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Evaluation of different genotypes and cultivars of gaillardia on growth and yield under Saurashtra region

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Abstract

The present investigation entitled "Evaluation of different genotypes and cultivars of gaillardia under Saurashtra region" was conducted at Instructional Farm, Department of Floriculture, College of Horticulture, J.A.U., Junagadh. The treatments comprised with 12 different genotypes and cultivar of gaillardia with three replications. The mean data showed significant variation among genotypes and cultivars with respect to plant height at peak flowering time. Significantly, maximum plant height (89.00, 81.00 and 85.00 cm) was recorded in genotype Ludhiana Selection – 1. Significantly, highest plant spread (50.67 cm N-S) was observed in Gaillardia Mix during first year. But during second year and pooled it was noted in Sarpan Gaillardia Grand Mix (55.06 and 52.85 cm N-S). Similarly, maximum plant spread E-W (71.87 cm) was noted in Sarpan Gaillardia Grand Mix during first year, but PG-1 recorded (73.31 and 71.93 cm N-S) during second and pooled. Whereas, maximum number of branches per plant (21.13, 21.16 and 21.14) was recorded in Gaillardia Mix but maximum stem diameter (10.28, 10.46 and 10.37 mm) was in PG -1 during both the years and pooled. Similarly, maximum fresh weight of plant after final harvest (2382.12, 2422.95 and 2402.53 g) was noted in Sarpan Yellow but dry weight of plant (637.11, 637.66 and 637.39 g) was registered in Gaillardia Mix during both the years as well as in pooled. Maximum flower yield per plant (2334.86, 2430.02 and 2382.44 g), highest flower yield per plot (46.62, 48.55 and 47.58 kg) and Maximum flower yield per hectare (86.33, 89.90 and 88.11 t/ha) were observed in cultivar Sarpan Yellow during both the years as well as in pooled data. Significantly highest number of flowers per plant (268.73, 287.61 and 278.17) was recorded in cultivar Gaillardia Mix during both the years as well as in pooled. While, highest flower weight (9.44, 9.51 and 9.48 g) was obtained in cultivar Gaillardia Double Mix during both the years as well as in pooled data.

Keywords: Gaillardia, genotypes, cultivars, growth, yield, Sarpan yellow, PG-1, gaillardia mix, Ludhiana sel.-1, Sarpan gaillardia grand mix

Introduction

Gaillardia is popularly known as 'blanket flower' or 'fire wheel'. It is an important flower crop of Gujarat and Maharashtra grown on commercial scale for loose flowers and as a substitute to chrysanthemum and china- aster (Bose *et al.* 2003) [3]. Gaillardia is used as ornamental herbaceous plant in garden and landscape as an informal hedges or screen as it has attractive yellow and red coloured flowers. Mostly in Gujarat and Maharashtra it used for religious purposes as a loose flower apart from it's also uses for interior decorations and decorative road side planting.

Due to its attractive spectacular forms, bright coloured flowers and hardiness, it is grown in flower beds, for edging, mixed borders, grown in window boxes and also used as a filler in flower arrangement besides being grown for loose flowers. Besides its utility in landscape, it is useful in reducing soil erosion in coastal dune areas (Carig, 1977) [5]. It can be used as a substitute for chrysanthemum and china aster for loose flower purpose as it is a photo insensitive and hardy crop. The plant has antitumor activity owing to the presence of methyl caffeate distributed throughout the plant. Also, it is having nematocidal property, when grown as catch crop and green manure.

It has tap root with one or several erect stems from the base. The pubescent plant grows to a height of 40 to 80 cm with rough hairy, lance shaped, alternate leaves. Plants are bushy with spreading branches. Flowering in blanket flower commences after about 3 to 4 months of seed sowing. The plants possess brilliant daisy like flowers with single, double and semi double forms. The large flowers are made of numerous tubular quilled petals. The flowers are born solitary at each node. The showy heads are 4 to 6 cm in diameter. The flowers have long hairy stalk, involucre broad, bracts in 2 to 3 series, ligules 3 toothed, giving a fringed appearance to flowers.

Gaillardia is major and important flower crops of Saurashtra region. There is no any developed variety in Saurashtra region only local genotype are growing in the region.

Looking at the importance and commercial potential, there is need to conserve and characterize the available variability and its evaluation to identify potential cultivars, which would result in further improvement and to develop cultivar for specific uses.

Materials and Methodology

The present investigation was carried out on "Evaluation of different genotypes and cultivars of gaillardia under Saurashtra region" was conducted at Instructional Farm, Department of Floriculture, College of Horticulture, J.A.U., Junagadh. Geographically, Junagadh is situated at 21.50 N latitude and 70.50 E longitude and on altitude of about 60 meters above the mean sea level (MSL). This station is about 80 kilometers away from Arabian Sea shore and on Western side at the foothill of the mount Girnar. This place enjoys the typical sub-tropical climate, characterized by fairly cold and dry winter, hot and dry summer and moderately humid monsoon. The experiment was laid out in Randomize Block Design having three replications and twelve different genotypes viz., Local Selection-1, Local Selection-2, Local Selection-3, Local Selection-4, Ludhiana Selection-1, Ludhiana Selection-2, Sarpan Yellow, Sarpan Gaillardia Grand Mix, Gaillardia Mix, PG-1, PG-3 and Gaillardia Double Mix. Seeds were sown in first week of August in lines 10 cm apart and 1.0 cm deep on raised beds. The seedlings were ready for transplanting after 45 days of seed sowing. The experimental plots were thoroughly irrigated a day before transplanting. The seedling transplanting was done on mid of October by using selected healthy seedlings of uniform size in ridge and furrow. Transplanting was done with spacing of 60 cm between two lines (rows) and 30 cm between two plants. The observations of growth and yield were recorded at regular interval throughout the period of crop. Five plants from each treatment plot were randomly selected, labeled and used for recording observations. The observations likewise, Plant height (cm), Plant spread (N-S & E-W) (cm), Number of branches per plant, Stem Diameter (mm), Fresh weight of plant (g), Dry weight of plant (g), Number of flowers per plant, Flower yield and Flower weight (g).

Results and Discussion

Growth Parameters

Plant height (cm)

Among different genotypes and cultivar, significantly maximum plant height (89.00, 81.00 and 85.00 cm) was recorded in genotype Ludhiana Selection – 1 followed by PG-1 during both year and pooled. However, minimum plant height (56.33, 63.00 and 59.67 cm) was noted in Local Selection - 3 in both the years as well as in pooled. Plant height being a genetically controlled factor, it varied among the genotypes as well as influence of the growing environmental conditions, production technology and cultural practices. The present findings in respect of plant height, in general are in agreement with those reported by Agale (2012)^[1] and Gawade (2018)^[7] in gaillardia, Palai *et al.* (1999)^[12] in chrysanthemum, Swaroop *et al.* (2004)^[16] in China aster and Bhati and Chitkara (1988)^[2] in marigold.

Plant spread (N-S & E-W) (cm)

Significantly highest plant spread(50.67 cm N-S) was

observed in Gaillardia Mix which was statistically at par with Sarpan Gaillardia Grand Mix, Ludhiana Selection -2, Gaillardia Double Mix, PG – 1 and PG – 3 in 1st year. Similarly, highest plant spread N-S (55.06 and 52.85 cm) was noted in Sarpan Gaillardia Grand Mix but which was statistically at par with Gaillardia Mix and PG – 3 during 2nd year and pooled. However, lowest plant spread (20.72, 21.57 and 21.14 cm) recorded in Local Selection- 3 in both the years as well as in pooled data.

Significantly maximum plant spread E-W (71.87 cm) was noted in Sarpan Gaillardia Grand Mix but which was at par with Ludhiana Selection - 2, Gaillardia Mix and PG – 1 during 1st year. Similarly, highest plant spread (73.31 and 71.93 cm) was noted in PG -1 which was at par with Sarpan Gaillardia Grand Mix and Gaillardia Mix during 2nd year and in pooled data. However, minimum plant spread recorded in local Selection- 4 (34.63, 33.17 and 33.90 cm) during both the year and in pooled. The variation in plant spread might be due to varietal trait and similar results were obtained also by Agale (2012)^[1], Saniya *et al.* (2021)^[14] and Gawade (2018)^[7] in gaillardia and also with the findings reported by Jagtap (2013)^[9].

Number of branches per plant

Significantly maximum number of branches per plant (21.13, 21.16 and 21.14) was recorded in Gaillardia Mix which was statistically at par with Sarpan Yellow. Whereas, Local Selection - 2 produced minimum number of branches (12.58, 12.74 and 12.66) at peak time of flowering in both the years as well as in pooled data. The difference in number of branches could be attributed to the genetic makeup of the cultivars. Increased number of branches leads to production of more number of leaves in turn it will enhance the yield by increasing source and sink relationship. These findings were confounded by Agale (2012)^[1], Kale (2002)^[10], Girange *et al.* (2016)^[8], Saniya *et al.* (2021)^[14] and Gawade (2018)^[7] in gaillardia.

Stem Diameter (mm)

Significantly maximum number of stem diameter (10.28, 10.46 and 10.37 mm) was recorded in PG -1 followed by Local Selection – 4 during both the years and pooled. Moreover, the minimum number of stem diameter (6.51, 6.73 and 6.62 mm) was recorded in Ludhiana Selection - 1 in both the years as well as in pooled. Similar trend was observed by Vikas *et al.* (2015)^[17] in dahlia, Choudhary *et al.* (2014)^[6] in marigold and Yadav *et al.* (2007)^[18] in chrysanthemum genotypes.

Fresh weight of plant (g)

Significant result and maximum fresh weight of plant after final harvest (2382.12, 2422.95 and 2402.53 g) was recorded in Sarpan Yellow in both the years as well as in pooled. However, it was observed at par with Sarpan Gaillardia Grand Mix, Local Selection-1 and Gaillardia Mix during 1st year and Local Selection – 1 during 2nd year. Whereas, Sarpan Gaillardia Grand Mix in pooled. While, minimum fresh weight (994.44, 1033.28 and 1013.86 g) was obtained in Local Selection- 4 in both the years as well as in pooled. Similar results were obtained by Girange *et al.* (2016)^[8] and Byadwal *et al.* (2018)^[4] in gaillardia and by Choudhary *et al.* (2014)^[6] in marigold.

Table 1: Evaluation of different genotypes and cultivars of gaillardia for growth parameters

Genotype/ Cultivar No.	Plant height (cm)			Plant spread (N-S cm)			Plant spread (E-W cm)			Number of branches per plant		
	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
G1	70.67	72.67	71.67	43.48	44.95	44.21	37.97	40.17	39.07	15.59	17.18	16.39
G2	58.33	64.33	61.33	33.36	34.88	34.12	42.60	45.44	44.02	12.58	12.74	12.66
G3	56.33	63.00	59.67	20.72	21.57	21.14	50.01	52.01	51.01	12.92	13.16	13.04
G4	65.33	68.67	67.00	27.02	28.23	27.63	34.63	33.17	33.90	13.98	14.32	14.15
G5	89.00	81.00	85.00	38.08	39.24	38.66	37.87	40.51	39.19	16.07	15.95	16.01
G6	74.67	75.00	74.83	47.18	49.65	48.42	67.33	64.17	65.75	14.56	15.49	15.03
G7	62.00	64.67	63.33	28.02	29.23	28.62	57.72	58.23	57.97	19.85	19.49	19.67
G8	64.67	68.33	66.50	50.63	55.06	52.85	71.87	71.31	71.59	15.58	15.32	15.45
G9	68.00	69.33	68.67	50.67	53.87	52.27	71.73	66.04	68.89	21.13	21.16	21.14
G10	75.67	75.67	75.67	45.86	47.99	46.93	70.55	73.31	71.93	17.06	17.95	17.50
G11	67.33	69.00	68.17	48.78	50.94	49.86	59.43	62.57	61.00	16.18	16.56	16.37
G12	62.33	67.33	64.83	46.19	48.33	47.26	59.33	62.04	60.69	17.39	17.77	17.58
S.Em.±	2.71	3.27	2.22	1.70	1.89	1.33	2.442	2.565	1.900	0.893	0.732	0.623
C.D. at 5%	7.93	9.57	6.50	4.97	5.4	3.81	7.13	7.49	5.42	2.61	2.14	1.78
C.V. %	6.93	8.12	8.1	7.37	7.83	7.98	7.68	7.97	8.40	9.62	7.72	9.39

Dry weight of plant (g)

Significantly maximum dry weight of plant (637.11, 637.66 and 637.39 g) was recorded in Gaillardia Mix followed by Sarpan Gaillardia Grand Mix in 1st year and Sarpan Yellow in 2nd year and in pooled. Moreover, the minimum dry weight of

plant (198.58, 195.02 and 196.80 g) was recorded in Local Selection 4 in both the years as well as in pooled. Similar results were obtained by Girange *et al.* (2016)^[8] and Byadwal *et al.* (2018)^[4] in gaillardia and by Choudhary *et al.* (2014)^[6] in marigold.

Table 2: Evaluation of different genotypes and cultivars of gaillardia for growth and yield parameters

Genotype/ Cultivar No.	Stem diameter (cm)			Fresh weight of plant (g)			Dry weight of plant (g)			Number of flowers per plant		
	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
G1	6.86	7.19	7.02	2193.82	2232.64	2213.23	401.80	429.87	415.83	178.59	193.66	186.13
G2	7.49	7.86	7.67	1000.16	1039.04	1019.60	269.39	289.00	279.19	150.30	158.90	154.60
G3	7.04	7.17	7.10	2034.98	2078.38	2056.68	344.48	376.39	360.44	173.06	180.89	176.97
G4	9.01	9.25	9.13	994.44	1033.28	1013.86	198.58	195.02	196.80	166.26	164.25	165.25
G5	6.51	6.73	6.62	1764.62	1804.42	1784.52	255.94	278.39	267.16	196.04	193.77	194.91
G6	8.85	9.07	8.96	1922.09	1962.37	1942.23	303.93	321.51	312.72	173.46	181.77	177.62
G7	8.67	8.89	8.78	2382.12	2422.95	2402.53	462.75	468.91	465.83	246.85	267.88	257.36
G8	7.50	7.72	7.61	2358.43	2400.10	2379.26	464.79	450.97	457.88	200.70	191.17	195.94
G9	8.77	8.99	8.88	2167.46	2208.73	2188.09	637.11	637.66	637.39	268.73	287.61	278.17
G10	10.28	10.46	10.37	1215.24	1255.50	1235.37	259.37	273.41	266.39	206.27	205.17	205.72
G11	8.31	8.46	8.38	1189.62	1228.48	1209.05	244.24	239.18	241.71	223.41	218.92	221.17
G12	6.66	6.78	6.72	1399.23	1438.70	1418.97	268.64	286.86	277.75	226.49	242.19	234.34
S.Em.±	0.339	0.383	0.267	76.566	72.681	55.720	14.530	15.964	11.570	11.320	8.578	7.470
C.D. at 5%	0.99	1.12	0.76	223.48	212.14	158.92	42.41	46.60	33.00	33.04	25.04	21.31
C.V. %	7.34	8.08	8.07	7.72	7.16	7.85	7.35	7.81	8.14	9.76	7.17	8.97

Number of flowers per plant

Significantly highest number of flowers per plant (268.73, 287.61 and 278.17) was recorded in cultivar Gaillardia Mix and was found at par with Sarpan Yellow in both the years and pooled. While, minimum number of flowers per plant were produced by Local Selection-2 (150.30, 158.90 and 154.60) in both the years as well as in pooled data. The result might be due to genetical diversity which is concerned to the number of flowers per plant. This finding was also supported by Agale (2012)^[11], Kale (2002)^[10] and Byadwal *et al.* (2018)^[4] in gaillardia, Similar finding was also observed by Palai (2009)^[12], Shabnam *et al.* (2020)^[15], Negi *et al.* (2020)^[11] and Parvathi Bennurmth *et al.* (2020)^[13] and Gawade *et al.* (2018)^[7] in chrysanthemum.

Flower yield per plant (g), per plot (kg), per hectare (t/ha)

Maximum flower yield per plant (2334.86, 2430.02 and 2382.44 g), flower yield per plot (46.62, 48.55 and 47.58 kg) and flower yield per hectare (86.33, 89.90 and 88.11 t/ha) were recorded in Sarpan Yellow during both the years as well

as in pooled. However, it was found at par with Gaillardia Double Mix during 1st year and was followed during 2nd year and pooled. Moreover, the minimum flower yield per plant (524.13, 548.42 and 536.28 g), flower yield per plot (10.52, 10.94 and 10.73 kg) and flower yield per hectare was produced by Local Selection-2 (19.48, 20.26 and 19.87 t/ha) were recorded in Local Selection - 2 in both the years as well as in pooled. Highest flower yield might be due to genetic variability on flower size, flower weight and number of flowers per plant which is reflected on flower yield. These findings were confounded by Agale (2012)^[11], Gawade (2018)^[7] and Saniya *et al.* (2021)^[14] in gaillardia. Similar finding was also observed by Shabnam *et al.* (2020)^[15] and Parvathi Bennurmth *et al.* (2020)^[13] in chrysanthemum

Flower weight (g)

It is observed from the data that highest flower weight (9.44, 9.51 and 9.48 g) was obtained in cultivar Gaillardia Double Mix which was statistically at par with the cultivar Sarpan Yellow. Whereas, the lowest flower weight was recorded in

Gaillardia Mix (2.20, 2.23 and 2.21 g) in both the years as well as in pooled data. This variation in flower weight among genotypes might be attributed to the higher water and carbohydrate levels in the flower. Water plays a very

important role in maintaining flower turgidity, freshness and petal orientation. Byadwal *et al.* (2018)^[4] and Saniya *et al.* (2021)^[14] obtained similar results in Gaillardia.

Table 3: Evaluation of different genotypes and cultivars of Gaillardia for yield parameters

Genotype/ Cultivar No.	Flower yield per plant (g)			Flower yield per plot (kg)			Flower yield per hectare (t/ha)			Flower weight (g)		
	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
G1	1007.90	1018.49	1013.20	20.21	20.35	20.28	37.42	37.69	37.56	4.65	4.62	4.63
G2	524.13	548.42	536.28	10.52	10.94	10.73	19.48	20.26	19.87	3.32	3.30	3.31
G3	1358.27	1351.86	1355.06	26.76	26.93	26.84	49.55	49.87	49.71	7.29	7.22	7.26
G4	1075.05	1088.25	1081.65	21.68	21.75	21.72	40.15	40.28	40.22	6.08	6.16	6.12
G5	810.84	869.24	840.04	16.22	17.34	16.78	30.04	32.12	31.08	4.30	4.35	4.32
G6	1513.13	1556.81	1534.97	30.32	31.11	30.71	56.15	57.60	56.88	8.25	8.25	8.25
G7	2334.86	2430.02	2382.44	46.62	48.55	47.58	86.33	89.90	88.11	9.40	9.39	9.40
G8	1286.69	1285.08	1285.88	25.73	25.70	25.71	47.66	47.58	47.62	6.49	6.49	6.49
G9	672.11	655.79	663.95	13.53	13.09	13.31	25.05	24.24	24.65	2.20	2.23	2.21
G10	1722.64	1756.99	1739.81	34.45	35.13	34.79	63.80	65.05	64.43	8.15	8.14	8.14
G11	1168.85	1154.53	1161.69	23.44	23.01	23.22	43.41	42.60	43.01	5.10	5.22	5.16
G12	2169.00	2201.29	2185.15	43.35	43.95	43.65	80.28	81.38	80.83	9.44	9.51	9.48
S.Em.±	62.169	56.815	44.857	1.232	1.089	0.872	2.280	2.016	1.616	0.264	0.279	0.207
C.D. at 5%	181.46	165.83	127.94	3.60	3.18	2.49	6.65	5.88	4.61	0.77	0.81	0.59
C.V. %	8.26	7.42	8.36	8.18	7.12	8.13	8.18	7.12	8.13	7.34	7.75	8.13

Conclusions

From the ongoing discussion it can be concluded that the highest plant height was noted in genotype Ludhiana Selection1 but plant spread (N-S) was registered highest in Sarpan Gaillardia Grand Mix. Similarly, plant spread (E-W) and stem diameter have given better performance in genotype PG-1. However, number of branches per plant was recorded in Gaillardia Mix. Likewise, the fresh weight and dry weight of plant was concentrated in single cultivar and it was registered highest in Sarpan Yellow. Highest number of flowers per plant was recorded in cultivar Gaillardia Mix. Significantly, maximum flower yield per plant, per plot and per hectare was recorded in Sarpan Yellow. Whereas, highest flower weight was obtained in Gaillardia Double Mix.

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