

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

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March 7, 2016

Joint Pan-African Grain Legume & World Cowpea Conference



MONSANTO

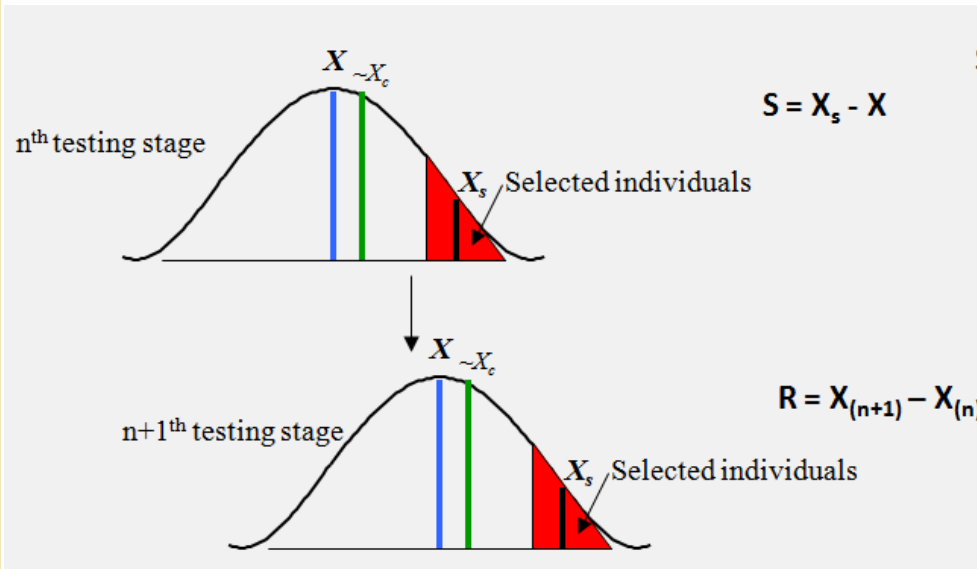


Maximizing Genetic Gain and Sustainable Production of Cowpea 4 year Project



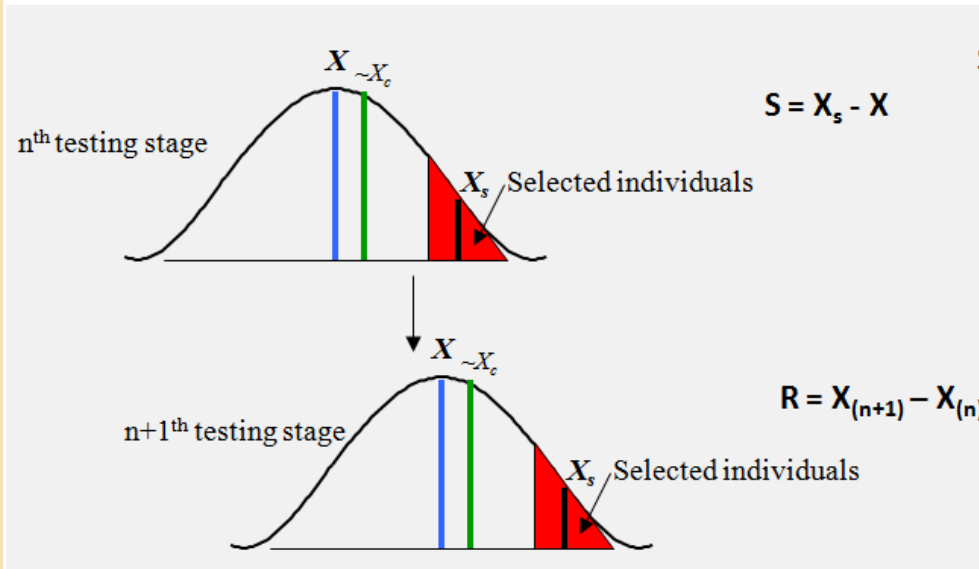
BILL & MELINDA
GATES foundation

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



Slide Courtesy K Smith & M Martin

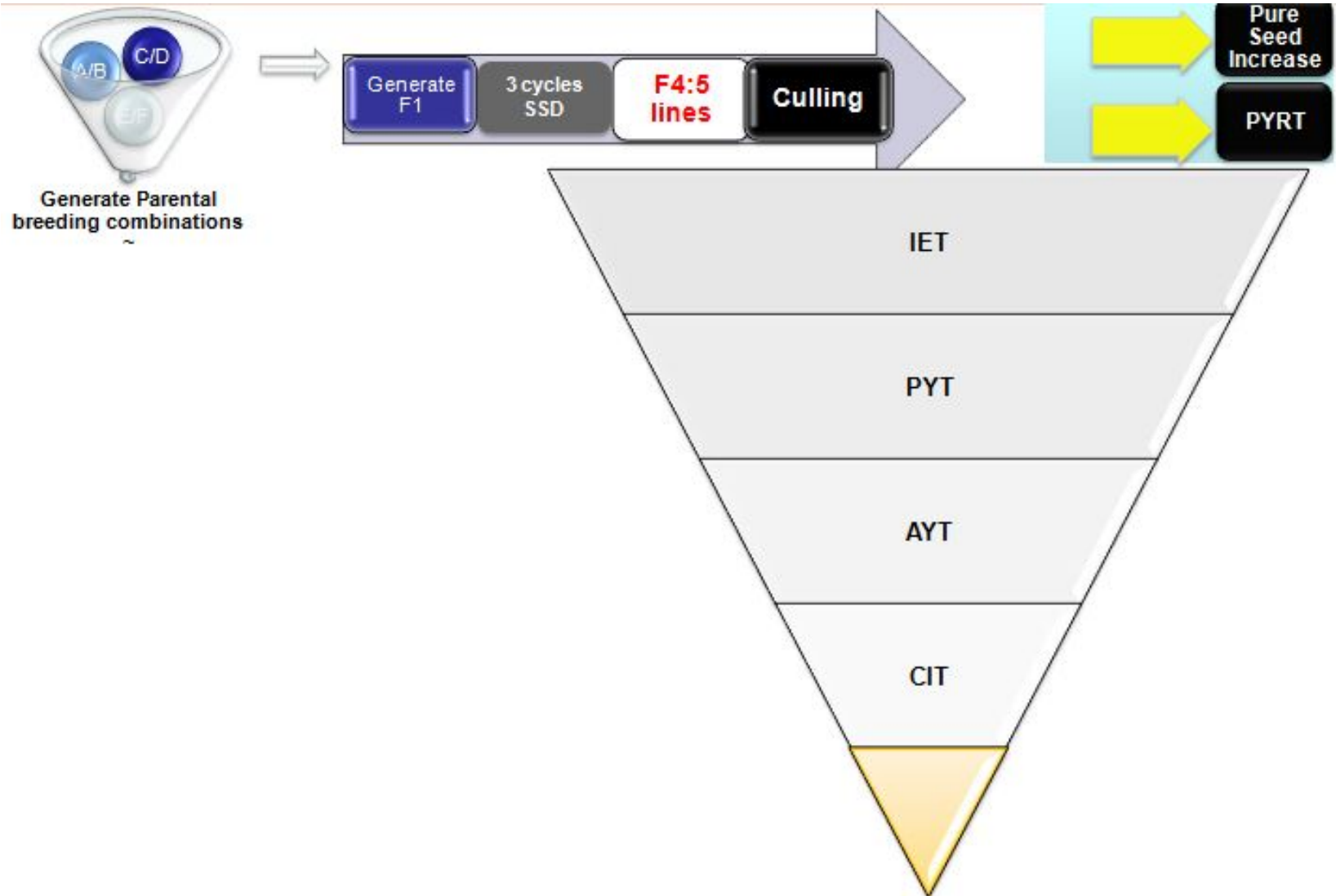
Genetic Purity

- **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

Typical SSD Workflow



Genetic Purity workflow by multiplex qPCR

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



DNA extraction

SNP Chip prep

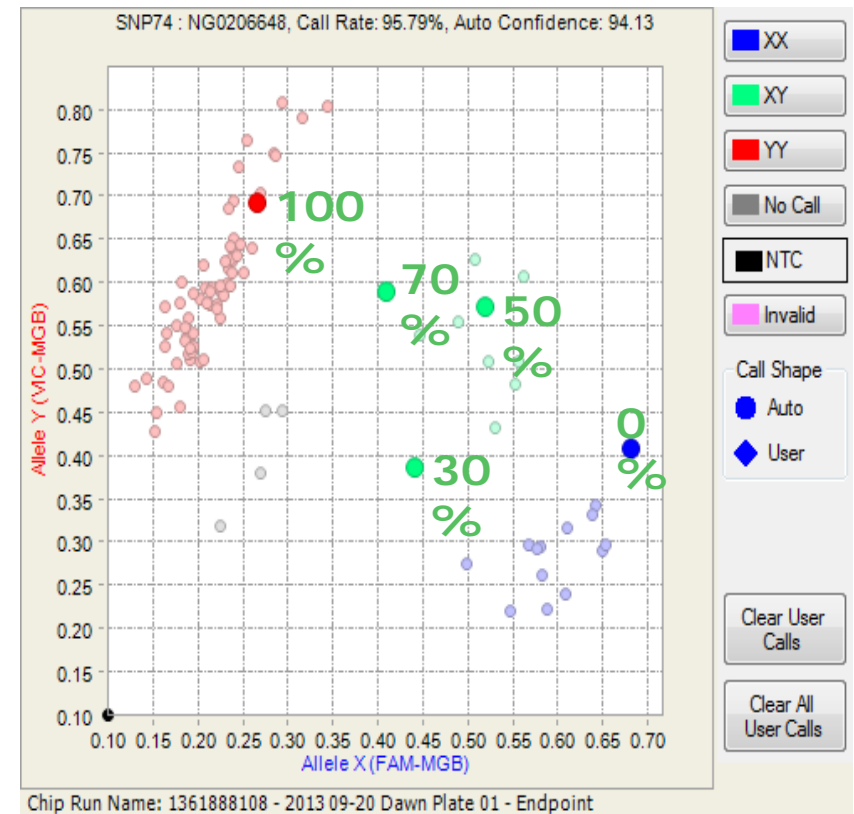
qPCR

Data analysis

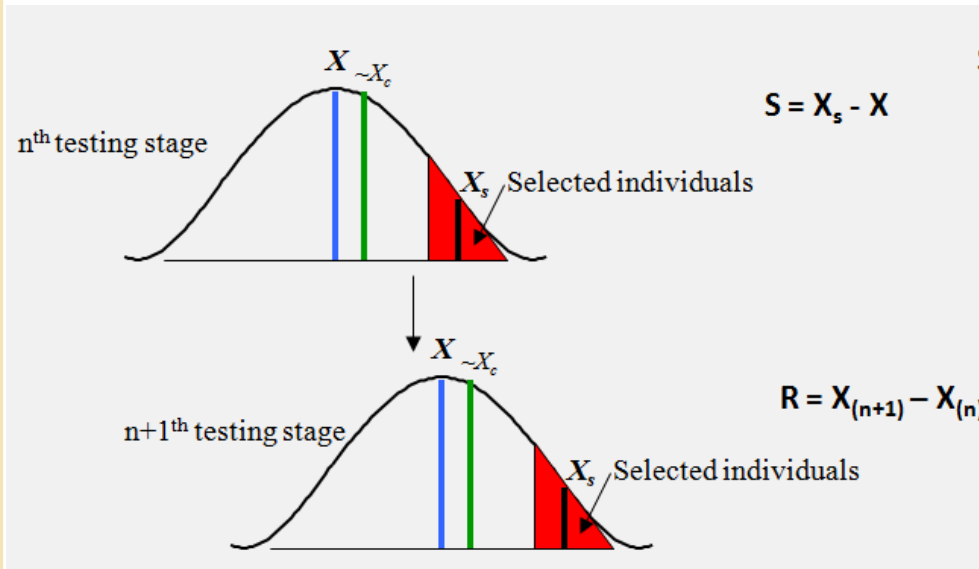
Total processing time: 4-5hours

9216 qPCR data points/per cycle

Approximately \$0.20 reagent cost per data point

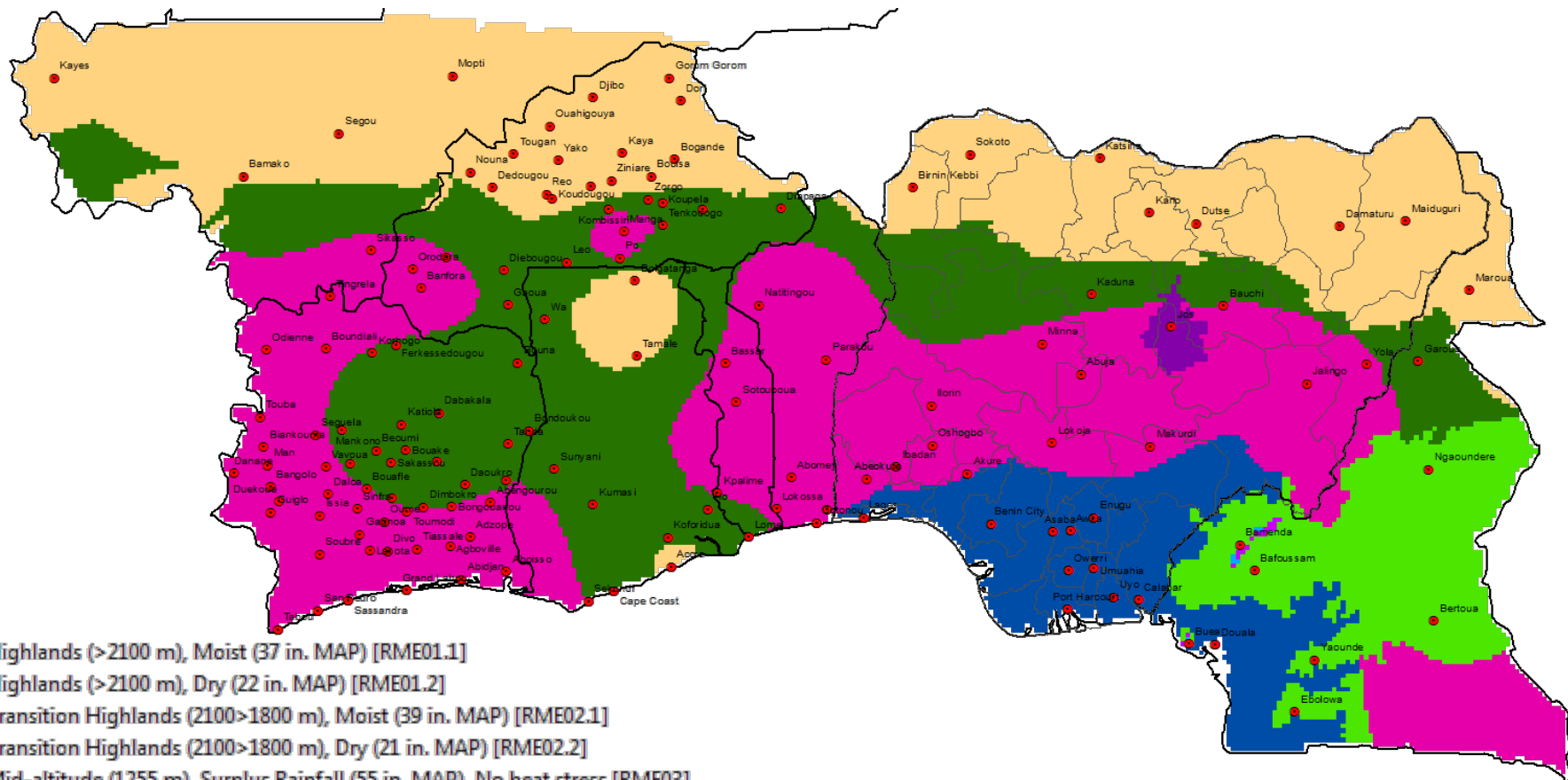


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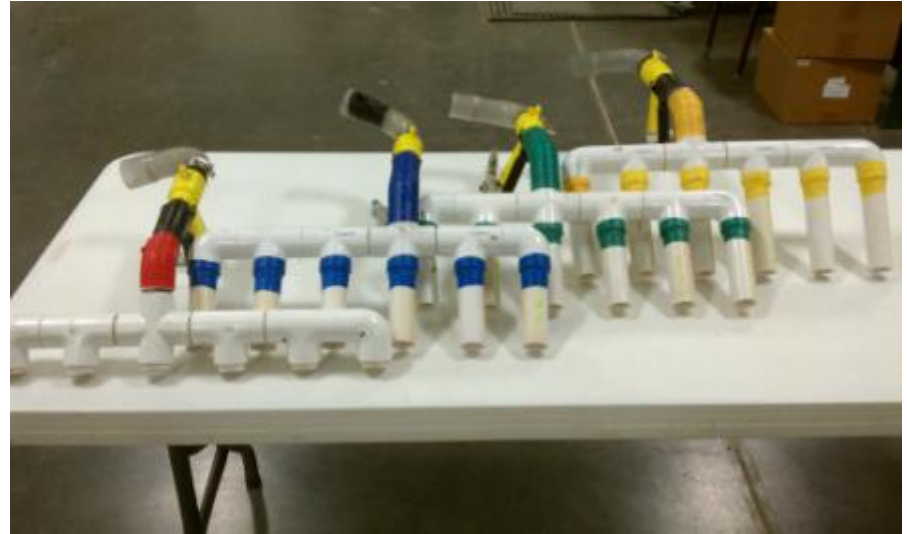
Environmental Analysis West Africa



- Highlands (>2100 m), Moist (37 in. MAP) [RME01.1]
- Highlands (>2100 m), Dry (22 in. MAP) [RME01.2]
- Transition Highlands (2100>1800 m), Moist (39 in. MAP) [RME02.1]
- Transition Highlands (2100>1800 m), Dry (21 in. MAP) [RME02.2]
- Mid-altitude (1255 m), Surplus Rainfall (55 in. MAP), No heat stress [RME03]
- Mid-altitude (1210 m), Drought prone (18 in. MAP), Low heat stress [RME04]
- Mid-altitude (1140 m), Opportunistic Drought (22 in. MAP), Low heat stress [RME05]
- Mid-altitude (1080 m), Sufficient Rainfall 36 in. MAP), Low heat stress [RME06]
- Low-altitude (350 m), Opportunistic Drought (22 in. MAP), [RME07]
- Low-altitude (305 m), Surplus Rainfall (42 in. MAP), High heat stress [RME08]
- Low-altitude (275 m), Sufficient Rainfall (36 in. MAP), Moderate heat stress [RME09]
- Low-altitude (210 m), Excessive Rainfall (90 in. MAP), Moderate heat stress [RME10]



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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