IITA Transforming African Agriculture CGIAR	**Crop: Maize** **Function:** Data collection	**SOP #**	IITA-MZ-SOP02
		Revision #	IITA-MZ-SOP02-01
		Implementation Date	15/07/2022
Page #	1 of 7	**Last Reviewed/Update Date**	30/06/2022
SOP Owner	Breeder (Wende Mengesha)	**Approval Date**	15/07/2022

Standard Operating Procedure (SOP) for Maize Data Collection

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1. Introduction

Data collection and management involves broadly five stages, viz. exploration and collection, characterization and evaluation, conservation, exchange and utilization, and documentation. In addition, it is also concerned directly or indirectly with the plant quarantine. At each of the various stages in the above process, information about plant material is used for communication and decision making. It is estimated that the scientists and technicians spend at least 30 percent of their time in handling of data generated at various stages (Rogers *et al.,* 1975). Documentation is, therefore, one of the most critical functions concerned with genetic resources.

2. Purpose

The SOP is to outline the roles, responsibilities, and procedures to be followed in collecting authentic data in maize breeding. To make an information system meaningful and more generally applicable, the data needs to be standardized in terms of terminology and measurement. All those involved in plant genetic resources work have recognized the need for an internationally accepted system to record, classify, communicate, correct, or update information about germplasm.

3. Scope

This SOP contains the descriptive procedure required for collecting data in maize breeding activities. It also covers management steps for a successful breeding program.

4. Definition of terms

5. Roles and Responsibilities

All staff involved in implementing breeding activities in the maize improvement program 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 collection 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 the Maize Improvement Program.

Breeders (B): Responsible for the field layout of experiments, coordinates planting and checks on the implementation of defined protocols on the different experimental sites. Ensures all trials 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. Involves in planting, field

management practices and post-trial management. Coordinates fertilizer application in on station and outstation experimental fields respectively. 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 and use 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 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.

6. Procedure

6.1 Basic Maize Traits for Optimum Yield Trials

1. Plant height (PHT) and ear height (EHT) are measured in cm as the distance from the base of the plant to first tassel branch and the node bearing the upper ear, respectively.
2. Days to anthesis (DYANTH) and days to silking (DYSK) are recorded as number of days from planting to the date when 50% of the plants in a plot have tassels shedding pollen and had emerged silks, respectively.
3. Anthesis-silking interval (ASI) is calculated as the difference between DYSK and DYANTH.

4. Husk cover (HUSK) is scored based on 1 to 5 scale, where 1 represents husk tightly arranged and extend beyond the ear tip and 5 represents loose and exposed husk tip.
5. Ear aspect is scored on 1 to 5 scale, where 1 represents clean, well filled, uniform and larger ears, while 5 represents diseased, poorly filled, variable and smaller ears.
6. Plant aspect is also scored on a 1 to 5 scale, where 1 represents uniform, clean, vigorous and good overall phenotypic appeal, while 5 represents weak, diseased and poor overall phenotypic appeal.
7. Collect days to flowering data until 50% anthesis. During the time of flowering, visit the trial daily to record flowering dates.
8. Streak virus data is collected in a 1-9 scale, where 1= no streak virus to 9 = severe infection with leaf heavily infected.
9. Collect rust disease on a 1-9 scale, where 1= no lesions, and 9 = severe infection with leaf abscission.
10. Collect data on northern corn leaf blight (NCLB) on a 1-9 scale, where 1=clean leaf with no leaf blight, and 9=severe infection of leaf.
11. Collect data on days to maturity from sowing date to maturity. During the maturation, visit the trial 3 times a week to determine days to maturity.
12. Collect data on lodging by scoring plants lying on the ground, using a scale of 1 - 9 where, 1= all plants erect, 9 = all plants lodged.
13. Collect data on the number of plants harvested by counting the number of plants in a plot.
14. Collect data on 100-seed weight by weighing 100 seeds sampled collected from the bulk threshed seed in a harvested plot.
15. Collect data on Curvularia, scored on a scale of 1-9; where 1=none and 9=severely affected by curvularia.

16. Collect data on Gray Leaf Spot, which is to observe GLS severity on the plants per plot based on degree of infection (relative or absolute area of plant tissue affected by disease) rated on a scale of 1-9 where 1=no GLS and 9=severe GLS severity.
17. Collect data on the number of ears harvested per plot by counting the number of ears in a plot.

6.2 Heat Stress Trial-Basic Traits with the under-listed specialized traits

1. Collect data on observation of blasting severity of the tassel (necrosis due to heat stress) at the time of flowering. It occurs under extreme temperatures and drought. The drying of tassel without pollen extrusion.
2. Collect data on severity of leaf rolling; usually scored under heat stress.
3. Collect data on Leaf Firing which is the flag-leaf and top younger leaves that are burnt due to heat stress.
4. Collect data on Barren Plants growing without exertion of ears.

6.3 Striga Trial-Basic Traits observed under Infested and Non-infested regions with the under-listed specialized traits

1. Collect data on 1st Striga Rating, which is the number of plants with Striga damaged symptom per plot at 8 weeks after planting.
2. Collect data on 2nd Striga Rating, which is the number of plants with Striga damaged symptom per plot at 10 weeks after planting.
3. Collect data on 1st Striga Count, which is the number of emerged Striga plants per plot at 8 weeks after planting
4. Collect data on 2nd Striga Count, which is the number of emerged Striga plants per plot at 10 weeks after planting

6.4 Fall Armyworm Trial-Basic Traits observed with the under-listed specialized traits

1. Collect data on Four Levels of Damage rating, which is the number of Individual ears for each of the germplasm entries scored at the time of harvest, and the average ear damage score for a germplasm entry is then computed.
2. Collect data on Fall Armyworm leaf damage rating on a scale of 1 to 9, where 1 = no damage to the leaf and 9 = severely damaged leaf. This rating is done four times starting 4 to 5 weeks after planting.

6.5 Stem Borer Trial-Basic Traits observed with the under-listed specialized traits

1. Collect data on Ear Damage, which is the number of cobs showing damage due to borer feeding.
2. Collect data on Stem Borer Rating, which scored using a scale of 1-9 (1 = no visible insect damage and 9= badly damaged and stunted plants with most of the leaves on several plants showing lesions while remaining plants have dead heart or broken stalks).
3. Collect data on Stem Tunnelling, which is the proportion of stem length tunnelled relative to height of the plant.
4. Collect data on Leaf Feeding, which is the feeding damage on the maize leaves rated using the scale of 1-9 (1 = limited number of pin holes and 9 = extensive feeding damage on the leaves).

5. Collect data on Dead Heart, which is the number of plants showing 'death' of the growing point.
6. Collect data on Stalk Breakage, which is the number of broken stalk due to borer damage at 10 weeks after planting (WAP).

7. Appendix

7.1 Contacts for support

For Technical problems with data collection, please contact: Bossey Bunmi (b.bossey@cgiar.org).

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

8. References