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Studies on growth and assessment of flower quality and yield performance of Ornamental sunflower (*Helianthus annuus* L.) genotypes

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Abstract
A study was conducted in the experimental block of College of Horticulture, Mysuru, to evaluate genotypes of sunflower suitable for Ornamental use from various sources. At 20 DAS, maximum plant height was recorded in RCR-94 (31.07 cm). At 40 DAS, the genotype RCR-93 (67.73 cm) exhibited maximum plant height. At 60 DAS, the genotype RCR- 94 (137.36 cm) showed maximum plant height followed by Tobias (124.54 cm) and Vincent (121.17 cm). Plant spread at east-west direction (E-W) was highest in RCR-93 (39.73 cm^2 at 20 DAS. At 40 DAS, Tobias (64.47 cm^2) recorded maximum plant spread at E-W direction. At 60 DAS, highest plant spread was seen in RGM-49 (95.53 cm^2) followed by PM-81 (86.20 cm^2) and RCR-72 (85.87 cm^2). At 40 days after sowing Red Giant (20.93) recorded higher number of leaves per plant. At 40 days after sowing, maximum leaf area index was recorded by Sungold Mix (1.32). RCR-91 (15.73) produced maximum number of branches at 40 days after sowing. R- 630 (578.67) produced maximum number of flower heads per plot followed by RCR-97 (566.67), Sunflower Sungold (468.00), Sungold Mix Open Pollinated (448.00) and PM-81 (425.33). Less number of flower heads per plot was recorded in Vincent (73.33). Genotype RCR- 97 (12.36) and R-630 (12.05) produced significantly large number of flower heads per ha. Sunflower Miniature (42.40 g) recorded significantly highest fresh flower weight. Highest cumulative water uptake (CWU) was recorded in genotype R-630 (48.53 g) and RCR-94 (42.73). Minimum cumulative water loss was recorded in Vincent (31.93 g) and RCR-97 (33.07 g). R- 127-1 (20.67 g) recorded minimum transpiration water loss. Higher water balance was recorded in RCR-94 (30.47 g). In the present investigation, higher number of flowers may be due to increased morphological parameters of the plant which lead to production of more photosynthesis. Such variation may be due to genetic makeup of the genotypes. This variation and divertity in characters can be utilized for future breeding programmes to develop innovative ornamental sunflower lines suitable for present trend in ornamental floriculture industry.

Keywords: Ornamental sunflower, growth, flowering, flower quality, yield

Introduction
Sunflower is one of the specialty cur flowers known recently for use in Ornamental Industry worldwide. In earlier days it was only popular for oil extraction. Recently there is an emerging demand for cut sunflowers for ornamental use. The botanical name of Sunflower is Helianthus annuus L. belongs to the family Asteraceae. The flower of sunflower is known as Head or capitullum. It consists of both male and female flowers arranged in a whorl spirally arounf the central head. It consists of ray florests and disc florets. The outer whorl is known as the ray florets and the inner whorl is known as the ray florets which consists of hermaphrodite florets. Height of the crop ranges from less than 1m to more than 4m. The large head, large petals and attractive centers make them desirable as an ornamental crop and for use in cut- flower arrangements. Depending on the variety, sunflowers bloom from 55 to 75 days after sowing. It is one of the hardiest specialty crop grown and is suitable for wide range of climatic conditions. Fresh speciality cut flowers can be sold in local market places or fresh produce markets.

From a horticulture perspective, it's important to choose genotypes of flowers with desired traits that may be exploited in gardens, as pot plants, and as cut flowers. Basic understanding of the diversity contained in the available germplasm is essential for the further diversity and promotion of such a crop for ornamental novelty. In this view to study the diverse genotypes in sunflower a research was carried out to study the various germplasm available in sunflower for use in ornamental purpose.

Materials and Methods

The research on Performance of ornamental sunflower (*Helianthus annuus* L.) genotypes was carried out at College of Horticulture, Mysuru with the major goal to investigate the genetic diversity among 23 germplasm lines of ornamental sunflower with differences in growth, flowering, yield and quality parameters and its suitability for cut flower purpose. The crop was grown in sandy loam soil. The soil was ploughed thrice and brought to a fine tilth. Ridges and furrow method of planting was followed and the crop was sown at a spacing of 60 cm x 40 cm Randomized complete block design with 3 replications was followed for the experiment. 23 sunflower genotypes with single and multiheads were collected from different parts of the country. Harvesting of flowers was done by using secateurs at one to two ray florets open stage in the early morning or late evening. Readings were taken from five plants randomly selected under each treatment and in each replication for recording various observations. The plant height, plant spread, number of branches and number of leaves at 20, 40 and 60 days after sowing was recorded from the tagged plants and the average was worked out and expressed in centimeter. Total surface leaf area was recorded through graphical method of calculation. Putting the selected leaves on the leaf on the graph sheet and trace its outline using a pencil and numbering the full squares inside the leaf trace also number the partial squares then calculating the leaf area by multiplying total number of full squares with $1cm^2$ and partial squares with $0.5cm^2$ so total area is derived from adding both the areas and expressed in cm^2. Total number of flower heads per plot can be multiplied by number of flower heads per plant to number of plants in each plot were recorded over the period of flowering and average was worked out and used for calculation of yield per plot and expressed in number of flower heads. Flower yield per hectare was worked out by counting the number of flower heads from each tagged plant and converted into total yield by multiplying with number of plants per hectare as per spacing provided. The weight of freshly harvested flower heads along with stalk in three replications were recorded and expressed in grams. Equal amount of water was taken in each conical flask for keeping flower stalks, the difference between initial weight of conical flask containing water without flower stalk and weight of same conical flask containing water without stalk next day was calculated by following formula. Observations on cumulative water uptake were recorded for the entire period of vase life of the flower stalk and expressed in grams. The difference between consecutive weights of the bottle with solutions and flower stalks represents the transpiration loss of water through flower stalk and expressed in gram. Observations on cumulative water loss were recorded for the entire period of vase life of the flower stalk. Transpiration water loss is taken by difference between the initial flower weight (on the first day) and final flower weight (on the last day of vase life) along with conical flask and it was calculated by following formula, Transpiration water loss = initial weight of flower stalk –weight of same flower stalk at last day. The water balance in cut flowers was calculated by following formula, Water balance = Water uptake – Transpiration loss.

Results and Discussion

Maximum plant height at 20 DAS, was recorded in RCR-94 (31.07 cm) followed by RCR-95 (28.80 cm) and RCR-93 (27.27 cm). Similar results were also reported by (Jayanthi and Vasanthachari, 2003) [6] and Amarjeet *et al*. (2017) [2] in Chrysanthemum. At 40 DAS, the genotype RCR-93 (67.73 cm) exhibited maximum plant height followed by RCR-91 (63.53 cm) Kumar and Yadav (2005) [10] and Paraneetha (2006) [17] also reported similar results in gerbera. At 60 DAS, the genotype RCR-94 (137.36 cm) showed maximum plant height followed by Tobias (124.54 cm) and Vincent (121.17 cm) (Table 1).The genetic makeup of genotypes (Kumar and Chattopadhyay, 2002) [9] and the climatic effects present during the experimental period may be responsible for the variation in plant height and also due to varying inter-nodal length of the respective genotypes Similar reports were reported by Vuppalapati and Pavani (2005) [26]; Sloan *et al*. (2004) [24] in ornamental sunflower. Plant spread at east-west direction (E-W) was found to be significantly highest in RCR-93 (39.73 cm^2), followed by Light Pink (39.33 cm^2) and RCR-95 (38.20 cm^2) at 20 DAS. At 40 DAS, Tobias (64.47 cm^2) has recorded maximum plant spread at E-W direction. Whereas Red Giant (27.80 cm^2) recorded minimum plant spread. At 60 DAS, highest plant spread was seen in RGM-49 (95.53 cm^2) followed by PM-81 (86.20 cm^2) and RCR-72 (85.87 cm^2). (Table 1) Whereas minimum plant spread was recorded in R-127-1 (55.13 cm^2). Increase in plant spread might be due to the production of more number of branches and by the genetic nature of the cultivar and its wide adaptability to the prevailing environmental conditions (Madhumati *et al*., 2018). Similar variations were earlier recorded by Kumar and Yadav (2005) [10] in Sunflower. Number of leaves per plant at 20 DAS was significantly higher in RCR-93 (14.00) followed by RCR-91 (13.20), Sungold Mix Open Pollinated (13.47), RCR-94 (12.00), while the genotype Sunflower Raichur (6.93) was found to have the least number of leaves at 20 DAS. At 40 days after sowing Red Giant (20.93) followed by RCR-94 (19.93) have recorded higher number of leaves per plant. (Table 1) This variation may be due to varietal character and plant structure. Similar results were also reported by Kumar and Yadav (2005) [9] and Naike *et al*. (2006) [14] in gerbera. Significant variation in leaf area index was observed among the genotypes at 3 different stages of growth. Sungold Mix recorded 0.18 (Yenez *et al*., 2005) as maximum LAI at 20 DAS while minimum was recorded by genotypes Teddy Bear (0.05) and R- 127-1 (0.05). (Table 2) At 40 days after sowing, maximum leaf area index was recorded by Sungold Mix (1.32) and minimum was recorded in genotype Teddy Bear (0.36) followed by R- 127-1 (0.38). Sungold Mix (3.18) recorded maximum leaf area index followed by Sunflower Miniature (2.77) and Vincent (2.48) at 60 days after sowing and minimum was recorded in genotype R-630 as 0.82 (Table 2) (Khanvilkar *et al*., 2003) [7]. It may be due to the genotypic effect combined with photoperiodic response of the

genotypes. Similar results were also obtained by Naik *et al*. (2006) [15] in gerbera. RCR-91 (14.13) recorded more number of branches and R-127-1 (1.93) produced minimum number of branches at 20 days after sowing (Aswath *et al*, 2007) [3]. RCR-91 (15.73) and R-127-1 (6.93) (Bhati and Chitkara, 1989) [4] produced maximum and minimum number of branches respectively at 40 days after sowing (Kulkarni and Reddy, 2004 [8] in chrysanthemum). The branch growth is influenced by the genetic characteristics of a genotype as well as how these qualities interact with the environment in which it grows. In the present investigation, higher number of flowers may be due to increased morphological parameters of the plant which leads to production of more photosynthesis (Miller, 1982) [13] R-630 (578.67) produced maximum number of flower heads per plot followed by RCR- 97 (566.67), Sunflower Sungold (468.00), Sungold Mix Open Pollinated (448.00) and PM-81 (425.33). (Table 3) However, significantly less number of flower heads per plot (Sharma *et al*., 2019 [21] in marigold) was recorded in Vincent (73.33). Similar variations were discovered by Ramachandrudu and Thangam, (2010) and Gulia *et al*. (2017) [5] in marigold. Variation in yield among genotypes could be attributed to both genetic and environmental variables also depends on number of plants present in the plot and number of branches per plant all these directly influence the higher number of flower heads per plot (Singh and Misra, 2008 [23] in marigold). Genotype RCR-97 (12.36) and R-630 (12.05) produced significantly large number of flower heads per ha (Table 3) whereas significant minimum number of flower heads were produced by genotype Vincent (1.55 lakh). This may be because of combination of genotypic and physiological factors. Singh and Mishra (2008) [23] and Shivakumar *et al*. (2015) [22] in marigold also found similar findings. Sunflower Miniature (42.40 g) recorded significantly highest fresh flower weight whereas RGM-49 (6.08 g), R-127-1 (8.66 g) and R-630 (10.24 g) recorded minimum fresh flower weight. Similar findings also reported by Radhakrishna *et al*. (2012) [19] in single and double type tuberose and Vijayalaxmi*et al*., (2010) [25] in single type tuberose and Agale (2012) [1] in gaillardia.

Highest cumulative water uptake (CWU) was recorded in genotype R-630 (48.53 g) and RCR-94 (42.73 g) followed by RCR-94 (42.73 g). (Table 4) Similar findings were recorded by Meinke *et al*. (1993) [12] in sunflower. R-630 (48.13 g) and Sunflower Miniature (44.80 g) recorded maximum value for cumulative water loss (CWL) whereas minimum cumulative water loss was recorded in Vincent (31.93 g) and RCR-97 (33.07 g). Similar findings were recorded by Meinke *et al*. (1993) [12] in Sunflower. Highest transpiration water loss was recorded in genotype Miniature Seeds (49.20 g), Red Giant (46.53 g), RCR-94 (47.42 g), RGM-49 (44.93 g) and Light Pink (44.87 g) whereas R-127-1 (20.67 g) recorded minimum transpiration water loss. (Table 4) Such variation may be due to genetic makeup of the similar genotypes. Such results were also reported by Parmeshwar (2010) [18] in sunflower. Higher water balance was recorded in RCR-94 (30.47 g), which was on par with Vincent (29.87 g) and followed by Tobias (27.93 g) and RCR-72 (27.13 g), This variation may be due to genetic makeup of all the genotypes used in this experiment. Narsude *et al*. (2010) [16] and Naik *et al*. (2019) [15] in marigold reported variations in shelf life.

Table 1: Pooled mean performance of genotypes for vegetative parameters in ornamental sunflower

Genotype	Plant height (cm)			Plant spread (cm^2)			Plant spread (cm^2)			No. of leaves (No.)		
				NS (north-south)			EW (east-west)					
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
Red Giant	17.53	52.20	92.73	19.47	26.69	75.73	19.13	27.80	74.20	9.33	20.93	28.00
Teddy Bear	13.67	34.53	75.21	26.27	45.67	73.13	26.27	46.40	70.87	9.73	16.13	27.93
Miniature Seeds	15.20	50.93	89.82	19.40	28.31	74.47	19.40	28.87	72.93	8.80	17.33	27.27
Sungold Mix	15.33	51.53	87.83	18.00	36.38	73.40	18.00	33.87	71.27	9.60	16.93	27.73
Russian Giant	16.00	52.53	100.66	22.20	40.61	73.47	22.20	39.73	72.20	12.40	18.93	29.53
Sunflower Miniature	18.67	54.20	86.98	22.00	52.32	81.53	22.00	52.60	80.67	9.00	13.60	27.60
Sungold Open Pollinated	17.93	53.27	107.43	20.93	56.94	78.33	21.13	58.13	77.47	9.47	14.53	30.40
Light Pink	18.47	52.80	92.44	36.93	52.48	86.07	39.33	54.07	85.20	10.40	15.87	28.47
Sungold Mix Open Pollinated	22.80	62.47	118.81	36.13	56.26	82.80	35.33	57.80	82.87	13.47	17.20	38.60
Sunflower Sungold	22.60	46.20	91.18	32.53	58.61	79.33	32.53	59.40	78.53	8.67	14.00	33.13
R-630	10.60	14.07	41.02	24.33	37.41	69.00	24.33	37.33	67.60	9.60	13.33	36.47
R-127-1	12.40	17.40	27.27	22.40	28.29	56.07	22.20	28.20	55.13	8.40	12.53	39.20
RGM-49	21.27	28.27	92.84	27.67	32.46	96.07	27.47	32.07	95.53	7.20	12.13	37.60
PM-81	21.26	33.67	77.58	27.93	57.51	87.20	27.53	59.27	86.20	9.00	15.00	46.73
RCR-72	19.47	35.00	83.95	36.47	57.95	86.13	34.60	58.80	85.87	9.87	17.33	28.47
RCR-91	23.53	63.53	109.57	36.60	52.74	78.07	34.00	54.87	76.73	13.20	20.67	31.07
RCR-93	27.27	67.73	103.32	39.87	52.69	77.47	39.73	54.27	77.20	14.00	20.13	29.20
RCR-94	31.07	63.20	137.36	35.73	52.39	83.60	35.73	53.40	83.07	12.00	20.67	29.33
RCR-95	28.80	60.00	86.98	36.53	53.93	84.07	38.20	55.87	82.60	11.80	20.73	26.13
RCR-97	18.53	40.80	98.35	28.60	53.51	66.40	28.60	55.53	65.87	8.53	18.60	26.47
Sunflower Raichur	6.93	38.60	95.83	26.73	53.36	65.93	26.73	55.27	65.13	6.93	18.53	30.67
Tobias	8.40	55.26	124.54	33.13	62.51	65.00	33.13	64.47	66.93	8.40	20.40	29.00
Vincent	8.66	51.20	121.17	33.40	62.29	67.00	34.33	63.93	66.20	8.67	16.40	27.27
Mean	18.10	46.90	96.82	28.84	50.24	76.53	28.78	49.30	75.58	9.93	17.04	31.14
SEm±	1.67	1.44	7.55	2.83	2.63	2.08	2.88	2.78	2.03	0.70	0.89	2.17
C.D @ 5%	4.76	4.26	21.32	8.06	7.49	5.93	8.21	7.90	5.78	1.98	2.55	6.19

DAS: days after sowing

Table 2: Pooled mean performance of genotypes for vegetative parameters in ornamental sunflower

Genotype	Leaf area (cm^2)			Leaf area index (LAI)			No. of branches per plant (No.)		
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
Red Giant	210.87	1526.00	3653.87	0.09	0.64	1.52	6.53	11.93	18.20
Teddy Bear	119.20	862.13	2075.80	0.05	0.36	0.86	6.40	13.87	16.27
Miniature Seeds	284.40	2058.73	4926.73	0.12	0.86	2.05	7.27	11.27	17.53
Sungold Mix	437.53	3166.83	7627.53	0.18	1.32	3.18	6.67	13.27	19.27
Russian Giant	255.67	1840.90	4340.60	0.11	0.77	1.81	6.47	13.73	20.73
Sunflower Miniature	383.73	2777.40	6650.93	0.16	1.16	2.77	7.13	13.87	20.80
Sungold Open Pollinated	331.80	2397.93	5728.93	0.14	1.00	2.39	6.33	12.67	23.13
Light Pink	283.27	2054.03	4907.93	0.12	0.86	2.04	6.53	13.60	22.47
Sungold Mix Open Pollinated	307.33	2225.37	5323.87	0.13	0.93	2.22	6.33	12.80	20.80
Sunflower Sungold	280.87	2153.53	5170.47	0.12	0.90	2.15	7.60	14.67	20.13
R-630	141.27	988.87	1977.73	0.06	0.41	0.82	4.67	7.60	14.73
R-127-1	129.87	909.07	2179.33	0.05	0.38	0.91	1.93	6.93	10.07
RGM-49	177.27	1240.87	3247.07	0.07	0.52	1.35	7.80	14.13	21.60
PM-81	157.93	1105.53	3316.60	0.07	0.46	1.38	7.67	14.13	24.73
RCR-72	152.47	1067.27	2566.20	0.06	0.44	1.07	8.07	13.73	23.00
RCR-91	219.53	1536.73	3696.00	0.09	0.64	1.54	14.13	15.73	22.47
RCR-93	243.13	1701.93	4081.93	0.10	0.71	1.70	9.13	13.73	23.20
RCR-94	163.73	1146.13	2749.60	0.07	0.48	1.15	8.33	14.67	23.27
RCR-95	175.67	1229.67	2944.67	0.07	0.51	1.23	7.07	14.53	23.53
RCR-97	178.80	1251.60	2998.33	0.07	0.52	1.25	7.33	11.47	21.07
Sunflower Raichur	347.40	2431.80	5839.87	0.14	1.01	2.43	7.53	12.13	21.73
Tobias	331.73	2322.13	5563.13	0.14	0.97	2.32	6.93	11.87	22.53
Vincent	334.13	2450.27	5885.60	0.14	1.02	2.45	6.93	11.33	19.73
Mean	245.55	1758.47	4237.08	0.10	0.73	1.77	7.17	12.77	20.48
SEm±	9.62	70.26	177.20	0.00	0.03	0.07	0.36	0.46	0.84
C.D @ 5%	27.4	200.26	505.04	0.01	0.08	0.21	1.01	1.32	2.40

Table 3: Pooled mean performance of genotypes for yield parameters in Ornamental Sunflower

Genotype	Total flower heads per plot (No.)	Total flower heads per ha (Lakhs)
Red Giant	325.33	6.77
Teddy Bear	334.67	6.97
Miniature Seeds	296.00	6.19
Sungold Mix	304.00	6.33
Russian Giant	291.60	6.44
Sunflower Miniature	304.00	6.33
Sungold Open Pollinated	310.67	6.47
Light Pink	442.67	9.22
Sungold Mix Open Pollinated	448.00	9.33
Sunflower Sungold	468.00	9.75
R-630	578.67	12.05
R-127-1	156.00	3.25
RGM-49	362.67	7.55
PM-81	425.33	8.86
RCR-72	412.00	8.66
RCR-91	346.67	7.94
RCR-93	357.33	7.44
RCR-94	346.67	7.22
RCR-95	342.67	7.13
RCR-97	566.67	12.36
Sunflower Raichur	394.67	8.22
Tobias	357.33	7.44
Vincent	73.33	1.55
Mean	358.48	7.54
S.Em±	11.96	0.23
C.D @ 5%	34.08	0.67

Table 4: Pooled Mean performance of 23 genotypes of ornamental sunflower for post harvest parameters

Genotype	Fresh weight (g)	Water uptake (g)	Transpiration water loss (g)	Water balance (g)	CWU (g)	CWL (g)
Red Giant	28.37	21.33	46.53	25.20	30.20	39.00
Teddy Bear	21.37	23.20	42.67	23.20	30.93	36.47
Miniature Seeds	27.12	26.73	49.20	26.73	29.93	35.47
Sungold Mix	17.15	23.87	41.93	23.87	29.93	35.73
Russian Giant	26.71	25.27	39.20	25.27	30.80	38.27
Sunflower Miniature	42.40	24.47	40.07	24.47	38.20	44.80
Sungold Open Pollinated	23.38	24.07	40.27	24.07	28.00	37.80
Light Pink	20.72	21.67	44.87	21.67	27.20	39.80
Sungold Mix Open Pollinated	34.47	22.93	43.27	22.93	30.60	39.73
Sunflower Sungold	24.69	24.40	40.53	24.40	25.73	37.60
R-630	10.24	15.47	26.27	15.47	48.53	48.13
R-127-1	8.66	11.33	20.67	11.33	29.47	38.53
RGM-49	6.08	12.67	44.93	12.67	30.87	36.47
PM-81	14.67	24.07	40.60	24.07	30.87	38.00
RCR-72	19.33	27.13	36.53	27.13	30.00	34.53
RCR-91	27.19	27.20	40.87	27.20	32.13	43.27
RCR-93	27.56	27.13	34.89	27.13	35.93	42.33
RCR-94	19.27	30.47	47.42	30.47	42.73	45.27
RCR-95	19.40	27.00	39.20	27.00	37.47	41.67
RCR-97	16.84	16.80	42.47	16.80	22.93	33.07
Sunflower Raichur	19.58	24.40	36.60	24.40	34.00	38.67
Tobias	37.33	27.93	40.67	27.93	34.27	40.27
Vincent	40.18	29.87	26.40	29.87	24.07	31.93
Mean	23.16	23.45	39.39	23.62	31.95	38.99
SEm±	1.74	0.55	1.75	0.59	0.54	1.31
C.D @ 5%	4.90	1.56	4.94	1.66	1.51	3.69

Conclusion

At 60 DAS, the genotype RCR-94 (137.36 cm) showed maximum plant height followed by Tobias (124.54 cm) and Vincent (121.17 cm). At 60 DAS, highest plant spread was seen in RGM-49 (95.53 cm^2) followed by PM-81 (86.20 cm^2) and RCR-72 (85.87 cm^2). Whereas RGM- 49 (12.13) recorded minimum number of leaves per plant also maximum number of leaves recorded in PM-81 (46.73) and minimum in RCR-95 (26.13) at 60 DAS. Sungold Mix (3.18) recorded maximum leaf area index followed by Sunflower Miniature (2.77) and Vincent (2.48) at 60 days after sowing. R-630 (578.67) produced maximum number of flower heads per plot followed by RCR-97 (566.67), Sunflower Sungold (468.00), Sungold Mix Open Pollinated (448.00) and PM-81 (425.33). Genotype RCR-97 (12.36) and R-630 (12.05) produced significantly large number of flower heads per ha whereas significant minimum number of flower heads were produced by genotype Vincent (1.55 lakh). Sunflower Miniature (42.40 g) recorded significantly highest fresh flower weight. Highest cumulative water uptake (CWU) was recorded in genotype R-630 (48.53 g) and RCR-94 (42.73 g), minimum cumulative water loss was recorded in Vincent (31.93 g) and RCR-97 (33.07 g). R-127-1 (20.67 g) recorded minimum transpiration water loss. This variation may be due to genetic makeup of all the genotypes used in this experiment. The above results may be because of combination of genotypic and physiological factors. From the above studies RCR-97, R-630, RCR -94, sunflower sungold, sungold mix can utilized for flower yield and landscaping. Sunflower miniature can be utilized for pot culture and landscaping.

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