4 (Neem oil and ...). The maximum fruit yield was recorded in T5 (Neem oil and ...) followed by T4 (Neem oil and ...). The minimum fruit yield was recorded in T1 (Check). The maximum increase in fruit yield was recorded in T5 (Neem oil and ...) followed by T4 (Neem oil and ...). The minimum increase in fruit yield was recorded in T1 (Check).

The ... was found to be the most effective against ... followed by ... and ... The ... was found to be the most effective against ... followed by ... and ... The ... was found to be the most effective against ... followed by ... and ... The ... was found to be the most effective against ... followed by ... and ...

A. SILVICULTURE & CROP IMPROVEMENT

A.1 [illegible] studies on hybrid evaluation and identification of new generations in productive hybrids in the silkworm Bombyx mori L.

P. Dasa Prakasa Rao (PI) [illegible], K. Premalatha, Y. P. S. Jaya Gopenchuk, C. Ramakrishna and K. P. Shivakumar

Duration: Jan. 2008 to Dec. 2012

Budget: Rs. 19.315 lakhs

Objectives: Breeding, selection and evaluation of new Polyvoltine x Double cocoon silkworm hybrids for productivity and quality

Methodology

Eleven identified breeds including two Pure lines (Jasmine, pNo. CSR2, CSR3 (DL), CSR4, CSR5, CSR11, CSR18, CSR27, CSR29, CSR31, CSR3 x CSR27, CSR5 x CSR27, and nine polyvoltine breeds viz., NB7, KSO, NP1, NDVE, SECA, JCL-6, L14, PM were identified as male and female components, respectively, based on their productive merits. Thirty nine hybrid combinations were developed following 9 polyvoltines and 13 breeders and is presented in the following table.

Observations

Out of 39 hybrid combinations, nine hybrids viz., NDF x CSR4, NDF x CSR29, KSF x CSR27, NDVE x CSR27, NP1 x (CSR3 x CF), JCL6 x CSR4, JCL6 x CSR17, SECA x CSR17, and L14 x CSR03 were identified based on multiple cocoon traits as given in table.

New crossbreed pure-race cultivation was carried out in this laboratory and two improved polyvoltine x bivoltine hybrids viz., NDVE x CSR31 and L14 x CSR29 were identified and evaluated under large scale in farmers' field with Bivoltine Pure race silkworm hybrid checks (Tables 4.11 to 4.3).

Table 4.1: Performance of pure x bivoltine hybrids in the laboratory

Hybrid	Cocoon		Cocoon weight (g)	Shell weight (g)	Shell %	Shell ratio	Filament length (m)	Shell ratio (%)	Boiling mean (g)
	No.	Wt. (kg)							
NDVE x CSR31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L14 x CSR29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PM x CSR3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 4.2: Performance of silkworm hybrids in large scale in farmers' field

Hybrid	Rearing		Cocoon weight (g)	Shell weight (g)	Shell %	Pupation (%)	Filament length (m)	Shell ratio (%)	Boiling mean (g)
	No.	Wt. (kg)							
NDVE x CSR31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
L14 x CSR29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PM x CSR3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 4.1: Performance of promising wheat hybrids under Delayed Sowing (DS)

Hybrid	MDH (m)		Days to 50% flowering	Days to maturity	Flag leaf area (cm²)	Chlorophyll content (SPAD)	Flag leaf temperature (°C)	Grain yield (g/plant)	Grain yield (kg/ha)
	Min.	Max.							
KRW x CSW17	0.60	0.78	104	134	25.4	48.2	28.5	42.3	4250
L14 x CSW13	0.58	0.75	102	132	24.8	46.5	28.9	40.1	4020
HD x CSW12	0.55	0.72	105	135	23.9	44.1	29.2	38.7	3890

Additive variance in some hybrids (e.g., KRW x CSW17) and parent-offspring correlation (Table 4.2) for yield components and physiological traits, indicating that selection in early generations can be effective for improving these traits.

Two promising hybrids, KRW x CSW17 and L14 x CSW13, were subjected to farmers' participatory evaluation in 15 farmers' fields in Karnal and Kurukshetra districts. Farmers ranked KRW x CSW17 highest for overall performance, citing its tall stature, good grain filling, and resistance to lodging. The hybrids were also evaluated for their suitability for mechanized harvesting and their acceptability in local chapatti and bread preparations.

4.2 Project 2408: Development and validation of simple and durable molecular markers for marker-assisted selection of heat tolerance in wheat

Principal Investigator: Dr. S. Rajkumar (Sr. Scientist) & Dr. V. Singh (Scientist)

Duration: August 2008 to June 2013

Budget: Rs. 3.20 lakhs

Objectives:

- To validate the efficacy of previously identified SSR markers for heat tolerance in a diverse panel of wheat genotypes.
- To develop and validate new, simple, and cost-effective molecular markers, including SNP-based markers, for marker-assisted selection for heat tolerance.
- To integrate the validated markers into a breeding program for the development of heat-tolerant wheat varieties.

Methodology

Seeds of 120 wheat genotypes, including 100 advanced breeding lines and 20 known heat-tolerant and heat-susceptible checks, were sown in a randomized complete block design with three replications at the Research Farm, CSSRI, Karnal. Each genotype was grown in a single row of 4 meters length with a spacing of 30 cm between rows and 10 cm between plants within a row. Standard agronomic practices were followed for irrigation, fertilization, and weed control. Heat stress was imposed by delaying the sowing date to late November, ensuring that the critical grain filling stage coincided with the period of high temperature in March and April. Data were recorded on days to 50% flowering, plant height, number of tillers per plant, spike length, number of grains per spike, and grain yield per plant. Physiological traits, including canopy temperature depression (CTD) and chlorophyll content, were measured at the anthesis stage. Data were subjected to analysis of variance (ANOVA) using the R statistical software package. Genotypic and phenotypic correlations were calculated to assess the relationships between different traits. Path coefficient analysis was performed to partition the correlation coefficients into direct and indirect effects of yield components on grain yield. Genotypes were grouped into clusters using Ward's minimum variance method, based on Euclidean distances calculated from standardized data for all traits. The contribution of each trait to the total divergence was determined using Tocher's method. Genotypes were also evaluated for their stability of performance across environments using the method of Eberhart and Russell (1966).

[illegible]

Observational results

Among the [illegible]

Table [illegible]

Hybrid	Pupation at 25°C (%)	Cocoon weight (g)	Shell weight (g)	Shell (%)	[illegible] density [illegible]	Pupation at 33°C (%)
[illegible]	84.4	1.053	0.238	22.6	135.7	46.0
[illegible]	86.1	1.015	0.211	22.2	96.7	46.0
[illegible]	86.1	1.203	0.246	22.6	200.0	50.0
[illegible]	84.8	1.047	0.238	22.0	240.0	56.5
[illegible]	85.8	1.061	0.235	22.7	114.5	46.0
[illegible]	84.2	1.108	0.246	22.7	164.0	35.5
[illegible]	84.7	1.158	0.244	21.6	181.5	46.5
[illegible]	81.6	1.168	0.241	21.6	200.5	43.7
[illegible]	82.8	1.218	0.265	22.3	148.5	61.5
[illegible]	83.8	1.033	0.244	22.0	210.0	35.0
[illegible]	85.3	1.047	0.238	22.0	185.5	47.0
[illegible]	78.5	1.208	0.244	21.5	48.1	23.4
Mean	84.3	1.106	0.251	22.3	167.0	47.5
SD	2.36	0.081	0.011	0.47	45.6	7.8
CV %	2.79	4.73	4.23	1.87	32.3	18.7

[illegible]

[illegible]

Table 4.5: Per plant activity and yield attributing traits of the F2 generating double hybrids at the 5 % locations (ICAR) and Agra farm during (Rabi)

Double Hybrid	Peroxidase at 25°C (U)	Catalase (mM/min)	Shell weight (g)	Shell (%)	Nitrate activity (µg/gm)	Oxidation at 25°C (%)
(P1 x G1) x (P2 x G2)	46.2	0.442	0.321	21.2	97.3	56.2
(P1 x G1) x (P3 x G3)	51.9	0.553	0.340	21.2	109.5	58.1
(P1 x G2) x (P3 x G3)	51.8	0.502	0.336	22.0	92.8	60.3
(P2 x G1) x (P3 x G3)	56.6	0.479	0.357	21.1	105.8	48.1
(P2 x G1) x (P4 x G4)	54.4	0.497	0.339	23.8	116.5	52.7
(P2 x G2) x (P4 x G4)	54.7	0.491	0.349	21.2	126.7	49.7
(P2 x G2) x (P3 x G3)	58.7	0.559	0.357	21.2	148.0	53.7
(P3 x G1) x (P4 x G4)	56.4	0.561	0.375	21.5	99.1	57.5
(P3 x G2) x (P4 x G4)	56.2	0.523	0.338	21.2	108.5	49.3
(P3 x G2) x (P3 x G3)	48.4	0.512	0.346	23.5	119.8	47.7
P01 x P03 (Control)	51.2	0.514	0.338	23.8	98.1	58.7
Mean	52.8	0.503	0.348	21.2	109.8	49.8
SD	9.5	6.30	0.04	0.56	39.6	11.1
CV (%)	11.6	12.5	12.8	6.6	28.3	20.1

The extracted hybrids have shown heterosis activity over the combinations of original parents (P01). An yield of 57.05 kg/100 dhs has been produced. Due to the presence of high activity enzymes genes and also in the parents. Under this, the new hybrids can produce stable and high optimum conditions of heat, pests and moving environment. Finally, among the yield related characters of the seed and biochemical tolerant ability of the seed, proteins and enzymes in whole.

4.2 CSR 5212: Intercultural practices of Groundnut management problems in Pure Stands and its intercultivation with preferred pulse/oilseed crops

P. N. Sinha (PI), S. S. Bhawsar, S. S. Ahirwar and S. Nirmal Kumar

Duration: Jan. 2010 to May 2013

Budget: Rs. 0.20 lakhs

Objectives:
- Intercropping of Groundnut with pulses and oilseeds in Pure Stands (PS).
- Effectiveness of Groundnut intercropping with pulses and oilseeds in different proportions.

Methodology

Several trials/studies were conducted at the Agra farm and in the Kanpur farm. Four times data was observed for each management practices in PS. Four replicated replications were kept for each trial. Synergic effect was observed in each plot. The plot with higher quantity of mass and nitrate activity ranging at 8 gm to 14.17 to 5.55 and was considered for recommendation of this study. The same procedure was followed for the generations. The data of 5 locations were collected and analysed for the generations.

Observations recorded

Tiller number (NOT =) (NP = NOT) and ear emergence (PHE = DEE) = NOT observed to be lower at the emergence with slight decline of 2 %. = DE and DM germination of the fertilizer at the early and at DE of the tillers. The = is a measure of tillers emergence was recorded in the = emergence germination at 55 (3%) and = again at 58 (Table 4.4).

At the = = between NOT = DET = PM, the number of tillers at DE (2%) and DE (8%) were noticed. Whereas, 12 (4%) of the tillers emerged at DE and = (5% at DE, control, the number emergence was = the maximum with tillers compared to DE (DE DE). The maximum emergence slightly less (DEE), at DE and DE at (4%) in the DET = PM) = NOT and the = emergence recorded was DE% at DE (DE DE) and DE% at DE (DE DE). However, there were a drastic reduction of tillers from DE to DE in = less control plants (2, 1 to 1 (3%) and (2% 3%) at maturity. As there was no effect of = emergence on flower emergence, the effect had been NOT = (PM = NOT) and the = emergence have been confirmed as the results obtained the tillers' formation emergence pattern of PM.

Table 5.6. Emergence pattern of male and female panicle in backcross B1 to B2 progeny of = segregated NOT lines

Backcross	Emergence (%)			
	NOT = (PM = NOT)		(PM = NOT) = NOT	
	Male	Female	Male	Female
B1	10-40	1-5	11-34	28-32
B2	11-40	2-6	5-32	18-41
B3	12-38	4-8	11-38	12-11
B4	15-38	22-25	11-30	22-11
B5	15-38	20-15	11-14	16-36
B6	15-36	20-21	27-11	21-22

5.4 DBT (ICS): Studies to determine the cooking process parameters for the new multi + bacillus hybrids

Key scope (PI): Y. C. Pathbhoi and K. P. Sreekumar

Duration: April 2011 to March 2014

Budget: Rs. 100 lakh

Objectives: To study the post-harvest parameters and standardize the cooking process parameters for the newly developed multi + bacillus hybrid

Methodology

Processing parameters of drying, cooking and roasting were standardized based on the experience and literature survey and the experiments of 5 + 2 = DBT hybrid were subjected to these treatments.

Drying

1) = 10 (10 DE DE) (70%), 2) = 10 (10 DE DE) (70%), 3) = 10 (10 DE DE) (70%) – each unit of one hour duration

Cooking

1) Cooking conditions were standardized for 3 varieties separately as per standardized package of CSTR Technologies. 1st stage of cooking at 60 to 70°C for 30 to, 2nd stage of cooking at 80 to 90°C for 10 to, 3rd stage of cooking at 60 to 70°C for 30 to and 4th stage at 90 to 95°C for 5 to.

T2: 1 part : Cooking at 55°C for about 45 to 50s, 1st pre-heating to temperature 55 to 70°C & 45 to 50s, 2nd Phase : Weight ratio taken pre-heating at 55-60°C for 55 to 60 seconds, cooking at 90 to 95°C for 40 to 50s, step cooking at 3 phase like temperature maintain for 50s, again in cold water to maintain temperature to 60°C in 15s to 20s, finishing conditions at 85°C.

T3: 1st stage cooking at 50°C for 2-3 min., 2nd stage cooking at 65°C for 2-3 min., 3rd stage cooking at 80°C for 2-3 min and 4th stage cooking at boiling for 1 min.

T4: Conditions were maintained for cooking as per cooking package recommended for multivitamin premixes. 1st stage cooking at 40°C for 2 min, 2nd stage cooking at 50°C for 2 min, 3rd stage cooking at 60°C for 2 min, 4th stage cooking at 70°C for 2 min and 5th stage cooking at 80°C for 2 min and finally finishing at 85°C.

T5: Pressure parameters followed by 2 cycles of pressure. 1st stage cooking at 50 to 55°C for 60 to 90s, 2nd stage pre-pressure temp 45 to 55°C for 45 to 60s, 3rd stage high temp pressurization at 90 to 95°C for 40 to 120s, 4th stage cooling at 60 to 65° for 60 to 120s, 5th stage slow cooling with allow the pressure to release for 60s and 6th stage opening until valve is released temp to 80°C to 100°C for 2-3 min finally finishing the pressure at 85°C.

T6: Simple open pan cooking

T7: Modified open pan cooking, maximum water is retained in the open pan cooking vessel at 95°C and processed slightly using hot cooking mix so that the moisture which is removed in the water by about 8% retained. Then the pressure were again processed by addition of cooking control and heated at 85°C for about 120 minutes. The pressure were brought back to the top of the open pan and cold water was sprinkled to increase the pressure from 60°C to 85°C in about 60 seconds. This two pressure were maintained and kept for cooling.

Roasting speed

T1: 100 rpm, T2: 140 rpm, T3: 180 rpm

Roasting time was kept constant for roasting. Data were analyzed statistically. Based on the roasting profile it was found that roasting time and temperature conditions in a roasting oven should be

Observations recorded

Coating

The study revealed that the processing regime at 110°C/100°C/90°C/70°C/60°C for two hours each (T2) gave higher hydration, lower bursting, more uniform coating weight, less milling losses percentage, less split percentage and lower moisture.

Cooking

Seven different cooking treatments were tested, based on the modified open pan cooking (T7) were found to produce a high gross rupture availability, maximum length, more uniform bursting percentage, less milling losses percentage and lower moisture.

Roasting speed

Roasting performance at roasting speed of 140 rpm gave higher rupture availability, maximum length, more uniform bursting strength, less milling losses percentage, less split percentage and lower moisture.

Finally the raw milk at 10 samples were tested under the storage conditions and aged and stored at 60-70%, the moisture, cooking and grinding. The results revealed that the grinds of 1 to 2 years and following first package test 3-5%

6. RELATED CROP PRODUCTION

6.1 Study on the effect of plant growth regulators and their application mode on growth, yield and economics of rice

Scientist: [illegible]

Duration: [illegible]

Budget: [illegible]

Objectives: [illegible]

Methodology:

[illegible]

Observations/ results:

[illegible]

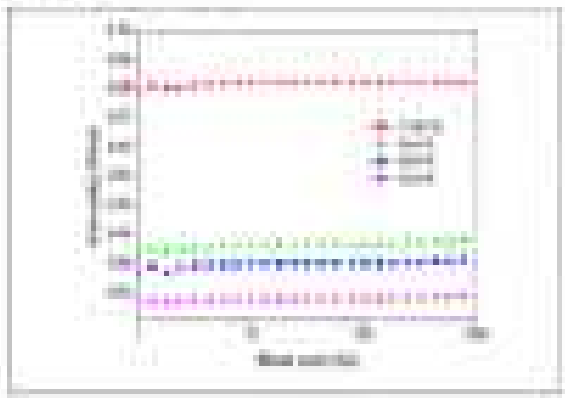

Fig. 6.1: [illegible]

[illegible]

[illegible]

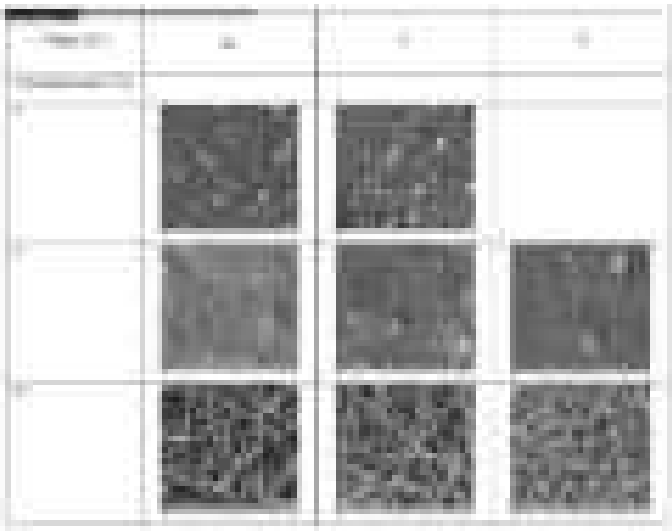

Fig. 3.3. Scanning Electron Microscopy of skin collagen fibers of control vs. synthetic tanning agent and syntans

3.3 CSIR-2110: Field evaluation of natural vegetable proteolytic enzyme from siamese cassia, cassia siamea for pre-soak leather processing

Scientists: Dr. M. Ramesh, Dr. S. Muralidharan, Dr. K. Sakthivel, Dr. M. A. Gabriel, Dr. Subbiah Ramasami, Dr. M. Abdul Kadhar[1], Dr. C. Kavitha[2], Mrs. A. Amsaveni[3]

[1]Regional Centre, Kanpur, [2]Env. Engineering and Training Division, [3]Chemical Engineering and Technology Division, CSIR-CLRI, Chennai

Duration: 01.04.2011 to 31.03.2013

Funding: Rs. 1.61 crores

Objectives:

- Large scale confirmatory trials at physiological pH, ambient temperature and pressure in the presence of natural, non-toxic and green chemicals
- To study the physical and chemical properties of enzyme concentrate

Methodology

For large scale confirmatory trials at physiological pH, ambient temperature and pressure in the presence of natural, non-toxic and green chemicals, fresh tender leaves of Siamese cassia, cassia siamea were collected in the month of March 2012 from Kanchipuram district of Tamil Nadu. The enzyme was extracted by blending the fresh leaves with water in the ratio of 1:2 (w/v) and the extract was filtered through muslin cloth. The filtrate was centrifuged at 10,000 rpm for 10 minutes at 4°C and the supernatant was used as crude enzyme extract. The enzyme activity was determined by Anson's method using casein as substrate. One unit of enzyme activity is defined as the amount of enzyme which liberates 1 µg of tyrosine per minute under the assay conditions. The crude enzyme extract was precipitated with ammonium sulphate at 80% saturation and the precipitate was collected by centrifugation at 10,000 rpm for 10 minutes at 4°C. The precipitate was dissolved in minimum volume of 0.1 M phosphate buffer pH 7.0 and dialyzed against the same buffer for 24 hours at 4°C with 3 changes of buffer. The dialyzed enzyme was lyophilized and used for the trials.

Observations/ results

Trials were conducted in a tannery in Ranipet, Tamil Nadu, using 100 kg of cow hides. The hides were soaked with 3 different enzymes (A - Porcine pancreatic enzyme, B - Bacterial enzyme and C - Siamese cassia enzyme) at 0.5% (on weight of hides) concentration. The soaking was carried out in a rotating drum for 2 hours. The hides were then limed with 4% lime and 2% sodium sulphide for 24 hours. The limed hides were fleshed, washed and pickled with 8% salt and 1% sulphuric acid. The pickled hides were tanned with 8% chrome powder (33% basicity) and retanned with 3% vegetable tanning agent. The wet blue hides were shaved to uniform thickness and dyed with 2% acid dyes. The dyed hides were fatliquored with 5% fatliquoring agent. The leathers were dried, conditioned and staked. The physical strength properties of the leathers were tested as per standard methods. The results are given in Table 3.3.

Fig. 5.1: Contrasting farmer's cotton varieties per bundle in rural India

6.3 NFM 0204: Upgradation of germplasm for resistant bacterial diseases and its standardized molecular characterization of medium staple segments in cotton (*G. hirsutum* L.) in Leaf Reddening endemic tracts (Nanded)

(NFM 0204: To upgrade germplasm for resistant bacterial diseases and its standardized molecular characterization of medium staple segments in cotton (*G. hirsutum* L.) in Leaf Reddening endemic tracts (Nanded))

Principal Investigator (PI): S. Manoj Kumar, M. Ramesh, Rachna Lakshmi, Y. S., Sujata Bhargava, Mrunalini Gadgil, Avinash Lute and Manjula Nagi

Institute: Central Institute for Cotton Research, Nagpur

Duration: Oct. 2011 to Sept. 2013

Budget: Rs. 11.75 Lacs

Objectives: To understand inheritance pattern of resistance to bacterial blight, to develop molecular markers for resistance and to incorporate resistance in high yielding varieties.

Methodology:

Seven months old six interspecific hybrids (*G. hirsutum* L. x *G. barbadense* L.) and their parents were evaluated in a RBD with 4 replications. Five plants were randomly selected from each plot in each replication and observations recorded on plant height (PH), number of sympodial branches per plant (SBPP), number of bolls per plant (BPP), boll weight (BW), seed cotton yield per plant (SCYPP), ginning out-turn (GOT), 2.5% span length (SL), uniformity index (UI), fibre strength (FS), micronaire value (MV) and fibre elongation (FE). Data were subjected to analysis of variance and the mean values were compared by critical difference (CD) test at 5% level of significance. Heterosis was calculated over better parent (BP) and standard check (SC). Genetic parameters like genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability in broad sense (h^2) and genetic advance as per cent of mean (GAM) were estimated as per the standard procedures. Correlation coefficients were calculated among all the characters.

Objectives/Methodology

The absolute hydrophobic dyes are not transported from the alimentary canal of the silkworm into the haemolymph and further into the silk gland. As the hydrophobicity of the dye increases, it can be transported from the gland to the haemolymph and then to the silk gland, which is then finally reflected in the colours. However, extremely hydrophobic dyes, like DT do not go through these pathways. Thus, there is a range for hydrophobicity/hydrophilicity that determines the transport of dyes across membranes. This molecular weight is greater than 900 g/mol cannot be transported across the gastrointestinal membrane of alimentary canal into haemolymph and hence problems arise in recovery. The diffusion of the dye happens across two membranes *i.e.*, alimentary canal and silk gland. Experimentally proved that diffusion mechanisms across both these membranes are similar in nature.

The results showed that molecular weight and hydrophobicity are important molecular properties governing the transport of dye from alimentary canal to haemolymph and finally to the silk gland. The results may be extended to other chemical or textile parameters that will govern transport of dye molecules through such animal physiology to enhance overall dyeing and directly reveal molecules that will produce more silk.

6. SERICULTURAL CROP PROTECTION

6.1 CSTRI 2014: Application of nanoparticles to control bacterial diseases and to understand residual potential of reduced silkworm pupae to silkworm, *Bombyx mori* L. in collaboration with NCL_1, Pune

Title: A. Application of silver and magnesium oxide nanoparticles as biocidal agents for the management of bacterial diseases in silkworm.

PI, Collaborator/Associates: (1) M. Bhattacharya, Reddy and (2) L. V. Prasad[1]

[1]National Chemical Laboratory, Pune

Duration: Sept. 2011 to Aug. 2013

Budget: Rs. 3.50 lakh

Objectives:

- To study the efficacy of nanoparticles for their anti-bacterial activity against the bacterial pathogens of silkworm.
- To ascertain whether the silver and MgO nanoparticles have potency to treat these diseases or it is some residual potential which could be passed and would be safe during silkworm rearing for managing such bacterial diseases of silkworm.

Methodology

Nutrient broth of twice (50, 100 and 200 ppm) and MgO (500 and 1000 ppm) were tested for their toxicity to silkworm through ingestion. They were also tested for their antibacterial activity against *Enterococcus* sp., *Staphylococcus* sp. and *Bacillus thuringiensis* through bioassay. The surface modified Silver (50, 100 and 200 ppm) and MgO (500 and 1000 ppm) nanoparticles were also tested for the study invasion of bacterial flora in reared silkworm *i.e.*, *Streptococcus* sp., *Staphylococcus* sp. and *Bacillus thuringiensis* through bioassay.

Observations/Results

The silver (50, 100 and 200 ppm) and MgO nanoparticles (500 and 1000 ppm) were found non-toxic to silkworm. The in vitro antibacterial efficacy of Silver and MgO nanoparticles were found effective in suppression of bacterial infection caused by different bacterial pathogens in silkworm.

Surface application of ZnO (25-200 ppm) and MgO (340-1020 ppm) formulations were found effective in suppressing bacterial disease (67.08 to 82.67%) caused by *Xanthomonas axonopodis* pathogenic variant of *Solanum* (Table 6.1, 6.2). These concentrations were found non-toxic to *Solanum* and treated soil was also found safe for microbial activity. Application of carbonaceous soil amendments along with zinc and magnesium formulations, new technology can be developed which will help in the management of bacterial leaf spot disease.

Table 6.1. Efficacy of formulations against *Xanthomonas* sp. causing bacterial leaf spot

Sl. No.	Treatment*	Larval mortality (%)	% decrease over Control
1	*Streptomyces* sp. + Ag Nano - 50 ppm	27.67	65.00
2	*Streptomyces* sp. + Ag Nano - 100 ppm	18.67	51.17
3	*Streptomyces* sp. + Ag Nano - 200 ppm	19.00	57.14
4	*Streptomyces* sp. + MgO - 500 ppm	19.33	53.28
5	*Streptomyces* sp. + MgO - 1000 ppm	15.00	61.07
6	Inoculated Control	43.00	-
	C.D. at 5%	5.97	-

*No. of larvae = 100/treatment

Table 6.2. Efficacy of bacterial strains against *Magnaporthe* sp. causing blast disease

Sl. No.	Treatment*	Larval mortality (%)	% decrease mortality over Control
1	*Bacillus* sp. + Ag Nano- 50 ppm	18.33	45.19
2	*Bacillus* sp. + Ag Nano- 100 ppm	11.00	61.27
3	*Bacillus* sp. + Ag Nano- 200 ppm	10.33	62.68
4	*Bacillus* sp. + MgO- 500 ppm	16.67	48.10
5	*Bacillus* sp. + MgO- 1000 ppm	13.33	54.37
6	Inoculated Control	29.33	-
	C.D. at 5%	2.58	-

*No. of larvae = 100/treatment

Table 6.3. Efficacy of formulations against *B. mori* causing bacterial leaf spot disease

Sl. No.	Treatment*	Larval mortality (%)	% decrease mortality over Control
1	*B. thuringiensis* + Ag Nano- 50 ppm	31.00	40.19
2	*B. thuringiensis* + Ag Nano- 100 ppm	46.33	47.13
3	*B. thuringiensis* + Ag Nano- 200 ppm	41.33	51.64
4	*B. thuringiensis* + MgO Nano- 500 ppm	44.67	45.15
5	*B. thuringiensis* + MgO Nano- 1000 ppm	19.33	64.37
6	Inoculated Control	48.00	-
	C.D. at 5%	3.200	-

*No. of larvae = 100/treatment

Table 6 : Effect of Beauveria bassiana on survival and biological characters

Sl. No.	Treatments*	Survival (%)	Single Cocoon wt. (g)	Single Shell wt. (g)	Shell percentage
1	Ag Bb 1x - 50 cpm	80.67	1.901	0.358	22.83
2	Ag Bb 1x - 100 cpm	84.33	1.920	0.346	22.49
3	Ag Bb 1x - 200 cpm	83.67	1.763	0.375	21.82
4	Ag Bb Neem-500 cpm	83.67	1.945	0.373	23.87
5	Ag Bb Neem-1000 cpm	83.67	1.901	0.436	23.89
6	Rio Soil Control	87.67	1.823	0.388	22.14
	C.D. at 5%	5.040	0.621	0.071	0.760

*No. of larvae = 300/treatment

6.2 Studies on the effect of new microbial formulations against pathogens in silkworm, *Bombyx mori* L. (Lepidoptera: Bombycidae) and its safety to natural enemies, *Dinocampus coccinellae* (Schrank) (Hymenoptera: Braconidae)

PI, Entomology Section (IT) and Dr. S. D. Sharma

Duration: Oct. 2011 to Sep. 2013

Budget: Rs. 0.00 lakhs

Objectives:

- Evaluation of new microbial formulations through hot water dipping against pathogens in silkworm, *Bombyx mori* L.
- To study the susceptibility status of different commercially reared silkworm breeds/hybrids against new microbial formulations

Methodology

Disease free layings of silkworm breeds/hybrids were reared as per standard rearing procedures described by Dandin (1998). At the 3rd moulting, silkworm larvae were gently mixed/dusted with virus nucleopolyhedrosis virus at 5 crores/ml (5 × 10^7 viruses/ml) (T1) and fed to the rearing trays (100 larvae/tray) in triplicates. The larvae in the same trays allowed to lay eggs. The eggs laid by infected moth mothers were collected and used for next generation rearing. The same procedure was repeated in different layings of moths/pupae and following the standard protocols. To study the susceptibility status of 21 different commercially cultivated silkworm breeds/hybrids, 5 day old larvae were fed with leaves of mulberry variety Kanva-2 treated with 10^7 spores/ml (T2) (around 100 larvae/tray) and reared in replicates. During larval, pupal and moth stages, mortality was recorded.

Observations/ results

Larval mortality (%) was recorded during larval and pupal stages. Mortality was 80.00% during moulting of the 3rd generation, wherein larvae were gently mixed/dusted with virus nucleopolyhedrosis virus at 5 crores/ml (5×10^7 viruses/ml) and fed to the rearing trays (100 larvae/tray) in triplicates. Mortality was recorded in the larval stage with no larvae and pupal mortality. In the 3rd, 4th and 5th generations where, moulting larvae were mixed/dusted with virus nucleopolyhedrosis virus at 5 crores/ml (5×10^7 spores/ml) (T1) (around 100 larvae/tray) and reared in replicates. During larval, pupal and moth stages, mortality was recorded.

Evaluation of commercially cultivated silkworm breeds/hybrids viz., CSR2, CSR4, CSR6, CSR26, CSR27, CSR50, CSR51, CSR2 × CSR4, CSR4 × CSR2, CSR26×CSR27, FC1 × FC2 against the new virus nucleopolyhedrosis virus revealed that all the tested breeds/hybrids were found susceptible. The percentage of infection at the larval stage ranged from 83.3 to 71.7, while the total infection was found to be 83.3 to 75.0%. Commercial breeds/hybrids, multivoltine breeds and hybrids viz., FC1, Kalsad 6CSR, SH1, NB4D2, CH1, KSR, FC1 × CSR2, CH1 × CSR2, NB4D2 × CSR2 were found relatively less susceptible. The percentage of infection at larval stage ranged from 33.3 to 16.3 and the total infection varied from 83 to 80%.

The results of the present study indicated that the new microbial biocontrol agent has the potential to be effective as pre-hot water treatment (T1) against silkworm, *Bombyx mori* L. larvae and pupae. Larval and pupal mortality was recorded in the silkworm larvae fed with leaves treated with virus nucleopolyhedrosis virus at 5 crores/ml. This virus was effective and it is

a comparative analysis could be attempted in successive generations if individual mulberry varieties are screened and large scale rearing conditions are maintained in a generation.

Table 6.6. Impact of new mulberry varieties on silkworm health and cocoons in successive generations

Generations	Survival %	Morbidity			% infestation of worm stage
		Larva	Pupa	Total	
F_1	91.60	5.60	8.00	13.60	80.00
F_2	92.40	5.60	8.00	13.60	81.60
F_3	91.60	5.60	8.00	13.60	81.60
F_4	90.80	5.60	8.00	13.60	81.60
F_5	92.80	5.60	8.00	13.60	81.60

7. SERICULTURE EXTENSION, ECONOMICS AND MANAGEMENT

7.1 Study (UAS): Assessment of women participation and time spent on different sericulture activities in Eastern dry zone of Karnataka

C. S. Chandrappa, H. Pallavi, S. Ravishankar, P. K. Srinivasa and M. Raghavendra

Research Extension Centre, Srirampura, Regional Sericultural Research Station, Kolhalu, Regional Sericultural Research Station, Anantapur

Duration: Jul. 2015 to Mar. 2018

Budget: Rs. 1.89 lakhs

Objectives:
- To understand the socio-economic status of women involved in sericulture activities.
- To examine the extent of participation of women in sericulture activities through different aspects of sericulture activity wise.
- To quantify the time spent on different activities by women.
- To identify constraints and suggestions faced by women.

Methodology

The study was conducted in Kolar (Karnataka), Srinivasapur (Andhra Pradesh) and Dindigul (Tamil Nadu) districts adopting multi-stage sampling. Multi-stage sampling method was adopted for selection of sample size. Two villages from each district were selected randomly for the purpose of collecting primary data. Within selected two villages, ten mulberry growing women were selected by personal interview method (20 women).

Observations and results

The study revealed that, majority of the sericulture women were in the middle-aged category (35-47 yrs) with a cultivated area/size of about 1.8 acres and family size of 3-5 members. All the farmers were literate (100%), with no job holding (85%) and belonged to backward classes (72%).

Participation of women was 43.83% in mulberry cultivation, 56.17% in silkworm rearing. The women were mainly involved in activities such as harvesting mulberry, stripping of shoots, shoot transportation, chawki rearing, bed cleaning, mounting, picking of cocoons and marketing of cocoons.

The silkworm rearing activities undertaken by women were, cleaning of rearing house, cleaning of rearing equipment, feeding of silkworms, picking of late worms, rearing of worms, harvesting of cocoons, marketing of cocoons and maintenance of rearing waste. The study revealed that the women spent 4.16 hours per day on

[illegible] activities conducted in Tuni mainly comprising of with [illegible] 3.24 lakh per day. The main constraints [illegible] by limited marketing skills of the Kelly fishery, low Biogenic exposure to wealth, lack of technological interventions [illegible] of fishermen, lack of resources to invest and low profitability of the activity.

7.3 A study on performance of bio-control agent *Arthrobotrys oligospora* and chemical molluscicide under evaluation programme on mammalian diseases in Andhra Pradesh and Tamil Nadu (Field study)

Investigators: S. Vijayalakshmi (PI) and P. Kumaravelan

Duration: September 2011 to December 2012

Budget: Rs. 3.55 lakh

Objectives:

- To evaluate the environmental persistence, technical viability, commercial feasibility, economic viability and analyze the economic attractiveness of the bio-control agent *Arthrobotrys oligospora* under field conditions in India
- To analyze the participation of the people in the various constructed and to identify constraints in the functioning of bio-control agent *Arthrobotrys oligospora* and molluscicide

Methodology:

The study was constructed by collecting data using a pre-tested structured interview schedule. The primary data was collected from marketing intermediaries and the farmers engaged in the cultivation of Horsegram/Maize and Pulses in Andhra Pradesh and Tamil Nadu and Cotton in Tamil Nadu. Random sampling method was used to collect the primary data from the selected villages of the Tamil Nadu and Andhra Pradesh. Simple tabular analysis was used for understanding the production of the farmers and the impact of bio-control agent *Arthrobotrys oligospora* and molluscicide.

Research findings:

Before the introduction of bio-control agent in the villages, the yield of the farmers ranged from 15-17% in case of paddy, 11-13% in case of groundnut, 10% in case of blue gram and 4-6% in case of maize. After introduction of bio-control agent in the field, the yield of the farmers increased significantly to 4-5% in case of paddy, 3-4% in case of groundnut, 2-3% in case of blue gram and 1-2% in case of maize. The participatory and production level of research in the form of 10 to 15% in terms of total yield, usage of 4% (2% to 6%) and expense yield (5) to 7(%) mainly to be considered that the work conducted in the vulnerability of agriculture.

The bio-control agent was mainly distributed in Andhra Pradesh and Tamil Nadu markets. Most of the respondents utilized the *Arthrobotrys oligospora* for controlling the pests in crops. Majority of the respondents said that the bio-control agent have easily distributed in nearby shops effective and easy. Some opined that, the shop owners were not easily distributed and it is also observed that awareness level of the people on the use of different bio-control agent is very low in the study area. The farmers expressed their opinion that the bio-control agent is very much helpful. Regular maintenance of the nursery was observed after the introduction of the bio-control agent in the area and contributed to the overall stability of the bio-control crops. The investment required was 2,21,000 Rs in 2007-08 to 3,80,000 Rs in 2011-12. An economic evaluation of the type of research (bio-control system) in other biological groups would be useful to emphasize (as) viability and overall profitability by means of socio-economic characteristics. The crop losses were also very much reduced and the average production yield levels increased from 1010 kg to 1643 kg after resorting to the use of bio-control agent (*Arthrobotrys oligospora*) in cotton (with 1100 to 1840 kg).

V. ONGOING RESEARCH PROJECT/PROGRAMMES

B. HOST PLANT IMPROVEMENT

B.1 PRI 0.001: Development of superior mulberry varieties suitable for moderate climate and rainfed (April 2012 to March 2014)

B.1.1 Annual yield evaluation of promising hybrids under irrigated and rainfed environments in different locations (cross combinations under B.0.001, Chaitanyanagara and B.0.01, Anantapur)

Bharat V. Kapur (Sachin Dixit, Jakkula V.N.), M. R. Krishna Kapur (Jyothi K.N., Pavankumar, K., Reddy, S. M. H. Qadri, M., S. Mallikarjuna[1], D. S. Chandrashekharaiah[2], R. Manjula[2], M. A. Shankara Bhat[3], C. Subramanya Reddy[3], Dr. Sathyanarayana Raju[3]

[1]Regional Sericultural Research Station, Chaitanyanagara, [2]Regional Sericultural Research Station, Anantapur

Objectives: To develop mulberry germplasm with sustainable growth and leaf yield under rainfed conditions in semi-arid environments

An analysis of pooled data on garnage and yield of 6 years in 4 locations under a rainfed conditions, genotype No. 3 has yielded the highest (8.13 kg or 20.3%) (Table B.1). Experiments were being conducted for assessing the drought tolerance in terms of biomass for 2 more years.

Table B.1: Leaf yield of selected genotypes under rainfed conditions

Genotype No.	Cross	Leaf yield (kg/plant)	Improvement over BC-1 (%)
1	BR4 x K11	5.680	-
2	BR4 x S13	6.814	19.9
3	BR4 x S13	6.831	-
4	BR4 x Kanva-2	5.655	-0.5
5	S466 x S54	5.441	-
6	K11 x Kanva	4.911	-
	BC-1 x S1	5.680	-

At RSRS, Chaitanyanagara, the leaf yield data of 4 crop seasons were recorded. Genotype No. 3 showed 17.21% higher leaf yield with 0.918 kg/plant which remained as a check variety 5.13 (2.203 kg). Two laboratory bred varieties developed with BR4 x CSR2 hybrids for evaluating leaf yield in different genotypes showing 21 days cycle. Other introduced Kokuso germplasm genotype No. 5 has shown higher RGR, yield and superior nutrition of leaves over other mulberry germplasm.

At RSRS, Anantapur, two crop cycle data on leaf yield and yield attributing parameters, soil moisture and nutrient content were recorded in germplasm seeds for multiplication and development. Promising hybrid S13 x Kanva-2 showed the highest yield of 6.814 kg/plant (genotype No. 2) followed by S1 x S13 (6.831 kg/plant) over the check variety BC-1 (5.680 kg).

6.3 PRR 3113 Development of sequence resistance varieties by exploitation of hybrid vigour based on molecular marker diversity at parental level (Apr. 2008 to Aug. 2013)

6.3.1 Marker validation of selected genotypes on blast resistance genes

M. S. Prabhu, Rajeeva Lochan Singh, Ramakrishna B. H. Wallya Kumar and Bindu R. Kaup (Jan-Dec. 2012)

Objectives: Primary screening of selected genotypes for blast resistance by screening isolates of pathotypes

Based on ratings of fifty two blast resistant genotypes from Pongsaly Rice Trial (PRT) were selected for primary screening for blast resistance at nursery and seedling stage. The nursery was raised in two sets with two replications each. Based on highly virulent pathotypes (> 75%), 10 hybrids were short listed for Primary Yield Evaluation (Table 6.2). Seedlings of the short listed genotypes were raised in nursery beds and eight week old seedlings were planted in PBS with two replications for primary yield assessment along with the check (IR 64).

Table 6.2: Some promising genotypes short listed from pongsaly rice trial (PRT)

Sl. No.	Parentage	Genetic Distance	Sl. No.	Parentage	Genetic Distance
1	BG 1 x MR 11	0.271	9	IR 36 x MR 219-4-2	0.247
2	BG 1 x MR 11	0.271	10	IR 36 x MR 219-2-2	0.247
3	BG 1 x MR 219-4-2	0.251	11	IR 36 x MR 219-4-2	0.247
4	IR 64 x MR 219-2-2	0.251	12	IR 64 x MR 219-4-2	0.237
5	Rasi 1 x MR 11	0.250	13	IR 64 x MR 219-2-2	0.236
6	IR 64 x BG 1	0.250	14	IR 64 x MR 219-2-2	0.236
7	IR 64 x BG 1	0.250	15	MR 219-4-2 x MR 11	0.236
8	IR 64 x BG 1	0.250	16	IR 64 x MR 11	0.232

6.3 PRR 3451 Development of disease resistant and productive marketable genotypes with special reference to neckrot and neckrot like diseases suitable to the coastal belt of South India (Jan. 2010 - Dec. 2012)

6.3.1 Screening of available resistant varieties against local rot and neckrot like diseases under artificial inoculations

K. Ganesha Rao (PI), Mona H. Rajesh (upto June 2012), M. R. Pandu Raju, D. J. Bhumbla and R. S. Chandel Jr.

Objectives: To identify and select suitable sources of local rot and neckrot like diseases through field/glasshouse selection and evaluation in Pongsaly Rice Trial (PRT)

Rice grown in coastal plains and deltaic areas is subject to various biotic and abiotic constraints. Among the biotic constraints, the fungal pathogens *Sclerotium oryzae* and *Helminthosporium oryzae* are more widely distributed in the coastal areas causing local rot and neckrot like diseases in rice. Survey of local rot and neckrot like diseases in coastal districts revealed the occurrence of these two pathogens. Local rot and neckrot like diseases are more severe in the coastal areas of Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Orissa and Pondicherry. Local rot and neckrot like diseases are more severe in the coastal areas of Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Orissa and Pondicherry. Local rot and neckrot like diseases are more severe in the coastal areas of Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Orissa and Pondicherry.

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The successful screening, tolerance, resistant and susceptible varieties were also screened for rehabilitation programme.

3.4 ITB 2012: Studies on the Nutrient influencing the nutrient uptake and its use efficiency in maize in coastal red laterite soils (July 2012 to June 2015)

N. L. Dalal (PI), A. S. Chaudhary and P. Nidheesh

Objectives: To study the factors affecting the uptake of the nutrients in maize in coastal laterite and tribal conditions.

The soil and leaf samples were collected from farmers of Chandragiri(Andhra), Erode, Dharmapuri, Tiruvarur (Karaikkal), Thanjavur, Pudukkottai, Ramanathapuram, Virudhunagar, Theni, Kanniyakumari and Tirunelveli (Tamil Nadu) along with basic data. The soil samples were analysed for physico-chemical, mineral properties of soil and for leaf samples were subjected to biochemical analysis. It was observed that increase in soil pH, lead to decrease in soil biochemical parameters whereas, increased soil organic carbon content increased the micronutrient of soil and their uptake by plant parts (Table 3.2 to 3.5).

Table 3.2: Physical parameters of soil samples collected from farmers' gardens

State, Region	Bulk density (g/cm³)	Water holding capacity (%)	Porosity (%)
Karnataka			
Chandragiri	1.30 ± 1.27	16.25–42.63	45.09–50.92
Erode	1.32 ± 1.28	17.40 ± 0.9	47.24–54.01
Kanniyakumari	1.28 ± 1.22	12.58–48.61	48.74–55.83
Annual	1.32 ± 1.27	18.42–49.83	44.28–52.15
Andhra Pradesh			
Anantapur	1.25 ± 1.28	12.61–52.61	53.61–58.83
Madanapalle	1.28 ± 1.30	14.68–51.28	53.68–55.83
Penukonda	1.30 ± 1.28	13.68–51.61	51.38–73.83
Tamil Nadu			
Dharmapuri	1.30 ± 1.27	13.68–38.61	51.82–57.61
Erode	1.28 ± 1.27	12.68–42.50	53.21–60.20
Krishnagiri	1.29 ± 1.32	16.70–48.83	53.61–60.23
Tiruvarur	1.22 ± 1.28	15.45–49.52	49.24–53.05

Table 3.3: Chemical properties of soil samples collected from farmers' gardens

State, Region	pH	EC (dS/m)	OC (%)	Available P (kg/ha)	Available K (kg/ha)
Karnataka					
Chandragiri	7.73±0.37	0.1±0.01	0.82±1.83	0.68–82.73	170–508
Erode	7.85±0.81	0.11±0.08	0.80±1.82	22.45–63.72	134–528
Kanniyakumari	7.87±1.9	0.13±0.82	0.71±0.82	13.68–128.68	134–702
Annual	7.82±0.33	0.07±0.01	0.78±0.41	27.20–78.68	164–1.1e
Andhra Pradesh					
Anantapur	7.82±8.68	0.08±0.12	0.84±0.82	0.68±1.00	483–627
Madanapalle	8.82±7.8	0.08±0.08	0.71±0.88	8.67–82.73	38–624
Penukonda	8.52±7.68	0.09±0.08	0.68±0.82	17.4–47.82	170–624

Tamil Nadu					
Adiramapattinam	1,82,616 (0)	0.27(0.42)	0.17(0.28)	0.47(0.72)	1,64,627
Kovilur	2,89,838 (0)	0.38(0.58)	0.45(0.69)	1.18(1.82)	2,61,854
Kumbakonam	1,11,548 (0)	0.15(0.23)	0.04(0.06)	0.17(0.26)	1,00,393
Mayiladuthurai	1,42,878 (0)	0.19(0.30)	0.42(0.65)	0.60(0.92)	1,28,590
Grand Total	7,26,880 (0)	1.00	1.08	2.42	6,54,463

Table 3.8: Financial assessment of various regional institutions in Thanjavur basin

Name of the Bank	Share Capital	Reserves	Deposits	Working Capital
Commercial Banks				
Indian Overseas Bank	0.02 (0.03)	0.20 (0.30)	2.42 (3.72)	2.64 (4.06)
Canara Bank	0.01 (0.02)	0.10 (0.15)	0.65 (1.00)	0.76 (1.17)
Karur Vysya Bank	0.00 (0.00)	0.08 (0.12)	0.30 (0.46)	0.38 (0.58)
Tamilnad Mercantile Bank	0.00 (0.00)	0.01 (0.02)	0.03 (0.05)	0.04 (0.06)
Co-operative Banks				
Thanjavur	0.00 (0.00)	0.01 (0.02)	0.02 (0.03)	0.03 (0.05)
Mayiladuthurai	0.00 (0.00)	0.01 (0.02)	0.01 (0.02)	0.02 (0.03)
Kumbakonam	0.00 (0.00)	0.00 (0.01)	0.01 (0.02)	0.01 (0.02)
Tamil Nadu				
Adiramapattinam	0.01 (0.02)	0.01 (0.02)	0.02 (0.03)	0.03 (0.05)
Kovilur	0.01 (0.02)	0.01 (0.02)	0.02 (0.03)	0.03 (0.05)
Kumbakonam	0.01 (0.02)	0.01 (0.02)	0.02 (0.03)	0.03 (0.05)
Mayiladuthurai	0.01 (0.02)	0.01 (0.02)	0.02 (0.03)	0.03 (0.05)
Grand Total	0.07 (0.10)	0.45 (0.68)	3.60 (5.53)	4.12 (6.33)

Table 3.9: Commercial analysis of land comprised in Thanjavur basin

Name of the Taluk	Value of Land (Rs. per Cent)	Value of Land and Buildings (Rs. per Cent)
Kumbakonam	1,40,000 - 1,50,000	1,60,000 - 1,70,000
Orissa	1,00,000 - 1,20,000	1,20,000 - 1,40,000
Kumbakonam	1,40,000 - 1,60,000	1,80,000 - 2,00,000
Andhra	1,10,000 - 1,30,000	1,30,000 - 1,50,000
Andhra Pradesh		
Hyderabad	1,70,000 - 1,90,000	1,90,000 - 2,10,000
Madanapalle	1,50,000 - 1,70,000	1,70,000 - 1,90,000
Kurnool	1,30,000 - 1,50,000	1,50,000 - 1,70,000
Tamil Nadu		
Adiramapattinam	1,60,000 - 1,80,000	1,80,000 - 2,00,000
Kovilur	1,40,000 - 1,60,000	1,60,000 - 1,80,000
Kumbakonam	1,50,000 - 1,70,000	1,70,000 - 1,90,000
Mayiladuthurai	1,30,000 - 1,50,000	1,50,000 - 1,70,000
Source of Income	2000	1900

6. HOST PLANT CROP PRODUCTION

6.1 [illegible]: Effect of conservative use of [illegible] fertilizers for [illegible] and annuals on [illegible] fertilizers for the succeeding [illegible] (June, 20[illegible] to Sep., 2013)

[illegible]

Objectives:
- [illegible]
- [illegible]

[illegible]

6.2 [illegible]

[illegible]

Objectives: [illegible]

[illegible]

Table 8.8: Effect of continuous application of fertilizer with manure on yield of mulberry [illegible] (kg/ha [illegible])

Treatment (N P K kg/ha/yr)	Leaf Yield (M t/ha/y)		
	[illegible]	[illegible]	[illegible]
T0: Control	[illegible]	[illegible]	[illegible]
T1: 300:120:120	[illegible]	[illegible]	[illegible]
T2: 300:120:120 + FYM 20 MT	[illegible]	[illegible]	[illegible]
T3: 225:90:90 + FYM 20 MT	[illegible]	[illegible]	[illegible]
T4: 300:120:120 + FYM 20 MT + 20 kg/ha biofertilizer	[illegible]	[illegible]	[illegible]
T5: 225:90:120 + FYM 20 MT + 20 kg/ha Azotobacter + 1 MT VAM	[illegible]	[illegible]	[illegible]
T6: 300:120:120 + Vermicompost 4.8 MT	[illegible]	[illegible]	[illegible]
T7: 225:140:140 + FYM 20 MT	[illegible]	[illegible]	[illegible]
CD at 5%		1.92	

Values in parentheses are [illegible]

The physical and chemical characteristics of soils viz., soil reaction (pH), electrical conductivity, organic carbon, available phosphorus and potassium were analysed (Table 8.9). [illegible]

Table 8.9: [illegible] application of [illegible] and fertilizers on physico-chemical properties of soil

Treatment (NPK kg/ha/yr)	pH	EC (dS/m)	Organic Carbon (%)	P (kg/ha)	K (kg/ha)
T0: Absolute control	8.06	0.27	0.27	30.16	81
T1: 300:120:120	7.79	0.24	0.50	20.16	307
T2: 300:120:120 + FYM 20 MT	7.65	0.25	0.69	23.05	272
T3: 225:90:90 + FYM 20 MT	7.69	0.30	0.75	21.26	285
T4: 300:120:120 + FYM 20 MT + 20 kg/ha biofertilizer	7.89	0.28	0.73	24.05	300
T5: 225:90:120 + FYM 20 MT + 20 kg/ha Azotobacter + 1 MT VAM	7.85	0.27	0.80	17.16	270
T6: 300:120:120 + Vermicompost 4.8 MT	7.87	[illegible]	0.67	23.66	[illegible]
T7: [illegible] + FYM 20 MT	7.79	0.25	0.50	24.26	[illegible]
F test	*	NS	*	*	*
CD at 5%	0.16	-	0.17	3.82	22.6

Soil analysis for micronutrients [illegible] indicated significant differences among the treatments. [illegible] (Table 8.10).

Table 5.4 Effect of conservation agriculture practices on soil physical properties after 4 cycles of rice-wheat system

Treatments (RDF kg/ha/yr)	Soil organic carbon (%)	Bulk density (Mg/m³)	Infiltration rate (cm/h)	Soil porosity (%)
T1: Conventional practice	0.39	1.59	1.08	39.9
T2: ZT-DSR-R	0.52	1.56	1.92	41.1
T3: ZT-DSR-R + Residue @ 4t/ha	0.61	1.53	2.67	42.3
T4: ZT-DSR-R + Residue @ 6t/ha	0.71	1.50	3.25	43.4
T5: ZT-DSR-R + Residue @ 8t/ha + Mungbean as intercrop	0.80	1.48	3.83	44.2
T6: ZT-DSR-R + Residue @ 6t/ha + Sesbania as intercrop + LCC	0.75	1.49	3.60	43.9
T7: ZT-DSR-R + Residue @ 6t/ha + Cowpea as intercrop + LCC	0.74	1.49	3.54	43.8
T8: ZT-DSR-R + Residue @ 6t/ha	0.71	1.50	3.44	43.6
C.D. (P=0.05)	0.04	0.04	0.07	0.8

5.3 **Soil microbial diversity and enzymatic activities in salt affected soils under different agricultural practices (Dr. Anil Kumar)**

A. Rhizosphere (CPA) and Bulk soil

Objective: To examine the soil fertility status of rhizospheric zone in comparison to bulk soil and to correlate the soil microbial population with the soil physico-chemical properties under different agricultural practices.

Evaluation of soil fertility in CPA and bulk soil revealed that soil pH in 20-25% soils varied from 8.5-7.5 and in 60-65% it varied from 7.5 to 6.5. Electrical conductivity in 60-65% of soils was more than 1.00 dS/m. Organic carbon content of soil was low in 60-65% of soil whereas it was optimum in 30-35% of soils. The available phosphorus content was low in 30-35% of soils. However, in the remaining soils it was medium to high. The available potassium in most of the soils was found to be high. Micronutrients like Fe, Mn, Zn and Cu were sufficient in most of the soils. However, deficiency of micronutrients like B and Mo was observed in some soils. The physicochemical properties of soils were slightly alkaline in nature, they were suitable for microbial population (Table 5.5).

Table 5.5 Fertility in rhizospheric growing areas of saline soils

Place	Parameters tested				
	pH	Electrical conductivity (mmhos/cm)	Organic matter (%)	Phosphorus (kg/ha)	Potassium (kg/ha)
Meerkya	8.0-8.5	0.32-1.98	0.20-1.41	7.5-9.8	90-143
Mawana	8.1-8.5	0.67-0.96	0.08-1.03	3.8-14.8	88-1120
Partapur	8.0-8.6	0.62-0.98	0.20-1.04	3.5-8.5	45-120
Rampur	8.1-8.5	0.32-0.98	0.21-1.61	3.8-11.8	84-168
Other districts of Karnataka	8.0-8.6	0.02-0.98	0.20-1.61	3.5-13.8	40-1010
Rajasthan	7.9-8.1	0.38-0.52	0.20-1.04	3.8-13.8	134-182
Haryana Province	7.8-8.15	0.27-0.98	0.50-1.04	4.5-14.3	134-210

III. NEW PLANT CROP PROTECTION

III.1 NFTL (BSH): Long-term effect of multiple cropping systems on soil ecology and productivity (July 2011 to June 16)

V. Ravindra Babu (PS), P. M. Ravikumar, K. Kumar, D. D. Sharma, G. R. Gopinath, Nithin K. Vadakkiyara, Rekha, M. M. T. Homelauni, S. Muthuraja[2], R. Sudharsan[3], M. R. Balakrishnappa[4], M. P. Reddy[5], S. Vidyavathi[6], T. Mugil Vendan, Ramasamy[7]

[1]Regional Extension Centre, Chettalli-ga, [2]Regional Sericultural Research Station, Channapatna, [3]Regional Horticultural Research Station, Hirehalli, [4]Regional Extension Centre, Sakleshpur, Karnataka, [5]Cluster Development Centre, Hanbargi, [6]Regional Agricultural Research Station, Polambakkam, [7]Regional Extension Centre, Vaniyambadi, [8]Regional Sericultural Research Station, Salem, Tamil Nadu

Objectives:
- To study the role of soil microflora and microfauna in sustainable multicrop production.
- To study the biochemical components / enzymes associated with soil health in different cropping systems.
- To investigate factors responsible for soil microbial/enzymatic changes in multicropping systems.

A survey was conducted to identify multicrop gardens and 180 soil samples were collected from Karnataka, Andhra Pradesh and Tamil Nadu during rainy, winter and summer seasons. An average of 9.6×10^7 CFU/g soil of microflora was isolated from these soil samples. Fungal isolates and actinomycetes were recorded at 3.6×10^6, 16.2×10^5 and 17.4×10^5 CFU/g, respectively. They were grouped as moderate (11.3×10^6), bountiful (60.4×10^6) & exuberant (45.8×10^6). Particle size analysis was employed for physical and chemical properties. Bacterial isolates like *Azotobacter chlorococcum*, *Pseudomonas fluorescens*, *Bacillus megaterium*, *Serratia marcescens*, *Azospirillum* sp., *Enterobacter* sp. and cellulolytic sp., were recorded in all the cropping systems (plants and organic farming). Screened and identified fungal isolates like *Trichoderma viride*, *Rhizobium* sp., *Aspergillus niger*, *Penicillium* sp., *P. notatum*, *Beauveria bassiana*, *Metarhizium anisopliae*, etc., showing root rot disease were also noted in diseased multicrop gardens. With regard to mycorrhizae, *Glomus*, *Acaulospora*, *Gigaspora*, *Sclerocystis* and *Entrophospora* species were predominant.

III.2 FNs 3310: Development of database for multicropping systems (Aug. 2012 - Jul. 2015)

Prabhakaran Nampoothiri, K.M. (PS), V. Ravindra Babu, D. D. Sharma and A. M. Bidari

Objectives:
- To develop a database pertaining to multicrop diseases in India
- To develop a web based disease diagnosis system
- To develop the database mapping of the pathogens of multicrop diseases
- To develop a web based knowledge system on possible methods of management of multicrop diseases under extension conditions

In order to develop a database, pertinent literature on various aspects of multicropping diseases during 1978-2009 were collected from various sources, screened and documented in Microsoft Access 97 format (PC). The information was categorized into multicropping systems, etiology, symptomatology, host range, management and control measures were collected from these published literatures. The literatures were compiled and categorized based on various parameters such as host, location, GPS location of various pathogens and diseases and relevant pictures were collected for developing the database. The database was evaluated in Linux platform by storing the database using the multicropping diseases using Content Management System (CMS). Based on the research, pertinent results were acquired and the web page for diseases on multicropping diseases was developed.

Fig. 10.1 Mulberry disease image

11. BIOMASS DEMONSTRATION EXPERIMENT

11.1 Effect of the incorporation of bio-fertilizers with neem formulations (Continuation)

B. Gad Kumar (PI), K. Nirmal Kumar, S. Vasudeva Reddy and P. Radhakrishna

Objectives: To improve productive efficacy, the direct and cumulative positive impact according to the organic-based manufacturing.

Productive bivoltine breeds, robust bivoltine breeds, and theirs bivoltine breeds and new robust breeds need a management for processing their pre and post cocoon parameters. The performance of the hybrid silk is consistently with the original breed characteristics and require adjustment for the hybrid when we pair with the bivoltine's season. The various breeds were selected for handling as given in Table 11.1.

Table 11.1. Local bivoltine breeds maintained

Polyvoltine	Robust	Non-diapause	Semi-bivoltine
CSR2	CSR2 x	CSR50	CSR2 (SL)
CSR4	CSR4 x	J99	CSR4 (SL)
CSR6	CSR6		CSR 6 (SL)
CSR7	CSR7		CSR 607 (SL)
CSR8	CSR8		CSR608 (SL)
CSR12	CSR5		
CSR15	CSR52		
CSR17	CSR53		
CSR18	53		
CSR20	200		
	nB7		
	98		

Silk Grade: Polyvoltine 14.5D-16.5 Pc grade less than 5%, Cocoon weight 1.8 gm - 1.9 gm, Shell weight 0.300 - 0.350 gm, Shell percentage 18.5-20%.

11.1 Title: (2008) Development of three-way cross hybrids for commercial exploitation (Aug. 2008 – Sept. 2014)

A. Basavaraja Nagaraj (PI), S. Umesh Kumar, H. Shivakumar and Suryakanth

Objectives: To develop suitable three-way cross hybrids for commercial exploitation.

Twenty eight hybrids of three-way crosses were created by utilizing their diversities in maize, PC1 (CBN1 x CBN8), PC2 (CCP2 x J1), PC3 (CBN1 x CCP2) and PC4 (CBN8 x CCP2) along with six parents viz., CCP2, CBN1, CBN7, CBN8, CBN4, CBN5, and CBN2 and seven double cross hybrids (CBN1 x CBN7, CBN1 x CBN8, CBN1 x J1, CBN1 and CBN2). These hybrids were evaluated for their resistant to leaf blight, Maize weevil, Cob rot and Aflatoxin contents and correlation index for nine characters. Best hybrids were selected in their respective groups (Table 11.2 & 11.3).

Table 11.2: Yielding performance of best identified three-way cross hybrids

Three-way cross hybrids	Days to 50% flowering	Plant stand (%)	Cob rot (%)	100 seed weight (g)	Yield (q/ha)
PC1 (CBN1 x CBN8)	61.5	89.7	3.2 (5)	0.460	32.7
PC2 (CBN1 x CCP2 x J1)	62.0	91.6	1.6 (2)	0.430	32.1
PC3 (CBN1 x CCP2)	63.0	88.3	3.2 (5)	0.470	33.0
PC4 (CBN8 x CCP2)	61.5	86.6	1.6 (2)	0.420	32.6
Double hybrid (p1)	61.7	89.2	1.6 (2)	0.460	32.8
CBN2 (CBN4 x CBN5)	64.0	91.0	1.6 (2)	0.420	32.6
CD (p=5%)	3.0	9.0	0.16	9.0	4.0

Table 11.3: Yielding performance of best identified three-way cross hybrids

Three-way cross hybrids	Field ASI (%)	Ear length (cm)	Ear girth (cm)	Shank length (cm)	Ear weight (g)	Grain yield (q/ha)
PC1 (CBN1 x CBN8)	17.5	18.5	3.51	8.9	15	7.20
PC2 (CBN1 x CCP2 x J1)	19.4	19.0	3.60	8.9	14	5.94
PC3 (CBN1 x CCP2)	18.5	17.53	3.37	8.7	13	6.11
PC4 (CBN8 x CCP2)	18.5	17.09	3.54	8.7	15	7.06
Double hybrid (p1)	19.4	18.0	3.61	8.9	14	6.68
CBN2 (CBN4 x CBN5)	17.5	18.7	3.60	8.7	15	6.52
CD (p=5%)	0.8	4.0	0.3	1.0	3.0	-

11.2 **AP: 1442: Investigation of molecular constitutive factors of adaptation, DNA fingerprinting, cultivation in high temperature environment of rice tropics through DNA marker assisted selection (Jun. 2011 - Dec. 2013)**

S. Bandana Devi, P. K. Mukherjee, S. Kumar Kumar, Ranjeeta and V. Chandrakumar

Objectives:
- Identification of DNA markers (SSR) linked to thermo tolerance in cultivars
- Development of thermo tolerant cultivars / hybrids through DNA marker assisted selection

The prime objective of the project is to identify molecular markers associated with thermo tolerance in cultivars. To achieve this, it is necessary to identify thermo tolerant and susceptible cultivars (lines). Accordingly, two tolerant cultivars (Nagina 22 and Dular) and two tolerant lines (IR 81 and DRR), and one susceptible cultivar (CSR2) (results were described last year) have been selected earlier in differential high temperature regimes (33, 34, 35 and 36°C).

DNA polymorphism in the selected lines

The DNA was isolated from the five identified cultivars (tolerant/susceptible) following protocol/procedure and quantified through 1% agarose gel. The DNA isolated from five lines was screened with 30 SSR primers to detect the polymorphism. Out of the 30 primers, 11 primers viz., RM13125, RM20228, RM24497, RM21, RM81, RM3412, RM5436, RM348, RM224, RM586, RM3844, RM1955 showed clear cut polymorphism among the lines.

Mid test segregating populations (MS 9)

DNA was isolated from 60 susceptible and 60 tolerant plants in the late segregating generation (F2 population) comprising approximately 200 samples of DNA were isolated from their F2 correspondence. The samples were quantified and polymerase chain reaction (PCR) was carried out. Tolerant and sensitive bulks were prepared each F2 individuals by pooling equal quantities of DNA. Based on the availability of DNA, approximately 50 ng/µl from each of twenty tolerant and twenty sensitive F2 plants by. To confirm the results obtained through BSA, 11 individuals each of tolerant and susceptible bulk could be genotyped earlier in other lines with each marker. This polymorphism was analysed on 3% Metaphor agarose gels.

Identification of SSR markers associated with thermo tolerance

Out of 11 polymorphic markers identified in the 3 bulks (tolerant, susceptible), RM13125, RM20228, RM24497, RM3412 and RM3775 showed polymorphism between the tolerant and susceptible pooling segregating in the F2. The SSR markers viz., RM13125, RM20228 and RM3412, generated polymorphic fragments of 224, 210 and 420 bp, respectively, which were present only in the tolerant type and tolerant breeds (Nagina 22, Dular) and IR 81 and not in sensitive type and sensitive breeds (Nagina 22, Dular) and IR 81 and not in sensitive type and sensitive breeds (CSR2). Similarly, the primer RM224 amplified fragments of 180,210 and 230 bp, respectively, which were present only in the susceptible bulk and susceptible breed (CSR2) and were not found in tolerant bulk and tolerant breeds. These three markers showed co-dominant pattern among all the four genotypes (susceptible/tolerant). Moreover, RM224 generated polymorphic fragments between 230 bp and susceptible 220 bp) only in three genotypes (susceptible i.e., DRR2 x CSR2, Nagina 22 x CSR2 and Cambridge x CSR2) not in IR81 x CSR2. In the case of the primer RM261 generated polymorphic fragments between 240 bp and susceptible 230 bp only in three genotypes (susceptible i.e., IR 81 x CSR2, Nagina 22 x CSR2 and Cambridge x CSR2) not in IR81 x CSR2. A typical gel photograph showing polymorphism generated by RM3412 in four different genotypes (susceptible/tolerant) are shown in Fig. 11.1.

These results clearly show that SSR markers are associated with thermo tolerance in cultivars. By the regression analysis (Table 11.1) and stepwise regression analysis were done to identify most prominent markers associated with the trait. Highest coefficient of determination (R^2 %) value was observed in RM3412 (50.6) in descending (F) (121.61), 50.6 % (21.56), RM81 (9.7) and RM3437 (9.1). Further, the stepwise regression analysis (Table 11.2) revealed that RM3412 is the most possible marker associated with thermo tolerance having highly significant R^2 value of 50% was recorded.

Fig. 11.1: Amplification pattern of SSR primer [illegible] in the tolerant and susceptible parents, F1s and the tolerant and susceptible progeny [illegible] in four F2 populations [illegible]. The [illegible] tolerant [illegible] and susceptible [illegible] in the [illegible] tolerant and susceptible progeny [illegible] in the F2 [illegible] linkage of the marker with [illegible].

Table 11.4: Analysis of correlation and regression analysis

Primer	Pearson correlation coefficient	R^2 (%)	F value	Significance (P value)
LFL1122	0.467	21.85	15.346	0.0001
LFL0526	0.579	33.55	29.604	0.0001
LFL0467	0.258	6.70	[illegible]	0.0408
[illegible]	0.258	6.70	[illegible]	0.0408
[illegible]	0.468	21.9	15.244	0.0001

Table 11.5: Results of stepwise regression analysis

Primer	R^2 (%)	Significance (P value)
LFL0526	33.55	0.000
Excluded variables		
LFL1122		0.462
[illegible]		0.872
LFL0467		0.066
[illegible]		0.368

11.4 **2012-2013: Maintenance of 0.5 Silkworm Grainage's stock of germplasm (CSR&TI Mysore)**

(i) Project Leader (PL) & Off. Incharge: Dr.S.D. Chaudhari

Objective: To maintain & conserve stock of silkworm germplasm (Bivoltine, Multivoltine, Tropical & Temperate) in its original characteristics & to supply the germplasm materials to scientists and other organizations.

Two maintenance rearing of mentioned stock of 50 hundred germplasm including 20 no's of Commercial CSR breeds, 8 DFLs (seven bivoltine breeds & one multivoltine breed) were completed during the year in April/May and Oct./Nov.'12. The performance of this breeds were monitored by adopting standard rearing techniques and various characters of the breeds were recorded and compared with the original characteristics.

11.5 **2010-2013: Studies on the breeding for development of bivoltine silkworm hybrid (pebrine resistant) for low temperature rearing**

Bivoltine silkworm breeds with higher productivity under low temperature conditions of Nilgiris and studies on breeding for genetic resistance and pebrine

Dr. Gopalakrishnan, (PL) and Dr. S.D. Chaudhari, Off. Incharge

Objectives: a. To develop new bivoltine breeds for higher productivity under low temperature conditions of Nilgiris.

b. To explore the natural resistance and tolerance of Nilgiris race to pebrine disease and to breed pebrine resistant bivoltine breeds.

Eleven cocoon breeds (CSR6, CSR7, CSR17, CSR43, CSR47, CSR50, CSR103, CSR104, CSR2, CSR4, CSR27) and 8 hybrids of cross (BL38, CSR6 x CSR17) were reared in the Nilgiris to evaluate their performance under the germplasm stock, assess and maintain at CSRTI, Mysore and also to study the breeding behaviours. The following eight breeding plans were effected (Table 11.5).

Table 11.5: Details of the breeding plans and crosses made

Breeding Plan	Crosses	Breeding Plan	Crosses
BP1	CSR17 x CSR4	BP5	CSR2 x CSR4
BP2	CSR 50 x CSR7	BP6	CSR47 x CSR4
BP3	CSR 103 x CSR4	BP7	CSR6 x CSR4
BP4	CSR 104 x CSR4	BP8	CSR4 x CSR4

The F1, F2 and F3 generations (seedlings) of the eight breeding plans were maintained in January/July, Oct./Nov./12 and Feb./Mar.'13 respectively. Individual cocoons harvested from the successful batches were reeled and F1 filaments prepared.

A total of 8 bivoltine breeds x 4 sets (CSR17, CSR 50, CSR 103 & CSR104) and 4 dual hybrids (CSR 6 CSR17, CSR 6 CSR27) were reared in the Nilgiris. Initial rearing of the 32 breeds were completed in Feb./Mar. 2013. Second rearing was completed in Oct./Nov. '12 and the third rearing is in progress in April/May 2013.

11.6 **Title No. 11: Effect of application of biocontrol agents and neem based formulations against sucking pests and grasshoppers on silkworm (Continuation)**

A. Rajalakshmi (PI) and R. Sakunthala, CSRS, Mysuru

Objectives:
- To evaluate safety and efficacy of new botanical formulations against sucking pests and grasshoppers on mulberry
- To maximize [illegible] and [illegible] in control treatments – the organic farmers and sericulturists are encouraged to adopt the safer and effective botanical formulations

From the pool of [illegible] and [illegible] from 3 different districts, namely, [illegible], [illegible], [illegible] and [illegible]. Silkworm seeds reared successfully during Aug-Sept. 13. Cocoons were collected between the seventeen [illegible] were preserved and processed for the next cycle of rearing.

Further, [illegible] of Polyvoltine [illegible] reared from [illegible] Eastern were reared in [illegible] (Pure Mysore and Nistari) in three seasons i.e. June-July and August-September 2013, October-November 2013. The cocoons prepared at Cocoons and brought over to the rearing laboratory at Mysuru.

11.7 **Title No. 12: Effect of botanical formulations against sucking pests and mealybugs on silkworm (Continuation)**

A. R. Sakunthala (PI) and K. S. [illegible], Mysuru, [illegible], Mysuru

Objectives:
- Plant protection to reduce the [illegible] and [illegible] in mulberry

A total of 12 acres of mulberry gardens were maintained to study the organic form of cultivation and for silkworm rearing. The leaf was harvested at an average leaf yield of 10.12 MT/ha/yr. Farm organic manure and vermicompost mixtures were effectively used and total 12.5 MT of vermicompost used. The field experimental silkworm rearing was conducted in the 10 MT of cocoons were used in the laboratory [illegible].

A total of 10 [illegible] seven were selected and reared in the year (May - June 2013, Aug. - Sept. 2013, Nov. - Dec. 2013 and Feb. - Mar. 2014) by following [illegible] and [illegible] technology. Mean values of the rearing [illegible] parameters viz., [illegible] [illegible] were recorded and presented in Table 11.7.

Table 11.7: Performance of [illegible] (mean of 4 rearings)

Breed	Larval [illegible] (No.)	Pupation (%)	Effective [illegible] (No.)	Cocoon weight (g)	Shell weight (g)	Shell %
Productive Breeds						
CSR2	472±28	98.6±1.2	465±1.1	1.63±0.1	0.308±0.02	20.6±2.6
CSR4	510±32	98.2±1.1	498±1.9	1.74±0.09	0.387±0.01	22.2±2.5
CSR6	494±26	98.6±0.7	487±1.8	1.73±0.1	0.386±0.02	21.1±2.2
CSR26	515±30	98.8±1.2	508±1.7	1.73±0.1	0.394±0.02	21.1±2.2
CSR27	494±29	98.4±2.4	477±2.7	1.67±0.11	0.368±0.01	20.4±2.4
CSR16	500±25	99.0±0.8	484±2.7	1.72±0.1	0.391±0.02	21.2±2.8
CSR17	510±25	98.8±1.1	494±1.08	1.81±0.08	0.404±0.01	20.9±2.7
Pureline Breeds						
CSR50	412±29	98.8±1.2	377±1.09	1.61±0.1	0.378±0.01	23.6±1.8
CSR51	470±24	98.8±1.2	453±1.07	1.73±0.1	0.398±0.02	21.6±2.1
CSR52	456±22	98.8±1.1	438±1.0	1.64±0.1	0.415±0.02	21.7±2.4
CSR31	438±28	98.8±1.3	417±1.0	1.71±0.08	0.384±0.01	22.0±2.2
Nistari	524±19	99.0±1.1	498±1.0	2.07±0.07	0.479±0.02	23.4±2.4
Pure Mysore	480±28	98.8±1.1	458±1.2	1.73±0.08	0.378±0.02	22.0±2.0
Bivoltine Breed						
CSR13(B)	461±27	98.8±1.1	438±1.0	1.87±0.14	0.394±0.01	21.1±1.8

A total seed of 10,000 kits of each hybrid was produced. The egg recovery ranged from 38.0% in CSR30 to 41.0% in CSR10. A total quantity of 8000 kits of improved silkworm seed crossbreeds was supplied to R1 and R2 in exchange for cocoons of CSR2 and CSR4 grown in Kamrup district, Nalbari district and 8 villages of Barpeta district.

11.6 AR 34 Mir (development of productive pervoltine breeds of the silkworm *Bombyx mori* L. tolerant to high temperature and Mor MPV (Dec. 2011 - Sep. 2013)

Experimenters: [PI] P. Hazarika Mahanta Rani Jupee Lucy Gogoi, V. Phomchakpa, C. Pachungnungsung, M. Saikia, Kabita Bora and K. Chutia (Field Unit)

Objectives: Development of pervoltine breeds tolerant to high temperature and MorMPV.

Twelve crosses in a multi cross scheme between six inbred lines were evaluated at R3, MorMPV laboratory at R1 and R2 in the cocoon season (PS) under natural and/or normal rearing conditions. The performance of 30 crosses in a spot cross under normal condition is depicted in Table 11.6.

Table 11.6. Performance of crosses tolerant tropical conditions of rearing

Sl. No.	Cross	Survival (%)	Cocoon weight (g)	Shell weight (g)	Shell %
1	PH1X2	87.00	1.80	0.267	18.69
2	PH1X3	89.47	1.918	0.294	18.81
3	PH1X5	89.47	1.914	0.293	18.31
4	PH1X1	82.50	1.259	0.248	18.81
5	PH1X4	85.50	1.11	0.208	18.80
6	PH2X3	89.09	1.724	0.278	18.87
7	PH2X1	91.70	1.219	0.221	18.64
8	PH2X5	82.00	1.204	0.224	18.33
9	PH2X4	89.40	1.118	0.228	18.87
10	PH3X5	87.11	1.309	0.228	17.47
11	H1X1	84.07	1.228	0.214	17.82
12	H1X2	82.33	1.287	0.247	18.81
13	H1X3	84.07	1.316	0.248	18.32
14	H1X4	86.20	1.167	0.208	18.69
15	H1X5	88.07	1.149	0.206	20.82
16	H2X3	86.20	1.178	0.207	18.84
17	PH1X1	88.07	1.19	0.207	18.64
18	PH1X2	86.11	1.107	0.211	18.87

11.6 GM 6868: Identification of pervoltine silkworm breeds of *Bombyx mori* L. (Continuous)

Experimenters: [PI] V. Phomchakpa, Gogoi Jupeelu, P. Hazarika Mahanta Rani, Jupee Lucy Gogoi, P.C. Sarmah and K. P. Bhattacharyya

Objectives: Maintenance and evaluation of pervoltine silkworm breeds.

Thirty six pervoltine breeds were maintained at 3 field gene banks, 1 centre, 2 sub centre, 7 seed farms, 4 high rise pervoltine farms and 2 basic seed farms through selfing/sib mating. 2 breeds were dropped from the pervoltine breeds group (19 GM) and 18 silkworm breeds were maintained at the rearing to cocoon stage. Seed characters of 6 pervoltine breeds were studied and the results are presented in Table 11.6.

Table 11.5: Rearing and reeling performance of single hybrids in autumn season of 5 crops (average)

Breed	Fecundity	Pupation (%)	Cocoon weight (g)	Shell weight (g)	Shell %	Filament length (m)	Reelability (%)	Raw silk (%)	[illegible]
L14	524 ±19	87.18 ±1.28	1.201 ±0.01	0.227 ±0.01	18.84 ±0.30	753	81.02	15.07	.33
L16	531 ±28	87.18 ±2.65	1.265 ±0.01	0.238 ±0.08	18.81 ±0.46	801	80.81	15.70	.33
[illegible]	506 ±88	84.58 ±2.28	1.211 ±0.05	0.228 ±0.08	18.84 ±0.23	808	87.34	15.28	.37
[illegible]	620 ±87	88.07 ±5.48	1.301 ±0.01	0.278 ±0.78	18.40 ±1.36	866	83.78	15.41	.66
[illegible]	541 ±38	90.41 ±2.08	1.313 ±0.03	0.241 ±0.01	18.02 ±0.31	804	89.13	15.38	.33
[illegible]	493 ±38	85.18 ±2.08	1.258 ±0.05	0.228 ±0.01	18.28 ±0.83	918	81.33	4.15	.45
[illegible]	448 ±18	88.04 ±2.32	1.323 ±0.01	0.228 ±0.08	18.78 ±0.27	408	83.58	5.13	.70
[illegible]	518 ±58	83.74 ±2.48	1.304 ±0.04	0.278 ±0.01	18.23 ±0.50	618	83.67	5.15	.66

11.16 [illegible]: Maintenance of breeds developed through molecular marker assisted selection, NPV tolerant and morphological mutant stocks (Jan. 2010 to Jan. 2013)

K. B. [illegible] (PI), [illegible]

Objectives:

- Maintenance of silkworm races conforming to their original characters.
- Maintenance of the homozygosity of the races developed through molecular marker assisted selection.
- Maintenance of NPV tolerant [illegible] stocks.
- Maintenance of the [illegible] mutant [illegible] stocks.

During the period, 20 breeds developed through molecular marker assisted selection [illegible], 14 NPV tolerant stocks and [illegible] stocks were maintained, conforming to their [illegible] during Aug-Sep and Nov-Dec 2012.

Multivariate analysis for the various quantitative characters was carried out by employing Mahalanobis D2 statistic (Rao, 1952) and the genotypes were grouped into clusters following Tocher's method (Singh and Chaudhary, 1985). The relative contribution of different characters towards genetic divergence was estimated as per the procedure suggested by Singh and Chaudhary (1985). The clustering pattern of the genotypes is presented in Table 11.5.1. The inter and intra cluster distances are presented in Table 11.5.2. The cluster means for different characters are presented in Table 11.5.3. The characteristics of the cluster I genotypes are given in Table 11.5.4.

Table 11.5.1 Performance of tea clones in Annamalai Valley based on multivariate analysis

Cluster	No. of clones	Mean values						
		Yield (kg/ha)	Plucking rate (%)	Shoot density (no./m²)	Shoot weight (g)	Total N (%)	Total polyphenols (%)	Caffeine (%)
Cluster I	100	4413.0	19.82	116.09	0.3168	3.8121	0.59	2.45
	(41.67)	(2110)	(26.08)	(85.38)	(0.4128)	(0.2128)	(2.5)	(8.72)
Cluster II	9 (3.75)	3743.0	19.61	111.00	0.3108	3.8171	0.61	2.76
	(10)	(1919)	(26.71)	(10)	(0.5574)	(0.2137)	(2.5)	(9.83)
Cluster III	131	3688.0	19.85	114.70	0.3197	3.8118	0.59	2.61
	(54.58)	(1914)	(26.33)	(86.13)	(0.5137)	(0.2128)	(2.5)	(9.13)
Cluster I	150	4749.0	19.00	120.56	0.3237	3.8131	0.59	2.78
	(62.5)	(2113)	(26.73)	(90.19)	(0.5137)	(0.2132)	(2.5)	(9.13)
Cluster II	69	4038.0	19.66	114.65	0.3168	3.8128	0.61	2.86
	(28.75)	(1809)	(26.07)	(85.77)	(0.5)	(0.213)	(2.5)	(9.19)
Cluster III	21	3743.0	19.84	114.10	0.3156	3.8124	0.62	2.84
	(8.75)	(1647)	(26.08)	(85.13)	(0.5)	(0.213)	(2.5)	(9.07)
Cluster IV	240	4179.0	19.71	118.22	0.3222	3.8128	0.59	2.82
	(100)	(1852)	(26.3)	(88.38)	(0.5)	(0.213)	(2.5)	(9.13)

Table 1 | 1-6. Description of mutant strains

Stock No.	Mutant name (Linkage group)	Description	Stock No.	Mutant name (Linkage group)	Description
1	ca-2 (-III)	Albino egg-2, yolkless white eggs	19	sr (II)	Spiny, larval body barely translucent
2	Rv (X)	Red egg, terminal oocyte red	20	sy (I)	Cyst gene in which body turns yellow
3	ca-1 (-I)	Pale cyst white egg	21	B (I)	Pale translucent egg
4	cg (III)	Ridged egg	22	bw (V)	Brown head & all spines
5	Gn (I)	Giant egg	23	ch (I-3)	Chain and no spine
6	b-3 (X)	Brown egg	24	ea (28)	Body, empty and body
7	cp (X)	Spindle shaped egg	25	ea (I)	Anterior tentacle short in mouse and dorsal abdomen
8	cd (II)	Dissociated body / cuticle larvae	26	e (I)	Co-spindle & white larvae negative
9	cd2 (I)	Striped, black mesenchyme cells	27	Ba (X)	Clumping of oocytes, body / cuticle larva
10	cd1 (I)	Mis-shaped larval body cells	28	Sm (I-4)	Segmental defect, larval cuticle pleomorphic
11	Sp (I)	Spine on the mesenchyme	29	lv (-II)	Lumbricus type II (-II) 2 lv
12	spm (X)	Lumen-obtained larval stem	30	Pm (-I)	Malformed stem mesenchyme
13	L (X)	No internal spicule on the larval stem	31	DeP (X)	Larva failed larval mesenchyme
14	n (-I)	Identified terminal oocyte nucleus	32	Pv (I)	PVA-obtained normal
15	Hat (-II)	Mesenchyme, brain head & larval stem	33	Y (X)	Yolkless (body)
16	Rh (X)	Red blood	34	P (X)	Pharyngeal-obtained
17	U (-II)	Larval stem terminal segment and thread and dorsal lobe of brain	35	IC (-I)	Golden yellow mesenchyme
18	Lab (X)	Twisty, spindle shaped larva with short hairs & larval abdomen			

11.11 **ADD 2410: Development of gene specific MP P detection breeding by device using DarWIN marker assisted selection (Apr 2012 to Mar 2015)**

S. K. Jadhav (PI) and Anindita Karmakar

Objectives:
- To develop perspective MP P in tank mix bio-bands using DarWIN marker
- To identify MP P marker amplification hybrids through laboratory evaluation and molecular testing

Under a previous project, a 25.5 kDa protein named DarWIN (DW) (mother isolate) was found identified and characterized in the gut fluid of *Darwinia* strain of *Helicoverpa armigera* (Hübner) showing potency against *Bacillus thuringiensis* Berliner. With the goal of developing MP P detection bio-bands assay employing DarWIN protein as a marker, two MP P specific antibodies from *Bacillus* strains, Bacillus 39 isolated from Egg *Bacillus* and Bacillus were collected as Gene positive (GP+) and protein positive bacillus strains, namely, DW10, DW14, DW36, DW39 and DW57, which are susceptible to MP P were selected as representative pyrosis (MPS). The DW and P P were injected into P P propping at 30° ± 1°C room temperature. The P P larvae (exclusively to Asia composition P P and the BC1 progeny were studied. Digestive juice samples were collected on the 2nd day of 5th instar from the larvae BC progeny of 6 isolates and examined by SDS PAGE. The BC1 individuals with high DarWIN expression (Fig. 11.2) were evaluated and recommended in inter accessions P P and BC1 progeny were tested. The promoters was recorded and no surviving of the population was considered upto 30 hr.

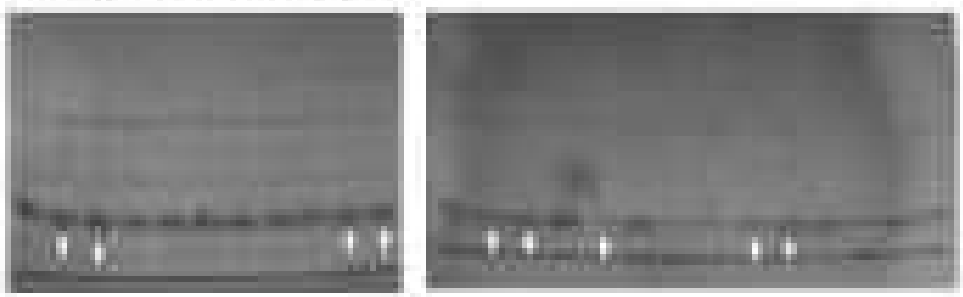


Fig. 11.2 SDS-PAGE profile of BC1 progeny segregating for differential expression of DarWIN in *Bacillus thuringiensis* Berliner isolates with high expression of this protein

The DarWIN marker associated antibiotic will be monitored upto F6/F7 in breed by testing the introduction of homozygous marker with high DarWIN protein expression.

11.12 **VPK 0412: Maintenance of breeding and multiplication and morphometric data of *Helicoverpa armigera* (Hübner) (Apr 2005 to Mar 2015)**

M. Manjunath (PI), Kailash Pandey, M. Bhanukiran Reddy and S. Krishna Kumar

Objectives: To maintain breeding and multiplication without data reference material for research and extension

The pupae, adults and moths obtained from the stock culture were used for morphometric studies. Pupae were maintained (Table 11.12). Average maximum length of male moth with forewing spread was found ranging between 35.67 and 37.27, as against female moth recorded in 35.07 & 37.33. Average weight between 1.200 & 1.667g, pupal weight between 0.240 & 0.333 g and pupal % between 19.97 & 22.91 in case of male pupae. The average length of male moth recorded the head region was between 21.11 and 23.00, abdomen was between 13.33 & 15.00, average weight between 0.760 & 1.174 g, pupal weight between 0.267 & 0.333g and pupal % between 12.93 & 17.15.

Table 11.12: [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]
[illegible]				[illegible]

12. SILKWORM CROP PRODUCTION

12.1 SRS (BH): Development of silkworm rearing package for newly developed breeds/hybrids (Apr. 2012 to Mar. 2013)

S. Parameshwara (PI) and P. G. Joga

Objectives: Standardization of silkworm rearing package for newly developed breeds/hybrids.

Three rearing trials at 100 dfls (NB4D2 female) in 14 pure breed and one control hybrid with 6 levels of package of 600, 700, 800 kg N / Ha/Yr and up to end of moult for a 2000 to 2200 kgs cocoon. It was observed that 700 kg N level was on par with 800 kg N level in respect of moult duration, cocoon and shell weight and ERR. Hence 700 kg N level is recommended for rearing.

One rearing trial of the hybrid (14 x CSR) was conducted with different spacing level (50 to 100 sq. ft and quantity of leaf) from 2000 to 2800 kgs of cocoon. During the course of rearing it was observed that the performance of the moult was dormant with 50 sq. ft level space with 2000 kg of mulberry. The rearing performance of (14 x CSR) hybrid at different spacing is depicted in Table 12.1.

Table 12.1: Rearing performance of 14+ pure and hybrid silkworm breeds and spacing

Hybrid	Total cocoon yield (kg/100 dfls)	Shell weight (g)	Moult duration		Cocoon yield (kg)	Shell yield (kg)	Shell %
			4th	5th (days)			
14	130	0.50	3.00	7.00	1.25	0.20	16.00
14 x CSR2	0.00	0.60	3.00	7.00	1.75	0.27	15.43

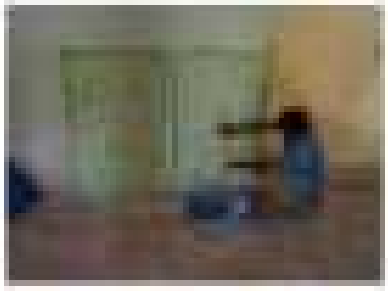
Feeding and silkworm rearing equipments for silkworm rearing

Three types of rearing stands, developed by RSRS, Anantapur, CSRTI, Mysuru and the modified rearing stand developed at by M/s. Ecotech Engineering, Mysuru were tested. The advantages and disadvantages of the stands are given below.

(1) Tiered frame stand type for silkworm rearing developed by RSRS, Anantapur

Advantages	1. Convenient for roof decorating 2. Easy to remove dust etc. 3. Reduces the labour hour as the time of cleaning
Disadvantages	1. It is bulky in nature and occupies large space 2. [illegible] 3. The cleaner can used in the open yard only as it requires use and carbonaceous energy and its fumes are injurious to eye mostly in darkened rooms.

c) Roof cleaning mobile developed by Pawan Tech Engg. & Allied Industry, Ajmer



Advantages	1. Convenient to work in cooling 2. Easy to operate 3. Reduces the labour cost at the time of cleaning 4. Occupies less space 5. Easy for disinfection and storage. 6. Made up of fibre it is light weight and easy to handle.
Disadvantages	Additional support is required to operate in small residential houses

d) Roof cleaning rotary mop developed by M/S Cleanzo Enterprises, Mysore

Advantages	1. Convenient to work in cooling
Disadvantages	1. The used quality of fabrics are not strong enough to cover the weight of cleaners person 2. The plastic handle used for rotating the mop is not rigid & it can be [illegible]

[illegible]

12.2 [illegible]: Large scale multiplication of [illegible] (Apr. [illegible] to Nov. [illegible])

[illegible]

Objectives: [illegible]

[illegible] Table 12.2.

Table 12.2: Large scale rearing performance of [illegible]

Season	DFL		Cocoon weight (g)	Shell weight (g)	Shell percentage (%)
	No.	Wt. (kg)			
Summer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rainy	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Winter	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] (Table 12.3).

Table 12.3: Rearing performance of [illegible]

Hybrid	Yield / 100 dfls (kg)	ERR		Cocoon weight (g)	Shell wt. (g)	Shell percentage (%)
		No.	Wt. (kg)			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
% improvement over control	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

12.3 [illegible]: Large scale on-farm evaluation and validation of new [illegible] hybrids [illegible]

[illegible]

Objectives: [illegible]

[illegible]

Table 12.4: Reaching up time variance of L14 inbred and L14 x CSR01 hybrid

Hybrid/ Hybrid	No. of DAs	Fecundity (No.)	Hatching (%)	No. of larvae (No.)	Larval duration (LD)	Cocoons (kg, DFL)
L14	1000	488	82.68	1,205,000	25.00	700
L14 x CSR01	500	480	91.00	1,205,000	24.00	850
PCS x CSR01 (C)	100	450	93.00	45,000	22.00	900

Race	Pupae 100 cBs (kg)	MAP		Cocoon yield (MT ha)	Shell yield (MT/ha)	Shell %
		No.	Wt. (kg)			
L14	40.00	82.00	10.00	1.200	0.300	17.00
L14 x CSR01	60.00	90.00	12.00	1.700	0.340	19.00
PCS x CSR01 (C)	65.00	95.00	13.00	1.700	0.320	18.00
% improvement over control	62.5	15.8	30.0	41.67	6.67	5.9

12.4 **DBT (BIC): Studies on reproductive efficiency of inbreds and their multivoltine and bivoltine breeds of silkworm Bombyx mori and egg production (April, 2013 to Mar, 2014)**

Scientists (PI) : Dr. S. D. Kulkarni

Objectives :

- To study the reproductive efficiency of new multivoltine and bivoltine breeds and hybrids in comparison.
- Large scale egg production for pure and polyvoltine trials.

Four selected pure breeds were assessed during the preparation of three-way cross hybrid, PCS x CSR01 and their cross hybrid, L14 x CSR02. In case of PCS x CSR01, the pairing was basically as 1:1. All the average egg yield was 625.00 g/kg of cocoons and the number of eggs /g was 1700. During the preparation of L14 x CSR01 hybrid, the pairing scheme was 2:1:2:1 with average egg yield of 850.00 g/kg cocoons and the number of eggs /g was 1101.

12.5 **DBT (BIC): Pilot commercialization trials of L14 x CSR01 silkworm hybrid in multivoltine rearing and acceptance (April, 2013 to Mar, 2014)**

Scientists (PI) : Dr. S. D. Kulkarni

Objectives : Large scale multiplication of L14 x CSR01 hybrid silkworm seed and commercialization.

A total of 12.01 lakh layings of the seed L14 were generated at CSRS&TI and 7.20 lakh CSR01 seed cocoons were produced (see Table). which were processed in 06 sericulture units (Table 12.5) in 4 CSRS districts. The silkworm seed cocoons were supplied to the rearers and the cocoon yield was recorded. The economic value, productivity and percentage improvement in the yield are presented in the Table 12.5.

Table 12.1: Details of 1-4-1 CIBA/2 Multiplication unit in Bhatinda

Sl. No.	Parameters	Seasons			
		Summer	Rainy	Winter	Total
1	No. of cycles	6	6	5	18
2	Adult emerged (No.)	910.00	600.00	425.10	1735.00
3	Cocoons (No.)	780 (1)	510 (1)	320±61	1610±0.0
4	Pupation (%)	85.12	85.75	85.15	85.01
5	Hatching (%)	87.78	88.00	88.00	87.72
6	Total egg weight (kg)	85.144	42.74	22.187	154.681
7	Egg yield/kg cocoons (g)	44.50	43.00	80.42	45.84
8	No. of eggs/g	1750	1840	1805	1811
9	Mortality (%)	0.72	0.80	0.0.02	1.38
10	Silk production	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0

[4,10] Silk worm larvae shall be fed on mulberry silk which will have to be 7.25 % in case of 1-4-1 CIBA. In addition 2000 Kg of CIBA 2000 Kg of 1-1-1 CIBA will also be used.

12.6 AR 1440: Developing an indigenous method for rearing Corydalus and other useful species (Oct. 2010 to Sep. 2013)

Scientists Dr. Ashok Kumar (PI), Dr. Ramesh Kumar (Co-PI)

Objectives To assess different eggs of *Corydalus* at different rearing temperatures to assess the viability of CIBA-1 culture in the laboratory following different doses of UV-C, P-ray, or X-Ray to plants.

Mother stock cultures of 10 species of eight *Corydalus* and other egg cases being reared and are produced 10 times during the year (Fig. 12.1). All stocks were cultured in the most suitable conditions and the eggs, pupae, adults and their cocoons were preserved (Fig. 12.2). The *Corydalus* (Cor) sp 1 and other species are shown in Fig. 12.3.

HPLC analysis of Cor- spp. analyzed against standards of chromatograms, *Corydalus* and cocoons of *Corydalus* revealed that artificially cultured *Corydalus* (*Corydalus* sp. 1 and sp. 2) can be more effective to produce this insect's products of *Corydalus* could best present in latex) more *Corydalus* can be reported to naturally available *C. cornutus* (Table 12.2).

Fig. 12.1: Mulberry silkworm cocoons of *Corydalus*

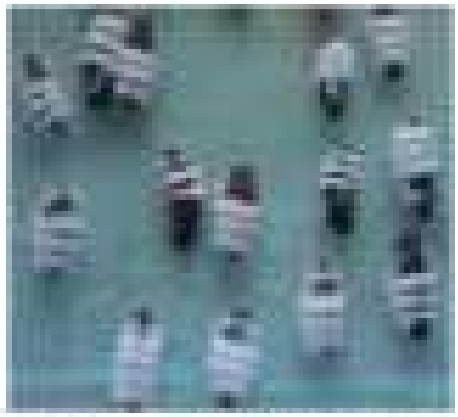


Fig. 12.2: In vitro culture of Centrospora on Gibberic agar

Fig. 12.3: Centrospora grown in rabbit blood with soda chloride

Table 12.1: Results of RFLP analysis of Eco-cpn against Aeromonas hydrophila isolated from Catla catla

Enterobacteriaceae	Eco-cpn gene		Centrospora spp.		Centrospora	
	Gene (bp)	Gene (kDa)	Gene (bp)	Gene (kDa)	Gene (bp)	Gene (kDa)
Escherichia coli (Type strain)	1,602	57.87	58,110	57.87	57,477	57.87
Klebsiella pneumoniae (Type strain)	-	57.87	-	?	-	57.87

13.7 **AIP 3070: Studies on nutritional aspects of livestock feed in environmental stress, egg productivity and inflammatory modulation of poultry** (Apr. 2012 to Mar. 2015)

M. Blessington Stanley (PI) and M. Hariram

Objectives: To characterize the role of prolactin family of hormones in stress and reproductive traits of chickens; To...

Four field of diseases, genotype performance and biochemical parameters of local poultry (red sindhi, aseel, giriraj, desi tata gramapriya, kadaknath, naked neck, black australorp) (CSW, Bikaner) were evaluated for body weight, egg weight and egg production. Average body weight of four breeds at 20 weeks of age ranged between 1.1 kg and 1.3 kg, and at 40 weeks of age between 1.6 kg and 2.0 kg. Egg weight ranged between 41.0 and 52.0 g and egg production between 41 and 59 % (Table 13.7).

Table 13.7: Growth parameters and egg recovery details of poultry breeds (Three to four birds)

Breed	Carcass weight (g)	Blood weight (g)	Blood %	Egg recovery (after slaughter)
CSW	1,094±8.20	0.275±0.01	25.13±0.62	53.00±0.12
LH	1,331±6.147	0.260±0.03	17.55±1.345	54.5±0.151
Raj	1,1 5±6.159	0.180±0.04	14.0±0.765	51.1±0.4 5

Total cooked carcass weight from 21 to 180.45 g/kg, raw carcass ranged from 38.24 to 139.3 g/kg, raw blood from 13.84 to 45.28 g/kg, raw bile acids from 20.14 to 32.40 mg/g. CSW recorded the highest values in all these parameters as the male counterparts followed by silk gaund, aseel, RIV had the lowest values. The total cholesterol values found in range from 10.41 to 19.40 mg/100g, glycogen levels were from 0.15 to 18.55 mg/100g, SGOT/GPT enzymes from 0.176 - 0.268 g/min/100g/ml and ALP enzymes from 0.18 to 0.39 g/min/100g/ml.

13. BREEDING

13.1 **AIP 4007: Evaluation of post-recovery parameters on recovery parameters in CSW-II, Bikaner** (Apr. 2012 to Mar. 2014)

T. C. Bhattacharyya (PI), Ali Haque and A. P. Jadhav

Objectives: To evaluate the economic characteristics and post recovery parameters of recovered CSW-II flock at Bikaner and its breeding tracts

A total of 297 recovered animals of the project for body weight were assessed, artificial conditioned and selected for body weight, 303 were bred and their breeding performance was studied and data sent to the concerned members units.

14. BIOLOGICAL CROP PROTECTION

14.1 S-1: Biological control of soilborne pathogens and testing their resistance on germplasm materials (July, 2010 to June, 2012)

Scientists: [illegible] (PI), P. Chandramohan and A. S. Hanamaratti (Co-PIs)

Objectives: To maintain the soilborne pathogens in pure form and periodically assess their virulence and pathogenicity

Pure cultures of [illegible] were maintained in PDA slants. Sensitivity of [illegible] to [illegible] was tested in vitro. [illegible] was tested against [illegible] under [illegible] conditions. Seedling mortality in [illegible] was recorded at [illegible] days after sowing. Data on [illegible] were recorded at [illegible] days after sowing. Data were analysed statistically. The results obtained in all the experiments are presented in the following tables (Tables 14.1 & 14.2).

Table 14.1: Evaluation of [illegible] against soilborne and seedborne pathogens

Host / fungicide	Concentration	Mycelial inhibition (%)	Soilborne pathogen	Concentration	Mortality reduction (%)
[illegible]	[illegible]	[illegible]	*R. bataticola*	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	*Fusarium* sp.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	*Sclerotium rolfsii*	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]

Table 14.2: Biocontrol evaluation of fungal and bacterial agents against pathogens

Fungal / bacterial agent	Conidial density (cfu)	Mortality reduction (%)	Seed-borne pathogen	Conc. (spores/seed)	% Mortality (Germ)		Mortality reduction (%)
					Germ	Plant	
B. bassiana	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
T. viride	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
P. fluorescens	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]	[illegible]

Note: Fungicide agar discs recorded in the experiment after 7 days. Other pathogens were recorded after 5 days.

14.1 **SP1 (CCP-1): Assessment of farmers' knowledge and awareness on crop losses due to diseases of field bund and the crop and on varietal preferences (Oct. 2012 to Dec. 2014)**

P. Chandrawati Nayak (PI), A. H. Rajeeva and Raj Gautam, M. Balakrishna Gowda, M. Siddeshwari, M. Shivaramaiah, V. S. Manjula, S. Raja Kumar, T. Sowmya Lavanya, Sk. G. Sahaheer, R. Vani Reddi, P. Sri Vidyadhareni, M Venkateswara Rao

Regional Rice Research Station, Gerbetta, Research Extension Centre, Rajendranagar, Mahbubnagar, Regional Rice Research Station, Karaikal, Research Extension Centre, Gudalur (Nilgiris), Research Extension Center, Jeypore, Research Extension Centre, Bhadrachalam, Rice Breeding Extension Centre, Vijayawada, Krishi Vigyan Kendra, Bhadrak

Objectives: Estimation of extent of crop loss due to the diseases; Document the age old knowledge of farmers on rice diseases in states of Karnataka, Andhra Pradesh and Tamil Nadu

Findings by survey on the diseases' incidence was conducted from October, 2012 to March, 2013 in the selected areas of the rice growing states. Number of farmers' eg. 5 during the 1 st year were considered. Data on number of farmers in the day of survey was enlisted. 10% of the total area was considered for disease assessment. Blast, Sheath rot, False smut, Brown spot and Bacterial Blight were the major diseases recorded. Severity of the diseases was also estimated after the final stage of crop (Table 14.2).

Table 14.1. Disease incidence

District surveyed	Percentage incidence			Grain yield (kg/ha)
	Crop loss	Hectares	Reasons	
Bangalore (Rural)	2.36	1.26	1.16	14.66
Karaikal	5.36	1.16	1.32	14.32
Mandya	1.32	1.47	1.26	18.66
Ramya Patti Sa	2.22	1.73	1.16	16.66
W. Godavari (Rural)	5.32	1.76	1.32	16.62
Allahabad	3.76	1.32	2.77	17.32
Shimla	1.66	1.25	1.26	18.21
Kerala	1.66	1.76	1.26	16.62
Trivandrum	3.27	1.32	1.66	17.64

14.2 **SP1 (KVK): Identification of probiotic bacteria from the resident silkworm and mulberry (host) antagonistic activity against the bacterial pathogens of silkworm, Bombyx mori L. (Oct. 2012 to Dec. 2014)**

S. Chandrakantha Naik (PI), M. Shivaramaiah, Sk. G. Sahaheer, Raj Gautam, Sk. Nagendra Prasad

Objectives: 1. To isolate and identify bacteria of gut and its resident from mulberry silkworm

2. To study in vitro antimicrobial activity against pathogens of silkworm

Isolated gut bacteria from the gut of mulberry silkworm and mulberry leaf was cultured on nutrient agar medium. The isolates were screened for presence of zones formed indicating the antagonistic activities, which may be considered as probiotic.

14.3 **FPS, (KVK): Natural enemies + botanicals as crop diversity on incidence and performance of natural enemies on rice-berry agro-ecosystem (Sept. 2011 to Aug. 2014)**

J. M. Ramesha Kumar (PI), B. T. Ramakrishna, M. Krishi Vardhan, H. Shivanna, Jeevan, B. Ramesh

Research Extension Centre, Siddhapura, Regional Agricultural Research Station, Chamarajanagara, Research Extension Centre, Kaul and Shimoga

Objectives: To assess the occurrence of insect pests and natural enemies in mulberry ecosystem under irrigated, semi-irrigated and rain fed conditions in relation to the host plant grown in the vicinity.

Data on the incidence of mulberry pests and also natural enemies were recorded in twenty one mulberry gardens each in irrigated (Mandya district), semi-irrigated (Kolar district) ecosystems and 10 mulberry gardens in rain-fed (Chamarajanagara) ecosystem in eight districts of Sugarcane Belt Region, Karnataka. Based on the rainfall pattern irrigated and rainfed crop seasons (semi-arid) bearing mulberry gardens were identified in mulberry ecosystem.

Irrigated belt of Mandya district

In all the mulberry gardens with crop diversity of Mulberry+Sugarcane, Mulberry+Paddy and Mulberry+Mulberry monthly incidence of leaf roller and root mealybug were recorded throughout the year. Leaf roller incidence of 13.08%, 10.20% & 6.83% was recorded. Incidence of mealybug was 4.12%, 2.33% & 0.2%. Among the natural enemies, *Oxyopes javanus* was recorded as 2.67, 1.27 & 0.67% respectively followed by *Pardosa pseudoannulata* (1.42, 0.88 & 0.13) and *Agelena* sp. (0.83, 0.27 & 0.03%). No predators were recorded in crop diversity surrounding mulberry were observed.

With regard to recovery of *Beauveria bassiana* after release, there existed a relationship with the crop diversity. Highest recovery (88.9%) was recorded in Mulberry+Mulberry followed by Mulberry+Sugarcane (66.6) and Mulberry+Paddy (44.4%). The results showed that mulberry itself may be considered as a better plant to attract natural enemies and hence may be Ecosystem conducive for Integrated Pest Management.

Semi-irrigated belt of Kolar district

In all the mulberry gardens with crop diversity of Mulberry+Tomato, Mulberry+Marigold and Mulberry+Mulberry (control), incidence of thrips and leaf roller was recorded. Leaf roller was significantly at par with each other incidence of 7.83%, 8.33% & 7.33% respectively followed by thrips recording at 4.83%, 4.1% & 2.83%. Among the natural enemies, *O. javanus* (2.33, 1.71 & 1.0%) and *Tetragnatha* sp. (1.83, 1.50 & 1.17%) were recorded. Similar to irrigated belt crop diversity as recorded in mulberry was not recorded.

With regard to recovery of *Beauveria bassiana* after release, there existed a relationship with the crop diversity. Highest recovery (44.4%) was recorded in Mulberry+Marigold followed by Mulberry+Mulberry (control) (33.33%) and Mulberry+Tomato (22.2%). The results indicated that Marigold may be considered as a trap plant, which supports natural enemies and may be Ecosystem conducive for Integrated Pest Management.

Rain fed belt of Chamarajanagara district

In the selected gardens with crop diversity of mulberry crop alone, pest incidence was negligible, except for a mealy bug incidence of 5.0% (maximum 10.0%) recorded only from January to April where the mulberry plants were almost without a foliage. No natural enemies were recorded as host was not available in adequate numbers.

With regard to recovery of *Beauveria bassiana* after release, there existed a relationship with the crop diversity. Highest recovery (66.6%) was recorded in Mulberry+Maize crop ecosystem, followed by Mulberry+Mulberry (control) (11.1%). The results indicated that natural crop such as Maize (Zea mays), Marigold (Tagetes erecta), Cosmos (Cosmos bipinnatus), Sunflower (Helianthus annuus), may be considered as an ecofriendly crop to be grown in mulberry ecosystem, especially Ecosystem conducive for Integrated Pest Management.

3.4.3 **PRIn. 2407 : Evaluation of sustainable management strategies of grand silkworm crop (*Antheraea mylitta* Drury) based on mulberry ecosystem (Apr. 2012 to Mar. 2015)**

B. J. Shivanna[1] (PI), B. Narendra Babu (Co-PI), P. M. Prathibha (Co-PI) and M. S. Jagadeesh (Co-PI)

[1]Research Extension Centre, Kodihalli, Hiriyur

Objectives:
- To monitor [illegible] population in [illegible]
- To identify suitable host-plant and chemical methods for the management of [illegible]
- To document safe period of the effective chemicals used in management of [illegible]

Five [illegible] were released in the two [illegible] at Rameshgaon and Ramnagaon. Regular [illegible] were carried out in these areas for recording [illegible] and [illegible] and [illegible]. No [illegible] population was recorded in the field due to severe drought situation. Field cultures were maintained in the laboratory on [illegible] and carried for monitoring experiments on [illegible]. Environmental [illegible] were also collected in the laboratory.

Two [illegible] namely ***Serratia marcescens*** and *B. bigeminata* were at 1 x 10^8 [illegible] were screened on [illegible] in four [illegible]. The [illegible] at 1 x 10^8 [illegible] caused 60 % [illegible] at 20 days after treatment (DAT) and 100 % [illegible] at 22 DAT. However, treatment with *A. bigeminata* [illegible] was relatively [illegible]. Three [illegible] ***Aromatia scrophulariae***, ***Acanthosia cassia*** and [illegible] [illegible] were [illegible] against [illegible] in four [illegible]. Three [illegible] were not found effective as [illegible] were [illegible].

Three [illegible], [illegible], [illegible] and [illegible] were tested for their [illegible] against [illegible] under [illegible]. Phosphine at 4 [illegible] (3.5% [illegible]) and fumigation of [illegible] for 5 [illegible] (92% [illegible]) caused 100 % [illegible] after [illegible]. [illegible] (0.5% EW) caused 90 % [illegible] after [illegible].

14.8 [illegible]: Maintenance of [illegible] for production of [illegible] and mass release of [illegible] against [illegible] in [illegible] (Continuous)

[illegible]

Objectives:
- To [illegible]
- To [illegible]
- To [illegible]
- To [illegible]

[illegible]

[illegible]

14.7 | CD 2101: Forewarning and forecasting of incidence and infestation pattern of coconut pests

M. K. Shekhar (PI), B. T. Shivanna, J. B. Narendra Babu, A. V. Manjunatha, B. Nadhimpinni, M. Krishi Kishore[1], B. Ramkrishnan[2], K. Sasikumar[3], A. Chandrasekhara Gowda[4], T. N. G. Rao[5] and Srinivasa Reddy[6]

[1]Regional Research and Extension Station, Chamarajanagara, [2]Research Extension Centre, Mathikere, [3]Regional Horticultural Research Station, Kadur, [4]Research Extension Centre, Arsikere, [5]Research Extension Centre, Sirsi, [6]Regional Horticultural Research and Extension Station, Hiriyur

Objectives: To monitor the incidence of major and minor pests in Karnataka, Tamil Nadu and Andhra Pradesh and assess the susceptibility in released hybrids

Fortnightly surveys on prevalence of leaflet eating caterpillar, slug caterpillar and rhinoceros beetle in CIBA&TT, Mudicode, Chidambaram, Kumbakonam, Thiruvarur, Thanjavur, Pudukkottai, Ramanathapuram, Virudhunagar, Tirunelveli, Tuticorin, Kanyakumari districts of Tamil Nadu, Kasaragod, Kannur, Kozhikode, Wayanad, Malappuram, Thrissur, Palakkad, Ernakulam, Alappuzha, Kottayam districts of Kerala, Chittoor, Nellore, Prakasam, Guntur, Krishna, West Godavari, East Godavari districts of Andhra Pradesh, Shimoga, Davangere, Chitradurga, Tumkur, Hassan, Mandya, Bangalore Rural, Kolar, Chikkaballapur districts of Karnataka were undertaken. Data was also collected from 2 survey areas, Periyakulam, Chamarajanagara, Periyapatna, Madikeri, Virajpet, Arsikere, Kadur, Tiptur, Turuvekere, Gubbi, Pavagada and Hiriyur. The results are presented in Table 14.7.

Table 14.7: Average incidence (%) of major / minor pests in coconut (2012-13)

Location	Major pests of coconut			Remarks
	Rugose spiralising whitefly	Leaf eating caterpillar	Rhinoceros beetle	
CIBA&TT, Mudicode	2.43 (0.00-11.00)	0.00 (0-0.00)	1.13 (0-5.00)	Low (0-5.00)
RRS, Arsikere	5.80 (0.00-21.00)	4.20 (0.00-12.00)	0.00 (0.00-0.00)	0.00 (0-0.00)
RRS, Chettalli	1.80 (0-5.00)	0 (0)	0.00 (0-0.00)	0.00 (0-0.00)
RRS, Bidare	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
RRS, Bhatkal	0.00 (0.00-0.00)	15.00 (5.00-30.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
RRS, Ambajipeta	3.00 (1.00-7.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
RRS, Ratnagiri	18.00 (14.00-22.00)	0 (0)	0.00 (0.00-0.00)	0.00 (0.00-0.00)
RRS, Vizianagaram	7.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)

Figures in parentheses indicate the range

14.8. Establishment of Sub-Distributed Centre (Sub-DIC) under Biotechnology Information System network programme (BTISNet) of Dept. of Biotechnology, Govt. of India

Coordinators: S. M. H. Qadri and [illegible]

Objectives:
- Maintain information repository of silkworm and mulberry genetic resources.
- Develop and maintain database of silkworm and mulberry genomic resources.
- Conduct training and workshops to train scientists in the area of bioinformatics.
- Guide students in project and dissertation work.
- Host databases through website and provide better support for sericulture biology and bioinformatics.

Eight databases viz., [illegible] mulberry genome database, [illegible] Database on DNA sequences [illegible] Database on mulberry pests and diseases and Database on silkworm pests and diseases were updated and maintained. A two day workshop on Bioinformatics and its applications was held in which [illegible] scientists from CSR&TI, Mysore and Regional stations participated. The workshop focused on basic genetics, molecular [illegible] biotechnology, [illegible] of proteomics and genomics, bioinformatics tools and techniques, [illegible] applications using open source software, biological databases, structural biology, 3D structure [illegible] and drug designing.

IX. AGRICULTURAL EXTENSION, ECONOMICS AND MANAGEMENT

IX.1 AESE 2400: Assessment of adoption of seed and cultivation management technologies in selected crops (Jan. 2012 to Dec. 2014)

M. Gangadhar (PI), M. P. Sukumaranayar, T. Nagar and K. Chandrasekhar

[1]Research Extension Centre, Hyderabad, [2]Research Extension Centre, Warangal, [3]Research Extension Centre, Guntur (Lam)

Objectives:
- To estimate the extent of technology created by different public and research institutions in Kharif and Rabi crops
- To document the adoption level of management practices for the seed and cultivation of mulberry and silkworm
- To investigate the impact of key economic, agronomical, socio economic and technical factors on adoption of improved and farmers' management practices, etc.
- To suggest the constraints faced by the farmers in adoption of seed and cultivation management practices.

Primary data was collected from a sample of 60 farmers in Chittoor district of Andhra Pradesh and 40 farmers in Kurnool district from 2012 Kharif season.

IX.2 AESE 2400: Impact evaluation of front line demonstrations on Bt cotton in Andhra Pradesh

Subhashini A.V. (PI), B.M. Reddy, V. Visalakshi[1], Aruna Devi[2]

Project Coordinator: A. Uma Reddy

Principal Scientists: Rama Krishna Rao (up to 31.07.2012), Satyanarayana, P. M. Jagga, T. Thippaiah, J. P. Venkateswarlu, S. Ramakrishnam, Venu Gopal, Chittemma, B. N. Rathod, S. B. Vanthy, S. B. Raghuja, M. Balakrishna Reddy, M. Chandrasekhar, Y. C. Radhakrishna, B. P. Shankarlal, Ramappa, S. Lakshmanan, D. Jaishankar[3], R. Balakrishna[4], Ch. Balakrishnaiah[5], B. B. Chandrashekar[6], Subhash N. Naik[7], B. M. Vinodkumar[8]

[1]Principal Scientist (Seed Technology), Bangalore, [2]Scientist (Biotechnology), Regional Research Station (PJTSAU), Guntur, [3]ARS, Nalgonda, [4]ARS, Aswaraopet, [5]ARS, Chintapalle

Objectives: Large scale demonstrations on evaluation of new cotton hybrids (NHH 44 x CPD 2) and management practices for more yield and quality in comparison to farmers' practice (FP)

A total of 5,800 demos of NHH 44 x CPD 2 and 1,000 demos of FP 2 x CPD 2 were conducted through KVKs and RRSs in Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra states

Table 1X.1: Yield gap analysis of NHH 44 x CPD 2

#	State	No. of farmers (Nos.)	Yield (kg/ha) (Nos.)	Yield (kg/ha)	Yield gap (percent) (Nos.)
1	Maharashtra	750	1,500.00	1,875	375.0
2	Andhra Pradesh	2,500	1,800.00	2,250	450.0
3	Tamil Nadu	1,500	1,875.00	2,344	468.8
4	Maharashtra & MP	50	2,000.00	2,500	500.0
	Overall Average	1,200	1,800.00	2,250	450.00

15. MISCELLANEOUS INVESTIGATIONS

15.1. Design and development of cotton sampling equipment and mechanical bale extraction

a. Portable harvester for collection of cotton samples

A Cotton Harvester to extract the lint for quality testing the samples from plant, collected in envelopes was designed and developed. Prototype of the machine developed was tested in farmers' fields in Nanded district to collect samples. There was no damage to the harvested seed as was observed when hand harvested lint was used for testing. The machine was separated from cotton into three streams. The machine was tested in farmer's field in Nanded district on 3rd September 2012 and 4th January 2013. The machine will be offered to Technical Research Development Corporation, New Delhi, for commercialization.

Fig. 15.1. A picture of the sampling machine from cotton plant in operation

b. Mechanized hanging basket for storage and transportation of cotton bales

The mechanized hanging basket for storage of cotton bales in ware house and transportation in case of fire hazard or natural calamities is designed to facilitate large scale cotton bales storage. This is an ambitious task to be developed and fabricated which is a vital study having multiple objectives. The system consists of PVC material of cotton cloth. A dummy unit has also been fabricated on the spot, which operated very satisfactorily. It is a time consuming process involving various stages of development.

Fig. 15.2. Wooden semi-hanging basket for bale storage (Research in progress)

Fig. 15.3. Building up work for the mechanized hanging basket

c. High capacity heat sterilizer

With a view to meet out the storage and transportation of high capacity bales of cotton for obtaining better prices, the capacity of the presently available heat sterilizer at 150-200 bale/shift was found to be inadequate. Since there is a shortfall from 400 to 500 bales/day capacity for heat sterilization with high capacity of steam

[illegible] cutting, incorporation in existing machineries of the mechanical items such as shell cup for hand tools or allowing access, on the angle of inclination or designed for existing skilled users, which have long scales. The preliminary testing of the scale has shortened the total time taken [illegible] up of material to about 4 minutes.


Fig. 16.1. High capacity chaff cutter for commercial cattle rearing farms

16.2. Training on mechanization in sericulture

During the year 726 users in more than 21 batches of one day training on different aspects of mechanization and silkworm rearing houses. 4,000 farmers, students, traders and others visited the Sericultural Engineering Division farm and workshop.

16.3. Fabrication & supply of machines

During the year, the following units costing Rs. 1.80 lakhs were fabricated and supplied to the stakeholders, mainly to the farmers and progressive sericulturists.

Seed reeler	: 4 units @ Rs. 4,000/unit
Rotary type spinning machine	: 02 units @ Rs. 5,000/unit
Plastic cocoon tray	: 03 units @ Rs. 300/unit

17. REGIONAL SERICULTURAL RESEARCH STATION, YODATHI, KARNATAKA

17.1 **CCDB(I) 01/05: Monitoring of soil fertility profile of sericultural areas of Karnataka to improve soil health and nutrient management for enhancing quality mulberry leaf and cocoon production (01/05/2010 to Jan 2013)**

S. Jayachandra Reddy[1], P. Siddhuraju, N. Nirmala Devi, M. T. Prasanthkumar[2], S. H. Dhananjaya[3] and M. Krishi Mahadevan[4]

[1]Assistant Professor, Centre, Chikkaballapura, [2]Research Associate (Centre, Bommasandra, [3]Associate Professor, Sericulture Centre, Bidarapura and [4]Research Extension Centre, Madanapalle

Objectives:

- To evaluate soil fertility status in different sericultural areas of Karnataka, Karnataka and compare and correlate soil characteristics for mapping and identification of nutrient management deficient soil in mulberry
- To maximize sustainable mulberry leaf production, leaf quality and cocoon productivity through soil test based integrated nutrient management

During the period 4/1 soil samples received from different sericultural areas of Karnataka and Tamil Nadu were tested for the soil characteristics of [illegible] and the corresponding soil fertility status (SFS) and Karnataka (21) and Tamil Nadu (28). The results are presented in Table 17.1.

Table 17.1: Fungicidal seed coating and nutrient coated seed treatments on the soil properties and yield

Treatments	Treatments					
	Bavistin @ 2 g/kg seed	Vitavax-power @ 2 g/kg seed	Rhizobium @ 600 g/ha	Pseudomonas @ 600 g/ha	Rhizobium + Pseudomonas @ 600 g/ha each	Control (Water)
Soil microbial biomass carbon (µg/g)	112.3	104.7	118.2	109.5	121.4	98.6
pH	6.8	6.9	6.7	6.8	6.6	7.0
EC (dS/m)	0.42	0.39	0.45	0.41	0.48	0.36
Organic carbon (%)	0.62	0.58	0.65	0.60	0.68	0.55
Available P (kg/ha)	18.4	16.9	19.2	17.8	20.1	15.6
Available K (kg/ha)	312	298	325	305	334	287
Seed yield (kg/ha)	1842	1765	1910	1798	1965	1620

16. REGIONAL AGRICULTURAL RESEARCH STATION, CHAMARAJANAGARA, KARNATAKA

16.1 FIN 2008: Development of sericulture cultural practices for cocoons & pupae production (April 2012 to Dec. 2014)

P. Shivanna, Mahadevaiah, H.S. Mahadeveshwaraiah and Shivayogi Raj

Central Institute of Research Centre and Station, Mysuru, Regional Sericultural Research Unit & Training Institute, Mysuru

Objectives:

- To work out the economical and suitable package of practices for cocoons & pupae production in mulberry silk production.
- To assess the post-harvest losses of the cocoons and pupae.
- To work out the economic viability of the cocoons & pupae production in mulberry silk production.

Rearings of five instar larvae consisting of mulberry leaves and polythene bags were maintained with a spacing of 30 cm x 30 cm in between the mulberry bushes (3x3 cm x 3x3 cm) in the RSRS farm. Pupae were collected immediately after shifting the mature larvae to the mounting site, cocoon harvested. The cocoons of two hybrid silkworm combinations, CSR2 x CSR4 and CSR6 x CSR5 were used in this experiment. The cocoons were harvested on the seventh day of mounting and the pupae were collected from the cocoons.

17. REGIONAL AGRICULTURAL RESEARCH STATION, ANANTAPUR, ANDHRA PRADESH

17.1 CSWCRTI/ 2010: Studies on the post-harvest quality status in different agricultural crops of Southern Andhra Pradesh for improving post-harvest and marketing management strategy (2010 to Jun, 2013)

P. M. Mahadev and Y.M. Jose Kumar, Dalapathi Rao Kopa

Objectives:

- To evaluate post-harvest quality status in different agricultural crops of Southern Andhra Pradesh and assessing post-harvest losses and marketing management strategy
- To provide recommendations among the farmers/agricultural technologists on improvement of post-harvest practices for quality maintenance and to fetch better prices in the market.

During the year 2009 and subsequent years, 2011 and 2012 were also taken into consideration for the study in Southern Andhra Pradesh. The data established during the year 2009, 2011, 2012 are presented in Table 17.1. The data indicates that the cocoons were harvested in the 5th instar larvae during the 6th

N, P, K, OC, Ca, Mg, Fe, Mn, Cu, Zn, B, Mo, Si, Al, Na, Cl, Co, Ni, Cr, Pb, Cd, Se, Li, Ti, V, Sr, Ba, Rb, Zr, Sn, Sb, Cs, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Re, Os, Ir, Pt, Au, Hg, Tl, Pb, Bi, Th, U

Table 19.1: Correlation coefficient between soil physical, OC, P_2O_5 and K_2O in the soils of Andhra Pradesh

Parameters	No. of samples	pH	Electrical conductivity (dS/m)	Organic carbon (%)	P_2O_5 (kg/ha)	K_2O (kg/ha)
Red sandy soils	14	5.1-7.8	0.03-0.18	0.28-0.84	3.48-62.34	134 - 328
Medium soils	65	6.5-8.4	0.07-1.0x	0.08-0.67	4.68-184	134-1254
Red Calcareous	42	6.8-7.88	0.07-0.68	0.16-0.58	4.62-14	68-356
Red Black	21	6.75-8.61	0.08-0.31	0.18-0.69	14-84.1	132-1473
Black soils	51	6.8-8.67	0.03-0.48	0.16-0.85	4.67-65	134-1180
Deep black soils	62	7.63-8.72	0.09-0.58	0.09-0.68	3.4-84.4	68-1308
Red soils	45	7.15-8.82	0.02-0.26	0.08-1.09	2.39-108	42-807
R. Soils	40	6.4-8.1	0.18-0.31	0.4-1.11	87-45	25-468
Sandy	19	6.84-8.64	0.03-0.16	0.16-0.48	3.4-8.68	25-356
Medium black	53	7.83-9.24	0.03-0.38	0.28-1.68	3.42-105	24-856
Red sandy	58	8.83-9.69	0.01-0.41	0.18-1.08	15.24-26	234-1087
Red sandstone	53	7.44-8.38	0.04-0.27	0.28-0.84	11.02	516-828
Alkaline soil	21	7.49	0.38	0.24	11.21	214
Fertilizers	11	7.28	0.18	0.68	116	268

19. REGIONAL AGRICULTURAL RESEARCH STATION, SALEM, TAMIL NADU

19.1 RPF(S) 5/05: Studies on rhizosphere interactions of mulberry varieties as influenced by different cultivation practices under alkaline soil conditions (Jul. 2005 to Jun. 2013)

S. Bhaktavatsalam (PI) and R. Kavitha (Co-PI)

Objectives: To determine the rhizosphere microbial population including solubilizers from the experimental mulberry fields and phosphorous solubilizers in the rhizosphere of mulberry grown under different level of calcareous particles.

The treatments were organic or inorganic fertilizers. Calcium carbonate was added in the range of 0 to 40 per cent in the form of lime. After applying treatments, rhizosphere soil samples were collected for microbiological analysis and the P solubilizers were enumerated. Significantly higher population of bacteria, fungi and actinomycetes were recorded in drip irrigation + green manuring treatment in all the three seasons (Table 19.1).

Table 19.1: Rhizosphere microflora as influenced by drip irrigation and cultivation practices

Treatments	Bacteria ($2x10^7$)		Actinomycetes ($1x10^5$)		Fungi ($3x10^4$)	
	April-10 June	July-10 Sept.	April-10 June	July-10 Sept.	April-10 June	July-10 Sept.
T1: Flood irrigation	8.20	12.30	0.65	0.78	2.30	4.21
T2: Drip irrigation	10.12	16.01	1.25	1.08	5.34	4.51
T3: Flood irrigation + Green Manuring	12.62	17.20	1.10	3.20	6.80	6.23
T4: Drip irrigation + Green Manuring	18.20	28.11	1.47	2.20	7.10	12.04
Significance at 5%	3.21	5.14	0.2	0.84	1.20	1.20

(All values are average of three samples)

OA 4 **RWTC (Q) 0303: Effect of wheat-fallow and wheat-cowpea cropping system on soil organic carbon dynamics in medium fertile soils (Jul. 2010 to Jun. 2015)**

S. Bandyopadhyay (PI) and M. Chakraborty

Objectives:
- To examine effect and extent of changes in soil physico-chemical properties in farmers' resource conditions
- To quantify role of organic carbon and fractions under conservation agriculture in maintaining soil quality
- To develop soil test based nutrient management strategies for sustainable crop production

The experiment was conducted in different agro-climatic zones of India. The following treatments were imposed:

T1: Control (Farmers practice)

T2: FYM + Recommended dose of fertilizers (RDF) (Nitrogen (N) + Phosphorus (P) + Potassium (K) + Sulphur (S) + Zinc (Zn) kg/ha) + Conventional tillage

T3: FYM + Recommended dose of fertilizers (RDF) (N + P + K + S + Zn kg/ha) + Reduced tillage

T4: FYM + Recommended dose of fertilizers (RDF) (N + P + K + S + Zn kg/ha) + Zero tillage

T5: FYM + Recommended dose of fertilizers (RDF) (N + P + K + S + Zn kg/ha) + Zero tillage + Crop residue @ 30% of recommended dose of chemical fertilizers (RDF)

Five harvests were made during the present year and there was no significant difference observed among the treatments for fruit and vegetable yield. However, maximum fruit yield was found in treatment T5 (Zero tillage + Crop residue @ 30% of recommended dose of chemical fertilizers (RDF)).

OA 5 **NAIP (SL 8001): Studies on adoption of sustainable disease control measures and its impact on vegetable production in farmers' fields in selected districts of Uttarakhand (Jul. 2010 to Jun. 2013)**

S. A. Mary Flora (PI) and R. Sundaravel

Objectives:
- To study the level of adoption by different categories of farmers and technical factors influencing the adoption levels
- To find out the relation between the knowledge and adoption and suggest the strategies for increasing the adoption

Data on knowledge, adoption levels of different disease control measures were collected from 240 vegetable growers of Dehradun and Haridwar districts. In Dehradun district, the knowledge level was 37% on different disease prevention measures followed by adoption. Regarding control measures for fungal diseases in cucurbits, the knowledge and adoption was 77.34% and 77.34% on different diseases prevention measures followed by adoption. Regarding control measures during different cropping seasons, the knowledge and adoption was 69.32% and 69.32% respectively in kharif season, 79.21% and 79.21% respectively in rabi season and 84.09% and 84.09% respectively in summer season. In Haridwar district, the level of knowledge and adoption was assessed on different disease prevention measures (79% and 87.21%). Adoption on different disease control measures during different seasons (65% and 65.87%) and disease management practices under low temperature and high humidity conditions (84.55% and 91.36).

20.4 [illegible] Studies on adoption of [illegible] pest management technologies (IPM) by the [illegible] Tamil Nadu [illegible]

[illegible] (?)

Objectives :

- To [illegible] IPM [illegible]
- To find out the level of [illegible] and adoption of [illegible] management (IPM) practices by the [illegible] in Tamil Nadu.
- To identify the factors influencing and constraints for adoption of [illegible] management practices.
- To [illegible] IPM [illegible]

Data on adoption of IPM [illegible] IPM [illegible] IPM [illegible] IPM [illegible] IPM practices [illegible]

20.5 [illegible] A study on the adoption of recommended packages of practices followed by [illegible] Tamil Nadu [illegible]

[illegible]

Objectives :

- To find out the level of adoption of recommended packages of practices by [illegible]
- To [illegible] adoption levels of packages [illegible]
- To [illegible] level of adoption.
- To find out the socio-economic profile of farmers of different farm [illegible]
- To work out the [illegible] different farm size groups [illegible]

To assess the level of adoption of [illegible] socio-economic profile of [illegible] different farm sizes, a [illegible] questionnaire was prepared and data was collected from [illegible] farmers [illegible] districts. [illegible] categories of farm [illegible] adoption [illegible] technologies [illegible]

A significant [illegible] adoption [illegible] technologies [illegible] age, education level, experience, annual income, land holdings, [illegible]

[illegible] assessing [illegible], impact [illegible] [illegible] and social [illegible]. The input [illegible] in erosion [illegible] [illegible] in Nilgiris using the [illegible] (Dr. B. [illegible]) and [illegible] No.1.10 below (Dr. B.1.10).

20.8 **Project (2009): Studies on the soil fertility status in different watersheds [project of Land Resources Division, Ministry of Rural Development (Dept. of Land Resources)] (Dec. 2009 to Mar. 2012)**

S. Dhanapal, Rajeev [illegible], [illegible] and R. Balasubramanian

Objectives:

- To evaluate the soil fertility status in different watersheds in Tamil Nadu and assess the soil quality index using physical, chemical and biological parameters
- To suggest soil fertility management measures for improving productivity and sustainable livelihood security among the farmers for the conservation of soil resources and their productivity

A total of 694 soil samples from 12 districts of Tamil Nadu were analysed for pH, EC, OC, P and K. The range, mean and coefficient of variation of soil fertility status and soil quality parameters are given in Tables 20.2 & 20.3.

Table 20.2. Descriptive statistics

Parameters	Acidic	Neutral	Alkaline	Fertility difference
pH	[illegible]	[illegible]	[illegible]	[illegible]
	Normal	Critical	Response	
EC (dS m^{-1})	[illegible]	[illegible]	[illegible]	
	Low	Medium	High	
OC (%)	[illegible]	[illegible]	[illegible]	
Avail. P (kg/ha)	[illegible]	[illegible]	[illegible]	
Avail. K (kg/ha)	[illegible]	[illegible]	[illegible]	

Table 20.3. Fertility status of soil samples in different watersheds

pH		EC (dS m^{-1})		OC (%)		Avail. P (kg/ha)		Avail. K (kg/ha)	
Range	%	Range	%	Range	%	Range	%	Range	%
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Based on the results, suitable soil and water conservation measures along with nutrient and water management practices were suggested to the farmers through training on **Soil Fertility and Integrated Nutrient Management**. Efforts will be made to monitor the impact of soil and water conservation measures adopted.

VI. PROJECTS FUNDED BY EXTERNAL FUNDING AGENCIES AND COLLABORATIVE PROJECTS

(a) DBT funded projects

A.1. **Title: DBT-CMFRI-SIBA marker assisted analysis of mahseer germ cells towards a cost-effective live biobanking conservation and enhanced utilization in cross improvement (Nov. 2010 to Oct. 2013) (completed under CMFRI, Kochi)**

N. Ganga Nair (PI), M. G. Pathan Raja, Ina P. Raymond Anderson

B. B. Ajithkumar and K. Jayesh Lasudkar

Central Biotechnological Bank (Marine Resources Diversity), Kochi

Objectives

- Identification of a panel of random amplified polymorphic DNA markers for discrimination and sexing by marker assisted selection (MAS) in adult mahseer (CMFRI, Mandapam)
- Germ isolation of a cost effective cryopreservation for short-term and medium-term (6 months and 1 year) storage (CMFRI, Mandapam & CIBSDC, Hisar)
- Evaluation of panel of flanking mahseer germ-specific for other important traits viz., spawning, reproductive, rearing, and quality, seed cost & easy trade and key insights in good aquaculture (CIBSDC, Hisar)

The genomic DNA of 360 mahseer germplasm specimens were extracted from the whole individuals (CIBSDC, Hisar) and the gonad tissues. A total of 108 arbitrary specific oligonucleotide (RAPD) markers were utilized for screening and identification of polymorphic markers for genotyping. The list of RAPD markers along with its source is provided in the Table A.1

Table A.1. Mahseer species RAPD markers (germ cells and gonad) utilized for screening

Sl. No.	Source	No. of RAPD markers
1	Labeo fimbriatus	120
2.	Labeo pangusia	110
3	Labeo dero	90
4	Labeo calbasu	90
	Total	108

A total of 108 arbitrary germplasm specimens of mahseer (Labeo species) were genotyped using RAPD polymorphic DNA markers. The groups of germplasm specimens which were subjected to DNA profiling by RAPD markers are listed in the Table A.2

Table A.2. Groups of mahseer germplasm profiled using RAPD markers

Sl. No.	Identifying groups	No. of spp.
1	Labeo fimbriatus (Fresh water species) [LFC]	30
2	Labeo dero and other freshwater species [LDC]	30
3	Labeo calbasu and other estuarine species [LCC]	30
4	Labeo pangusia and other marine species [LPC]	480
	Total	570

LFC: Labeo fimbriatus, LDC: Labeo dero, LCC: Labeo calbasu, LPC: Labeo pangusia

Based on the genotyping and phylogeny, diversity of mahseer germplasm consists of 360 species of mahseer were identified. Assessment of the genetic diversity and suggestions on the diversity revealed in the species. Over lapping of genetic associations between mahseer germplasm were carried out using RAPD

[illegible] polymorphic + additional [illegible] SNP markers. Dice dissimilarity coefficients ranged from 0.111 (119–12) and 0.875 (119) and 0.875 (Mara and Lumia Bay). PIC values ranged from 0.000 to 0.820 with a mean of 0.379. The number of alleles range 6 from 1 to 6 with an average of 3 alleles/locus/site. Fig. 4.1 dense clustering based on SNP + allele data. STRUCTURE analysis identified 6 as majority of the tested accessions and admixture.

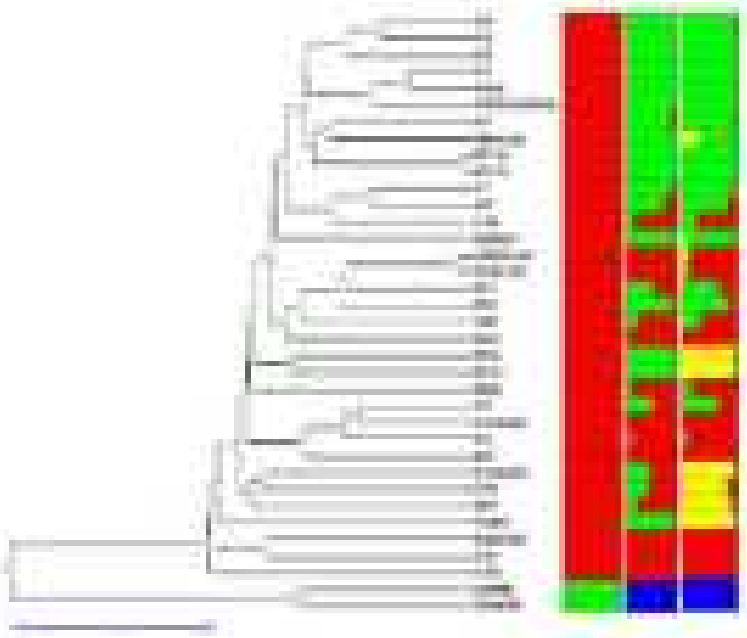


Fig. 4.1: Clustering of [illegible] relative genotypes [illegible] along with STRUCTURE [illegible]
[illegible] from [illegible] [illegible]

For the first time, a large number of [illegible] species accessions from [illegible] were compared to [illegible] the breeding, [illegible] and its breeding history of [illegible] using [illegible] [illegible]. The [illegible] [illegible] of [illegible] was [illegible] by [illegible] [illegible] and [illegible] [illegible]. [illegible] [illegible], a [illegible] [illegible] over [illegible] [illegible] [illegible]

Biocontrol agents (BCAs) like *B. cereus*, *B. subtilis* and *P. aeruginosa* were found effective in suppressing the *Sclerotinia sclerotiorum* in vitro. Data based on evaluation of BCAs were effective in controlling root rot disease of chickpea under glass house conditions. The shelf life of talc based formulations was upto 180 days.

Cell free culture filtrates of *Bacillus cereus*, *Bacillus subtilis* and *Pseudomonas aeruginosa* were tested for suppressive effect on *Sclerotinia sclerotiorum* radial growth and dry mycelial mass at 10%, 20% and 30% v/v culture filtrate. At 20% and 30% concentrations (v/v) all the isolates substantially suppressed the growth of *S. sclerotiorum*. At 10% concentration of CCF *B. cereus* could record the radial growth up to 31.70% followed by *P. aeruginosa* (51%) and *B. subtilis* (54%). Similarly, the fungal dry mass also reduced when the CCF culture filtrate was incorporated in potato dextrose (Table 4.3). Pathogenic isolates characterized as *B. cereus*, *B. subtilis* and *P. aeruginosa* (1.00 µg / ml) were compatible and antagonistic culture agencies when the pathogen and combinations among themselves was confirmed (Fig. 4.2).

Table 4.3. Effect of cell free culture filtrates (CCF) of antagonistic bacteria on radial growth and mycelial dry mass of *S. sclerotiorum*

Sl. No.	Bacterial culture	CCF %	Mycelial dry mass (gm)	Dry mass (g)	% Inhibition
1	*Bacillus cereus*	10	0.140	0.070	46.66
		20	0.120	0.049	67.33
		30	0.105 (81.25%)	0.030	80.00
2	*Bacillus subtilis*	10	0.130	0.059	60.67
		20	0.120	0.039	74.00
		30	0.110 (75 %)	0.029	80.67
3	*Pseudomonas aeruginosa*	10	0.130	0.059	60.67
		20	0.120	0.039	74.00
		30	0.110 (85 %)	0.029	80.67
4	Combination of three isolates	10	0.120	0.049	74.00
		20	0.110	0.039	80.67
		30	0.105 (93.75%)	0.025	83.33
5	Control 1*	00	0.120	0.194*	-
6	Control 2**	00	0.120	0.300*	-
	CD at 5%		0.110	0.001 (C1) 0.002 (C2)	-

*Control for *B. subtilis* and *P. aeruginosa*

**Control for *B. cereus* and combination

Figures in parentheses indicate decline in dry mycelial mass over control

Mass multiplication of BCAs on talc based formulation and their viability

Efficacy of *B. cereus*, *B. subtilis* and *P. aeruginosa* was a matter of success or less based on inoculum and survival of chemical fungicide as well as talc formulation. The viability of BCAs was evaluated based on colony forming units in dry talc mixtures. The dry temperature was 30°C. Shelf life of talc based formulations was upto 180 days and it gradually declined as the days progressed. At 180 days it ranged from 7.1×10^{8} to 9^{8} cfu/g talc (Table 4.4).

Table 4.4: Viability of wheat stock bacteria (cfu) based on the dilution factor[a]

Bacterial culture	Days after inoculation				
	0	90	60	120	150
B. cepacia	421	45	12	3	1
B. subtilis	351	51	10	6	1
P. aeruginosa	343	41	11	7	1

In vivo control of root rot diseases of maize in by isolates of *B. cepacia*, *B. subtilis* and *P. aeruginosa* under Kisii Kisii conditions

Efficacy of the bioactive strains against root rot disease was evaluated under glasshouse conditions with artificially infested soil heavily planted in pots. The effect on the disease caused and the bacterial strains significant survival of maize by the fungi was recorded in relation with *P. aeruginosa* (Table 4.5).

Table 4.5: Effect of BCAs on survival of maize plant up to the presence of root rot in a sample of *P. aeruginosa*

Treatment	Mean germination plant (%)	Plant age (days) after inoculation (days after planting)					Total dead	Survival (%)
		30	45	60	75	90		
B. cepacia	84	3	5	8	3	5	5	52
B. subtilis	92	4	6	9	5	3	6	64
P. aeruginosa	87	1	3	5	3	9	9	55
Control	89	6	9	9	5	3	14	52
Absolute control	90	6	9	9	5	1	9	58

Fig. 4.2: Competition by BCAs *B. subtilis*, *P. aeruginosa* and *B. cepacia*

3. DIT funded project:

4.1 **Kilo, 2013. Popularization of productive sensitive adhesive double hybrid *Phytophthora* with the Ministry of Agriculture (AGO, 2011-12 Seq, 2013)**

A. Academic Degree (Ms. B. Nyakundi Kisii, S. Ms. H. Owiti and Dawidson Otieno)

Objectives: To co-release production timelines of Kenyan double hybrid *Phytophthora* (CDR1 x DMR4) (CR1 x CR10) among the members of the farmers

Hybrid is currently used in tropical and sub-tropical countries. Hybrid seeds are produced with 5 farmers in each season with 1000 dibs. Six acres were established by the planting 2000 dibs during 2012/13. The seed rate (seeds/ dibs) in maize was 80.1 kg as against 80.2 kg in control hybrid. CDR2 x CR4

The crosses were terminated at the emergence of second instar. The mortality in [illegible] was 76.00% as compared to the 96.00 kg a.i/ha of Spinosad (SC) + (SC) mixture (Table 6.1 & 6.2).

Table 6.1 Combination testing performance of double hybrid Bt x transgenic and CSB2 x CSB1 (Mean of 3 crops)

Hybrid	Yield (q/ha)	Yield increase (%)	Ratio (kg cotton/ Bt a.i.
Bt x transgenic	2555.0	84.00	207.46
CSB2 x CSB1 (Control)	2432.0	67.00	201.28

Table 6.2 Comparative ranking performance of double hybrid Bt x transgenic and CSB2 x CSB1

Hybrid	Cocoon weight (g)	Shell weight (g)	Shell (%)	Lint/ Kapas (%)	Fibre length (cm)	Micronaire (µg)	Boll with (%)	Seed/ cotton (g)
Bt x transgenic	3.60	2.333	31.00	39	2.60	3.40	74.00	4.4
CSB2 x CSB1 (Control)	3.20	2.000	30.00	38	2.50	3.30	75.00	4.0

E. Project in collaboration with Senbiotech Research Laboratory, Bangalore

E.1 "BT 2417": Characterization, purification and cloning of novel vegetative insecticidal protein genes from Bacillus thuringiensis strains

S. B. Bandela Nagaraj (PI) and N. M. Patil (Co-PI, Senbiotech Research Laboratory, Bangalore)

Objectives:

- Characterization of Bacillus thuringiensis strains containing Cry/Vip genes using PCR and sequencing through collaborative work with Senbiotech Research Laboratory, Bangalore.
- Cloning and characterization of Bacillus thuringiensis Vip3A gene.
- Development of a molecular marker for Bacillus thuringiensis strains containing Vip3A gene.

Characterization of Bacillus thuringiensis strains containing Vip3A genes

The Bacillus thuringiensis strains were collected from various sources. After isolation, the genomic DNA was extracted from the strains using standard protocol and the quality and quantity of DNA was checked by agarose gel electrophoresis. Primers were designed by aligning the Vip3A genes available in the NCBI database. PCR was carried out using the designed primers and the amplified products were purified using the QIAquick PCR purification kit (Qiagen, Germany) and sequenced using the ABI PRISM 3730 DNA Analyzer (Applied Biosystems, USA). The sequences were analyzed using the BLAST program of NCBI (http://www.ncbi.nlm.nih.gov/BLAST/). The sequences were also analyzed using the Vector NTI software (Invitrogen, USA).

Cloning and characterization of Bacillus thuringiensis Vip3A genes

The strains that showed positive amplification with Vip3A gene primers were used for cloning the Vip3A gene. The Vip3A gene was amplified using the primers designed from the conserved regions of the Vip3A genes available in the NCBI database. The PCR product was purified using the QIAquick PCR purification kit (Qiagen, Germany) and cloned into the pGEM-T Easy vector (Promega, USA). The recombinant plasmid was transformed into competent cells of E. coli DH5α strain and the transformants were selected on LB agar plates containing ampicillin (100 µg/ml), IPTG (0.5 mM) and X-gal (80 µg/ml). The plasmid DNA was isolated from the transformants using the QIAprep Spin Miniprep kit (Qiagen, Germany) and the presence of the insert was confirmed by restriction digestion with EcoRI enzyme. The Vip3A gene was sequenced using the ABI PRISM 3730 DNA Analyzer (Applied Biosystems, USA). The sequences were analyzed using the BLAST program of NCBI (http://www.ncbi.nlm.nih.gov/BLAST/). The sequences were also analyzed using the Vector NTI software (Invitrogen, USA).

Development of a molecular marker for Bacillus thuringiensis strains containing Vip3A gene

To detect the Bacillus thuringiensis Vip3A genes, a strategy of homology cloning using the polymerase chain reaction (PCR) and degenerate primers was employed. Conserved regions present in the known Vip3A genes were employed. Primer pairs 5'- [illegible] and 5'- [illegible] were designed based on an alignment of the other known Vip3A genes. PCR was performed in a programmable PCR machine.

Fig. 3.1: PCR amplification of [illegible] gene ([illegible]) analysis

[illegible] using PCR technique [illegible]

[illegible] Multi-locational projects

3.1 [illegible]: [illegible] hybrids among the farmers of south India (Nov. 2012 to Oct. 2015)

[illegible] CSRTI, Mysore (Team Co-ordinator)

[illegible] NSSO, Bangalore

[illegible] SSTL, Bangalore

[illegible] APSSRDI, Hindupur

[illegible] KSSRDI, Bangalore

[illegible] Directorate of Sericulture, Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra

Objective: To popularise the [illegible] hybrids for commercial exploitation

The parental [illegible] CSR18, [illegible] were supplied by CSRTI, Mysore to NSSO [illegible]. A total quantity of [illegible] dfls of [illegible] were supplied to farmers of Karnataka, Andhra Pradesh and Tamil Nadu through [illegible].

The hybrid [illegible] recorded an average cocoon yield of [illegible] kg/100 dfls, respectively. The control hybrid [illegible] recorded average yield of [illegible] kg/100 dfls. (Tables [illegible])

Table 8.1: Performance of [illegible]

Strains	Cells (lbs.)	No. of nauplii	Average initial body weight (mg)	Yield (lbs per lbs)	Survival (%)	Average weight (g)	Growth (%)
Air drying Pre-Acclim	28100	130	1427743	50.82	1.750	0.864	33.08
Type II Nauplii	11700	80	8846.23	37.82	1.737	0.882	33.08
Air drying Lv	5200	7	1826.79	50.80	1.816	0.878	31.08
Total/Avg	44900	140	238481.94	51.24	1.734	0.872	31.44

Table 8.2: Performance of [illegible]

Strains	Cells (lbs.)	No. of nauplii	Average initial body weight (mg)	Yield (lbs per lbs)	Laboratory weight (g)	Total weight (g)	Growth (%)
Air drying Pre-Acclim	19500	71	7428.03	37.94	1.787	0.259	25.0
Type II Nauplii	800	6	347.90	42.69	1.737	0.868	30.1
Air drying Lv	1055	20	3573.03	46.78	1.400	0.294	20.4
Total/Avg	21400	107	11349.04	34.73	1.400	0.348	30.4

Table 8.3: Performance of [illegible]

Strains	Cells (lbs.)	No. of nauplii	Average initial body weight (mg)	Yield (lbs per lbs)	Conversion weight (g)	Total weight (g)	Growth (%)
Air drying Pre-Acclim	4100	18	2353.08	56.07	1.804	0.362	21.46
Type II Nauplii	8260	60	3116.88	41.80	1.798	0.861	28.69
Air drying Lv	15200	78	8315.38	50.98	1.784	0.378	21.21
Total/Avg	24260	120	13777.20	60.80	1.778	0.819	27.01

Table 8.4: Performance of [illegible] (Control)

Label/Strains	Cells (lbs.)	No. of nauplii	Average initial body weight (mg)	Yield (lbs per lbs)	Conversion weight (g)	Total weight (g)	Growth (%)
Total/Avg	9300	28	4366.1	61.0	1.775	0.870	30.8

VII. CENTRAL OFFICE PROJECTS & PROGRAMMES (NATIONAL)

1. All India Co-ordinated Experiment on Poultry (AICEP) Phase III

Duration	2011 to 2016
Project Coordinator	S. D. M. Dash
Investigators	Mehta, P., Nagpal, S.N., Sahu, O.V., Singh, M., Chhabra, R., Rajkumar, U., Reddy, M., Singh, M., Chowdary,
Objectives	To test the efficacy of vaccines in different agro-climatic zones of India, for controlling organic diseases of poultry

Field locations in the different zones

Zone	Field centres
Southern	CSWRI, Avikanagar Directorate of Poultry Biotechnology and Management, Hyderabad Research Extension Centre, Nellikuppam
Central	Research Extension Centre, Amravati Central Avian Research Institute, Izatnagar
North Eastern	Regional Agricultural Research Station, Jharnapani Research Extension Centre, Kahikuchi Research Extension Centre, Nagaland Krishi Vigyan Kendra, Tripura

Samplings of broilers for serum, oropharyngeal swab and faecal samples collected from different centres at 6 weeks interval and sent to the laboratory. Post mortem of dead birds were done and suspected tissues collected in different centres and sent to the laboratory. Data on sero-monitoring and bacterial isolation collected.

Field performance recorded in 4 CSWRI Poultry Units

Genotype	Name	Origin
Male	CSW1	CSWRI, Avikanagar
Male	Pratap-4M	CSWRI, Mumbai
Male	SUVARNA	KVK-II, Bangalore
Male	VENKATA	KVK-II, Bangalore
Male	VENCOBB	CSWRI, Mumbai

2. Backyard Chicken Rural Entrepreneurship Programme (BCREP) Phase III

Duration	Jan 2011 to Dec 2015
Project Coordinator	Director, CSWRI, Mumbai
Investigators	S. Nandeshwar and A. Vasishtha, Nagpur
Objectives	To evaluate the field performance of improved

A total of 13 cotton varieties/ hybrids developed in the Institute (Three varieties of Arboreum cotton, Desi x Arboreum x Desi hybrids and Desi hybrids) were given below.

Sl. No.	Variety name	Type of hybrid/ variety
1	ARCH 86 (Krishi), Karnataka	Multi x Multi, Multi x Multi
2	ARCH 3, Chamarajanagara, Karnataka	Multi x Multi
3	Suraksha (Desi Cotton) ARCH 79, Tiruchirappalli, Tamil Nadu	Multi x Multi, Multi x Multi
4	Suraksha (Desi Cotton) ARCH 78, Kallidaikurichi, Tamil Nadu	Multi x Multi, Multi x Multi
5	ARCH 8, Aruppukkottai, TN	Multi x Multi, Multi x Multi
6	CICR, Sirsa(Haryana)	Multi x Multi
7	CICR, Sirsa(Haryana)	Multi x Multi
8	ARCH, Surat, Gujarat	Multi x Multi
9	CICR, Coimbatore, Tamil Nadu	Multi x Multi
10	CICR, Udaipur, Rajasthan	Multi x Multi
11	Farmers' Training Centre, CICR, Vaniyambadi, Tamil Nadu	Multi x Multi, Multi x Multi
12	Suraksha (Desi Cotton) ARCH 77, Aruppukkottai, Tamil Nadu	Multi x Multi, Multi x Multi
13	MRF, Sullurpeta, Andhra Pradesh	Multi x Multi, Multi x Multi

Sl. No.	Multi x Multiline hybrids	Sl. No.	Uniculture x Uniculture hybrids
1	PA183 x PA1833	1	(MP1 x MP5) x (MP13 x MP9)
2	PA x PA2	2	MP1 x MP13
3	PA4 x P13	3	Ka2 x Ha5
4	MDH9 x CB15	4	CBR2a x CCH3
5	MD7 x CBR2	5	(CBR2 x CB15) x (CB11 x CB15)
6	MP5 x (RH8 x MD7)	6	CBR2 x CBR x CB R2 B4
7	MRDP-2 x RH8	7	CBR2 x CB14 (2)
8	PA4 x CoH-2 (2)	8	(CB14 x CB15) x (CCH3 x CH07) (2)

VIII. ON STATION TRIALS CONDUCTED BY IIMRs

1. IIMR, Kanpur, Kanpur (U.P.)

a. Evaluation of newly developed male sterile lines in A1 and A2 at the permanent centre of IIMR, Kanpur

The evaluation of MC1, MC2 and MC3 male sterile in CMS source and restorer percentage was recorded as 99.91 % for MC1, 99.96% for MC2 and 97.4% for MC3. Growth and yield data of new male sterile is recorded. The results indicated that the newly MCS is similar in growth and yield like MC1.

b. Evaluation of maize hybrids

Out of 20 hybrids in hybrids, DH x DMR30 and MB45 x DMR31 were taken up with PM x DMR3 as control. The maximum performance recorded the yielding like with hybrids, MB45 x DMR31 produced 60 ladies' in respect and percent (PMR 9700) and weight 61.40 g and shoot percentage (71.00) compared to other with hybrid and PM x DMR3.

c. Evaluation of two cross hybrids

Three male and 2 new female hybrids, DC x 66 and weight hybrid) and D11 x IC16 (female hybrids) were taken up with DMR3 x DMR4 and FC1 x FC2 as controls. The results on the cobbing performance of the male hybrids revealed that the weight hybrid DC x 66 and the new hybrid D11 x IC16 were better performance in terms with respect to survival (DMR-8500 & 9700). Likewise weight (1,755.6 & 1,784 g) and shoot weight (1,284 & 1,457 g). While regard to cobbing performance, IC11 x D16 was better for Maximum length (246.40 cm), diameter (24.1 and cobbability (94 %).

d. Evaluation of three way crosses

Four trials on cobbing dependent three way crosses viz., FC1 x DMR3; FC2 x DMR17 were taken up with FC1 x FC2 as control. The cobbing, FC2 x DMR17 performed better for cobbing (PMR-8400) and weight (1,784 g) and shelled percentage (81.07). Cobbing performance in the best hybrid FC2 x DMR17 was found better for Maximum weight (246.67 cm).

2. IIMR, Chiplima, Chiplima (Odisha)

a. Evaluation (MC1 and MC2) doubled by varieties under water stress conditions

Average seed yield of two crops indicated that, MC2 gave the highest yield of 4,341 kg/hectare followed by MC1 with 3,781 kg/hectare and check variety (CC2) with 3,135 kg/hectare. Improvement in seed yield was 20.79% and 38.46% over check 1 and 2, respectively. Days to 50% flowering was recorded as 65 days. Days to maturity was recorded as 95 days. Parental lines were maintained with maintenance with proper isolation distance.

b. Testing of DH2/DH4 female lines under stress and shelter testing developed through selfcross material evaluation

Three on trial on 3 trials (DH1) were maintained with 21 rows in each (2 x 4 in sampling FC2 x FC1 and DMR3 x DMR4 as control. This has a potential to test the new diversity lines in DH1 x DH2 were superior with higher ESPC (4 number (DH2) and by weight (36.75% kg in comparison to control hybrid FC2 x FC1. Similarly, the new weight had 50 DH2 x 45 and was higher DH2 by number (DH2) and by weight (50.50 %) in comparison to control hybrid DMR3 x DMR4. However, the number of ears decreased slightly in newer set, which we need to focus to increase the high yield.

5. Hybrids developed through pedigree method

a. Yield trial of new single cross hybrids (KH 12-1 x KH 12-2), (KH 12-3 x KH 12-4), (KH 12-5 x KH 12-6) and (KH 12-7 x KH 12-8)

Four new single cross hybrids (KH 12-1 x KH 12-2), (KH 12-3 x KH 12-4), (KH 12-5 x KH 12-6) and (KH 12-7 x KH 12-8) were tested in yield trial which was conducted during May, 2013. The growing and cutting performance were compared with KH 11-3 hybrid. The results revealed superiority of KH 12-3 x KH 12-4 in terms of higher survival (97%) (Table) and KH 12-1 x KH 12-2 in respect of plant extension rate (7.4 cm/day) (Fig). Mean single cane weight (1.667 kg), cane yield (116 t/ha) and pol content (18.62%) were also recorded in KH 12-3 x KH 12-4.

b. Yield trial of new single cross hybrids developed through pedigree method

Four new single cross hybrids (CO 11-1 x CO 11-2), (CO 11-3 x CO 11-4), (CO 11-5 x CO 11-6) and (CO 11-7 x CO 11-8) were compared with two standards, CoSe 13-234 and CoSe 13-439. The growing and cutting performance were evaluated which revealed that survival (83%) was significantly higher in CO 11-1 x CO 11-2 while good ratooning ability was observed in CO 11-3 x CO 11-4 (Fig). Mean single cane weight (1.4 kg), cane yield (105 t/ha) and pol content (18.2%) were also recorded in the promising hybrid (CO 11-3 x CO 11-4).

c. Yield trial of early maturing sweet sorghum single cross hybrids developed through pedigree method and their parents

The new breeding single cross hybrids (IS 27406 x IS 27405) and (IS 27406 x IS 27407) were compared with the existing hybrids (CSH 22 SS x CSH 24 SS) and (SSV 84 x CSV 216R) and their parents. Comparison of the juice and cooking data indicated superiority of the new hybrids over the control hybrids in terms of juice yield (Table). Brix (%), sucrose (%), purity (%), stalk yield (t/ha) and juice yield (kl/ha) were also recorded in the promising hybrids (IS 27406 x IS 27405) and (IS 27406 x IS 27407).

6. Hybrids developed through backcross method

a. Yield trial of new single cross hybrids developed through backcross method

Nine new single cross hybrids were tested in the yield trial in comparison to the standard hybrid (CSH 24 SS). Among the hybrids, CO 11-1 x CO 11-2 recorded highest single cane weight (1.2 kg) and cane yield (105 t/ha) followed by CO 11-3 x CO 11-4 (1.1 kg single cane weight and 100 t/ha cane yield). Regarding the juice characters, CO 11-1 x CO 11-2 recorded highest juice brix (20.2%) followed by CO 11-3 x CO 11-4 (19.8%). Regarding the cooking characters, CO 11-1 x CO 11-2 was superior with respect to juice yield (kl/ha) (Table). Among the hybrids, CO 11-1 x CO 11-2 recorded highest single cane weight (1.2 kg) and cane yield (105 t/ha) followed by CO 11-3 x CO 11-4 (1.1 kg single cane weight and 100 t/ha cane yield). Regarding the juice characters, CO 11-1 x CO 11-2 was superior with respect to juice yield (kl/ha) (Table).

b. Yield trial of early maturing sweet sorghum single cross hybrids developed through backcross method and their parents

Nine single cross hybrids were compared with the standard hybrid (CSH 24 SS). Among the hybrids, CO 11-1 x CO 11-2 recorded highest single cane weight (1.2 kg) and cane yield (105 t/ha) followed by CO 11-3 x CO 11-4 (1.1 kg single cane weight and 100 t/ha cane yield). Regarding the juice characters, CO 11-1 x CO 11-2 was superior with respect to juice yield (kl/ha) (Table). Among the hybrids, CO 11-1 x CO 11-2 recorded highest single cane weight (1.2 kg) and cane yield (105 t/ha) followed by CO 11-3 x CO 11-4 (1.1 kg single cane weight and 100 t/ha cane yield). Regarding the juice characters, CO 11-1 x CO 11-2 was superior with respect to juice yield (kl/ha) (Table).

c. Yield trial of new forage hybrids

Four new multicut sorghum hybrids (CO 11-1 x CO 11-2), (CO 11-3 x CO 11-4), (CO 11-5 x CO 11-6) and (CO 11-7 x CO 11-8) were tested in yield trial. Results revealed that CO 11-1 x CO 11-2 recorded highest fodder yield in response to 90 kg N/ha (Table) (49.8 t/ha) followed by CO 11-3 x CO 11-4 (45.2 t/ha). Regarding the quality parameters, CO 11-1 x CO 11-2 recorded highest crude protein (10.2%) followed by CO 11-3 x CO 11-4 (9.8%). Regarding the cooking parameters, CO 11-1 x CO 11-2 recorded highest juice brix (20.2%) followed by CO 11-3 x CO 11-4 (19.8%). Regarding the cooking characters, CO 11-1 x CO 11-2 was superior with respect to juice yield (kl/ha) (Table). Among the hybrids, CO 11-1 x CO 11-2 recorded highest single cane weight (1.2 kg) and cane yield (105 t/ha) followed by CO 11-3 x CO 11-4 (1.1 kg single cane weight and 100 t/ha cane yield). Regarding the juice characters, CO 11-1 x CO 11-2 was superior with respect to juice yield (kl/ha) (Table).

III. SERICULTURE EXTENSION, ECONOMICS AND MANAGEMENT

G. N. Vindhya, Dr. K. S. Chandrashekar, S. K. Nagaraja, B. Gangadhar, Debaraja Sahoo, A. G. Ganga, G. S. Sudha

1. Model sericultural Clusters survey

In the model sericultural SHG, a total of 117100 dfls of CSR1 x CSR2 were reared in 33 centres and cocoon worth Rupees 1 crore was produced in 108 constituents from 105 villages. The average cocoon yield recorded was 68.22 kg /100 dfls for CSR1 hybrids. A total of Rs. 4,07,870 was collected as service charges. A total of 160 farmers could be benefited from the activities carried in mulberry and bivoltine rearing.

2. Survey of weed complex and ecology of important mulberry varieties

Name of the Centre	Mulberry area (ha)	Name of the Centre	Mulberry area (ha)
1. CSRTI, Mysuru	20.70	16. RSO, Hosur	120.13
2. RSRS, Kodathi	6.30	17. RSO, Kodihalli	0.81
3. RSO, Chikkaballapur	13.44	18. RSO, Ramanagaram	18.11
4. RSO, Bidar, Bhalki	22.24	19. RSO, Udamalpet	23.01
5. RSO, Gulbarga, Aland	7.32	20. RSO, Kollegal, Shivapuram	21.46
6. RSO, Chintamani	125.40	21. RSO, Kollegal, Yelandahalli	4.87
7. RSO, Kolar, Malur	38.83	22. RSO, Palakkad	8.83
8. RSO, Madhugiri	127.29	23. RSO, Kollegal, Kudachanahalli	2.81
9. RSO, Thirupathur	32.94	24. RSO, Attur	51.00
10. RSO, Tumkur, Pavagada	13.27	25. RSO, Basavanahalli	24.35
11. RSO, Hosakote	22.39	26. RSO, Pudukkottai	49.29
12. RSO, Gulbarga, Chincholi	15.33	27. RSO, Thanjavur	46.38
13. RSO, Gulbarga, Sedam	13.83	28. RSO, Gulbarga, Aurad	13.35
14. CSRI, Pattikonda	12.69	29. RSO, Kollegal, Mamballi	59.14
15. CSTRI, Kalahasti	227.33	30. RSO, Gulbarga, Shahabad	5.40
16. RSRS, Salem	142.44		
17. RSO, Chikkaballapur, Gudibanda	6.38	Total	1827.36

3. Training of Rural Youths

Name of the Centre	No. of persons trained								Total
	ARAM	MC & FW	IFM	DF	DWCF	BFM	ITM	VA	
RSETI, Araria	40	40	40			40	40		160
RSETI, Bettiah	80	80	40						120
RSETI, Chhatihar	40	40	40						120
RSETI, Madhubani	160						80		120
RSETI, Nawadah		80	80						160
RSETI, Nalanda	80	40	80						160
RSETI, Patna	40	40		40	80			80	160
RSETI, Samastipur	40	40						80	80
RSETI, Muzaffarpur	40	80		40	80	80			240
RSETI, Rohtas	80	80		40					120
RSETI, Kaimur (Bhabua)	80	80		40		40			120
RSETI, Gaya	80	80		40		40			120
RSETI, Banka	40	40		40					80
CPC, Hajipur	80	80		80					160
CDC, Patna Kotwa	80	80		80					160
RSETI, Supaul	80	80		80	80	80			160
RSETI, Gopalganj	80	40		80	40	40			160
RSETI, Purnea	80	80		80	80	80			160
RSETI, Aurangabad	40	40		40	40	40			80
RSETI, Jamui	80	40		40	80	40			160
RSETI, Jehanabad	40	80		40	40	40			120
RSETI, Saharsa	80	80		80	40	40			160
RSETI, Sitamarhi		40		40					80
RSETI, Pakribarwan	40	40		80	40				160
RSETI, Kaimur		80		80					160
RSETI, Madhepura	80	40	40						160
RSETI, Siwan	80	80	40						160
RSETI, Purnea		40	40						80
RSETI, Arwal	40	80							120
RSETI, Lakhisarai	80	80							160
RSETI, Khagaria	40		40						80
RSETI, Bhojpur	80	80							160
Total	1920	1920	360	720	720	560	80	80	6760

ARAM (Agriculture and Allied Management) MC&FW (Micro enterprise and Fashion Management) IFM (Integrated Farming Management) DF (Dairy Farming) DWCF (Dairy Cattle Feeding) BFM (Bee Farming Management) ITM (Integrated Fish Management) VA (Value addition)

4. Performance of CSW fry stock in the cage farms of RGC (Nos.)

Sl. No.	Name of the Centre	No. of cages	No. of stocked	Average weight (g)
1	RGC, Chikkallargi	1331	266200	68.20
2	RGC, Hadkonda	329	165000	68.10
3	RGC, Sri. Ramalingapura	144	28800	68.20
4	RGC, Sri. Kolpur	164	32800	68.20
5	RGC, Hosur	810	200000	68.60
6	RGC, Yakkeri Angadi	331	66200	68.40
7	RGC, Hadkasanna	2041	204100	68.20
8	RGC, Rayachoti	44	8800	68.60
9	RGC, Vasavi nagar, Hosur	3231	646200	68.20
10	RGC, Hosur Kodi	331	67431	68.20
11	RGC, Sri. Ramakuppam	160	32000	64.80
12	RGC, Sri. Bidar	24	4800	68.60
13	DRC, Hirehalya	351	281000	81.20
14	CSW, Pura Kalan	710	284000	64.80
15	RSRS, Basavi	231	73113	79.20
16	RGC, Gundlahalya Kaval	1864	181219	67.27
17	RGC, Hosur	851	170051	68.40
18	RGC, Kyasanagere	344	27000	78.40
19	RGC, Sathyagalahalya	831	166471	64.10
20	RGC, Ullarthalgeri	2041	1632841	74.70
21	RGC, Sri. Bilichakanahal	351	84000	68.20
22	RGC, Sri. Yaragatnahalli	44	8800	68.80
23	RGC, Pakkirkeri	241	22184	78.61
24	RGC, Sri. Kolkatta	16	3200	64.10
25	RGC, Ankenahalli	141	27581	61.94
26	RGC, Basavanahalli	171	119000	68.60
27	RGC, Pandavapura	351	68641	62.19
28	RGC, Hiriyanagalkeri	16	3140	78.50
29	RGC, Sri. Ayanagalahalli	27	18681	68.79
30	RGC, Sri. Madiha	1871	149000	81.63
31	RGC, Sri. Bilikanagere	16	25600	68.20
	Total	19814	4383643	68.63

3. Rural Development Programmes

Name of the Centre	Source					Total
	Cash in hand/ advances/ charges	Value of materials	Staff of craftsmen & weavers	Share of charges received	Others	
RSETI, Chamarajanagar	–	1,45,000	–	–	41,429	1,86,429
RSETI, Kodagu	–	2,75,000	50,000	–	–	3,25,000
RSETI, Mandya	–	100	50,000	–	–	50,100
RSETI, Chikkaballapura	–	80,100	–	–	–	80,100
RSETI, Kolar	–	80,000	12,700	–	–	92,700
RSETI, Dist. Hospet	–	31,000	–	–	–	31,000
RSETI, Chamarajanagara	–	80,000	400	–	1000	81,400
RSETI, Dist. Shivamogga	–	–	1,500	33,000	–	34,500
RSETI, Ramanagara	–	80,000	3,000	–	12,000	95,000
RSETI, Belagavi-II	–	81,200	–	–	8,000	89,200
RSETI, Vijayapura	–	–	5,000	–	8,000	13,000
RSETI, Dist. Bidar	–	80,000	26,000	–	30,707	96,707
RSETI, Bidar	10,000	70,000	5,000	–	21,000	86,000
RSETI, Kanakapura	–	–	5,000	41,000	3,000	89,000
RSETI, Davanagere	–	80,000	–	–	–	80,000
RSETI, Udupi-Hejmadi	–	–	–	–	900	900
RSETI, Dist. Shivamogga	–	–	–	–	150	150
RSETI, Yelahanka	–	–	–	–	215	215
RSETI, Dist. Kalaburgi	–	–	–	–	500	500
RSETI, Dist. Ramanagaram	–	–	–	–	600	600
Total	10,000	9,19,800	1,80,100	1,40,000	1,10,000	13,49,900

4. Workers on contractual/ project programmes recruited by RSETIs and studied cases

Name of the Centre	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i) (a)+(b)-(c)	(j)
RSETI, Kodagu	12	–	–	0	–	0	0	12	1	0
RSETI, Chamarajanagara	1	–	–	1	–	1	–	–	–	1
RSETI, Chikkaballapura	0	–	–	1	–	1	1	–	–	1
RSETI, Kolar	0	–	–	0	–	1	–	–	–	1
RSETI, Dist. Ramanagaram	0	–	–	0	–	1	0	–	–	1
RSETI, Dist. Hospet	1	–	–	1	–	1	–	–	–	1

Name of the Centre	CO	PR	EX	HO	RC	EP	DE	FR	Wor sho	SI
RSKVP, Chamarajanagara	0	0	2	0	-	-	-	-	1	0
RRC, Gulbarga	1	1	1	1	-	-	-	-	-	1
RSKVP, Hirekerur	0	-	-	-	0	0	-	-	0	0
RRC, Mysuru	0	0	0	0	0	1	-	-	-	-
RSKVP, Kalyanakarnataka	0	0	0	0	0	1	-	-	-	0
RRC, Muddebihal	0	0	0	0	0	1	-	-	-	1
RSKVP, Pavagada	0	0	0	0	0	1	-	-	-	-
RRC, Vedavyasakendra	0	0	0	0	0	1	-	-	-	-
RSKVP, Yelandur	0	0	0	0	0	1	-	-	-	1
RSKVP, Bidar	0	0	0	0	0	1	-	-	-	-
CRC, Hubballi	0	0	0	0	0	1	-	-	-	1
CEC, Pavagada	0	0	0	0	0	1	-	-	-	-
KSHSB, Bidar	0	-	0	0	-	0	0	-	0	-
RRC, Gokarnakshetrayan	0	-	0	0	0	0	0	-	-	-
RSKVP, Haveri	0	-	0	0	0	0	0	-	-	-
RRC, Kanakagiri	0	-	0	0	0	0	0	-	-	-
RSKVP, Shantiyanilaya	0	-	0	0	0	0	0	-	-	-
RSKVP, Udupi-Kapu	0	-	0	0	0	0	0	-	-	-
RSKVP, Shri Kshetra Dharmasthala	0	-	0	0	0	0	0	-	-	-
RRC, Shri Vyasarajamatha	0	-	-	-	0	-	0	-	-	-
RSKVP, Puttaparthi	0	-	0	0	0	0	0	-	0	-
RRC, Shri Kaivara	0	-	0	0	0	0	0	-	-	-
RRC, Ankolamath	0	-	-	0	-	-	-	0	-	-
RSKVP, Gavimath	0	-	0	0	0	0	-	-	-	0
RRC, Chamrasi	0	-	-	0	0	0	0	-	-	0
RSKVP, Hosakerepakkal	0	-	-	0	-	-	0	-	-	-
RRC, Shri Ramanguhakal	0	-	-	0	0	-	0	0	-	0
RSKVP, Shri Mahadeshwara	0	-	-	0	-	-	0	-	-	0
RRC, Shri Kanakaguggu	0	-	-	-	0	-	0	-	-	-
Total	349	19	82	134	103	34	112	7	5	18

CO: Group Discussion, PR: Project Work, EX: Excursion, FO: Field Trip, AP: Awareness programme,
EP: Enlightenment programme, DE: Demonstration, FR: Formative Work, WS: Workshop, SI: Study Visit

X. HUMAN RESOURCE DEVELOPMENT

S.C. Sharma, S.S. Pillai, Anna Joseph, Vinod Kumar, A.S. Gaur and R. Dhaipule

a. Management Development Programme (MDP)

Sl. No.	Name of the course	Duration	Number of persons trained
1	Information security for technical officials	05 days	02
2	Effective Planning	03 days	01
3	Latest tips utilization in weaving	03 days	01
4	Risk Analysis	05 days	01
5	Project Management	05 days	01
6	Marine Insurance	04 days	01
7	Export Import Management	05 days	01
8	Hiring, Legal Issues & Grievance Management	05 days	01
9	Production of Bio-control Agents	05 days	01
	Sub-total	-	13

b. Induction / Orientation Programme (IOP) - Not applicable

Sl. No.	Name of the course	Duration	Number of persons trained
1	Effective Planning	03 days	12
2	Latest tips utilization in weaving	03 days	01
3	Production of Bio-control Agents	05 days	01
4	Hiring, Legal Issues & Grievance Management	05 days	02
5	Medical Coverage	05 days	01
6	Insurance programme for human resources	05 days	01
7	Marine Insurance	04 days	01
	Sub-total	-	19

c. Domestic Courses

Sl. No.	Name of the course	Duration	Number of persons trained
1	Information Security & Threats in Banking	05 days	01
	Total		01

d. Training under Technical Cooperation Programmes

Sl. No.	Name of the course	Duration	No. of persons trained
1	Commercial Insect Rearing	15 days	01
2	Mulberry Cultivation	15 days	01
3	Disease Investigation	15 days	01
4	Quality Evaluation of Silk and Silkworm	15 days	01
	Total	-	04

a. Short duration training programmes

Two trainees from Haryana participated in a 10 days training programme on Livelihood enhancement including Agroforestry for tribal farmers in Nilokheri, Karnal under tribal sub-plan organized to increase the participation of stakeholders at the farmers' level.

b. Programmes on research

The training module was prepared for the stakeholders' viz. unemployed youth, from Government Organizations, Corporates, Departments / Consultancy, etc., to train their staff in the most recent technologies being developed in the Institute. Accordingly, the additional requirements were observed and 257 candidates were trained under various research based programmes.

Sl. No.	Name of the Courses	Duration	Number of persons trained
1	Land degradation (ICAR & A)	10-11 days	19
2	Advanced practical training (Officials)	15 days	36
3	Orientation on research (Ph.D Scholar)	10 days	03
4	Soil resource management (Officials)	05 days	10
5	Extensive formation training (Officials)	04 days	03
6	Integrated pest & Diseases management in crops	03 days	17
7	Remote sensing technology (Officials)	15 days	10
8	Production of bio-control agents at village level	05 days	01
9	Preparation of soil samples (Farmers)	04 days	23
10	Post Graduate Diploma in Agriculture	06 days	06
11	Laboratory techniques in soil testing (Farmers)	10 days	23
12	Glasswares washing (Farmers)	08 days	32
13	Physical properties (Farmers)	04 days	23
14	Preparation of solutions (Farmers)	06 days	10
15	Extensive training on Integrated farming System (Farmers)	06 days	01
16	Awareness programmes (Farmers)	05 days	11
17	Planning and monitoring (Farmers)	03 days	10
		Total	257

c. Participation of SC/ST participants in training programmes

Sl. No.	Name of the training programme	No. of participants (Persons)						Total
		SC	ST	OBC	Gen	Male	Female	
1	Management oriented programmes	19	4	78	50	134	19	153
2	Technology oriented training programmes	19	14	154	133	320	40	360
3	Certificate courses	6	10	5	6	21	6	27
4	Farmers/Farm Women oriented and Skill development programmes	79	17	267	234	517	79	596
	Total	113	45	504	423	992	144	1136

A) Training of stakeholders at FCRC on Farmers' visits

Sl. No.	Name of the training	Number of persons trained
2015-16, Sukma & nearby areas		
i	Silkworm seed technology management	175
ii	Mulberry crop protection	250
iii	Rearing training	200
iv	Silkworm crop protection	250
v	Backward linkage management	270
2015-16, Dhamtari, Kanker & nearby areas		
vi	Silkworm seed technology management	50
vii	Mulberry crop protection	50
viii	Rearing training	45
ix	Silkworm crop protection	50
x	Various activities	50
2015-16, Korba, Janjgir & nearby areas		
xi	Silkworm seed technology management	345
xii	Mulberry crop protection	300
xiii	Rearing training	400
xiv	Silkworm crop protection	450
xv	Backward linkage management	450
2015-16, Bastar & nearby areas		
xvi	Silkworm seed technology management	350
xvii	Mulberry cultivation & post cocoon management	200
xviii	Silkworm rearing & silkworm crop protection	225
xix	Backward linkage management	75
xx	Post cocoon management & quality control	75
Works already undertaken by CSB&TI, Ryeore		
xxi	Silkworm seed technology management	150
xxii	Mulberry cultivation & post cocoon management	150
xxiii	Silkworm rearing & silkworm crop protection	50
	Total	**5150**

i. Production training in agriculture & allied activities

To upgrade the farming practices, effective training need was identified in 18 districts. A total of 1000 ha area covered with an average finishing percentage of 28.81, simple interest weight of 1,119 seed percentage of 27.34. The average minimum yield increased by 2 to 3 q/100 ha.

Participation of different factors in the different training programmes

Name of the	No. of villages	Agricultural area (ha)	Common weight (kg)	Total weight (kg)	Yield (q/ha)	Yield 100 kg/ha	Data Avg (kg)
Mar-Dec 2012*	10	34.00	1,101	3,101	31.11	93.33	280.00
May-Jun 2012*	10	35.50	1,071	3,341	30.11	91.33	270.00
Jan-Jul 2012*	10	35.40	1,070	3,344	30.03	90.07	240.10
Jul-Aug 2012*	10	34.00	1,020	3,021	31.61	89.07	280.00
Aug-Oct 2012*	10	34.02	1,044	3,034	31.61	90.33	240.10
Oct-Nov 2012*	10	34.20	1,010	3,041	30.61	90.70	270.00
Nov-Dec 2012*	10	35.70	1,002	3,052	31.03	89.02	270.00
Jan-Feb 2013*	10	35.20	1,071	3,341	30.31	93.03	280.00
Jan-Feb 2013 a	10	35.11	1,074	3,050	30.13	90.91	280.00
Feb-Mar 2013*	10	35.10	1,054	3,061	31.03	94.41	280.10
Total / Avg.	1000	35.01	1,773	3,270	31.30	92.14	267.30

* Double Hybrid, 8 t/ha = 2012

j. ISO 9001:2008 certification

The first post-harvest processing unit in Country Development Services (CDS) was established in the year 2001 and started a full scale production since inception.

k. Revenue generation

A total income of Rs. 3.86 lakhs was generated from the sale of commercial income like power production and spare etc.

XI. PROGRAMMES BEING IMPLEMENTED IN COORDINATION WITH CSIR'S OF DIFFERENT STATES (AT A GLANCE)

Sl. No.	Name of the Project / Programme	Duration	States involved	Page No.
1	[illegible]	Apr. 2017 - Mar. 2018	Karnataka, Andhra Pradesh, Tamil Nadu, Himachal Pradesh and Madhya Pradesh	32
2	[illegible]	Nov. 2016 - Dec. 2018	Karnataka, Andhra Pradesh, Tamil Nadu, Himachal Pradesh and Madhya Pradesh	33
3	[illegible]	Aug. 2017 - Dec. 2018	Karnataka, Andhra Pradesh, Tamil Nadu	37
4	[illegible]	Jan. 2017 - Dec. 2018	Karnataka, Andhra Pradesh, Tamil Nadu	37
5	[illegible]	3 years	Karnataka, Andhra Pradesh, Tamil Nadu, Himachal Pradesh and Madhya Pradesh	44
6	[illegible]	Nov. 2016 - Dec. 2018	Karnataka, Andhra Pradesh, Tamil Nadu, Himachal Pradesh and Madhya Pradesh	60

III. ACTIVITIES REGARDING OFFICIAL LANGUAGE IMPLEMENTATION

During 2012-13 Official Language policy has been implemented well at Central Sericultural Research and Training Institute, Mysuru. Compliance of section 3(3) of the Official Languages Act has been ensured. The progress in implementation of Hindi was reviewed time to time by monitoring meetings of the Official Language implementation committee.

Organization of Hindi workshops, Hindi day, noting/drafting in, translation of technical books in Hindi, publication of Hindi magazine have been done and Hindi noting/drafting exercise has been implemented. In addition to general Hindi workshops an Official Language Technical Workshop was organized on 08.02.2013.

During the year i.e. as on 31.03.2013 the Institute has received a letter under Official Languages ruling of the enforcement Order for the constituent participating units in Official Language ruling for year 2012-13, duly taken on the various items of official language implementation during the period was furnished.

1. Compliance of section 3(3) : The papers coming under section 3(3) of Official Languages Act 1963 have been issued in bilingual.

2. Compliance of Rule 11 : All types of forms, letter heads, Rubber stamps, Name boards, Sign boards, Memo cards, etc are in bilingual. Check points on Hindi are also displayed at various counters. Display boards, Signboards, Direction boards etc are displayed in bilingual. Check points on Hindi are also displayed at various counters. Display boards, Signboards, Direction boards etc are displayed in bilingual.

3. Hindi Correspondence : During the year the percentage of letters sent in Hindi in different regions were as mentioned in the prescribed targets (88.0%, 71.0% and 70.0%) letters were sent in Hindi to Central Govt. Offices of A, B and C regions respectively and 94.0% and 94.0% letters in Hindi to Public Sector Undertakings of A & B regions.

4. Organization of meetings of the Official Language Implementation Committee : The progress of implementation of the Official Language has been reviewed from time to time by conducting OLIC meeting in every quarter. During the year 2012-13 Official Language Implementation Committee meetings were organized on 15.06.2012, 27.09.2012, 24.12.2012 and 19.03.2013 and follow up action on the decisions taken in the meeting was taken.

5. Organization of Hindi Workshop : Hindi workshop was organized in each quarter for the officers of the institute to provide a brief idea as to use of Hindi in the official work and the implementation of Official Language Policy. During the year, 24 officers and 24 staff have been trained in Hindi workshops organized on 30.05.2012, 27.08.2012, 27.12.2012 and 07.03.2013 respectively for technical and administrative officers, officers and administrative staff.

6. Organization of Official Language Technical workshop : In addition to the above mentioned workshop, Official Language technical workshop was organized on "Development of Vocabulary Committee – with new technological" in which 100 candidates participated. The officers concerned during the academic topics were invited and motivated as a resource. Apart from it, talk on Hindi typing session "Technical Hindi Workshop" conducted by two experts of the institute was also organized during the commemorative function.

7. Implementation of noting-drafting incentive scheme : To encourage the officers and staff of the institute while doing official noting in Hindi, CSRTI has introduced noting-drafting incentive scheme. The scheme was implemented in which cash awards are given for writing good noting in Hindi. During the year cash awards were given to 8 officials and the next Review Meeting of Official Language is tentatively held on 14.06.2013. Apart from this, Hindi is also made compulsory in the written examination conducted for recruitment of the staff.

8. Felicitation of Hindi book declaration : A meeting was convened by the Director in Gujarati section according to agenda on 08.03.2013. During this the five Members of state Bhasha samman Puraskar by the committee of the institute was also released. The meeting was chaired by the Director and Head of Gujarati section. Two issues of Rashtriya Hindi (Rashtriya Hindi) (Hindi Patrika) was also published.

9. Nomination of the subordinate officers under "Group A" of the Official Language rules : The Director, in which 50% of the staff are having working knowledge in Hindi, are notified under "Group A" of the official language rules. Apart from this notice, 4 Central Government officers have been notified.

10. Organization of Hindi competitions : Official Language fortnight was organized from 14.09.2012 to 14.09.2012 during which 10 different Hindi competitions viz. 1. Essay writing 2. Debate 3. Memory test 4. Group discussion 5. Elocution 6. Noting drafting as administrative glossary 7. Technical glossary 8. Antakshari (song the Hindi alphabet) and 10. Antyakshri competitions were organized. The winners of the competitions were awarded with the cash prizes / Certificates / Mementos.

11. Work on computers in Hindi : On the basis of section 3(3) Rules, the Director has issued the order to all the officers / staff members to work in Hindi on the computers. Efforts have been made to provide the computers to the staff members in the Hindi typing.

12. Awards : During the year i.e. in June 2012 the previous was awarded with a citation under the Official Language Working Award scheme of CSSARTI for the excellent performance made in the implementation of official language policy of the institute for the year 2011-12.

Apart from this, 2012-13, Gujarat state institute, was awarded as second prize under the Working Award Scheme of the Town Official Language implementation committee. Slider for excellent performance made in Official Language Policy during 2011-12.

XIII. ADMINISTRATIVE REPORTS

Central Horticultural Research & Training Institute, Mysore, Karnataka & its regional units

Regional Horticultural Research Stations (RHRS)

1. Ibrahim J, Karnataka
2. Chinthamani Agara, Karnataka
3. Anantapur, Andhra Pradesh
4. Kodur, Tamil Nadu

Research Extension Centres (RECs)

1. Bidarakoppa	9. Sri Kalahasti	17. Palampur
2. Chintamani	10. Uttarahalli	18. Jorhat
3. Madhura	11. Kodaikanal Hyderabad	19. Bajauhari
4. Erode	12. Bhopal	20. Ranchi
5. Kalyandurgam	13. Bhubaneswar	21. Hanumangarh
6. Mahaboobnagar	14. Ranipet Farm	
7. Paschim	15. Umiam	

Sub-units of Research Extension Centre (RECU-SU)

1. Kanakapura	4. Belur	8. Kanchipuram
2. Koppa	5. Kunigal	9. Virudhur
3. Kuppadandi	7. Hiriyooralahalli	11. Thiruvannigaya
4. Pilakkanda	8. Kayamkulam	

Cluster Promotion Centre (CPC)

1. Thrissur

Cluster Development Centre (CDC)

1. Palakkad

Retirement/resignation/death of personnel during the year

The following are the names and designations of persons who retired on superannuation/resigned/died while rendering their services in the service and the employees of the Institute are hereby acknowledged.

Name	Designation	Date
A. Retired		
1. Smt. M. S. Ambika	STA (SG)	30.04.2012
2. Smt. N. Venkateshamma	Asst. Farm	30.04.2012

3. Dr. N. L. Kalyani	Scientist E	30.09.2012
4. Shri Vasudevan	STA (SG)	30.09.2012
5. Shri Sreekumar	Tech. Assistant	31.07.2012
6. Dr. P. Rajesh Kumar via Fax	Scientist E	31.07.2012
7. Shri Sreenivas	Asst. Tech.	31.07.2012
8. Shri Parthasarathy	Welder	31.05.2012
9. Shri. V. Sasikumaran	STA	30.06.2012
10. Shri. C. Sibichan	Sr. Tech. Asst. Gr. I	30.06.2012
11. Shri. M. Mahalingam	STA	30.11.2012
12. Dr. K. S. Chandrakumar	Scientist E	30.11.2012
13. Shri. S. Nagaraj	Scientist E	31.10.2012
14. Dr. S. R. Gangadhara Prabhu	Scientist E	31.10.2012
15. Dr. C. S. Chandramohanan	Scientist E	31.01.2013
16. Shri. V. K. Sharma	Sr. Director (HAG)	28.02.2013
17. Dr. S. R. Dash	Director	31.03.2013
18. Shri. Mukesh Doss	Tech. Asst.	31.03.2013
B. Resigned		
1. Dr. Mahesh Rajput	Scientist D	15.10.2012

The retaining bar clamping was planned using floating type pins with their orientation in the groove and the alignment of the workpiece was suitably achieved.

1. Shri. G. R. Manikandanan	Tech. Asst.	30.06.2012
2. Smt. Saraswathy	Scientist E	30.11.2012

Budget (Rs. in lakhs):

Plan	Non-Plan	Total
447.00	3.90 (E)	4,50,90*

R & D & ADMINISTRATIVE PERSONNEL OF CSIR-CSIO AND IT'S NEXTED UNITS

I. R & D Personnel

A. CSIR-CSIO, Chandigarh

(As on 31.03.2013)

Planning, monitoring, evaluation & outreach

Dr. S. P. Kaushik, Sr.PS
Dr. (Mrs.) M. Muralidharan, Sr.SC
Mr. Rajendra Kr. Prasad, Sr.SC
Dr. Ravindra M. Mahajan, Sr.SC

Multidisciplinary Engineering, Instrumentation & Industrial Services

Dr. Vinay V. Rajput, Pr.SO
Dr. M. S. Pratap Rao Lee, Sr.SC
Mr. Rajendra K., Sr.SC
Dr. M. R. Raghavendra, Sr.SO
Dr. S. Gandhi Babu, Sr.SC
Dr. A. S. Dhanjal, Sr.SC
Mrs. Reena M., Sr.SC

Multidisciplinary Projects

Dr. S. P. Kaushik, Pr.SO
Dr. S. D. Bhanot, Sr.SC
Dr. S. Pratibha Peer, Sr.SC
Dr. P. N. Prabhakar Kumar, Sr.SO

Technical Services

Dr. S. Harinarayana
Dr. S. Lakshmana

Advanced Engineering Laboratory I

Dr. A. Hanumantha Rao, Pr.SO
Dr. V. Ravi Reddy, Sr.SC
Dr. S. Bhaskara Rao, Sr.SO

Advanced Lasertech

Dr. V. N. Sastry, Sr.SC
Dr. A. K. Sharma, Sr.SO

Advanced Physiology

Dr. Jasvinder Singh, Sr.SO
Mr. M. Ramesh, Sr.SC
Dr. G. Bhaskarananda Reddy, Sr.SO

Agronomy

Dr. Deepak, Sr.SO
Dr. R. Balasubramanian, Sr.SC
Dr. K. Ramakrishnan, Sr.SC
Mr. Vinod Kumar Yadav, Sr.SO

Applied Science & Biotechnology

Mr. K. Umapathy, Sr.SO
Dr. Bhupinder Singh, Sr.SO

Multidisciplinary Technologies

Dr. Mukul V. Pujara, Sr.SO
Mrs. M. G. Subhasha, Sr.SO
Dr. R. B. Choudhary, Sr.SO

Molecular Biology

Dr. R. Bhattacharjee, Sr.SO

Farm Mechanization

Dr. T. Thippeswamy, Sr.SO
Mr. J. P. Ramakrishnaiah, Sr.SO
Dr. S. M. Dhaka, Sr.SO

Differentiation Biology Laboratory II

Dr. P. Rama Mohana Rao, Sr.SO
Mrs. I. Praveena, Sr.SO
Dr. Basavaraju, Sr.SO
Mr. C. Narasimhaiah, Sr.SO
Dr. P. C. Sandha, Sr.SO

Molecular Biology II

Dr. S. K. Ahmed, Sr.SO
Dr. Virendra Kumar, Sr.SO

Differentiation Pathobiology

Dr. M. Nagaraju Kuruba, Sr.SO
Mrs. A. P. Padma Priya Nagaraju, Sr.SC
Dr. B. Chandrasekharam, Sr.SC

Planning, Technology & Communication

Dr. P. D. Jagat, Sr.SO
Mrs. S. Parameshwari, Sr.SO

Plant Biotechnology

Dr. G. A. Bhatkhande, Sc-D

Dr. Hitesh Purohit, Sc-C

Mr. K. T. Shanmuga, Sc-C

Mr. J. D. Kanjariya Pankaj, Sc-C

Dr. S. V. Bhatt Jayadipsinh, Sc-C

Technology Information Centre (TIC)

Dr. D. B. Bhattacharjee, Sc-C

Dr. P. C. Dave, Sc-C

Marketing

Dr. P. C. Pakhare, Sc-C

Dr. Sangeeta, Sc-C

Mr. K. P. Shivakumar, Sc-C

Marketing Chemicals

Dr. S. G. Sharma, Sc-D

Dr. S. N. Pathak, Sc-C

Mr. Vasant Joshi, Sc-C

Mr. A. D. Dabhi, Sc-C

Dr. Girish Kumar, Sc-C

Dr. P. Bhagya, Sc-C

B. Technical units of CSIR/AU, Bhavnagar

CSIR-5, Navsari

Dr. Jadhav, Sc-E

Dr. M. Bhaskaran, Sc-C

Dr. P. Sachinkumar, Sc-C

Dr. M. Manoharan, Sc-C

Mr. B. J. Prajapati, Sc-C

Dr. P. Karthikeyan, Sc-C

Dr. P. C. Ambikar, Sc-C

Mr. Hanumanthanayaka, Sc-C

CSIR, Bhavnagar

Mr. M. Venkateshwarlu, Sc-C

CSIR, Bhubaneshwar

Dr. S. K. Dasgupta, Sc-E

CSIR, Chandigarh

Mr. Ch. Satya Narayana Raju, Sc-D

Dr. C. Subhash Chandra Bose, Sc-E

Dr. P. Srinivasa Reddy, Sc-C

Mr. M. A. Sivasankar Reddy, Sc-C

Dr. M. Raja Reddy, Sc-C

Mr. M. Chandrasekhar, Sc-C

Dr. B. Shivanker Reddy, Sc-E

CSIR, Hyderabad

Dr. M. Venkateshwarlu, Sc-C

Mr. P. Vijay Kumar, Sc-C

CSIR, N. Delhi

Dr. T. Bhagat, Sc-C

Dr. Jayakumar Vijayaraj, Sc-D

Dept. Chemical Engg.

Dr. M. T. Shivaramaiah, Sc-D

Dr. A. Uma Devi, Sc-B

Dept. Chemistry

Dr. T. S. Balaji Rao Naidu, Sc-E

Dept. Crystallography & Biophysics

Dr. M. M. Kantharaju, Sc-D

Dept. Organic Chemistry

Dr. J. S. Chandrasekhar, Sc-E

Dr. S. Krishnaiah, Sc-D

Dr. C. Ramesh Kumar, Sc-D

Dr. S. Srihari Reddy, Sc-D

Dr. P. Ravinder, Sc-C

Dept. Inorganic & Physical Chemistry

Dr. K. C. Mondal, Sc-D

Dept. Polymers

Dr. V. Jayathirtha Rao, Sc-E

Dr. P. Venkateswara Rao, Sc-E

Dr. K. Mukkanti, Sc-E

Dr. P. Thirupathi Reddy, Sc-E

Dr. M. Sathish, Sc-D

Dr. A. Nagaraju, Sc-D

Dr. P. Muralidhar Reddy, Sc-D

Dr. M. Vijaya Kumar, Sc-D

Dr. K. Ramesh, Sc-D

Dr. P. Ramesh Kumar, Sc-D

Dr. A. Ramesh, Sc-D

Dr. D. N. Kamal Raj, Sc-C

Dr. V. Rajakumar, Sc-C

Dr. R. Anandaraju, Sc-C

Dr. J. Ramakrishna, Sc-C

Dr. S. Ashok Kumar, Sc-B

Dept. Toxicology

Dr. B. Sreedhar, Sc-D

Dr. N. Rama Devi, Sc-C

Dept. Environmental Sciences

Dr. A. Dasaratha Rami Reddy, Sc-D

Dr. T. Anjaneyulu, Sc-C

Dept. Centre for Biotechnology

Dr. A. Murali, Sc-D

Dr. N. Pratibha Devi, Sc-C

Dr. T. Divya Jyothi Lakshmi, Sc-C

Dept. Biological Sciences

Dr. K. Venkateswarlu, Sc-C

Dept. Civil

Dr. M. Vijaya, Sc-D

Dept. Electronics

Dr. B. Prabhakar Rao, Sc-C

Dr. P. Nirmala Kumari, Sc-C

Dept. Metallurgy

Dr. K. Venugopal, Sc-C

Dept. Mechanical

Dr. M. Sreenivasa Rao, Sc-C

Dept. Physics

Dr. K. Sambaiah, Sc-D

Dept. Technology Management

Dr. K. Ravi Reddy, Sc-C

Dept. Technology Transfer

Dr. Vijaya Kumar Kolla, Sc-C

Dept. Technical

Mr. M. Madhava, Sc-D

Mr. K. Suresh, Sc-C

Dept. Technical Services

Mr. P. P. Sasidharan, Sc-E

Dept. Electronics

Mr. R. Gururaj, Sc-D

Mr. K. Rajasekaran, Sc-C

Dept. Finance

Dr. C. V. Ranjana, Sc-C

Dr. B. S. Chandrasekhar, Sc-C

Dept. Hindi

Dr. P. S. Sekhar

Dept. Library & Documentation

Dr. K. Devadas

Dept. Publications

Mr. A. J. Ramadas

Dept. Publication

(Mr. R. D. Gohil)
(Mr. B. Parthasarathi)
(Mr. Parimal Bhatt)
(Mr. D. B. Gajera)
(Mr. Rajesh)
(Dr. P. Ganeshkumar)
(Mr. T. Kumaresan)
(Mr. Chandrakant Bhatt)
(Mr. B. Manna)
(Mr. R. Balakrishnan)

(Mr. Rajesh Rajpara)
(Mr. Kalpesh Ramanlal)
(Mr. Ranvir Singh)
(Mr. Arunkumar)
(Dr. B. K. Kaushika)
(Mr. Pravinbhai)
(Dr. P. Pandey)
(Mr. R. H. Khan)

(Mr. A. Maria Jason)
(Mr. Vijay Kumar Bharti)
(Mr. A. H. Khan)
(Mr. Prajapati)
(Mr. P. Anbazhagan)
(Mr. S. Thyagarajasankar)

(Dr. B. Jayaram)
(Mr. K. Dhanaraj)
(Mr. P. Ganesan)
(Mr. V. Jayaram)
(Mr. B. S. Pagar)
(Mr. R. P. Saxena)

Staff Members as on 31.03.2013

Category	Sanctioned	Filled	Vacant
Scientist	1	1	0
R & D	171	141	34
Technical	188	155	33
Administrative	115	100	20
Supporting	87	71	16
Total	**562**	**468**	**93**

XIV RESEARCH ADVISORY COMMITTEE

The Director,
Central Sericultural Germplasm Resources Centre,
Central Silk Board, P.B. No.44, Thally Road,
Hosur - 635 109, Tamil Nadu

The Director,
Seri Bio Tech Research Laboratory,
CSB Campus, Sarjapur Road,
Carmelaram Post, Kodathi,
Bangalore 560 035

The Director,
Karnataka State Sericulture Research &
Development Institute,
Thalaghattapura, Bangalore - 560 062

The Director,
Andhra Pradesh State Sericulture Research &
Development Institute,
Kirikera, Hindupur-515 211,
Andhra Pradesh

The Director,
Karnataka State Sericulture Research &
Development Institute,
Thalaghattapura, Bangalore - 560 062

The Director,
Andhra Pradesh State Sericulture Research &
Development Institute,
Kirikera, Hindupur-515 211,
Andhra Pradesh

Sri [illegible]
S/o. [illegible]
[illegible] Taluk,
Mandya District

Smt. R. [illegible]
W/o Mr. [illegible]
[illegible] Taluk,
[illegible] Dist. 571 [illegible], Karnataka

Sri [illegible]
S/o. [illegible]
[illegible] P.O.
[illegible]
[illegible] Dist., Andhra Pradesh

Sri [illegible]
S/o. [illegible]
[illegible]
[illegible]
[illegible]
[illegible] Dist., Andhra Pradesh

Sri S. R. [illegible]
S/o. [illegible]
[illegible] P.O. 635 [illegible]
[illegible] Taluk, [illegible] Dist.
Tamil Nadu

Sri M. [illegible]
S/o. [illegible]
[illegible] P.O.
[illegible]
Salem – 636 [illegible]
Tamil Nadu

Address

Officer-in-charge,
Regional Sericultural Research Station
Central Silk Board,
Ministry of Textiles, Govt. of India,
P.B. No. [illegible], [illegible], Anantapur 515 001
Andhra Pradesh

Officer-in-charge,
Regional Sericultural Research Station
Central Silk Board,
Ministry of Textiles, Govt. of India,
[illegible]
Chamarajanagar 571 313, Karnataka.

The Deputy Secretary (Tech.),
Regional Office of Central Silk Board
Ministry of Textiles, Govt. of India,
[illegible]
Mumbai [illegible], Maharashtra

The Deputy Secretary (Tech.),
Regional Office of Central Silk Board
Ministry of Textiles, Govt. of India,
[illegible]
[illegible]
Chennai [illegible], Tamil Nadu

Officer-in-charge,
Regional Sericultural Research Station
Central Silk Board,
Ministry of Textiles, Govt. of India,
[illegible]
Kodathi, Bangalore [illegible]

Officer-in-charge,
Regional Sericultural Research Station
Central Silk Board,
Ministry of Textiles, Govt. of India,
[illegible]
[illegible], Salem [illegible], Tamil Nadu

The Deputy Secretary (Tech.),
Regional Office of Central Silk Board
Ministry of Textiles, [illegible]
[illegible], Hyderabad [illegible], Andhra Pradesh

Details of Review meeting held during the year

Sl. No.	Meeting	Date
1	Research Council (RC)	22nd - 23rd June 2012 4th - 5th December 2012
2	Research Advisory Committee (RAC)	27th - 28th July 2012 22nd - 23rd February 2013
3	Regional Research Advisory Committee (RRAC)	[illegible] at Salem, Tamil Nadu [illegible] at Anantapur [illegible] at Chamarajanagar

XV. TRAINING ATTENDED

Institute/Place	Subject
Central Silk Board, Bangalore	Farmers Training Programme (12.03.2012 to 16.03.2012) Participant: S.J.H.A.S.
Central Silk Board, Bangalore	Training Programme for Quality Promotion Programme (Update) (20.03.2012 to 23.03.2012) Participants: Dakshayani Mahadik, N., Deepika, Jamila Ann, C., Joy Rajkumar Singh, Kamala, C. J., Mallikarjuna, K., Mallikarjuna, K., Ong, S. T., Sasikumar Sajjan, S., Sellam, G. K., Prasad, C. V., Rajasekhar, K., Ram prakash, Sarala, K., Srinivasa, G. C., Srivastava Reddy, R., Sreekantaiah, G., Srinivasa, S. T., Subramanian, M. P., Subramania Reddy, C., Thejeshkumar, T., Thiruvenkatarao, K., Vindhya, G.S.
New Industrial Enterprises Association, New Delhi, programme conducted at Goa	Training For Technical Programme (05.03.2012 to 08.03.2012) Participant: Sharma, C.D.
CSWRI, Mannavi	Silk Reeling (03.01.2012 to 13.01.2012) Participant: Krishna, P. S.

XVI. PARTICIPATION OF SCIENTISTS IN SYMPOSIA/SEMINARS/WORKSHOPS/CONFERENCES

Scientists of the Institute and invited guests were given lectures on the recent advances in R&D in sugar production and participation in the technical and management sessions of the Workshop/Conference by the faculty and others.

a. Workshop/Seminar

Sl. no.	Symposium/Seminar/ Workshop/Conference
1	International Conference on Solid waste management and pollution at HPCB/CTE, Mysore (20.07.2012 to 01.08.2012) **Participants:** Sukumaran, M. K., Sukumaran, K.
2	2nd International Conference on Solid Waste Management organised by Mysore City Corporation, Mysore, Centre for Quality Management System, Jaipur, University, Institute of Environmental Science and Technology Management, Noida and Anjac, Mysore (30.07.2012 to 01.08.2012) **Participant:** Krishna, P.
3	International Conference on Anthropological Impact on the Environment and Conservation Biology at Dept. of Zoology, University of Kerala and Nehru College, Pandit (30.11.2012 to 04.12.2012) **Participants:** Sukumaran, M. K., Sukumaran, K.
4	International Conference on Anthropological Impact on the Environment and Conservation at Dept. of Zoology, Sri Krishnadevaraya University, Tirupati (26.11.2012 to 29.11.2012) **Participants:** Rao Reddy, B., Reddy, G. P., Sreenivasa Reddy, P.
5	International Conference on Biological Invasions and Biodiversity organised by Department of Environmental Science, Pondicherry University (26.09.2012 to 28.09.2012) **Participant:** Rajkumar, S.

c) Seminar

Sl. No.	Symposium/Seminar/ Workshop/Conference
1	Workshop on Biometric Identification and Verification (BIV) System (12-13/03/2013) **Participants:** Ashwath, B. N.; Anil Reddy, N.; Krishna Moorthy, B.; Narasimha Reddy, N.; Siddaramaiah, T.C.; Shankar, S.N.; Sudha, P. S.
2	Collaborative research programme on Indian Rice Breeding on DNA System (01/04/2012 to 31/03/2013) **Participants:** Dayananda, Pavan Kumar, P.; Sandhu, P. S.
3	Workshop on Farm Mechanization and its applications in Horticulture (2012) Bijapur (19-21/2012) **Participants:** Ashwath, S. C.; Babu, A. M.; Babu, C. N.; Balakrishna, P.; Balasubramanyam, M.; Bhagya, P.C.; Chandrashekhara, P.; Chikkanna, L.Gandhi, A. S.; Dasappa, Gopal Krishna, Gandhi Dass, S.; Gangadhar, B.; Gowda, C. S.; Harish Naik, V.; Gunasekhar, V.; Hanumanthappa, Jagadeesh, P. S.; Kantha Reddy, Kalyan, M. S.; Kumar, M. V.; Lakshmanappa, G.; Laxminarayana, V.; Nagendra, V.; Nandeeshappa, S.; Nandish, Gowdru, Nagaraja, H. N.; Narasimhan Reddy, N.; Nagaraja, N. R.; Nataraj, N.; Nayana Kumar, H. R.; Nirmala Kumar, J. B.; Nirmala Begum, A.; Nirmal Kumar, G.; Nirmala Rani, P.; Parameshwara, C.; Prakash Kumar, P.; Purushotham, S.; Qadri, S. M. H.; Rajashekhar, S.; Radhakrishna, V. C.; Raghunath, M. K.; Rajashekara, K.; Ramesh, M.; Rayanagouda M.; Lokajgahi Ravikumarappa, J. D.; Reddy, M. G.; Sandhu, P. S.; Shakti N. Kulkarni; Sabari Kumar, Bilamal, B. D.; Shamsudeen, R. S.; Shankar, M. A.; Shivaprakash, K. N.; Shivanna, B. T.; Sree Rama Murthy, P.; Shivaprakasha, K.; Sudha, S. N.; Sathisha Rao, P.; Surya, A. S.; Thyagaraju, T.; Tulasiram, K.; Venkateshwar Prasad, G.; Vindhya, G. S.; Kumar Sarkar, Vinod Kumar, Yadav, Vipan Kumar, Yadav, Vipan Kumar.
4	Workshop on Biometrics and its applications conducted by Karnataka Comm. (DOPAR) Mysuru (23/11/2012 to 30/11/2012) **Participants:** Babu, C. M.; Balakrishna, P.; Balasubramanyam, H.; Chandrashekhar, M.; Chandrappa, H. K.; Chowdappa, H. G.; Gangadhar, B.; Kalpana, H. R.; Kiran, U.; Krishna Murthy, B.; Kumar, N.; Mogli, P.; Muralidharan Reddy, M.; Nishitha Rao, Y.; Nobin Mammen, M.; Pushpavathi, B.; Rajashekara, H.; Ramesh, N.; Sankar, P. S.; Shankar, M. A.; Shivashankar, K. S.; Shivaprakash, M.; Sreenivasa Murthy, T.; Subaharan, K.; Subramanyam, A.; Sudhakara Reddy, D.; Sudhakar, P.; Thyagaraju, T.; Venkateshwara Rao, M.; Vijayakumar, R.; Kiran Kumar, Nayak Ramesh Yadav, ...
5	Agricultural extension workshop at [Village] Mysuru (21/11/12) **Participants:** Ananda, K. A.; Reddy, A. M.; Chowdary, N. R.; Ashwin Lobo Sudesh, M.; Bhagya, P.; Chikkanna, Gopalaraj, Shankar, S. S.; Gandhi Dass, S.; Gangadhar, B.; Harsha, S. S.; Harish Naik, V.; Hiremath, I.; Jayaram, K. B.; Jayaraman, V.; Jogi, P. S.; Kantha Reddy, Kamalapur, Kalpana, R. S.; Kulkarni, S. B.; Laxminarayana, K.; Mallikarjuna, N.; Nandeesha Murthy, B.; Mary Jessymol, A. V.; Nataraj, N.; Nayana, Manjunathappa, H. R.; Muniswamy Reddy, Nagaraj, B. S.; Nirmala Kumar, A. P.; Narendra Kumar, J. S.; Nirmala Begum, A.; Nitish Kumar, S.; Nobin Mammen, M.; Pallavi, S. N.; Parameshwara, C.; Prashanth Kumar, P. M.; Prithviraj, Lal, B. S.; Purushotham, S.; Radhakrishna, V. C.; Raghunath, M. K.; Rajashekara, S.; Ramesh, M.; Ravindra M. Malligawad, Ravindrachandra, J. P.; Sathisha, G. C.; Sekar Naidu, Shantha, P. C.; Shankar, M. A.; Shivaprakash, K. S.; Shivaprasad, H. S.; Sreenivasa, B. T.; Sudha, V. G.; Surya, A. S.; Tulasiram, T.; Vaidyanath, K.; Vindhya, G. S.; Vinod Kumar; Vinod Kumar Yadav, B.; Vinod Kumar; Vasantha, S.(Dr)
6	Extension harvest-mela organized Bagalkote (07/01/2013) **Participants:** Babu Abdulkhadri, M.; Chikkanna, Chembary, N. B.; Gowda, G. D.; Hariprasad, A. S.; Krishna, G. S.; Srinivasa, B. T.; Gangadhar, P.; Manjula, M. S.; Vasantharaj, M. T.
7	Workshop on Diversified Agricultural Extension Activities for Women Farmers Empowerment through Agricultural Technology Information Centre (ATIC), Central Silk Board, Kataria, Bangalore and Technology Assessment for Rural Development (TARD) at ZRS, Bangalore (28.03.2013) **Participants:** Jahnavi, G.; Jyoti, P. G.; Mallamma, K. L.; Parvathalu, S.; Sandeep, R.; Vijayalakshmi, N.; Sridevi Jayant, J. S.

9	Evaluation of Jatropha & Pongamia in Marginal Lands (14.10.2011) **Participants:** [illegible]
10	National Workshop on Success of Classical Biological Control of Papaya Mealybug in India at NBAII, Bangalore (26.11.2012) **Participants:** Mary Josephine, A.K. ; Ramachandra Gowda, G. B. ; Sudhakara, N. ; Bhaskar, M. A. ; Srinivasa, B. T. ; Vinod Kumar,
11	National consultative Approach of Integrated & Technology to promote agriculture growth with value addition at JK College, Madurai (02.12.2012 to 03.12.2012) **Participants:** Sakthi Devi, S. ; Jeya, M. P. P.
12	Climate change, forest ecosystem and biodiversity – Adaptability and adaptation strategy at Forest Range Office, Dalle Gudi (17.12.2012 to 19.12.2012) **Participants:** Jeya, M. P. P.
13	Farmers Workshop on issue partly organized by NBAII, Karaikkudi (17.01.2013) **Participants:** Jeyaharan, J. ; Rajkumar, M. ; Shivakumaran, N. ; Subramanian, M. R. ; Chinnaraja Rao, P.
14	National symposium on Innovative Agricultural and Marine Technologies for crop production, Food Safety in Environmental Sustainability, Tirunelveli (19.11.2012 to 20.11.2012) **Participants:** Ravikumar, J.
15	Conservation agriculture a solution for resource conservation and mitigation of climate change at CRIDA, Hyderabad (24.05.2013 to 02.10.2013) **Participants:** Radhajeyaraj, R.
16	Lac cultivation in Kolli Hills (Value addition & marketing training at Indian Institute of Natural Resins and Gums, Ranchi (01.11.2013 to 07.11.2013) **Participants:** Krishnamoorthy, K.
17	Evaluation of Jatropha, Bandharuva (14.04.2011) **Participants:** [illegible] - Senthilkumar, M. ; Saravanna Reddy, S. ; Saravana Reddy, N. ; Chandrasekhar, Rao, M.
18	National Skill Development Training Programme for Village Youth Promotion – India at Department of Agriculture, Govt. Degree College, Madurai (24.07.2013 to 07.08.2013) **Participants:** [illegible]
19	National Seminar on "Value Added Agricultural Products for Livelihood Improvement and Sustainable Development" by International Society of Professional Extensionists, ANGRAU, Hyderabad (19.01.2013 to 21.01.2013) **Participants:** [illegible]
20	Consultancy on Biodiversity at Bangalore, Mandya District (19.02.2013) **Participants:** [illegible]
21	National symposium on Plant Physiology Technology for Health Improvement organized by Dept. of Food Science and Nutrition, Periyar University, Salem, Tamil Nadu (09.01.2013 to 10.01.2013) **Participants:** Rajkumar, S.
22	National Seminar on Biotechnological Interventions in Plant and Microbial Improvement for Crop Sustainability organized by Department of Biotechnology, Periyar University, Salem, Tamil Nadu (30.01.2013 to 31.01.2013) **Participants:** Rajkumar, S.
23	Pulse Crop Workshop on Agriculture conducted by Government of Agriculture Department of Tamil Nadu (14.04.2012) **Participants:** Balakrishnan, S.

XVII. SERVICES RENDERED

Analysis of individuals classified under various activities and gainfully [illegible] as per NIC 2008:

Sl. No.	Particulars	Number of workers	Revenue Amount (Rs.)
1	Gold	[illegible]	[illegible]
2	Gold Bonds, etc. (Gold Bonds, Gold Deposit Accounts, Gold Coins, Gold Bars, Jewellery)	20	[illegible]
3	Miscellaneous Services (Services, Business)	4	[illegible]
4	Coal	10	[illegible]
5	Private and Public Limited Companies, Joint Stock Companies	4	[illegible]
6	Water	11	[illegible]
	Total	[illegible]	[illegible]

XVIII. ROYALTY RECEIVED

Name the plant and Royalty received from NRDC, Hyderabad processing of various products / research and commercialised by the institute during 2008-09 and 2009-10 As on date as stated by Controlling Officer are as in Annex.

Sl. No.	For the Year	Reference letter No.	Income (Rs.)	Amount (Rs.)
1	2008-09	No. CSR-3/1 (2) (2) A-NRDC dtd. 15.06.2012	71,000/-	3,20,850.00
2	2009-10	No. CSR-3/1 (2) (2) A-NRDC dtd. 14.06.2012	59,000/-	2,54,611.00

XIX. RIGHT TO INFORMATION ACT 2005 (RTI)

Name of CPIO: Dr. B. M. H. Gowda, Director, CSR&TTI, Mysuru

Sl. No.	Date of Request	Brief of contact address and letter No.
1	14.05.2012	No. CSR-RTI/05/2012 to Dr.[illegible]
2	21.06.2012	No. CSR-RTI/06/2012 to [illegible] dtd. 18.06.2012
3	16.04.2012	No. CSR-RTI/04/2012 to [illegible]
4	10.05.2012	No. CSR-RTI/05-[illegible] dtd. 21.05.2012
5	28.05.2012	No. CSR-RTI/05/2012 to [illegible]
6	19.07.2012	No. CSR-RTI/07/2012 to [illegible]
7	24.07.2012	No. CSR-RTI/07/2012 to [illegible]
8	08.10.2012	No. CSR-RTI/10/2012 to [illegible]
9	12.07.2012	No. CSR-RTI/07/2012 to [illegible]
10	16.07.2012	No. CSR-RTI/07/2012 to [illegible]
11	24.07.2012	No. CSR-RTI/07/2012 to [illegible]
12	22.05.2012	No. CSR-RTI/05/2012 to [illegible]
13	19.05.2012	No. CSR-RTI/05/2012 to [illegible]
14	17.05.2012	No. CSR-RTI/05/2012 to [illegible]
15	19.10.2012	No. CSR-RTI/10/2012 to [illegible]
16	26.10.2012	No. CSR-RTI/10/2012 to [illegible]
17	08.10.2012	No. CSR-RTI/10/2012 to [illegible]
18	25.10.2012	No. CSR-RTI/10/2012 to [illegible]
19	12.01.2013	No. CSR-RTI/01/2013 to [illegible]

XX. LIST OF DIGNITARIES WHO VISITED THE INSTITUTE

Sl. No.	Name of visitor/ signatories	Address	Date of visit
1	Mr. Shrawat [illegible] (IAS)	Collector, [illegible]	11.04.2012
2	Mr. Kamal [illegible] (IAS)	CEO, Zilla Parishad, [illegible]	23.05.2012
3	Mr. R. T. [illegible] (IAS)	Chief Secretary, Govt. of [illegible]	03.06.2012
4	Mr. M. Shivaraj	Member, MPSC, Govt. of India, New Delhi	02.08.2012
5	Dr. K. [illegible],	JAXA, Tsukuba Space Center, Japan	03.08.2012
6	Mr. Koji Yamada	JAXA Research Institute, Tokyo, Japan	03.08.2012
7	Mr. [illegible]	Town Planner, Bicholim, Goa	07.11.2012
8	Mr. K. S. Rama Murthy	Chairman, CSB, Bangalore	21.12.2012

XXI. METEOROLOGICAL DATA

Meteorological Data for the Year 2012

Station : CSIR-NIO, Dona Paula

Month	Temperature (°C)			Humidity (%)			Rainfall (mm)
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	31.50	17.70	24.60	90.00	35.00	62.50	0.00
February	34.00	17.10	25.55	90.00	37.00	63.50	0.00
March	35.00	19.00	27.00	90.00	39.00	64.50	0.00
April	33.00	19.40	27.20	90.00	42.00	66.00	124.00
May	33.00	19.00	27.50	89.00	49.00	69.00	56.00
June	34.00	24.00	28.00	91.00	61.00	76.00	814.00
July	33.00	23.40	28.20	91.00	60.00	75.50	9.00
August	33.00	23.20	28.00	90.00	61.00	75.50	60.00
September	33.00	23.00	28.00	90.00	60.00	75.00	83.00
October	33.00	23.40	28.00	91.00	61.00	76.00	125.00
November	31.00	23.00	27.00	91.00	59.00	75.50	37.00
December	32.00	21.00	27.00	90.00	57.00	73.50	10.00
Jan - Dec	35.00	17.10	27.00	91.00	35.00	69.00	1328.00
Jan - Dec	31.50	17.70	24.60	90.00	57.00	73.50	10.00
						Total for the year	1437.00
						No. of rainy days	16

[illegible], [illegible], [illegible]

Month	Temperature (°C)			Humidity (%)			Rainfall (mm)
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	27.50	17.25	22.4	75.0	51.0	63.0	0.00
February	28.00	18.00	23.0	78.0	58.0	68.0	0.00
March	29.00	19.00	24.0	80.0	60.0	70.0	0.00
April	28.50	18.00	23.2	82.0	62.0	72.0	21.50
May	30.00	20.50	25.2	85.0	65.0	75.0	0.00
June	32.00	22.00	27.0	88.0	67.0	78.0	0.00
July	32.00	23.00	27.5	90.0	70.0	80.0	0.00
August	31.00	22.00	26.5	87.0	69.0	78.0	0.00
September	30.00	21.00	25.5	84.0	66.0	75.0	0.00
October	29.00	20.00	24.5	81.0	63.0	72.0	0.00
November	28.00	19.00	23.5	79.0	61.0	70.0	0.00
December	27.50	18.00	22.8	77.0	59.0	68.0	0.00
Total							21.50

[illegible], [illegible], [illegible]

Month	Temperature (°C)			Humidity (%)			Rainfall (mm)
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	28.40	17.60	23.00	80.00	55.00	68.00	0.00
February	29.10	18.20	23.65	82.00	57.00	69.50	0.00
March	30.00	19.00	24.50	84.00	59.00	71.50	0.00
April	31.20	20.10	25.65	86.00	61.00	73.50	12.40
May	32.50	21.30	26.90	88.00	63.00	75.50	0.00
June	33.80	22.50	28.15	90.00	65.00	77.50	0.00
July	34.00	23.00	28.50	91.00	66.00	78.50	0.00
August	33.50	22.80	28.15	89.00	64.00	76.50	0.00
September	32.00	21.50	26.75	85.00	62.00	73.50	8.60
October	30.50	20.00	25.25	82.00	60.00	71.00	0.00
November	29.20	18.80	24.00	80.00	58.00	69.00	0.00
December	28.60	18.00	23.30	79.00	57.00	68.00	0.00
Total							20.90

[illegible] [illegible], Hill Region

Month	Temperature (°C)			Humidity (%)			Rainfall (mm)
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	32.0	17.0	24.5	95.0	68.0	82.0	0.00
February	35.0	19.0	27.0	92.0	65.0	78.5	0.00
March	38.0	22.0	30.0	90.0	60.0	75.0	12.50
April	40.0	25.0	32.5	85.0	55.0	70.0	45.00
May	41.0	27.0	34.0	82.0	58.0	70.0	0.00
June	38.0	26.0	32.0	88.0	70.0	79.0	210.00
July	34.0	24.0	29.0	95.0	80.0	87.5	650.00
August	33.0	23.0	28.0	96.0	82.0	89.0	720.00
September	34.0	23.0	28.5	93.0	75.0	84.0	310.00
October	33.0	21.0	27.0	90.0	68.0	79.0	95.00
November	29.0	17.0	23.0	88.0	62.0	75.0	25.00
December	26.0	14.0	20.0	91.0	70.0	80.5	0.00
Warm night	41.0	27.0	34.0	95.0	55.0	74.0	1210.00
Entire Year	41.0	14.0	27.0	96.0	55.0	78.0	3260.00

[illegible] [illegible], [illegible]

Month	Temperature (°C)			Humidity (%)			Rainfall (mm)
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	33.00	21.00	27.00	92.00	65.00	78.50	0.00
February	34.00	22.00	28.00	90.00	62.00	76.00	0.00
March	36.00	24.00	30.00	88.00	60.00	74.00	15.00
April	37.00	25.00	31.00	85.00	58.00	71.50	40.00
May	38.00	26.00	32.00	82.00	55.00	68.50	95.00
June	35.00	25.00	30.00	90.00	72.00	81.00	180.00
July	33.00	24.00	28.50	94.00	78.00	86.00	320.00
August	32.00	23.00	27.50	95.00	80.00	87.50	410.00
September	33.00	23.00	28.00	93.00	76.00	84.50	260.00
October	34.00	22.00	28.00	90.00	70.00	80.00	110.00
November	31.00	19.00	25.00	89.00	65.00	77.00	30.00
December	28.00	16.00	22.00	91.00	72.00	81.50	5.00
Warm night	38.00	25.00	31.50	95.00	55.00	75.00	1450.00
Entire Year	38.00	16.00	28.00	96.00	55.00	79.00	3900.00

XXII. PUBLICATIONS

Research papers	A. International journals	11
	B. National journals	03
Popular articles		05
Books		02
Technical/Training manuals		02
Technical reports		01
Issues/hints/details/leaves		09
Extension pamphlets/literature prepared		01
Papers/abstracts presented in seminar/symposia/ conferences	A. International	13
	B. National	07
Others (CDs)		01

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Entrepreneurs trained under the entrepreneurship programme

1. Mr. Ramesh, Kolaikkuttam village, Tamil Nadu
2. Mr. Balasubramanian, Kolaikkuttam village, Tamil Nadu
3. Mr. Ramakrishnan, Kolaikkuttam village, Tamil Nadu
4. Mr. Sundaram, Kolaikkuttam village, Tamil Nadu
5. Mr. Kannan, Kolaikkuttam village, Tamil Nadu
6. Mr. Muthusamy, Kolaikkuttam village, Tamil Nadu
7. Mr. Selvam, Kolaikkuttam village, Tamil Nadu
8. Mr. Rajendran, Kolaikkuttam village, Tamil Nadu
9. Mr. Velayutham, Kolaikkuttam village, Tamil Nadu
10. Mr. Subramanian, Kolaikkuttam village, Tamil Nadu
11. Mr. Natarajan, Kolaikkuttam village, Tamil Nadu
12. Mr. Palaniappan, Kolaikkuttam village, Tamil Nadu
13. Mr. Karuppiah, Kolaikkuttam village, Tamil Nadu
14. Mr. Annamalai, Kolaikkuttam village, Tamil Nadu
15. Mr. Thangavel, Kolaikkuttam village, Tamil Nadu
16. Mr. Ramasamy, Kolaikkuttam village, Tamil Nadu
17. Mr. Kandasamy, Kolaikkuttam village, Tamil Nadu
18. Mr. Perumal, Kolaikkuttam village, Tamil Nadu
19. Mr. Sivakumar, Kolaikkuttam village, Tamil Nadu
20. Mr. Vijayakumar, Kolaikkuttam village, Tamil Nadu
21. Mr. Ganesan, Kolaikkuttam village, Tamil Nadu
22. Mr. Murugesan, Kolaikkuttam village, Tamil Nadu
23. Mr. Rajagopal, Kolaikkuttam village, Tamil Nadu
24. Mr. Subramaniam, Kolaikkuttam village, Tamil Nadu
25. Mr. Natarajan, Kolaikkuttam village, Tamil Nadu
26. Mr. Ramalingam, Kolaikkuttam village, Tamil Nadu
27. Mr. Sundaram, Kolaikkuttam village, Tamil Nadu
28. Mr. Kannappan, Kolaikkuttam village, Tamil Nadu
29. Mr. Muthusamy, Kolaikkuttam village, Tamil Nadu
30. Mr. Selvaraj, Kolaikkuttam village, Tamil Nadu
31. Mr. Rajendran, Kolaikkuttam village, Tamil Nadu
32. Mr. Velayutham, Kolaikkuttam village, Tamil Nadu
33. Mr. Subramanian, Kolaikkuttam village, Tamil Nadu
34. Mr. Natarajan, Kolaikkuttam village, Tamil Nadu
35. Mr. Palaniappan, Kolaikkuttam village, Tamil Nadu
36. Mr. Karuppiah, Kolaikkuttam village, Tamil Nadu
37. Mr. Annamalai, Kolaikkuttam village, Tamil Nadu
38. Mr. Thangavel, Kolaikkuttam village, Tamil Nadu
39. Mr. Ramasamy, Kolaikkuttam village, Tamil Nadu
40. Mr. Kandasamy, Kolaikkuttam village, Tamil Nadu
41. Mr. Perumal, Kolaikkuttam village, Tamil Nadu

11. Management strategies of Fusarium wilt disease in mulberry (A. Farooq)
12. Insect resistance in mulberry (M. Sakthi)
13. Crop irrigation system in mulberry (P. Geetha)
14. Control of gall midge in mulberry (M. Sakthi)
15. Perspectives in silkworm Bombyx mori (V. Makeshkumar)
16. Studies on the management of spike and leaf disease in Tasar
17. Rearing of silkworm in open-top chamber (M. Sakthi)
18. Mulberry resistance to chemical and radioactive (P. Geetha)
19. Pupal parasitoid of silkworm
20. Resistant varieties against pebrine disease (P. Geetha)

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2. Kalyan, R. S. and V. N. Patil (2012) Shahtoot upjivanvidhi mein sharirik prabhavkaryon ka pragnikaran pp. 9-11.
3. Gadhi, S. M. H. and B. Ashok Kumar (2011) Central Silkworm Seed Technology – Ek avalokan pp. 1-8.
4. Sudhir Verma (2012) Shahtoon rakshak dhaulidhar rasi prabhavkaari – Anumodakta evam nashil kaarakatayen pp. 45-48.
5. Sharma, S. K. (2012) Sericultural in Agricultural Agricultural, pp. 13-21.
6. Sharma, S. K. and Reddy, S. S. (2012) Reshem udyog pradhikaran evam vaidhanik paramarsh, pp.41-52.
7. Sharma, S. D., Sahasrabuddhe Ashish, M., Narasimha Prasad, A. R. and Chandrashekaran, S. (2012) Reshem kiron evam unka sahitya parichayatmak, pp.27-37.
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1. Sudha, B. M. N., Kavitha, G. S. and Gadi, S. M. N. (2013) Citizen Report Cards to analyze women empowerment in the Amazing, pp. 201

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BSF - Basic Seed Farm (1)	RSRS- Regional Sericultural Research Station (4)
CDC - Cluster Development Centre (21)	Sub Unit of RSC (28)
CPC - Cluster Promotion Centre (1)	SSRS- Seed Multiplication & Research Station (1)
RSC - Research Extension Centre (19)	

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