**Supplementary table 1** The 32 lowland *Sorghum bicolor* parental and 4 CMS lines used in this study

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Genotype | Cytoplasmic  status | Source | Geographic origin |  | Genotype | Cytoplasmic  status | Origin | Geographic origin |
| 72472 | R line | IBC | South Welo |  | 211239B | R line | IBC | North Welo |
| 72482 | R line | IBC | South Welo |  | 214838A | R line | IBC | North Welo |
| 72572 | R line | IBC | South Welo |  | 214838B | R line | IBC | North Welo |
| 73059 | R line | IBC | North Welo |  | 239167A | R line | IBC | South Welo |
| 75454 | R line | IBC | North Welo |  | 242039B | R line | IBC | North Welo |
| 200538 | R line | IBC | South Welo |  | 242049A | R line | IBC | North Welo |
| 200654 | R line | IBC | North Welo |  | 242050B | R line | IBC | South Welo |
| 214855 | R line | IBC | South Welo |  | 244725A | R line | IBC | Wag Hemra |
| 237260 | R line | IBC | North Welo |  | 244725B | R line | IBC | Wag Hemra |
| 239156 | R line | IBC | South Welo |  | 244735A | R line | IBC | Wag Hemra |
| 239175 | R line | IBC | North Welo |  | 69286A | R line | IBC | South Welo |
| 239208 | R line | IBC | South Welo |  | 71160A | R line | IBC | North Welo |
| 242036 | R line | IBC | North Welo |  | 72578A | R line | IBC | South Welo |
| 242047 | R line | IBC | South Welo |  | 73056A | R line | IBC | North Welo |
| 244712 | R line | IBC | Wag Hemra |  | ICSA 101 | A1 line | ICRISAT | ICRISAT |
| 244715 | R line | IBC | Wag Hemra |  | ICSA 743 | A3 line | ICRISAT | ICRISAT |
| 244727 | R line | IBC | Wag Hemra |  | ICSA 749 | A2 line | ICRISAT | ICRISAT |
| 244733 | R line | IBC | Wag Hemra |  | ICSA 756 | A4 line | ICRISAT | ICRISAT |

R = male parents with fertility restorer gene; IBC = Institute of Biodiversity Conservation of Ethiopia; A1 to A4 denote cytoplasmic male sterile lines with A1 to A4 cytoplasm systems; ICRISAT= International Crops Research Institute for the Semi-Arid Tropics/India

**Supplementary table 2** Descriptors used for morphological assessment for qualitative and quantitative traits of sorghum in the study

|  |  |  |  |
| --- | --- | --- | --- |
| Descriptors | Classes | | |
| Quantitative traits | | | |
| Days to 50% flowering (DTF) | | 1 - Early; 2 - Intermediate; 3 - Late | |
| Days to 50% maturity (DTM) | | 1 - Early; 2 - Intermediate; 3 - Late | |
| Grain filling duration (GFD) | | 1 - Short; 2 - Intermediate; 3 – Long | |
| Plant height (PH) | | 1 - Short (< 2m); 2 - Medium (2 - 3m); 3 - Tall (> 3m) | |
| Panicle length (PL) | | 1 - Small (< 15 cm); 2 - Medium (15 - 20 cm); 3 - Big (> 30 cm) | |
| Panicle exsersion (PE) | | 1 - < 10 cm; 2 - 10 - 20 cm; 3 - >20 cm | |
| Leaf length (LL) | | 1 - Short (< 70cm); 2 - Intermediate (70 -75 cm; 3 - Long (> 75 cm) | |
| Leaf number (LN) | | 1 - < 10 leaves; 2 - 10 - 12 leaves; 3 - > 12 leaves | |
| Leaf width (LW) | | 1 - < 8 cm; 2 - 8 - 10 cm; 3 - >10 cm | |
| Grain yield (GY) | | 1 - < 1.5 tons/ha; 2 - 1.5 - 2.5 tons/ha; 3 - > 2.5 tons/ha | |
| Panicle weight (PW) | | 1 - < 80 gm; 2 - 80 - 100 gm; 3 - > 100 gm | |
| Biomass (BIOM) | | 1 - < 20 tons/ha; 2 - 20 - 30 tons/ ha; 3 - > 30 tons/ha | |
| 1000 seed weight (SWT) | | 1 - < 25 gm; 2 - 25 - 30 gm; 3 - > 30 gm | |
| Qualitative traits | | | |
| Ear-head compaction (HCO) | | | 1 - Compact; 2 - Loose; 3 - Semi compact; 4 - Semi loose |
| Ear-head orientation (HO) | | | 1 - Erect; 2 - Re-curves |
| Ear-hear shape (HS) | | | 1 - Elliptical; 2 - Oblong; 3 - Round; 4 - Semi-loose; 5 - Loose |
| Grain colour (GC) | | | 1 - Red; 2 - Yellow; 3 - Brown; 4 - White; 5 - Light orange; 6 - White with red; 6 - White with red |
| Awn (AW) | | | 1 - Absent; 2 Present |
| Midrib colour (MC) | | | 1 - White; 2 - Dull green; 3 - Yellow; 4 - Brown; 5 - Purple |
| Leaf orientation (LO) | | | 1 - Erect; 2 Dropping |
| Leaf colour (LC) | | | 1 - Dark green; 2 - Light green |
| Glume colour (Gcol) | | | 1 - White; 2 - Red; 3 - Purple; 4 - Black; 5 - Gray; 6 - brown; 7 - Dark brown |
| Glume cover (Gcov) | | | 1 - 25%; 2 - 50%; 3 - 75%; 4 - 100%; 5 - > 100% |
| Stay-green (SG) | | | 1 - No senescent; 2 - 25% senescent; 3 - 50% senescent; 4 - 75% senescent ; 5 - 100% senescent |
| Leaf Rolling (LR) | | | 1 - Not rolled; 2 - 25% rolled; 3 - 50% rolled; 4 - 75% rolled; 5 - 100% rolled |