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Effect of tinting methods with various food dyes on vase life of gypsophila (*Gypsophila paniculata*) cv. crystal white

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Abstract
An experiment was conducted to study the effect of food dyes, lemon yellow, Apple green, Rose pink and Orange red at 3% concentrations and tinting methods Stem absorption, dipping and spraying methods on vase life of gypsophila flowers at Floricultural Research Station, SKLTSHU, Rajendranagar, Hyderabad during 2019-2020 and 2020-2021. The results of the experiment revealed that, quantity of dye uptake (ml), time taken for color absorption, percentage of florets tinted and differed significantly but the interactions due to food dyes and method of absorption did not differ significantly for vase life. However, maximum quantity of dye uptake (ml) was recorded in lemon yellow (9.33) and minimum in rose pink (7.43), time taken for color absorption (hrs.) was maximum (1.26) in rose pink which is on par with orange red (1.25) and minimum in lemon yellow (0.89) which is on par with apple green (0.92), maximum percentage of tinted florets was recorded in lemon yellow (87.11) and minimum in orange red (67.89),maximum vase life (5.00 days) was recorded in lemon yellow and minimum in orange red (4.00 days) which is on par with apple green (4.44 days) and rose pink (4.11 days).Among the different food dyes and methods of absorption, lemon yellow @ 3% by stem absorption had shown best vase life of gypsophila flowers.

Keywords: Food dyes, tinting methods, quantity of dye uptake (ml.), percentage of tinted florets and vase life

Introduction
Gypsophila **(***Gypsophila paniculata* L.) is commonly known as Baby's-breath' is a member of Caryopyllaceae family and is native to Central and Eastern Europe. It is an extremely hardy perennial plant with a very deep tap root system. Flowers are numerous produced in large inflorescences, usually in profusely branched panicles. The light airy mosses of small white to pink flowers of gypsophila makes good contrast to large flowers in bouquets as flower filler which acclaims a great value as cut flower in floristry.

Tinting is an important value addition technique in flower crops where colour pigments are absent or light or dull. Colouring inflorescences with edible dyes enhance the visual appearance of these flowers and increase their economic value. It can also provide a great variety of colours for aesthetic beautification. For decorative purpose where a particular colour is desired, tinting of white flower is an easy way of obtaining the color of interest, whereas certified synthetic food colours are less expensive, less hazardous and impart an intense and uniform colour to flowers. (Sowmeya *et al.*, 2017) [5]. Tinting techniques has already been experimented in tuberose (Sambandha murthy and Appavu, 1980; Mekala *et al*., 2012, Suresh *et al.*, 2016; Safeena *et al.*, 2016; Sweta Kumari and Prahlad Deb, 2018) [4, 1, 3, 9].

Materials and Methods
The experiment was carried out at Floricultural Research Station, Rajendranagar, Hyderabad, during the years 2019 and 2020 on gypsophila with the cultivar crystal white and four food dyes namely Lemon yellow, Apple green, Rose pink and Orange red at 3% concentrations respectively and different methods of tinting i.e., Stem absorption method, dipping method and spraying method to find out the efficacy on vase life of gypsophila flowers. Uniform spikes of 60 cm length with more than 75% open florets were harvested and used in the study. The harvested spikes were placed in the 200 ml flasks with 100 ml of dye solutions of 3 per cent concentration. After tinting by different methods, the spikes were transferred to 500 ml glass

bottles containing 200 ml of distilled water to study the vase life.

The vase life was studied by recording colour intensity (RHS colour chart), Quantity of food dye uptake (ml.), time taken for color absorption (hrs.), percentage of flowers wilted (%) and vase life (days). The data recorded was statistically analysed using OPSTAT software and the difference of means was compared at five per cent level of significance.

Results and Discussion

Color intensity (RHS Chart)

Data pertaining to color intensity on tinting during vase life period of gypsophila flowers treated with different methods of application of food dyes are presented in the Table 1. The gypsophila flowers are white in color before treated with food dyes. The gypsophila flowers treated with food dyes consists of treatments lemon yellow at 3% by stem absorption (T_1) (D_1M_1), dipping (T_2) (D_1M_2) and spraying (T_3) (D_1M_3) methods imparted yellow shade of 98, 2B and 6A respectively. Apple green at 3% by stem absorption (T_4) (D_2M_1) dipping (T_5) (D_2M_2) and spraying (T_6) (D_2M_3) methods imparted green shade of 140 A, 140B and 141B respectively. Rose pink at 3% by stem absorption (T_7) (D_3M_1) dipping (T_8) (D_3M_2) and spraying (T_9) (D_3M_3) methods imparted rose pink shade of N66B, 67B and N66A respectively. Orange red at 3% by stem absorption (T_{10}) (D4M1) dipping (T_{11}) (D_4M_2) and spraying (T_{12}) (D_4M_3) method imparted red purple shade 71 C, 72A and 71 A as per the RHS color chart. These results are in conformity with Sravan kumar *et al*. (2014) [6] in gladiolus.

Quantity of dye up take (ml)

The mean quantity of dye uptake of solution differed significantly with food dyes and methods of application and presented in the Table 2 and fig.1. Among the food dyes, the highest uptake of (9.33 ml) was recorded in (D_1) Lemon yellow at 3% concentration followed by Apple green at 3% concentration (D_2) (8.30 ml) which is on par with (D_4) Orange red (8.12) and lowest (7.43 ml) was recorded in (D_3) rose pink at 3% concentration respectively. The highest value (9.36 ml) was recorded in M_3 (spraying method) followed by M_2 (dipping method) (8.96 ml). The interaction between food dyes and methods of application was significant. Highest values (11.33 ml) for quantity of dye uptake was recorded in the treatment D_1M_3 (Lemon yellow by spraying method) and lowest (5.87 ml) in the treatment D_4M_1 (Orange red by stem absorption method) and other treatments due to interactions recorded intermediate values which are on par with each other at 3% concentration respectively. These results are in accordance with Mekala *et al.*, (2012) [1] in tuberose and Sudha Patil and Dhaduk (2008) [7] in ladys lace cut flower.

Time taken for color absorption (hrs)

There was a significant difference in time taken for color absorption among the various food dyes and method of application of food dyes. (Table.3 & fig.2). The highest mean value (1.26 hrs) was recorded in D_3 (rose pink) which is on par with D_4 orange red (1.25 hrs) and lowest value (0.89 hrs.) in D_1 (Lemon yellow) at 3% concentration respectively. It was found highest (2.65 hrs) in M_1 (stem absorption) and lowest (0.19 hrs.) in M_3 (spraying method). The interactions of the treatments due to food dyes and methods of application differed significantly. Highest time taken for color absorption (3.20 hrs) was recorded in the treatment D_4M_1 (orange red by stem absorption) and lowest (0.13 hrs) in D_2M_3 (Apple green by spraying method) and other treatments due to interactions recorded intermediate values which are on par with each other at 3% concentration respectively. These results are in accordance with reports of Sudha and Dhaduk (2007) [8] in candytuft cut flowers.

Percentage of flowers tinted (%)

Data recorded on percentage of flowers tinted with different food dyes and methods of application differed significantly. (Table.4 and fig.3). Highest mean value of percentage of flowers was recorded in the treatment D_1 (Lemon yellow) (87.11%) followed by D_2 (Apple green) (81.44%) and lowest was recorded in the treatment D_4 (Orange red) (67.89%) at 3% concentration. The highest mean value (80.25%) was recorded in M_1 (Stem absorption) followed by M_3 (Spraying method) (77.67%) and lowest value (76.33%) in M_2 (Dipping method). The interactions of the treatments due to food dyes and methods of application for percentage of flowers tinted differed significantly. Highest (92.00%) was recorded in the treatment D_1M_1 (Lemon yellow by stem absorption) and lowest (65.33%) in D_4M_2 (Orange red by dipping method) at 3% concentrations respectively. These are in accordance with reports of Sambandamurthy and Appavu (1980) [4] in tuberose cut flowers.

Vase life of flowers (days)

Data related to vase life period of gypsophila flowers tinted with different food dyes and methods of application differed significantly and presented in Table. 5 and fig.4). The highest mean value (5.00 days) was recorded in the treatment D_1 (Lemon yellow) which is on par with D_2 (Apple green) (4.44), D_3 (Rose pink) (4.11), D_4 (Orange red) (4.00) and lowest mean value (4.00) in the treatment D_4 (Orange red). The highest mean value (5.00 days) was recorded in M_1 (Stem absorption method) and lowest value (3.83 days) in M_3 (Spraying method). This might be due to optimum reserve of food materials which are utilized for long time and extended the vase life. The reduced vase life might be due to toxic effect on the cell metabolism when kept in the edible dye solution for 3% concentration. (Sweta Kumari *et al*., 2018) [9]. The interaction effect of food dyes and methods of application on vase life of gypsophila cut flowers did not differed significantly. The results are attributed due to the fact that higher water absorption maintained better water balance and flower freshness, saved from early wilting and enhanced vase life.

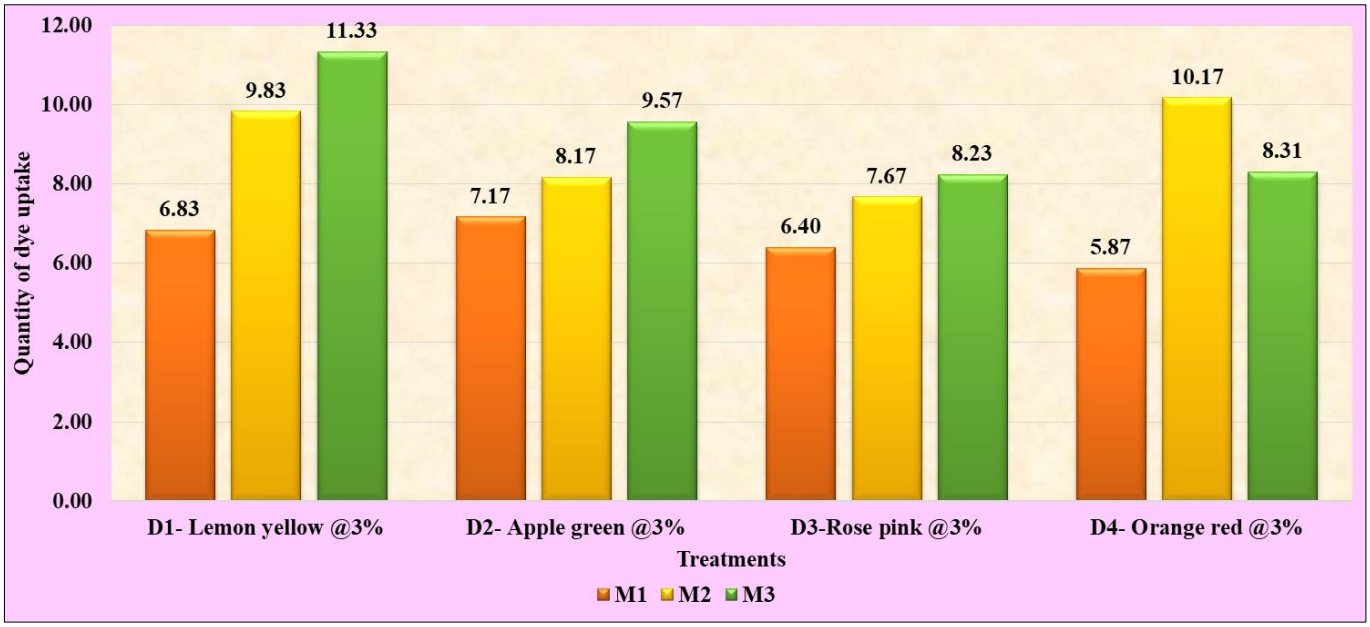
Table 1: Effect of different methods of application of Food dyes on color intensity (RHS Chart) of gypsophila cut flowers cv. crystal white

Treatments	Color intensity	RHS
T_1: D_1M_1-Lemon yellow @ 3% stem absorption	Yellow group	98.00
T_2: D_1M_2-Lemon yellow @ 3% dipping	Yellow group	2B
T_3: D_1M_3-Lemon yellow @ 3% spraying	Yellow group	6A
T_4: D_2M_1-Apple green @ 3% stem absorption	Green group	140 A
T_5: D_2M_2-Apple green @ 3% dipping	Green group	140 B
T_6: D_2M_3-Apple green @ 3% spraying	Green group	141 B
T_7: D_3M_1-Rose pink @ 3% stem absorption	Rose pink	N66 B
T_8: D_3M_2-Rose pink @ 3% dipping	Rose pink	67 B
T_9: D_3M_3-Rose pink @ 3% spraying	Rose pink	N66 A
T_{10}: D_4M_1-Orange red @ 3% stem absorption	Red purple	71 C
T_{11}: D_4M_2-Orange red @ 3% dipping	Red purple	72 A
T_{12}: D_4M_3-Orange red @ 3% spraying	Red purple	71 A

Table 2: Effect of different methods of application of Food dyes on quantity of dye uptake (ml) of gypsophila cut flowers cv. crystal white

Treatment	Quantity of dye uptake (ml)			
	M_1	M_2	M_3	Mean
D_1-Lemon yellow @3%	6.83	9.83	11.33	9.33 [a]
D_2-Apple green @3%	7.17	8.17	9.57	8.30 [b]
D_3-Rose pink @3%	6.40	7.67	8.23	7.43 [c]
D_4-Orange red @3%	5.87	10.17	8.31	8.12 [b]
Mean	6.57 [c]	8.96 [b]	9.36 [a]	
	S.Em±		CD(P=0.05)	
D (Dyes)	0.13		0.40	
M (Methods of absorption)	0.12		0.35	
DXM (Interactions)	0.23		0.69	

Figures bearing same letters did not differ significantly.
M_1. Stem Absorption method
M_2. Dipping method
M_3. Spraying method



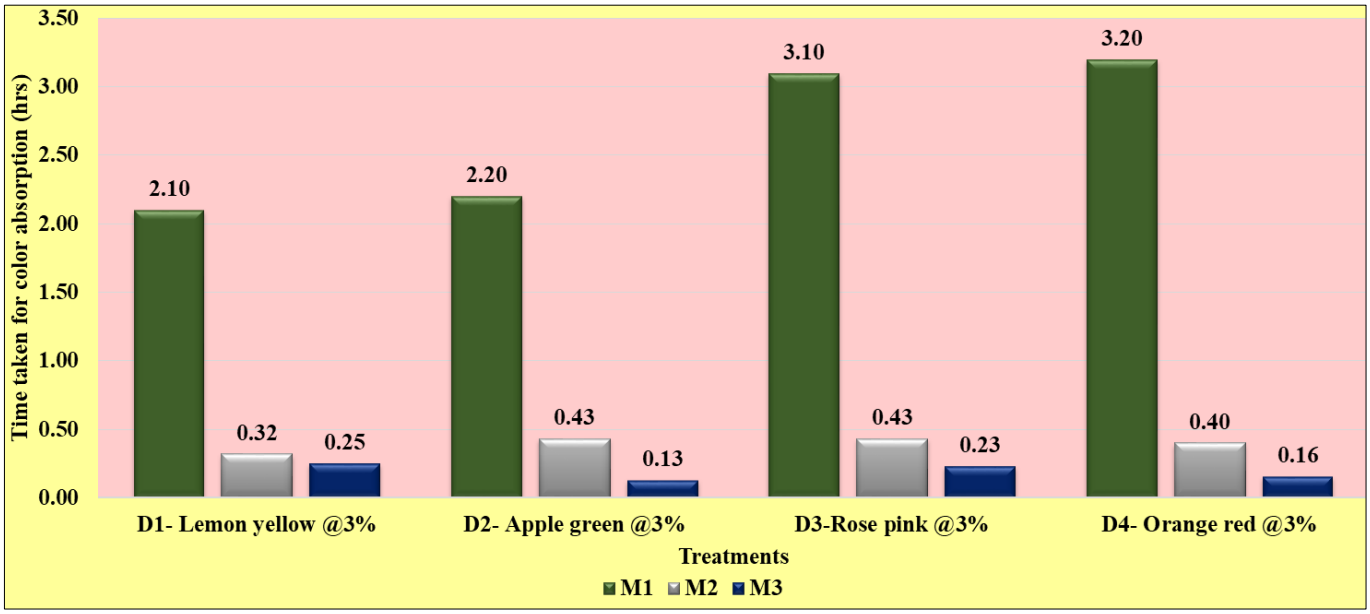
M_1. Stem Absorption method M_2. Dipping method M_3. Spraying method

Fig 1: Effect of different methods of application of Food dyes on quantity of dye up take (ml) of gypsophila cut flowers cv. crystal white.

Table 3: Effect of different methods of application of Food dyes on time taken for color absorption (hrs) of gypsophila cut flowers cv. crystal white

Treatment	Time taken for color absorption (Hrs)			
	M_1	M_2	M_3	Mean
D_1-Lemon yellow @3%	2.10	0.32	0.25	0.89 [b]
D_2-Apple green @3%	2.20	0.43	0.13	0.92 [b]
D_3-Rose pink @3%	3.10	0.43	0.23	1.26 [a]
D_4-Orange red @3%	3.20	0.40	0.16	1.25 [a]
Mean	2.65 [a]	0.40 [b]	0.19 [c]	
	S.Em±		CD(P=0.05)	
D (Dyes)	0.02		0.07	
M (Methods of absorption)	0.02		0.06	
DXM (Interactions)	0.04		0.12	

Figures bearing same letters did not differ significantly.
M_1. Stem Absorption method
M_2. Dipping method
M_3. Spraying method



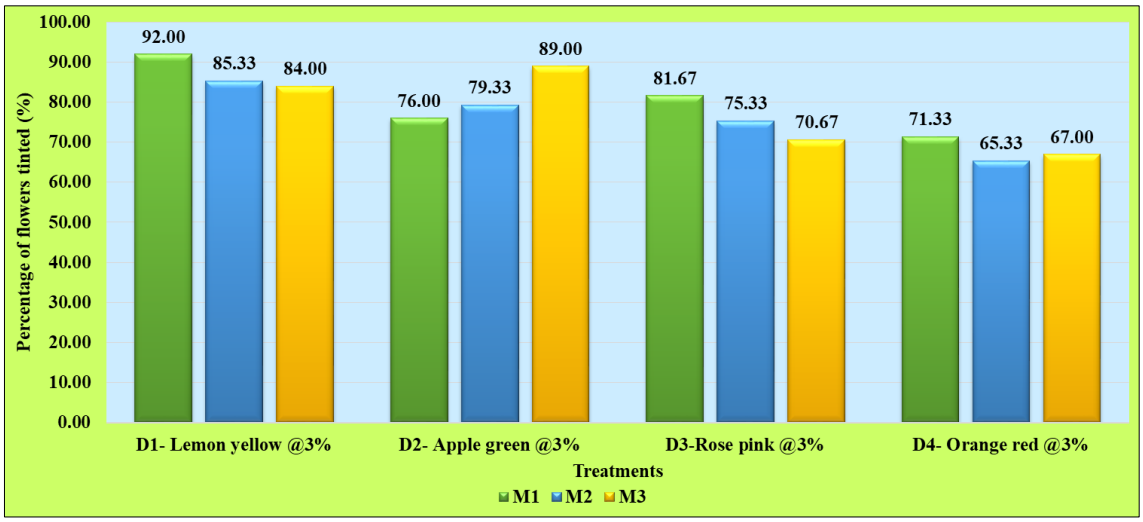
M_1. Stem Absorption method, M_2. Dipping method, M_3. Spraying method

Fig 2: Effect of different methods of application of Food dyes on time taken for color absorption (hrs) of gypsophila cut flowers cv. Crystal white

Table 4: Effect of different methods of application of Food dyes on percentage of flowers tinted (%) of gypsophila cut flowers cv. crystal white

Percentage of flowers tinted (%)				
Treatment	M_1	M_2	M_3	Mean
D_1-Lemon yellow @3%	92.00	85.33	84.00	87.11 [a]
D_2-Apple green @3%	76.00	79.33	89.00	81.44 [b]
D_3-Rose pink @3%	81.67	75.33	70.67	75.89 [c]
D_4-Orange red @3%	71.33	65.33	67.00	67.89 [d]
Mean	80.25 [a]	76.33 [c]	77.67 [b]	
	S.Em±		CD(P=0.05)	
D (Dyes)	0.46		1.37	
M (Methods of absorption)	0.40		1.20	
DXM (Interactions)	0.80		2.36	

Figures bearing same letters did not differ significantly.
M_1. Stem Absorption method
M_2. Dipping method
M_3. Spraying method



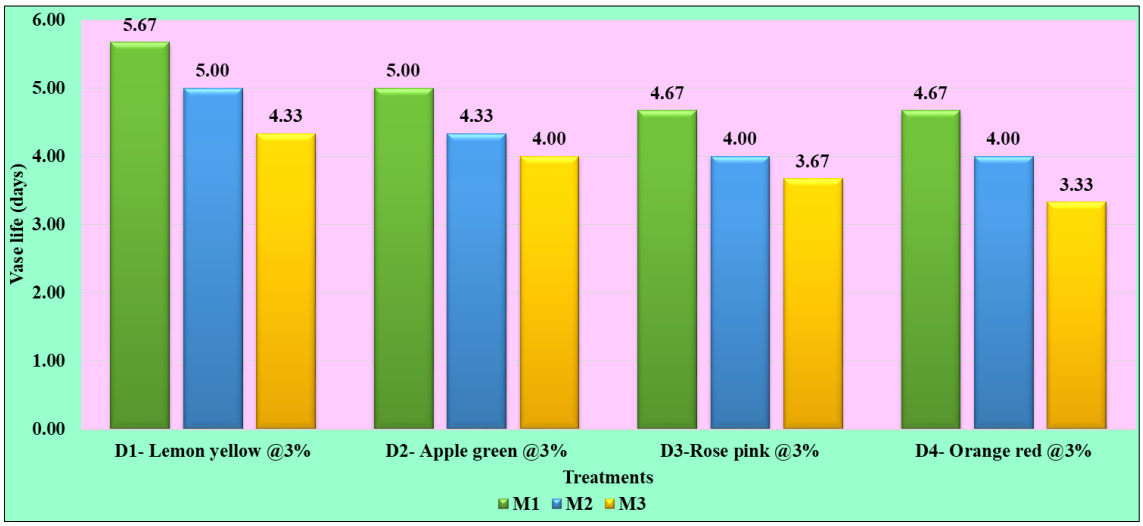
M_1. Stem Absorption method, M_2. Dipping method, M_3. Spraying method

Fig 3: Effect of different methods of application of Food dyes on percentage of flowers tinted (%) of gypsophila cut flowers cv. crystal white.

Table 5: Effect of different methods of application of Food dyes on vase life (days) of gypsophila cut flowers cv. crystal white

Treatment	Vase life (days)			
	M_1	**M_2**	**M_3**	**Mean**
D_1-Lemon yellow @3%	5.67	5.00	4.33	5.00 [a]
D_2-Apple green @3%	5.00	4.33	4.00	4.44 [b]
D_3-Rose pink @3%	4.67	4.00	3.67	4.11 [b]
D_4-Orange red @3%	4.67	4.00	3.33	4.00 [b]
Mean	5.00 [a]	4.33 [b]	3.83 [c]	
	S.Em±		CD(P=0.05)	
D (Dyes)	0.15		0.46	
M (Methods of absorption)	0.13		0.39	
DXM (Interactions)	0.25		NS	

Figures bearing same letters did not differ significantly.
M_1. Stem Absorption method
M_2. Dipping method
M_3. Spraying method



M_1. Stem Absorption method, M_2. Dipping method, M_3. Spraying method

Fig 4: Effect of different methods of application of Food dyes on vase life (days) of gypsophila cut flowers cv. crystal white.

Conclusion

Among different food dyes on tinting and various methods of application of food dyes, the treatment Lemon yellow dye followed by apple green dye through stem absorption at 3% concentration was found to be the best treatment for enhancing the vase life of gypsophila cut flowers. Similar research findings were seen in tuberose. (Prashanth *et al.*, 2020) [2].

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