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Studies on Characterization of Garlic (*Allium sativum* L.) Genotypes based on Morphological characters

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ABSTRACT: The present investigation entitled on studies on characterization of Garlic (*Allium sativum* L.) genotypes for yield and quality was carried out during 2019-20 at HREC, Karnataka. The experiment was laid out in Randomized Complete Block Design with 3 replications and forty five genotypes collected from different parts of the country. Garlic cultivation depends on performance of genotypes that are suitable to different conditions imposed by specific environments. Socharacterization and evolution of garlic cultivation is basic step towards its population for its successful cultivation. The garlic genotypes were categorized on the basis of density of leaves, leaf length, width, pseudostem length, width, bulb size, shape, number of cloves, distribution of cloves, clove color, size, color of flesh. The material assessed in the investigation showed wide range of variation for various charters observed. Based on results, there are variation in garlic genotypes especially with respect to leaves, bulbs, cloves and color. These traits may be used as criterion of selection, for improving agronomic characters of garlic in breeding programme. Considering genotypes characterization and other desirable attributes, the genotypes G-22,G-23,G-38,G-39 garlic are considered promising and can be selected preliminarily for further trial with a view to develop varieties.

Keywords: Garlic, Characterization, Gentotypes, Clove, Bulb.

INTRODUCTION

Garlic is considered as one of most important spices. It has been widely used throughout history as food additive for both its flavor and medicinal effect. It is used for its unique flavor as a food ingredients as well as dietary supplements (Khanum *et al*., 2004). Evaluation and document are important for exploitation of genetic variability for sustainable human diets. The characterization gives a rapid, reliable and efficient tool of information to augment the utilization of germplasm. There are many different cultivar strain of garlic. They may different in colour, size, number of cloves, pungency, and suitability of cooking**.** In Asia people use fresh leaves of garlic as salad and pickle is also prepared from garlic clones (Pandey and Singh 1907).

India is the second largest garlic producing country with production of 2920.30 metric tonnes from 3.58 lakh hectare area and having an average productivity of 8.16 tonnes per hectare during 2019-20.In India major garlic producing states are Madhya Pradesh, Gujarat, Uttar Pradesh, Rajasthan, Assam, Punjab, Maharashtra, West Bengal and Haryana. In Karnataka, garlic is grown during *Rabi* season in an area of 1,0022 hectares with production of 12.29 thousand ton and a productivity of 10.57 tons per hectare (NHRDF website).

Stevellkova (2008); Immelman, (2006) reported that high genetic diversity from point of morphological characters in garlic genotypes and pointed that first step of description of garlic genetics resources comprised of morphological characterization. The morphological characters traits like number of bulbs, weight of bulb, number of cloves may use as criteria of selection for

improving agronomical character in garlic breeding programme.

A large number of ecotypes have been established overtime in various areas of cultivation. Considerable morphological and biochemical variation between and ecotypes are been established (Bradley *et al.*,1996). To meet the garlic domestic requirement and fulfill the export demand, selection of suitable variety for growing under different agronomic condition is necessary. Lack of high yielding, better storage varieties, cultivation of inferior genotypes with nonscientific production practices are considered as to be main cause for low yield and productivity. The characterization of germplasm materials helps to ensure an efficient and effective use of genotypes for further crop improvement. Hence the present study was conducted with objectives of evaluation and characterization of garlic genotypes in order to provide tool of information to augment the utilization of germplasm in further breeding programme.

MATERIALS AND METHODS

An investigation was conducted at Horticulture Research and Extension Centre, Arsikere, University of Horticultural Sciences, Bagalkot, Karnataka and Tamilnadu Agriculture University, Coimbatore, India during 2019-20. The area is located in longitude of 76.5°E. latitude 13.15N Attitude, 800 mt MSL, mean minimum temperature 13.84°C, the mean maximum temperature 34.62°C with average rainfall 694 mm peak in May-June and September-October. The experimental material consists of 45 garlic genotypes and AAS-2 as check variety. The genotypes were collected from local places Karnataka, Tamilnadu, Maharashtra, Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh and other parts of different agroclimatic region of the country. All the genotypes were planted in RBD design in 3 replication in 1squre meter plot per genotype at spacing between plant was 10 cm and row to row distance was maintained at 15 cm. The recommended packages of practices were followed throughout the crop season. Observations were recorded on 5 plants in each replication for all the characters. Using 45 garlic bulb in gaccessions, 9 quantitative and 6 qualitative traits were recorded as per DUS guidelines over 5 samples in each replication.

Table: Place of collection of genotypes under study.

Sr. No.	Genotypes name	Place of collection
1.	GS-1,GS-2,GS-3,GS-4,GS-5,GS-6	Madhya Pradesh
2.	GS-7,GS-8,GS-9,GS-10,GS-11	Uttar Pradesh
3.	GS-12,GS-13	Jammu
4.	GS-14,GS-15	Tamilnadu
5.	GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-22,GS-23	Maharashtra
6.	GS-24,GS-25,GS-26,GS-27,GS-28	Karnataka
7.	GS-29,GS-30,GS-31,GS-32,GS-33,GS-34	Gujarat
8.	GS-35,GS-36,GS-37,GS-38,GS-39,GS-40	Haryana
9.	GS-41,GS-42,GS-43	Rajasthan
10.	GS-44,GS-45	New Delhi
11.	AAS-2 (Vannur local)	UHS, Bagalkot

Field view of Garlic (*Allium sativum* L.) characterization.

RESULTS AND DISCUSSION

Variability was observed among the genotypes in respect to bulb as well as other foliage characters as indicated in different table. The results of experimental studies indicated that, density of leaves of the genotypes were spare, medium and dense. Out of 45 genotypes, 9 genotypes as sparse, 22 genotypes as medium and 16 genotypes as dense of foliage. The leaf color of the genotypes were categorized as light, medium, dark in color under this group 14 genotypes classified as light green in colour, 21 genotypes categorized as medium in nature,11 genotypes as dark in color as indicated in table. Mishra and Vikram (2017) reported to indicated that the leaf colour of the genotypes were light green, dark green and green. Variability was observed among the genotypes in respect of colour of bulb, colour of cloves, colour of flesh and pungency.

With respect to leaf length,8 genotypes showed short in nature(<25cm), 33 garlic genotypes medium in length (25-30 cm),4 genotypes as long in nature(>35 cm). Similarly based on leaf width, 8 genotypes showed narrow (<1.5 cm), 29 genotypes as medium (1.5-2.5 cm) and 6 garlic genotypes showed in broad categories (>2.5cm). Similar study was conducted by Aslam *et al.,* (2016).

Based on pseudo stemcharacters, the genotypes revealed significant variation for these characters. Out of 45 garlic genotypes, 12 genotypes are small (<5 cm), 24 genotypes as medium (5-10cm),15 genotypes as long pesudostem nature in length (>10cm). Based on observation on pesudostem width, 15 genotypes as showed in narrow (<1cm), 20 genotypes as medium (1-1.5cm) and 12 genotypes as broad pesudostem width (>1.5cm). 8 Garlic genotypes bear flowering stem in nature, while rest of garlic genotypes has no flowering stem in nature. It was noted that garlic genotypes with respect to time of maturity, 3 genotypes come to early maturity (<130 days), 33 genotypes take medium days (130-160 days), while 10 genotypes has taken late bearing (>160 days) for maturity.

Based on bulb characters traits, 40 genotypes categorised as small (<2.5cm), 5 genotypes as medium bulb size (2.5-3.5cm) and no one garlic genotypes showed as long bulb size(>3.5 cm) in the research study. Bulb shape in longitudinal section and cross section is observed visually a single observation of a group of plants. It was observed that, 9 genotypes are elliptical in nature, 7 genotypes as ovate in nature and 29 genotypes are grouped as circular in nature under longitudinal shape. Similarly in case of bulb cross section, 10 genotypes as elliptical in nature, 35 genotypes as circular in nature. It also reported that with respect to bulb position of clove at a tip region, 39 genotypes as inserted, while 6 garlic genotypes as excreted at tip region.

Stavelokova (2008); Panthee *et al.,* (2006) also revealed that high diversity in garlic genotypes with respect to morphological traits which is in accordance with result of this study.

Bulb compactness as categorised as loose, medium and compact. Among 45 genotypes, 5 genotypes are loose bulb, 32 grouped as medium compactness and 27 are grouped to compact of bulb among garlic genotypes. The investigation also revealed that, among garlic genotypes with respect to bulb ground layers of external scales, 32 are white in colour, 7 are in yellowish white, 2 are in reddish white, 4 are in purple in colour. It also noted that, 4 garlic genotypes are loose, 22 are medium skin and 19 genotypes are strong in nature with respect to bulb skin adherence of dry external scales.

Nine garlic genotypes contain few individual cloves(<10), whereas 31 genotypes contain more individual clones (11-20 number) and 4 genotypes contain more than 20 individual cloves per bulb as it contributes to yield characters. The cloves having high bulb yield with large sized cloves, less number of cloves/bulb and other desirable traits and they reported high values of heritability, GCV and genetic advance (Dubey *et al.,* 2010). Thirteen garlic genotypes were small in size (<1cm), 18 genotypes were medium in size(1-2cm), 13 genotypes were large in size (more than 2cm), whereas 17 genotypes were white in colour, 9 genotypes are cream, 9 genotypes are pink in colour and 10 genotypes are purple in colour in clove scales, whereas and 22 genotypes white and 24 genotypes are yellowish in colour with respect of clove colour of flesh. Since bulb and clove characteristics is one of the important traits considered on the basis of consumer likeness need to be taken in to consideration for varietal development (Islam *et al.,* 2004). These variation among the different characters mentioned above differently could be utilized for the important of desired traits by the breeders. It seems that number of clove per bulb may be important traits in increasing bulb yield that should be considered in development of local varieties. These results might be due to the genetic variations among garlic cultivars and their ability for exploiting the environmental sources particularly, light, CO_2, water and nutrients (Abdel-Razzaak and El-Sharkawy, 2013).

Based on results it can be concluded that there are variation in garlic genotypes especially with respect to leaves, bulbs, cloves and color. These traits may be used as criterion of selection, for improving agronomic characters of garlic in breeding programs. Considering genotypes characterization and other desirable attributes, the genotypes G-22,G-23,G-38,G-39 garlic are considered promising and can be selected preliminarily for further trial with a view to develop varieties.

Table 1: Characterization of garlic genotypes based on leaf characters

	Density of leaves			Foliage Attitude			Leaf colour		
	Sparse	**Medium**	**Dense**	**Erect**	**Semi Erect**	**Drooping**	**Light**	**Medium**	**Dark**
Genotypes	GS-1,GS-2,GS-3,GS-6,GS-10,GS-16,GS-17,GS-44,GS-45	GS-14,GS-15,GS-18,GS-23,GS-17,GS-34,GS-11,GS-20,GS-21,GS-22,GS-23,GS-26,GS-27,GS-28,GS-31,GS-32,GS-33,GS-39,GS-40,GS-41,GS-42,GS-4, AAS-2	GS-7,GS-8,GS-9,GS-12,GS-13,GS-20,GS-24,GS-25,GS-29,GS-30,GS-31,GS-34,GS-35,GS-36,GS-37,GS-38	GS-1,GS-2,GS-4,GS-6,GS-12,GS-13,GS-27,GS-32,GS-33,GS-34,GS-41,GS-42, AAS-2	GS-3,GS-7,GS-8,GS-10,GS-11,GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-23,GS-24,GS-25,GS-26,GS-38,GS-39,GS-40,GS-43	GS-5,GS-9,GS-14,GS-15,GS-22,GS-28,GS,29,GS-30,GS-31,GS-35,GS-36,GS-37,GS-44,GS-45	GS-1,GS-2,GS-6,GS-8,GS-9,GS-10,GS-25,GS-26,GS-27,GS-31GS-32,GS-34,GS-44,GS-45	GS-3,GS-5,GS-11,GS-14,GS-15,GS-16,GS-17,GS-18,GS-19,GS-20,GS-22,GS-24,GS-29,GS-30,GS-35,GS-38,GS-36,GS-37,GS-41,GS-42,GS-43, AAS-2	GS-11,GS-4,GS-7,GS-12,GS-13,GS-21,GS-23,GS-28,GS-33,GS-39,GS-40

Table 2: Characterization of garlic genotypes based on leaf characters.

	Leaf length			Leaf width		
	Short (<25 cm)	**Medium (25 cm-30cm)**	**Long(>35 cm)**	**Narrow (<1.5 cm)**	**Medium(1.5-2.5 cm)**	**Broad(>2.5 cm)**
Genotypes	GS-7,GS-12,GS-13,GS-15,GS-28,GS-43,GS-44,GS-45	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-6,GS-8,GS-9,GS-10,GS-11,GS-14,GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-22,GS-23,GS-24,GS-25,GS-26,GS-27,GS-29,GS-31,GS-32,GS-33,GS-34,GS-35,GS-36,GS-37,GS-38,GS-41	GS-30,GS-40,GS-39,GS-42	GS-7,GS-16,GS-15,GS-19,GS-21,GS-41,GS-42,GS-44	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-6,GS-8,GS-9,GS-10,GS-11,GS-12,GS-13,GS-14,GS-17,GS-18,GS-20,GS-22,GS-24,GS-25,GS-26,GS-27,GS-31,GS-32,GS-33,GS-34,GS-35,GS-36,GS-37,GS-38,GS-39,GS- AAS-2 40,	GS-23,GS-28,GS-29,GS-30,GS-43,GS-45

Table 3: Characterization of garlic genotypes based on Pseudo stem characters.

	Pseudo stem length			Pseudo stem width		
	Small (<5 cm)	**Medium (5cm-10cm)**	**Long(>10cm)**	**Narrow (<1 cm)**	**Medium (1cm-1.5cm)**	**Broad(>1.5 cm)**
Genotypes	GS-1,GS-2,GS-6,GS-9,GS-11,GS-12,GS-14,GS-15,GS-19,GS-34,GS-41,GS-42	GS-3,GS-4,GS-14,GS-15,GS-17,GS-20,GS-21,GS-22,GS-23,GS-24,GS-25,GS-26,GS-32,GS-33,GS-34,GS-35,GS-36,GS-37,GS-38,GS-39,GS-40,GS-43,GS-44,GS-45	GS-5,GS-7,GS-8,GS-10,GS-11,GS-13,GS-16,GS-17,GS-18,GS-26,GS-27,GS-29,GS-30,GS-31,GS-38	GS-1,GS-2,GS-6,GS-9,GS-11,GS-12,GS-18,GS-19,GS-21,GS-26,GS-11,GS-32,GS-33,GS-41,GS-42	GS-3,GS-4,GS-5,GS-10,GS-14,GS-17,GS-20,GS-22,GS-23,GS-24,GS-25,GS-34,GS-35,GS-36,GS-38,GS-39,GS-40,GS-43,GS-44,GS-45 AAS-2	GS-7,GS-8,GS-13,GS-15,GS-16,GS-17,GS-27,GS-28,GS-29,GS-30,GS-31,GS-37

Table 4: Characterization of garlic genotypes based on Pseudo stem characters.

	Flowering stem		Time of maturity(from date of planting)		
	Absent	**Present**	**Early(<130 days)**	**Medium(130-160 days)**	**Late (>160 days)**
Genotypes	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-6,GS-8,GS-9,GS-10,GS-11,GS-13,GS-14,GS-18,GS-19,GS-20,GS-21,GS-22,GS-23,GS-24,GS-25,GS-26,GS-27,GS-28,GS-29,GS-30,GS-31,GS-32,GS-33,GS-34,GS-35,GS-36,GS-37,GS-38,GS-39,GS-40,GS-44,GS-45	GS-7,GS-15,GS-12,GS-16,GS-17,GS-41,GS-42,GS-43	GS-14,GS-26, AAS-2	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-6,GS-7,GS-9,GS-10,GS-11,GS-15,GS-15,GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-24,GS-25GS-28,GS-30,,GS-31,GS-32,GS-33,GS-34,GS-36,GS-37,GS-38,GS-39,GS-40,GS-41,GS-42,GS-43	GS-8,GS-12,GS-13,GS-22,GS-23,GS-27,GS-29,GS-35,GS-44,GS-45

Table 5: Characterization of garlic genotypes based on bulb characters.

	Bulb size			Bulb Shape in longitudinal section		
	Small (<2.5 cm)	**Medium (2.5 cm-3.5cm)**	**Long(>3.5-5cm)**	**Elliptical**	**Ovate**	**Circular**
Genotypes	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-6,GS-7,GS-8,GS-9,GS-11,GS-12,GS-13,GS-14,GS-15,GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-23,GS-24,GS-25,GS-26,GS-27,GS-28,GS-29,GS-30,GS-31,GS-32,GS-33,GS-34,GS-35,GS-36,GS-37,GS-38,GS-39,GS-40,GS-43,GS-44	GS-10,GS-22,GS-41,GS-42,GS-45, AAS-2	Nil	GS-9,GS-16,GS-17,GS-18,GS-21,GS-34,GS-36,GS-42,GS-43	GS-19,GS-20,GS-22,GS-23,GS-24,GS-25,GS-26	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-6,GS-7,GS-8,GS-10,GS-11,GS-12,GS-13,GS-14,GS-15, GS-27,GS-28,GS-29,GS-30,GS-31,GS-32,GS-33,GS-35,GS-37,GS-38,GS-39,GS-40,GS-41,GS-44,GS-45, AAS-2

Table 6: Characterization of garlic genotypes based on bulb characters.

	Bulb shape in cross section		Bulb position of clove at tip		Bulb compactness		
	Elliptical	**Circular**	**Inserted**	**Excreted**	**Loose**	**Medium**	**Compact**
Genotypes	GS-3,GS-4,GS-17,GS-21,GS-31,GS-34,GS-36,GS-41,GS-42,GS-43	GS-1,GS-2,GS-5,GS-6,GS-7,GS-8,GS-9,GS-10,GS-11,GS-12,GS-13,GS-14,GS-15,GS-16,GS-18,GS-19,GS-20,GS-22,GS-23,GS-24,GS-25,GS-26,GS-27,GS-28,GS-29,GS-30,GS-32,GS-33,GS-35,GS-37,GS-38,GS-39,GS-40,GS-44,GS-45	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-6,GS-7,GS-8,GS-9,GS-10,GS-11,GS-12,GS-13,GS-14,GS-15,GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-22,GS-23,GS-24,GS-25,GS-26,GS-27,GS-28,GS-29,GS-30,GS-31,GS-32,GS-33,GS-35,GS-37,GS-38,GS-39,GS-40,GS-42	GS-34,GS-36,GS-41,GS-43,GS-44,GS-45	GS-5,GS-8,GS-27,GS-43,GS-44	GS-3,GS-4,GS-5,GS-11,GS-14,GS-16,GS-17,GS-24,GS-25,GS-28,GS-29,GS-30,GS-31,GS-41,GS-42,GS-44,GS-45, AAS-2	GS-1,GS-2,GS-6,GS-7,GS-8,GS-9,GS-10,GS-12,GS-13,GS-15,GS-18,GS-19,GS-20,GS-21,GS-22,GS-23,GS-26,GS-27,GS-32,GS-33,GS-34,GS-35,GS-36,GS-37,GS-38,GS-39,GS-40

Table 7: Characterization of garlic genotypes based on bulb characters.

	Bulb ground layer of external scales				Bulb skin adherence of dry external scales		
	White	Yellowish white	Reddish white	Purple	Weak	Medium	Strong
Genotypes	GS-3,GS-6,GS-7,GS-8,GS-10,GS-11,GS-12,GS-13,GS-14,GS-15,GS-18,GS-19,GS-20,GS-21,GS-22,GS-23,GS-24,GS-26,GS-27,GS-30,GS-31,GS-32,GS-33,GS-34,GS-36,GS-37,GS-38,GS-39,GS-40,GS-42,GS-43,GS-44, AAS-2	GS-1,GS-2,GS-5,GS-4,GS-25,GS-35,GS-41	GS-16,GS-17	GS-9,GS-28,GS-29,GS-45	GS-4,GS-9,GS-44,GS-45	GS-1,GS-3,GS-6,GS-7,GS-12,GS-14,GS-15,GS-16,GS-17,GS-20,GS-21,GS-28,GS-29,GS-30,GS-31,GS-32,GS-35,GS-36,GS-37,GS-40,GS-41,GS-43	GS-2,GS-5,GS-8,GS-10,GS-11,GS-13,GS-18,GS-19,GS-22,GS-23,GS-24,GS-25,GS-26,GS-27,GS-33,GS-34,GS-38,GS-39,GS-42, AAS-2

Table 8: Characterization of garlic genotypes based on clove characters.

	Number of cloves per bulb			Distribution of clove		External cloves	
	Few (<10)	Medium (11-20)	Many (>20)	Radial	Non radial	Absent	Present
Genotypes	GS-7,GS-10,GS-11,GS-16,GS-17,GS-23,GS-42,GS-44,GS-45	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-6,GS-8,GS-9,GS-12,GS-13,GS-14,GS-15,GS-18,GS-19,GS-20,GS-21,GS-22,GS-25,GS-26,GS-27,GS-28,GS-29,GS-30,GS-31,GS-32,GS-33,GS-34,GS-35,GS-38,GS-39,GS-40, AAS-2	GS-24,GS-36,GS-37,GS-43	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-6,GS-8,GS-9,GS-10,GS-11,GS-12,GS-14,GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-22,GS-24,GS-26,GS-27,GS-28,GS-29,GS-30,GS-31,GS-32,GS-33,GS-34,GS-35,GS-36,GS-37,GS-38,GS-39,GS-40,GS-44,GS-45	GS-7,GS,13,GS-15,GS-23,GS-25,GS-42,GS-43	GS-1,GS-2,GS-,3,GS-4,GS-5,GS-7,GS-8,GS-9,GS-10,GS-11,GS-13,GS-14,GS-15,GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-22,GS-23,GS-24,GS-25,GS-26,GS-27,GS-28,GS-29,GS-30,GS-31,GS-32,GS-33,GS-34,GS-35,GS-36,GS-37,GS-38,GS-39,GS-40,GS-43,GS-44	GS-6,GS-12,GS-23,GS-25,GS-41,GS-42,GS-45

Table 9: Characterization of garlic genotypes based on clove characters.

	Clove size			Clove color of scale				Clove color of flesh	
	Small(<1cm)	Medium (1-2 cm)	large((>2cm)	White	Cream	Pink	Purple	White	Yellowish
Genotypes	GS-4,GS-6,GS-9,GS-15,GS-16,GS-19,GS-27,GS-28,GS-29,GS-30,GS-31,GS-34,GS-37, AAS-2	GS-1,GS-2,GS-3,GS-5,GS-8,GS-12,GS-13,GS-21,GS-22,GS-24,GS-25,GS-32,GS-33,GS-35,GS-36,GS-38,GS-39,GS-40	GS-7,GS-10,GS-11,GS-14,GS-17,GS-18,GS-20,GS-23,GS-26, 41,GS-42,GS-43,GS-44,GS-45	GS-3,GS-8,GS-14,GS-15,GS-19,GS-20,GS-33,GS-34,GS-35,GS-36,GS-38,GS-39,GS-40,GS-41,GS-43,GS-44,GS-45	GS-2,GS-4,GS-7,GS-10,GS-13,GS-18,GS-21,GS-22,GS-37	GS-1,GS-5,GS-6,GS-9,GS-11,GS-12,GS-16,GS-17,GS-42, AAS-2	GS-23,GS-24,GS-25,GS-26,GS-27,GS-28,GS-29,GS-30,GS-31,GS-32	GS-1,GS-3,GS-5,GS-6,GS-7,GS-8,GS-10,GS-11,GS-12,GS-13,GS-14,GS-34,GS-35,GS-36,GS-37,GS-38,GS-39,GS-40,GS-42,GS-43,GS-44,GS-45, AAS-2	GS-2,GS-4,GS-9,GS,GS-15,GS-16,GS-17,GS-18,GS-19,GS-20,GS-21,GS-22,GS-23,GS-24,GS-25,GS-26,GS-27,GS-28,GS-29,GS-30,GS-31,GS-32,GS-33,GS-41

FUTURE SCOPE

Performance of the identified superior genotypes could be confirmed by large scale performance trial at different locations for yield stability and the best genotypes could be adopted for commercial cultivation

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Conflict of Interest. None.

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