Research Article

Value Addition of Tuberose (*Polianthes tuberosa* L.) cv. Calcutta Double Cut Flower by Colouring with Edible Dyes

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Abstract

Tuberose (*Polianthes tuberosa* L.) is a popular cut flower having white coloured fragrant blooms. In order to increase the value and appeal of flower along with fragrance, the spikes of tuberose can be tinted with artificial colours. Due to single colour it has fewer acceptances to the people. So, tinting or artificial colouring of tuberose may be a potential value addition venture. An investigation is carried out to study the artificial colouring of tuberose flowers *cv*. Calcutta Double to identify the suitable food dyes, its doses and developmental stage of flower buds making the flowers more acceptable to the consumers and enhancing vase life. The harvested tuberose spikes were dipped in the colouring solutions containing food dyes *viz.* Blue, Apple green, Tomato red, Orange red, Lemon yellow and Rose pink at a concentration of 2%, 4% and 6% for all. The study revealed that the spikes at 2-buds flowering stage subjected to tinting with the food dyes Lemon yellow proved to be the best from the consumer's preference point of view. A 6% dyes recorded better colour uptake as well as colour intensity than the 2% dyes but 2% dyes performed the best with respect to more vase life.

Keywords: Artificial colouring, Calcutta double, Value Addition, Vase life

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Introduction

Flowers have immense use in human life due to their aesthetic beauty, diverse form, texture, colour and fragrance. All over the world, floriculture sector is experiencing significant changes on competitive basis. Due to globalization and its impact on income generation in different parts of the world, the per capita consumption of flowers in most of the countries is increasing day by day. India is one of the emerging countries in the floriculture sector in the world. Tuberose *(Polianthes tuberosa L.*) is a perennial plant belongs to the family Agavaceae and is native of Mexico. Because of its magnificent inflorescence, shape, size and keeping quality, it occupies prime position both in domestic and international market. It is used in flower arrangements and due to its excellent fragrance it is also used as loose flower in perfume industry. The elongated spikes produces cluster of fragrant waxy white flowers that bloom from bottom towards top of the spikes unlike other cut flowers. The tuberose flowers are found only in white colour with an intensity of creaminess. Artificial colouring of spikes is fetching a premium price in the market. The value addition technique like colouring of white flowers can add value up to 5 to 10 times [1]. Such type of artificial colouring is done by using food colours. Certified synthetic food colours are less expensive and lead to minimum health hazards by imparting an intense and uniform colour. Vase life of tinted flowers is also an important consideration, which varies with the dyes used, its concentration and also with the stage of harvest. Some chemicals prolong the vase life and some chemicals retards the vase life of flowers. Food dyes are also of chemicals in nature and their role in vase life alteration is unknown [2]. Tinting or artificial colouring of tuberose may be a potential value addition venture. An investigation is carried out to study the artificial colouring of tuberose flowers cv. Calcutta Double to identify the suitable food dyes and its doses. Developmental stage of flower buds making the flowers more acceptable to the consumers and enhancing vase life.

Materials and Methods

The study was conducted at research laboratory of Division of Horticulture & Postharvest Technology, Institute of Agriculture, Visva-Bharti, Sriniketan, Bolpur during the period of September to October 2014. Flowers were harvested in the morning between 8.00 to 9.00 am, from farmer field with 2-3 flowers open in each spike. To prepare 2, 4, and 6 percent of colour solution powder of Blue, Apple green, Lemon yellow, Tomato red, Orange red and Rose

pink colour of 2g, 4g and 6g were mixed in 100ml of filtrated water. The uniform spikes with 55cm stalk length with 2-3 florets opening with 3 spikes were put in conical flask containing 100ml of edible dyes solutions. Spikes were removed from colour solution after 6 hours immediately after it put in vase solution. For preparing 3 per cent sugar solution about 30g sugars was added to 1 litre of distilled water. Citric acid solution of 350ppm was prepared by dissolving 350mg of citric acid in 1 litre of water. Flasks of 500ml capacity were used. 200ml of filtered water used for vase solution. Treatment details of food dyes used in experiment consists of 19 treatments and 3 replication. T_0= Control, T_1= 2% Blue, T_2= 4% Blue, T_3= 6% Blue, T_4= 2% Apple green, T_5= 4% Apple green, T_6= 6% Apple green, T_7= 2% Lemon yellow, T_8= 4% Lemon yellow, T_9= 6% Lemon yellow, T_{10}= 2% Tomato red, T_{11}= 4% Tomato red, T_{12}= 6% Tomato red, T_{13}= 2% Orange red, T_{14}= 4 % Orange red, T_{15}= 6% Orange red, T_{16}= 2% Rose pink, T_{17}= 4% Rose pink and T_{18}= 6% Rose pink. Different observation like colour solution uptake, amount of water absorbed during tinting, effect of colour on spike weight, flower length, flower diameter, number of flower open and number of flower drop were taken. The diameter of the fourth pair of floret in the spikes from the base was recorded with vernier callipers daily. The colour obtained and the colour retention by the spikes was recorded by using RHS colour chart. The wilting of fifty percent of florets in the spikes was taken as an index of end of vase life of the flower spikes. The vase solutions were prepared at the beginning of experiment. The data were analyzed completely randomized design (CBD). The obtained featured values, as the average, were statistically verified by means of variance analysis method (ANOVA). Differences among treatments were considered significant only when $P \leq 0.05$.

Results and Discussion

Colour solution uptake (ml/spike)

The different food dyes showed significant difference for uptake of colour solution (**Table 1**). Maximum amount of colour solution absorbed for Apple green food dye (9.61ml/spike) at 6% in T_6. Minimum colour solution absorption found for Tomato red (0.71ml/spike) in T_{12} at 2% food dye tinted spikes. Maximum colour absorption occurs for 6% food dyes and minimum for 2% for all dyes. As the concentration increased, more edible dye was available to the flowers due to increased amount of edible dye absorption. Reported similar findings in their experiment and mentioned for increase in colour shade intensity with increase in concentration of colours [3-5].

Table 1 Amount of colour solution absorbed during tinting (ml/spike)

Treatments		Amount of colour solution taken
T_1	2% Blue	8.22
T_2	4% Blue	8.34
T_3	6% Blue	8.50
T_4	2% Apple green	9.27
T_5	4% Apple green	9.37
T_6	6% Apple green	9.61
T_7	2% Lemon yellow	4.35
T_8	4% Lemon yellow	5.22
T_9	6% Lemon yellow	5.41
T_{10}	2% Tomato red	0.75
T_{11}	4% Tomato red	0.66
T_{12}	6% Tomato red	0.71
T_{13}	2% Orange red	6.37
T_{14}	4 % Orange red	6.76
T_{15}	6% Orange red	6.29
T_{16}	2% Rose pink	7.30
T_{17}	4% Rose pink	7.42
T_{18}	6% Rose pink	7.27
S.E. (±m)		0.11
C.D. at 5%		0.32

Amount of vase solution absorbed during tinting (ml/spike)

The different food dyes showed significant difference for uptake of water (**Table 2**). Maximum amount of colour solution absorbed for Lemon yellow food dye (14.09ml/spike) in T_6 at 6%. Minimum water absorption found for Tomato red (6.59ml/spike) in T_{12} at 6% food dye tinted spikes on first day. Uptake of water leading to flaccidity and deplasmolysis of cells in turn leading to reduced size of cells and that of petals. There may be adequate availability of sucrose which might have facilitated higher rate of respiration necessary for cell division, cell expansion and providing carbon skeleton for the tissue structure contributing to floret expansion, formation of cell constituents and thus caused increased floret size [6].

Table 2 Effect of tinting treatments on volume of water uptake (ml) in tuberose

Treatments		2nd day	3rd day	4th day	5th day	6th day	7th day	8th day
T_0	Control	8.80	7.00	4.54	3.42	3.20	1.04	0.74
T_1	2% Blue	10.50	7.22	5.46	4.24	2.17	-	-
T_2	4% Blue	11.00	8.10	5.62	3.61	1.67	-	-
T_3	6% Blue	9.88	7.30	5.18	3.53	1.61	-	-
T_4	2% Apple green	11.38	9.13	7.11	6.48	5.48	3.08	2.10
T_5	4% Apple green	11.08	8.59	6.57	6.48	5.26	3.22	2.28
T_6	6% Apple green	11.46	9.20	6.30	6.23	5.07	3.14	2.19
T_7	2% Lemon yellow	12.98	10.15	8.45	5.49	4.03	2.10	-
T_8	4% Lemon yellow	13.21	10.31	8.14	5.26	3.46	1.84	-
T_9	6% Lemon yellow	14.09	12.02	7.83	5.17	4.28	2.18	-
T_{10}	2% Tomato red	6.87	6.39	3.31	-	-	-	-
T_{11}	4% Tomato red	6.69	5.95	3.22	-	-	-	-
T_{12}	6% Tomato red	6.59	6.19	2.72	-	-	-	-
T_{13}	2% Orange red	8.27	7.21	6.24	2.48	-	-	-
T_{14}	4 % Orange red	7.62	6.59	5.71	2.84	-	-	-
T_{15}	6% Orange red	8.29	6.26	5.32	2.51	-	-	-
T_{16}	2% Rose pink	9.53	7.87	6.72	5.11	3.73	-	-
T_{17}	4% Rose pink	9.75	7.91	6.38	4.71	3.60	-	-
T_{18}	6% Rose pink	10.31	8.01	5.50	4.75	3.68	-	-
S.E. (±m)		0.20	0.13	0.12	0.14	0.07	0.05	0.03
C.D. at 5%		0.57	0.39	0.34	0.39	0.21	0.15	0.09

Effect of tinting treatments on spike weight (g/spike)

Spike weight showed the significant difference for different food dyes from day one to eight days. The spike weight increased from first to third days and decreased from 4th days. The spike weight was increased maximum in spikes which were treated with, Lemon yellow 55.33g/spike on 3rd days (**Table 3**) whereas the minimum spike weight was gained in control 43.33g/spike. Spike weight showed the significant difference for concentration of food dyes treatments on fourth to eight days. The maximum spike weight was decreased at 6% food dyes treatment whereas minimum spike weight decreased in control. The reduced spike weight might be due to higher concentration of colour that effect on the cell metabolism when kept in the edible dye solution for 6% concentration. Maximum spike weight was decreased in higher concentration, where the spikes were losing their weight by dropping more number of florets.

Effect of tinting treatments on flower length and flower diameter (cm)

The different food dyes showed significant difference for flower length (**Table 4**). Maximum length achieved by Lemon yellow food dye (5.17cm) in T_9 at 6% on second day. Minimum flower length gained by Tomato red (4.47cm) in T_{12} at 6% food dye tinted spikes on 6th day. The different food dyes showed significant difference for flower length. Maximum flower diameter achieved by Rose pink food dye (3.8cm) in T_{18} at 6%. Lowest flower length gained by Orange red (3.26cm) in T_{12} at 6 % food dye. Flower length and floret diameter increased first 2 days after that it decreased. The similar results were observed by [7] on postharvest quality of tuberose spikes as affected by colouring agents and storage. Flower length was an important quality parameter when flowers were kept for interior decoration it marked the environment pleasant. The information regarding the longevity and keeping quality of tuberose flowers was very meager and authors were not aware of any study regarding the improvement of fragrance by a fungicidal treatment.

Table 3 Effect of tinting treatments on spike weight (g/spike)

Treatments		0th day	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day
T_0	Control	39.00	41.00	41.33	43.33	41.17	36.00	34.00	31.00	29.00
T_1	2% Blue	41.33	43.33	46.33	47.33	45.33	37.75	34.10	-	-
T_2	4% Blue	40.00	43.00	46.00	47.16	45.50	37.25	33.83	-	-
T_3	6% Blue	40.33	42.17	45.00	46.43	45.05	37.25	33.67	-	-
T_4	2% Apple green	40.17	44.13	48.22	50.00	48.67	46.00	42.16	38.22	33.50
T_5	4% Apple green	40.99	45.13	49.16	52.81	51.23	47.02	42.24	38.00	32.48
T_6	6% Apple green	40.73	44.76	48.90	50.94	49.17	45.83	41.50	37.10	32.25
T_7	2% Lemon yellow	41.00	45.88	52.38	54.77	52.40	44.33	39.83	34.77	-
T_8	4% Lemon yellow	40.33	45.03	50.77	53.71	51.42	43.33	40.00	34.08	-
T_9	6% Lemon yellow	42.00	46.13	52.30	55.33	53.17	43.30	38.53	34.27	-
T_{10}	2% Tomato red	42.00	43.00	44.50	44.97	40.42	-	-	-	-
T_{11}	4% Tomato red	39.00	41.16	44.63	45.00	39.33	-	-	-	-
T_{12}	6% Tomato red	42.33	43.08	44.50	44.50	40.17	-	-	-	-
T_{13}	2% Orange red	41.00	42.50	46.00	46.72	40.50	36.00	-	-	-
T_{14}	4 % Orange red	41.67	43.50	44.70	45.84	41.67	36.50	-	-	-
T_{15}	6% Orange red	41.83	43.88	44.97	45.50	39.33	35.50	-	-	-
T_{16}	2% Rose pink	41.33	43.97	47.03	47.70	42.00	38.17	33.30	-	-
T_{17}	4% Rose pink	42.33	45.07	46.70	47.16	41.67	37.50	33.33	-	-
T_{18}	6% Rose pink	42.47	45.09	46.67	47.27	41.83	37.83	34.00	-	-
S.E. (±m)		0.62	0.65	0.62	0.69	0.63	0.62	0.44	0.23	0.26
C.D. at 5		1.76	1.82	1.76	1.96	1.81	1.78	1.25	0.67	0.74

Table 4 Effect of tinting treatments on flower length (cm) and flower diameter (cm)

Treatments		0th day		1st day		2nd day		3rd day		4th day	
		L	D	L	D	L	D	L	D	L	D
T_0	Control	4.17	2.69	4.19	3.04	4.32	3.39	4.12	3.05	2.51	2.32
T_1	2% Blue	4.32	2.63	4.38	3.11	4.64	3.30	4.12	2.93	3.25	2.48
T_2	4% Blue	4.33	2.71	4.38	2.93	4.68	3.29	4.11	2.90	3.22	2.49
T_3	6% Blue	4.36	2.66	4.39	3.07	4.61	3.28	4.12	2.90	3.07	2.50
T_4	2% Apple green	4.31	2.63	4.60	2.94	4.82	3.39	4.36	3.15	3.52	2.81
T_5	4% Apple green	4.34	2.64	4.50	2.95	4.78	3.44	4.41	3.08	3.54	2.72
T_6	6% Apple green	4.30	2.64	4.61	3.02	4.80	3.46	4.43	3.07	3.57	2.77
T_7	2% Lemon yellow	4.26	2.58	4.81	3.28	5.13	3.61	4.35	3.18	3.72	2.51
T_8	4% Lemon yellow	4.27	2.59	4.76	3.00	5.16	3.61	4.62	3.17	3.61	2.54
T_9	6% Lemon yellow	4.29	2.61	4.70	3.10	5.17	3.62	4.38	3.15	3.67	2.52
T_{10}	2% Tomato red	4.29	2.67	4.29	3.14	4.52	3.48	3.83	3.08	2.59	2.42
T_{11}	4% Tomato red	4.19	2.71	4.25	3.04	4.47	3.51	3.25	3.11	2.50	2.38
T_{12}	6% Tomato red	4.14	2.59	4.21	3.13	4.45	3.51	3.56	3.08	2.46	2.38
T_{13}	2% Orange red	4.17	2.64	4.29	3.14	4.63	3.33	4.21	2.96	2.47	2.31
T_{14}	4 % Orange red	4.25	2.59	4.42	3.09	4.61	3.31	3.99	2.86	2.64	2.29
T_{15}	6% Orange red	4.27	2.59	4.48	3.09	4.59	3.26	3.82	2.91	2.41	2.25
T_{16}	2% Rose pink	4.27	2.62	4.56	3.13	4.72	3.78	3.81	3.21	3.09	2.57
T_{17}	4% Rose pink	4.35	2.63	4.56	3.07	4.74	3.76	3.77	3.32	3.09	2.53
T_{18}	6% Rose pink	4.34	2.65	4.57	3.07	4.75	3.84	4.29	3.34	3.28	2.57
S.E. (±m)		0.04	0.02	0.03	0.05	0.03	0.02	0.15	0.02	0.04	0.05
C.D. at 5%		0.10	0.05	0.09	0.15	0.09	0.06	0.44	0.06	0.12	0.13

L= Length, D= Diameter

Effect of tinting treatments on number of flowers open

The counting of flower opening started after harvesting of flower till fourth days because maximum no of flower opened during these days and the dropping of flower was almost negligible up to 3 days and flower dropping start from 4th days. The opening of flower after 4th days was almost negligible. Number of florets opened per day showed the significant difference for different food dyes from one to fourth day, where the maximum number of florets was

opened in Apple green, Pink rose, Orange red, Lemon yellow treated spikes, whereas minimum opened in Blue edible dye (**Table 5**). Mean number of maximum florets was open in Apple green tinted spikes, whereas minimum number of florets opened in Blue food dye. The biological activity of artificial colorants has renewed following the claims that a red food dye was carcinogenic and that some food additives and colorants in particular might be responsible for producing behavioural changes and learning disabilities in children e.g., hyperkinesias, minimal brain disfunction [8].

Table 5 Effect of tinting treatments on number of flowers open

Treatments		0th day	1st day	2nd day	3rd day	4th day
T_0	Control	1.67	3.33	4.00	4.00	2.33
T_1	2% Blue	1.33	2.33	4.33	3.67	2.67
T_2	4% Blue	1.67	2.67	4.33	3.67	3.00
T_3	6% Blue	1.67	2.33	3.33	3.33	2.33
T_4	2% Apple green	1.67	4.33	7.67	5.67	3.33
T_5	4% Apple green	1.67	4.33	7.67	5.33	3.00
T_6	6% Apple green	1.33	4.33	7.67	6.33	4.33
T_7	2% Lemon yellow	1.33	3.33	4.33	3.33	3.67
T_8	4% Lemon yellow	1.33	3.33	4.67	3.67	3.00
T_9	6% Lemon yellow	1.33	3.33	4.00	4.00	3.33
T_{10}	2% Tomato red	1.33	3.67	5.57	4.33	3.00
T_{11}	4% Tomato red	1.67	3.33	5.67	4.67	3.00
T_{12}	6% Tomato red	1.67	3.33	5.33	4.00	3.33
T_{13}	2% Orange red	1.67	4.67	5.67	5.67	3.33
T_{14}	4 % Orange red	2.00	4.67	6.00	4.67	3.33
T_{15}	6% Orange red	1.67	4.67	5.67	4.33	3.33
T_{16}	2% Rose pink	1.33	3.67	7.00	4.33	3.67
T_{17}	4% Rose pink	1.67	3.67	6.67	4.67	3.00
T_{18}	6% Rose pink	1.33	3.67	6.67	6.00	3.33
S.E. (±m)		0.37	0.33	0.30	0.36	0.34
C.D. at 5%		NS	0.95	0.87	1.03	1.09

Table 6 Effect of tinting treatments on number of flowers drops

Treatments		4th day	5th day	6th day	7th day	8th day
T_0	Control	0.34	2.70	3.70	4.57	6.67
T_1	2% Blue	0.34	2.70	3.66	-	-
T_2	4% Blue	0.68	3.34	3.68	-	-
T_3	6% Blue	1.00	3.40	3.79	-	-
T_4	2% Apple green	1.34	2.38	3.39	5.52	6.67
T_5	4% Apple green	1.35	2.55	3.52	5.70	6.67
T_6	6% Apple green	1.38	2.70	3.62	5.70	7.33
T_7	2% Lemon yellow	1.41	3.69	5.36	6.49	-
T_8	4% Lemon yellow	1.68	3.70	5.65	7.34	-
T_9	6% Lemon yellow	2.00	4.08	5.63	7.77	-
T_{10}	2% Tomato red	4.04	-	-	-	-
T_{11}	4% Tomato red	4.22	-	-	-	-
T_{12}	6% Tomato red	4.75	-	-	-	-
T_{13}	2% Orange red	1.69	5.04	-	-	-
T_{14}	4 % Orange red	1.70	5.15	-	-	-
T_{15}	6% Orange red	1.72	5.49	-	-	-
T_{16}	2% Rose Pink	1.39	3.68	6.40	-	-
T_{17}	4% Rose Pink	1.36	3.70	6.68	-	-
T_{18}	6% Rose Pink	1.50	3.72	7.00	-	-
SE(±m)		0.03	0.06	0.05	0.05	0.15
C.D. at 5%		0.08	0.18	0.16	0.12	0.44

Effect of tinting treatments on number of flowers drops

Number of florets dropping per day showed the significant difference for different food dyes from fourth to seventh days. The maximum number of florets was dropped in 4th days on Orange red was 4.75 flower/spike (**Table 6**) whereas minimum dropped in control (0.34 flower/spike). The florets in Blue edible dye treated spikes wilted but not dropped might be toxic for cell metabolism in the applied treatments and affected the osmotic pressure of the cells thus altering the cell turgidity. Also this Orange red edible dye might have created blockage during translocation in vascular vessels of the spikes. The different concentrations of food dyes treatments showed significant difference for florets dropping on fourth days. Maximum florets dropping found in 6% concentration and minimum found in control. Flower dropping was more found in higher concentration. The Maximum florets dropping might be due to toxic effect on the cell metabolism when kept in the edible dye solution 6% concentration. Flower dropping was more found in higher concentration where the spikes were losing their weight and decreased the vase life. From [9] reported that tetrazine and carminozine affect adversely and alter biochemical markers in vital organs e.g. Liver and kidney not only at higher dose also at low doses.

Figure 1 From left to right flowers colour were Blue, Lemon yellow, Apple green, Tomato red, Orange red and Rose pink

Conclusion

The study revealed that the spikes at 2-3 buds flowering stage subjected to tinting with the food dye Lemon yellow proved to be the best from the consumer's preference point of view. A 6% dye recorded better colour uptake as well as colour intensity than the 2% dye but 2% dye performed the best with respect to more vase life.

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References

[1] Mekala, P., Ganga, M. and Jawaharlal, M. 2012. Artificial colouring of tuberose flowers for value addition. South Indian Horticulture, 60: 216-223.

[2] Jain, R., Janakiram, T. and Kumawat, G. L. 2015. Studies on post-harvest attributes of tuberose (Polianthes tuberosa) cultivars as influenced by tinting with edible colours. Current Horticulture, 3(2): 18–24.

[3] Sambandhamurthy, S. and Appavu, K. 1980. Effect of the chemicals on the colouring of tuberose (Polyantha tuberosa L.). National seminar on production technology of Horticultural crops. South Indian Horticulture, 7(2): 103-104.

[4] Patil, S. D. and Dhaduk, B. K. 2007. Post harvest behaviour of candytuft cut flowers (Iberia umbellata L.) as affected by harvesting stages, chemical preservatives and colouring solutions. Asian Journal of Horticulture 2(2): 256-265.

[5] Sravan Kumar, B., Lalitha Kameswari, L., Pratap M. and Venkateswar Rao, P. 2015. Optimization of stage of harvest of spike of tuberose cultivar Suvasini for tinting. Environment and Ecology, 33(4): 1441-1447.

[6] Singh, K. and Arora, J. S. 2000. Effect of harvesting stages, sucrose, BAP and GA_3 on bud opening and vase life of tuberose. Journal of ornamental Horticultural Science, 69(6): 993- 997.
[7] Kumar, V., Battacharjee, S. K., Rajive Kumar, R., Misra, L. and Krishnan. P. S. 2003. Post harvest and quality of tuberose spikes as affected by colouring agents and storage. Journal of Ornamental Horticulture, 6(2): 119.
[8] Feingold, B. F. 1975. Why Your Child is Hyperactive (Random House, New York).
[9] Amin, K. A., Abdel, H., Hameid, A. H. and Elstar, A. 2010. Effect of food and azo dyes tetrazine and carminozine on biochemical parameters related to renal hepatic function and oxidative stress, biomarkers in young male rats. Food and Chemical Toxicity, 48: 2994-2995.

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