

Original Research Article

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## Evaluation of Winter Annuals for Suitability as Cut and Loose Flowers under Hill Zone of Karnataka

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### ABSTRACT

#### Keywords

Winter annuals,  
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An investigation was carried on winter annuals for their growth, flowering, flower quality and yield under hill zone of Karnataka was at Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere, during 2019-20. The study was conducted to evaluate the mean performance for growth, flowering, flower quality, yield parameters and suitability of winter annuals as cut and loose flower by consumer preference. Among all the seasonal annuals under observation, the highest flower yield per plant and plot was observed in *Chrysanthemum coronarium* (432.44 g, 13.45 kg), followed by *Calendula officinalis* (236.28 g, 8.23 kg) and *Callistephus chinensis* (174.25 g, 6.19 kg). The consumer preference regarding the suitability of winter annuals under study for cut and loose flower in which the highest score for cut flower suitability among the annuals was obtained in *Callistephus chinensis* (5.00), *Gomphrena globosa* (5.00), *Helichrysum bracteatum* (5.00), followed by *Chrysanthemum coronarium* (4.76), and *Calendula officinalis* (4.22). The maximum score for loose flower suitability was obtained in *Callistephus chinensis* (5.00), *Chrysanthemum coronarium* (5.00), followed by *Calendula officinalis* (4.74), and *Gomphrena globosa* (4.66).

### Introduction

The term "annual" when applied to herbaceous ornamentals, refers to plants that are grown for only one season. Ornamental annuals are the herbaceous plants that grow from seeds, produce flowers, set seeds, and complete their life cycle within one growing season of the year, having a short period of the lifespan. Winter flowering annuals serve as essential components in any landscape plan (Brown, 2012). Apart from growing in beds of

various size and shapes with one or more annuals (Howe and Waters, 1998), They are frequently used as bedding plants, garden plants, plants for rockery, window basket, cut flowers, loose flowers and herbaceous border in gardens (Love *et al.*, 2009). However, few types are grown for cut flowers and also attractive foliage (Steven and Gast, 1992). Hence, there is scope of exploiting these annuals as cut and loose flowers for commercial utilization.

The description of the seasonal annuals used in investigation and its landscape and commercial uses are as follows. Calendula (*Calendula officinalis* L., pot marigold), a member of the Asteraceae family, is an important aromatic ornamental plant indigenous to Europe (Khan, 2011). In addition to being used as a bedding plant or specialty cut flower in landscape horticulture, calendula is also used in cosmetics and pharmaceuticals (Warner and Erwin 2005; Ercetin *et al.*, 2012). China aster [*Callistephus chinensis* (L.) Nees.] belongs to the family Asteraceae and is native of China. Among the annuals, China aster is ranked third for popularity, after Chrysanthemum and Marigold (Sheela, 2008). China aster is a free blooming half hardy, easy growing winter annual crop grown for cut flower as well as loose flower. (Dharmendra *et al.*, 2019). Garland chrysanthemum, botanically known as *Chrysanthemum coronarium* L., is an annual under the chrysanthemum group of flowers. It is more hardy, vigorous and grows taller. Its flowers are in various shades of yellow, white, having single or double forms (Desai, 1962). The growers are attracted towards annual chrysanthemum flowers as it's of short duration, to produce marketable attractive good keeping quality flowers (Hawa *et al.*, 2018).

Bachelor's button (*Gomphrena globosa* L.) belongs to the family Amaranthaceae, which is half-hardy, used in beds, borders, rockeries, and pots. It is an annual ornamental plant that grows with varying height. (Ashwini *et al.*, 2019) and is one of the important commercial flower crop grown for "loose flower" used for garland making. Though not fragrant, the flowers are very popular due to their attractive colour, light weight and good keeping quality. *Helichrysum bracteatum* commonly known as the strawflower is a flowering plant in the family Asteraceae native to Australia, with yellow, orange, pink, deep rose, red, wine,

magneto, purple and white blooms. (Maryam, 2014). *Helichrysum* are producing worldwide as fresh and dried flowers, which retains the color for a longer time. The dwarf cultivars can be used as bedding plants. *Xerochrysum viscosum* is produced worldwide as fresh and dried flowers, which belongs to the family Asteraceae. They have been commonly used in folk medicine as an herbal tea.

## Materials and Methods

The present study was carried out at Department of Floriculture and Landscape Architecture, College of Horticulture, Mudigere, during 2019-20. The objective of the investigation is to study the growth, flowering, yield parameters and to evaluate the suitability of these annuals for loose and cut flower. The experiment was laid out in Randomized Completely Block Design with 6 treatments and 4 replications. The study was conducted with 6 winter annuals *viz.*, *Calendula officinalis* L. (pot marigold), *Callistephus chinensis* (L.) Nees (China aster), *Chrysanthemum coronarium* L. (annual chrysanthemum), *Gomphrena globosa* L. (globe amaranth), *Helichrysum bracteatum* Andr. (helichrysum or paper flower), *Xerochrysum viscosum* (Seiber ex DC.) R.J. Bayer (golden everlasting).

Nursery raising of six different annuals were undertaken in pro trays and the seedlings were transplanted at 45 days' age. The transplanting of uniform size seedlings was done at a spacing of 30 cm × 30 cm from plant to plant and row to row accommodating nine plants per square meter area in case of China aster, Annual chrysanthemum, helichrysum or paper flower, globe amaranth, at 25 cm × 25 cm in case of Calendula and Xerochrysum. The crop was fertilized with NPK 20:20:20 gram per meter square in the form of urea, SSP and MOP. The cultural operations like irrigation, pinching, weeding, staking and earthing up

are done during the experimentation as and when required. The observations recorded on various growth and flowering parameters were subjected to descriptive statistical measures such as mean, range, standard error, and coefficient of variation (Gomez and Gomez, 1984).

## Results and Discussion

The variability estimates of parameters were divided as high, moderate, and low. The parameters which had higher variations with the maximum coefficient of variation, need a scope of improvement through fine-tuning of production technology through the sophistication of cultural practices, nutrition, breeding, etc. These slender ranges of variations clearly indicate the steadiness of observations with the minimum probability of improvement through production technology and environment manipulation.

A perusal of data presented in Table 1 describes the mean performance of *Calendula officinalis* L. for various recorded observations. It is evident from the data that the mean plant height was 67.30 cm, and it ranged from 53.20-71.00 cm. The mean plant spread (N-S) was 42.77 cm, and it ranged from 35.50-53.00 cm, and mean plant spread (E-W) was 43.08 cm with a range of 32.00-56.00 cm. The average number of leaves was 143.92 which ranged from 104.00-167.00. The average number of days taken for flower bud initiation was 25.42 and ranged from 23.00-29.60. The average days taken for 50 per cent flowering 43.68 and ranged from 41.00-46.00. The average duration of flowering was 64.50 days, and it ranged from 61.00-70.00 days. The average number of flowering stems per plant and the average number of flowers per plant was 28.10 and 139.80. Respective ranges for these characters are 23.00-32.00 and 96.00-162.00. Bhattarai *et al.*, (2019) stated that *Calendula officinalis* L. recorded

earliness in flower bud initiation, flower bud differentiation, blooming, and wilting under the open condition. The diameter of the flower ranged from 4.60-6.12 cm with a mean size of 5.29 cm. The average petiole length and stalk length was 5.63 cm and 39.62 cm, which ranged from 3.40-6.50 cm and 32.00-43.00 cm, respectively. The average shelf and vase life was 2.34 and 3.55 days. Respective ranges for these parameters were 1.50-2.60 days and 2.85-4.00 days. The average flower yield per plant and plot was 236.28 g and 8.23 kg, which ranged from 182.00-278.00 g per plant and 7.40-10.30 kg per plot. In this species, the least variability was found in plant height (cm) with a minimum coefficient of variation, *i.e.*, 1.71. There was the highest variability in petiole length with a maximum coefficient of variation, *i.e.*, 34.5.

The data presented in Table 2 exhibits the mean performance of *Callistephus chinensis* (L.) Nees for various parameters. Data shows that the mean plant height was 45.21 cm, and it ranged from 36.00-48.50 cm. The mean plant spread (N-S) was 31.11 cm, and it ranged from 28.00-36.00 cm, and mean plant spread (E-W) was 32.32 cm with a range of 29.50-39.00 cm. The average number of leaves was 141.53, which ranged from 124.00-162.00. The average number of days taken for flower bud initiation ranged from 40.00-47.00 days, and the average days taken was 43.22. Average days taken for 50 per cent flowering were 59.44 which ranged from 57.00-64.00. The average of duration of flowering was 43.87 days, and it ranged from 37.00-52.00 days. average number of flowering stems per plant and the average number of flowers per plant ranged from 12.00-19.00 and 22.00-46.00. Respective mean values for these parameters were 15.36 and 31.25. The diameter of the flower ranged from 5.50-7.80 cm with a mean size of 6.48 cm. The average petiole length and stalk length was 7.84 and 42.67cm, which ranged

from 5.80-9.60 and 29.00-54.00cm, respectively. The average shelf and vase life was 4.68 and 8.10 days. The shelf life of China aster (4.00-5.50 days), which was highest among the annuals which show its suitability as a loose flower. Respective ranges for these parameters were 4.00-5.50 and 7.00-10.50 days. Flower yield per plant and plot ranged from 152.00-215.00 g and 5.10-7.50 kg, with their average yield of 174.25 g and 6.19 kg. The increased flower yield per plant was because of increased flower weight and the number of flowers per plant. The similar results were in China aster by Munikrishnappa *et al.*, (2013) and Zosiamliana *et al.*, (2012). This species had the highest variability in number of flowers per plant with a maximum coefficient of variation of 41.31, and the least variability was found in plant height with the minimum coefficient of variation, *i.e.*, 1.94.

The data presented in Table 3 exhibit the mean performance of *Chrysanthemum coronarium* L. for various parameters. Data shows that the mean plant height was 111.01 cm, and it ranged from 96.00-119.00 cm. The mean plant spread (N-S) was 44.82 cm, and it ranged from 39.00-48.50 cm, and mean plant spread (E-W) was 45.21 cm with a range of 42.50-51.20 cm. The average number of leaves was 215.19, which ranged from 186.00-262.00. The branching pattern as influenced by pinching time in garland chrysanthemum (*Chrysanthemum coronarium* L.) was evaluated by Dorajeerao and Mokashi (2012) and concluded that early pinching at 20 DAS recorded significantly higher plant height, the maximum number of leaves (259.24), number of branches (39.58), plant spread (29.14 cm). The average number of days taken for flower bud initiation ranged from 39.00-46.00, and average days taken was 42.20. Average days taken for 50 per cent flowering were 53.95, which ranged from 49.00-57.00. The average of duration of

flowering was 66.90 days, and it ranged from 64.00-72.00 days. The average number of flowering stems per plant and an average number of flowers per plant ranged from 54.00-61.00 and 128.00-176.00. Respective mean values for these parameters were 40.85 and 159.25. The diameter of the flower ranged from 4.10-5.70 cm with a mean size of 5.01 cm. The average petiole length and stalk length was 6.49cm and 65.44, which ranged from 4.50-7.80cm and 52.00-74.00cm, respectively. The average shelf and vase life was 2.85 and 5.12 days. Respective ranges for these parameters were 2.10-3.40 and 4.20-6.00 days. Flower yield per plant and per plot ranged from 315.00-504.00 g and 12.00-15.50 kg with their average yield of 13.45 g and 13.45 kg. This annual recorded the highest flower yield per plant (315.00-504.00 g) compared to other annuals under study. This may be due to genetic nature, growing situation and environmental conditions of the plant which led the good vegetative growth, in turn the more number of branches and flower heads leading to the higher flower yield. The higher flower yield (35786.92 kg/ha) was recorded with the application of a higher nitrogen level (150 kg/ha) in Annual chrysanthemum (Karavadia and Dhaduk, 2002). This species had the highest variability in the petiole length with a maximum coefficient of variation, *i.e.*, 26.99, and the least variability was found in plant spread (N-S) with the minimum coefficient of variation, *i.e.*, 1.04.

A perusal of data presented in Table 4 describes the mean performance of *Gomphrena globosa* L. for various recorded observations. It is evident from the data that the mean plant height was 54.02 cm, and it ranged from 49.00-61.00 cm. The mean plant spread (N-S) was 41.24 cm, and it ranged from 37.00-46.50 cm, and the mean plant spread (E-W) was 44.10 cm with a range of 38.00-47.00 cm.

**Table.1** Evaluation of Pot marigold (*Calendula officinalis* L.) for growth, flowering, flower quality, and yield parameters

Parameters	Mean	Min	Max	SE	CV (%)
Plant height (cm)	67.30	53.20	71.00	0.67	1.71
Plant spread (N-S) (cm)	42.77	35.50	53.00	0.76	3.08
plant spread (E-W) (cm)	43.08	32.00	56.00	0.68	2.74
Number of leaves	143.92	104.00	167.00	2.98	3.59
Days taken for flower bud initiation	25.42	23.00	29.60	2.10	14.30
Days taken for 50% flowering	43.68	41.00	46.00	1.45	5.77
Duration of flowering (days)	64.50	61.00	70.00	2.78	7.48
Number of flowering stems per plant	28.10	23.00	32.00	2.67	16.44
Number of flowers/plant	139.80	96.00	162.00	21.90	27.13
Diameter of flower (cm)	5.29	4.60	6.12	0.44	14.55
Petiole length (cm)	5.63	3.40	6.50	1.12	34.58
Stalk length (cm)	39.62	32.00	43.00	3.82	16.69
Shelf life (days)	2.34	1.50	2.60	0.43	31.83
Vase life (days)	3.55	2.85	4.00	0.35	17.31
Flower yield (loose flowers) (g/plant)	236.28	182.00	278.00	28.42	20.83
Flower yield per plot (kg)	8.23	7.40	10.30	1.04	21.92

**Table.2** Evaluation of China aster [*Callistephus chinensis* (L.) Nees] for growth, flowering, flower quality, and yield parameters

Parameters	Mean	Min	Max	SE	CV (%)
Plant height (cm)	45.21	36.00	48.50	0.51	1.94
Plant spread (N-S) (cm)	31.11	28.00	36.00	0.66	3.70
plant spread (E-W) (cm)	32.32	29.50	39.00	0.37	2.01
Number of leaves	141.53	124.00	162.00	6.13	7.51
Days taken for flower bud initiation	43.22	40.00	47.00	2.04	8.18
Days taken for 50% flowering	59.44	57.00	64.00	2.28	6.65
Duration of flowering (days)	43.87	37.00	52.00	4.38	17.28
Number of flowering stems per plant	15.36	12.00	19.00	2.03	22.84
Number of flowers per plant	31.25	22.00	46.00	7.45	41.31
Diameter of flower (cm)	6.48	5.50	7.80	0.69	18.32
Petiole length (cm)	7.84	5.80	9.60	1.11	24.43
Stalk length (cm)	42.67	29.00	54.00	7.31	29.68
Shelf life (days)	4.68	4.00	5.50	0.44	16.23
Vase life (days)	8.10	7.00	10.50	1.20	25.69
Flower yield (loose flowers) (g/plant)	174.25	152.00	215.00	20.40	20.28
Flower yield per plot (kg)	6.19	5.10	7.50	0.70	19.63

**Table.3** Evaluation of Annual Chrysanthemum (*Chrysanthemum coronarium* L.) for growth, flowering, flower quality, and yield parameters

Parameters	Mean	Min	Max	SE	CV (%)
Plant height (cm)	111.01	96.00	119.00	0.79	1.23
Plant spread (N-S) (cm)	44.82	39.00	48.50	0.27	1.04
plant spread (E-W) (cm)	45.21	42.50	51.20	0.67	2.56
Number of leaves	215.19	186.00	262.00	3.84	3.09
Days taken for flower bud initiation	42.20	39.00	46.00	2.04	8.38
Days taken for 50% flowering	53.95	49.00	57.00	2.50	8.02
Duration of flowering (days)	66.90	64.00	72.00	2.56	6.62
Number of flowering stems per plant	40.85	31.00	46.00	4.93	20.89
Number of flowers per plant	159.25	128.00	176.00	15.64	17.01
Diameter of flower (cm)	5.01	4.10	5.70	0.47	16.41
Petiole length (cm)	6.49	4.50	7.80	1.01	26.99
Stalk length (cm)	65.44	52.00	74.00	6.80	18.01
Shelf life (days)	2.85	2.10	3.40	0.39	23.60
Vase life (days)	5.12	4.20	6.00	0.52	17.59
Flower yield (loose flowers) (g/plant)	432.44	315.00	504.00	59.19	23.71
Flower yield per plot (kg)	13.45	12.00	15.50	1.05	13.57

**Table.4** Evaluation of Globe Amaranth (*Gomphrena globosa* L.) for growth, flowering, flower quality, and yield parameters

Parameters	Mean	Min	Max	SE	CV (%)
Plant height (cm)	54.02	49.00	61.00	0.21	0.67
Plant spread (N-S) (cm)	41.24	37.00	46.50	0.50	2.09
plant spread (E-W) (cm)	44.10	38.00	47.00	0.46	1.83
Number of leaves	85.49	71.00	112.00	1.70	3.45
Days taken for flower bud initiation	51.88	49.00	57.00	2.57	8.57
Days taken for 50% flowering	63.16	58.00	66.00	2.58	7.09
Duration of flowering (days)	59.72	55.00	68.00	4.15	12.05
Number of flowering stems per plant	28.14	21.00	36.00	4.35	26.74
Number of flowers per plant	51.33	38.00	64.00	7.51	25.35
Diameter of flower (cm)	2.57	2.10	3.40	0.42	28.05
Petiole length (cm)	11.46	7.40	14.00	2.05	31.00
Stalk length (cm)	34.25	27.00	42.00	4.34	21.93
Shelf life (days)	3.15	2.40	3.90	0.43	23.81
Vase life (days)	4.38	3.80	5.50	0.56	22.15
Flower yield (loose flowers) (g/plant)	52.33	44.00	67.00	7.36	24.35
Flower yield per plot (kg)	1.72	1.30	2.10	0.23	23.34

**Table.5** Evaluation of Paper flower (*Helichrysum bracteatum* Andr.) for growth, flowering, flower quality, and yield parameters

Parameters	Mean	Min	Max	SE	CV (%)
Plant height (cm)	92.84	78.00	108.00	1.47	2.75
Plant spread (N-S) (cm)	32.12	23.00	36.00	0.34	1.81
plant spread (E-W) (cm)	34.03	31.00	39.00	0.25	1.25
Number of leaves	94.75	84.00	112.00	2.46	4.50
Days taken for flower bud initiation	37.90	35.00	43.00	2.56	11.69
Days taken for 50% flowering	54.82	49.00	58.00	2.91	9.21
Duration of flowering (days)	64.20	59.00	72.00	3.97	10.71
Number of flowering stems per plant	7.62	5.00	12.00	2.20	50.10
Number of flowers per plant	21.82	12.00	38.00	8.15	64.71
Diameter of flower (cm)	5.96	5.10	6.30	0.43	12.59
Petiole length (cm)	5.01	3.80	6.80	0.91	31.57
Stalk length (cm)	73.28	62.00	79.00	5.64	13.33
Shelf life (days)	3.71	3.00	4.80	0.55	25.83
Vase life (days)	14.85	11.00	18.20	2.09	24.42
Flower yield (loose flowers) (g/plant)	73.57	56.00	87.00	9.19	21.62
Flower yield per plot (kg)	1.70	1.55	1.92	0.11	11.45

**Table.6** Evaluation of Golden everlasting [*Xerochrysum viscosum* (Seiber ex DC) R.J. Bayer] for growth, flowering, flower quality, and yield parameters

Parameters	Mean	Min	Max	SE	CV (%)
Plant height (cm)	27.69	19.50	33.60	0.60	3.74
Plant spread (N-S) (cm)	36.94	26.00	41.50	0.49	2.30
plant spread (E-W) (cm)	35.45	28.00	38.00	0.17	0.82
Number of leaves	41.66	19.00	58.00	0.96	3.99
Days taken for flower bud initiation	39.10	32.00	44.00	3.63	16.10
Days taken for 50% flowering	53.84	51.00	57.00	1.74	5.60
Duration of flowering (days)	46.20	42.00	49.00	2.14	8.02
Number of flowering stems per plant	9.20	5.65	13.20	2.19	41.25
Number of flowers per plant	18.68	6.40	32.00	7.41	68.69
Diameter of flower (cm)	3.68	3.10	4.30	0.35	16.33
Petiole length (cm)	6.05	4.60	7.10	0.75	21.44
Stalk length (cm)	22.50	17.00	31.40	4.49	34.57
Shelf life (days)	1.89	1.20	3.00	0.56	51.36
Vase life (days)	6.72	4.50	8.40	1.16	29.84
Flower yield (loose flowers) (g/plant)	32.52	21.80	39.60	5.45	29.03
Flower yield per plot (kg)	0.85	0.60	1.10	0.14	29.41

**Table.7** Consumer preference of annuals

Sl no.	Winter annuals	Cut flower suitability	Loose flower suitability	Overall acceptance
1.	<i>Calendula officinalis</i> L.	4.22	4.74	4.88
2.	<i>Callistephus chinensis</i> (L.) Nees	5.00	5.00	5.00
3.	<i>Chrysanthemum coronarium</i> L.	4.76	5.00	5.00
4.	<i>Gomphrena globosa</i> L.	5.00	4.66	4.92
5.	<i>Helichrysum bracteatum</i> Andr.	5.00	3.25	4.05
6.	<i>Xerochrysum viscosum</i> Rx. B.	4.00	3.42	2.63

**Table.8** Scorecard for different parameters of annuals (1-5 hedonic scale)

Cut flower suitability		Loose flower suitability		Overall Acceptance	
5	Highly Suitable	5	Highly Suitable	5	Excellent
4	Suitable	4	Suitable	4	Very good
3	Moderately Suitable	3	Moderately Suitable	3	Good
2	Less Suitable	2	Less Suitable	2	Fair
1	Not Suitable	1	Not Suitable	1	Dislike

The average number of leaves was 85.49, which ranged from 71.00-112.00. The average number of days taken for flower bud initiation was 51.88 and ranged from 49.00-57.00. Average days taken for 50 per cent flowering were 63.16, which ranged from 58.00-66.00. The average of duration of flowering was 59.72 days, and it ranged from 55.00-68.00 days. The average number of flowering stems per plant and the average number of flowers per plant was 28.14 and 51.33. Respective ranges for these characters are 21.00-36.00 and 38.64. The diameter of the flower ranged from 2.10-3.40 cm with a mean size of 2.57 cm. The average petiole length and stalk length was 11.46 cm and 34.25 cm, which ranged from 7.40-14.00 cm and 27.00-42.00 cm, respectively. The average shelf and vase life was 3.15 and 4.38 days. Respective ranges for these parameters were 2.40-3.90 and 3.80-5.50 days. The average flower yield per plant and plot was 1.72 g and 10.90 kg, which ranged from

44.00-67.00 g and 1.30-2.10 kg. Hemalatha *et al.*, (2014) stated that the maximum number of flowers per plant, per square meter, per hectare, was recorded by spacing 30 cm × 30 cm and application of 120 per cent of recommended dosage of fertilizers in *Gomphrena*. In this species, the least variability was found in plant height with a minimum coefficient of variation, *i.e.*, 0.67. The highest variability was found in petiole length with the maximum coefficient of variation, *i.e.*, 31.00.

The data presented in Table 5 exhibit the mean performance of *Helichrysum bracteatum* Andr. for various parameters. Data shows that the mean plant height was 92.84 cm, and it ranged from 78.00-108.00 cm. The mean plant spread (N-S) was 32.12 cm, and it ranged from 23.00-36.00 cm, and mean plant spread (E-W) was 34.03 cm with a range of 31.00-39.00 cm. The average number of leaves was 94.75, which ranged from

84.00-112.00. The average number of days taken for flower bud initiation ranged from 35.00-43.00, and average days taken was 37.90. Average days taken for 50 per cent flowering were 54.82 which ranged from 49.00-58.00 and 46.00-55.00. The average of duration of flowering was 64.20 days, and it ranged from 59.00-72.00 days. The average number of flowering stems per plant and an average number of flowers per plant ranged from 7.62 and 21.82. Respective mean values for these parameters were 5.00-12.00 and 12.00-38.00. The diameter of the flower ranged from 5.10-6.30 cm with a mean size of 5.96 cm. According to Vishnu Swaru (1995) plants of *Helichrysum* are 75.00-90.00 cm tall, with flower size of about 7.00 cm and days taken for flowering is about 105-120. The average petiole length and stalk length was 5.01 cm and 73.28 cm, which ranged from 3.80-6.80 cm and 62.00-79.00 cm, respectively. The average shelf and vase life was 3.71 and 14.85 days. A respective range for these parameters was 3.00-4.80 days. The vase life (11.00-18.20 days) was recorded highest among the annuals under study; this may be due to the strong genetic characteristic of *Helichrysum*. Flower yield per plant and per plot ranged from 56.00-87.00 g and 1.55-1.92 kg, with their average yield of 73.57 g and 1.7 kg. This species had the highest variability in number of flowers per plant with the maximum coefficient of variation, *i.e.*, 64.71, and the least variability was found in plant spread (E-W) with the minimum coefficient of variation, *i.e.*, 1.25.

A perusal of data presented in Table 6 describes the mean performance of *Xerochrysum viscosum* (Seiber ex DC) R.J. Bayer for various recorded observations. It is evident from the data that the mean plant height was 27.69 cm, and it ranged from 19.50-33.60 cm. The mean plant spread (N-S) was 36.94 cm, and it ranged from 26.00-41.50 cm, and mean plant spread (E-W) was 35.45

cm with a range of 28.00-38.00 cm. The average number of leaves was 41.66, which ranged from 19.00-58.00. The average number of days taken for flower bud initiation was 39.10 and ranged from 32.00-44.00. Average days taken for 50 per cent flowering were 53.84 which ranged from 51.00-57.00. The average of duration of flowering was 46.20 days, and it ranged from 42.00-49.00 days. The average number of flowering stems per plant and the average number of flowers per plant was 9.20 and 18.68. Respective ranges for these characters are 5.65-13.20 and 13.20. The diameter of the flower ranged from 3.10-4.30 cm with a mean size of 3.68 cm. The average petiole length and stalk length was 6.05 cm and 22.50 cm, which ranged from 4.60-7.10 cm and 17.00-31.40 cm, respectively. The average shelf and vase life was 1.89 and 6.72 days. Respective ranges for these parameters were 1.20-3.00 and 4.50-8.40 days. The average flower yield per plant and per plot was 32.52 g and 0.85 kg, which ranged from 21.80-39.60 g and 0.60-1.10 kg. In this species, the least variability was found in plant spread (E-W) with the minimum coefficient of variation, *i.e.*, 0.82. There was the highest variability in the number of flowers per plant with the maximum coefficient of variation, *i.e.*, 68.69.

### **Consumer preference**

All the winter annuals are not suitable for loose flower, cut flower, and seed production. So, here the attempt has been made to know the various attributes of seasonal annuals like flower color, cut flower suitability, and loose flower suitability and overall acceptability. The score has been given using a 1-5 hedonic scale, and the same is presented in Table 8. The consumer preference regarding the suitability of winter annuals under study for cut and loose flower is shown in Table 7. The highest score for cut flower suitability among the annuals was obtained in *Callistephus*

*chinensis* (5.00), *Gomphrena globosa* (5.00), *Helichrysum bracteatum* (5.00), followed by *Chrysanthemum coronarium* (4.76), and *Calendula officinalis* (4.22). The maximum score for loose flower suitability was obtained in *Callistephus chinensis* (5.00), *Chrysanthemum coronarium* (5.00), followed by *Calendula officinalis* (4.74), and *Gomphrena globosa* (4.66). The maximum score for overall acceptance was obtained in *Callistephus chinensis* (5.00), *Chrysanthemum coronarium* (5.00), followed by *Gomphrena globosa* (4.92), and *Calendula officinalis* (4.88).

From the present investigation, it can be concluded that, among all the seasonal annuals under observation, the highest flower yield per plant and plot was observed in *Chrysanthemum coronarium* (432.44 g, 13.45 kg), followed by *Calendula officinalis* (236.28 g, 8.23 kg) and *Callistephus chinensis* (174.25 g, 6.19 kg). The minimum flower yield per plant was observed in *Xerochrysum bracteatum* (35.52 gm). The consumer preference regarding the suitability of winter annuals under study for cut and loose flower in which the highest score for cut flower suitability among the annuals was obtained in *Callistephus chinensis* (5.00), *Gomphrena globosa* (5.00), *Helichrysum bracteatum* (5.00), followed by *Chrysanthemum coronarium* (4.76), and *Calendula officinalis* (4.22). The maximum score for loose flower suitability was obtained in *Callistephus chinensis* (5.00), *Chrysanthemum coronarium* (5.00), followed by *Calendula officinalis* (4.74), and *Gomphrena globosa* (4.66).

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