

# Key access and utilization descriptors for sorghum genetic resources

This list consists of an initial set of characterization and evaluation descriptors for sorghum [*Sorghum bicolor* (L.) Moench] genetic resources utilization. This strategic set of descriptors, together with passport data, will become the basis for the global accession level information portal being developed by Bioversity International with the financial support of the Global Crop Diversity Trust (GCDDT). It will facilitate access to and utilization of sorghum accessions held in genebanks and does not preclude the addition of further descriptors, should data subsequently become available.

Based on the comprehensive list 'Descriptors for Sorghum [*Sorghum bicolor* (L.) Moench]' published by ICRISAT and IBPGR (now Bioversity International) in 1993, the list was subsequently compared with a number of sources such as UPOV technical guidelines for Sorghum (*Sorghum bicolor* L.) (1989); 'Descriptors for SORGHUM' (USDA, ARS, GRIN); 'Characterization of ICRISAT-Bred Sorghum Hybrid Parents (Set I)'<sup>1</sup> (ICRISAT, 2006); as well as the list of traits provided by the National Institute of Agrobiological Sciences (NIAS). The initial list also builds on the results of the Global Public Goods Activity 4.2.1.1 led by Dr Hari D. Upadhyaya (ICRISAT), particularly with regards to those descriptors highlighted as the most important diagnostic and breeding traits, and also on the Descriptors Draft for Sorghum, which was revised by a Committee formed at the Expert Consultation Meeting for Developing a Strategy for the Global Conservation of Sorghum Genetic Resources held at ICRISAT in 2007. It was further refined during a crop-specific consultation meeting held at the National Bureau of Plant Genetic Resources (NBPGR, India) in June 2009.

A worldwide distribution of experts was involved in an online survey to define a first priority set of descriptors to describe, to access and to utilize sorghum genetic resources. This key set was afterwards validated by a Core Advisory Group (see 'Contributors') led by Dr Jeff Dahlberg of the United Sorghum Checkoff Program and Dr Hari D. Upadhyaya of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), together with sorghum leading organizations such as NBPGR, USDA and the Directorate of Sorghum Research (formerly National Research Centre for Sorghum), amongst others.

Biotic and abiotic stresses included in the list were chosen because of their wide geographic occurrence and significant economic impact at a global level.

Numbers in parentheses on the right-hand side are the corresponding descriptor numbers listed in the 1993 publication. Descriptors with numbers ending in 'letters' are either modified or are new descriptors that were added during the development of the list below.

# Race and Group name

(1.5.5/6)

(As per Dahlberg, 2000)

1	Bicolor	92	Durra-dochna
10	Bicolor	93	Subglabrescens
11	Dochna	94	Subglabrescens-milo
12	Nervosum	95	Milo-kaura
13	Nervosum-kaoliang	10	Guinea-caudatum
14	Nervosum-broomcorn	100	Caudatum-guineense
15	Sudanense	101	Nigricans-guineense
2	Guinea	11	Guinea-kafir
20	Guineense	110	Caffrorum-roxburghii
21	Conspicuum	111	Roxburghii-shallu
22	Margaritifерum	12	Guinea-durra
23	Roxburghii	120	Durra-roxburghii
3	Caudatum	121	Membranaceum
30	Caudatum	122	Durra-membranaceum
31	Caudatum-nigricans	13	Kafir-caudatum
32	Nigricans	130	Caudatum-kafir
33	Sumac	131	Caffrorum-birdproof
34	Nigricans-feterita	132	Caffrorum-darso
35	Dobbs	133	Caffrorum-feterita
36	Caudatum-kaura	14	Durra-caudatum
37	Zerazera	140	Caudatum-durra
4	Kafir	141	Nigricans-durra
40	Caffrorum	142	Durra-nigricans
5	Durra	143	Durra-feterita/Kaura
50	Durra	15	Kafir-durra
51	Nandyal	150	Durra-kafir
52	Cernuum	151	Caffrorum-durra
6	Guinea-bicolor	16	Perennial wild
60	Guinea-bicolor	160	S. halepense
61	Dochna-honey	161	S. propinquum
62	Dochna-roxburghii	17	Annual wild
7	Caudatum-bicolor	170	S. bicolor ssp. drummondii
70	Caudatum-bicolor	18	S. bicolor ssp. verticilliform
71	Caudatum-dochna	180	verticilliform
72	Nigricans-bicolor	181	arundinaceum
73	Dochna-nigricans	182	virgatum
8	Kafir-bicolor	183	aethiopicum
80	Bicolor-kafir	19	Unclassified
81	Caffrorum-bicolor	20	Breeding material
82	Dochna-kafir	200	Unclassified
9	Durra-bicolor	21	Mixed
90	Durra-bicolor		
91	Dochna-durra		

**Plant height [cm]** (4.1.1)

From the ground (base of plant) to the tip of the panicle at 50% flowering. Mean of 10 randomly selected plants

**Stalk juiciness** (4.1.3)

- 0 Not juicy
- 1 Slightly juicy
- 3 Juicy

**Fodder yield** (4.1.a)

- 3 Low
- 5 Medium
- 7 High

**Days to 50% flowering** (4.2.1)

From planting date until 50% of the plants have started flowering

**Planting date [YYYYMMDD]** (5.4)

When planting is done (if moisture is sufficient) or when irrigation is done after planting

**Flowering behaviour** (4.2.a)

If grown under long days

- 0 Absent
- 3 Early
- 7 Late

**Inflorescence compactness and shape** (4.2.2)

- 1 Very lax panicle (typical of wild sorghums)
- 2 Very loose erect primary branches
- 3 Very loose drooping primary branches
- 4 Loose erect primary branches
- 5 Loose drooping primary branches
- 6 Semi-loose erect primary branches
- 7 Semi-loose drooping primary branches
- 8 Semi-compact elliptic
- 9 Semi-compact oval
- 10 Compact elliptic
- 11 Compact oval
- 12 Half broom corn
- 13 Broomcorn
- 99 Other (specify in the descriptor **Notes**)

### Grain covering (4.2.4)

Amount of grain covered by glumes at maturity. Involuted grain is found when the grain has completely twisted inside of the glumes and is fully exposed such as in the Guinea race

- 1 25% grain covered
- 2 50% grain covered
- 3 75% grain covered
- 4 Grain fully covered
- 5 Glumes longer than grain
- 6 Involuted

### Shattering (4.2.6)

Observed at maturity

- 3 Low
- 5 Intermediate
- 7 High

### Grain colour (4.3.1)

Phenotypic colour of the grain

- 1 White
- 2 Chalky white
- 3 Straw
- 4 Grey
- 5 Light red
- 6 Red
- 7 Yellow
- 8 Light brown
- 9 Brown
- 10 Black
- 11 Purple
- 12 Variegated (when streaks of red or white appear in the grain)
- 13 Reddish brown
- 14 Mixed (when there are mixed grain colours in the grain)

### 100-seed weight [g] (4.3.3)

Measured at 12% moisture content

### Pigmented testa (Grain sub-coat) (4.3.5)

Tannins are not present without the presence of a pigmented testa

- 0 Absent ( $b_1b_1b_2b_2$  or  $B_1-b_2b_2$  or  $b_1b_1B_2-$ )
- 1 Present ( $B_1-B_2-$ )

### Endosperm texture (4.3.8)

- 1 Completely corneous
- 2 Mostly corneous
- 3 Intermediate-partly corneous
- 4 Mostly starchy (floury)
- 5 Completely starchy (floury)

**Genotypic pericarp colour** (4.3.a)

Genetically, there are three pericarp colours in sorghum

- 1 White (R-yy or rryy)
- 2 Lemon Yellow (rrY-)
- 3 Red (R-Y-)

**Seedling vigour** (6.1.1)

Observed 15 days after emergence

- 3 Low
- 5 Intermediate
- 7 High

**Lodging susceptibility** (6.1.2)

Indicate if root or stalk

- 3 Low
- 5 Intermediate
- 7 High

**Senescence rating [%]** (6.1.3)

Death of leaves and stalk at grain maturity

- 1 Very slightly senescent (10%)
- 3 Slightly senescent (25%)
- 5 Intermediate (about half of leaves dead) (50%)
- 7 Mostly senescent (75%)
- 9 Completely senescent (leaves and stalk dead)

**Desirability rating** (6.1.4)

Overall agronomic desirability (use and yield potential) of the total plant as observed visually

- 1 Very good
- 2 Good
- 3 Average
- 4 Poor
- 5 Very poor

**Photosensitivity** (6.2.1)

Recorded on the basis of rainy season (long days): post-rainy season (short days) ratios of plant height (4.1.1) and days to flowering (4.2.1) above

- 1 Insensitive
- 2 Partially sensitive
- 3 Very sensitive

**Inflorescence exertion** (6.2.4)

- 1 Slightly exerted (<2 cm but ligule of flag leaf definitively below inflorescence base)
- 2 Exserted (2-10 cm between ligule and inflorescence base)
- 3 Well-exserted (>10 cm between ligule and inflorescence base)
- 4 Peduncle recurved (inflorescence below ligule and clearly exposed splitting the leaf sheath)

**Inflorescence length [cm]** (6.2.5)

From base of inflorescence (head) to tip. Mean of five randomly selected plants

**Restoration response (Milo source)** (6.2.7)

The reaction of the F<sub>1</sub> plant when a male sterile (A line) is pollinated with the accession

- 1 Maintainer
- 2 Partial maintainer/restorer
- 3 Restorer

**Male sterile cytoplasm system** (6.2.8)

There are four major distinct cytoplasmic-genetic systems

- 1 A<sub>1</sub>
- 2 A<sub>2</sub>
- 3 A<sub>3</sub>
- 4 A<sub>4</sub>
- 5 Other (specify in the descriptor **Notes**)

**Pollen shed** (6.2.a)

Visual score (early morning) when the panicle is lightly tapped. Observed at 50% flowering.

Mean of five randomly selected plants

- 3 Low
- 5 Intermediate
- 7 High

**Grain yield** (6.3.a)

Overall estimation of the grain yield for the accession based upon the particular growing conditions in which it was accessed

- 3 Low
- 5 Medium
- 7 High

## ABIOTIC STRESSES

### Reaction to low temperature (7.1)

#### Pollen susceptibility (7.1.a)

Measured as reduction in pollen production at low temperatures (10°C to 15°C)

#### Seedling susceptibility (7.1.1)

Measured as reduction in seed germination at low temperatures (10°C to 15°C)

#### Reproductive susceptibility (7.1.2)

Measured as reduction in seed set at low temperatures (10°C to 15°C)

### Reaction to drought (7.3)

#### Pre-anthesis drought reaction (7.3.a)

Measured as plants stressed prior to flowering. Plant symptoms include leaf rolling, leaf erectness, leaf bleaching, leaf firing, delayed flowering, poor panicle exertion, saddle effect, panicle/floret blasting, and reduced panicle size. Ratings may be on individual symptoms or a combination of symptoms

#### Post-anthesis drought reaction (stay-green ability) (7.3.b)

Measured as plants stressed post-flowering. Plant symptoms include premature leaf and plant death, stalk collapse and lodging, charcoal rot (*Macrophomina phaseolina*) infestation, and reduced seed size

## BIOTIC STRESSES

### Sorghum shoot fly (*Atherigona soccata*) (8.1.1)

### Spotted stem borer (*Chilo partellus*) (8.1.2)

### Sorghum midge (*Stenodiplosis sorghicola*) (8.1.5)

### Anthracnose (*Colletotrichum graminicola*) (8.2.3)

### Grain moulds (*Curvularia lunata*; *Fusarium* spp.) (8.2.4)

## NOTES

Any additional information may be specified here, particularly that referring to the category '99=Other' present in some of the descriptors above.

### CONTRIBUTORS

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