International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 1153-1157

Received: 10-07-2019
Accepted: 12-08-2019

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Standardization of tinting techniques in gerbera, carnation and gladiolus

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Abstract
An investigation was carried out to study the vase life, colour intensity, moisture content of tinted gerbera, carnation and gladiolus flowers. The experiment comprised of two factors *i.e.,* first one was flowers treated with six food dyes with 5% concentration along with control and with three different time of immersion for 2.5, 5.0 and 7.5 hrs. The results revealed that flowers treated with distilled water (Control) and immersed for 2.5 hrs had recorded the higher vase life (7, 8 and 6 days), maximum mean moisture content (60.3, 64.8 and 57.71%) in gerbera, carnation and gladiolus respectively. With respect to the colour intensity, colour distribution and consumer acceptability the flowers treated with blue, orange and green dyes which were immersed for about 7.5 hrs duration had recorded the higher consumer acceptance. The flowers which were treated with blue, green and orange (1.30, 1.40 and 1.50 hrs) (1.20, 1.39 and 1.48 hrs) and (50min, 58min and 1.23 hrs) were found to absorb the dyes quickly in gerbera, carnation and gladiolus respectively, Thus it can be concluded that tinting with blue, green and orange which were immersed for 7.5 hrs duration had gained the maximum consumer preference with bright attractive flowers.

Keywords: Tinting, gerbera, carnation, gladiolus, value addition

Introduction

Tinting is one of the important value addition techniques in flower crops where colour pigments are light or dull in colour. Tinting serves as an excellent method with the intention to attain the preferred colour at post- harvest stage. For decorative purpose where a particular colour is desired, tinting of white flowers could be the only way of obtaining the colour of interest. Tinted flowers can fetch a premium price in the market. Tinting helps to add one colour or combination of two colours in cut flowers. The tinted flowers enhances the appearance and make the arrangement more attractive incase of fresh and dry flowers (Sowmeya *et al.*, 2017) [8].

Gerbera, Carnation and Gladiolus are popular cut flowers, globally these have wide range of bright, vivid and clear coloured flowers, these spectacular eye catching flowers are complement to any kind of flower arrangements (Soni and Godra., 2017) [7]. Tinting in these crops will helps to provide the great variety of colours and these tinted flowers can be effectively utilized in the bouquet preparation, flower arrangement and stage decorations *etc.*, to increase its aesthetic value and appeal.

Materials and Methods

Collection of fresh flowers: To the present study three flower crops *viz.*, gladiolous (*Gladiolous* spp), gerbera (*Gerbera gemsonii*) and carnation (*Dianthus caryophyllus*) were choosen based on the demand and scope for value addition. White flowered cultivars of these flower species *viz.*, gladiolous cv. White prosperity, gerbera cv. Balance and carnation cv. Baltico having uniform size, shaped, matured and fresh flowers were collected from the private forms located at Athani, Bangalore and Tumkur were selected with 2 factors *i.e.,* six different colours along with control and three different immersion time.

Tinting of flowers was done by stem absorption method. The collected fresh flowers of gerbera, gladiolus and carnation were conditioned by dipping them in solution containing one percent sodium hypochlorite solution overnight, later the conditioned flowers were cut to maintain a uniform length and the basal pair of leaves were removed and slant cut of 45 degree was given at the base in order to make maximum dye absorption.

Later these pre - treated flowers were placed in test bottles for the absorption of dye solution. The dyes are used at five percent concentration.

The time taken for absorption of food dyes by cut stems of gladiolus, gerbera and carnation was calculated based on the colour change in the flowers and it is expressed in hours. Colour intensity was recorded by using Royal Horticultural Society (RHS) colour chart which was expressed by using the different colour codes. The vase life was determined by recording how many days the flowers remain fresh wilting of fifty per cent of florets in the spikes was taken as an index of end of vase life of the flower spikes and vase life was recorded in days. Moisture was determined by recording the fresh and dry weight of the florets (Kept in easy drier at 60°C). Moisture content was expressed in fresh weight basis in percentage.

Results and Discussion

Time taken for colour uptake (hrs)

Among the six colours blue, green and orange had recorded the quicker absorption of dye (1.30, 1.40 and 1.50 hrs), (1.20, 1.39, 1.48 hrs) and (50min, 58min, 1. 23 hrs) with respect to the pink no colour was expressed in gerbera, carnation and gladiolus flowers respectively. Different times required to express fully in flowers was dependent on the colour/dye characteristics tinting with food dyes recorded better colour uptake as well as colour intensity. Results are in conformity with the observation made by Mekala *et al.*, (2012).

Colour intensity

Visual quality of colours obtained for blue (N109B), green (134A), orange (25D) and yellow (2A) with 7.50 hrs of immersion were found more intensified in gerbera. In case of tinted carnation the colour codes obtained for blue (110B), green (140A), orange (28A) and yellow (7A) dyes with 7.5 hrs of immersion were observed more intensified. In tinted spikes of gladiolus the colours obtained for blue (110B), green (140A), orange (28A) yellow (7A) and red (113C) dyes with 7.5 hrs of immersion were found superior when compared to other treatments. Colour intensity was found to be best in flowers immersed in dye solution for 7.5 hrs. It was observed that with increasing time of immersion in food dyes increased the colour intensity of the tinted flowers. Because of the availability of more time for the absorption of the dye solution. Obtained results were in conformity with the findings of Safeena *et al.* (2016).

Vase life (Days)

As evident from the mean values of effective vase life of tinted flowers indicated that, there was decreasing in trend in the freshness of tinted flowers in case of gerbera maximum vase life was recorded by control (6.50 days) and the lowest was found in the blue, pink and green colour tinted gerbera flowers (4.50 days). Among the different time of immersion maximum vase life was recorded by T_1 (5.71 days) and minimum was noticed in T_3 (4.35 days). In the interaction effect maximum vase life was recorded in the control flower which was immersed for 2.50 hrs (7.00 days) and the lowest was recorded in the flowers which were treated with blue, pink, green, yellow and orange colours and immersed for 7.5hrs (4.00 days). The maximum vase life was recorded by C_1 (7.50 days) and the minimum was found in the C_3 (4.83 days). With respect to different time of immersion maximum vase life was recorded in T_1 (6.35 days) whereas, minimum was noticed in T_3 (4.57 days). In the interaction effect higher vase life was found in control flowers which were immersed for 2.5 hrs (8 days) and the lowest vase life was recorded in the flowers which were immersed for 7.5 hrs in blue, pink, green and yellow colours (4 days) in carnation. With respect to gladiolus the maximum vase life of 5.50 days was recorded by C_1 and the minimum vase life was noticed by C_3 (3.32 days) among the different colours. Among different time of immersion, maximum vase life was recorded by T_1 (4.21 days) whereas, minimum was noticed in T_3 (3.28 days). In the interaction effect higher vase life was found in control treatments which were immersed for about 2.50 hrs (6.00 days) and the lowest vase life was recorded in the flowers which were immersed for 7.50 hrs in blue, pink, green, yellow, orange and in red colours and also in the flowers which were dipped blue, green, yellow and orange colours which were dipped for 5.00 hrs (3days).

It was found that higher the absorption of dyes, lower will be the vase life of the tinted flowers. Decreased vase life was due to accelerated ion leakage (singh *et al.*, 2009). The edible dyes used in the experiment alter the cell metabolism. Hence certain barriers were formed which restricts for the movement of water and food materials. Therefore osmotic pressure of the cell will be affected thus altering the cell turgidity. The obtained results may also be due to the fact that higher water absorption maintained better water balance and flower freshness, saves from early wilting and enhances vase life. These results were in accordance with Varu and Barad (2010) in tuberose cv. Double, Awadhesh and Bhagwan. (2013), and Mekala *et al.* (2012) in tuberose.

Moisture (%)

There was a decreasing trend in moisture content of tinted flowers as the vase life proceeds Among the seven different treatments the control treatment recorded the highest moisture content of about 60.71, 63.70 and 54.70 per cent and the lowest of about 42.70, 45.05 and 30.53 per cent was noticed in pink colour in gerbera, carnation and gladiolus respectively. The highest moisture was found in flowers immersed in dyes for 2.5hrs (54.55, 57.66 and 42.88%) and the lowest was found in flowers which were immersed in dyes for 7.5 hrs (42.76, 43.83 and 30.47%) in gerbera, carnation and gladiolus respectively.

In the interaction effect due to use of different colours and different time of immersion tested the highest moisture content was found in control flowers which were immersed for 2.5 hrs (64.15, 68.15 and 60.06%) and the lowest was found in pink colour tinted flowers which were immersed in dye solution for 7.5hrs (37.90, 39.00 and 25.65%) in gerbera, carnation and gladiolous respectively. Wilting of tinted flowers occurred due to the declined relative water content (RWC) and due to loss in membrane integrity as a result of loss of turgor pressure of cells (Halevy and Mayak, 1981). Reduced moisture levels which inturn causes the dehydration of petals due to the faster rate of senescence which inturn causes the wilting and absicission of the petals. These obtained results were in accordance with the reports of doorn and woltering (2004) and Yamini (2016).

Table 1: Effect of different tinting treatments on colour intensity in single colour tinted flowers of gerbera, carnation and gladiolus

Treatments	Gerbera	Carnation	Gladiolus
$C_1{}^xT_1$	NN155B (Yellowish white)	NN155C (White)	NN155D (White)
$C_1{}^xT_2$	NN155B (Yellowish white)	NN155C (White)	NN155D (White)
$C_1{}^xT_3$	NN155B (Yellowish white)	NN155C (White)	NN155D (White)
$C_2{}^xT_1$	N109C (Brilliant blue)	N109C (Brilliant blue)	111a (Strong blue)
$C_2{}^xT_2$	110B (Strong blue)	N109B (Strong blue)	118B (Brilliant greenish blue)
$C_2{}^xT_3$	N109B (Strong blue)	110B (Strong blue)	55A (Strong greenish blue)
$C_3{}^xT_1$	NN155B (Yellowish white)	NN155B (Yellowish white)	N25B (White)
$C_3{}^xT_2$	NN155B (Yellowish white)	NN155B (Yellowish white)	N30D (White)
$C_3{}^xT_3$	NN155B (Yellowish white)	NN155B (Yellowish white)	N28A (White)
$C_4{}^xT_1$	130A (Brilliant green)	140C (Briliant yellowish green)	1C (Light greenish yellow)
$C_4{}^xT_2$	129A (Brilliant green)	140B (Briliant yellowish green)	5A (Brilliant greenish yellow)
$C_4{}^xT_3$	134A (Vivid yellowish green)	140A (Vivid yellowish green)	3A (Brilliant greenish Yellow)
$C_5{}^xT_1$	2C (Light yellowish green)	1C (Light greenish yellow)	134B (Strong yellowish green)
$C_5{}^xT_2$	4B (Light yellowish green)	1A (Light greenish yellow)	140B (Brilliant yellow green)
$C_5{}^xT_3$	2A (Vivid greenish yellow)	7A (Brilliant yellow)	140A (Vivid yellow green)
$C_6{}^xT_1$	25D (Light orange yellow)	25B (Strong orange)	114C (Strong greenish blue)
$C_6{}^xT_2$	24A (Strong orange)	N25B (Strong orange)	114B (Moderate greenish blue)
$C_6{}^xT_3$	N25A (Strong orange)	28A (Vivid yellowish pink)	114a (Dark greenish blue)
$C_7{}^xT_1$	NN155B (Yellowish white)	37A (Strong yellowish pink)	59B (Deep purplish red)
$C_7{}^xT_2$	49B (Moderate pink)	39B (Deep yellowish pink)	118B (Dark red)
$C_7{}^xT_3$	48C (Strong pink)	45A (Vivid red)	113C (Deep purpalish pink)

Table 2: Effect of different tinting treatments on vase life of gerbera, carnation and gladiolus

Treatments	Vase life (Days)		
Colours(C)	**Gerbera**	**Carnation**	**Gladiolus**
C_1 - Control	6.50	7.50	5.50
C_2 - Blue	4.50	5.00	3.33
C_3 - Pink	4.50	4.83	3.33
C_4 - Green	4.50	5.00	3.33
C_5 - Yellow	4.67	5.00	3.33
C_6 - Orange	5.00	5.33	3.33
C_7 - Red	5.50	5.66	3.50
Mean	5.02	5.47	3.64
S.Em±	0.01	0.01	0.07
C.D. @ 1%	0.36	0.36	0.25
Duration of immersion (T)			
T_1 - 2.50 hrs	5.71	6.35	4.21
T_2 - 5.00 hrs	5.00	5.50	3.50
T_3 - 7.50 hrs	4.35	4.57	3.28
Mean	5.02	5.47	3.66
S.Em±	0.07	0.08	0.04
C.D. @ 1%	0.24	0.24	0.16
Colour X Time (C X T)			
C_1 X T_1	7.00	8.00	6.00
C_1 X T_2	6.50	7.50	5.50
C_1 X T_3	6.00	7.00	5.00
C_2 X T_1	5.00	6.00	4.00
C_2 X T_2	4.50	5.00	3.00
C_2 X T_3	4.00	4.00	3.00
C_3 X T_1	5.00	5.50	3.50
C_3 X T_2	4.50	5.00	3.50
C_3 X T_3	4.00	4.00	3.00
C_4 X T_1	5.00	6.00	4.00
C_4 X T_2	4.50	5.00	3.00
C_4 X T_3	4.00	4.00	3.00
C_5 X T_1	5.50	6.00	4.00
C_5 X T_2	4.50	5.00	3.00
C_5 X T_3	4.00	4.00	3.00
C_6 X T_1	6.00	6.00	4.00
C_6 X T_2	5.00	5.50	3.00
C_6 X T_3	4.00	4.50	3.00
C_7 X T_1	6.50	7.00	4.00
C_7 X T_2	5.50	5.50	3.50
C_7 X T_3	4.50	4.50	3.00
Mean	5.02	5.47	3.66
SE.m±	0.2	0.21	0.13
C.D. @ 1%	0.64	0.63	0.44

Table 3: Effect of different tinting treatments on moisture content (%) in gerbera, carnation and gladiolus

Treatments	Gerbera				Carnation				Gladiolous			
DAT (Days after tinting)												
Colours	**1**	**3**	**6**	**Mean**	**1**	**3**	**6**	**Mean**	**1**	**3**	**6**	**Mean**
C_1 – Control	78.33 (8.85)	60.71 (7.80)	31.75 (5.66)	56.93	83.21 (9.12)	63.70 (7.98)	37.69 (6.17)	61.53	84.30 (9.18)	54.70 (7.39)	9.30 (2.25)	49.43
C_2 – Blue	77.90 (8.82)	44.75 (6.68)	0 (0.70)	40.88	82.10 (9.06)	48.00 (6.91)	8.08 (2.13)	46.06	83.01 (9.11)	32.38 (5.67)	0 (0.70)	38.46
C_3 – Pink	76.80 (8.76)	42.70 (6.53)	0 (0.70)	39.83	81.85 (9.04)	45.05 (6.70)	0 (0.70)	42.30	82.02 (9.06)	30.53 (5.51)	0 (0.70)	37.51
C_4 – Green	77.25 (8.79))	44.43 (6.66)	0 (0.70)	40.56	81.96 (9.05)	47.26 (6.86)	7.96 (2.12)	45.72	82.85 (9.10)	30.78 (5.53)	0 (0.70)	37.87
C_5 – Yellow	77.52 (8.80)	49.53 (7.01))	0 (0.70)	42.35	82.26 (9.07)	48.13 (6.92)	8.35 (2.15)	46.24	83.15 (9.12)	32.51 (5.67)	0 (0.70)	38.55
C_6 – Orange	78.00 (8.83)	48.78 (6.96)	8.65 (2.18)	45.14	82.98 (9.11)	50.85 (7.12)	8.51 (2.17)	47.44	83.37 (9.13)	33.98 (5.81)	0 (0.70)	39.11
C_7 – Red	78.10 (8.83)	53.91 (7.32)	10.02 (2.31)	47.34	83.15 (9.11)	52.98 (7.26)	11.70 (2.46)	49.27	83.66 (9.15)	36.80 (6.05)	0 (0.70)	40.15
S.Em±	0.04	0.05	0.02		0.03	0.04	0.03		0.03	0.05	0.002	
C.D. @ 1%	0.20	0.16	0.08		0.14	0.14	0.11		0.14	0.14	0.005	
Duration of immersion (T)												
T_1 - 7.50 hrs	78.32 (8.85)	54.55 (7.37)	13.37 (2.81)	48.74	83.39 (9.13)	57.66 (7.58)	25.14 (4.75)	55.34	84.20 (9.17)	42.88 (6.53)	3.98 (1.37)	43.68
T_2 - 10.00 hrs	77.73 (8.82)	50.46 (7.09)	4.44 (1.41)	44.21	82.63 (9.09)	51.06 (7.13)	5.28 (1.48)	46.32	83.20 (9.12)	34.51 (5.83)	0 (0.70)	39.23
T_3 - 12.50 hrs	77.02 (8.77)	42.76 (6.52)	3.78 (1.35)	41.18	81.48 (9.02)	43.83 (6.60)	4.85 (1.44)	43.38	82.19 (9.06)	30.47 (5.48)	0 (0.70)	37.55
S.Em±	0.03	0.03	0.01		0.02	0.026	0.018		0.02	0.03	0.008	
C.D. @ 1%	0.13	0.10	0.06		0.09	0.09	0.07		0.09	0.09	0.003	
Colour X Time (C X T)												
C_1 X T_1	78.95 (8.88)	64.15 (8.00)	37.65 (6.18)	60.3	84.05 (9.17)	68.15 (8.25)	42.12 (6.53)	64.8	85.15 (9.23)	60.06 (7.75)	27.9 (5.33)	57.71
C_1 X T_2	78.45 (8.85)	60.45 (7.77)	31.10 (5.62)	56.7	83.45 (9.13)	63.06 (7.94)	36.95 (6.12)	61.2	84.25 (9.18)	55.00 (7.42)	0 (0.70)	46.42
C_1 X T_3	77.60 (8.81)	57.55 (7.58)	26.50 (5.19)	53.9	82.15 (9.06)	59.90 (7.74)	34.00 (5.87)	58.7	83.50 (9.14)	49.06 (7.00)	0 (0.70)	44.19
C_2 X T_1	78.45 (8.85)	50.05 (7.07)	0 (0.70)	42.8	82.95 (9.11)	56.00 (7.48)	24.25 (4.97)	54.4	84.00 (9.16)	38.95 (6.24)	0 (0.70)	40.98
C_2 X T_2	78.00 (8.83)	44.25 (6.65)	0 (0.70)	40.8	82.00 (9.05)	48.02 (6.93)	0 (0.70)	43.3	83.02 (9.11)	32.10 (5.67)	0 (0.70)	38.38
C_2 X T_3	77.25 (8.79)	39.95 (6.32)	0 (0.70)	39.1	81.35 (9.02)	40.00 (6.32)	0 (0.70)	40.5	82.03 (9.06)	26.11 (5.11)	0 (0.70)	36.05
C_3 X T_1	77.45 (8.80)	47.15 (6.86)	0 (0.70)	41.5	82.70 (9.09)	50.10 (7.09)	0 (0.70)	44.3	83.00 (9.11)	34.95 (5.91)	0 (0.70)	39.32
C_3 X T_2	76.95 (8.77)	43.05 (6.56)	0 (0.70)	40.0	81.95 (9.05)	46.05 (6.78)	0 (0.70)	42.7	82.02 (9.06)	31.00 (5.57)	0 (0.70)	37.68
C_3 X T_3	76.00 (8.71)	37.90 (6.15)	0 (0.70)	38.0	80.90 (8.99)	39.00 (6.24)	0 (0.70)	40.0	81.05 (9.00)	25.65 (5.06)	0 (0.70)	35.57
C_4 X T_1	78.00 (8.83)	48.15 (6.94)	0 (0.70)	42.1	82.95 (9.10)	55.12 (7.42)	23.90 (4.94)	54.0	83.85 (9.16)	39.00 (6.24)	0 (0.70)	40.95
C_4 X T_2	77.05 (8.77)	46.00 (6.78)	0 (0.70)	41.0	82.00 (9.05)	47.02 (6.85)	0 (0.70)	43.0	82.75 (9.10)	27.35 (5.23)	0 (0.70)	36.70
C_4 X T_3	76.70 (8.76)	39.15 (6.26)	0 (0.70)	38.6	80.95 (8.99)	39.65 (6.30)	0 (0.70)	40.2	81.96 (9.05)	26.00 (5.10)	0 (0.70)	35.99
C_5 X T_1	78.00 (8.83)	53.10 (7.29)	0 (0.70)	43.7	83.05 (9.11)	56.25 (7.50)	25.05 (5.05)	54.8	84.16 (9.17)	41.45 (6.44)	0 (0.70)	41.87
C_5 X T_2	77.52 (8.80)	56.20 (7.49)	0 (0.70)	44.6	82.75 (9.09)	48.05 (6.93)	0 (0.70)	43.6	83.25 (9.12)	28.95 (5.38)	0 (0.70)	37.40
C_5 X T_3	77.05 (8.77)	39.30 (6.27)	0 (0.70)	38.8	81.00 (9.00)	40.10 (6.33)	0 (0.70)	40.4	82.05 (9.06)	27.15 (5.21)	0 (0.70)	36.40
C_6 X T_1	78.60 (8.86)	57.25 (7.56)	25.95 (5.14)	53.9	84.00 (9.16)	57.05 (7.55)	25.55 (5.10)	55.5	84.46 (9.19)	42.75 (6.54)	0 (0.70)	42.40
C_6 X T_2	78.05 (8.83)	49.10 (7.00)	0 (0.70)	42.4	83.00 (9.11)	52.15 (7.22)	0 (0.70)	45.1	83.45 (9.13)	30.10 (5.48)	0 (0.70)	37.85
C_6 X T_3	77.45 (8.80)	40.00 (6.32)	0 (0.70)	39.2	81.95 (9.05)	43.35 (6.58)	0 (0.70)	41.8	82.20 (9.06)	29.10 (5.40)	0 (0.70)	37.10
C_7 X T_1	78.85 (8.88)	62.05 (7.87)	30.05 (5.53)	57.0	84.05 (9.17)	60.97 (7.81)	35.10 (5.96)	60.0	84.80 (9.21)	43.05 (6.56)	0 (0.70)	42.62
C_7 X T_2	78.15 (8.84)	54.2 (7.36)	0 (0.70)	44.1	83.30 (9.13)	53.10 (7.28)	0 (0.70)	45.5	83.65 (9.15)	37.11 (6.09)	0 (0.70)	40.26

C_7 X T_3	77.15 (8.78)	45.50 (6.74)	0 (0.70)	40.9	82.10 (9.06)	44.87 (6.70)	0 (0.70)	42.3	82.55 (9.08)	30.47 (5.50)	0 (0.70)	37.60
SE.m±	0.08	0.08	0.04		0.06	0.07	0.05		0.06	0.08	0.02	
C.D. @ 1%	0.35	0.27	0.15		0.24	0.24	0.19		0.25	0.25	0.009	

0: Wilting of flowers, Values in parentheses are indicates square root transformed values.

Conclusion

Flowers treated with blue, green and orange which were immersed for 7.5 hrs were found best with regard the colour intensity, colour distribution which results in the formation of bright coloured attractive flowers and maximum consumer acceptability.

Acknowledgement

The authors thank Department of Post Harvest technology, Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot, Karnataka, India for providing all possible facilities for present study in partial fulfilment of M. Sc research work.

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