A Potted History of Cotton Breeding
(Diversity & Selection)

Kater Hake

ICAC Plenary, Brisbane AU Dec. 3 2019
Source of Cotton Diversity

cotton evolved on PANGEA

USGS. http://pubs.usgs.gov/gip/dynamic/historical.html,
Source of Cotton Diversity

USGS. http://pubs.usgs.gov/gip/dynamic/historical.html,
Source of Cotton Diversity

USGS. http://pubs.usgs.gov/gip/dynamic/historical.html,
Source of Cotton Diversity

USGS. http://pubs.usgs.gov/gip/dynamic/historical.html,
Source of Cotton Diversity

USGS. http://pubs.usgs.gov/gip/dynamic/historical.html,
Source of Cotton Diversity
Cotton farmers (breeders) started with massive genetic diversity both:
- within the genome &
- within the AD species
Selection of long fiber mutants
Selection in Gibberellin & Florigen domesticated crops
Selection in Gibberellin & Florigen domesticated crops
Goldilocks Zone of Gibberellin and Florigen

Not too tall, not too short
Not too leafy, not enough leaves
Just right - height optimized for harvest, water and disease
Just right - leaves to bolls so mature maximum number in the season

Tecoman, Mexico
Goldilocks Zone of Gibberellin and Florigen

Not too tall, not too short
Not too leafy, not enough leaves
Just right - height optimized for harvest, water and disease
Just right - leaves to bolls so mature maximum number in the season

Tecoman, Mexico
Selection within elite varieties

… in North America many pedigrees trace back to a few introductions in 1600s. Selection within local varieties and occasional outcrosses directed the first 200 year of cotton cultivar development.
Both pollen □ and seed □ movement create diversity from which to select
Cotton Breeding was regionalized
BREEDING HISTORY OF DELTAPINE 16 AND DELTAPINE 50
Keith R. Jones
Benoit, MS

1959
Deltapine Smooth Leaf X Deltapine 45

1960
Individual Plant Selections

1963
200 lines

1964-67
1 line tested widely

1968
DP 16 was 1st sold in US and later important in Mexico, Columbia, Australia and China

Beltwide 1998 pp 536-537
Seed Quality Drove Breeding Innovation
Company A elite by Company B elite

![Map showing regions of Acala, Desert, Delta & Southeast, and Texas with color coding for bales.](image-url)
Continent A elite by Continent B elite

Delta & Southeast

Acala

Texas Desert
Public/Private Germplasm Exchange (Universal MTA)

Dr. Don Jones, Cotton Incorporated
Cotton breeders selected out of elite varieties and crossed elite by elite to avoid losing centuries of improved fiber quality and yield.
Now have the tools to pull the traits from non-elites and augment elite fiber and yield with new traits.
Bring stress and pest tolerance from wild cottons to commercial plant breeders
Take Home Messages

• Historic cotton breeding was successful because massive diversity for millions of farmer/breeders to select from within

• Modern cotton breeding has been successful because of large populations and the skills of a few breeders to optimize gene combinations

• Germplasm exchange plays a role in expanding diversity BUT just as important is investment in people and resources to select locally adapted high yielding varieties

• Transplanting varieties can put growers at risk from local diseases & insects
  Deltapine 90 impacted by Nematodes and Bacterial Blight in Brazil
  Deltapine 50 impacted by Blue Disease in Argentina
  Smoothleaf varieties impacted by Jassids in Turkey and India
Take Home Messages

• Historic cotton breeding was successful because massive diversity for millions of farmer/breeders to select from within

• Modern cotton breeding has been successful because of large populations and the skills of a few breeders to optimize gene combinations

• Germplasm exchange plays a role in expanding diversity BUT just as important is investment in people and resources to select locally adapted high yielding varieties

• Transplanting varieties can put growers at risk from local diseases & insects
  - Deltapine 90 impacted by Nematodes and Bacterial Blight in Brazil
  - Deltapine 50 impacted by Blue Disease in Argentina
  - Smoothleaf varieties impacted by Jassids in Turkey and India
Take Home Messages

• Historic cotton breeding was successful because massive diversity for millions of farmer/breeders to select from within

• Modern cotton breeding has been successful because of large populations and the skills of a few breeders to optimize gene combinations

• Germplasm exchange plays a role in expanding diversity BUT just as important is investment in people and resources to select locally adapted high yielding varieties

• Transplanting varieties can put growers at risk from local diseases & insects
  
  Deltapine 90 impacted by Nematodes and Bacterial Blight in Brazil
  Deltapine 50 impacted by Blue Disease in Argentina
  Smoothleaf varieties impacted by Jassids in Turkey and India
Take Home Messages

• Historic cotton breeding was successful because massive diversity for millions of farmer/breeders to select from within

• Modern cotton breeding has been successful because of large populations and the skills of a few breeders to optimize gene combinations

• Germplasm exchange plays a role in expanding diversity BUT just as important is investment in people and resources to select locally adapted high yielding varieties

• Transplanting varieties can put growers at risk from local diseases & insects
  Deltapine 90 impacted by Nematodes and Bacterial Blight in Brazil
  Deltapine 50 impacted by Blue Disease in Argentina
  Smoothleaf varieties impacted by Jassids in Turkey and India
Cotton breeders achieved this, INVEST in them
Potted History of Cotton Breeding

Diversity

Selection

- Selection
- Man's observations
- Yield comparisons
- Yield trials
- Statistical analysis
- Fiber quality measurement
- Gene (PCR) measurement
- Genomic Selection

Diversity

- Diversity
- Natural mutations
- Natural crossing
- Germplasm exchange
- Crossing elite by elite
- Induced mutations
- Wild germplasm
- GMO traits
- Genome editing
- Organelle editing
- Metabolic editing
Thank You