RECOMMENDATIONS OF THE SUB-COMMITTEE ON BT COTTON AND RELATED ISSUES CONSTITUTED BY MINISTRY OF ENVIRONMENT & FORESTS UNDER THE CHAIRMANSHIP OF DR S NAGARAJAN, DIRECTOR IARI, NEW DELHI.

Interested Parties/Individuals are invited to give their comments on the recommendation by 31st December 2005.

12th December 2005
Ministry of Environment and Forests
New Delhi

The views/recommendation are solely that of the Sub-Committee and not that of Ministry of environment and Forests or the Genetic Engineering Approval Committee.

Recommendations of the Sub-Committee on Bt cotton and related issues.

1.0 In accordance with the decision taken in the 56th meeting of the GEAC, MoEF had constituted a Sub-Committee under the chairmanship of Dr. S. Nagarajan Director IARI to look into the existing processes, protocols for large scale trials and other related issues to Bt Cotton and give recommendation for rationalization of the same.

2.0 The Composition of the Sub-Committee is as follows: -

i. Dr. S. Nagarajan*, Director, Director IARI, Pusa. N. Delhi. - Chairman
ii. Dr B.M. Khadi, Director, Central Institute for Cotton Research, Nagpur.
iii. Dr. T.V. Ramanaiah, Director, Department of Biotechnology.
iv. Dr. T. P. Rajendran, ADG, ICAR, New Delhi.
v. Dr. B.S. Dhillon, Director NBPGRI. (Scientist with Background of Bio-Statistics nominated by Chairman).
vi. Dr. S. Srinivasan Director CIRCOT, Mumbai.(co-opted Member)
vii Dr. Ranjini Warrier, Member Secretary GEAC. - Member Secretary

** Presently, Chairman, Protection of Plant Varieties and Farmer's Rights Authority*

3.0 The Committee has made the following recommendations in respect of:

a. Number of locations for LST.

1. The number of LST trials from the present requirement of 80 per zone has been optimized as given below.

Table 1 Number of locations for LST of hybrid Bt cotton

Cotton hybrids*	**Zones** /Locations***		
	Southern	**Central**	**Northern**
H x B	10	10	-
a x a	20	30	15
H x H	40	60	40
h x a	10	30	-

**H hirsutum; B barbadance; h herbaceum; a arborium*

*** To be optimally divided between irrigated, rain-fed and suppressive soils (the trial may also accommodate both normal sown and late sown conditions)*

**** The number of locations has been reduced taking into consideration the area under cotton cultivation in each zone and type of hybrids grown in the region.*

This rationalization and significantly reduced number of LST will cut down the work load in generating data, time and man power needed and thus will permit even smaller seed companies reap the benefit of Bt technology. This will permit more number of Bt cotton hybrids come for official testing. This reduced expenditure in developing better Bt cotton hybrids would reduce the cost of Bt cotton seed and may reduce illegal Bt cotton growing.

b. Parameters to be monitored during LST.

1. The LST field data book has been designed consisting of part A, B & C. This would substantially simplify collection and analysis of pest-dynamics information and that of natural enemies of boll worm in part A; plant morphology and yield related information in part B and fiber/seed oil quality or industrial application in part C *(Refer Annexure-I)*

c. Number of years for LST*.

1. The LST design and information on planting details are given in yield book. AICCIP recommended fertilizer dose should be adopted. When the GEAC cleared Bt gene is used in a CVRC released hybrid background to develop a new Bt cotton hybrid (para 3.15.1) then one year of LST is enough (Figure 1).

Para 3.15.1 is reproduced below:-

New variant of a safe gene in CVRC released hybrid:

A given Bt gene family can have number of variants within it and this may not drastically change the insecticidal protein and altogether alter the manner it controls the target pest. There are several variants within generic Cry 1Ac and are designated using subscripts as Cry 1Ac-1; Cry 1Ac-2 etc. This indicates that these are variants of Cry 1Ac but do not have complete DNA homology, but do have some base pair differences and hence may have some variation in the protein system. Such micro variants put together form the family and

they need one year of LST if the Bt variant is in the background of a CVRC notified hybrid.

2. For GEAC cleared Bt gene (para 13.15.2) but parked in a new hybrid/variety back ground or new inter specific hybrid background, one year of LST are suggested (Figure-2). Para 3.15.2 is reproduced below:-

GEAC cleared Bt gene in new hybrids:

If the GEAC cleared Bt gene or its variant is used to develop a Bt cotton hybrid using a non CVRC notified hybrid as the basis, there all two years of ICAR trials and one year of LST is needed. It is because the public and research system never had an opportunity to asses the performance stability of the material and so needs a two year testing to assess it properly.

3. When a new variant of the GEAC approved Bt gene, that has completed biosafety and other related tests and is comparable to the GEAC cleared Bt gene for the insectical protein properties, and is developed as a Bt cotton hybrid in a CVRC released background, then one year of LST is adequate (Figure 1).

4. For all other conditions* two years of LST is recommended, namely for a altogether new crop hybrid say H x B; a x a; h x a or totally new gene or when a non CVRC approved background is used (Figure 3).

**This category includes pyramided as well as fused genes.*

Based on the above recommendations, the period of LST is summarized below:

Material	***Bt gene***				
	GEAC cleared Bt gene	*Variant of the GEAC cleared Bt gene*	*New Bt gene/not cleared by GEAC*	*Pyramided genes*	*Fused gene(s)*
CVRC approved Hybrid	*One year*	*One year*	*Two years*	*Two years*	*Two years*
Not put up to CVRC or not approved by CVRC	*one year*	*one year*	*Two years*	*Two years*	*Two years*

** As per the prevailing practice, for CVRC notified variety/hybrid containing GEAC approved transgene, one year of LST is necessary; for non-CVRC notified variety/hybrid containing GEAC approved transgene, one to two years of LST based on merit of the case and for CVRC and non-CVRC notified varieties containing new gene including fusion or pyramided two years of LST is mandatory.*

d. The stage at which seed production should be permitted.

1. The best genotype should be sent to ICAR trial on the basis of performance in the MLT assessed by MEC/GEAC. Simultaneously the LST and other seed production requirements can be approved in one go. For seed production approval of 100 hectares for each case is recommended.

2. For situations when two years of LST/ICAR are essential then for the first year seed production 10 hectares and during second year LST/ICAR trial 100 hectares can be given.

e. The stage at which the Bt cotton hybrid should enter ICAR trials.

1. After the MLT data is evaluated by MEC and recommended to RCGM/GEAC, the GEAC can permit the performing entry for ICAR/LST/Seed Production. The number of years of test in this box will depend where the material falls in the above listed grouping (Figure 1, 2).

f. Other recommendations

1. Identifying the Designated Officer (DO) in the SAU to monitor the MLT/LST falling in their jurisdiction is suggested. There can be a fee levied for this purpose to meet out the cost of service extended by the SAU.

2. One copy of all MLT/LST field data record, properly bound should be submitted to the concerned DO of the SAU by the agency that tests their produce apart from sending it to the Member Secretary of the MEC.

4.0 The recommendations of the sub-committee to the GEAC/MoEF to be operatIonalized from the time it is adopted.

5.0 Annexure

The following Annexure are attached:-

Annexure I: - The LST field data book containing part A, B & C as mentioned in **b** above.

Annexure II: **Figure 1:** Flow Diagram on the recommended Protocol for Released Event/Gene in CVRC notified hybrids/varieties.

Annexure III: **Figure-2:** Flow Diagram on the recommended Protocol for New hybrids/variety with released Event/Gene;

Annexure IV: ***Figure-3:*** *Flow Diagram on the recommended Protocol for (i) CVRC released hybrid/variety with new gene and (ii) New hybrid /variety with new gene.*

****

All information provided in italics has been added as an explanatory note for further clarification:

FIELD NOTE BOOK

Field note Book*

crop year
Date of sowing
Date of harvest

LST size	Below 0.5h trials
Sub-plot size	15x25m three or more
Plot size	(15x25m)*3 or n, n = number of candidates + commercial Bt – hybrid + commercial hybrid if any or another released Bt. cotton
Space between plant to plant	60-90 cm (depending on the genotype)
Space between row to row	90-120 cm (")
Space between replication	2 m
Quadrat comprises of four plants	(two each of adjacent rows)
Row length (m)	(25 m)
Row width (m)	(15 m)
Space between experimental area and refuge/border	2 m

cotton plant ⟶ • • | line
• • |
- row -

Data to be monitored on three fixed quadrats in each sub-plot. All observation related to pest predator noted on this. Each quadrat should be atleast 3 metres apart from one another and from the border

Specifications on entries

Bt cotton tests hybrids

Analogues non-Bt cotton hybrids (wherever available)

Specifications on checks

Recently released Bt cotton as check (zone wise)

Regional (non Bt cotton hybrid of the zone)

No. of locations

North - |
Central - | refer para 3 (a) of recommendation in the text
South - |

*retain one copy and send the second copy to the Head, Department of Plant Breeding of the SAU where the trial is located

Yield Data Book

Part – A. Pest-predator dynamics

Table A-1 : Summary of Larval Counts of Bollworm complex including Spodoptera in LST

Sl. No.	Hybrid	Larval count (larvae / plt - mean 50 plts / entry) at 60,75, 90.105,120 & 135 DAS																					
		Spotted Bollworm						American Bollworm						Pink Bollworm						Spodoptera			
		60	90	120	135			60	90	120	135			60	90	120	135			60	90	120	135
`	Quadrat 1_____(Locations _____)																						
1																							
2																							
3																							
4																							
a																							
b																							
c																							
	Quadrat 2_____(Locations _____)																						
1																							
2																							
3																							
4																							
a																							
b																							
c																							
	Quadrat 3_____(Locations _____)																						
1																							
2																							
3																							
4																							
a																							
b																							
c																							
	Mean : _____(Locations _____)																						
1																							
2																							
3																							
4																							
a																							
b																							
c																							

Table A-2: Summary of damage in fruiting bodies, Open boll & Locule over____locations_____Zone

Sl. No.	Hybrid	Damage (%) per quadrat: Fruiting bodies 60	90	120	135	Open boll	Locule
`	Quadrat 1 : _____(Locations _____)						
1							
2							
3							
4							
a							
b							
c							
	Quadrat 2 : _____(Locations _____)						
1							
2							
3							
4							
a							
b							
c							
	Quadrat 3 : _____(Locations _____)						
1							
2							
3							
4							
a							
b							
c							
	Mean _____(Locations _____)						
1							
2							
3							
4							
a							
b							
c							

Table A-3: Summary of Sucking Pest Population of G.M. cotton hybrids & checks over ___locations_____Zone

Sl. No.	Hybrid	Sucking Pests/per quadrat																				
		Aphid					Jassid					Thrip					Whitefly				
			60	90	120	135		60	90	120	135		60	90	120	135		60	90	120	135
`	Quadrat 1_____(Locations _____)																				
1																					
2																					
3																					
4																					
a																					
b																					
c																					
	Quadrat 2_____(Locations _____)																				
1																					
2																					
3																					
4																					
a																					
b																					
c																					
	Quadrat 3_____(Locations _____)																				
1																					
2																					
3																					
4																					
a																					
b																					
c																					
	Zone : _____(Locations _____)																				
1	**Mean**																				
2																					
3																					
4																					
a																					
b																					
c																					

Table A-4: Summary of Beneficial Insect Population of G.M. cotton hybrids & checks

Sl. No.	Hybrid	Beneficial Insects																					
		Candidate Bt						Second Bt						Bt. Check						Hybrid			
		60	90		120	135		60	90		120	135		60	90		120	135		60	90		120	135
`	_____(Locations _____)																							
1	Quadrat 1																							
2	Coccinellids																							
3	Chrysopa																							
4	Syrphids																							
a	Spider																							
b																								
c																								
	_____(Locations _____)																							
1	Quadrat 2																							
2																								
3																								
4																								
a																								
b																								
c																								
	_____(Locations _____)																							
1	Quadrat 3																							
2																								
3																								
4																								

Table A-5: Summary of Viral, bacterial & fungal diseases incidence of G.M. cotton hybrids & checks over _____Zone

Sl. No.	Hybrid	Incidence (%) (DAS)																	
		Cotton Leaf Curl Virus				Bacterial Blight				Wilt				Any other (Specify)					
		60	90	120	135	60	90	120	135	60	90	120	135	60	90	120	135		
`	Quadrat 1_____(Locations _____)																		
1	Bt Cotton A																		
2	Bt Cotton B																		
3	Non Bt Check of A																		
4	Non Bt Check of B																		
a	Hybrid																		
b																			
c	_____																		
	Quadrat 2_____(Locations _____)																		
1																			
2																			
3																			
4																			
a																			
b																			
c	_____																		
	Quadrat 3_____(Locations _____)																		
1																			
2																			
3																			
4																			

Yield Data Book

Part – B. Yield data

Field note Book - B

Location
Code - SZ/LST/8-2005k

Table B-1: LST agronomic traits of G.M. cotton hybrids & checks

Sl. No.	Hybrid test material	Germination (%)	Plants/ plot	Bolls/ plant	Boll Weight (g)	Sympodia/ plant	Monopodia/ plant	Plant Height (cm)	Days to 50% flowering	Bartlett's Index	Seed Cotton Yield (Qtl/ha)	Seed Cotton Yield % over best check	Lint Yield (Qtl/ha)
	________________(Locations ________)												
1													
2													
3													
4													
a													
b													
c													
	________________(Locations ________)												
1													
2													
3													
4													
a													
b													
c													
	________________(Locations ________)												
1													
2													
3													
4													
a													
b													
c													
	________________(Locations ________)												
1													
2													
3													
4													
a													
b													
c													

Field note Book - B

Table B-2: Summary of Bartlett's Index & Picking wise Yield of G. M. Cotton Hybrid and check.

Sl. No.	Hybrid	Date of sowing	Seed Cotton Yield - Kg / picking (P) (DAS)							Total Yield (Qtl/ha)	Bart-lett's Index
			I 120	II 135	III 150	IV 165	V 180	VI (final) >180	Total (Kg)		
	Entry 1: _____(Locations _____)										
1											
2											
3											
4											
a											
b											
c											
	Entry 2: _____(Locations _____)										
1											
2											
3											
4											
a											
b											
c											
	Entry 3: _____(Locations _____)										
1											
2											
3											
4											
a											
b											
c											
	Entry 4:_____(Locations _____)										
1											
2											
3											
4											
a	Mean										
b											
c											
	Bartlett's Index (B.I.) =		(6 x I P + 5 x II P + 4 x III P + 3 x IV P + 2 x V P + 1 x VI P)								

Yield Data Book

Part-C. Fiber and oil details

(see text for sample size and authentic laboratory

for testing on payment basis)

Field note Book - C

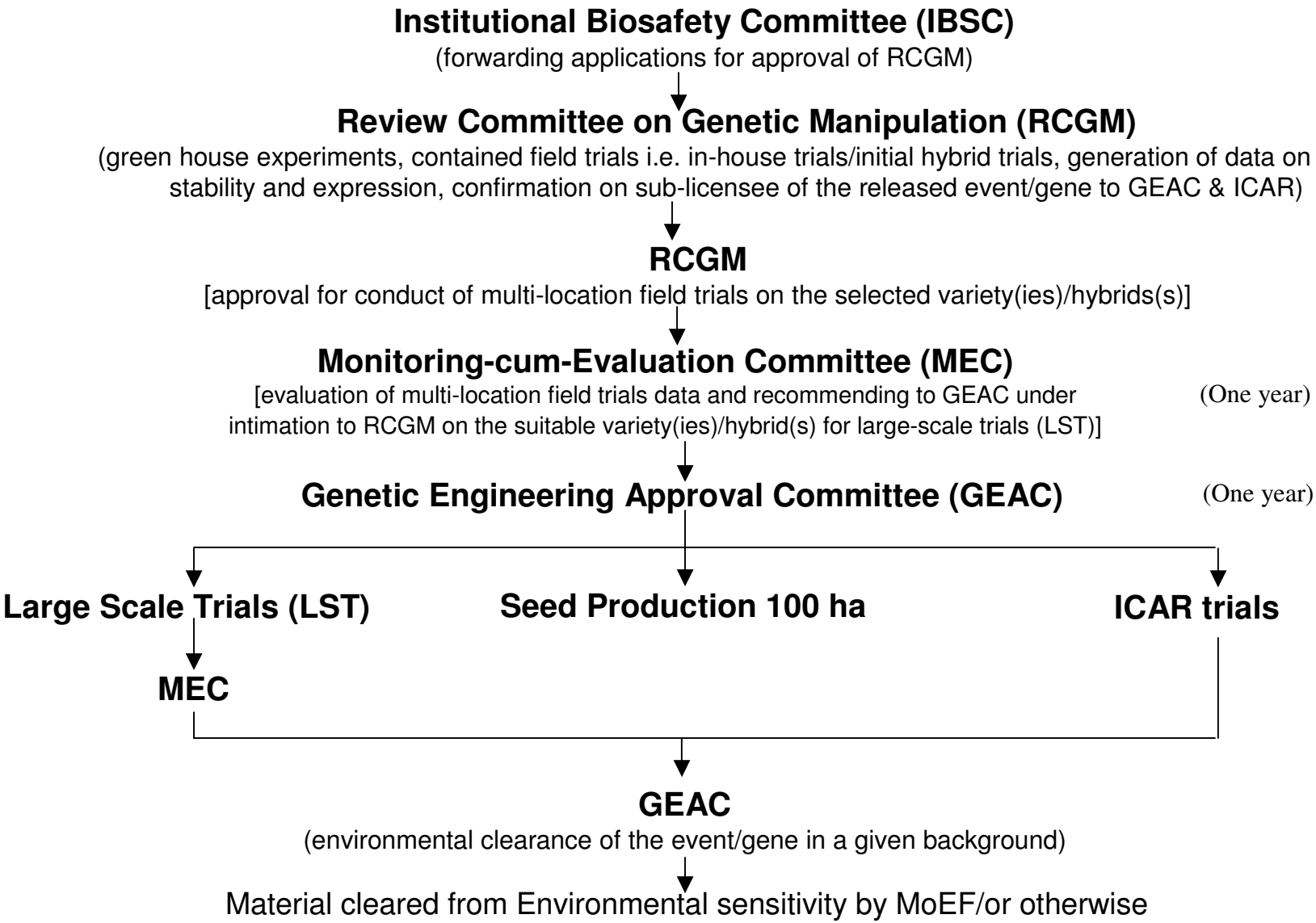
Table C-1 : *Summary of fibre properties & oil (%) of G.M. cotton hybrids & checks from three LST (each is a mean of 5 observations). Zone :

Sl. No.	Location / Entry		Ginning out-turn (%)	Seed Index (g)	Lint Index (g)	2.5% Span length (mm)	Uniformity ratio (%)	Fineness (Micronaire)	Strength 3.2 mm gauge (g/tex)	Spinnable counts	Count Strength Product (CSP)	Oil (%)
`	_____(Locations _____)											
1	LST-1											
2	Entry A											
3	Entry B											
4	Entry C											
	check											
a												
b												
c												
`	_____(Locations _____)											
1	LST-2											
2	Entry A											
3	Entry B											
4	Entry C											
	check											
a												
b												
c												
`	_____(Locations _____)											
1	LST-3											
2	Entry A											
3	Entry B											
4	Entry C											
	check											
a												
b												
c												
`												
	LST-4											
	LST-5											

*To be done by CCTI, Mathunga, Mumbai (Fee to be decided by the Institute

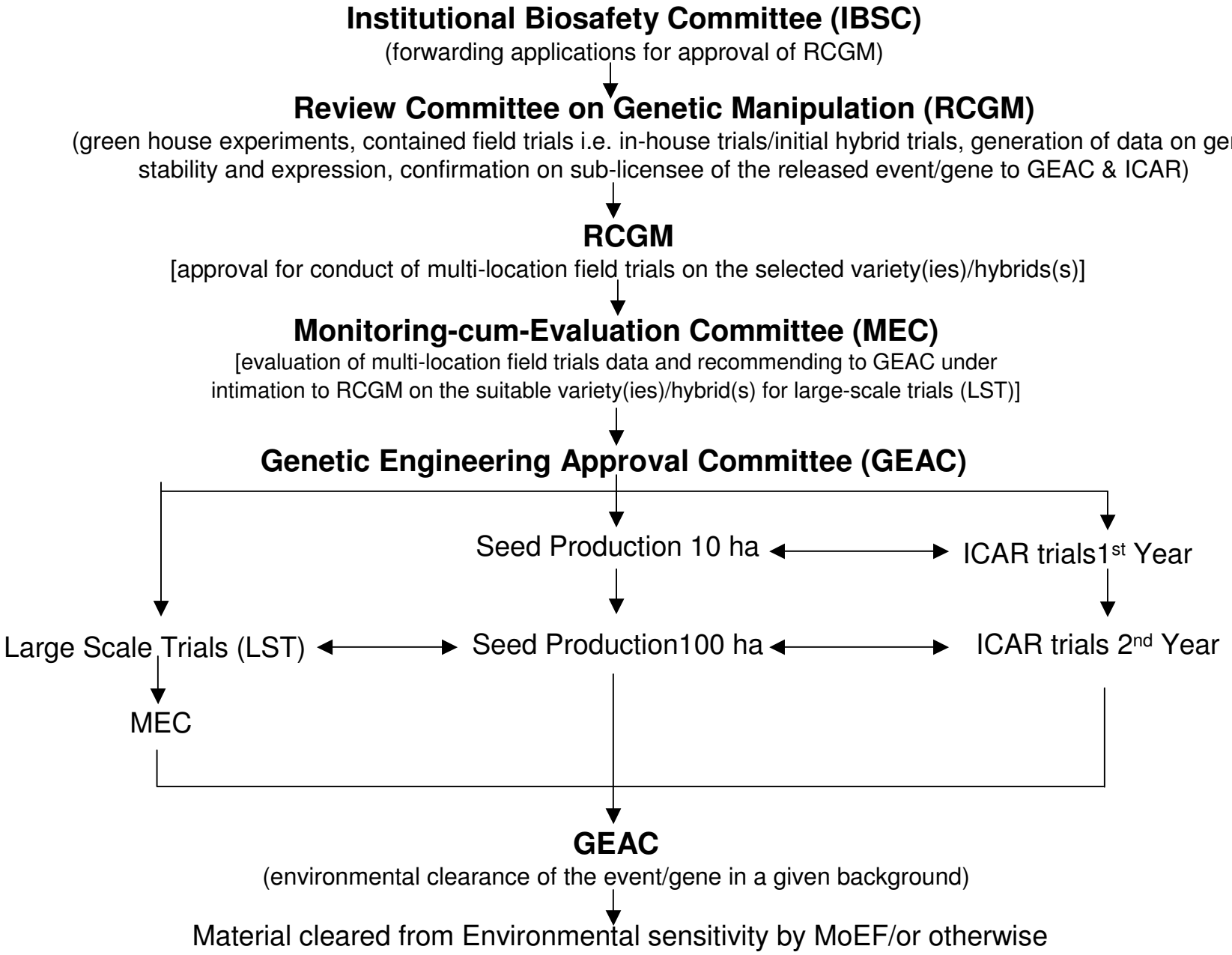
Annexure-II:

Figure:1 Flow Diagram on the recommended Protocol for Released Event/Gene for CVRC notified hybrids/varieties



Annexure-III

Figure2: Flow Diagram on the recommended Protocol for New hybrids/variety with approved gene



Annexure IV Figure 3: Flow Diagram on the recommended Protocol for i) CVRC released hybrid/variety with new gene and (ii) New hybrid/variety with new gene