FIBRE CROPS

COTTON (*Gossypium* sp.)

Diploid cotton : (2n = 26)

G.*arboreum* - Karunganni cotton

G.*herbaceum* - Uppam cotton

Tetraploid cotton : (2n = 52)

G.*hirsutum* - American cotton

G.*barbadense* = Egyptain cotton, sea island cotton.

A. Floral biology

Simple, solitary, terminal extra axillary, petals yellow to cream in colour, hermophrodite, bracteoles called as epicalyx, three in number, free and deeply serrated and persistent at the base of the flower. Nectary gland is present on each bracteole. Calyx five united, cup shaped, corolla five, polypetalous, a purple spot is present on the inner side of the claw of the petal (petal spot) in some species. Androecium forming a staminal column (monadelphous), bearing numerous anthers. Ovary superior penta carpellary, style slender, passes thro' staminal column with three to five lobed stigma, ovules many in axile placentation.

B. Anthesis and pollination

There is much variation in case of flower opening. Asiatic cottons open between 8 and 10 AM. American cottons open much earlier. Temperature affects the flower opening. After flower opening the cream yellow colour corolla turns pink within a day and later changes to red. The receptivity of the stigma is 8 to 10 AM.

C. Selfing

Cotton is an example for often cross pollinated crop. Selfing is done by sealing the flower bud by using thread, paper clips, wet clay or mud and other devices to prevent entry of insects responsible for cross pollination.

D. Emasculation and crossing

Emasculation is done by removing the staminal column by giving a cut with thumb nail. Emasculation is done in the evening usually a day before flower opening. Immediately after emasculation the flower is covered with colour butter paper bag for easy identification next day morning. Pollen from the male flower is dusted on the emasculated flower by rubbing the staminal column of the male parent. Immediately after pollination the flower is covered with white butter paper bag and proper labelling is also done. This method is known as Doak's method.

E. Agencies dealing with Cotton Research

1. National Agency : CICR - Central Institute of Cotton Research, Nagpur
2. State level : CICR - Regional Station, Coimbatore. All India, Coordinated cotton improvement project
3. TNAU : Cotton Breeding Station, Coimbatore, RRS, Kovilpatti CRS, Srivilliputhur.

F. Varieties released

1. Introduction : **Cambodia cotton** in South India, **MCU- 1**

2. Selection : **K1** cotton reselection from SRT -1

3. Hybridization and selection

a) Inter varietal : **MCU 5** - Multiple cross derivative
MCU 6 - Multiple cross derivative
MCU 8 - Single cross hybrid derivative.
MCU 9 - (MCU 5 x MCU 8)
MCU 11 - (MCU 5 x Egyptian *hirsutum*)

b) Interspecific hybridization : Acala 1517 lines of G.*hirsutum* resistant to wilt and best fibre quality are due to natural crossing with G.*barbadense*. Evaluation of tetraploid cotton is due to interspecific crossing and natural doubling.

Old world diploid linted cotton x G.*raimondii*
(A genome) (Dgenome)
↓
F_1 sterile
↓
Doubling
↓
G.*barbadense*
(AD genome)

Old world diploid linted cotton x G. *thurberi*
(A genome) (D genome)
↓
F_1 sterile
↓
(Doubling)
↓
G.*hirsutum*
(AD genome)

4. Heterosis breeding

Both intraspecific and interspecific hybrids are evolved in cotton.

a) Intraspecific : G.*hirsutum* x G.*hirsutum* Shankar (H4) cotton of Surat (Gujarat 67 x American nectariless)

b) Interspecific hybrids : Varalakshmi (Laxmi x SB 289E)
(*hirsutum*) x (*barbadense*)
CBS 156 (Acala glandless x SB 10856)
DCH 32 (DS 26 x SB 425) (Jayalakshmi)
TCHB 213 (TCH 1218 x TCB 209)

G. Hybrid Seed production

1. DOAK's method of hybrid seed production

In this method, manual emasculation of flowers is done one day before anthesis, and pollination next day morning. For convenience, the parental varieties are grown in same fields in the ratio of 4:1 (Emasculation and pollination is done as described earlier).

2. Use of male sterile line

Cytoplamic. genic male sterility was developed by Vesta G. Meyer an American scientist. She obtained CMS lines by transferring *hirsutum* genome to the cytoplasm of wild species G.*harknessi*. Restorer lines were also developed in *hirsutum* and *barbadense* back ground. Genic male sterility was also observed in cotton but utilisation is difficult due to segregation of sterile line in 50:50 ratio of sterile and fertile and maintenance of sterile line is laborious.

Another type of male sterility is transformation of staminal column into a petaloid condition. This was obtained when G.*arboreum* genome is transformed to cytoplasm of G.*anamalum*

3. Practical difficulties in use of CMS lines for hybrid seed production

a) Lack of simply inherited restorer gene that maintains fertility over a wide range of environment.
b) lack of development of good combiners possessing male sterile cytoplasm and restorer factor.
c) Lack of dependable and economic method of controlling pollination by insect pollen vectors.

4. Mutation breeding

MCU 7- Xray irradiated mutant of L 1143
MCU 10 - Gamma irradiated mutant of MCU 4

5. Population improvement followed in USA

a) Recurrent selection : Pima S_1 Pima S_4 of G.*barbadense*
b) Synthetic variety : Deltapine 15 developed at konyvllwer USA.
c) Composite : Pima 17 of G.*barbadense*.

H. Special breeding techniques in cotton

a) Bulked progeny method (Texas method)

In commercial cotton varieties with a broad genetic base is desirable so that they have the adaptability to the requirement of varied and widely different environmental conditions. Texas method provides such plasticity.

(i) Open pollinated seeds of selected F_2 single plants are grown in replicated randomized block design along with standard check variety. Best progeny are marked and harvested on single plant basis. Yield and fibre quality will be assessed and best ones will be selected and seeds will be bulked for testing in F_4.
(ii) Again the F_4 bulks are also tested in replicated randomised block design the process done in F_3 is repeated.
(iii) The F_5 and F_6 progenies are tested in MLT and later released as variety.

b) Mass pedigree selection technique of Harland

This system was used by Harland for the improvement of Peruvian cotton variety with spectacular success.

First season : Examine a large number of selected single plant from a heterogenous commercial crop and fix up specification or norms for making selection.

Second season :

(i) Grow progeny rows of single plants in replication

(ii) Examine bulk samples from these progeny rows and eliminate rows failing to confirm to the norms fixed during first season. This is known as bulk norm test

(iii) Examine the single plants in the selected progeny rows and eliminate the plants failing to confirm to the norms. This is called 'single plant norm test'.

Third season

Repeat the bulk norms test as done in second season and select the best lines.

Fourth season

Mix the seeds of selected lines and raise the multiplication plot and distribute them.

COTTON

TCHB 213 SEED PRODUCTION GUIDELINES

Parentage : TCH 1218 (G.*hirsutum*) x TCB 209 (G.*barbadense*)

For the seed production in an area of one acre, the female parent TCH 1218 is to be raised in 80 cents and the male parent TCB 209 in 20 cents.

Spacing

For female parent 4' x 2'
Male parent 3' x 2'

Synchronisation

Sowing of male parent should be advanced by 15 days. The male parent should be sown 5 meters away from the female.

Seed rate

Female parent : 800 g
Male parent : 200 g

Season

August. Dibble the seeds of male parent at 2 seeds/hill on 1st August and female parent on 15th August.

Emasculation and pollination

Emasculate and pollinate as far as possible in the buds appearing during the first six to eight weeks of reproductive phase to ensure good setting and development of bolls.

Restrict emasculation to each day evening from 3 to 6pm and pollination next morning between 9 AM to 1 PM.

Cover the male buds in the previous day evening with butter paper bag for their use in the next day.

Emasculated buds may be protected with butter paper bag. Tie a thread to the pedicel of the bud immediately after pollination.

Close the crossing programme after 9th week from commencement of crossing and flowers appearing subsequently are removed to facilitate proper development of crossed bolls.

Nip the top and side shoots to arrest further vertical and horizontal growth respectively.

Normally one flower from the male parent will cover 5 to 10 flowers of the female parent for crossing.