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Value addition of candytuft (*Iberis umbellata* L.) cut flowers coloured with edible dyes

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The present investigation was conducted with a view to screen out the effect of different edible dye concentration and time duration of immersion on vase life and quality of candytuft cut flowers. The shades of colour deepened as the concentration and time of immersion were increased. Similar results were obtained in all edible dyes, without affecting physiological processes. The shades retained at the end of vase life by the inflorescences for all dyes. There was no significant difference found in the various treatments, indicating that there is no adverse significant effect of dye concentration, time of immersion and combination of both factors on the vase life and quality of cut flowers of candytuft.

Key words: Candytuft Flower, Value addition, Colouring solutions.

INTRODUCTION

All over the world, the floriculture sector is experiencing rapid changes. Due to globalization and its effect on income generation in different parts of the world resulting in per capita consumption of flowers in most countries. A produce when subjected to a change for higher monitory gains, is referred as value addition. Candytuft is an important winter annual cut flower plant. The plants are useful for massing in beds, in annual borders and edging along paths. The flowers of candytuft are used as cut flower in bouquets and flower arrangements. Flowers and their colours symbolize different human moods. The impact of colour is so tremendous in our mind that the name itself is able to draw our attention to attributes to thing that is resembled by that colour. In nature, unlike other cut flowers candytufts are found in white colour. Colouring these inflorescences with edible dyes can really enhance the value of these flowers and helps the farmers in earning more from their produce. It can also provide a great variety of colours for aesthetic beautification. The present investigation was undertaken to screen out the effect of different edible dye concentration and time duration of immersion on vase life and quality of candytuft cut flowers.

MATERIALS AND METHODS

The present investigation was carried out in month of February-2005 at the Research Laboratory, Department of Floriculture and Landscaping, ASPEE College of Horticulture and Forestry, N.A.U., Navsari. Seven different edible dyes were used as Colouring agents *viz.*, Yellow, Orange Red, Falsa Blue, Apple Green, Pink Rose, Tomato Red and Kalakhatta at concentration of 0.5% dye (C_1), 1.0% dye (C_2) and 1.5% dye (C_3). Six different time of immersion were taken at half an hour interval that is 0.5 hr (D_1), 1.0 hr (D_2), 1.5hrs (D_3), 2.0 hrs (D_4), 2.5 hrs (D_5) and 3.0 hrs (D_6). In the first part, the observations were taken on changes in weight (%) of flowers, total solution uptake (ml), useful vase life and total vase life. In second part, observations on colour shades obtained at the time interval of 30 min. in three concentrations as well as shades retained at the end of vase life were recorded. Quantitative observations on total vase life and cost benefit ratio were also recorded. The colour shades obtained and retained were compared visually with Ridgeway Colour Charts. The data recorded on all quantitative parameters were statistically analyzed as per Completely Randomized Design with Factorial Concept. Treatments were repeated thrice.

RESULTS AND DISCUSSION

Colour shades obtained:

it was observed From the Table 1, 2, 3, 4, 5, 6 and 7, that the colour shades obtained on inflorescences were directly dependent on the dye concentration and the time of immersion. It is seen that the treatment D_1C_1 gave the lightest shades of flowers (Light Yellow) and the treatment D_6C_3 gave darkest shade (Yellow-2) for Yellow dye. The shades of colour deepened as the concentration and time of immersion were increased. Similar results were

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Table. 1: Effect of Yellow dye concentration and time of immersion on colour shades obtained and retained in flowers.

Treatments	Colour obtained during experiment	Colour retained at the end of vase life
Control	White	White
D_1C_1	Light Yellow	Light Yellow
D_1C_2	Light golden rod Yellow	Light Yellow
D_1C_3	Light Yellow-1	Light golden rod Yellow
D_2C_1	Lemon Chiffon-1	Light Yellow
D_2C_2	Light golden rod Yellow	Light Yellow
D_2C_3	Yellow	Light golden rod Yellow
D_3C_1	Light golden rod Yellow	Light Yellow
D_3C_2	Yellow	Light Yellow-1
D_3C_3	Yellow-1	Lemon Chiffon-1
D_4C_1	Light golden rod Yellow	Light Yellow-1
D_4C_2	Yellow	Lemon Chiffon-1
D_4C_3	Yellow-1	Lemon Chiffon-1
D_5C_1	Light Yellow	Light golden rod yellow
D_5C_2	Yellow-1	Yellow
D_5C_3	Yellow-1	Yellow
D_6C_1	Yellow	Light golden rod yellow
D_6C_2	Yellow-1	Yellow
D_6C_3	Yellow-2	Yellow-1

Table. 2: Effect of Orange Red dye concentration and time of immersion on colour shades obtained and retained in flowers.

Treatments	Colour obtained during experiment	Colour retained at the end of vase life
Control	White	White
D_1C_1	Light Coral-1	Light Coral
D_1C_2	Light Coral-1	Light Coral
D_1C_3	Coral-1	Light Coral-1
D_2C_1	Coral	Light Coral
D_2C_2	Coral-1	Light Coral-1
D_2C_3	Coral-1	Light Coral-1
D_3C_1	Coral-1	Light Coral-1
D_3C_2	Coral-1	Light Coral-1
D_3C_3	Coral-2	Coral
D_4C_1	Coral-2	Light Coral-1
D_4C_2	Coral-2	Coral
D_4C_3	Coral-3	Coral
D_5C_1	Coral-2	Coral
D_5C_2	Coral-2	Coral-1
D_5C_3	Coral-3	Coral-2
D_6C_1	Coral-3	Coral-1
D_6C_2	Indian Red-1	Coral-1
D_6C_3	Indian Red-1	Coral-2

Table. 3: Effect of Falsa Blue dye concentration and tim and retained in flowers.

Treatments	Colour obtained during experiment	Colour retained at the end of vase life
Control	White	White
D_1C_1	Light Sky Blue	Light Sky Blue
D_1C_2	Light Sky Blue-1	Light Sky Blue
D_1C_3	Light Sky Blue-2	Light Sky Blue-1
D_2C_1	Light Sky Blue-1	Light Sky Blue
D_2C_2	Light Sky Blue-2	Light Sky Blue-1
D_2C_3	Light Sky Blue-2	Light Steel Blue-1
D_3C_1	Light Sky Blue-1	Light Sky Blue-1
D_3C_2	Light Sky Blue-2	Light Sky Blue-2
D_3C_3	Sky Blue-1	Light Steel Blue-2
D_4C_1	Light Sky Blue-1	Light Sky Blue-2
D_4C_2	Sky Blue-1	Light Sky Blue-2
D_4C_3	Sky Blue-2	Sky Blue-1
D_5C_1	Sky Blue-2	Light Sky Blue-2
D_5C_2	Deep Sky Blue-1	Sky Blue-1
D_5C_3	Deep Sky Blue-2	Sky Blue-2
D_6C_1	Deep Sky Blue-2	Sky Blue-1
D_6C_2	Steel Blue-1	Deep Sky Bluue-1
D_6C_3	Steel Blue-2	Deep Sky Bluue-2

Table. 4: Effect of Apple Green dye concentration and time of immersion on colour shades obtained and retained in flowers.

Treatments	Colour obtained during experiment	Colour retained at the end of vase life
Control	White	White
D_1C_1	Light Green Yellow	Light Green Yellow
D_1C_2	Light Green Yellow	Light Green Yellow
D_1C_3	Light Green Yellow	Light Green Yellow
D_2C_1	Light Green Yellow	Light Green Yellow
D_2C_2	Green Yellow	Light Green Yellow
D_2C_3	Light Green Yellow	Green Yellow
D_3C_1	Green Yellow	Light Green Yellow
D_3C_2	Green Yellow	Green Yellow
D_3C_3	Yellow Green	Green Yellow
D_4C_1	Light Green	Green Yellow
D_4C_2	Green Yellow	Light Green
D_4C_3	Green Yellow-1	Light Green
D_5C_1	Light Green	Light Green
D_5C_2	Green Yellow-1	Green Yellow-1
D_5C_3	Yellow Green-1	Yellow Green-1
D_6C_1	Yellow Green	Green Yellow-1
D_6C_2	Yellow Green	Yellow Green
D_6C_3	Yellow Green-1	Yellow Green

Table. 5: Effect of Pink Rose dye concentration and time of immersion on colour shades obtained and retained in flowers.

Treatments	Colour obtained during experiment	Colour retained at the end of vase life
Control	White	White
D1C1	White	White
D1C2	White	White
D1C3	Pink	White
D2C1	Pink	White
D2C2	Light Pink	Pink
D2C3	Pink-1	Pink
D3C1	Pink	Pink
D3C2	Light Pink	Pink
D3C3	Pink-1	Light Pink
D4C1	Pink-1	Light Pink
D4C2	Pink-2	Light Pink
D4C3	Pink-2	Pink-1
D5C1	Pink-1	Light Pink
D5C2	Pink-2	Pink-1
D5C3	Light Pink-1	Light Pink-1
D6C1	Pink-2	Light Pink
D6C2	Light Pink-1	Pink-1
D6C3	Light Pink-2	Light Pink-1

Table. 6: Effect of Tomato Red dye concentration and time of immersion on colour shades obtained and retained in flowers.

Treatments	Colour obtained during experiment	Colour retained at the end of vase life
Control	White	White
D_1C_1	Pink-1	Pink
D_1C_2	Coral-1	Pink
D_1C_3	Coral-1	Pink-1
D_2C_1	Pink-1	Pink-1
D_2C_2	Pale Violet Red	Pink-1
D_2C_3	Indian Red-1	Coral-1
D_3C_1	Coral-1	Coral-1
D_3C_2	Indian Red-1	Coral-1
D_3C_3	Indian Red-1	Pale Violet Red
D_4C_1	Indian Red-1	Coral-1
D_4C_2	Indian Red-1	Coral-1
D_4C_3	Indian Red-2	Pale Violet Red
D_5C_1	Indian Red-2	Pale Violet Red
D_5C_2	Indian Red-2	Pale Violet Red
D_5C_3	Orange Red-1	Indian Red-1
D_6C_1	Indian Red-2	Pale Violet Red
D_6C_2	Orange Red-1	Indian Red-1
D_6C_3	Orange Red-1	Indian Red-2

Table No. 7: Effect of Kalakhatta dye concentration and time of immersion on colour shades obtained and retained in flowers.

Treatments	Colour obtained during experiment	Colour retained at the end of vase life
Control	White	White
D_1C_1	White	White
D_1C_2	White	White
D_1C_3	Pink	Pink
D_2C_1	Pink	White
D_2C_2	Pink	Pink
D_2C_3	Pink-1	Pink
D_3C_1	Pink	Pink
D_3C_2	Pink-1	Pink
D_3C_3	Pink-2	Pink-1
D_4C_1	Pink-1	Pink-1
D_4C_2	Pink-2	Pink-1
D_4C_3	Pink-2	Pink-1
D_5C_1	Pink-1	Pink-1
D_5C_2	Pink-2	Pink-2
D_5C_3	Light Pink-1	Pink-2
D_6C_1	Pink-2	Pink-1
D_6C_2	Rosy Brown-1	Light Pink-1
D_6C_3	Rosy Brown-2	Rosy Brown-1

obtained in all edible dyes. The lightest shades were obtained in D_1C_1 for Orange Red dye and Falsa Blue Dye (Light Coral-1 and Light Sky Blue respectively) while darkest shades were obtained in D_6C_3 (Indian Red-1 and Steel Blue-2 respectively). The lightest shade of Apple Green dye was recorded in D_1C_1 and D_1C_2 (Light Green Yellow) while D_4C_3, D_5C_3 and D_6C_3 gave darkest shade (Yellow Green-1). In the dye, Pink Rose, the lightest shade given by D_1C_3, D_2C_1 and D_3C_1 (Pink) and the darkest shade (Light Pink-2) was obtained in D_6C_3. Similarly in Tomato Red dye D_1C_1 and D_2C_1 gave lightest shade (Pink-1) and D_5C_3, D_6C_2 and D_6C_3 gave darkest shade (Orange Red-1) while in case of Kalakhatta dye light shade was started to obtained with treatments D_1C_3, D_2C_1, D_2C_2 and D_3C_1 (Pink) and darkest shade was given by D_6C_3 (Rosy Brown-3). The higher time of immersion (3.0 hrs) and maximum concentration (1.5% dyes) allowed more dye to be translocated up to the central buds of an inflorescence without affecting physiological processes.

Colour shades retained at the end of vase life:
The shades retained at the end of vase life by the inflorescences for all dyes are presented in Table 1, 2, 3, 4, 5, 6 and 7**.** It is observed that initial treatments showed lightest shades of dyes. The lower concentration (0.5% dye) and minimum time of immersion showed lightest shades of dyes viz., Yellow (Light Yellow), Orange Red (Light Coral), Falsa Blue (Light Sky Blue-1), Apple Green (Light Green Yellow) and Tomato Red (Pink). There was no colour retention observed in Pink Rose Dye and Kalakhatta dye at lower concentration and minimum time of immersion. The darkest shades of all edible dyes were retained in D_6C_3 (Yellow-1, Coral-2, Deep Sky Blue-2, Yellow Green, Pink-2, Indian Red-2 and Rosy Brown-2, respectively) but the shades were tanning than the time of experiment conducted. That can be attributed to higher dye concentration absorbed by flowers. The higher time of immersion (3.0 hrs) and maximum concentration (1.5% dyes) allowed more dye to be translocated up to the central buds of an inflorescence.

Effect of colouring on vase life of cut candytuft:
The vase life of flowers of candytuft was recorded when the fresh open flowers had withered in inflorescences. There was no significant difference found in the various treatments, indicating that there is no adverse significant effect of dye concentration, time of immersion and combination of both factors on the vase life and quality of cut flowers of candytuft (Table. 8& 9).

No significant ill effect was observed. The reason may be the dye is not toxic to cell metabolism neither it creates any barrier in movement of water and food materials. It might not affect the osmotic pressure of the cell thus not altering cell turgidity.

Imparting different shades of blue, red, scarlet, rose and yellow by dipping tuberose spikes in the different stains, was made possible by Sambandhamurthy and Appavu (1980). Sangama (2002) also got the different colours in tuberose using different stains. Vinodkumar *et al*. (2003) in their series of experiment with five colouring agents induced colour successfully without affecting vase life of tuberose. Similarly Dhaduk and Naik (2003) found the same results in tuberose cv. Single Local and Double Local using carmozine red, Tetrazine yellow and Falsa blue. Patil and Dhaduk (2005) proved the same results in Candytuft cut flowers.

Cost benefit ratio :
The highest C.B.R. (1:1.63) was obtained for treatment C_1 (0.5%) and C_2 (0.1%) in all edible dyes i.e. Yellow, Orange Red, Falsa Blue, Apple Green, Pink Rose, Tomato Red and Kalakhatta (Table. 10). The C.B.R. for C_3 (1.5%) was less as compared to C_1 (0.5%) and C_2 (1.0%) but for quicker results 1.0 hr of

Table. 8: Effect of the dye concentration on the vase life of candytuft cut flowers.

Treatments	T_1- Yellow	T_2-Orange Red	T_3-Falsa Blue	T_4- Apple Green	T_5- Pink Rose	T_6- Tomato Red
C_1 (0.5% dye)	4.68	4.90	4.88	4.93	4.55	4.77
C_2 (1.0% dye)	4.69	4.93	4.90	4.96	4.63	4.89
C_3 (1.5% dye)	4.73	5.04	4.95	5.10	4.68	4.97
SE M±	0.10	0.19	0.18	0.19	0.11	0.19
CD at 5%	NS	NS	NS	NS	NS	NS
CV%	0.20	0.36	0.35	0.37	0.23	0.38

Table. 9: Effect of time of immersion on the vase life of candytuft cut flowers.

Treatments	T_1-Yellow	T_2-Orange Red	T_3-Falsa Blue	T_4- Apple Green	T_5- Pink Rose	T_6- Tomato Red	T_7- Kalakhatta
D_1 (0.5hr)	4.71	4.95	4.92	4.97	4.61	4.83	4.54
D_2 (1.0hr)	4.72	4.98	4.92	4.98	4.54	4.91	4.51
D_3 (1.5hrs)	4.71	4.95	4.92	4.98	4.64	4.90	4.54
D_4 (2.0hrs)	4.69	5.01	4.88	5.01	4.56	4.85	4.53
D_5 (2.5hrs)	4.69	4.92	4.91	5.00	4.68	4.88	4.58
D_6 (3.0hrs)	4.70	4.95	4.93	5.03	4.70	4.90	4.60
SE M±	0.14	0.27	0.26	0.28	0.16	0.28	0.19
CD at 5%	NS	NS	NS	NS	NS	NS	NS
CV%	0.20	0.36	0.35	0.37	0.23	0.38	0.27

Table.10: Economics of colouring of flowers with edible dye.

Dye Concentration	Cost of dye (Rs./ Flowers)	Cost of flower (Rs./ Flower)	Total Input (Rs./ Flower)	Total Income (Rs./Flower)	Net realization (Rs./Flower)	C.B.R.
C_1 (0.5%)	0.006	0.5	0.51	0.83	0.32	1:1.63
C_2 (1.0%)	0.012	0.5	0.51	0.83	0.32	1:1.63
C_3 (1.5%)	0.018	0.5	0.51	0.83	0.31	1:1.60

immersion and higher concentration of C_3 (1.5 %) can be used for dyeing the flowers without affecting the quality and vase life of cut flowers of candytuft. So, the flowers will reach to the market the same day of harvesting.

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