

Consumer Acceptance of Ornamental Sunflower genotypes as per visual appearance and grouping of genotypes as per DUS guidelines

Abstract

23 Ornamental sunflower genotypes were evaluated for DUS (Distinctness, Uniformity and Stability) characteristics at College of Horticulture, Mysuru. Red Giant, Teddy Bear, Miniature Seeds, Sungold Mix, Russian Giant, Sunflower Miniature, Sungold Open Pollinated, Light Pink, Sungold Mix Open Pollinated, Sunflower Sungold, PM-81, RCR-72, RCR-91, RCR-93 and RCR-95 were genotypes that belonged to medium head size with flat head shape. Tobias and Vincent had large head size and fusiform ray floret shape, RCR-94 showed strongly convex head shape whereas, Sunflower R and Tobias recorded flat head shape and Vincent recorded small convex head shape. 7 genotypes belonged to the green group. These were Teddy Bear, Miniature Seeds, Russian Giant, Sungold Open Pollinated, Light Pink, Sungold Mix Open Pollinated and Sunflower Sungold, whereas, 6 genotypes belonged to greyish orange group (Red Giant, Sunflower Miniature, R-630, RCR-93, RCR-95 and Tobias). 8 genotypes belonged to yellow green group. 16 genotypes (Red Giant, Teddy Bear, Miniature Seeds, Russian Giant, Sunflower Miniature, Sungold Mix Open Pollinated, Sunflower Sungold, RGM-49, PM-81, RCR-72, RCR-91, RCR-93, RCR-94, RCR-95, Sunflower Rand Tobias) belonged to yellow group of ray forets. The sensory ratings were given for all the 23 genotypes for colour of ray and disc florets, size of flower head, shape, appearance, stem girth and overall suitability for ornamental purpose. Highest score for colour of ray florets was scored by RCR-97 (8.07) and R-630 (8.00), while highest score for colour of disc

florets was obtained by Vincent (7.62) and lowest score was recorded in Sunflower Miniature (6.17). The score for overall consumer acceptability was recorded highest in R-630 (8.42) and lowest in Tobias (5.21). R-630 (8.42) recorded highest overall acceptability score.

Key words: Sensory, RHS, Distinctness, Uniformity, Ray florets, disc florets

Introduction

Identification and characterization of new cultivars is crucial in any crop improvement programme, for their efficient utilisation and germplasm conservation. Morphological trait characterization has been used as a foundation for germplasm classification traditionally by visual identification. Characterization of varieties is crucial for IPR (intellectual property rights) protection. (Singh et al., 2018) Sunflower (*Helianthus annuus* L.) was termed as the “Golden Girl of American Agriculture”. In Earlier days it was one of the important oilseed crop. It bears beautiful shade of light to yellow floret flower heads, but in earlier years it was only used for oil extraction and seeds of sunflower were and are consumed as snacks, as bird feed and also fed to livestock. The species known as the ornamental sunflower contains numerous genotypes with ray and disc florets that are of different colours and may or may not have multiple branches of varying heights. Sunflower is an annual, erect and herbaceous plant with alternate and simple leaves, with stout, lanceolate petioles and leaves that are rough on both surfaces. Seeds are pointed at base and round at end. Colour of the seed may vary from black to white and brown, striped or mottled seed. The shape of ray florets may be fusiform, lanceolate, ovate. Head size may range from small, medium to large with flat to convex head shape. Colour of disc florets and ray floret may range from yellow group to yellow green group. Due to the short duration of crop, early maturity, photo-insensitivity, wide adaptability into different kinds of cropping pattern and drought tolerant it has gained tremendous importance in flower market. The height of plant ranges from one meter to over four meters. The desired traits that may be exploited in sunflower are categorised

into uses such as for garden use, as pot plants, and as cut flowers. Colour of ray and disc florets, medium to large heads, large petals and attractive centres make this crop desirable as an ornamental crop and for use in ornamental industry. Characteristics of the sunflower inflorescence include small heads, multiple flowers and pollen less flowers. DUS characterisation has been considered necessary to recognize the contributions made at any time in conserving, improving and making available plant genetic resources of traditional varieties and for the development of new plant varieties. A small attempt was made to study the DUS characters based on morphological studies of ray floret grouping, ray floret colour, disc floret colour in Ornamental sunflower and to further study the consumer preference for best genotypes of Ornamental Sunflower based on various floral parameters.

Material and Methods

A Research related to study of floral characters of sunflower for use in ornamental industry based on DUS guidelines as per Protection of Plant Varieties and Farmers Rights Authority (PPV & FRA) (Anonymous, 2009), was conducted at College of Horticulture Mysuru, based on ray floret grouping as per flower head, ray floret and disc floret colour as per RHS colour chart and finally overall consumer acceptance based on external appearance and acceptance was conducted in twenty three genotypes of sunflower which were procured and collected from various parts of India in order to identify and select the best suitable sunflower genotypes for ornamental use. The grouping of genotypes was done according to ray floret grouping as per flower head as per DUS guidelines from Protection of Plant Varieties and Farmers Rights Authority (PPV & FRA) (Anonymous, 2009), the number of ray florets in a flower were classified as few (30), medium (30-40) and many (>40) for *Helianthus annuus* L. Further ray floret and disc florets colour (RHS colour chart) was done according to DUS characters of Protection of Plant Varieties and Farmers Rights Authority (PPV & FRA) act (Anonymous, 2009), ray floret colour was classified as (Light yellow), (Yellow), (Orange) and (Purple). RHS colour chart was used to identify the colour

of ray floret of germplasm studied and grouped according as per DUS guidelines. The disc floret colour of (*Helianthus annuus*L.) was described as yellow, orange, and purple. Disc floret colour was identified using RHS colour chart and grouped according to DUS guidelines. Consumer acceptance was measured in terms of sensory and visual evaluation for flower colour of ray florets and disc florets, appearance, size of flower head, shape, stem length and overall suitability for ornamental purpose. and was given the scale from (1-10).

Ray floret colour	Disc floret colour	Appearance	Flower head size	Shape	Stem length	Overall suitability	Score
Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Highly Suitable	8.10-10.00
Very good	Very good	Very good	Very good	Very good	Very good	Moderately Suitable	7.00-8.00
Good	Good	Good	Good	Good	Good	Acceptable	5.00-6.90
Poor	Poor	Poor	Poor	Poor	Poor	Slightly Suitable	3.00-4.90
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Not Suitable	1.00-2.90

List 1: Consumer acceptance scores based on sensory and visual evaluation of flowers

Results and Discussion

DUS (Distinctness, Uniformity and Stability) testing was carried out to study the distinctness of 23 different genotypes to learn the difference from existing varieties with respect to flower parameters like flower head size, shape, ray floret shape and disc floret shape (**Table 1**). The genotypes which belongs to medium head size, flat head shape and having fusiform ray floret shape were Red Giant, Teddy Bear, Miniature Seeds, Sungold Mix, Russian Giant, Sunflower Miniature, Sungold Open Pollinated, Light Pink, Sungold Mix Open Pollinated, Sunflower Sungold, PM-81, RCR-72, RCR-91, RCR-93 and RCR-95. Genotypes

RCR-94, Sunflower R. While Tobias and Vincent had large head size and fusiform ray floret shape, RCR-94 showed strongly convex head shape whereas, Sunflower R and Tobias recorded flat head shape and Vincent recorded small convex head shape. As per Sloan and Harkness, 2006 flower head diameter ranging from 8-15 cm were considered ideal for florist use.

Genotypes R-630, R-127-1 and RGM-49 recorded small head size, flat and small convex head shape with narrow ovate ray floret shape. Similar results were reported by Cvejic S *et al.* (2017) in ornamental sunflower and Dhaneet *al.* (2004) in gerbera. With respect to colour of disc florets, 7 genotypes belonged to the green group. These were Teddy Bear, Miniature Seeds, Russian Giant, Sungold Open Pollinated, Light Pink, Sungold Mix Open Pollinated and Sunflower Sungold, whereas, 6 genotypes belonged to greyish orange group (Red Giant, Sunflower Miniature, R-630, RCR-93, RCR-95 and Tobias). With respect to yellow green group, 8 genotypes belonged to this group (Sungold Mix, R-127-1, PM-81, RCR-72, RCR-91, RCR-94, RCR-97 and Sunflower R. Whereas RGM-49 showed moderate reddish brown colour and belonged to red group and Vincent showed greyish red colour disc florets. Ray floret and disc floret colour according to the RHS colour chart of the ornamental sunflower genotype is presented in **Table 2**. A wide colour variation was observed in the ray and disc florets of different genotypes of ornamental sunflower. With respect to ray florets twenty three genotypes were studied and grouped into three distinct groups. Colour group ranged from yellow group, yellow-orange group and yellow orange green group. Among these three groups 16 genotypes (Red Giant, Teddy Bear, Miniature Seeds, Russian Giant, Sunflower Miniature, Sungold Mix Open Pollinated, Sunflower Sungold, RGM-49, PM-81, RCR-72, RCR-91, RCR-93, RCR-94, RCR-95, Sunflower Rand Tobias) belonged to yellow group. Yellow-orange group had four genotypes (R-630, R-127-1, RCR-97 and Vincent) and three genotypes (Sungold Mix, Sungold Open Pollinated and Light Pink) belonged to yellow orange green group (**Table 2**). These results were in agreement with reports of Kumar and Yadav (2005) and Naik *et al.* (2006) in gerbera Talukdar *et al.* (2003) in chrysanthemum and Kale (2002) in gaillardia

environmental and genetic variables. Similar results were observed by Barooah and Talukdar (2009) in gerbera, Poornima *et al.* (2006) in China aster.

Accordingly Consumer acceptance in the (1-10 scale) was conducted. Based on the observation, the sensory ratings were given for all the 23 genotypes for colour of based on ray and disc florets, size of flower head, shape, appearance, stem girth and overall suitability for ornamental purpose and are described in **Table 3**. Highest score for colour of ray florets was scored by RCR-97 (8.07) and R-630 (8.00), while highest score for colour of disc florets was obtained by Vincent (7.62) and lowest score was recorded in Sunflower Miniature (6.17). R-630 (7.75) scored highest for size of the flower head while lowest score was obtained in genotype Sunflower Miniature (5.75), while range of scores for flower shape was between 5.64 -7.50 to the genotypes Sunflower Miniature and R-630, respectively. The consumer score for appearance of flower ranged from 5.96 to 8.14 in Sungold Open Pollinated and R-630 respectively. Score for stem girth was highest in RCR-72 (7.47) and lowest in Sunflower Miniature (5.60). Finally, the score for overall consumer acceptability was recorded highest in R-630 (8.42) and lowest in Tobias (5.21). Consumer acceptance demonstrates sensory evaluation made by various consumers for various genotypes including colour of ray and disc florets, size of flower head, shape, appearance, stem girth and overall acceptability for ornamental purpose. R-630 (8.42) recorded highest overall acceptability score. Lowest overall acceptability was scored by Tobias (5.21). Similar findings were also observed by Priyanka *et al.* (2015) in crossandra and Parmeshwar (2010) and Mladenovic *et al.* (2016) and Purwati and Herwati (2016) in sunflower.

Summary and Conclusion

The genotypes which belongs to medium head size, flat head shape and having fusiform ray floret shape were Red Giant, Teddy Bear, Miniature Seeds, Sungold Mix, Russian Giant, Sunflower Miniature, Sungold Open Pollinated,

Light Pink, Sungold Mix Open Pollinated, Sunflower Sungold, PM-81, RCR-72, RCR-91, RCR-93 and RCR-95. Genotypes RCR-94, Sunflower R. Teddy Bear, Miniature Seeds, Russian Giant, Sungold Open Pollinated, Light Pink, Sungold Mix Open Pollinated and Sunflower Sungold, belonged to green group. Greyish orange group genotypes were (Red Giant, Sunflower Miniature, R-630, RCR-93, RCR-95 and Tobias). Sungold Mix, R-127-1, PM-81, RCR-72, RCR-91, RCR-94, RCR-97 and Sunflower R belonged to yellow green group, Whereas RGM-49 belonged to red group and Vincent showed greyish red colour disc florets. As per Disc floret colour 16 genotypes (Red Giant, Teddy Bear, Miniature Seeds, Russian Giant, Sunflower Miniature, Sungold Mix Open Pollinated, Sunflower Sungold, RGM-49, PM-81, RCR-72, RCR-91, RCR-93, RCR-94, RCR-95, Sunflower Rand Tobias) belonged to yellow group. Yellow-orange group had four genotypes (R-630, R-127-1, RCR-97 and Vincent) and three genotypes (Sungold Mix, Sungold Open Pollinated and Light Pink) belonged to yellow orange green group. Considering overall consumer preference based on flower colour, appearance, R-630 was considered the best genotype preferred for ornamental use followed by Teddy Bear Sungold Mix Open Pollinated, RGM-49, PM-81, RCR-91, RCR-97, Sunflower R (7.78) and Vincent which achieved high ratings.

Table1: DUS characters of ornamental sunflower

Sl. No.	Genotype	Head size	Head shape	Ray floret shape
1	Red Giant	Medium	Flat	Fusiform
2	Teddy Bear	Medium	Flat	Fusiform
3	Miniature Seeds	Medium	Flat	Fusiform
4	Sungold Mix	Medium	Flat	Fusiform
5	Russian Giant	Medium	Flat	Fusiform
6	Sunflower Miniature	Medium	Flat	Fusiform
7	Sungold Open Pollinated	Medium	Flat	Fusiform
8	Light Pink	Medium	Flat	Fusiform
9	Sungold Mix Open Pollinated	Medium	Flat	Fusiform
10	Sunflower Sungold	Medium	Small convex	Fusiform
11	R-630	Small	Flat	Narrow ovate
12	R-127-1	Small	Small convex	Narrow ovate
13	RGM-49	Small	Flat	Fusiform
14	PM-81	Medium	Flat	Fusiform
15	RCR-72	Medium	Flat	Fusiform
16	RCR-91	Medium	Flat	Fusiform
17	RCR-93	Medium	Flat	Fusiform
18	RCR-94	Large	Strongly convex	Fusiform
19	RCR-95	Medium	Flat	Fusiform
20	RCR-97	Medium	Strongly convex	Narrow ovate
21	Sunflower Raichur	Large	Flat	Fusiform
22	Tobias	Large	Flat	Fusiform
23	Vincent	Large	Small convex	Fusiform

Table 2: Classification of 23 ornamental sunflower genotypes based on flower colour

Sl. No.	Name of the group (Ray florets)	No. of genotypes included	Genotypes included in the group
1	Yellow Group	16	RGM-49, RCR-72, PM-81, RCR-93, RCR-94, R-127-1, R-630, Light Pink, Sungold Open Pollinated, Sungold Mix Open Pollinated, Red Giant, Russian Giant and Sunflower Sungold
2	Yellow-Orange Group	4	Tobias, Vincent, Sunflower Raichur and Teddy Bear
3	Yellow orange green group	3	RCR-91, RCR-95 and RCR-97
Sl. No.	Name of the group (Disc florets)	No. of genotypes included	Genotypes included in the group
1	Yellow group	16	Red Giant, Teddy Bear, Miniature Seeds, Russian Giant, Sunflower Miniature, Sungold Mix Open Pollinated, Sunflower Sungold, RGM-49, PM-81, RCR-72, RCR-91, RCR-93, RCR-94, RCR-95, Sunflower Raichur and Tobias
2	Yellow orange group	4	R-630, R-127-1, RCR-97 and Vincent
3	Yellow orange green group	3	Sungold Mix, Sungold Open Pollinated and Light Pink

Table 3: Consumer acceptance based on flower Colour and overall suitability for ornamental purpose in ornamental sunflower

Sl. No.	Genotype	Score (0-10 scale)						Overall suitability for ornamental purpose
		Colour of ray florets	Colour of disc florets	Size of flower head	Shape	Appearance	Stem girth	
1	Red Giant	6.75	6.67	6.17	6.10	6.14	5.80	6.71
2	Teddy Bear	6.40	7.28	6.89	6.60	7.17	6.57	7.50
3	Miniature Seeds	6.70	6.31	5.92	6.50	6.64	6.10	6.75
4	Sungold Mix	6.85	6.64	6.64	6.57	6.71	5.85	6.78
5	Russian Giant	6.85	6.51	6.60	6.42	6.82	5.75	6.82
6	Sunflower Miniature	6.50	6.17	5.75	5.64	6.32	5.60	6.21
7	Sungold Open Pollinated	6.28	6.35	6.39	6.46	5.96	5.67	6.28
8	Light Pink	6.28	6.28	6.50	5.96	6.17	5.64	6.32
9	Sungold Mix OpenPollinated	6.85	6.82	6.32	6.28	6.85	6.46	7.00
10	Sunflower Sungold	6.60	6.82	6.71	6.60	6.57	6.71	6.85
11	R-630	8.00	6.57	7.75	7.50	8.14	7.07	8.42
12	R-127-1	5.40	7.10	6.65	6.65	7.60	6.50	6.55
13	RGM-49	5.50	6.25	6.70	7.10	7.74	6.67	7.10
14	PM-81	7.53	7.17	6.96	6.75	6.78	6.82	7.42
15	RCR-72	7.10	6.28	6.61	7.15	7.10	7.47	6.50
16	RCR-91	7.14	7.39	7.25	7.03	7.21	7.28	7.03
17	RCR-93	6.89	6.78	6.60	6.50	6.35	5.89	6.92
18	RCR-94	7.07	6.71	6.60	6.82	6.75	6.07	6.67
19	RCR-95	7.20	7.15	6.60	7.16	6.05	6.55	6.10
20	RCR-97	8.07	7.71	7.50	6.89	6.96	7.25	7.07
21	Sunflower Raichur	7.46	7.25	7.42	7.28	7.60	7.14	7.78
22	Tobias	7.15	7.14	7.10	7.10	6.54	6.30	5.21
23	Vincent	7.69	7.62	7.32	7.14	7.60	6.92	7.62

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