# GENETIC GAIN AND SUSTAINABILITY

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# COTTON SUSTAINABILITY

- Important for the future profitability and competitiveness of cotton in the marketplace against MMF.
- NCC, CI, CCI, & Cotton Board is assessing key technologies and trends that will impact the future sustainability of cotton production systems.
- I will focus on land use efficiency (LUE) where steady progress has been made and is not appreciated as a key driver of sustainability, especially in the next 30yr
  - Increasing yields from **genetic gain** and grower mgmt (and GXM)

# LUE IS A COMMONLY USED KPI

- LUE = acres to produce a lb of lint†

† Can use TSC instead of lint.

# **LUE** FOR 2 PERIODS OF US COTTON PRODUCTION †

- **1930-1939** mean area 31,223,000 mill acres harvest (13.2 M bales), mean lint yld/acre = 212 lb/ac,
  - **LUE = 0.0047 acres to prod lb lint**
- **2007-2016** mean area 10,018,800 mill acres harvest (16.7 M bales) , mean lint yld/acre = 832 lb/ac,
  - **LUE = 0.0012 acres to prod lb lint**

**~4X Increase in LUE for cotton**

† Source: USDA-AMS.

# MANY POSITIVE FACTORS HAVE IMPROVED COTTON LUE

- **BW eradication**
- **Mechanization**
- **Pest management (weeds & insects)**
- **Fertility management**
- **Irrigation technologies & efficiencies**
- **Genetic improvements from breeding (genetic gain)**

# GENETIC GAIN OR IMPROVEMENTS ON THE FARM IMPACTED BY MANY FACTORS
## FOCUS ON 2 MOST IMPORTANT

- **Genetic gain in breeding program**
  - **Estimated in commercial breeding program at appropriate test stage relative to a GG check (proprietary)**
  - **Important benchmark or metric for commercial breeding program**
- **Variety turnover or refresh rate**
  - **Large amount of GG is "left on the table" by cotton growers**
    - **Risk management**
    - **Lack of "data" on new products**
    - **Seed availability (Inventory & supply chain management) from seed companies**
    - **Reluctance to give up proven older varieties**

# THIS WILL ALL CHANGE DRAMATICALLY OVER THE NEXT 30YR AND IMPACT LUE AND COTTON SUSTAINABILITY

- Genetic gain in breeding program
  - Impact of new breeding technologies (GWS, Genome Editing, HTP, Data Science, Predictive Analytics & etc)
- Variety turnover or refresh rate
  - Precision product placement & data science
  - Improved seed production/processing technologies by seed companies
  - Inventory management/data science

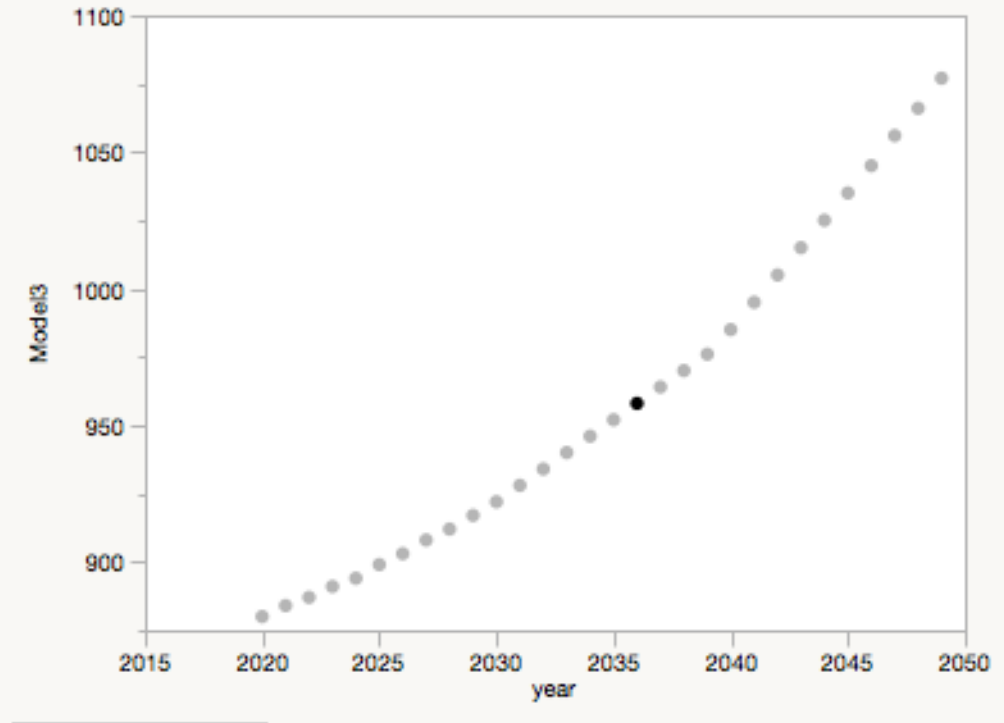
# HOW WILL GENETIC GAIN FROM BREEDING IMPACT SUSTAINABILITY OVER THE NEXT 30YR

## BASICALLY WHAT IS US YIELD IN 2050??

- **Model (3 eras)**
  - **2020-2029† 2% annual genetic gain from breeding, 5yr variety refresh rate**
  - **2030-2039 2.5% annual genetic gain from breeding, 4yr variety refresh rate**
  - **2040-2050 3.0% annual genetic gain from breeding, 3yr variety refresh rate**

† **Set Base US Yield in 2020 = 880 lb/a**

# GAINS FROM BREEDING OVER THE NEXT 30YR




- Average rate of gain over 30yr period ~ 6 lb lint/ac
- Predicted average lint yield in 2050 is 1077 lb/ac
- Doesn't include gains from other technologies other than those that protect yield
- No yield plateau in this period

# GAINS IN COTTON SUSTAINABILITY THROUGH BREEDING BY 2050

- **1930-1939** mean area 31,223,000 mill acres harvest (13.2 M bales), mean lint yld/acre = 212 lb/ac,
  - **LUE = 0.0047 acres to produce lb lint**
- **2007-2016** mean area 10,018,800 mill acres harvest (16.7 M bales) , mean lint yld/acre = 832 lb/ac,
  - **LUE = 0.0012 acres to produce lb lint**
- **2050** area 8,000,000 mill acres harvest (17.2 M bales) , mean lint yld/acre = 1077 lb/ac,
  - **LUE = 0.0009 acres to produce lb lint**

**25% increase in LUE by 2050**

# SUMMARY

- Cotton breeding technologies will contribute significantly to cotton sustainability over the next 30yr
- Rate of gain expected to steepen w/ implementation of new technologies
- Metrics going forward (how to track)
  - Realized annual gain from new varieties
  - Variety refresh rate

# ACKNOWLEDGEMENT

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# QUESTIONS