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Asim Naim Siddique
Department of Horticulture
Floriculture and Landscaping,
Naini Agricultural Institute
Sam Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj, Uttar
Pradesh, India

Dr. Samir Ebson Topno
Department of Horticulture
Floriculture and Landscaping,
Naini Agricultural Institute
Sam Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj, Uttar
Pradesh, India

Effect on growth, photosynthetic characteristics and chlorophyll content of different varieties of freesia (*Freesia corymbosa*)

Asim Naim Siddique and Dr. Samir Ebson Topno

Abstract

The study entitled “Effect on growth, photosynthetic characteristics and chlorophyll content of different varieties of freesia (*Freesia corymbosa*)” was conducted to identify the suitable variety for growing in Uttar Pradesh to meet the national demand. Five farmer’s varieties each with one cultivar were laid out in Randomized block Design (RBD) with three replications during rabi 2019-20. The five different varieties of freesia were V1: Orange, V2: Yellow, V3: Red, V4: Pink and V5: Random colour varieties of freesia. In present experiment data were recorded for various characters viz., growth parameters, photosynthetic characteristics and yield and quality parameters. It is concluded that farmer’s varieties of Freesia (*Freesia corymbosa*) had significant effects on growth parameters photosynthetic characteristics and yield and quality parameters. Among the five varieties of freesia, variety V1, V2, V3 and V5 were found suitable in terms of these parameters. While freesia variety V4 was found least important for these attributes. Based on the cost of cultivation and its marketing including roughly all charges, the maximum B:C ratio was recorded in V5 (1:3.92). Based on findings of this experiment, it is recommended that freesia variety V5 should be used for commercial cultivation of freesia.

Keywords: Freesia, farmer’s varieties

Introduction

Freesia (*Freesia corymbosa*) is a genus of herbaceous perennial flowering plants in the family Iridaceae, first described as a genus in 1866 by Christian Friedrich Ecklon (1886) and named after the German botanist and medical practitioner, Friedrich Freese (1795-1876). It is native to the eastern side of southern Africa, from Kenya south to South Africa, most species being found in Cape Provinces. Species of the former genus *Anomatheca* are now included in *Freesia*. The plants commonly known as "freesias", with fragrant funnel-shaped flowers, are cultivated hybrids of a number of *Freesia* species. Some other species are also grown as ornamental plants. They are herbaceous plants which grow from a conical corm 1–2.5 cm (1/2–1 in) diameter, which sends up a tuft of narrow leaves 10–30 cm (4–12 in) long, and a sparsely branched stem 10–40 cm (4–16 in) tall bearing a few leaves and a loose one-sided spike of flowers with six sepals. Many species have fragrant narrowly funnel-shaped flowers, although those formerly placed in the genus *Anomatheca*, such as *F. laxa*, have flat flowers. Freesias are used as food plants by the larvae of some Lepidoptera species including the large yellow underwing. For a generous display of flowers, plant freesia corms in groups of 6 to 10, positioned no more than 2” apart. Plant single colours together or mix them for a rainbow effect. Like gladiolas, freesias usually need support to keep their stems upright. Circular supports that surround the stems are ideal. Another option is to use slender bamboo canes or small branches and then tie the stems in with twine. A wide range of colours and an alluring floral fragrance make freesia hard to resist. With up to eight trumpet-shaped, upward-pointing blossoms on leafless stems, freesias make delightful cut flowers that last a long time in the vase. The freesia bulb plant is easy to force indoors on sunny windowsills. Learning how to grow freesias in the garden and freesia flower care will allow you to enjoy these beauties year after year. In India Freesia is not a commercially exploited cut flower crop. On the other hand, Freesias are mostly professionally cultivated in Netherlands by about 80 growers. Freesias can be readily increased from seed. Due to their specific and pleasing scent, they are often used in hand creams, shampoos, candles, etc. However, the flowers themselves are mainly used in wedding bouquets. In India, success of this flower crop depends upon the availability of suitable variety which can be grown at commercial level.

Corresponding Author:
Asim Naim Siddique
Department of Horticulture
Floriculture and Landscaping,
Naini Agricultural Institute
Sam Higginbottom University of
Agriculture, Technology and
Sciences, Prayagraj, Uttar
Pradesh, India

Success of this crop in Uttar Pradesh not only meet the ever-growing demand for this flower in domestic uses but also in international markets. Great damages are produced by *Fusarium sp.* but the disease can be prevented by steam disinfection of the soil before planting (Preda, 1976) [7]. As an alternative to the bulb culture of *Freesia*, seeding can be also used for obtaining flowers but in this case, to the flowering a period of 7 months has to pass and although the flowers are bigger they have no perfume (Bāla, 2003, 2007, Şelaru, 1995, 2002) [2, 3, 8, 9]. Degeneration also diminishes plants length, stem length, flower buds in inflorescence, number of ramification, the flowering period, diameter of the flowers and the bulbs are smaller and flattened (Cantor and Pop, 2008) [5].

Materials and Methods

The experimental material for present investigation comprised of five varieties of freesia. For this purpose, 5 treatments having one cultivar were laid out in Randomized block Design (RBD) with three replications. These treatments were the framers variety of freesia: H1: Orange, H2: Yellow, H3: Red, H4: Pink and H5: Random colour varieties of freesia planted during rabi 2019-20. The experiment was conducted in Randomized Block (RBD) with three replications under field conditions. The row to row and plant to plant distance was kept at spacing of 30×30 cm². The nitrogen was applied in two splits, one at the time of sowing and other at 25 days after sowing. Entire Phosphorus was applied as basal dose. All recommended practices were followed and timely plant

protection measures were taken to avoid damage through insect-pests and diseases. Observations for growth, photosynthetic characteristics and yield parameters were recorded on randomly selected competitive plants for each treatment in each replication. Analysis of variance was worked out to test the significance of F and T-tests. It was carried out according to procedure of RBD analysis for each character as per methodology suggested by Panse and Sukhatme (1967) [6]. The significance of difference among treatment means were tested by F-test. Wherever, the F- test was found to be significant, critical difference (CD) at 5 per cent level of significance was calculated..

Results and Discussion

Analysis of variance for the field data revealed that significance mean sum of squares due to treatments were observed for all the characters viz., (A) Growth parameters: Plant height (cm), Number of leaves per plant and Day to first flower initiation (B) Photosynthetic characteristics: Leaf area, Leaf weight, thickness of leaves and chlorophyll content: (C) Yield parameters: No of flowers / plant were significant at 5% level of significance indicating presence of good amount of variability among the treatments for these characters. This indicated ample scope for varietal selection in freesia. Replications were non-significant for all the characters indicating good homogeneity among replications. This suggests that there is an ample scope to identify suitable variety to improve varietal performance in Freesia. (Table-1).

Table 1: Mean sum of squares for different characters in freesia (*Freesia corymbosa*) for growth parameters

Source	d. f	Plant height (cm)30DAP	Plant height (cm)60DAP	Plant height (cm) 90DAP	Number of leaves per plant30 DAP	Number of leaves per plant 60 DAP	Number of leaves per plant90 DAP	Day of first flower initiation
Treat.	4	3.19**	2.09**	34.7**	1.07**	1.27**	1.43**	21.43**
Repl.	2	1.49	1.98	1.87	0.27	0.47	0.2	0.07
Error	8	0.37	0.53	1.15	0.27	0.22	0.28	1.48

Table 2: Mean sum of squares for different characters in freesia (*Freesia corymbosa*) for Photosynthetic characteristics

Source	d.f	Leaf weight (g)	Leaf area cm ² 30 DAP	Leaf area cm ² 60 DAP	Leaf area cm ² 90 DAP	No of buds per plants 30 DAP	No of buds per plants 60 DAP	No of buds per plants 90 DAP	Thickness of leaves	Number of flower / plant
Treat.	4	0.22**	230.89**	923.57**	2565.46**	0.68**	1.15**	10.38**	0.04**	108.23**
Repl.	2	0.06	1.25	5	13.87	0.08	0.13	1.11	0.001	3.8
Error	8	0.03	1.08	4.33	12.02	0.02	0.03	0.26	0.004	3.384

** Significant at 1% level of significance

Table 3: Mean performance of farmer’s varieties for growth parameters in freesia (*Freesia corymbosa*)

S. No.	Varieties	Plant height (cm)30DAP	Plant height (cm)60DAP	Plant height (cm)90DAP	Number of leaves per plant30 DAP	Number of leaves per plant 60 DAP	Number of leaves per plant90 DAP	Day of first flower initiation
1	V1	17.85	25.34	41.49	2.67	4.33	8	66
2	V2	16.35	24.01	40.16	3.67	5.33	7.33	70.67
3	V3	15.46	23.18	36.1	3.33	5.67	7.67	71
4	V4	15.32	24.61	34.56	2.67	5.33	6.67	73.33
5	V5	15.77	23.71	33.9	2.67	4.67	6.33	69.67
	S.Em+	0.35	0.42	0.62	0.3	0.27	0.31	0.7
	CD(5%)	1.14	1.37	2.02	0.98	0.88	1.01	2.28
	CV	3.77	3.01	2.88	16.93	9.14	7.35	1.73
	GM	16.15	24.17	37.24	3.07	5.13	7.2	70.13
	Minimum	15.32	23.18	33.9	2.67	4.33	6.33	66
	Maximum	17.85	25.34	41.49	3.67	5.67	8	73.33

Table 4: Mean performance for different characters in freesia (*Freesia corymbosa*) for Photosynthetic characteristics

S. No.	Varieties	Leaf weight (g)	Leaf area cm ² 30 DAP	Leaf area cm ² 60 DAP	Leaf area cm ² 90 DAP	No of buds per plants 30 DAP	No of buds per plants 60 DAP	No of buds per plants 90 DAP	Thickness of leaves	Number of flowers / plant
1	V1	3.22	64.22	128.43	214.06	2.33	3.03	9.1	1.78	19.67

2	V2	2.93	81.49	162.98	271.64	3.33	4.33	13	1.76	23.33
3	V3	2.65	75.28	150.57	250.94	3.07	3.99	11.96	1.93	24.67
4	V4	2.61	65.32	130.65	217.75	3.1	4.03	12.09	1.69	29
5	V5	2.6	60.26	120.51	200.85	2.3	2.99	8.97	1.61	35.33
	S.Em+	0.1	0.60	1.2	2	0.08	0.1	0.29	0.04	1.06
	CD(5%)	0.33	1.96	3.91	6.52	0.26	0.33	0.95	0.13	3.46
	CV	6.19	1.50	1.5	1.5	5	4.72	4.63	3.61	6.97
	GM	2.8	69.31	138.63	231.05	2.83	3.67	11.02	1.75	26.4
	Min.	2.6	60.26	120.51	200.85	2.3	2.99	8.97	1.61	19.67
	Max.	3.22	81.49	162.98	271.64	3.33	4.33	13	1.93	35.33

Table 5: Economics of freesia cultivation

S. No.	Varieties	Number of flowers / plant	Flower yield (No./ha) (in lacs)	Cost of cultivation at prevailing rates including marketing (Rs. lac ha-1)	Gross returns (Rs. lac ha-1)	Net Returns (Rs. lac ha-1)	B:C ratio
1	V1	19.67	21.85	10.0	21.85	11.85	2.18
2	V2	23.33	25.92	10.0	25.92	15.92	5.59
3	V3	24.67	27.41	10.0	27.41	17.41	2.74
4	V4	29	32.22	10.0	32.22	22.22	3.22
5	V5	35.33	39.25	10.0	39.25	29.25	3.92

It is apparent from the discussion that variety V1 was significantly higher for height (cm) 30DAP, 60DAP and 90DAP in comparison to other varieties. Among these varieties, the variety V2 was significantly higher for Number of leaves per plant 30 DAP in comparison to other varieties. The variety V3 was significantly higher for Number of leaves per plant 60 DAP in comparison to other varieties. While, the variety V1 was significantly higher for Number of leaves per plant 90 DAP in comparison to other varieties. Among these varieties, the variety V1 was significantly lower for Days of first flower initiation in comparison to other varieties. The variety V1 was significantly higher for leaf weight (g) in comparison to other varieties.

Among these varieties, the variety V2 and V3 were significantly higher for Leaf area cm²30 DAP in comparison to other varieties. The variety V2 was significantly higher for Leaf area cm²60 DAP and 90 DAP in comparison to other varieties. Among these varieties, the variety V2 was significantly higher for No of buds per plants 30 DAP, 60 DAP and 90DAP in comparison to other varieties. Among these varieties, the variety V3 was significantly higher for thickness of leaves in comparison to other varieties. Among all the varieties, the variety V5 was significantly higher for Number of flowers / plant in comparison to other varieties.

Thus among the 5 varieties of Freesia, Variety V1, V2, V3 and V5 were found suitable for one and the other characters. Variety V4 was found least important. Based on the cost of cultivation and its marketing including roughly all charges, the maximum B:C ratio was recorded in V5 (1:3.92) followed by V4 (1:3.22), V3 (1:2.74), V2 (1:2.59) and V1 (1:2.18).

It is to mention here that in past a little work has been done on various aspects related to the cultivation of Freesia. A very little information is available on the work done in past on Freesia. A little work done in the past can be taken as support for the present study. According to Bala (2010) ^[4] *Freesia hybrida* is one of the most cultivated cut flowers worldwide. Modern technologies recommend cultivating Freesia in rotation with chrysanthemum and tomatoes, to avoid pests and diseases apparition into culture of that is the main cause of species degeneration. The greatest expenses in a Freesia culture from bulbs are made on the achievement of the bulbs but they compensate the quality and quantity of the flowers. In our research, the cultivars have been cultivated in a modern greenhouse and as we couldn't do a rotation of crops, we prevented their apparition into culture by thermal disinfection

of soil before setting the crops and pest control by preventing them with several treatments recommended in this matter. The results show that the lowest number of lower stalks was recorded by 'Striped Sun' cv. while 'Troubadur' cv. has shown a higher number of floral stalks in the second year. Other researched aspects have shown a diminution of the values to the first year. The greatest diminution of the floral stem length was recorded by 'Algarve' cv. While 'Yvonne' cv. has recorded greater values of the same character in the second year. The degeneration appeared different to the researched cultivars on the aspects mentioned in the paper, even if all had benefited of the same cultural conditions.

These results are in accordance with Ali *et al.*, (2011) ^[1] from the experiment "Response of freesia cultivars to different growing media" conducted at Ornamental Horticulture nursery, Department of Horticulture, Agricultural University, Peshawar during 2005-2006. Four cultivars of freesia i.e. Valentino, Jessica, Golden Wave and White Wings were planted in four different planting media i.e. control, leaf mold, mushroom compost and poultry manure. The experiment was laid out in randomized complete block design with split plot arrangement. Media were used as main plots while cultivars as sub plots. Media mostly affected the parameters studied during the experiment. Early emergence (25.22 days), maximum number of leaves (10.44), maximum lamina length (22.7 cm), maximum leaf area (310.54 cm²), maximum number of florets plant-1 (41.71), maximum number of spikes plant-1 (7.67) and maximum plant height (36.18cm), was recorded in plants grown in mushroom compost, while late emergence (62.23 days), less number of leaves (8.14), less lamina length (18.16cm), less leaf area (205.55 cm²) plant-1, late flowering (153.39 days), less number of florets plant-1 (21.33), less number of spikes plant-1 (3.93), less spike persistence (8.01 days) and less plant height (28.28 cm) was obtained in poultry manure. Early flowering (142.66 days) occurred in control, while maximum spike persistence (9.89 days) was observed in leaf mold. Among the cultivars, some parameters showed significant variation. Early emergence (33.90 days) and early flowering (145.84 days), and spike persistence (9.24 days) was recorded in cv. White Wings, while minimum leaf area plant-1 (221.42 cm²), late flowering (147.04), less florets plant-1 (28.46), and minimum plant height (30.19 cm) was produced by the cv. Golden Wave. Maximum leaf area per plant (275.68cm²) and maximum plant height (34.01 cm) was given by cv. Valentino, while late

emergence (36.33 days), minimum spikes per plant (6.06) and less spike persistence (9.03 days) were recorded for cv. Jessica. Non-significant interactions were observed between the planting media and cultivars.

Conclusion

On account of acquired results, it is concluded that farmer's varieties of *Freesia* (*Freesia corymbose*) had significant effects on growth parameters photosynthetic characteristics and yield parameters. Among the five varieties of freesia, variety V1, V2, V3 and V5 were found suitable in terms of these parameters. While freesia variety V4 was found least important for these attributes. Based on the cost of cultivation and its marketing including roughly all charges, the maximum B:C ratio was recorded in V5 (1:3.92) Based on findings of this experiment, it is recommended that freesia variety V5 should be used for commercial cultivation of freesia.

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