A Case Study

ADVANCE RESEARCH JOURNAL OF
C R P
IMPROVEMENT
Volume 5 | Issue 2 | Dec., 2014 | 223-228
e ISSN-2231-640X

DOI :
10.15740/HAS/ARJCI/5.2/223-228
Visit us: *www.researchjournal.co.in*

Studies on identification of stable diagnostic qualitative characteristics of *Rabi* sorghum genotypes

■ ASHOK S. SAJJAN, R.B. GOUDAR[1] AND B.D. BIRADAR[1]

AUTHORS' INFO

Associated Co-author:
[1]College of Agriculture (U.A.S.), BIJAPUR (KARNATAKA) INDIA

Author for correspondence:
ASHOK S. SAJJAN
College of Agriculture, University of Agricultural Sciences, BIJAPUR (KARNATAKA) INDIA
Email: assajjan@gmail.com

ABSTRACT : Characterization of cultivars, establishment morphological identity and genetic purity of the seed lots are crucial for varietal improvement, protection of varieties and seed production in Sorghum. The field experiment was laid out in a RBD with two replication and 60 treatment combinations at RARS, Bijapur during 2011-12 and 13. The present investigation revealed that the individuality of any crop variety or genotypes plays significant role in identification through morphological characters. Though the genotypes looks similar and alike while growing in the same condition, at the same time the study is needed due to the dependence of exhibition of these morphological characters in the changing environmental condition. This is the basic step towards the breeding of new crop varieties where in one can change the phenology of the crop through various advanced breeding programmes.

Key **W**ords : Cultivars, Genetic purity, Genotypes and Panicle density

How to cite this paper : Sajjan, Ashok S., Goudar, R.B. and Biradar, B.D. (2014). Studies on identification of stable diagnostic qualitative characteristics of *Rabi* sorghum genotypes. *Adv. Res. J. Crop Improv.*, **5** (2) : 223-228.

Paper **H**istory : **Received :** 27.10.2014; **Accepted :** 21.11.2014

Sorghum [*Sorghum bicolor* (L.) Moench] is one of the important tropical grain crops.After initiation of All India Co-ordinated Crop Research Project on sorghum by ICAR in 1960, there are several new cultivar were released by public and private breeders, so there is a need to test genetic purity or identity of the genotypes to avoid duplication of crop varieties including hybrids. Traditionally, genetic purity determination has been carried out by the evaluation of morphological or physiological traits expressed by seed, seedling or mature plants. Though the genotypes looks similar but alike while growing in the same condition. At the same time the study is needed due to the dependence of exhibition of these morphological characters in the changing environmental condition. This is the basic step towards the breeding of new crop varieties where we can change the phenology of the crop through various advanced breeding programmes once thorough with these morphological characters. Hence the characterization and identification of genotypes (*Rabi* sorghum) is initiated.

RESEARCH PROCEDURE

The field experiment was conducted at the Regional Agricultural Research Station, University of Agricultural Sciences, Campus Bijapur, Karanataka state during 2011-12. The field experiment was laid out in a Randomized Block Design with two replication and 60 treatment combinations. The crop was raised by following all the agronomical practices recommended for sorghum as per the packages of practices for high yields published by University of Agricultural Sciences, Dharwad and the Department of Agriculture, Karnataka. Five plants were selected at random from each genotype and were tagged and observed for various stable and distinguishable characters according to the guidelines of PPV and FR (2001). Various plant morphological traits recorded at different plant growth stages and at harvest.

RESEARCH ANALYSIS AND REASONING

The varietal description for identification of crop varieties has assumed critical importance in national and international

Table A : Grouping of *Rabi* sorghum genotypes based on leaf and seed character

Sr. No.	Leaf colour	Colour of the caryopsis	Seed coat lustre	Seed shape	Flag leaf yellow colouration of midrib
1.	Light green	White,	Non lustrous	Narrow elliptic ,	Absent
2.	Medium green	Grayed white,	Lustrous	Elliptic	Present
3.	Dark green	Yellow white,		Circular	
4.		Yellow orange			
5.		and Grayed orange			

Table B : Grouping of *Rabi* sorghum genotypes based on anther and panicle character

Sr. No.	Colour of dry anther	Panicle density	Panicle shape	Glume (%)	Glume colour
1.	Yellow orange	Very loose	Reversed pyramid ,	Very short (25% of the grain covered)	Green white,
2.	Orange,	Loose	Panicle broader in upper part,	Short (50% of the grain covered).	Yellow white,
3.	Orange red	Semi loose	Symmetric,	Medium(75% of the grain covered)	Grayed yellow,
4.	Grayed orange	Semi compact	Panicle broader in lower part	Long (100% of the grain covered)	Grayed orange,
5.		Compact	Pyramid		Grayed red
6.					Grayed purple

seed programmes. There is considerable need for the development of reproducible methods and identifiable characters for the purpose. The results of the present investigation are discussed below.

Colour of the caryopsis:

The colour of the caryopsis of *Rabi* sorghum genotypes were grouped as yellow white, grayed orange, Grayed white, yellow orange and white and are presented in Table 1. The genotypes are grouped into various category as mentioned below.

Seed coat lustre :

The grain luster of sorghum genotypes were grouped as lustrous and non lustrous are presented in Table 2.

Seed shape :

Seed shape for different sorghum genotypes grouped into

Table 1 : Colour of the caryopsis

Yellow white	Grayed orange	Grayed white	White colour	Yellow orange
EP 59, Phule Maulee, EP 87, EP 94, EP 95, EP 97, EP 117, PEC 7, M 35-1, LG 1, and IS 21863, CSV 22, R 16, IS 8971, B 35, IS 30443, IS 3121, RS 585, M 35-1, IS 5919, IS 30079, BTX 623, IS 608, IS 32787, IS 26617, IS 27786, IS 26025, IS 473, IS 995, IS 2382, IS 2872, IS 30572 and CSV 22	IS19262, IS23992, IS28389, IS30450, IS603, and IS1041.	IS 2864, IS 1212, IS 25548 and IS 32378.	IS8777, 1S1233, Phule Maulee, and check M 35-1.	IS28451, IS10969, IS20727, M 35, Phule Maulee, IS13549, IS602, IS2379, Phule Maulee, IS2397, IS2413,

Table 2 : Seed coat lustre

Lustrous	Non-Lustrous
EP 87 EP 95, EP 117, IS 28389, IS 10969, IS 20727, IS 30443, Phule Maulee, RS 585, IS 32787, IS 603, IS 995, IS 2379 and IS 30572	EP 59, Phule Maulee, EP 94, EP 97, PEC 7, M 35-1, LG 1, IS 19262, IS 23992, IS 21863, CSV 22, IS 28451, IS 32378, R 16, IS 30450, IS 8777, IS 8971, B 35, M 35, IS 3121, M 35-1, IS 5919, IS 30079, BTX 623, IS 608, IS 25548, IS 26617, IS 27786, IS 26025, IS 13549, IS 473, IS 602, IS 1041, IS 1212, IS 1219, IS 1233, Phule Maulee, IS 2382, IS 2389, IS 2397, IS 2872, M 35-1 and CSV 22)

Table 3 : Seed shape

Circular	Elliptic	Narrow Elliptic
EP 59, Phule Maulee, EP 87, EP 94, EP 95, EP 97, EP 117, PEC 7, M 35-1, LG 1, IS 19262, IS 21863, CSV 22, R 16, IS 8777, B 35, M 35, IS 30443, IS 3121, M 35-1, IS 5919, IS 30079, BTX 623, IS 26617, IS 27786, IS 26025, IS 13549, IS 473, IS 1041, IS 1212, Phule Maulee, IS 2397, IS 2413, IS 2872, and two checks (M 35-1 and CSV 22).	Phule Maulee, IS608, IS32787, IS602, IS 603, IS995 and IS2426,	IS 23992, IS 28451, IS 32378, IS 28389, IS 10969, IS 30450, IS 8971, IS 25548, IS 1219, IS 1233, IS 2379, IS 2382, IS 2389, IS 2864, IS 30572 and IS 20727.

circular, elliptic and narrow elliptic are presented in Table 3.

Leaf colour :

The Colour of the leaf was observed under natural day light condition and genotypes were grouped into dark green, medium green, light green. Among the sixty genotypes ten were grouped under dark green condition, Forty four genotypes were grouped under medium green leaf colour and six were grouped under light green colour.

Flag leaf :

Yellow coloration of midrib :

The yellow coloration of mid rib also varied among the sorghum genotypes and presented in the following list.

Colour of dry anther :

The Colour of dry anther was observed after complete drying of anther. The dry anther Colour varied among the genotypes. Based on the coloration of dry anther the genotypes were grouped into yellow orange, orange, Orange red, Grayed orange.

Glume coverage (%) :

The coverage of grain by the outer layer is considered as glume and expressed in per cent. This character also varied among the genotypes. Based on the coverage of grain by glume

Table 4 : Leaf colour

Leaf colour	Genotypes
Dark green	EP59, EP87, EP94, EP95, EP97, EP117, R-16, B-35, BTX623, IS608.
Medium green	Phule Maulee, IS30572, IS19262, IS23992, IS21863, CSV-22, IS28451, IS32378, IS28389, IS10969, IS20727, IS30450, IS8777, IS8971, IS30443, Phule Maulee, IS3121, RS585, IS5919, IS30079, IS32787, IS25548, IS26617, IS27786, IS26025, IS13549, IS473, IS602, IS603, IS995, IS1041, IS1212, IS1219, IS1233, IS2379, Phule Maulee, IS2382, IS2389, IS2397, IS2413, IS2426, IS2864, IS2872, CSV-22. Six genotypes were light green in leaf colour *viz*, PEC7 M-35-1, LG-1, M-35-1, M-35-1, M-35-1
Light green	PEC7, M-35-1 LG-1.

Table 5 : Flag leaf yellow colouration of midrib

Flag leaf yellow colouration of midrib	Genotypes
Present	EP59, Phule Maulee, EP87, EP94, EP117, PEC7, M 35-1, IS30572, IS19262, IS23992, IS28451, IS32378, IS28389, IS10969, R16, IS20727, IS30450, IS8777, IS8971, IS30443, IS3121, IS5919, IS30079, IS26025, IS13549, IS473, IS602, IS603, IS995, IS1041, IS1212, IS1219, IS1233, IS2379
Absent	EP94, EP95, EP97, LG-1, CSV 22, B 35, M 35, Phule Maulee, M 35-1, BTX623, IS608, IS32787, IS25548, IS26617, IS27786, M 35-1, Phule Maulee, IS2382, IS2389, IS2397, IS2413, IS2426, IS2864, IS2872 and CSV 22.

Table 6 : Colour of dry anther

Colour of dry anther	Genotypes
Yellow orange	EP59, EP87, EP94, EP95, EP97, EP117, PEC7, M-35-1, IS30572, IS19262, IS23992, IS21863, CSV-22, IS28451, IS32378, IS28389, IS10969, IS20727, IS30450, IS8777, IS8971, B-35, M-35-1, IS30443, IS3121, RS585, M-35-1, IS5919, IS30079, IS608, IS32787, IS25548, IS26617, IS27786, M-35-1, IS26025, IS13549, IS473, IS602, IS607, IS995, IS1041, IS1212, IS1219, IS1233, IS2379, IS2382, IS2389, IS2397, IS2413, IS2426, IS2864, IS2872, CSV-22.
grayed orange	Phule Maulee
Orange	LG-1, R-16 and BTX623
Orange red	Nil

Table 7 : Glume coverage (%)

Glume (%)	Genotypes
50% grain covered	Nil
75% grain covered	EP95, EP97, EP117, PEC7, LG-1, IS19262, IS20727, IS8777, IS8971, B-35, IS3121, RS585
100% grain covered	EP59, Phule Maulee, EP87, EP94, M-35-1, IS30572, IS23992, IS21863, CSV-22, IS28451, IS32378, IS28389, IS10969, R-16, IS30450, M-35-1, IS30443, Phule Maulee, M-35-1, IS5919, IS30079, BTX623, IS608, IS32787, IS25548, IS26617, IS27786, M-35-1, IS26025, IS13549, IS473, IS602, IS603, IS995, IS1041, IS1212, IS1219, IS1233, IS2379, Phule Maulee, IS2382, IS2389, IS2397, IS2413, IS2426, IS2864, IS2872, CSV-22

the genotypes were grouped into 100 per cent coverage, 75 per cent coverage, 50 per cent coverage. Among the sixty genotypes there were no genotypes where 50 per cent grain is covered by glume and forty eight genotypes were grouped under the grain covered 100 per cent by the glume and twelve genotypes were grouped under the grain covered by 75 per cent by the glume are as follows .

Glume colour :

The colour of the glume which is covered on the grain

Table 8 : Glume colour

Glume colour	Genotypes
Yellow white	EP59, EP87, EP94, EP95, EP97, EP117, PEC7, M 35-1, IS30572, IS19262, IS23992, IS21863, CSV-22, IS28451, IS32378, IS28389, IS10969, IS20727, IS30450, IS8777, IS8971, M 35, IS30443, IS3121, RS585, M-35-1, IS5919, IS30079, IS608, IS32787, IS25548, IS26617, IS27786, M-35-1, IS26025, IS13549, IS473, IS602, IS603, IS995, IS1041, IS1212, IS1219, IS1233, IS2379, IS2382, IS2389, IS2397, IS2413, IS2426, IS2864, IS2872, CSV-22.
Grayed orange	Phule Maulee
Green white	BTX623
Grayed red	Nil
Grayed purple	Nil

Table 9 : Panicle dnsity

Panicle dnsity	Genotypes
Compact	EP59, EP87, EP94, EP95, EP97, EP117, PEC7, M-35-1, LG-1, CSV-22, R-16, M-35-1, M-35-1, M-35-1, CSV-22.
Semi compact	BTX623 and IS608.
Loose	Nil
Semi loose	Phule Maulee, IS30572, IS19262, IS23992, IS21863, IS28451, IS32378, IS28389, IS10969, IS20727, IS30450, IS8777, IS8971, IS30443, Phule Maulee, IS3121, IS5919, IS30079, IS32787, IS25548, IS26617, IS27786, IS26025, IS13549, IS473, IS602, IS603, IS995, IS1041, IS1212, IS1219, IS1233, IS2379, Phule Maulee, IS2382, IS2389, IS2397, IS2413, IS2426, IS2864, IS2872.
Very loose	B-35 and RS-585.

Table 10 : Panicl shape

Panicle shape	Genotypes
Reverse pyramid	EP59, EP94, EP97, EP117, PEC7, LG-1, IS20727, IS608, IS32787, IS2382, IS2413, IS2426.
Panicle broader in upper part	Phule Maulee, EP87, EP95, Phule Maulee, RS585, IS30079, IS995, IS1041, Phule Maulee, IS2864, IS2872.
Symmetric	M-35-1, IS30572, IS19262, IS23992, IS21863, IS28451, IS32378, IS28389, IS10969, R-16, M-35-1, IS30443, IS3121, M-35-1, IS26617, IS27786, M-35-1, IS603, IS1212, IS1219, IS1233, IS2379.
panicle broader in lower part	CSV-22, B-35, BTX623, IS25548, IS473, IS602, CSV-22
Pyramidal	IS30450, IS8777, IS8971, IS5919, IS26025, IS13549, IS2389, IS2397.

Table 11 : Panicle length (cm)

Panicle length (cm)	Genotypes
Very short (<11cm)	Nil
Short (11-20cm)	Phule Maulee, IS3121, IS5919, IS2382, IS2389.
Medium(21-30cm)	EP59, Phule Maulee, EP87, EP94, EP95, EP97, EP117, PEC7, M-35-1, LG-1, IS30572, IS19262, IS23992, IS21863, CSV-22, IS28451, IS32378, IS28389, IS10969, R-16, IS20727, IS30450, IS8777, IS8971, B-35, M-35-1, IS30443, RS585, M-35-1, IS30079, BTX623, IS608, IS32787, IS25548, IS26617, IS27786, M-35-1, IS26025, IS13549, IS473, IS602, IS603, IS995, IS1041, IS1212, IS1219, IS1233, IS2379, Phule Maulee CSV-22
Long (31-40cm)	IS2397, IS2413, IS2426, IS2864, IS2872
very long (>40cm)	Nil

surface also varied among the genotypes and they are classified into different colour such as, green white, Yellow white, Grayed orange, grayed red, grayed purple as listed below.

Panicle density :

The panicle density of the genotypes are varied. Based on the visual appearance of density of the panicle they are grouped into compact, semi compact, loose, semi loose, very loose. Among the sixty genotypes, the density of fifteen panicles was compact in nature. Density of two panicles was semi compact in nature; forty one genotypes showed semi loose density of panicles, two genotypes were having very loose density of the panicle.

Panicle shape :

The shape of panicle of the genotypes also varied. Based on the visible appearance the shape of the panicle of the genotypes were grouped into reverse pyramid, panicle broader in upper part, symmetric, panicle broader in lower part and pyramidal. Among the sixty sorghum genotypes, the shape of panicle of twelve genotypes were reverse pyramid in nature. Eleven genotypes showed panicle broader in upper part shape, the shape of panicle of twenty two genotypes were symmetric in nature, seven genotypes showed shape of the panicle broader in lower part, eight genotypes showed pyramidal shape of the panicle.

Panicle length (cm) :

The length of the panicle varied significantly among the sorghum genotypes. The average length of the panicle of the genotypes was 24.01cm in 1st season, 26.29 cm in 2nd season and 25.15 cm in pooled results. The highest length of the panicle observed in IS2864 *viz.*, 36.40 cm in 1st season, 38.60 cm in 2nd season and 37.50 cm in pooled results. The lowest panicle length was seen in IS2382 *viz.*, 15.52 in 1st season 21.15 in 2nd season and 18.33cm in pooled results. Based on pooled results of the length of panicle, sorghum genotypes were grouped into very short (<11 cm), short (11-20 cm), medium (21-30 cm), long (31-40 cm), very long (>40 cm). Among the sixty genotypes five were short in panicle length; fifty genotypes were medium in panicle length, whereas five genotypes were long in panicle length.

The variation was observed for leaf color in the evaluated *Rabi* sorghum genotypes. In most of the *Rabi* sorghum genotypes, light green leaves were common while some of the genotypes had dark green leaves and medium green leaves; on the contrary Elangovan *et al*. (2007) had earlier reported dark green leaves for most of 400 accessions of his study. The possible reason for this could be the differences of genetic material in both the season for this trait. The observation made on colour of dry anther among the *Rabi* sorghum genotypes displayed ample variation. Five different colours were observed for anther colour *viz.*, orange, yellow orange and grayed orange. Most of the genotypes were yellow orange in dry anther colour, only one genotype is grayed orange (Phule Maulee), three genotypes were orange in colour of dry anther (LG-1, R-16 and BTX623) and none of the genotypes were orange red in colour of dry anther. These results are conformity with the findings of Paukens (1975). Midrib color among the sorghum genotypes displayed ample variation. Panicle density of *Rabi* sorghum genotypes were classified as compact, semi compact, loose, semi loose and very loose. Among the sixty genotypes, the density of fifteen panicles was compact in nature. Density of two panicles was semi compact in nature; forty one genotypes showed semi loose density of panicles, two genotypes were having very loose density of the panicle. The shape of the panicle was categorized into reverse pyramid, panicle broader at upper end, panicle broader at lower end. Among the sixty sorghum genotypes, the shape of panicle of twelve genotypes was reverse pyramid in nature. Eleven genotypes showed panicle broader in upper part shape, the shape of panicle of twenty two genotypes were symmetric in nature, seven genotypes showed shape of the panicle broader in lower part, eight genotypes showed pyramidal shape of the panicle. These results are compatible with the findings of Geleta and Labuschagne (2005) who also reported similar results for qualitative traits in a study of 45 accessions of sorghum. Bonetti *et al.* (1995) in and Teshome *et al.* (1997) in sorghum and Arunkumar *et al.* (2004) also recorded similar observations. .Elangovan *et al.* (2007) also observed the same results for midrib color and panicle shape while studying 400 sorghum accessions.

Summary and conclusion :

Characterization of cultivars, establishment morphological identity and genetic purity of the seed lots are crucial for varietal improvement, protection of varieties and seed production. A rapid and reliable technique to verify the identity and assess the purity of seed lots is important in seed quality assurance programmes to meet the minimum seed certification standards of seed quality prescribed for the certified class. The present investigation revealed that the individuality of any crop variety or genotypes plays significant role in identification through morphological characters. Though the genotypes looks similar and alike while growing in the same condition, at the same time the study is needed due to the dependence of exhibition of these morphological characters in the changing environmental condition. This is the basic step towards the breeding of new crop varieties where in one can change the phenology of the crop through various advanced breeding programmes.Similar work on the related topic was also done by Mohanraj *et al.* (2011); Dinesh *et al.* (2012); Tomar and Sivakumar (2012); Elangovan (2006) and Agarwal *et al.* (2006).

Acknowledgement :

We would like to express special gratitude towards Dr. Sujay Rakshit, Principal Scientist, DSR, Hyderabad who has

spared the basic seed material for conducting research work.

LITERATURE CITED

Agrawal, S. B., Tomar, Rajani and Baghel, S.S. (2006). Effect of rate and time of atrazine application on grain yield of forage sorghum cultivars. *Internat. J. agric. Sci.*, **2** (1): 47-49.

Arunkumar, M.B., Sherry, R.J., Dadlani, Malvika, Varier, Anuradha and Sharma, S.P. (2004). Characterization of pearl millet hybrids and their parental lines using morphological characters. *Seed Res.*, **32**: 15-19.

Bonetti, A., Miggiano, A., Dinelli, G. and Lovato, A. (1995). Identification of bean (*Phaseolus vulgaris* L.) cultivars grown in Italy by field and electrophoresis test: A comparative study. *Seed Sci. Technol*., **23**: 69-84.

Dinesh, H.B., Talekar, Sidramappa, Satheesh Naik, S.J., Gururaja Rao, M.R., Basavaraj, T. and Manjunatha, C. (2012). Effect of male sterility inducing cytoplasm on hybrid mean performance for bioenergy traits in sweet sorghum [*Sorghum bicolor* (L.) Moench]. *Internat. J. agric. Sci.*, **8**(2): 514-517.

Elangovan, M. (2006). Characterization and evaluation of exotic sorghum germplasm collections. *Internat. J. agric. Sci.*, **2** (1): 231 -234.

Geleta, N. and Labuschagne, M.T. (2005). Qualitative traits variation in sorghum germplasm from eastern highlands of Ethiopia. *Biodiversity Conservation*, **14** (13) : 3055-3064.

Kumar, Ashwani, Chowdhary, R.K. and Kapoor, R.L. (1993). Varietal identification in pearl millet through morphological characters. *Seed Res*., **21** (1) : 52-54.

Mohanraj, K., Durai, A. Anna, Kumar, Ravinder and Nanjundan, J. (2011). Molecular genetic diversity and its relationship with heterosis for grain yield and related traits in Sorghum [*Sorghum bicolor* (L.) Moench]. *Internat. J. agric. Sci*., **7**(2): 316-320.

Paukens, J. (1975). Methods for determining cultivar trueness and purity in maize (*Zea mays* L.). *Seed Sci. Technol*., **3** (1) : 176-181.

Prabhakar, Elangovan M. and Reddy, D.C.S. (2007). Characterization and evaluation of sorghum germplasm from KARNATAKA (INDIA).

Teshome, A., Baum, B.R., Fahrig, L., Torrance, J.K., Aranason, T.J. and Lambert, J.D. (1997). Sorghum [*Sorghum bicolor* (L.) Moench] landrace variation and classification in North Shewa and South Welo. *Ethiopia. Euphytica*, **97** (3) : 255-263.

Tomar, Sandeep Singh and Sivakumar, S. (2012). Genetic diversity studies in sweet sorghum [*Sorghum bicolor* (L.) Moench] based on quantitative traits. *Internat. J. agric. Sci.*, **8**(2): 380-384.