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Performance of different genotypes of gaillardia (*Gaillardia pulchella* Foug.) in respect to flowering, quality and yield parameter

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Abstract
An investigation was conducted on the performance of twelve genotypes of gaillardia (*Gaillardia puchella* Foug.) in respect to flower, quality and yield parameter Among the twelve genotypes of gaillardia, the maximum plant height (81.03 cm) was recorded in the genotype 'Genotype-3'. The minimum days taken to first flower opening (42.60 days), days taken to 50 per cent flowering (64.3 days), the maximum flower diameter (6.29 cm), number of ray florets per flower (214.26), number of whorls of ray florets (5.96), *in-situ* life of flower (12.06 days) and number of flowers per plant (131.53) was recorded in 'Genotype-11'. The maximum flower stalk length and shelf life of flower (15.66 hours) was recorded in 'Genotype-10' (32.64 cm). The maximum duration of flowering (143.66 days) was found in 'Genotype-3' which was at par to the (139.40 days) 'Genotype-11'. The maximum fresh weight of flower (4.40 g) was recorded in 'Genotype-9'. The maximum length of ray florets (3.03 cm) was recorded in 'Genotype-8'

Keywords: Genotype, gaillardia, ray floret, disc floret, *in-situ* life, shelf life

Introduction
Gaillardia (*Gaillardia pulchella* Foug.) popularly known as 'Fire Wheel' or 'Blanket Flower', belong to the family Compositae and is native to Central and Western United States, having the basic chromosome number X=18 (Srivastava and Kandpal, 2006) [13]. There are about twenty eight species reported in the genus Gaillardia, but only two of them viz. *Gaillardia pulchella* (annual) and *Gaillardia aristica* (perennial) are under cultivation. The generic name Gaillardia was proposed by Mr. Gaillard de Marentoneau, a French botanist in 18th century. The plants possess brilliant daisy-like flowers with single, double and semi double forms (Cox and Klett, 1984). Flowers are small and numerous, born solitary at each node, showy heads are 4 to 6 cm in diameter having a long hairy stalk. Individual flowers in a capitulam are called florets. As a member of Asteraceae (Compositae) it has both ray (Pistillate) and disc florets (Hermaphrodite). The crop produce flowers in a wide range of colors such as yellow, orange, cream, scarlet, bronze, brick red, red tipped and red with yellow tipped and can be grown all around the year. Gaillardia is a perfect plant for flower beds, borders, corners and plants are drought resistance. It is also used for making garlands, bouquets and as loose flower especially in summer season when other loose flowers are not available.

Materials and Methods
The experiment was conducted at Instructional Farm of the Department of Floriculture and Landscaping, Collage of Horticulture & Forestry, Jhalrapatan, Jhalawar, Agriculture University, Kota (Rajasthan), during the year 2017-2018. To studies the performance of the twelve genotypes of gaillardia ('Genotype-1', 'Genotype-2', 'Genotype-3', 'Genotype-4', 'Genotype-5', 'Genotype-6', 'Genotype-7', 'Genotype-8', 'Genotype-9', 'Genotype-10', 'Genotype-11' and 'Genotype-12').These genotypes of gaillardia collected from different states of country (Rajasthan, Uttar Pradesh, Madhya Pradesh and Karnataka). The well decomposed vermicompost at the rate of 4 kg/sqm was recommended dose of NPK (100:80:60 g/m²) with applied at the time of bed preparation. Seeds are sown in nursery beds and 40 days old seedlings were transplanted in main field at spacing of 30 X 40 cm (plant to plant and row to row). The experiment was laid out in randomized block design with three replications.

Results and Discussion
The data presented in Table 1 revealed that significant different as among genotypes.

The maximum plant height (81.03 cm) was recorded in 'Genotype-3'and minimum plant height was recorded in 'Genotype-12' (67.93 cm). The variation due to genetically controlled factor, plant height varied among the genotypes. The results find support from reports of Bhaskarwar *et al*. (2016) [4], Girange *et al*. (2016) in gaillardia.

The lowest days taken to first flower opening and days taken to 50 per cent flowering (42.60 days and 64.30 days) was identified in 'Genotype-11', while the highest days taken to first flower opening and days taken to 50 per cent flowering (65.93 and 84.33 days) was recorded in 'Genotype-12'. Such variation in days taken to first flower opening and days taken to 50 per cent flowering may be due to genetic trait. The results have been reported by Talukdar *et al.* (2006) [16], Kishan *et al.* (2008) [9] in chrysanthemum and Zosiamliana *et al*. (2013) [19] in China aster.

The maximum flower diameter was reported in 'Genotype-11' (6.29 cm) which was at par to 'Genotype-10' (6.00 cm), whereas the minimum was reported in 'Genotype-12' (4.95 cm) being at par to 'Genotype-8' (5.35 cm). This variation among the genotypes was mainly due to flower size. Similar variations have been reported previously by Tamut and Kulkarni (2013) [17] in gaillardia.

The maximum flower stalk length was recorded in 'Genotype-10' (32.64 cm), whereas the minimum was recorded in 'Genotype-12' (17.42 cm). Flower stalk length might be associated with plant height. The results have been founded in line with those of Tamut and Kulkarni (2013) [17] in gaillardia and Zosiamliana *et al.* (2013) in China aster.

The maximum fresh weight of flower was recorded in 'Genotype-9' (4.40 g), while the minimum was recorded in 'Genotype-2' (1.31 g). The weight of flowers was clearly in relationship with the size of flowers. The greater size of the flowers, greater would be the fresh weight of flowers. The variation in fresh flower weight was also reported by Kishan *et al.* (2008) [9] and Kumar *et al.* (2007) in chrysanthemum.

The maximum duration of flowering (143.66 days) was found in 'Genotype-3' which was at par with 'Genotype-11' (139.40 days), whereas the minimum duration of flowering was found in 'Genotype-2' (108.80 days). The variation in duration of flowering among the genotypes was attributed to genetic makeup of the plant, environmental influence and other management factors. Similar results have also been reported earlier by Singh *et al.* (2017) in gerbera, Ajeet kumar *et al.* (2015) [2] in dahlia, Choudhary *et al.* (2014) in marigold.

The maximum number of disc florets (242.30) per flower was recorded in 'Genotype-1' while the minimum number of disc florets per flower (117.26) was in 'Genotype-12'. Variations in this study were due to genotypes characters, which attributed to their genetical costitution. Similar results on disc florets number have been reported by Reddy *el al.* (2016) and Swaroop *et al*. (2008) in chrysanthemum.

The maximum numbers of ray florets per flower were recorded (214.26) in 'Genotype-11' which was at par to 'Genotype-7' (208.80), while the minimum was recorded (16.53) in 'Genotype-12'. Similar results were also found by Dewan *et al.* (2016) [7] in chrysanthemum, Tamut and Kulkarni (2013) [17] in gaillardia.

The maximum number of whorls of ray florets (5.96) was recorded in 'Genotype-11', whereas the minimum (1.26) in 'Genotype-2'. The similar results were also found by Tamut and Kulkarni (2013) [17] in gaillardia, Baskaran *et al.* (2004) in chrysanthemum. The maximum length of ray florets was recorded in 'Genotype-8' (3.03 cm), while the minimum was recorded in 'Genotype-5' (2.50 cm). Similar results findings have been reported by Baskaran *et al.* (2010) [3], Kunigunda (2004) in chrysanthemum.

The maximum width of ray floret (1.84 cm) in was recorded 'Genotype-6' and the minimum in was recorded 'Genotype-12' (1.22 cm). Similar results on width of ray floret have been reported by Singh *et al*., (2017) in gladiolus, Baskaran *et al.* (2010) [3] in chrysanthemum.

The maximum shelf life of flower was recorded (15.66 hours) in 'Genotype-10' which was at par to 'Genotype-9' (15.60 hours), while minimum number of hours of shelf life was recorded (9.00 hours) in 'Genotype-2'. Similar result was found also by Agale and Dawane (2016) [1], Bhaskarwar *et al*. (2016) [3] in gaillardia.

The maximum *in-situ* life of flower was recorded in 'Genotype-11' (12.06 days), while the minimum was recorded in 'Genotype-3' (8.60 days). It is mainly due to genotypical characters. Similar variations are also reported by Uddin *et al.* (2015) [18] in chrysanthemum.

The highest number of flowers per plant was recorded in 'Genotype-11' (131.53) followed by 'Genotype-7' (117.93), while the minimum number of flowers per plant (82.46) was recorded in 'Genotype-8'. Variation in number of flowers per plant is related to recurrent blooming habit due to their genetic makeup. Similar result have been reported by Suvija *et al.* (2016) in chrysanthemum, Ajeetkumar *et al.* (2015) [2] in dahlia.

The maximum weight of flowers per plant was noted in 'Genotype-11' (578.72 g) which was at par with genotypes 'Genotype-10' (413.54 g), while the minimum was recorded in 'Genotype-2' (102.67 g). The variation among the accessions was mainly because of increased flower size. Similar results have been reported by Suvija *et al.* (2016), Talukdar *et al.* (2003) [14, 16] in chrysanthemum, Tamut and Kulkarni (2013) [17], Mahawer *et al.* (2011) in gaillardia.

Table 1: Performance of Gaillardia Genotypes in Respect to Flowering, Quality and Yield Parameter

S. No.	Name of genotypes	Plant height (cm)	days taken to first flower opening	Flower diameter (cm)	Flower stalk length (cm)	No. of disc florets per flower	No. of ray florets per flower	No. of whorls of ray florets	Length of ray floret (cm)	Width of ray floret (cm)
1.	Genotype - 1	78.40	56.40	5.67	30.70	242.30	152.46	4.63	2.86	1.49
2.	Genotype - 2	75.86	50.00	5.40	32.52	147.86	25.53	1.26	2.64	1.48
3.	Genotype - 3	81.03	45.45	5.88	28.18	130.66	87.00	2.40	2.76	1.63
4.	Genotype - 4	72.39	52.53	5.58	27.76	156.66	142.46	3.46	2.54	1.43
5.	Genotype - 5	71.40	50.47	5.50	29.52	152.86	142.66	4.13	2.50	1.51
6.	Genotype - 6	74.86	49.33	5.65	27.73	149.00	138.33	4.33	2.41	1.84
7.	Genotype - 7	79.03	47.20	5.65	32.26	174.66	208.80	4.53	2.61	1.24
8.	Genotype - 8	75.49	48.13	5.35	28.27	141.26	187.60	4.06	3.03	1.34
9.	Genotype - 9	73.60	45.60	5.94	31.54	151.06	192.60	5.26	2.75	1.53
10	Genotype - 10	74.40	47.00	6.00	32.64	148.66	194.53	5.13	2.78	1.75
11.	Genotype - 11	78.26	42.60	6.29	30.11	155.20	214.26	5.96	2.83	1.54
12.	Genotype - 12	67.93	65.93	4.95	17.42	117.26	16.53	1.40	2.71	1.22
	Mean	75.22	50.05	5.66	29.05	155.63	141.90	3.88	2.70	1.50
	SEm±	0.70	0.55	0.11	0.44	2.61	3.41	0.11	0.06	0.05
	CD 5%	2.06	1.63	0.34	1.29	7.65	10.00	0.33	0.18	0.16

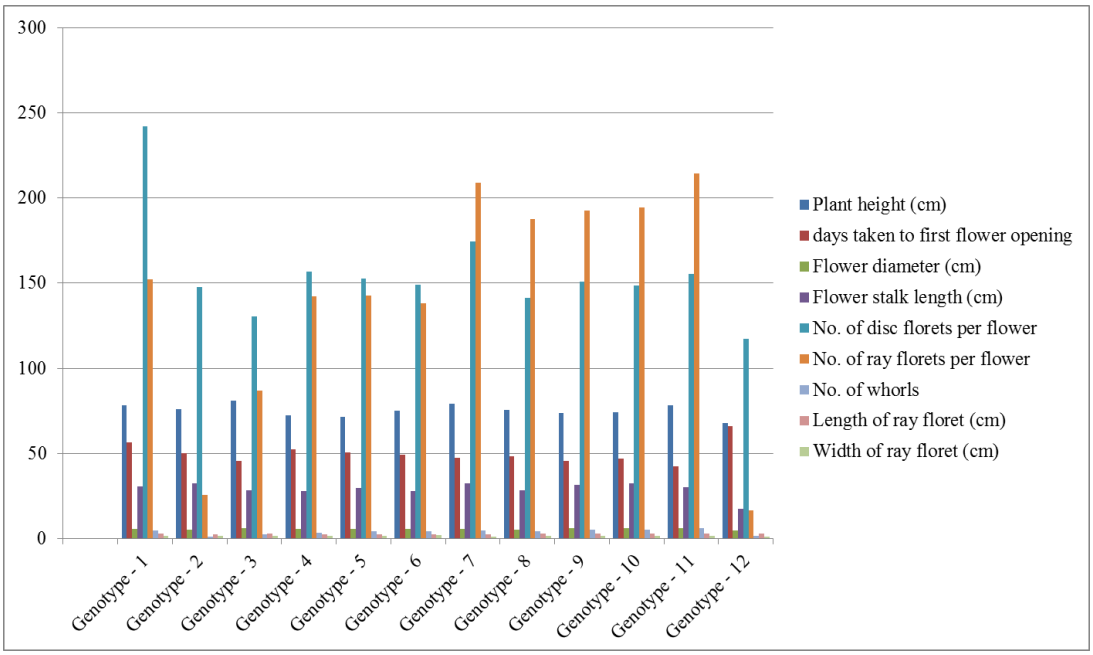

Fig 1: Performance of Gaillardia Genotypes in Respect to Flowering, Quality and Yield Parameter

Table 2: Performance of Gaillardia Genotypes in Respect to Flowering, Quality and Yield Parameter

S. No.	Name of genotypes	Shelf life of flower (hours)	*In-situ* flower life (days)	Vase Life of flower	Fresh flower weight (g)	Duration of flowering (days)	Number of flower pluckings	Number of flowers per plant	Weight of flowers per plant (g)
1.	Genotype - 1	13.53	10.40	6.20	3.60	127.06	19.10	96.40	346.70
2.	Genotype - 2	9.00	10.00	6.20	1.31	108.80	14.53	78.40	102.67
3.	Genotype - 3	11.93	8.60	5.87	2.24	143.66	17.28	104.20	233.07
4.	Genotype - 4	9.93	11.33	6.73	4.16	126.53	18.86	82.46	342.77
5.	Genotype - 5	12.26	10.60	6.60	3.36	121.06	16.66	90.40	304.03
6.	Genotype - 6	11.93	9.73	7.00	3.51	127.66	18.66	94.46	331.59
7.	Genotype - 7	13.80	11.13	6.60	3.27	129.80	19.46	117.93	385.65
8.	Genotype - 8	13.93	13.53	8.07	3.14	124.06	17.86	75.60	237.35
9.	Genotype - 9	15.60	10.66	6.60	3.05	135.86	20.26	92.46	281.75
10	Genotype - 10	15.66	11.40	7.47	3.89	134.00	18.93	106.40	413.54
11.	Genotype - 11	14.66	12.06	7.67	4.40	139.40	21.33	131.53	578.72
12.	Genotype - 12	10.60	10.60	6.40	1.49	125.33	15.60	87.46	129.66
	Mean	12.74	10.84	6.78	3.12	126.94	18.21	96.48	307.29
	SEm±	0.25	0.23	0.12	0.03	2.76	0.24	0.60	3.46
	CD 5%	0.76	0.69	0.25	0.08	8.10	0.69	1.78	10.15

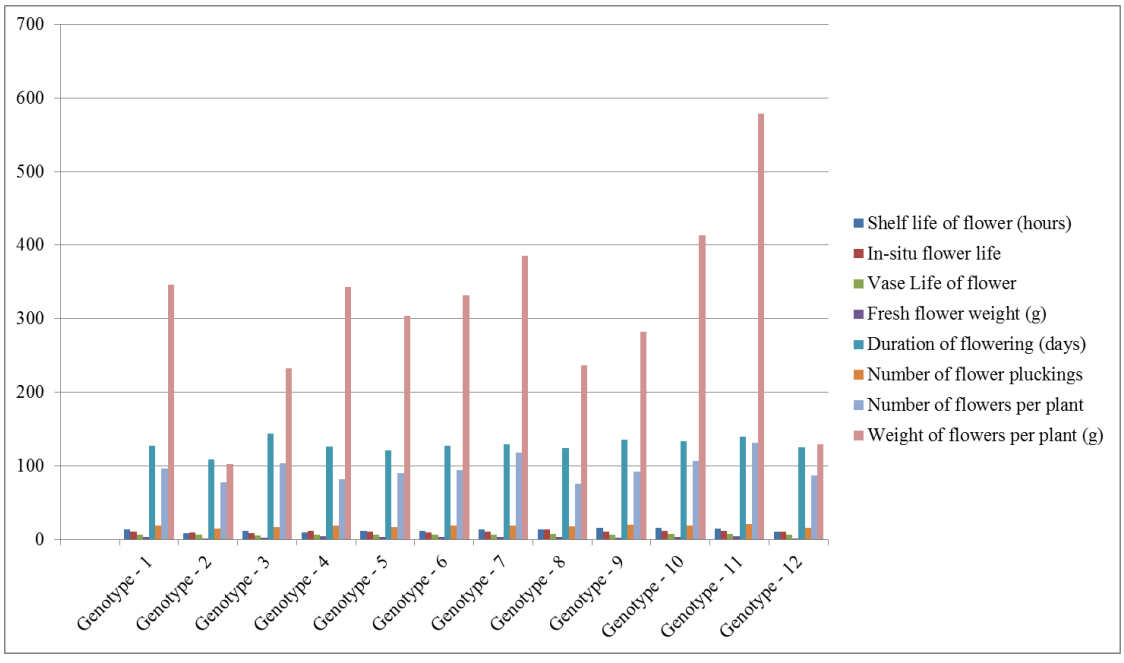

Fig 2: Performance of Gaillardia Genotypes in Respect to Flowering, Quality and Yield Parameter

Conclusion

Gaillardia genotypes showed wide range of variations in their growth and flowering characteristics. The maximum plant height was found in 'Genotype-3'. The days taken to first flower opening, days taken to 50 per cent flowering, flower diameter, fresh flower weight, duration of flowering, number of flowers per plant, weight of flowers per plant, number flower plucking and weight of flowers per plot the 'Genotype-11' has been found superior in these characters.

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