Revising conventional breeding approaches for meeting the changing needs of cotton

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Diversity of Situations in Asia and plant breeding challenges

- Experiences with commercialization of Bt cotton
- Asian countries differ in terms of species and products grown
- Giant China and many others rely mainly on varieties while India is relying heavily on hybrids.....who's right? Need for introspection ?
- Egypt and neighboring countries need immediate focus on maintaining their supremacy in Barbadense cotton
- Asian countries also differing in terms of priorities of resistance requirement for pests and diseases
- Loss of species diversity especially diploid cotton has lead several problems
- We need to share our views concepts beneficial to Asian Breeders
- We must work in collaborative project mode

The basic challenges of Cotton breeding

- Enhancing productivity of cotton *per se* in different situations by Following revised approaches and revising the existing approaches
- Developing genotypes Making cotton based cropping system more remunerative,
- Enhancing the value of cotton and value added (special) cottons ?

After effects and side effects of Bt cotton

- During the era of Bt cotton genes responsible for
- conventional mechanism of resistance to Bollworms have been disused
- *Changes seen on introduction of Bt gene and the Priority of Traits*

The impact of rise in Harvest Index (HI)

- **With same photosynthetic output (source) the quantum of sink has increased**
- **Some genotypes lack matching photosynthetic potential (source) to meet extra demand of Sink**
- **They cannot cope with this drain,**
- **Leaves are weakened, subsequent reddening, disease incidence and senescence**
- **In some hybrids there is Mismatch between source and sink at a later stage of growth (upper half of the plant)**

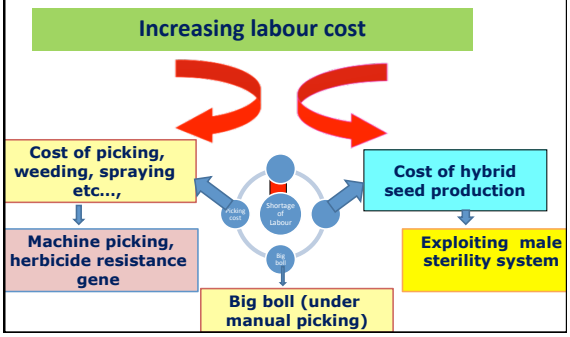
Central dogma of varietal development

Hybridization of carefully chosen varieties which are complimenting for yield traits followed by selection in segregating/back cross generations.

Carefully Choosing parents complimenting for array of yield influencing traits contributing to
Boll weight and Boll number
Physiological traits contributing to
Biomass and Harvest index etc.,.

- If desired traits are not available in just two parents multiple crossing must be initiated
- It may become necessary to determine how much is the desired contribution from each chosen parent

What's the next major threat to cotton after boll worm….?



The heat of Increasing labour cost

- It is felt in general but still at different levels in neighboring Asian countries
- Can we make machines to pick cotton from existing cotton plant types or modify cotton plant type to suit the machines ?

Compact Varietal Cultivation of Asia

In China and Uzbekistan with a crop density 300,000 plants/ ha farmers harvesting >50 q/ha

Turkey also has shorter plant types

India has started introducing compact cotton varieties to indian farmers

FUTURE TRENDS

Increase in labour cost has its impact on the cost of cultivation

- **It has necessitated high density planting and use of machines for picking cotton**
- **Compact early maturing varieties are the best choice for this situation**
- **This can facilitate and promote double cropping in cotton ecosystem.**
- **Public sector can play important role in developing compact varieties of cotton.**

Suitability of Compact cotton to different Spindle type and Stripper type of machines hand pickers

Changing outlook of plant type

Reducing stature (horizontal growth) to increase density and increase productivity evenwith few bolls per plant

bring synchronous maturity to solve labour cost ,improve plant protection efficiency

By virtue of earliness explore effective double cropping options

Compact cotton varieties for summer situation

- Enhancing Remunerative value of sole crop is getting difficult than fitting cotton in double cropping system and enhance the total remunerative value of the system
- Breeding for earliness(and compactness) plays key role in making highly successful double cropping systems

The Irony of Hybrids in Machine Picking Situation

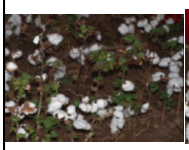
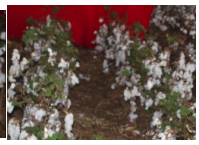
Compact Type-
Synchronous Maturity
High Density
High yield

High Density
Increasing Seed Cost
Reducing Income

EVEN THOUGH SEED COST INCREASES
SEED INDUSTRY IS SENSING NEED FOR BRINGING COMPACTNESS IN EVEN HYBRIDS TO THE EXTENT POSSIBLE
INCREASE DENSITY TO MAXIMIZE PRODUCTIVITY

A perfect match between

Three dimensional space requirement of a genotype	Space provided	Realizing potentiality
	Mismatch	Yield not realized
	Matching Space	Yield realized


It is ..... To even distinguishable compacts as super compacts, medium compacts determine ideal population density
Breeders and Agronomists must work out this

Development of Trait based Populations in Cotton (Principles of Polygenic Equilibrium of cross pollinated crops can be adopted)

Developing Trait based populations for each Physiological yield component , Boll weight, Boll number fibre trait component ,Pest , Disease resistance . etc.,.

Identify Elite lines for a trait -Make multiple crosses

- random mating- attaining and maintaining Polygenic (Linkage) Equilibrium-

Distributing to Breeders for selfing -selecting superior recombinants with highest expression

Need for national programs on trait basedPopulations
This encourages continuous recombination helps overcome linkage disadvantage
Such populations can spin out highly desirable recombinants

Developing and Exploiting Heterotic Groups of Cotton

PHASE I

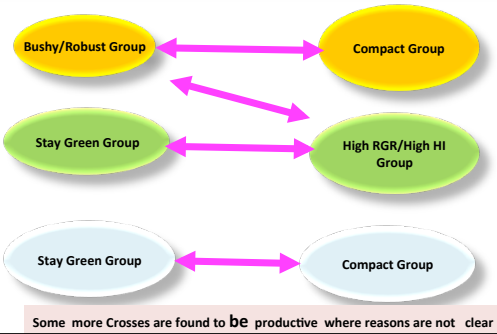
- **Evaluation of large no. crosses.**
- **Forming Heterotic groups based on hybrid performance.**
- **Developing Heterotic Boxes.**
- **Making within group crosses and advancing the generations.**

Phase I

- Exploiting Heterotic Populations

Phase II

Identification of Constellation of Diverse Groups of Hirsutum Cotton Genotypes



Some more Crosses are found to be productive where reasons are not clear

Finalizing the heterotic boxes for exploitation in Phase 2 based Predicted Potentiality of the Heterotic Boxes

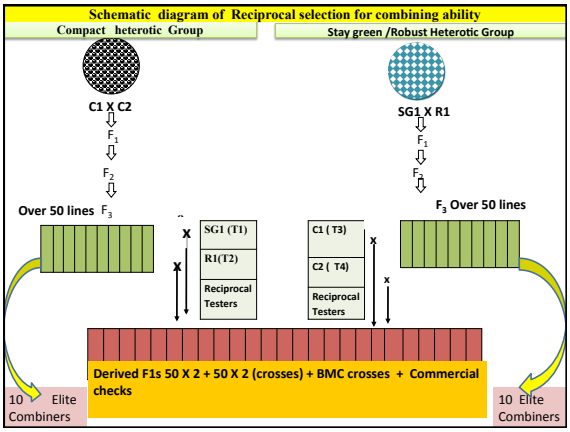
		GROUP 1	GROUP 2	MEAN SCY (kg/ha) NON PARENTAL CROSSES (3/4y)	PRESENT GENERATION AT OFFSEASON NURSARY
HETEROTIC BOX 1		STAY GREEN & ROBUST x COMPACT			
	A	DSMR 10	DSC 7	4015	F_2/F_3
	B	DSG3-5	DSC 68		F_2/F_3
HETEROTIC BOX 3		ROBUST x COMPACT			
	A	DSMR 10	DSC 7	4012	F_2/F_3
	B	DRCR 8	DSC 68		F_2/F_3
HETEROTIC BOX 4		ROBUST SG Vs RGR			
	A	DSMR 10	100	3978	F_2/F_3
	B	DSG3-5	178-24		F_2/F_3
HETEROTIC BOX 5		SG ROBUST Vs RGR			
	A	DSMR 10	100	3845	F_2/F_3
	B	DSG3-5	RCR 4		F_2/F_3
HETEROTIC BOX 6		SG RobuBust VS RGR COMPACT			
	A	DSMR 10	100	3812	F_2/F_3
	B	DSG3-5	DSC 7		F_2/F_3
HETEROTIC BOX 7		ROBUST VS COMPACT			
	A	DRCR 8	DSC2028	3753	F_2/F_3
	B	DSMR 10	DSC 7		F_2/F_3

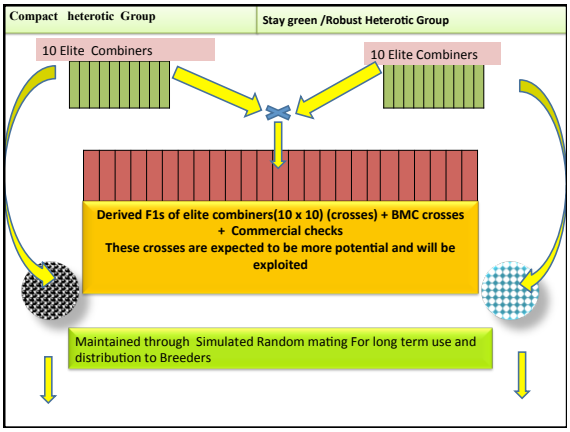
How do we proceed after forming heterotic groups ?

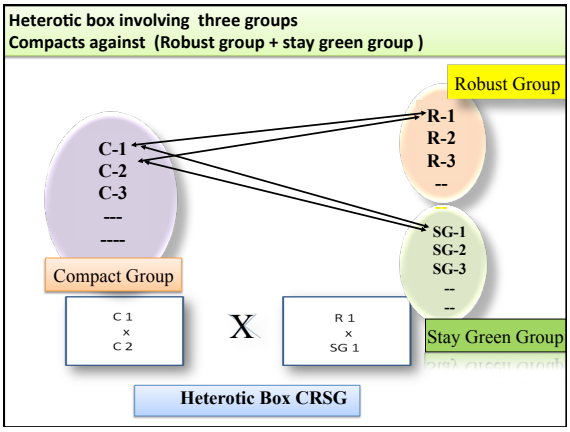
- Each group has many genotypes IdentifyElite Combiners
- How many of them should be used to develop opposite heterotic populations ?

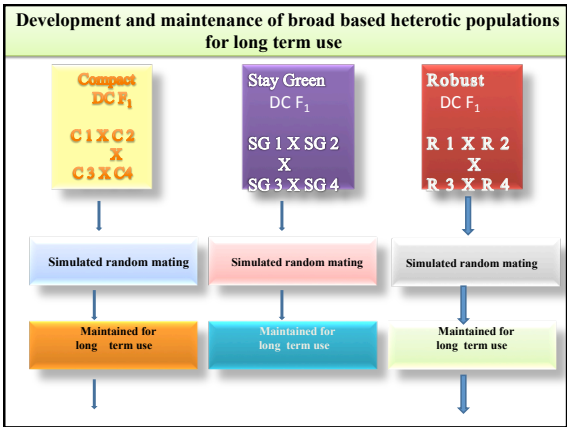
OPTION 1: Heterotic box is formed based on 2 elite combiners from the opposite group

OPTION 2: Developing broad based heterotic populations 4 elite combiners of a group are involved in developing multiple crosses [SG1, SG2,SG3, SG4……..] [C1,C2,C3,C4……]









CONSTITUTION OF BROAD BASED STAY GREEN GROUP BEING DEVELOPEDBASED IN STAY GREEN

DSG3-5

DSG 6-1

DSG3-70

DSG79-61-2

1. Intermating & maintaining through simulated random mating

2. Distributing selfed lines to breeders

ADDITIONAL 4 NEW PARENTS INVOLVED IN DEVELOPING STAY GREEN GROUP MAY BE ADDEDTO MAIN STREAM IF FOUND TO BE CONSISTANT AS COMBINERS

DSG 59-56

DRCR109

DSG-100

DSG 3-48

THESE NEW LINES MAY BE INCLUDED IN STAY GREEN BROAD BASED POPULATION LATER BASED ON CONSISTANT PERFORMANCE OF CROSSES BASED ON THESE

BROAD BASED POPULATIONS OF STAYGREEN GROUP

DSG3-5

DSG 6-1

DSG3-70

DSG79-61-2

THE CONSTITUION MAY BE RESTRICTED TO 4 OR MORE

DSG 59-56

DRCR109

DSG-100

DSG 3-48

DSG53-98

DSG2-18

1 Maintaining through simulated random mating

2. Distributing selfed lines to breeders

BBP(Broad Based Population) OF COMPACT GROUP INVOLVING 8 ELITE COMBINERS

TIME SCHEDULE	2011-12	2012-13	2013-14	2014-15

DSC-79

DRCH 7

DSC68

DRCH19

THE CONSTITUION MAY BE RESTRICTED TO 4 OR MORE

DSC2028

DSC11

DRCH2IPS9

DSC31N

1. Intermating & maintaining through simulated random mating

2. Distributing selfed lines to breeders

BBP(Broad Based Population) INVOLVING ELITE COMBINERS

ROBUST GRUOP

TIME SCHEDULE	2011-12	2012-13	2013-14	2014-15

DSMR10

DBMR1

DRCR8

DRCR752

THE CONSTITUION MAY BE RESTRICTED TO 4 OR MORE

DRCR2

DRCR99152

DRAH178-4

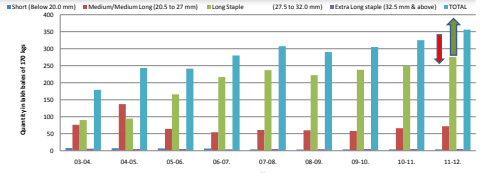
DCSH 501

1. Intermating & maintaining through simulated random mating

2. Distributing selfed lines to breeders

The lopsided Change in Composition of Fibre classes in Cotton

- At the time of Independence India was mostly producing Short staple cotton
- Hirsutum Cottons brought boost in Medium staple cotton production
- Interspecific Hybrids brought self sufficiency and even export of ELS cotton
- With the onset of Bt cotton era, there is an Increase in total cotton production and Long Staple cotton production but a relative reduction in Other classes



What is the impact of this?

Are we responding to the mismatch between Requirement and Production of fibre classes

- A severe shortfall in ELS cotton production
- Against the requirement of 10 just 4 lakh bales of ELS cotton is produced Out of it, Barbadense is slowly getting eliminated
- Pima and Giza cottons are being imported to overcome deficit
- Desi cottons are required for Denim cotton and surgical cotton but there is a severe shortfall of Desi cotton production
- The requirement of medium staple cotton is high but production has declined

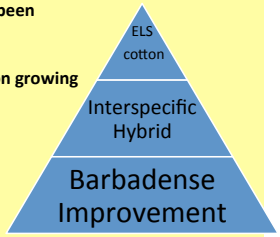
There is an urgent **need** to focus on ELS Cotton and Desi Cotton Research

Need for balanced growth in Fibre Quality classes

- Need for promotion of research on Barbadense and ELS cotton
- Promotion of Desi cotton to increase short staple cotton production

Need for Lont Efforts of Asian countries for Barbadense Improvement

- **Barbadense cotton has excellent fibre quality.**
- **In international market, the demand for ELS cotton is increasing.**
- **Barbadense cotton output has been stagnant at the level of Suvin. There is need for exchange of genetic stocks between ELS cotton growing countries like Egypt and India**



Limits of Barbadense and Barbadense Breeder

- **Suvin, an excellent source of this ELS cotton but extremely low productivity ,boll size, Low GOT%, late maturity, Susceptible to biotic stresses**
- **Need for increasing productivity of barbadense cotton with acceptable fibre properties Making it a more remunerative option to cotton growers.**
- **Fibre Quality: There is need for overcoming low micronaire value, improve fibre strength and Strength/ Length ratio, GOT**
- **Most Defects of Interspecific hybrids are inherited from Barbadense parent .An improvement in Barbadense cotton can mean a leap in production of Interspecific hybrids**

Potentiality of New Barbadense varieties

Sl. no	Entries	Boll wt (gm)	GOT %	SCY(kg/ha)	2.5% S L (mm)	UR %	Micronaire value	Maturity Ratio	Tenacity (g/t)	Elongation %	Sl ratio
1	534 M	3.00	37	**1703**	30.6	48	3.1	0.60	**28.9**	6.7	**0.94**
2	ICB 125	3.73	35	**1698**	30.2	49	3.6	0.65	**28.6**	7.0	**0.95**
3	SN X ICB 263-8	3.13	36	**1620**	30.9	49	4.4	0.72	**29.6**	7.0	**0.96**
4	SN X ICB 75-10	2.73	34	**1557**	34.6	48	4.1	0.68	**29.0**	6.5	**0.84**
5	SN X ICB 75-16	3.20	35	**1180**	34.1	47	3.6	0.64	**31.8**	6.8	**0.93**
6	SN X ICB 75-16 R II IPS 3	3.86	33	**1073**	32.9	48	2.8	0.57	**31.5**	6.5	**0.96**
7	SN X ICB 75-10 R II IPS 4	4.33	36	**1069**	33.6	46	3.0	0.61	**30.4**	6.7	**0.90**
8	SN X ICB 179-13 R II IPS 4	3.60	38	**973**	36.4	46	3.5	0.62	**27.2**	6.5	0.75
9	SN X ICB 75-16 R I IPS 1	3.40	32	**886**	33.4	46	2.8	0.56	**31.4**	6.3	**0.94**
10	SN X ICB 179-13 R I IPS 1	3.00	33	**820**	35.4	46	2.7	0.56	**29.9**	6.5	**0.85**
11	SN X ICB 75-16 R I IPS 2	3.00	33	**695**	31.9	46	2.5	0.55	**29.0**	6.3	**0.91**
12	SN X ICB 75-10 R I IPS 2	2.93	32	**621**	33.2	45	2.8	0.58	**31.7**	6.7	**0.96**
13	SN X ICB 75-10 R I IPS 1	3.06	30	**615**	31.9	45	2.8	0.58	**31.3**	6.2	**0.98**
14	Suvin	3.73	33	**605**	32.6	46	3.1	0.59	**28.6**	6.4	**0.88**

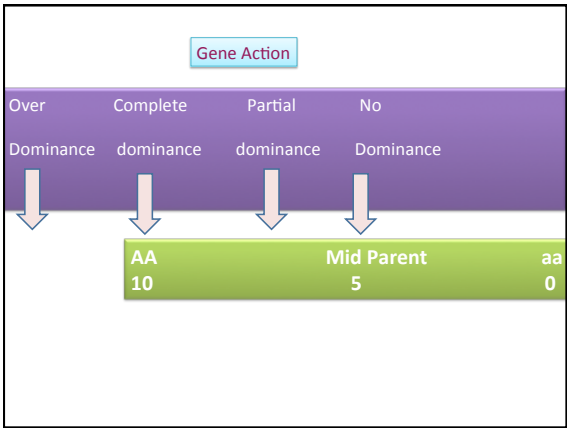
Development of Hirsutum v/s Barbadense Heterotic Populations

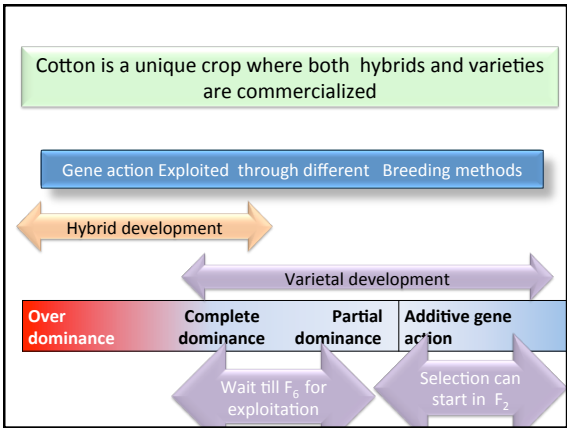
I Application of Principles of Population genetisa and Quantitative Genetics for refining Methods / Steps of Cotton Breeding

A good understanding of Principles of Plant Breeding is the basis for a successful results in Varietal and Hybrid Development

- Many a times we (Cotton breeders) realize committing mistakes that cause irrevocable loss of material precious time or both
- A sound knowledge principles of Population Genetics and Quantitative Genetics equips him better in taking up right decisions in terms of
  - Effective choice of Breeding method
  - Effective handling of the segregating material
  - adopting right strategies/ method selection at different stages of handling the material

Developing confidence in adopting need based (sudden) modification in the strategy/ methodology of handling the segregating material





Consequences of selfing involving polygenic loci

The Myth and Misconception about Proportion of homozygous Individuals For Polygenic Traits in segregating generations

Segregating loci	Selfing generations (F)													
	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15
1	50.00	75.00	87.50	93.75	96.88	98.44	99.22	99.61	99.80	99.90	99.95	99.98	99.99	99.99
2	25.00	56.25	76.56	87.89	93.85	96.90	98.44	99.22	99.61	99.80	99.90	99.95	99.98	99.99
5	3.13	23.73	51.29	72.42	85.32	92.43	96.15	98.06	99.03	99.51	99.76	99.88	99.94	99.97
10	0.10	5.63	26.31	52.45	72.80	85.43	92.46	96.16	98.06	99.03	99.51	99.76	99.88	99.94
20	0.000	0.32	6.92	27.51	52.99	72.98	85.48	92.47	96.17	98.06	99.03	99.51	99.76	99.88
50	0.000	0.000	0.13	3.97	20.44	45.50	67.56	82.23	90.69	95.23	97.59	98.79	99.39	99.70
80	0.000	0.000	0.002	0.57	7.89	28.37	53.39	73.12	85.52	92.48	99.03	98.07	99.03	99.51
100	0.000	0.000	0.000	0.16	4.18	20.70	45.64	67.61	82.24	90.69	97.59	97.59	98.79	99.39
150	0.000	0.000	0.000	0.006	0.85	9.42	30.84	55.59	74.58	86.37	92.94	96.40	98.19	99.09
200	0.000	0.000	0.000	0.000	0.17	4.29	20.83	45.71	67.64	82.25	90.69	95.23	97.59	98.79
250	0.000	0.000	0.000	0.000	0.036	1.95	14.07	37.59	61.34	78.33	88.51	94.08	96.99	98.49
300	0.000	0.000	0.000	0.000	0.007	0.89	9.51	30.91	55.63	74.59	86.37	92.94	96.40	98.19

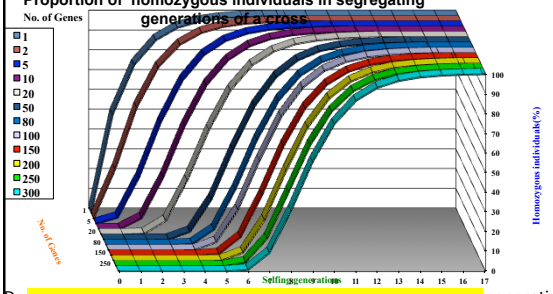
Proportion of fully homozygous Plants even by F_6 is very less.

Constitution of F6 Population segregating for 200 loci

Loci for which plants are Heterozygous	Homozygous	Percentage	Total (Upto)
0	200	0.17	0.17
1	199	1.13	1.3
2	198	3.62	4.92
3	197	7.7	12.6
4	196	12.2	24.9
5	195	15.5	40.3
6	194	16.2	56.6
7	193	14.5	71.1
8	192	11.3	82.4
9	191	7.77	90.1
10	190	4.79	94.9
11	189	2.67	97.6
12	188	1.35	98.9

If proportion of nearly homozygous individuals Is considered that is higher in F_6 (heterozygosity at upto 10 out of300 loci)

Proportion of homozygous individuals in segregating generations of a cross



Do generati

Which means
Plants are segregating for some more loci in F_4, F_5, generations
Bulking of lines should be avoided in these generatons. Instead
Sister lines can be grown from selections made in a line to confirm uniformity

Consequences of Selfing $F_1$and variability released inF_2 after Hybridization

No.of loic segregating	*Homozygous types in F_1*	*Genotypes Possible in F_2*	*Minimum Perfect Population in F_2*
1	2	3	4
2	4	9	16
3	8	27	64
4	16	81	256
10	1,024	59,049	1,084,576
21	2,097,152	10,460,353,203	4,398,046,511,104
n	2^n	3^n	4^n

*+ Assuming no linkage

Evan When "n" is unrealistically low (21) minimum pop size in F_2(4^n) is 4trillion
With regular varietal spacing it requires 111mill ha of cotton area to raise one F_2

For realistic numbers of loci(say 200) to raise minimum F_2 population of one cross 4^{20} in cotton crop we may have to go to moon/mars in search of land !!!

The paradox of Minimum Population size required in F_2 and later generations

With few hundred plants normally raised in F_2 can we expect to get entire range of segregants and the desired best recombinant ?????
Its Comparable to of using a bucketful of sea water to study diversity of marine fauna including sharks and whales !!!!

Advantages of following Single Seed Decent method
Min. Population size reduces from 4^n in F_2 to 2^n in F_6
When no. of loci are just 21 (4 trillion to 2 million -2million times reduction) when artificial selection is initiated in F_6 ---

When ' n' is large (say >200) billion times reduction in minimum population size !!!!
Thus Chance of observing entire range of variability and picking most potential segregants is enhanced

Single seed and Pedigree approaches can even be be mixed
Mild selection in regular season and quick advancing through SSD by using off-season facility and initiate full fledged artificial selection in F_6,
Its also helps to avoid confusing heterozygotes at loci showing dominance !!

When Desirable and undesirable alleles of a parent are linked in Trans combination
AbCdEf .....
aBcDeF.....
crossovers must occur frequently between the desirable and undesirable alleles .
BUT
Frequency of Crossing over between such closely inked genes is low

Genes linked in repulsion phase

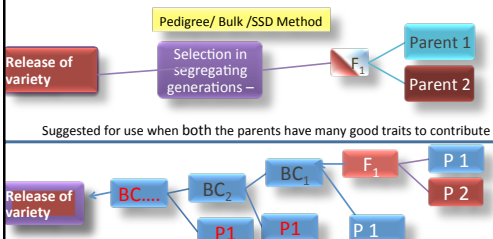
	B	b	Total
A	0.1	0.4	0.5
a	0.4	0.1	0.5
Total	0.5	0.5	

After continuos random mating
At State of Joint equilibrium

	B	b	Total
A	0.25	0.25	0.5
a	0.25	0.25	0.5
Total	0.5	0.5	

To enhance the chance of such cross overs it is necessary to **intermate productive** genotypes in early generations --- Effective recombination at these desired sites

Procedures of Handling the Material after hybridization

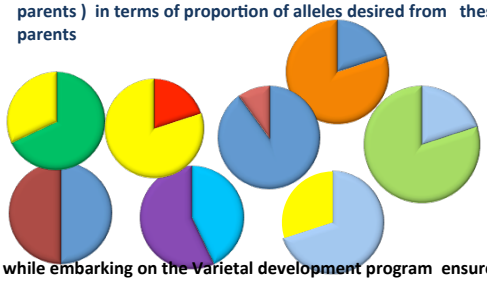


Back cross Method considered as more scientific

Breeders are clear about when to use Back cross breeding - when the donor parent has bad genetic background except for one simple trait (resistance,... etc.,),.
What about Pedigree/Bulk/SSD in present format?

Target Genotype

Target Varietal genotype aimed at (based on combination of parents) in terms of proportion of alleles desired from these parents



while embarking on the Varietal development program ensure that The segregants most commonly observed in segregating generations of breeding approach should match with Target genotype set

Otherwise the selected approach may not give the desired result !

PROPORTION OF ALLES FROM THE TWO PARENTS AMONG PLANTS IN ANY SEGREGATING GENERATION

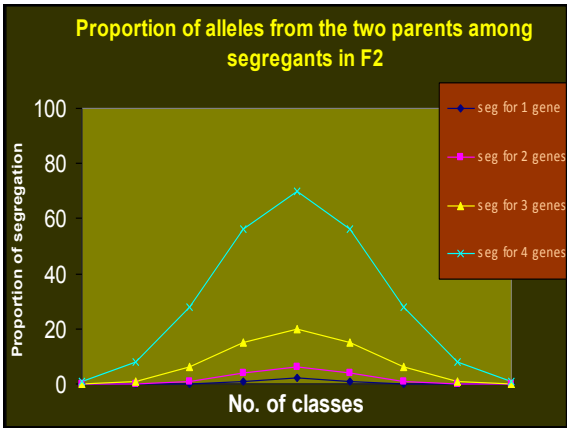
Choice of Breeding Method for VarietaL development depends upon…

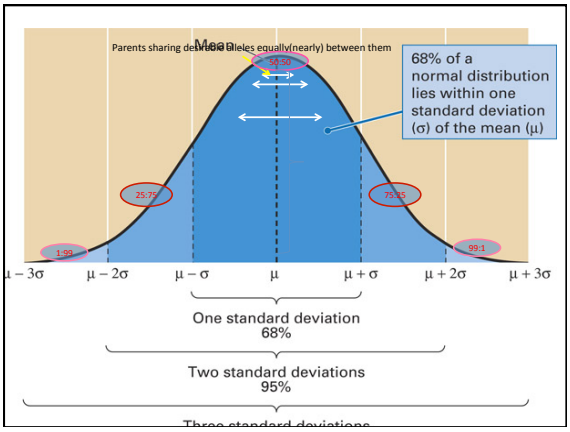
Target Genotype

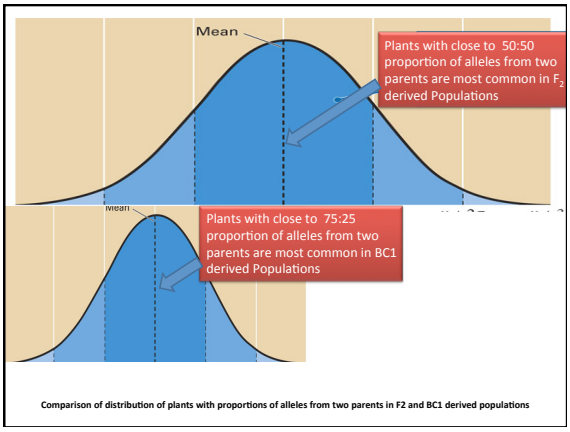
Two varietal genotypes are hybridized with objective of recombining desirable alleles(yield components) distributed between them

Are we assessing the situation reg. distribution of desirable alleles between parents and based on this defining Target genotype correctly ?

Once this target genotype is understood find out whether our breeding approaches create such segregants with high frequency?







Development of Cotton genotypes for organic situation

There is increasing awareness about organic cotton cultivation
GM cotton can not be grown in GM situation

Seed Chain of Non GM cotton isin shambles
Varieties developed for Conventional situation can not be tried under organic situation WHY?
Ecosystem of organic cotton cultivation is considerably different From Conventional cotton's ecosystem where-
Hamfull pesticides are flooded
and excessive usage of inorganic fertilizer is affecting
microclimate of Soil -
Forms in which nutrients are available ,
diversity of micro fauna and availability of beneficial micro organisms(known and unknown)
Availability of high organic content

Projects presently being handled

BioRe - Madhya Pradesh
Chetna Organics –Orissa
Rama bai foundation –Karnataka

These programs can be extended to other neighbouring countries

Promotion of Special cotton types to enhance remunerative value of cotton

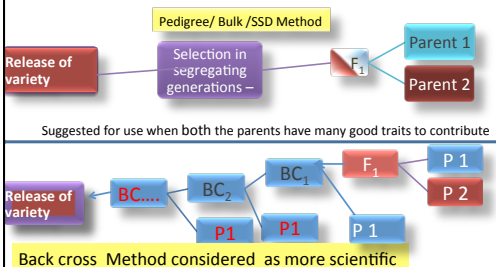
- Breeding varieties with special features meant for niche markets fetching high remuneration
- Superior fibre quality
- Desi Cotton varieties with High micronaire for use as surgical cotton

Denim Cotton
Development of Different Naturally coloured cotton types

Use of related species and wild species for transfering desired genetic bits and pieces

- Need for improving male sterility system to increase the longevity of hybrids
- Relook at *G herknessi* - Did we forget something while back crossing ????
- Continuous search for other species for better cytoplasm for male sterility system
- Use of different wild species with desirable alleles general attempt to explore changes in back cross derived generations –drought, pest tolerance

Procedures of Handling the Material after hybridization



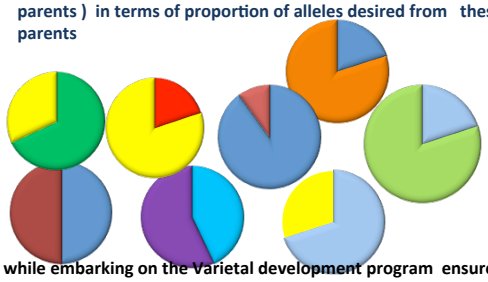
Back cross Method considered as more scientific

Breeders are clear about when to use Back cross breeding - when the donor parent has bad genetic background except for one simple trait (resistance,... etc.,.),.

What about Pedigree/Bulk/SSD in present format?

Target Genotype

Target Varietal genotype aimed at (based on combination of parents) in terms of proportion of alleles desired from these parents



while embarking on the Varietal development program ensure that The segregants most commonly observed in segregating generations of breeding approach should match with Target genotype set
Otherwise the selected approach may not give the desired result !

Choice of Breeding Method for VarietaL development depends upon

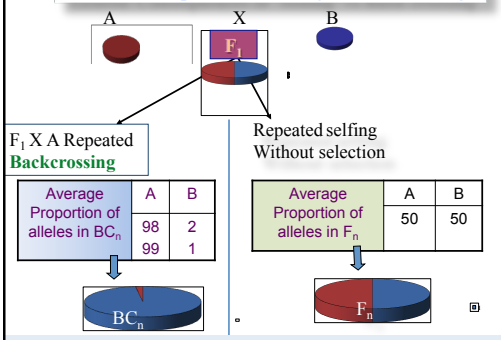
Target Genotype

Two varietal genotypes are hybridized with objective of recombining desirable alleles(yield components) distributed between them

Are we assessing the situation reg. distribution of desirable alleles between parents and based on this defining Target genotype correctly ?

Once this target genotype is understood find out whether our breeding approaches create such segregants with high frequency?

Genetic Consequences of Selfing vs Back crossing



• These approaches lead to contrasting differences in proportion of alleles of two parents in the resulting populations or products

I **Hence it is necessary to understand what's our target genotype before embarking on a breeding procedure and parallely What are the types of segregants most commonly observed in a selected breeding approach**

II **What are most common proportions of alleles** from two parents **seen among segregants** in

a) F_2 and later generations

b) Limited back cross derived Populations

c) Complete Back cross derived populations ???

Proportion of alleles of two parents among segregants of F_2 generation

One gene case	Genotypes and Prop of alleles of two parents			
	AA	Aa	aa	
Prop of alleles of parents	100:0	50:50	0:100	
Segregation ratio	1	2	1	

Two gene case	AABB 1	AABb 2 AaBB 2	AaBb 4 AAbb 2 aaBB 2	aaBb 2 Aabb 2	aabb 1
Prop of alleles of parents	100:0	75:25	50:50	25:75	0:100
Segregation ratio	1	4	6	4	1

➢ 50: 50 and nearly 50: 50 types are most commonly observed in F_2 generation

➢This pattern remains same when large no. of loci (Quantitative character) are considered in F_2 generation where selection is initiated in Pedigree method

Proportion of alleles of two parents among segregants of F_6 generation

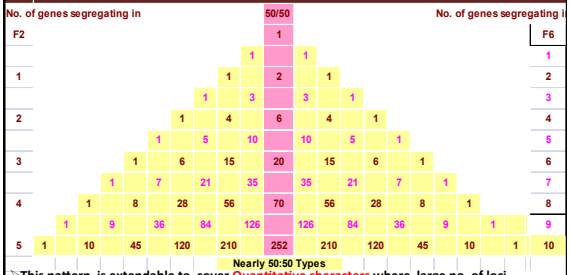
Two gene case	Genotypes and Proportion of alleles of two parents AABB 1	AAbb 1 aaBB 1	aabb 1
Prop of alleles of parents	100:0	50:50	0:100
Segregation ratio	1	2	1

➢50: 50 types are most commonly observed even in F_6 generation

➢The trend remains same when more genes are considered

➢Extending it to cover the case of quantitative characters

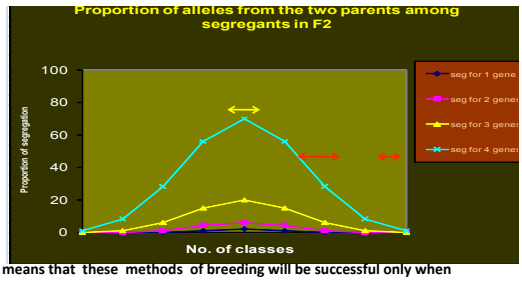
Proportin of alleles from the two parents among segregants in early as well as later segregating generations



➢This pattern is extendable to cover Quantitative characters where large no. of loci are involved in segregation

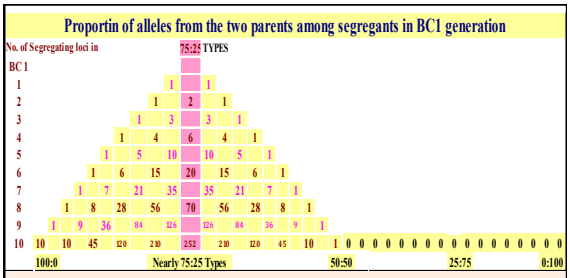
➢The trend remains same whether selection is initiated in in F_2 or F_6 when plants would have become nearly homozygous

➢50: 50 types are most commonly observed in these populations are subjected toselection through Pedigree / Bulk/SSD method



It means that these methods of breeding will be successful only when
The target genotype is 50:50 (or nearly) type

If the target genotype is 70:30, 80: 20 ,(unequal distribution of desirable alleles between parents) the frequency of desired target genotypes among segregants will be less in F_2/ F_6
Chance of success with these methods is reduced - Breeder may fail in deriving superior target genotype



The chance of occurrence of desirable target genotype (70: 30) is enhanced by handlin single back cross derived population(BC1F2 onwards)!
How to decide about "what is a target genotype in given situation ??

Approach I Comparison of Segregating populations

Study on Evaluation of B1 , B2 and F_2 populations of the cross

Situation I : Decreasing order of performance being B1>F_2>B2

POPULATION	PROPORTION OF ALLELES		METHOD OF BREDING	RESULT OF SELECTION IN SEGREGATING GENERATIONS
	P1	P2		
B1 (F_1 X P1)	75	25	Limited backcross breeding(with P1)	CAN BE SUCCESSFUL
F_2 (SELFING F_1)	50	50	Pedigree/Bulk/SSD	PARTIALLY SUCCESSFUL/FAILURE
B2 (F_1 X P2)	25	75		MAY BE A FAILURE

- Here P1 parent has higher proportion of desired alleles contributing to higher productivity of B1>F_2>B2
- Selfed generations of B1 populations can be subjected to selection either by following pedigree or bulk or single seed decent method of breeding

Situation 2: Decreasing order of performance being B2 >F2 >B1

POPULATION	PROPORTION OF ALLELES		METHOD OF BREDING	RESULT OF SELECTION IN SEGREGATING GENERATIONS
	P1	P2		
B2 (F_1 X P2)	25	75	Limited backcross breeding(with P2)	CAN BE SUCCESSFUL
F_2 (SELFING F_1)	50	50	Pedigree/Bulk/SSD	PARTIALLY SUCCESSFUL /FAILURE
B1 (F_1 X P1)	75	25		LIKELY TO BE A FAILURE

- Here P2 parent has higher proportion of desired alleles contributing to higher productivity of B1>F_2>B2
- Selfed generations of B2 populations can be subjected to selection either by following pedigree or bulk or single seed decent method of breeding

Situation III: Decreasing order of performance being F2>B1 or B2

POPULATION	PROPORTION OF ALLELES		RESULT OF SELECTION IN SEGREGATING GENERATIONS
	P1	P2	
F_2	50	50	CAN BE SUCESSFUL
B1 or B2	75 25	25 75	MAY BE PARTIALLY SUCESSFUL

- Here P1 and P2 parents have equal proportion of desired alleles contributing to higher productivity of F_2>B1 > B2 or F_2>B2 > B1
- Selfed F_2 and later segregating generations can be subjected to selection either by following pedigree or bulk or single seed decent method of breeding

Approach II
Assessing the target genotype based on distribution of desirable traits

Traits mattering in Bt era

Breeding for Fibre quality
Mixed feelings about mixed cotton

- Enhancing the genetic potential in each fibre length class so that trend of blending can be avoided
- Introgression breeding to transfer fibre strength
- Maintaining fibre quality balance S/L ratio