BIOLOGY OF COTTON

CFT Training
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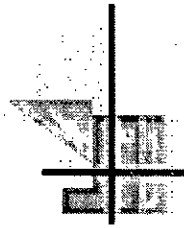
2. Cotton Crop

- Unique among agricultural crops
- Provides natural fibre
- By-products such as edible oil and animal feed for livestock
- Research is geared to improving the fibre
- The natural fibre is now called "Gift from Nature"
- Cotton plant will continue providing fibre and food for humans and livestock.
- Imagine a world without the cotton plant.



3. Cotton Plant

- Cotton plant is perennial in nature
- Domestication has made it annual
- It is determinate in nature and will continue producing flowers and bolls as long as growth conditions are favourable
- It is a warm climate crop
- Hence grown between 37^0N and 32^0S
- BUT expanded to 45^0N (in China)
- Requires an average 75cm (750mm) of water.

4. Taxonomy

- Order - Malvales
- Family - Malvaceae
- Tribe - Gossypieae
- Genus - Gossypium
- Species - hirsutum

5. Diversity

- Genus Gossypium has 50 species (wild and cultivated)
- 45 of these are diploids (~~20~~ 2n -26 chromosomes)
- Only 4 species commercially grown
- G.hirsutum and G.barbadense (New World spp.)
- G.arboreum and G.herbacium (Old World spp.)
- G.barbadensis ~~e~~ originated from Peru
- G.hirsutum originated from Mexico
- Most, commonly cultivated is G.hirsutum

Barbadense

Diversity Cont.

- G.barbadense is most sensitive to day length hence limited in production.
- G.hirsitum and G.barbadense are the most important agricultural cottons.
- They are allotetraploids $(2n = 52)$
- Uganda grows G.hirsutum

6. Cotton Parts

a) Nodes:

- Occur on cotton stem and each capable of producing a branch,
- Each node above numbers 5-7 can produce a fruiting branch.
- Internode length can be a genotypic character
- Length can also be modified by growing conditions (e.g frequent irrigation/rain, excess nitrogen and failure to plant retain fruits – heat sterility insect etc.

Cotton Parts Cont.

b) Branches

- Located on main stem in spiral order
- Two types of branches:-
- Monopodial or vegetative branches
- Do not bear fruits
- Form at the base of the plant

Cotton Parts Cont.

- Give cotton plant bushy look
- (2) Sympodia or fruiting branches
- Bear fruits
- Form on subsequent nodes after monopodia
- Will continue to be formed till plant is physiologically exhausted or terminated
- Plants with only sympodial branches start fruiting earlier than those with monopodial branches.

7. Flowers

Cotton plant has a full flower

- Flowers begin to form 4-5 weeks after planting
- Floral buds or squares flower 25 days after their formation
- Flowers open at dawn and remain open for full day
- Flower is hermaphroditic and consist of

  * Bracteoles which are normally 3 around flower base, green in colour and teethed. They enclose the whole flower.

  * Calyx consist of 5 sepals fused together.

Flowers Cont.

* Corolla consist of petals, ~~of~~ fused at the base. Petals of G hirsutum are white or white cream while those of G. barbadensee are bright yellow.
* Gynoecium (female flower part) consist of ovary style and 5-~~cobed~~ lobed stigma. The ovary has 5 carpels each constituting a locule. Each locule has 8-10 ovules which form seed when fertilized.
* Anderoecium (male flower part) consists of a staminal column (surrounding the style) bearing anthers.

Flowers Cont.

Squares mature in 25 days after formation
Petals emerge and induce the anthers to open
Pollen is shed onto stigma causing pollination
Fertilization occurs 12-20 hours after pollination

- Cotton is self-fertilization crop
- Outcrossing may occur but often 10% or less
- Pollen grains are large, heavy and sticky

Wind pollination not possible
Out crossing may occur due to insect activity

Flowers Cont.

Chemical applications control insect pollination

- Cotton pollen dispersal is localised around pollen source
- Decrease significantly with distance.

8. Boll

- Formation starts after fertilization
- Acquires full size in 25-30 days
- Full maturity in 50 days
- Shape may be round and pointed
- At maturity it opens revealing white seed cotton
- Boll may contain 3-5 locules
- Boll weight may vary according to variety
- G.hirsutum has largest bolls among cultivated species (3-10gm).

9. Seed

- Results from fertilized ovule
- Development depends on potassium availability
- Size varies with varieties
- G.hirsutum has larger and fuzzier seeds than G.barbadense
- Seed weight measured by seed index (weight of 100 seeds)
- It produces fibres for which cotton is grown
- One boll produces 20-25 seed on average



Seed Cont.

- Can remain viable for 5 years
- If harvested immediately after opening dormancy can be 3-4 weeks
- Germinates 2-3 days after planting
- Emerges 6-7 days after planting
- Cotton seed has 15-22% oil content (28-35% in the kernel)
- Oil and protein contents inherited independently

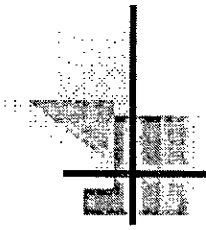
10. Root

- Has a tap root system
- Roots absorb water and nutrients from the soil
- Roots also anchor the plant
- Primary root can grow deeper than 3 meters
- Root length depends on variety and growing conditions



11. Production Constraints

- Cotton affected by large number of insect pests
- Most important being:
  * Cotton bollworm (40%-100% loss)
  * Lygus
  * Cotton stainers
- Also affected by number of diseases most important being:
  * Bacterial blight
  * Wilts (verticillum and Fusarium)



Production Constraints Cont.

- Poor soil fertility
- Weeds (30% more loss)
- Generally poor agronomic practices (late planting, poor pest management etc).