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Standardization of chemicals for improving post harvest life of loose flowers of tuberose (*Polianthes tuberosa*)

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ABSTRACT

An experiment was carried out to study the effect of various concentrations of boric acid and sodium benzoate on post harvest life of loose flowers of tuberose for three years from 2016 to 2018 under AICRP on Floriculture. The experiment was laid out in completely randomized design with four replications consisting eight treatments of chemicals, *viz*. boric acid (2, 3, 4 and 5%), sodium benzoate (10, 25 and 50 ppm) and control. The results of pooled analysis of three years indicated that the florets (loose flowers) of tuberose treated with 4% boric acid significantly improved the post harvest life with the minimum change in fresh weight of florets (6.91, 17.38, 29.67 and 45.74%), maximum fresh flower (98.67, 81.00, 56.00 and 35.00%) at 12, 24, 36 and 48 hours, respectively. Application of 4% boric acid also recorded significantly maximum number of opened flowers (5.17), half opened flowers (4.67) as well as minimum closed flowers (15.17) at 48 hr out of 25 flowers. The maximum longevity (39.33 hr), minimum rotting at 48 hr (40.25%) and highest score of acceptability at 36 hr as per hedonic scale (8.05) were also recorded in the same treatment. Quick dip of loose flowers of tuberose in 4% boric acid was found beneficial for improving post harvest life of loose flowers with 56% fresh up to 36 hr.

Key words: Boric acid, Florets, Sodium benzoate, Tuberose

Tuberose (*Polianthes tuberosa* L.), belongs to the family Asparagaceae is one of the important bulbous flower crops of tropical and sub-tropical regions having 30 basic chromosome number. It is commonly known as *Gulchari* and *Gulshabbo* in Hindi, *Rajanigandha* in Bengali, *Sukandarji* and *Nelasanpengi* in Telugu, *Nilasompangi* in Tamil and *Sugandharaja* in Kannad.

Among the commercially grown flowers in India, tuberose occupies an important position owing to its popularity as a cut flower, loose flower, for perfumery as well as its potential as a source of secondary metabolites. Waxy white loose flowers of tuberose impregnate the atmosphere with their sweet fragrance, which are used for making garlands, *veni*, *gajara*, other floral ornaments and essential oil. Single flower type tuberose is highly fragrant and used to extract concrete which is sold at a premium price in market. Although, tuberose has a high potential in field, but it declines rapidly after harvesting and more than 50% of the buds normally open after harvest and florets as well as buds usually abscised in few days (Weithaka *et al*. 2001). The florets of tuberose are highly perishable and this is the limitation for marketing. Treating florets with different chemicals may improve the flower quality and shelf life (Talukdar and Barooah 2011). Mukhopadhyay *et al.* (1980) used boric acid at 2% as post harvest dip showed some promise with 40% of flowers remaining fresh, while 20% maintained their bud stage after 96 hr of harvest. It is also reported that use of certain chemicals (elicitors) play a key role in increasing shelf life of loose flowers (florets) where a single day enhancement of shelf life is an important issue to extend the availability for costumers (Das and Barman 1998).

In view of the increasing demand of fresh loose flowers of tuberose and the need for enhancing post harvest life, the present experiment was designed to enhance shelf life of loose flowers by using different chemicals by quick dip method.

MATERIALS AND METHODS

The experiment was carried at Laboratory, Department of Floriculture and Landscape Architecture, ASPEE College of Horticulture & Forestry, Navsari Agricultural University, Navsari in ambient condition under AICRP on Floriculture during 2016-18. Uniform sized fully opened fresh florets of tuberose variety Arka Prajwal were collected in the

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early morning from Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari which comes under south Gujarat Heavy Rainfall Zone-I, AES-III. Navsari is geographically situated at 20° - 95' North latitude and 75°- 95' East longitude with an altitude of 10 m above mean sea level.

The experiment was laid out in completely randomized design with four repetitions. Eight treatments were comprised of two chemicals with different concentrations *viz*. boric acid (2, 3, 4 and 5%), sodium benzoate (10, 25 and 50 ppm) and control.

Different solutions were prepared in slightly warm distilled water then cooled them at ambient condition. Freshly harvested fully opened 25 florets (loose flowers) of tuberose per treatment were taken and quick dip treatment (5 seconds) of chemical solutions was given in laboratory thereafter florets were taken out and surface dried then put in plastic plates.

Change in fresh weight in percentage was recorded in relation to the initial weight of florets at 12, 24, 36 and 48 hr on the basis of following formula:

$$\text{Change in fresh weight} = \frac{\text{Initial fresh weight-fresh weight at particular hours}}{\text{Initial fresh weight}} \times 100$$

Freshness of flowers was recorded on the basis 25 florets at 12, 24, 36 and 48 hr and expressed in per cent on the basis of following formula:

$$\text{Per cent of fresh flowers} = \frac{\text{Number of fresh florets at particular hours}}{\text{25 florets (flowers)}} \times 100$$

Arc sine transformation was used for per cent of fresh flowers at 12, 24 and 48 hr only. Flower opening index, viz. fully opened, half opened and closed florets were observed at 48 hr from 25 flowers treatment wise. Rotting per cent was also observed visually at 48 hr while acceptability on the basis of hedonic scale (1-9) as well as flower colour as per RHS colour chart was recorded at 36 hr.

Completion of total longevity was calculated on the basis of at least 50% of fresh flowers. The data of three years were pooled and analyzed statistically as per method suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Change in fresh weight and per cent of fresh flowers

On the basis of pooled analysis, various chemicals had significant effect on change in fresh weight and per cent fresh flowers of tuberose at different intervals (Table 1). The minimum change in fresh weight of florets (6.91, 17.38, 29.67 and 45.74%) and maximum per cent of fresh flowers (98.67, 81.00, 56.00 and 35.00) at 12, 24, 36 and 48 hr, respectively were recorded with quick dip in 4% boric acid.

The minimum change in fresh weight and maximum per cent of fresh florets might be due to the treatment with boric acid could increase the osmotic concentration and

Table 1 Effect of boric acid and sodium benzoate on changes in fresh weight (%) of loose flowers of tuberose variety Arka Prajwal

Treatment	Change in fresh weight (%)				Per cent of fresh flowers				Flower opening index at 48 hr (out of 25 flowers)		
	12 hr	24 hr	36 hr	48 hr	12 hr	24 hr	36 hr	48 hr	Opened flowers	Half opened flower	Closed flower
Control	12.28	30.32	47.56	64.32	70.94 (89.00)	53.54 (64.67)	39.33	23.76 (16.33)	2.83	2.50	19.67
Boric acid @ 2%	9.14	22.61	36.64	54.48	80.10 (96.00)	60.50 (75.67)	52.33	33.80 (31.00)	3.75	4.08	17.17
Boric acid @ 3%	9.12	22.24	35.78	53.90	78.95 (95.00)	61.19 (76.50)	52.00	31.32 (27.17)	3.92	3.67	17.33
Boric acid @ 4%	6.91	17.38	29.67	45.74	85.74 (98.67)	64.40 (81.00)	56.00	36.24 (35.00)	5.17	4.67	15.17
Boric acid @ 5%	10.92	26.54	41.59	57.84	77.05 (94.33)	59.91 (74.67)	48.00	31.28 (27.00)	3.67	3.92	17.42
Sodium benzoate @ 10 ppm	12.30	29.00	44.03	63.19	72.93 (91.00)	57.29 (70.67)	44.33	28.62 (23.00)	3.50	3.08	18.42
Sodium benzoate @ 25 ppm	13.06	29.96	45.39	65.61	71.16 (89.33)	54.75 (66.67)	41.33	27.44 (21.33)	3.00	2.50	19.50
Sodium benzoate @ 50 ppm	13.88	32.29	47.96	68.80	70.90 (89.00)	54.75 (66.67)	40.33	25.30 (18.33)	2.50	2.25	20.25
CD (P=0.05)	1.34	2.60	2.88	4.17	4.01	2.82	3.24	1.62	0.68	0.56	0.92
CV (%)	15.02	12.15	8.63	8.64	6.73	6.03	8.52	6.49	23.53	20.62	6.23

Data in parenthesis are original mean value.

Table 2 Effect of boric acid and sodium benzoate on rotting per cent and acceptability on visual basis

Treatment	Longevity (hrs)*	Rotting per cent (48 hrs)	Acceptability on visual basis (1-9 hedonic scale)	Flower colour as per RHS colour chart
Control	26.58	57.50	3.02	NN155 (A) Yellow White
Boric acid @ 2%	36.33	45.17	6.70	NN155 (B) Yellow White
Boric acid @ 3%	36.42	45.92	7.40	NN155 (D) White
Boric acid @ 4%	39.33	40.25	8.05	NN155 (D) White
Boric acid @ 5%	33.92	48.25	7.17	NN155 (D) White
Sodium benzoate @ 10 ppm	29.00	50.17	5.38	NN155(B) Yellow White
Sodium benzoate @ 25 ppm	26.42	52.25	4.63	NN155 (B) Yellow White
Sodium benzoate @ 50 ppm	26.58	54.92	3.80	NN155 (A) Yellow White
CD at 5%	1.58	3.01	-	
CV (%)	6.09	7.50	-	

* Completion of total longevity on the basis of 50% of fresh flowers

pressure potential of the petal cells thus improving the water balance and longevity (Halevy 1976) in tuberose flowers.

Furthermore, the result may also be attributed to minimum amount of ethylene evolution from florets treated with boric acid @ 4% which ultimately minimized physiological loss in weight resulted minimum change in fresh weight and maximum fresh flowers. The results are also in accordance with findings of Sudhagar *et al*. (2010) and Kumar *et al*. (2006) in tuberose.

Flower opening index

According to pooled data presented in Table 1, treatment of tuberose florets with boric acid @ 4% (T_4) recorded maximum opened flowers (5.17), half opened flowers (4.67) as well as minimum closed flowers (15.17) out of 25 florets at 48 hr. Majumder *et al.* (2014) also observed higher bud opening in tuberose var. Mexican Single with the application of 2% boric acid treatment. It might be due to that boric acid helps in membrane stability and resistance enhancement against senescence related changes which increases the amount of protein (Hashemabadi *et al*. 2011) resulting increases bud opening.

Longevity and rotting percentage

The data pertaining to longevity and rotting percentage of tuberose flowers were significantly influenced by different chemical concentrations are presented in Table 2.

It is explicit from the data that maximum longevity of tuberose florets (39.33 hr) and minimum rotting per cent at 48 hr (40.25) were recorded when flowers treated with boric acid @ 4%. The reduction in rotting percentage could be attributed to boric acid which decreased microbial growth thereby helped in increasing shelf life recorded in the present investigation. Similar results had also been recorded in gladiolus (Murali 1990; Gowda and Gowda 1990; Singh *et al*. 2000).

The longevity of florets with boric acid treatment may be attributed to its action on retention and translocation of the sugars to the corolla and most probably due to anti-ethylene activity of the boric acid which retards the early senescence (De and Barman 1998). Boric acid also resulted in almost complete inhibition of the climacteric ethylene production in carnation florets (Serrano *et al*. 2006).

Acceptability on visual basis and flower colour

The data pertaining to acceptability as well as colour of flowers as per RHS colour chart are presented in Table 2.

The highest acceptability (8.05) on visual basis as per hedonic scale (1-9) at 36 hours was recorded in boric acid @ 4% and the same treatment recorded NN155(D) White colour (using mini RHS colour chart). This might be due to effectiveness of boric acid in increasing anti-oxidant activity besides an anti- ethylene activity and had reduced per cent of solute leakage from the florets indicating increased membrane integrity of florets due to which the good colour retention is observed. The potential of the boric acid has also been reported earlier by Bhattacharjee (2002) in crossandra.

Conclusion

From the present investigation, it can be concluded that quick dip (5 seconds) with boric acid @ 4% improved the postharvest life of tuberose flowers with 56% up to 36 hr.

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