

DTMA Drought Phenotyping Protocol

Latest update: Based on discussions held at the DTMA Meeting, Ibadan, Nigeria, September 2008.

A. Measured in all trials

No.	Traits	Description	Unit/Precision
1	Plant height	Measured as height between the base of a plant to the insertion of the first tassel branch of the same plant of 6 alternating plants in the plot. Enter the data individually and use the computer to calculate the average	Measure: 1 cm Average: 0.1 cm
2	Ear Height	Measured as height between the base of a plant to the insertion of the top ear of the same plant; observations taken of 6 alternating plants in the plot. Enter the data individually and use the computer to calculate the average	Measure: 1 cm Average: 0.1 cm
3	Anthesis date	Measured as number of days after planting when 50% of the plants shed pollen. This is determined on a daily basis by counting the number of plants with at least one anther extruded divided by the total number of plants in the plot	1 day
4	Silking date	Measured as number of days after planting when 50% of the plants silk. This is determined on a daily basis by counting the number of plants with at least one silk extruded divided by the total number of plants in the plot	1 day
5	Anthesis silking interval	Calculated as Silking date minus Anthesis date	1 day
6	Senescence	Scored using a scale from 0 to 10, dividing the percentage of estimated total leaf area that is dead by 10: 1 = 10% dead leaf area; 2 = 20% dead leaf area; 3 = 30% dead leaf area; 4 = 40% dead leaf area; 5 = 50% dead leaf area; 6 = 60% dead leaf area; 7 = 70% dead leaf area; 8 = 80% dead leaf area; 9 = 90% dead leaf area; 10 = 100% dead leaf area; leaf senescence is scored on 2 occasions (20 and 30 days after female flowering)	5%
7	Grain weight, grain moisture, and grain yield	Shelled grain weight from all ears and grain moisture are determined. Grain yield per plot is calculated, adjusted to 12.5% grain moisture and converted to tons per hectare.	1 gram
8	Ear number per plant	Number of ears per plant. Counted as number of ears with at least one fully developed grain divided by the number of harvested plants.	0.1
9	Normalized Difference Vegetation Index (NDVI)	Measured with a portable field spectroradiometer (e.g. GreenSeeker) Taken 60 cm above the plants on 2-3 occasions: <ul style="list-style-type: none"> • 1 month post planting; measurements • Anthesis. • 2 and 4 weeks after flowering in inbred lines • 4 weeks after flowering for hybrids 	NDVI Index

B. Measured in selected trials

No.	Traits	Description	Unit/Precision
10	Hundred kernel weight	Three samples of 100 kernels randomly selected from the total kernels and their weight measured. Enter the data individually and use the computer to calculate the average	0.1gram
11	Kernel number	Calculated as grain weight divided by ear number and single kernel weight	1
12	Chlorophyll content	Measured with a portable chlorophyll meter (e.g. SPAD). Take the measure from six alternating plants. Take the measures in the middle between leaf tip and leaf base, and in between leaf rib and between leaf rim; enter the data individually and use the computer to calculate the average.	SPAD units
13	Stomatal conductance	Measured with a portable porometer: 5-6 weeks post planting, middle of youngest fully emerged leaf sun-exposed. 1 measurement per leaf, 3 per plot. 1 min per measurement. 4h around noon. Again around flowering. Flowering most important time	$\mu\text{mol H}_2\text{O m}^{-2} \text{s}^{-1}$

C. New experimental traits

No.	Traits	Description	Unit/Precision
14	Stable oxygen isotope enrichment ($\Delta^{18}\text{O}$) in kernels	Samples analyzed by isotope-ratio mass spectrometry. One measurement per row from the pooled set of mature kernels. Measured In subsets of inbreds and testcrosses with contrasting yields.	‰ (per mil)
15	Total mineral content in kernels	Determined in the same kernels used for $\Delta^{18}\text{O}$ analyses. Measured as ash content	% (per cent)
15	Total N content in kernels	Determined in the same kernels used for $\Delta^{18}\text{O}$ analyses. Measured using a Elemental Analyzer Isotope Ratio Mass Spectrometer	% (per cent)
15	Stable nitrogen isotope composition ($\delta^{15}\text{N}$) in kernels	Determined in the same kernels used for $\Delta^{18}\text{O}$ analyses. Measured using an Isotope Ratio Mass Spectrometer	‰ (per mil)
17	Photochemical Radiation Index (PRI)	Measured in leaves with an hyperspectral spectroradiometer at anthesis and 2-3 weeks later.	Arbitrary units
18	WI (Water Index)	Measured in leaves with an hyperspectral spectroradiometer at anthesis and 2-3 weeks later.	Arbitrary units
19	Thermal Imaging (Canopy temperature)	Measured in several rows simultaneously to allow a comparison. Thermal images will be taken using an Infrared Camera placed several meters above the canopy.	$^{\circ}\text{C}$