

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

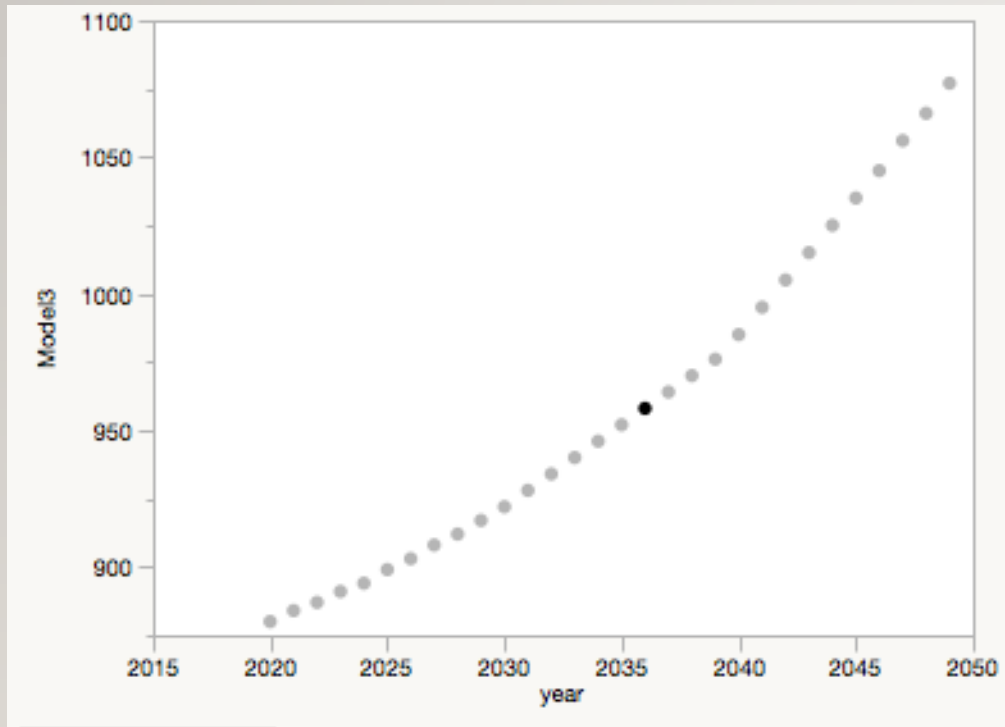
- **Genetic gain in breeding program**
 - **Impact of new breeding technologies (GWS, Genome Editing, HTP, Data Science, Predictive Analytics & etc)**
- **Variety turnover or refresh rate**
 - **Precision product placement & data science**
 - **Improved seed production/processing technologies by seed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