Transforming Crop Breeding at Monsanto: How Relevant to Cowpeas in Africa

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Joint Pan-African Grain Legume & World Cowpea Conference
Maximizing Genetic Gain and Sustainable Production of Cowpea 4 year Project
Ten Key Steps to Maximize Genetic Gain …

- Understand and leverage Global **Germplasm diversity**
- Optimize Testing network and generate high quality phenotypic data
- **Reduce** breeding cycle time
- **Ramp-up numbers** of breeding crosses
- Insure **genetic purity & genetic integrity** at all stages of breeding
- Develop efficient **breeding workflows** for pipeline advancements
- Fully utilize **integrated IT systems**
- Take full advantage of genotyping platforms for **MAS, MABC, and GWS**
- Focus on developing tolerance to **biotic and abiotic stress traits**
- **Break antagonism** between traits (linkage drag)
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Genetic Purity & Integrity in some crops hinders Genetic Gain

• Improve genetic variation in population available for selection

• Compromises quality of genotypic & phenotypic data quality

• Complicates MABC trait conversion (heterogeneous RP)

Causes: admixtures, outcrossing, legacy germplasm (costly to cleanup)

Solutions:

SSD, DH, P/O testing, purity characterization of key parents
Inbred Engine (SSD) and Improved Purity Assays in Cotton

Genetic Purity

- **BEFORE (2011)**
  - 20% F7 lost High HET

- **CURRENT (2015)**
  - <5% F7 lost High HET

Benefits

- Recycle/refresh time REDUCED by 2yr
- Homogeneous/homozygous entries in yield plots = Higher H
- Quality marker data for GWS
- Improved performance of native plant health traits
- Effective MAS

Slide Courtesy K Smith & M Martin
Typical SSD Workflow

Generate Parental breeding combinations

IET
PYT
AYT
CIT

Pure Seed Increase
PYRT
Genetic Purity workflow by multiplex qPCR

- Bulk seed method (prior to FP)
- Effective & Rapid

Total processing time: 4-5 hours
9216 qPCR data points/ per cycle
Approximately $0.20 reagent cost per data point
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Seed Handling

A PNEUMATIC VOLUMETRIC SEED PACKAGING SYSTEM
Seed Handling

Can be used to package any breeding/testing plot given adequate seed supply

- 36 packets (3 lines, 12 reps each) can be filled with seed and new packets for the next 3 lines set up in 2.5 to 3 minutes

- Tubes which hold the seed, once calibrated (cut to length) produce accurate seed counts (within 5-10 seeds of desired total; 0-5 seeds from tube to tube)

- Variations in seed size can be handled by grouping varieties into seed size groups and then calibrating tubes accordingly

- When using a planter which meters seed, the slight variation in seed count is not an issue
Monsanto Commitment to Food & Nutrition Security

- Maximizing Genetic Gain of Cowpea
- BT Cowpea
- Water Efficient Maize for Africa (WEMA)
- Virus Resistant Cassava
- Monsanto Beachell-Borlaug Intl Scholars
- Borlaug Training Foundation
Thank You

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