Agricultural Outlook Forum
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# World's Most Promising Cotton Yield Technologies & their Potential to Raise Production

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# World's Most Promising Cotton Yield Technologies *& their Potential to Raise Production*

COTTON

- **World's most promising yield technologies**
  - agronomy
    - farmer production education
    - investment capital
    - precision application
    - no-till (with herbicide tolerance)
  - genetic improvement
    - edaphic stress
    - metabolic efficiency
    - seed resource reallocation
    - plant architecture
    - hybridization

# Yield Technologies

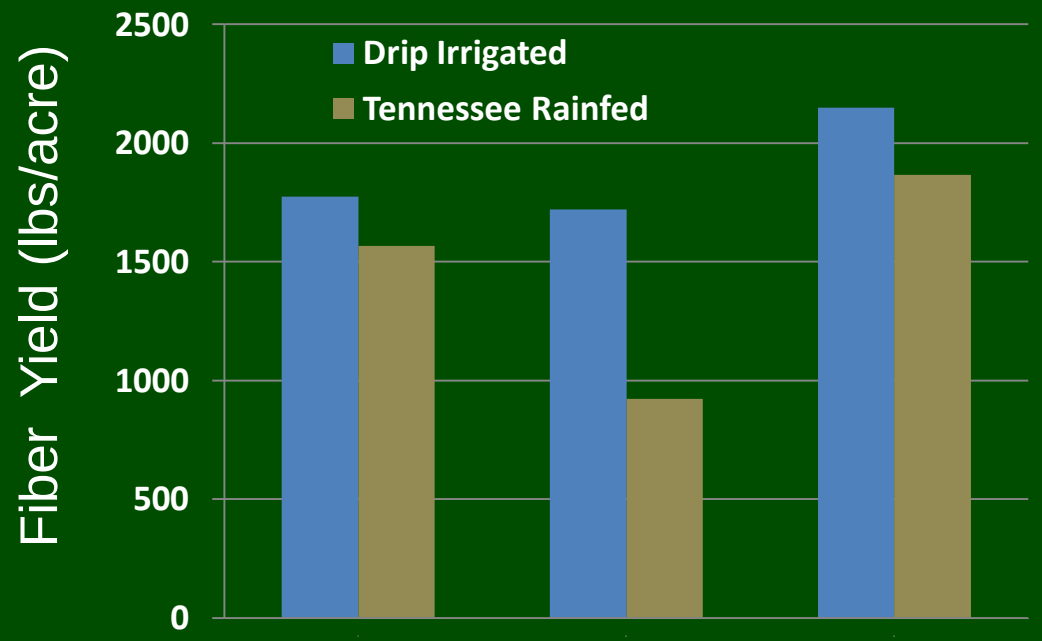
▲ In addition to basic farming expertise, any technology advancement requires adjustments to entire production system.

e.g. Introduction of high priced Bt-cotton seed to eastern China:

- lower seeding rates
- disease susceptible foreign variety
- yield boost caused K deficiencies
- 2 pests no longer controlled

# Farmer Production Education

## Supplemental irrigation raises Water Use Efficiency in rainfed cotton but requires investment in water delivery systems




# Investment Capital

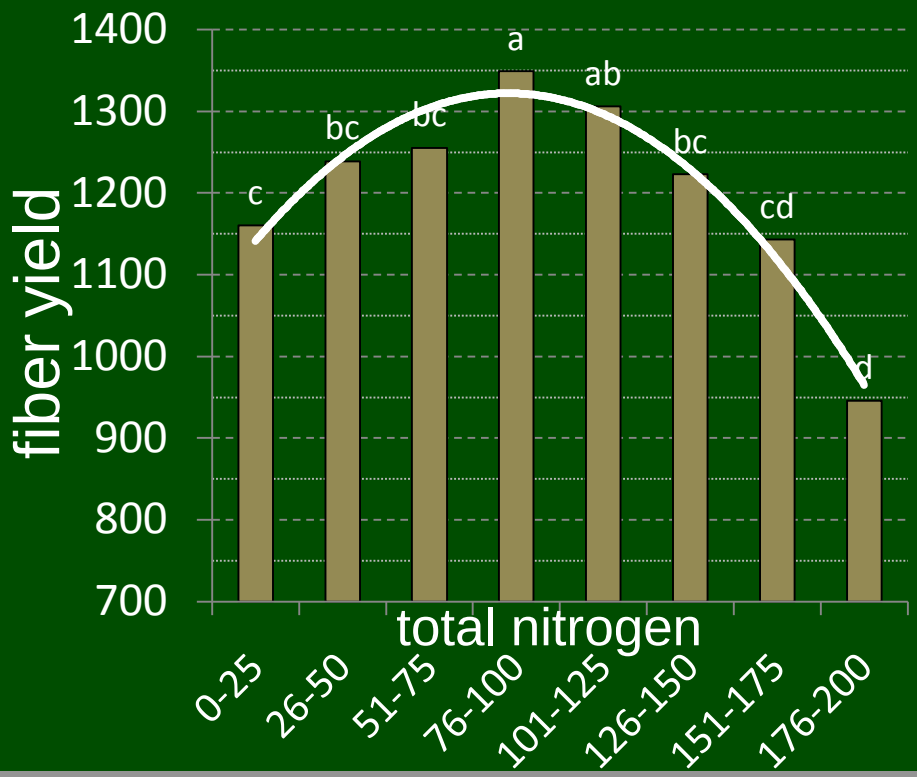
# ▲ Optimum agronomic management:

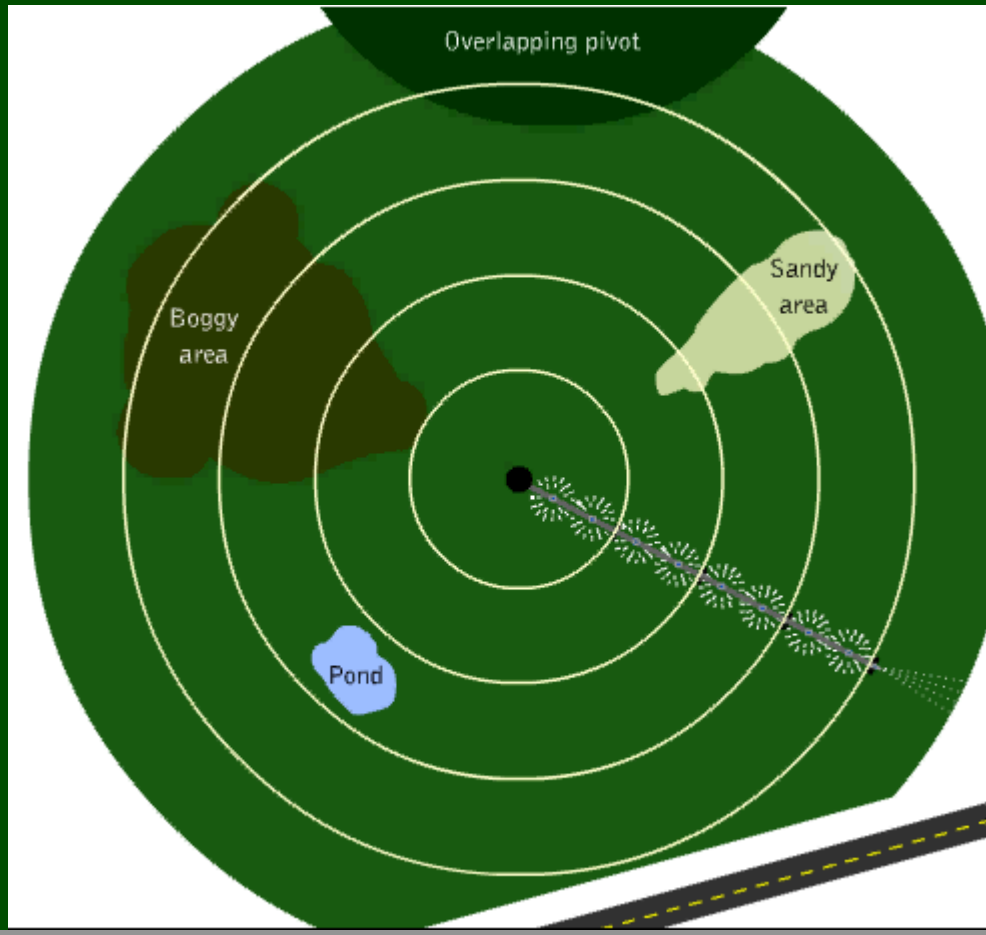
**1970's farm scale recipe**

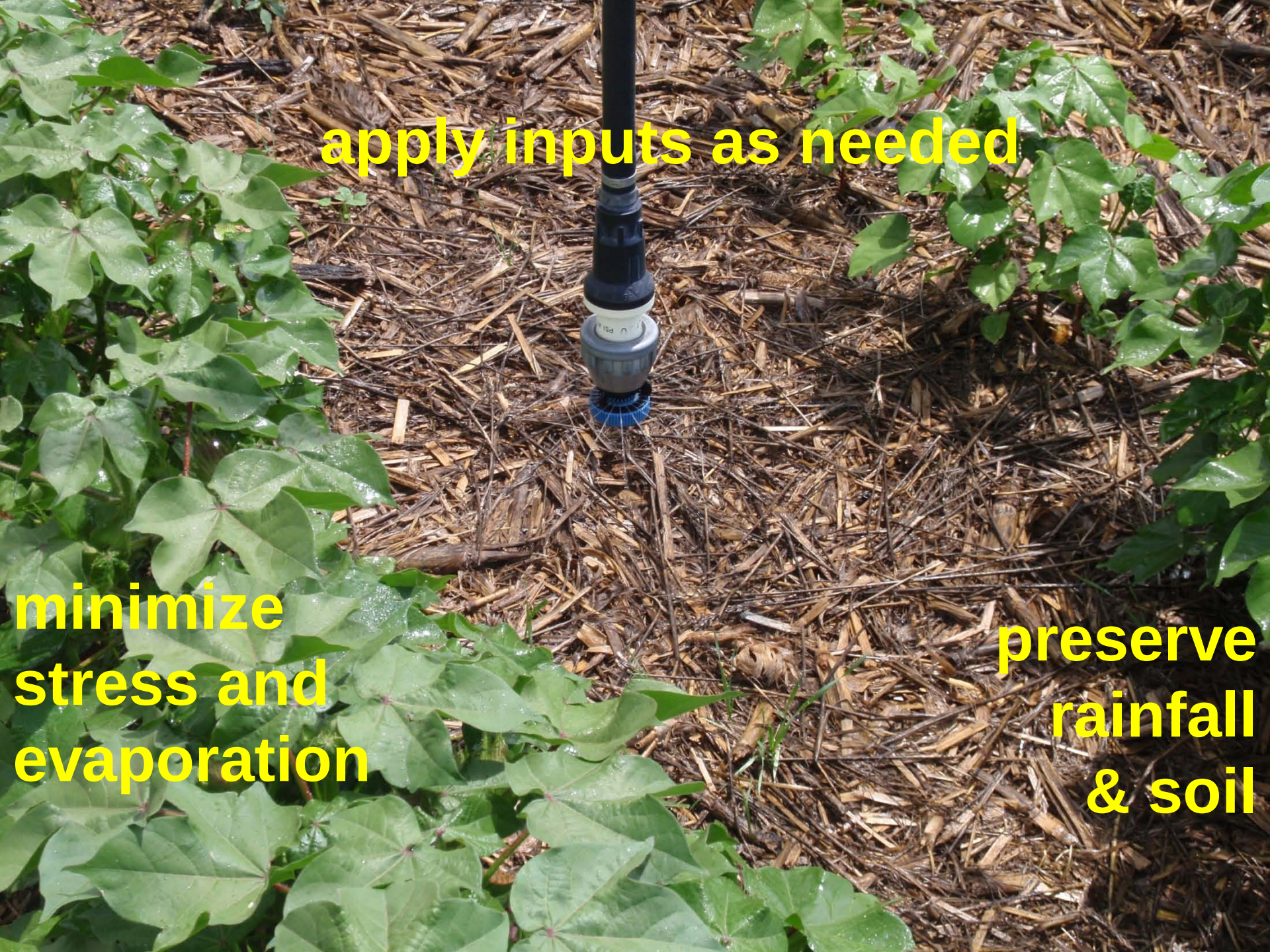
**1990's field scale**

**2000's soil type scale**

**2010's 10 m² scale**




apply inputs as needed
minimize
stress and
evaporation
preserve
rainfall
& soil

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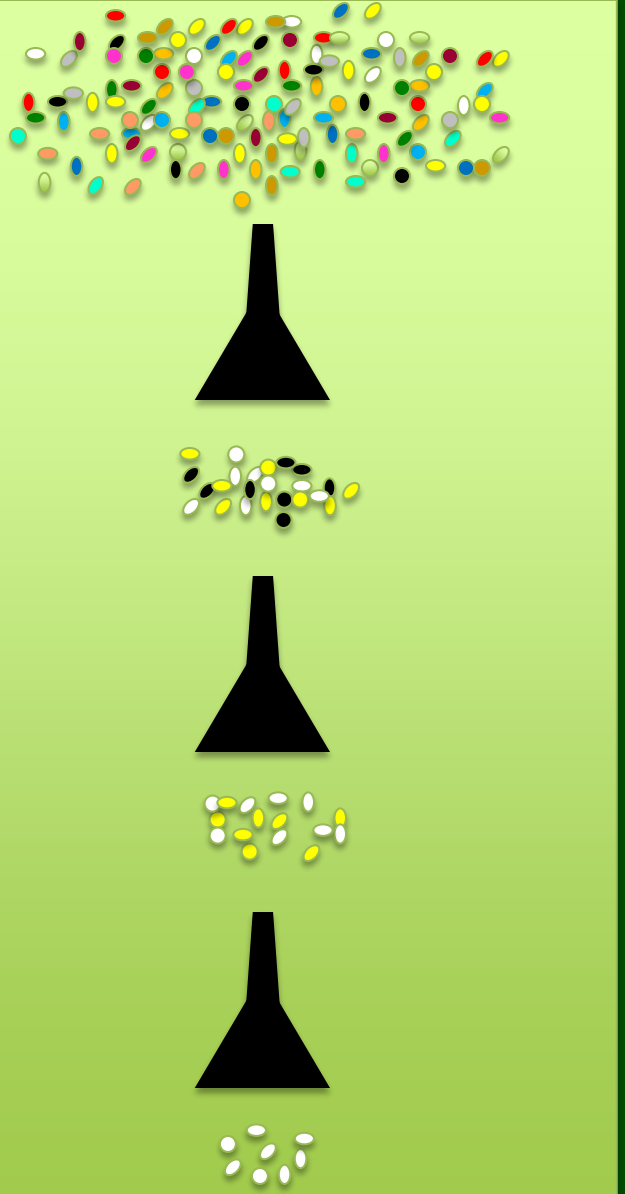
# Yield Technologies



- Highly diverse *Gossypium* diploids wild plants
- 4 plants crossed making 2 *Gossypium* tetraplids
- Man domesticated the long fiber mutants
- Breeding further narrowed germplasm

# Genetic Diversity Lost

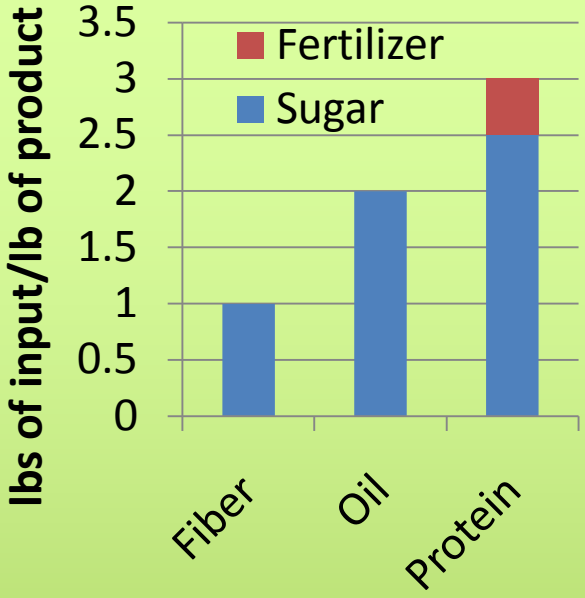
- Plants are immobile so evolved to tolerate stress.

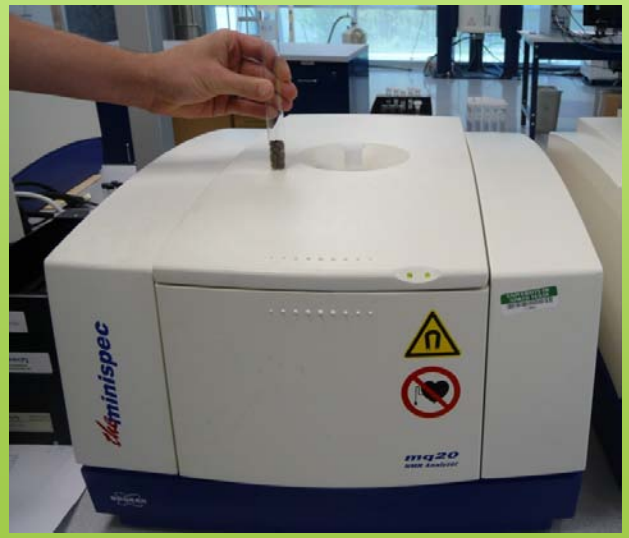
- DNA tools allow breeding with wild cotton for soil borne stresses:
  - nematodes
  - diseases
  - drought

# Genetic Diversity Regained

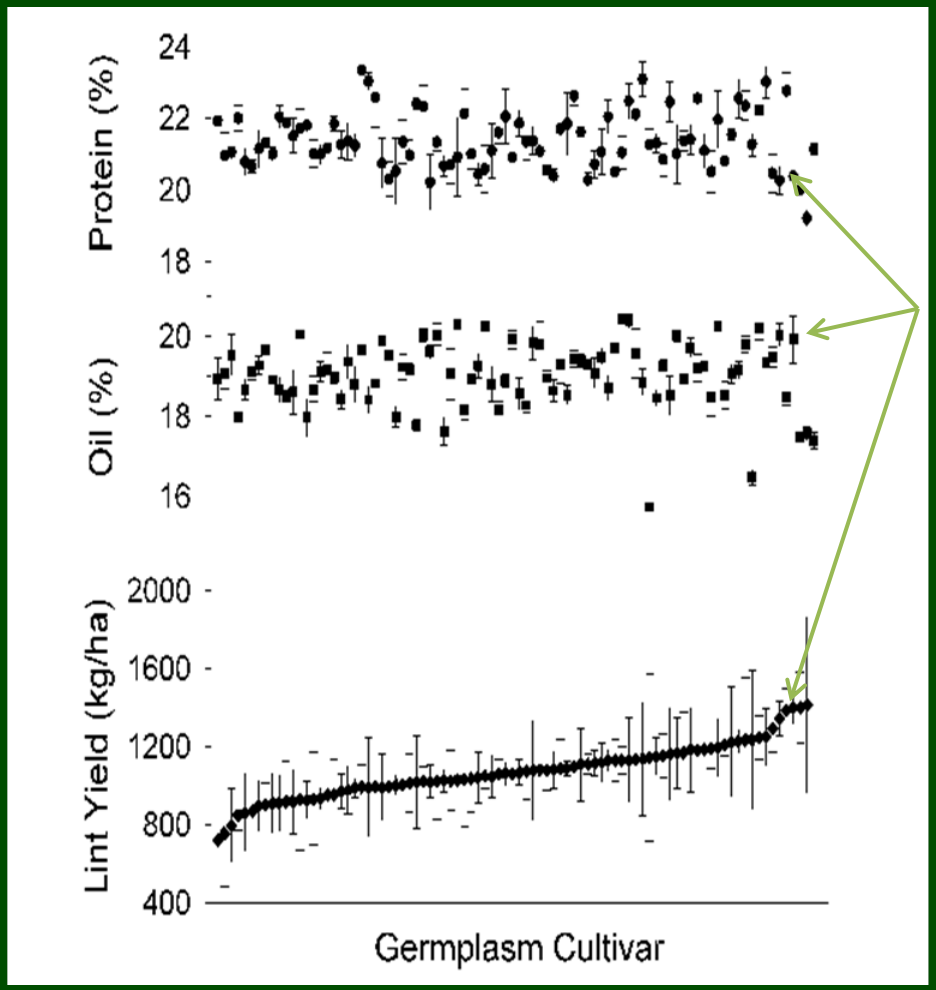
In addition to the multiple breeding tools, we could reach back in time to the rapid evolution of the fiber and make it better the 2nd time around.

# Sequenced Cotton Genome

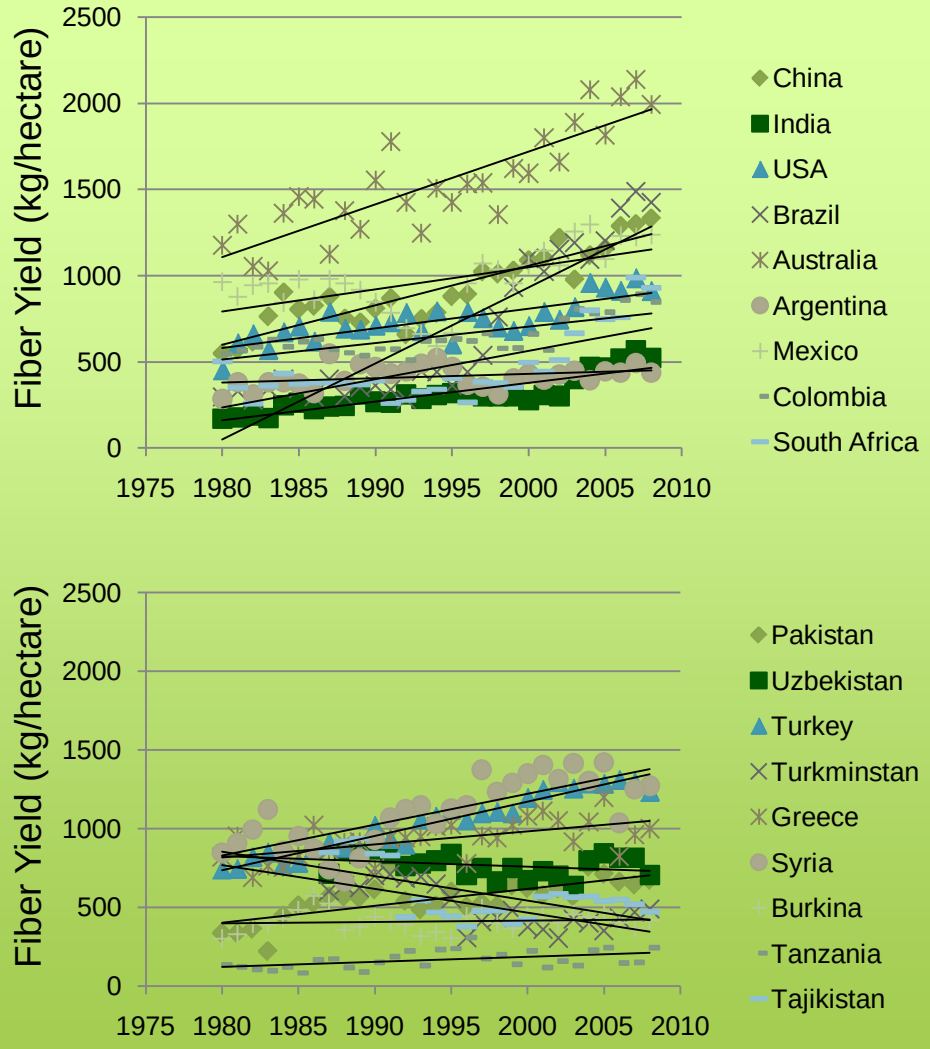



## We have the tools to breed seed with MORE fiber & oil, LESS protein



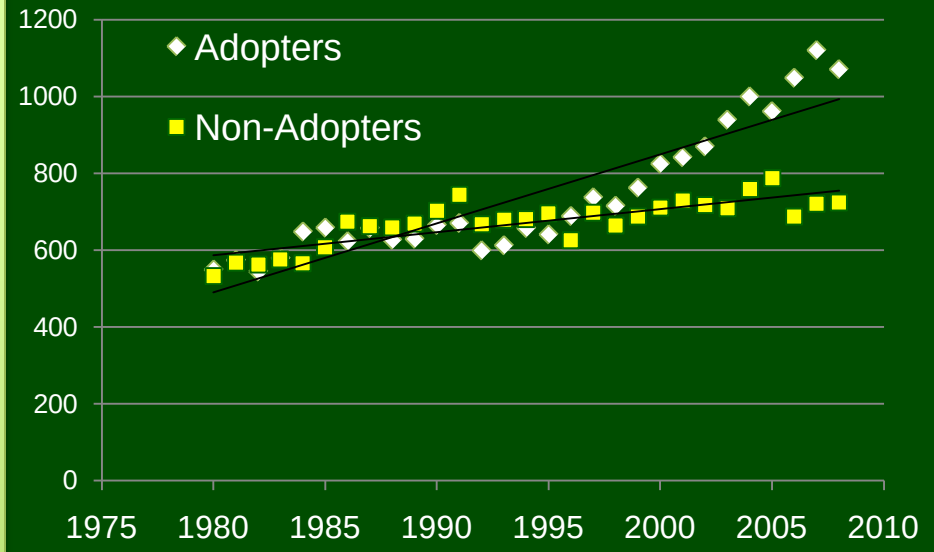

# Seed Resource Allocation







Adapted from David Zilberman, U.C. Berkeley

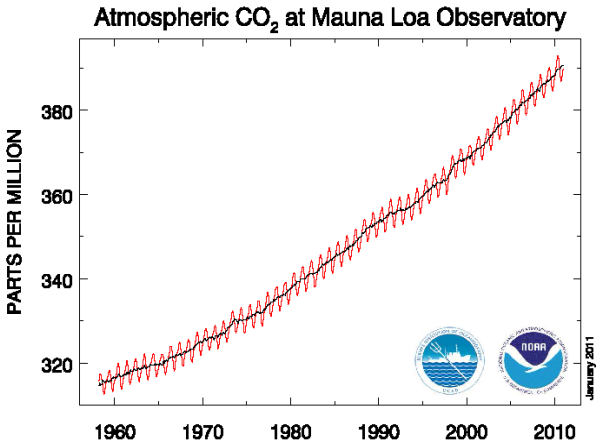


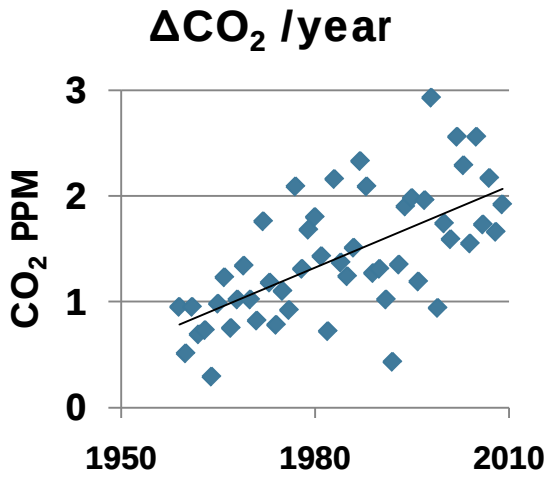

**▲ Biotech adopters benefit from all the ancillary benefits of a robust, professional local seed industry PLUS the trait.**

# Professional Seed Industry

- *& their potential to raise production*
  - China
  - India
  - USA
  - Africa

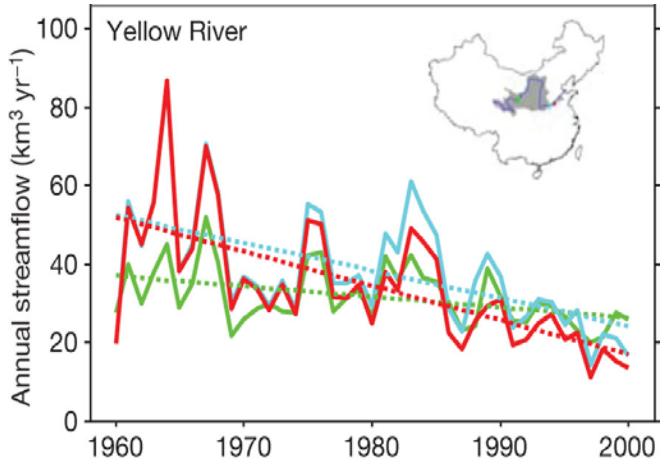
# Raise Production

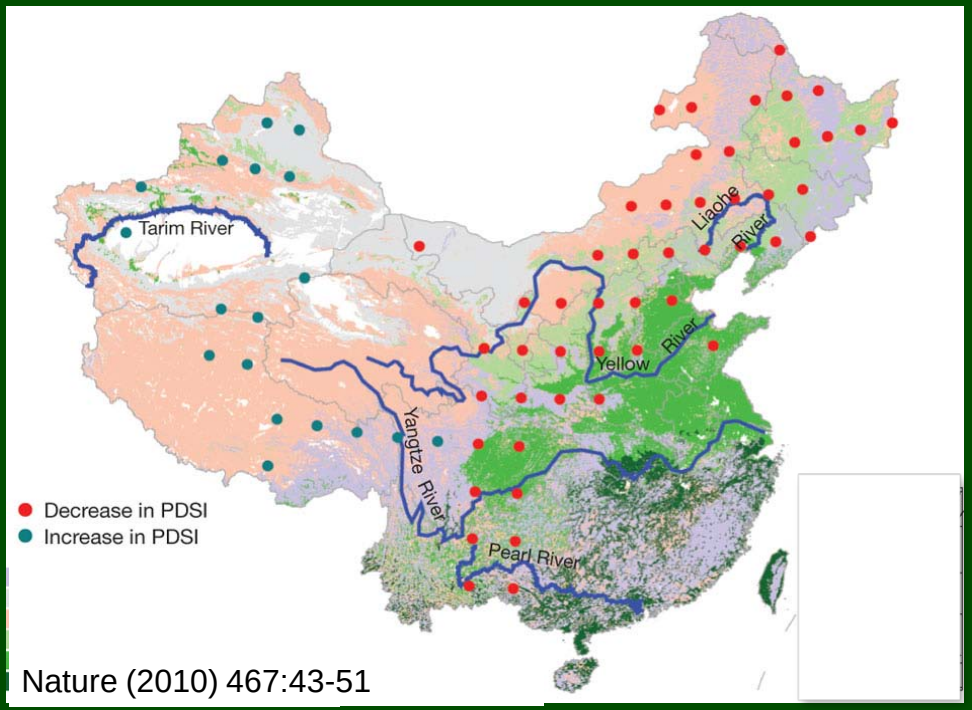



- Climate Disruption creates uncertainty as to how well India benefits from yield technology.
- Seed has had a huge impact:
  - Bt-cotton insect control
  - locally adapted hybrids
- Anticipate future seed benefits:
  - no-till facilitated by glyphosate herbicide tolerance.
  - higher stand density facilitated by lower cost hybrid seed production and apomixis hybrids


- Water supply limitations are not solved with drought tolerance.
- Western China adopting USA production system.
- Eastern China likely not, maybe no-till with Herbicide Tolerance




Nature (2010) 467:43-51

# China

- As the first adopter of USA-centric innovations we will benefit greatly, IF their development is funded.
- Supplemental irrigation in the rainbelt is expanding rapidly but West Texas water supply is uncertain.

- **The modal fertilizer rate in Africa is Zero!**

- **Slight improvement in input resources, infrastructure and education would have a dramatic impact on African cotton yields.**


Optimistic that cotton yield gains can satisfy some of the expanding global demand for textile fiber.