Field Testing and Phenotyping for Breeding

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Introduction

Who are we?

- **Sanesh Ramburan (Phenotyping Lead Africa)**
  - Based in South Africa (Petit breeding station)
  - 20 years experience (Multi-environment trials, cropping systems research, commercial breeding, plant physiology, cultivar adoption, G x E).
  - Crop experience – Wheat, Barley, Oats, Sugarcane, Maize.
  - 3 years with Bayer (Legacy Monsanto)
  - Roles – Organization leadership, testing network design and management, operational management, analytics/systems/processes.
- **Jamlick Mwathi (Testing Lead – Sub-Saharan Africa)**
  - Based in Kenya (Nairobi)
  - 12 years of experience in breeding, multi-environment trials, project management.
  - Crop experience - Rice and Maize.
  - 9 years with Bayer/Legacy Monsanto.
  - Roles – Testing network management, resource optimization, team management.

Introduction

What will this seminar cover?

1. Overview and fundamentals of field testing and phenotyping

- Field testing concepts, critical considerations for network design, organizational structures, and key disciplines within phenotyping.

2. Field trial execution

- Site selection, land prep, planting, trial management, data collection, harvesting.

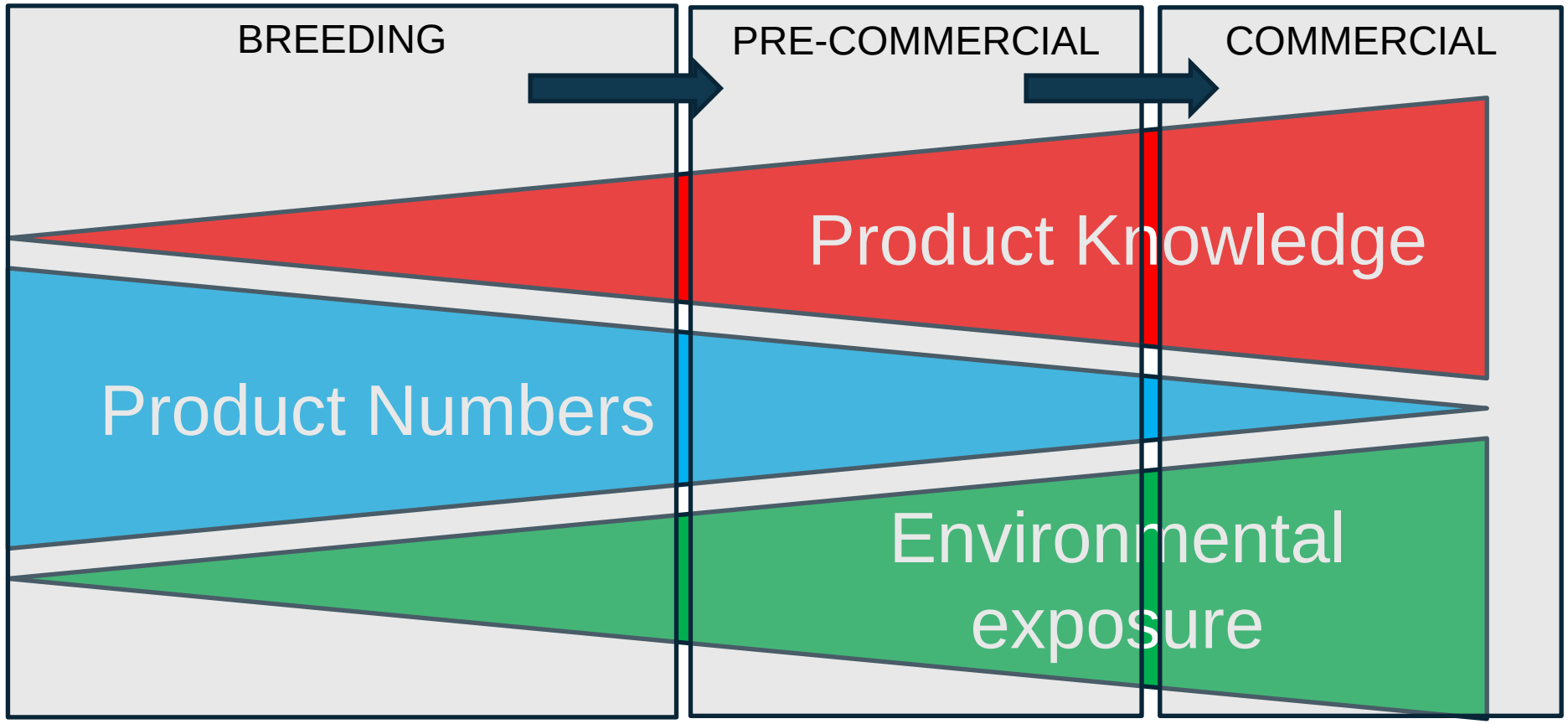
3. Data quality management

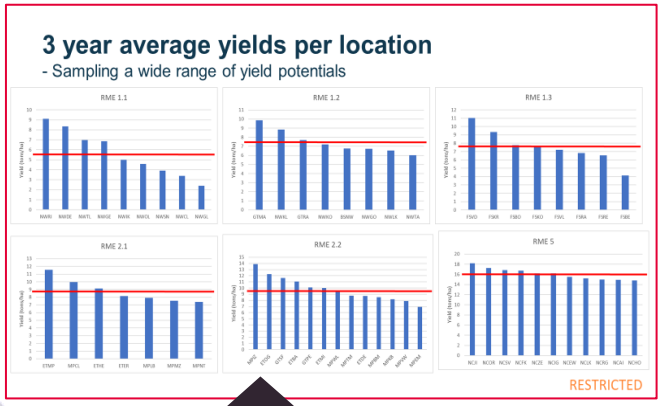
- Tiers of data quality management, importance of managing spatial variation, automated QC.

Fundamentals of Field Testing and Phenotyping

RESTRICTED

The Product Testing Journey (The big picture!)





Farmer managed (aligned with target market)

Field uniformity

Representative of target environments

Optimized Field Testing Networks

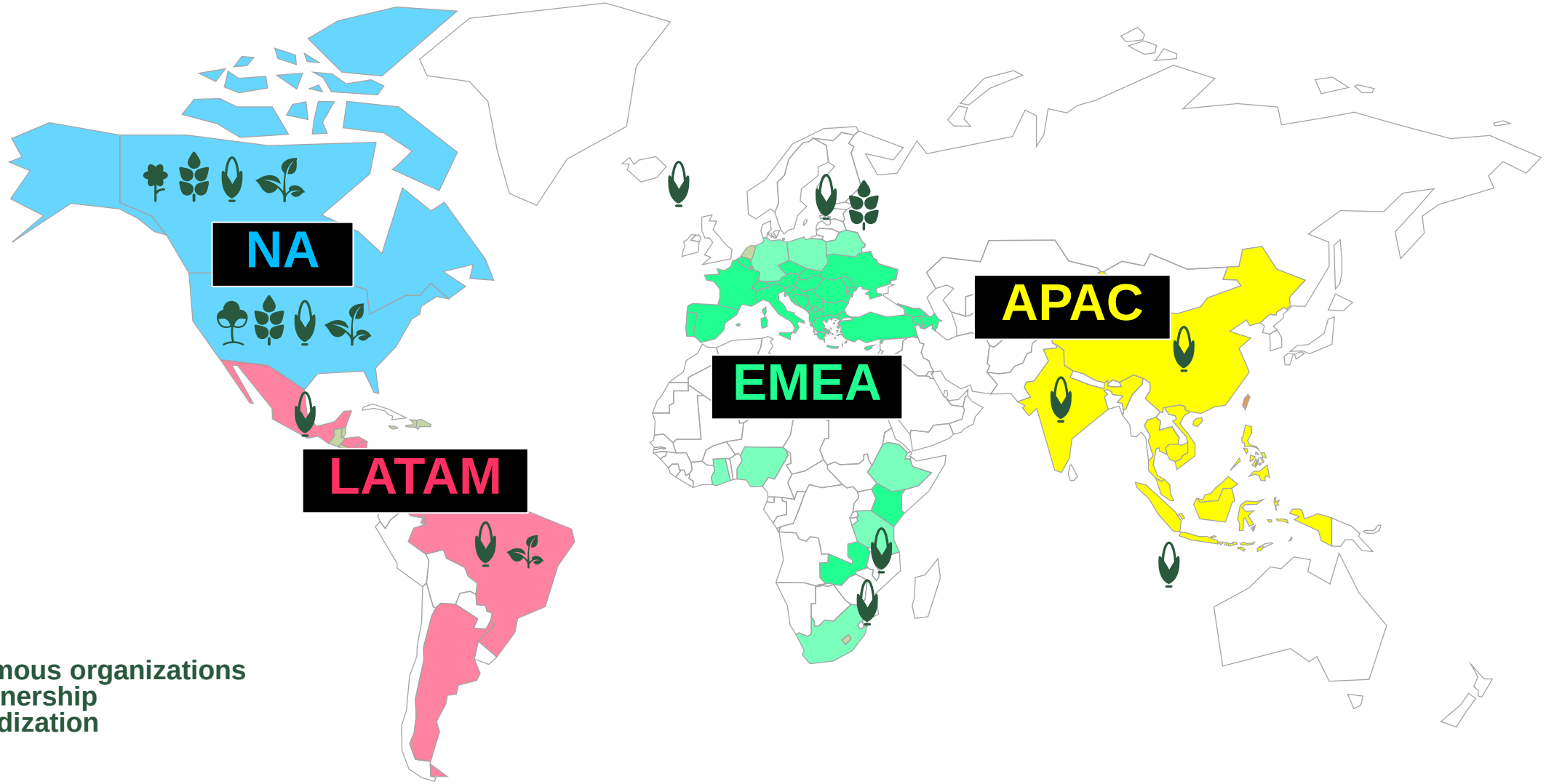
Collaborator/ Contractor relationships critical

Wide distribution (spread risk)

Capture pest/disease variations

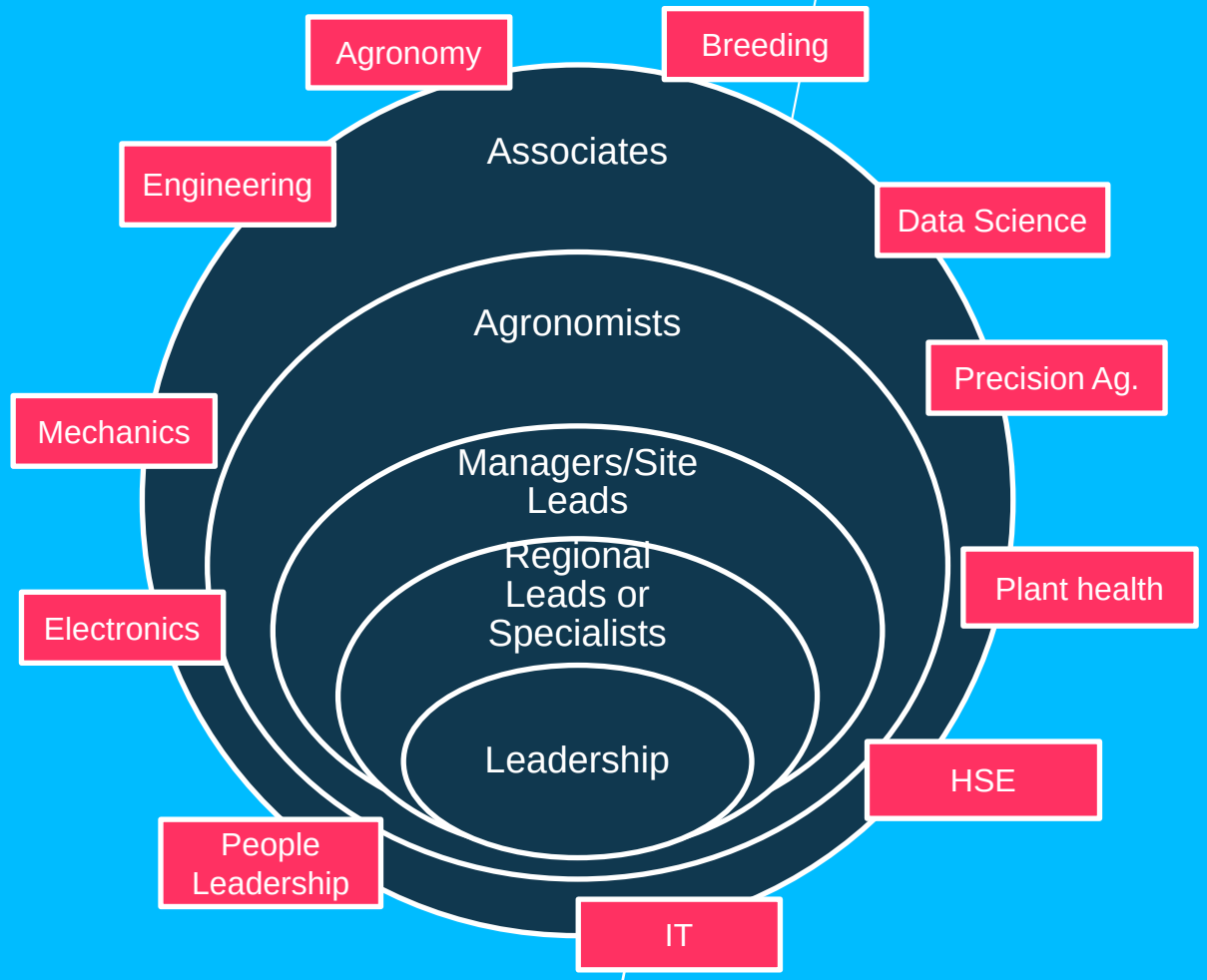
Practical and accessible sites

Bayer Field Testing/Phenotyping Global Hubs



Autonomous organizations
Data ownership
Standardization

Modern Transdisciplinary Phenotyping



Field Trial Execution

Key concepts

Goal is to identify and eliminate all possible variables

Uneven emergence

- poor seed to soil contact
- inadequate moisture
- Cloddy field conditions
- avoid taking certain notes

Sprayer tire track damage

- careless or inexperienced operator
- guess rows effect
- lack attention to detail
- difficult to quantify effects

Guess Rows

- Deactivate plots with guess rows +/- 15 cm variance
- May require several ranges to be deactivated
- Monitor this while planting
- Recalibrate/fix GPS immediately

Gaps

- Hand plant gaps before V2 stage
- Deactivate plots with gaps >1.2m
- Deactivate adjacent plot due to competition

Weed Control

- Poor weed control creates variability
- Late season weed control
  - Harvest issues
  - Accurate moisture readings
  - Questionable data
- Deactivate due to weed pressure

Fertilizer deficiencies

- blockage or restricted knife on an anhydrous applicator
- Use only calibrated fertilizer equipment
- Ensure all monitoring equipment is working properly
- Possibly change fertilizer application technique to reduce potential variability

Ponding

- Intense rainfall, poorly drained soils
- Poor field selection
- Inspect fields during off season…
- Avoid mapping plots in these areas…use filler

Animal Damage

- Avoid plots near bushy areas
- Need to differentiate between animal damage and stalk lodging
- Take good notes and make sure QA/QC delegate is aware of situation

Nematode Damage

- sandy soils
- Stunted plants, damaged roots
- Variation across plots, reps & field
- Abandon by rep or entire location

Severe weather events

- determine value in taking field notes
- determine if field is harvestable
- could impact pollination
- only collect harvest traits

Soil variability

- site selection…
- use filler or better rep placement…
- Deactivate the plots

Data Quality Management

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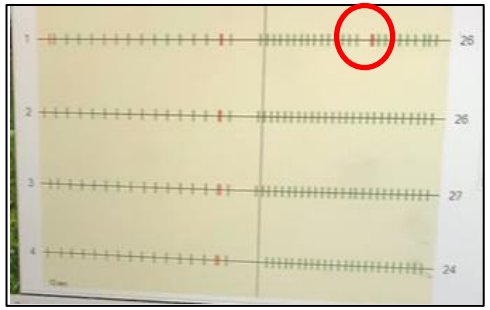
Different tiers of data quality management (Field Trials)

Pre-planting

- Entry verification
- Trial packing
- Trial scanning

Planting

- Skips/double
- Alley alignment
- Range shift/plot swap



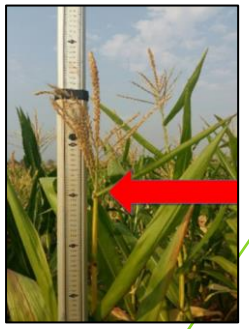
Early season trial management

- Gap identification and plot deactivation
  - Establish rules and thresholds
  - Capture reasons for discarding plots
  - Neighboring plot effect

Different tiers of data quality management (Field Trials)

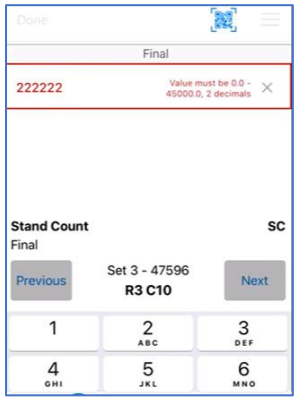
// Infield data collection (Protocol-related QC)

- // Establish protocols that minimize data collection errors e.g. SOPs, training and verification



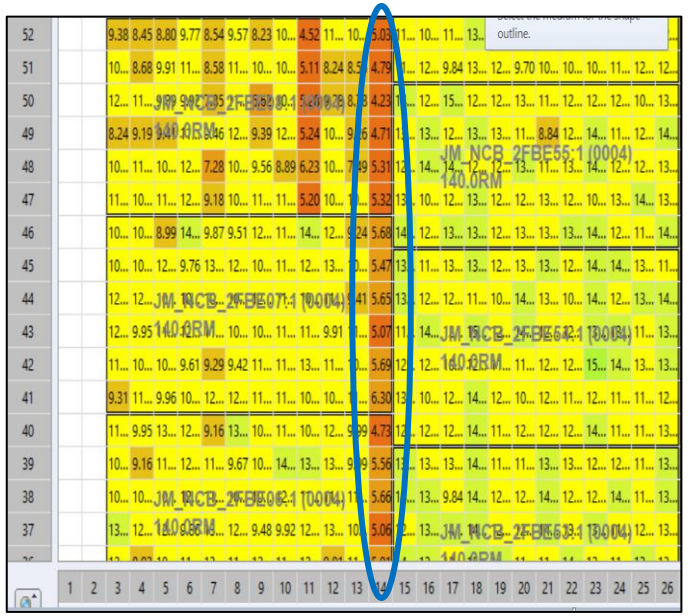
// Plot data collection (Digital tool QC)

- // Numeric thresholds for traits – minimize finger errors



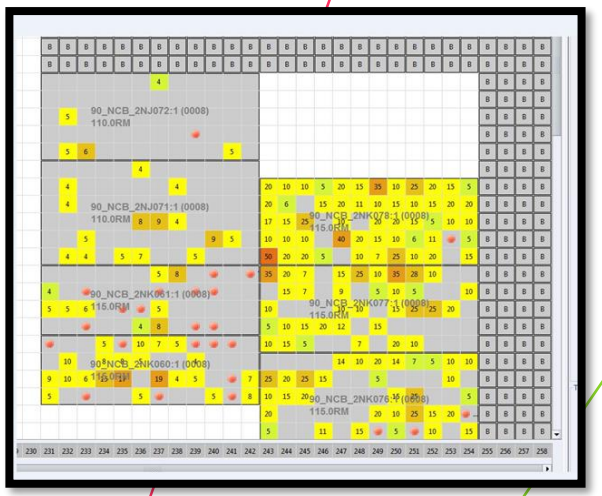
// Field-level QC

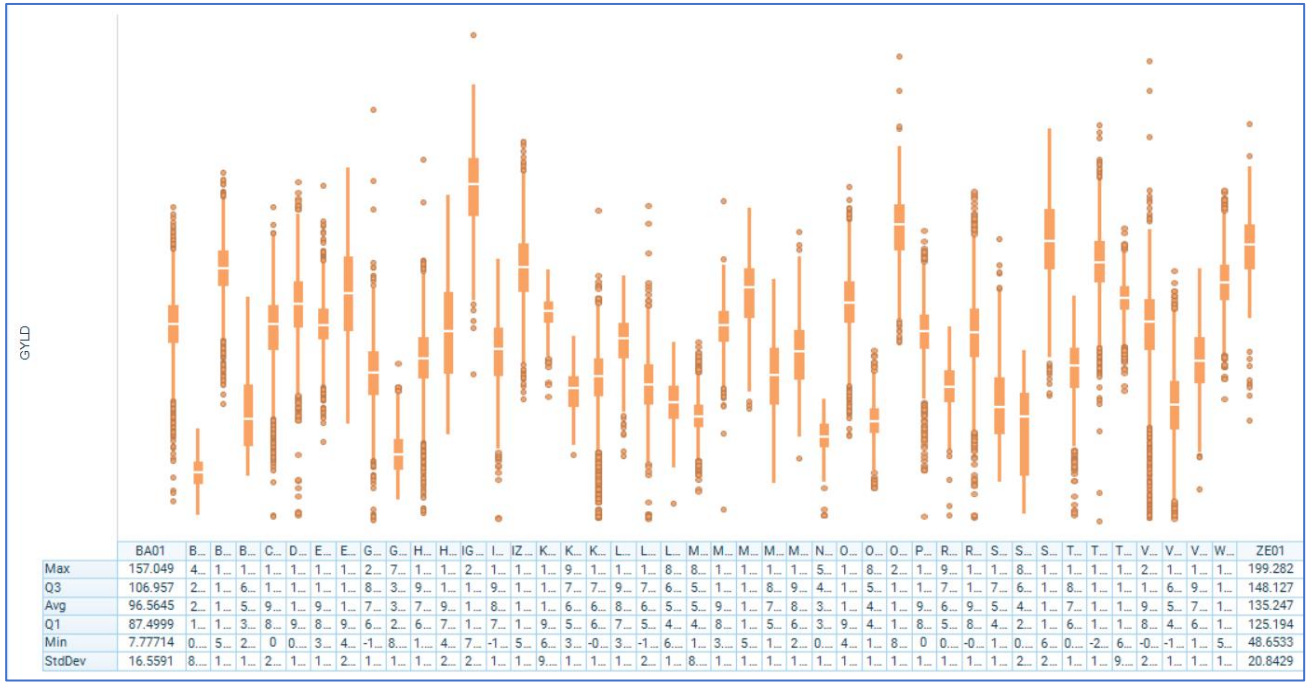
- // Digital trial maps – identification of spatial trends
- // UAV-collected traits



Different tiers of data quality management (Field Trials)

- **Post-harvest multi-trait QC and outlier detection**
  - Are calculated traits calculating correctly?
  - Network level visualization of trends





	BA01	ZE01
Max	157.049	199.282
Q3	106.957	148.127
Avg	96.5645	135.247
Q1	87.4999	125.194
Min	7.77714	48.6533
StdDev	16.5591	20.8429

Other critical topics – to be covered in workshops

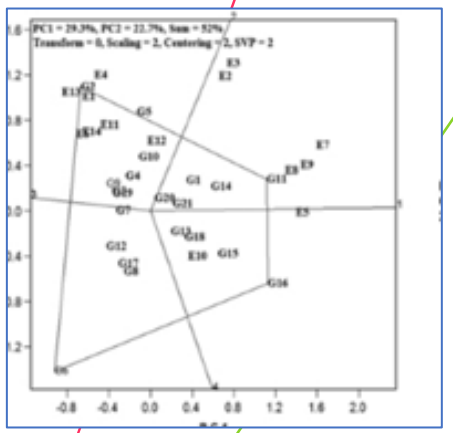
// Mechanization and automation

// Testing network optimization – G x E, location evaluation, network design

// Digital data collection – UAV workflows

// Weather/Soil/Management data – Metadata

// OR models and system efficiencies



Thank you!