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Standard Operating Procedure (SOP) for Maize Trial Designing

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1. Introduction



Trial design is a very important activity in germplasm evaluation processes. Good field designs are important at all major stages of a plant breeding program from the earlier stages of screening large number of genotypes to a few elite selections for release. At each stage, good field designs are critical to ensure an efficient cost-effective operation and to ensure the best possible genetic material is identified. Designs can range from unreplicated trials in one location to a fully replicated trial across many testing environments.

2. Purpose

Blocking helps to effectively control trial errors. The major reason of blocking is to reduce plot-to-plot variation and to improve the precision of the experiment. Failure to adequately block a field experiment can result in unacceptably large error variance and/or biased estimates of genotype effects (See Mead, 1997 for an example). To control field variation, especially with a large number of entries, it is essential to make use of incomplete block designs.

3. Scope

This SOP contains the trial designing procedure required for maize breeding activities. It covers designs steps for different testing stages (breeding nursery, stage 1 – Stage 4/5, and on-farm trial).

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4. *Definition of terms*

Design: Whenever an agriculture experiment is done by using certain (statistical) procedure then it is called design.

OR

Experimental design are various types of plot arrangement which are used to test a set of treatments to draw a valid conclusion about a particular problem.

Designation: an official name, description, or title.

Pedigree: the recorded ancestry or lineage of a plant or family.


Nursery: Place where plants are grown until they are large enough to be planted in their final positions.

5. *Roles and Responsibilities*

All staff involved in implementing breeding activities in the maize breeding unit at IITA must use the breeding data management SOP. No alteration should be made to the procedures unless approved exceptionally by the program leaders. The list of individuals responsible for each section of the data management SOP in the breeding data cycle are listed below.

Crop Lead (CL) Responsible for the overall management of the trials and for delegating team responsibilities. The CL is the lead breeder and coordinator of Maize Improvement Program at IITA.

Breeder (B): Coordinate the field layout of experiments, planting and checks on the implementation of defined protocols on the different experimental sites. Ensures all trials

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are established in the on-station and out-stations respectively. This includes trial management and data collection.



Trial Manager (TM): Oversees trial preparations and management protocols, land acquisitions, oversees planting in the outstations. Also supervises planning of inputs and other planting logistics for the various stations.

Research Supervisor (RS): Coordinates the activities of the Research Technician to ensure that assigned tasks are carried out correctly. The RS involves in planting, field management and post-trial management practices as well as coordinates fertilizer application in on station and outstation experimental fields. S/he involves in the Nursery and seed increase protocols as delegated by the CL and B respectively.

Research Technician (RT): The Research Technician performs field tasks as defined in the trial protocols such as field data collection or field management practices. RT's responsibility is to perform assigned tasks including the use of digital tools defined in the protocol for capturing, storing, transmitting, and ensuring quality of data within defined time periods.

Research Administrative Manager (RM): Responsible for experiment creation in EBS in order to generate the randomization plan for the specified experimental design by the CL for the trials to be established. Generates Seed labels and Field-Tags for the trials. Carries out required analyses using the relevant statistical methods. Generates trial field layout for data capture using the digital tools. Receives transmitted data captured from the field and ensures that the data quality is uncompromised.

Data Manager (DM) Provides end-user support and training on the usage of EBS and digital tools. The DM reinforces the implementation of data collection and data management protocols.

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6. Procedure

6.1. Normal Yield Trial

- Site selection
- Soil testing
- Land preparations
- Planting
- **Border rows:** At least two border rows should be planted on both sides of the trial



6.2 Trial designing steps for stage 1 Variety Trials

Prepare crosses that need to be evaluated in stage 1 trial from the previous season breeding nursery

- Maintain the pedigree of the line
- Establish the list of the lines
- Design the trials in Fieldbook/EBS

6.3 Trial protocols for stage 1 testing (1 tester , 2 reps, 2 locations)

- The design should be an Alpha lattice design
- Available check varieties will be included in the trial
- Number of entries evaluated are larger than the subsequent stages
- The trial should have two replications
- The trial will be grown in 2 locations
- It will be conducted only for one season

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6.4 Trial protocols for stage 2 testing (>2-3 testers, 3 replication, 4-6 locations, F3 – F4)

- The design should be an Alpha lattice design
- Available check varieties will be included in the trial
- Number of entries evaluated are smaller compared to stage 1
- The trial should have three replications
- The trial will be grown in 4-6 locations

6.5 Trial protocols for stage 3 testing (3 testers, 3 Reps, 6-8 locs)



- The design should be Alpha lattice design
- Available check varieties will be included in the trial
- The materials selected from Stage 2 (50%) will be tested in stage 3
- The trial should have three replications
- The trial will be grown in at least 6-8 locations

6.6 Regional trial/Validation (20-50 locations)

- The design should be Alpha lattice design
- Available check varieties will be included in the trial
- The materials selected from Stage 3 (50%) will be tested in the regional trials
- The trial should have three replications
- The trial will be grown in 20-50 locations

6.7 Trial designing steps for the On-farm Trials

- Analyse the data and summarize the results of the multi-location trials for decision making

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- Identify the best 4-6 entries that are superior over the checks
- Maintain the pedigree of the candidate varieties
- Prepare sufficient amount of seeds of the candidates along with the local checks

6.8 Trial protocols for the on-farm variety Trial



- The trial will be grown in un replicated plots
- Two-three volunteer farmers need to be selected in each target agroecology for the trial
- A total of 20-50 on-farm locations needs to be grown for variety registration
- Available local/standard varieties need to be included as checks
- Number of entries need to be between 4-6
- Liaise with the national program for the on-farm trials and submission of variety registration application in the country of registration
- Prepare and dispatch seeds to the respective on-farm testing sites
- Coordinate with the national program to facilitate the planting of the on-farm trials
- It will be conducted only for one season

7. *Appendix*

7.1 Contacts for support

For Technical problems with digital tools (Zebra printers, ToshibaSX5 printer, Fieldbook App), printing field labels and uploading data to EBS, seed Inventory Information, please contact: Simon Imoro s.imoro@cgiar.org and Bossey Bunmi b.bossey@cgiar.org.

Experimental design and data analysis: Ibnou Dieng, i.dieng@cgiar.org, Bossey Bunmi b.bossey@cgiar.org.

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8. *References*

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