Supporting Emergence or Reference Drought Tolerance Phenotyping Centers - Drought Phenotyping Network

Generation
Cultivating Plant Diversity for the Resource-Poor

Embrapa

CIMMYT
International Maize and Wheat Improvement Center

FAPED

Organized at Embrapa Maize and Sorghum, Rodovia MG 424 km 45
35701-970 Sete Lagoas, MG, Brazil | 17 to 18th of June 2008

LOCALIZATION AND EDAFO-CLIMATE CHARACTERISTICS OF SETE LAGOAS AND JANAÚBA (MG) SPECIFIC SITES– EMBRAPA MAIZE AND SORGHUM

Reinaldo L. Gomide[7], Paulo E. P. de Albuquerque[7], Camilo de Lelis T. de Andrade[7], João Herbert M. Viana[7]

LOCALIZATION AND CLIMATE CHARACTERISTICS

The specific sites selection and placement at Sete Lagoas and Janaúba, MG, Brazil, were established for the GCP Phenotyping- DPN and Modeling- WPN Projects, in two Embrapa Maize and Sorghum experimental fields. The selected areas were surveyed and mapped with a Leica TC 805L total laser station system, by means of topography software. The contour lines maps were drawn in a 0.5 m vertical distance, and six geodesic reference benchmarks were placed in the two areas, using a Topcon Hiper L1L2 GPS and a Topcon datalogger, model FC – 100 and the software TopSURV. The differential correction was processed with the IBGE bases of Uberlândia, Varginha, and Montes Claros, using the Topcon Tools Software (Table 2).

Table 2. Geodesic benchmark coordinates of Sete Lagoas and Janaúba, MG, specific sites at Embrapa Maize and Sorghum, datum SAD 69, UTM projection S zone 23, 48 to 42 W.

Name	Latitude South	Longitude West	Altitude Ellipsoid (m)
Sete Lagoas Specific Site			
BU9-BaseM-1	19° 27' 17.20515	44° 10' 19.34919	730.702
BU9-BaseM-2	19° 27' 18.30578	44° 10' 27.55812	741.035
BU9-BaseM-3	19° 27' 17.04167	44° 10' 22.71995	731.214
Janaúba Specific Site			
BU9-BaseM-4	15° 45' 19.797"	43° 16' 54.949"	535.370
BU9-BaseM-5	15° 45' 20.695"	43° 16' 47.481"	538.280
BU9-BaseM-6	15° 45' 26.875"	43° 16' 54.534"	530.137

[7] Embrapa Maize and Sorghum, Rod. MG 424 km 45, 35701-970 Sete Lagoas, MG, Brazil, email: gomide@cnpms.embrapa.br.

Regular square grids were placed in the field of both specific sites, with grid node distance of 25 m. Soil samples were collected in triplicate, in a radius of 1 m from each node point, in the depths of 0 to 10 and 10 to 30 cm. These samples were analyzed for fertility, according to Embrapa (1997) procedure.

The climatic classification of the specific site of Sete Lagoas, MG, is Cwa, according to Köeppen. This means that is a savannas type of climate with dry winter and wet raining summer. The annual average air temperature is of 21.1°C with thermal amplitude of about 6º C. The lowest values of the air temperature are fluctuating close to 11.5 °C, registered on June and July; on the other hand, the greatest values are in the range of 28.5 to 30 ^{o}C, observed from January to March and October to December. August and September are the driest months of the year with air relative humidity (RH) of about 58 %, and from January to March and December are the wettest months (RH of about 75 %). The dry season initiate in May and end up to September, period in which are registered monthly rainfalls in the range of 9 to 40 mm. The rainy season goes from November to March with precipitation rates from 150 to 290 mm. The average annual precipitation is of 1384 mm. The wind speed values start to increase in June, but September shows the strongest winds (about 2 m/s). March to May show low values of wind speed.

At Sete Lagoas, MG, specific site, a time climatic series database of 45 years (from 1960 to 2005) was used to characterize the local climate. This database was provided by the 5th District of the National Institute of Meteorology (INMET), located at Belo Horizonte, MG. It is recommended to determine the soil water balance with the Thornthwaite e Mather (Sentelhas et al., 1999) method in order to obtain monthly information during the year of ETc, water deficiency, water excess, and water storage in the soil.

Figure 2 (left) shows the hydrological soil water balance results of the Sete Lagoas, MG, specific site, for a 45 years database series. In the computations was considered a total water availability in the soil profile of 100 mm, until a depth of 1 m (according to the soil type, this is the total amount of water retained between field capacity and permanent wilting). It was observed a deficiency period well defined from May to September, which is the winter or dry season when are registered the lowest average values of air temperatures and total precipitation. The greatest deficiencies values occurred in August and September (-42.4 and -32.2 mm, respectively). From November to March the deficiencies values are zero. Beginning April these deficiencies assume again very low values (around -3.8 mm). However, starting on May the deficiencies values start to increase again (-13.6 mm). The greatest values of excesses were verified on December and January (about 180 mm).

The annual averages of the main climatic elements of the Janaúba, MG, specific site are the following: precipitation of 873.5 mm, air temperature and air relative humidity of 24.7°C and 65%, respectively. According to the classification of Köeppen, the typical Janaúba climate is Aw, that is, of savanna with dry winter and medium air temperature of the coldest month of 18°C. The Penman-Monteith reference evapotranspiration (ETo) has the lowest and greatest values in June, in which daily average ETo is around 3.4 mm/day, and in October, in which daily average ETo is about 5.0 mm/day. It was installed an automatic weather station in Janaúba.

The representative soil of Janaúba is a Red-yellowish Latosoil, having a franc-clay-sandy texture in the layer of 0-20 cm. The total available water in the soil is about 130 mm.m^{-1} of soil (this is the

amount of water retained between the potentials of -10 and -1500 kPa). The soil density in the layers of 0-20 and 20-40 cm are of 1590 kg.m^{-3} and 1650 kg.m^{-3}, respectively.

A series of climatic data from 1977 to 1990 (14 years) was used to compute the hydrological soil water balance in Janaúba site, according to Thornthwaite and Matter method (Sentelhas et al., 1999) (Figure 2, right). A period of water deficiency very defined is observed from March to November, occasion that coincides with winter season and also surpasses this season, entering throughout summer season. The largest water deficiencies in Janaúba are verified in the months of July to October (above 70 mm). In February to March, the water deficiencies are the lowest values (2 to 5 mm). But starting in April again these deficiencies start elevating abruptly until November. On the other hand, the water excess is observed only in the month of January (around 45 mm).

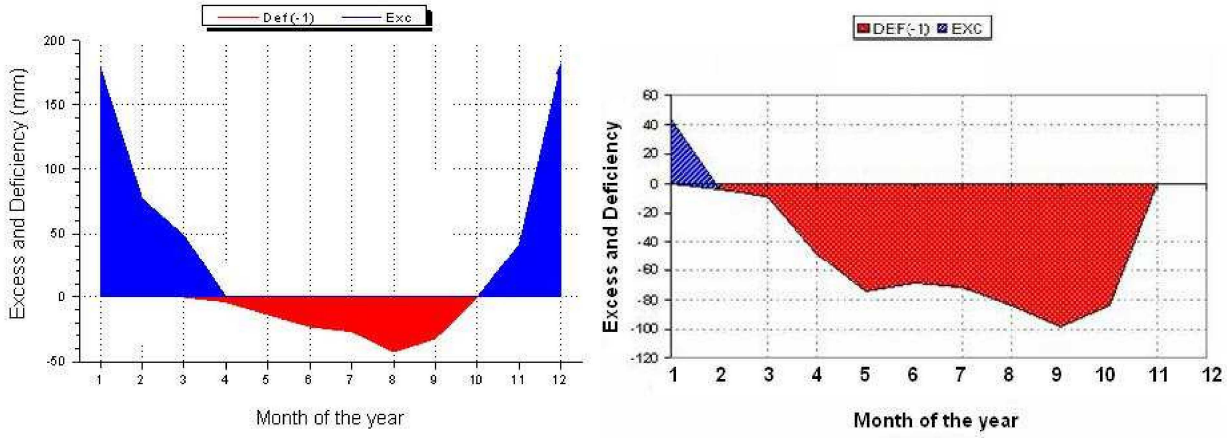

Figura 2. Monthly hydrological soil water balance variation, considering a total soil water availability until 1 m depth of 100 mm, for a time climatic series database of 45 (1960 to 2005) and 14 (1977 to 1990) years at Sete Lagoas (left) and Janaúba (right), MG, specific sites, Embrapa Maize and Sorghum.

SOIL CHEMICAL, PHYSICAL, AND HYDRIC ATTRIBUTES

Soil samples were collected in the Sete Lagoas specific site in the layers of 0-18, 18-50 e 50-150 cm, localized at the Ap, AB e B horizons in the soil profile, for some physical characteristics determination and textural classification of the soil (Table 2). The same soil place sampling was used to determine with more detail granulometric and hydric soil characteristics in the depths of 0-10, 10-30, 30-50 e 50-70 cm (Table 3).

The soil water availability (TSWA, in mm/ h cm soil layer) was calculated on basis in the amount water retained between the soil matric potential of –33 e –1500 kPa (Richards, 1949), corresponding to the field capacity (FC, in volume % or cm^3 of water/100cm^3 of soil) and permanent wilting point (PWP, in volume % or cm^3 of water/100cm^3 of soil), respectively, by the following equation:

$$TSWA = 10 \times [(FC - PWP) / 100] \times h$$

in which h is the depth of the soil layer, in cm.

The soil of the Sete Lagoas site is an Oxysoil, dark red Latossol, with a clay texture (Table 2).

Table 2. Some soil physics characteristics and textural classification of the Sete Lagoas specific site soil, according to the soil profile horizons.

Depth (cm)	Horizon	Sand ($g.kg^{-1}$)	Silt ($g.kg^{-1}$)	Clay ($g.kg^{-1}$)	Textural classifi-cation	Bulk density ($kg.m^{-3}$)
0 – 18	A_p	110	180	710	Clay	930
18 – 50	AB	100	100	800	Clay	1010
50 -150	B	100	0	900	Clay	920

Table 3 shows the results of some soil physical and hydric characteristics obtained for the depths of 0-10, 10-30, 30-50 e 50-70 cm in the Sete Lagoas site. It can be observed that this soil different layers have a low sand content and high clay content, mainly in the deeper layers. The TSWA in each layer changes with the soil depth (Table 3). It was verified that occurred a reduction of the TSWA with the soil depth.

Some soil chemical characteristics for the depths of 0-20 e 20-40 cm of the Sete Lagoas site are presented on Table 4. It can be observed that this soil does not present Al toxicity problem.

Table 3. Some soil physical and hydric characteristics for four different layers of the Sete Lagoas, MG, specific site.

Depth (cm)	FC[(1)] (%)	PWP[(2)] (%)	Db[(3)] ($g.cm^{-3}$)	TSWA[(4)] ($mm.h\ cm^{-1}$)	Sand (%)	Silt	Clay (%)
0-10	32,43	22,89	0,91	9,54	9	37	53
10-30	35,08	26,1	1,03	17,96	8	27	65
30-50	34,28	25,57	0,98	17,42	8	17	75
50-70	33,63	25,94	0,95	15,38	8	18	74

[(1)] Field capacity (amount of water retained in the soil matric potential of -33 kPa, % in volume or cm^3 of water / 100 cm^3 of soil).

[(2)] Permanent wilting point (amount of water retained in the soil matric potential of -1500 kPa, (% in volume or cm^3 of water / 100 cm^3 of soil).

[(3)] Bulk density of the soil.

[(4)] Total soil water availability in each layer (mm of water / h cm, h is the soil layer thickness in cm).

Tabela 4. Average analytic results of some chemical characteristics of the Sete Lagoas specific site.

Depth	pH	H+Al	Al	Ca	Mg	K	P	O..M.	Al Sat.
(cm)	H_2O	□ □ □	cmol.100dm^{-3}		□ □ □	(mg.100 cm^{-3})		(dag.kg^{-1})	
0-20	6,2	3,91	0,000	5,90	1,01	159	19	3,90	0
20-40	5,3	5,53	0,008	4,98	0,64	66	10	3,59	0,17

Figure 2 shows the potential model equation adjusted to the characteristic water retention curve of the Sete Lagoas specific site (Albuquerque, 2005).

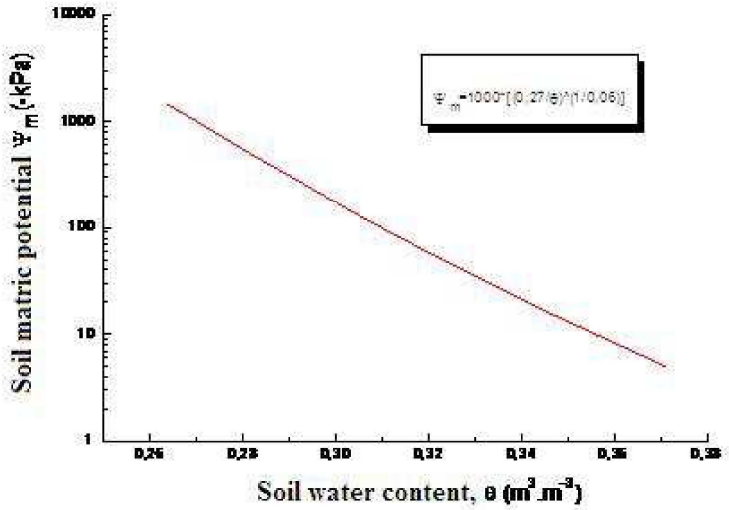

Figura 2. Potential model equation adjusted to the characteristic water retention curve of the Sete Lagoas specific site (Albuquerque, 2005).

The soil of Janaúba specific site is classified as an Oxysoil, red-yellow Latossol , loam clay-sand texture for the layer of 0-20 cm (120 g.kg^{-1} of coarse sand, 370 g.kg^{-1} of fine sand, 210 g.kg^{-1} of silt e 300 g.kg^{-1} of clay). The van Genuchten (1980) model was used to fit the water retention curve of the Janúba site soil (Figura 3). The bulk density of the Janaúba soil in the 0-20 cm layer is 1590 kg.m^{-3} and in the 20-40 cm layer is 1650 kg.m^{-3}.

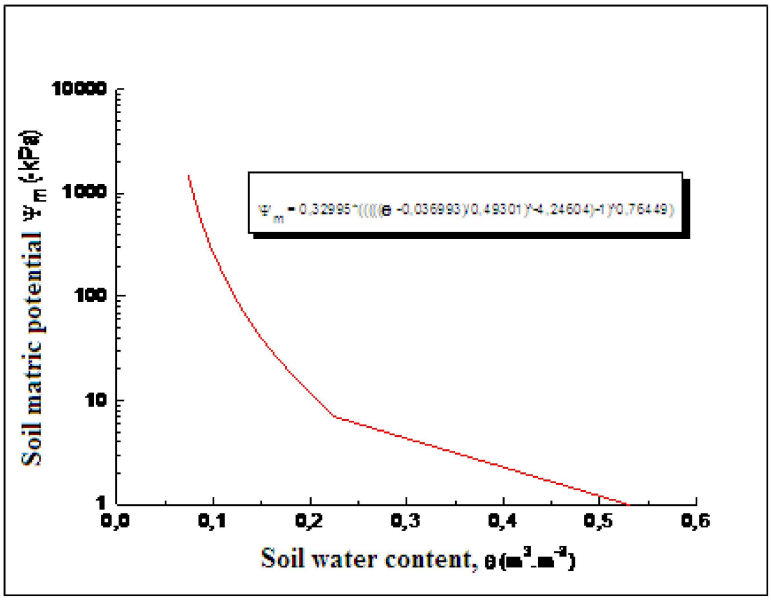

Figure 3. Water retention curve of the Janaúba specific site soil according to van Genuchten (1980) model.

LOCALIZATION AND EDAFO-CLIMATE CHARACTERISTICS OF SANTO ANTÔNIO DE GOIÁS AND PORANGATU (GO) SPECIFIC SITES - EMBRAPA RICE AND BEANS

Luís Fernando Stone[8]*, Silvando Carlos da Silva*[8]*, Cleber Morais Guimarães*[8]

LOCALIZATION AND CLIMATE CHARACTERISTICS

The city of Santo Antônio de Goiás is located at 16°28' South latitude and 49°17' West longitude (Figure 1), presenting an altitude of 823m. According to Köppen's classification, the locality presents an Aw, tropical savannah, mesothermic climate.

The pluvial regime is well defined, that is, rainy season from October to April and "dry" period from May to September. The average annual rainfall is 1.461,8 mm. December and March are the

[8] Embrapa Rice and Beans, Rod. GO 462 km 12, 75375-000 Santo Antônio de Goiás, GO, email: stone@cnpaf.embrapa.br.