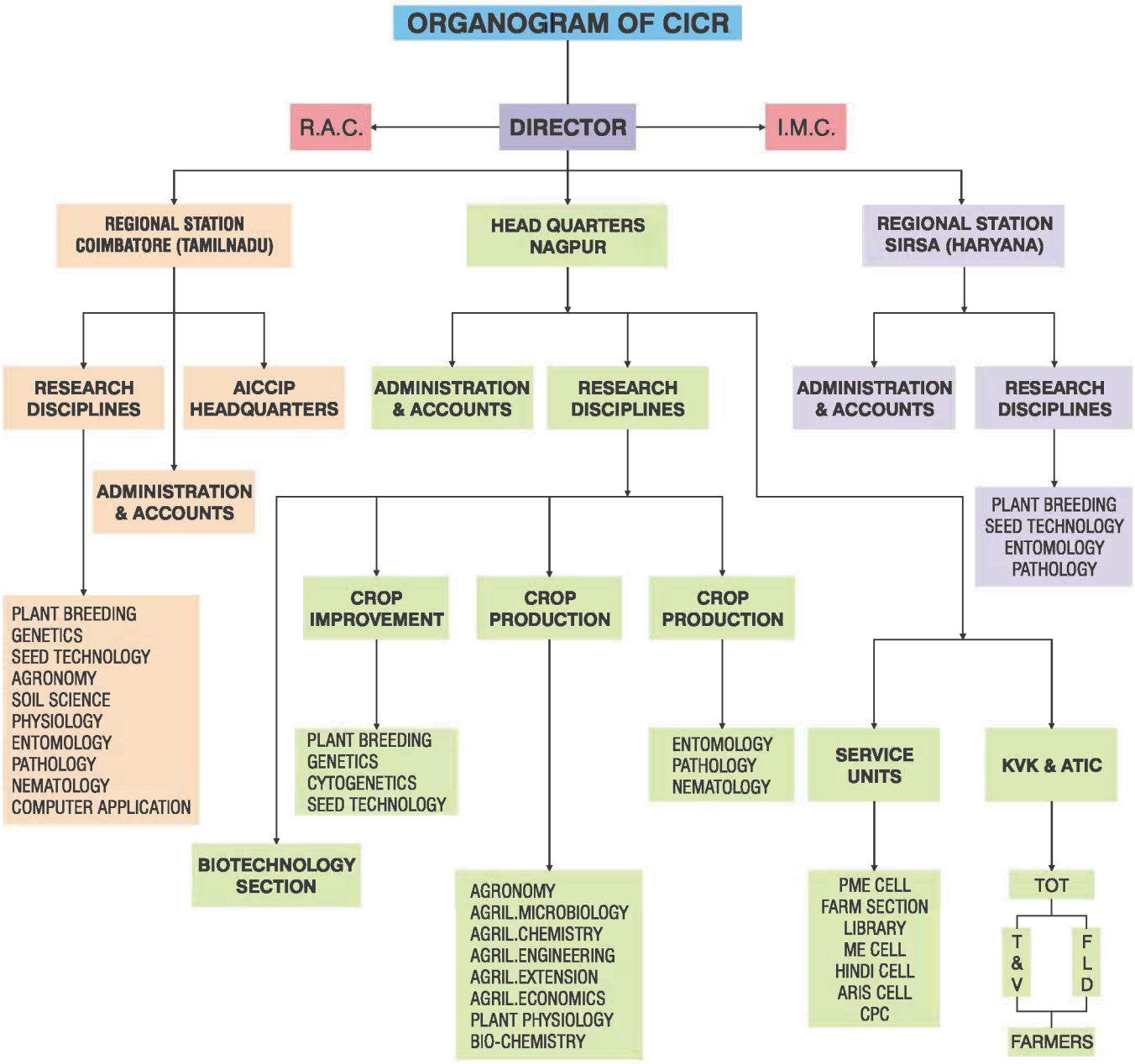
2. Introduction

2.1 : Brief History

- The Central Institute for Cotton Research was established at Nagpur by the ICAR, in 1976. The two regional stations of IARI at Sirsa (Haryana) and Coimbatore (Tamil Nadu) were transferred to CICR to cater to the needs of north and south India, respectively.

2.2 : Mandate

- To conduct basic and strategic research on cotton to improve yield, fibre quality and by-products.
- To create new genetic variability for location-specific adoption in cotton-based cropping systems.
- To assist in the transfer of modern cotton production technology to various user agencies.
- To extend consultancy and linkage with international agencies to accomplish the above mandate.



2.3: Production, Process and Technologies Developed during last five years

- Twenty-eight (28) genetic stocks (G. hirsutum – 22 and G. arboreum – 6) have been registered with NBPGR, New Delhi for their unique, novel economically/ commercially useful and distinct characteristics.
- Six high yielding cotton varieties / hybrids resistant to biotic and abiotic stresses with improved fibre qualities were released.

Sr. No.	Varieties/ Hybrids	Year of release	Spinning potential (counts)	Area of adaptability	Special qualities
	G. hirsutum				
1	CCH 510-4 (Suraj)	2008	60s	Irrigated : South & Central zone.	Superior fibre quality and tolerant to jassids
2	CNHO12 (Saraswati)	2009	20s	Central zone	Dwarf stature, early maturity, high seed oil content with synchronous boll bursting
	G. arboreum				
3	CISA 614	2010		North zone	Superior fibre quality
4	CNA 1003 (Roja)	2011	20s	Rainfed: South Zone	Medium to long staple cotton variety comparable to upland genotypes for seed cotton yield and fibre quality
	Intra-specific hybrid (Intra *hirsutum*)				
5	CSHH 243	2007	50s	Irrigated areas of north zone.	CLCuV resistant. (2420 CSP value at 50s counts, 2088 at 60s counts)
6	CSHG 1862	2011	40s	Irrigated areas of north zone.	A GMS based hybrid

- **Strategy for hybrid development :** A Thermosensitive Genetic Male sterile line (TGMS 1-1) was identified and characterized in desi cotton (G. arboreum). It produces completely male fertile flowers at minimum temperature of less than 18°C and produces completely male sterile flowers at minimum temperature more than 24°C with continuous good sunshine. Complete male sterility could be obtained only during summer flowering (i.e. month of May) for consecutive four years. This line could be successfully employed for hybrid seed production in summer with 30% boll setting efficiency.
- **Gene constructs developed and gene sequences catalogued**

  Two inverted repeat generating plasmids and five hair-pin constructs for RNAi mediated targeting of CLCuV in transgenic cotton were developed and catalogued in Gene Bank .

  Pollen tube pathway transformation was developed for direct gene transfer into cotton plants. The process is under validation.

  To silence gossypol biosynthesis in cotton seed through RNA interference, RNAi construct was generated for target gene coding for δ Cadinene synthase under seed specific promoter.
- **Site specific nutrient management (SSNM) for rainfed cotton :** This approach taking into account indigenous nutrient supply and crop demand was found to be better than the blanket recommendation of N-P-K.
- Reduced tillage system for cotton varieties was developed. The technology comprises use of pre-plant herbicide application followed by one pass of a harrow and 1-2 inter row cultivation with 1 hand weeding to control late emerging weeds. The Bt systems improved soil organic C and yielded equal to or better than the conventional till system.
- For rainfed Bt cotton hybrids grown at wider row spacing growing a green manure cover crop in the inter row space followed by surface mulching resulted in a saving of 20 kg/ha of fertilizer N and gave significantly higher yields.
- Several innovative cropping systems were evaluated and the most remunerative ones were identified. For the central zone, cotton + Cow pea, Cotton + Green Gram (1:3), Cotton + Marigold (8:2) and Cotton + Raddish (1:1) were identified.
- Nutrient use efficiency under rained conditions can be improved when cotton is grown with soil moisture conserving practices such as Broad bed furrow (BBF) and ridge furrow (RF) and application of

recommended fertilizers.

- **Strategies to control leaf reddening were developed :** (i) spraying with acephate and (ii) foliar nutrient sprays of urea (2.3%), DAP (2%), (iii) Cultivating genotypes tolerant to reddening.
- Cotton varieties most suitable for organic systems were identified. Among the G. hirsutum cultivars, NH-615 was the highest yielding followed by PKV-081 and Suraj. JLA-794 was the best yielding desi cotton genotype followed by CAN-347.
- Effective weed control can be achieved by application of a pre-emergence herbicide (Pendimethalin @1 kg a.i./ha) and early post-emergence herbicide (pyrilhiolac Na @ 70 g a.i./ha).
- 67 lines having high epicuticular wax content (93-283 μ/cm^2)were identified from 7185 germplasm lines that could be tolerant to drought and sucking pests.
- A new cultivation technique of growing cotton under polyethylene mulching and raising of zero tilled rotation maize was standardized. The new method saves 40% irrigation water compared with conventional irrigation and up to 85% when combined with drip. There is no need for separate weed control and the technique enhances yield of cotton. This technology is economically feasible in irrigated condition particularly for seed production. The polyfilm recommended has 30 micron and is classified category of recyclable plastics and hence does not cause any environmental problem.
- Bio-inoculants viz., Azospirillum, PSB and Pink Pigmented Facultative Methylotrophs (PPFM) were isolated from various cotton ecosystems and all the bio inoculants were compatible with each other and improved the vigour index of cotton. The sulphur oxidation property of PPFM was reported for the first time in India.
- A novel approach of exhausting weed seed bank before the crop emergence by stale seed bed (SSBT) approach was standardized for cotton and cotton based intercropping system. Stale seed bed technique (SSBT) using a mixture of pendimethalin 1.0 kg + glyphosate 1.0 kg one week after irrigation (one week before sowing) recorded the highest weed control efficiency of 86.6% at 35- 45 DAS with the highest net return and B:C ratio .
- Low cost drip system was developed which produced yields equivalent to 96.7% of existing drip system and could save 41.8% of irrigation water in comparison to ridge-furrow method of irrigation. Water use efficiency of 49.6 kg/ha-cm was calculated as compared to 35.6 kg/ha-cm with ridge-furrow method of irrigation. The cost of low cost (polytube) drip system are respectively of Rs. 31,252, per hectare and this was cheaper by 57.8 % in comparison to the conventional drip system (Rs 74,080/-).
- A novel solar operated knapsack sprayer was developed tested and modified which has a field capacity of 4 hrs/ha. The weight of the sprayer without pesticide is 9 kg, with a swath of 90 cm giving 20 sprays with single charge.
- A Herbicide Wick Applicator was developed to smear the weeds with herbicide solution in between the rows of cotton plants. This was developed especially for HDPS system. The wick applicator was tested in the laboratory and calibrated in field. The field capacity of wick applicator was found to be 100 lit./ha. to 550 lit./ha. which could be changed depending upon the density and age of weeds.
- Set of improved implements for small and marginal cotton farmers, e.g. Adjustable Blade Hoe, Adjustable Ridger, Bund former.
- Mealy Quit' bio originated insecticidal formulation against mealybug has been developed. Mealy Quit has been tested at 9 locations of India. The formulation has been found effective against mealybug P. solenopsis under field conditions.
- Based on the volatiles released during the signal transduction pathway in cotton, Mealy Kill 50 EC was developed and validated for its use on sucking pests of cotton and mealy bugs. It effected control of mealybugs and whiteflies by dissolving the waxy coating and making the pests vulnerable to biotic and abiotic factors. The formulation is also effective against jassid, nymphs and aphids. Mealy Kill 50Ec has been formulated using a natural emulsifier 5% soap nut extract thus making it compatible for organic systems.
- Protocol for multiplication of P. solenopsis and its biological control agents *viz.*, Aenasius bambawalei, Cryptolaemus montrouzieri has been developed. A simple protocol for studying biology of P. solenopsis under lab conditions has been developed.
- Low cost insect cage made up of PVC pipe and muslin cloth has been designed to conduct laboratory bioassay on insect on live cotton plant. The cage is light in weight (Appx. 500 gm), easy to assemble and dismantle by ordinary man, easy to pack and transport, raw material locally available, can be secure and store in little space when not in use, longevity more than 3 years with proper use, can be pop up inside cage while working with the insects on live plant with the help of 30 inch long zip.
- A new sampling technique for mirids has been

devised and optimum sample size established for field population estimates of mirid, Campylomma livida in cotton + pigeon pea cropping system in the central zone and Creontiades biseratense in cotton + pulse – maize cropping system in South zone.

- An artificial diet for sucking pests has been developed. It is ready to use, and can support nymphs and adults throughout the period of bioassay. The diet needs to be stored at 4°C and needs to be changed every alternate day. The diet has been validated across labs (Coimbatore, for jassids and Sirsa for whiteflies). This technology is for use by researchers.
- Primers have been designed for amplification of the coat protein gene of the virus causing CLCDV. PCR conditions have been standardized. The PCR protocol can be used in cotton as well as in chickpea before the manifestation of symptoms in the field.
- A monophasic diet of cotton seed flour was developed for rearing of pink bollworm in the lab. Larvae were reared from neonates till pupation on a single diet. There were no aberrations in the emergence of the adults or in their mating and fecundity.
- BT Quant, Lectin Quant are ELISA plates developed at CICR to quantify Bt toxins and lectins respectively. These plates have a shelf life of 6months when stored at 4°C.
- Ready-to-use PCR kit was developed for detection of Xanthomonas malvacearum. Pathovar-specific diagnostic PCR kit detects this pathogen in seeds and other sources. Useful for Plant quarantine stations, Plant Protection agencies, Scientists and researchers in Agril Universities and Private seed Companies.
- Protocol for the management of cotton stem weevil in Tamil Nadu was developed by integrating the cultural, botanical and chemical control strategies and demonstrated at the farmers fields. The protocol was also disseminated to farmers through State Department of Agriculture.
- Till date, seven technologies have been commercialized and patented and nine technologies are under the process of patenting and commercialization.
- The total resource generated up to March 2013 through the commercialization of the technologies was Rs. 1,96,65,254.

2.4 : Staff Position (as on 31st March, 2013)

Name of the Post	Sanctioned Cadre Strength				Post Filled Up			
	NGP	CBE	Sirsa	Total	NGP	CBE	Sirsa	Total
Director (RMP)	1	--	--	1	1	--	--	1
P.C. (Cotton) & Head	--	1	--	1	--	1	--	1
Scientific	51	20	8	79	33	14	6	53
Technical	46	16	10	72	39	12	8	59
Administrative	34	9	5	48	28	7	5	40
Supporting	43	17	10	70	37	11	10	58
Krishi Vigyan Kendra								
Training Organizer	1	--	--	1	1	--	--	1
Technical	11	--	--	11	10	--	--	10
Administrative	2	--	--	2	2	--	--	2
Supporting	2	--	--	2	1	--	--	1

NGP – Nagpur; CBE - Coimbatore

2.5 : Financial Statement

The budget grant and actual expenditure for the year 2012-13 are furnished below : **(Rs. in Lakhs)**

S. No.	Scheme	Sanctioned	Expenditure
CICR			
1	Plan	200.00	185.81
2	Non-Plan	2390.09	2439.32
Plan Schemes		1634.83	1623.05
NAIP Plan Schemes		48.78	30.65
Deposit Schemes funded by outside agencies		567.16	295.32