

✓ CHANGES IN SOLUBLE CARBOHYDRATES AND PROTEINS IN CUT GLADIOLUS

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ABSTRACT

The amount of soluble carbohydrates present in a single floret of cut gladiolus increased with floret opening and gradually decreased with senescence. Soluble proteins were found to be higher in bud stage and at fully opened stage. Pulsing with 20 per cent sucrose significantly increased the amount of soluble carbohydrates and soluble proteins.

Key words : Protein, carbohydrate, gladiolus, pulsing, vase life

Postharvest life of every flower depends on factors like amount of respirable substrates, water balance and physiological factors like respiration and transpiration. Pulsing with energy sources like sucrose or metal ions was found to be beneficial in improving vase life (Murali and Reddy, 1993). In this investigation an attempt was made to find out the relative amount of soluble proteins and soluble carbohydrates at different physiological stages of an individual floret in cut gladiolus subjected to pulsing with 20 per cent sucrose solution and varied periods of cold storage. Two varieties, viz., Rose Memento with comparatively better and Melody seedling with comparatively poor vase performance were subjected to this study.

MATERIALS AND METHODS

Spikes were harvested when the first floret showed colour and the lot was

subjected to 20 per cent sucrose pulsing while other lot was kept as control. These spikes were then taken for vase life studies after subjecting them for varied periods (0, 3 and 6 days) of cold storage at 3°C and 80% RH, before keeping in vase. While in vase, the second floret from the base of the spike was selected for biochemical analysis at its different stages of development, viz., at bud stage, at fully opened stage and at senescence. Soluble proteins were estimated by Folin-Cio-Calteau reagent (Lowry *et al.*, 1951) and soluble carbohydrates by phenol-sulphuric acid method (Sadasivan and Manickam, 1996).

RESULTS AND DISCUSSION

In Melody seedling, the soluble protein content varied significantly with the stages of floret, duration of cold storage and the levels of pulsing (Table 1). During bud

Table 1. Estimates of total soluble proteins and soluble carbohydrates (mg/g fresh weight) during different stages of floret development in gladiolus spikes as influenced by sucrose pulsing and cold storage in Melody Seedling

Period of storage	Bud (F ₁)			Fully opened (F ₂)			Senescence (F ₃)			Average of pulsing		
	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	G. Mean
Soluble proteins												
S ₀	3.79	9.44	6.62	4.29	4.57	4.43	2.25	2.93	2.59	3.44	5.65	4.54
S ₁	3.95	6.52	5.24	3.05	3.15	3.10	2.70	2.54	2.62	3.23	4.07	3.65
S ₂	5.40	8.55	6.98	5.36	4.75	5.10	2.63	3.39	3.01	4.46	5.57	5.01
Mean	4.38	8.17	6.28	4.23	4.15	4.21	2.53	2.95	2.74	3.71	5.09	4.73
CD at 5% S = 0.69, P = 0.57, SxP = NS, F = 0.69, FxS = NS, FxP = 0.99, FxSxP = NS												
Soluble carbohydrates												
S ₀	4.10	10.40	7.25	10.19	11.43	10.81	6.63	4.16	5.40	6.97	8.66	7.82
S ₁	9.32	9.83	9.58	9.53	12.06	10.80	3.83	9.58	6.70	7.56	10.49	9.03
S ₂	7.80	7.36	7.58	12.50	11.24	11.87	3.30	4.23	3.76	7.86	7.61	7.74
Mean	7.07	9.20	8.14	10.74	11.58	11.16	4.59	5.99	5.29	7.46	8.92	8.20
CD at 5% S = 0.79, P = 0.64, SxP = 1.11, F = 0.79, FxS = 1.36, FxP = NS, FxSxP = 1.93												

S₀ = 0 day storage at 3°C and 80% RH, S₁ = 3 day cold storage at 3°C and 80% RH, S₂ = 6 day cold storage at 3°C and 80% RH

P₀ = Without pulsing, P₁ = 20% sucrose pulsing

stage, the soluble protein content was much higher (6.28 mg/g) than in fully opened floret (4.21 mg/g) or at senescence (2.74). Pulsing with 20 per cent sucrose significantly increased the protein content from 3.71 to 5.09 mg/g. Interaction between pulsing and stages of floret was found significant. Maximum protein content (8.17 mg/g) was observed in the buds of gladiolus pulsed with 20 per cent sucrose, while it was lowest (2.53 mg/g) in faded flowers of unpulsed spike.

In variety Rose Memento, total soluble protein content significantly increased with 20 per cent sucrose pulsing but it did not differ significantly with the duration of cold storage (Table 2). Total soluble proteins significantly differed with the stage of floret development. It was highest in fully opened floret (7.54 mg/g) followed by the bud stage and at senescence.

Interaction between period of cold storage and pulsing was significant. The pulsed florets stored for 3 days in cold storage recorded significantly higher content of soluble protein (7.45 mg/g) while the unpulsed spikes stored for 3 days in cold storage recorded the least (5.68 mg/g). Significant interaction between storage period and stages of floret revealed higher soluble protein content at fully opened stage (8.47 mg/g) compared to the protein content at senescence stage (4.62) for 3 days stored spikes. Significant interaction between pulsing and stages of floret showed that the protein content was higher (8.86 mg/g) in the bud stage of 20 per cent sucrose pulsed spikes.

In Melody seedling, effects due to storage period, pulsing, stage of floret and interaction due to storage and pulsing, storage x floret stage and storage x pulsing

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Table 2. Estimates of total soluble proteins and soluble carbohydrates (mg/g fresh weight) during different stages of floret development in gladiolus spikes as influenced by sucrose pulsing and cold storage in Rose Memento

Period of storage	Bud (F ₁)			Fully opened (F ₂)			Senescence (F ₃)			Average of pulsing		
	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	Mean	P ₀	P ₁	G. Mean
Soluble proteins												
S ₀	3.64	8.97	6.30	7.33	7.00	7.17	6.11	4.10	5.41	5.69	6.89	6.29
S ₁	4.44	8.77	6.61	7.39	9.55	8.47	5.20	4.04	4.62	5.68	7.45	6.56
S ₂	7.39	8.84	8.11	7.26	6.66	6.96	5.72	3.66	4.69	6.79	6.38	6.58
Mean	5.15	8.86	7.01	7.33	7.74	7.54	5.68	4.14	4.91	6.05	6.91	6.48
CD at 5% : S = NS, P = 0.50, SxP = 0.87, F = 0.61, FxS = 1.07, FxP = 0.87, FxSxP = NS												
Soluble carbohydrates												
S ₀	5.89	10.63	8.26	12.33	11.99	12.16	6.32	5.59	5.96	8.18	9.41	8.79
S ₁	10.62	9.67	10.30	10.23	14.26	12.25	3.30	5.10	4.20	8.05	9.78	8.92
S ₂	8.57	8.23	8.40	11.29	9.93	10.61	4.67	4.50	4.58	8.17	7.55	7.87
Mean	8.36	9.61	8.99	11.29	12.06	11.67	4.76	5.06	4.91	8.13	8.91	8.53
CD at 5% : S = NS, P = NS, SxP = NS, F = 1.09, FxS = NS, FxP = 0, FxSxP = 2.67												

S₀ = 0 day storage at 3°C and 80% RH, S₁ = 3 day cold storage at 3°C and 80% RH, S₂ = 6 day cold storage at 3°C and 80% RH
 P₀ = Without pulsing, P₁ = 20% sucrose pulsing

x floret stage were significant (Table 1). The spikes stored for 3 days in cold storage (9.03 mg/g) showed significantly higher content of soluble carbohydrates than the spikes stored for 6 days or the spikes which were not subjected to cold storage. Pulsing with 20 per cent sucrose solution before cold storage significantly increased the soluble carbohydrate level from 7.46 to 8.92 mg/g. Spikes subjected to 20 per cent sucrose pulsing and stored for 3 days in cold storage and the unpulsed spikes stored for 6 days in cold storage recorded highest soluble carbohydrate content in fully opened flower (12.06 and 12.50 mg/g, respectively) while it was lowest in spikes which were not subjected to pulsing treatment and stored for 6 days at floret senescence (3.30 mg/g).

Unlike Melody seedling, in Rose Memento the period of storage, level of

pulsing and their interaction effect were not significant (Table 2), but the effects due to floret stage and interaction between period of storage x pulsing x flower stage were significant. At fully opened stage, soluble carbohydrate level was significantly (11.67) higher than at bud stage (8.99 mg/g) or flower senescence (4.91 mg/g). Twenty per cent sucrose pulsed spikes stored for 3 days in cold storage exhibited higher soluble carbohydrate content (14.26 mg/g) at fully opened stage.

Floret development in cut gladiolus requires a continuous source of energy and osmoticum. Floret opening from bud stage results due to the accumulation of reducing sugars in flower buds (Chin and Sacalis, 1977, Ho and Nichols, 1975). Improvement in vase performance of gladiolus by sucrose pulsing has also been

Fresh weight)	
ed by sucrose	
ge of pulsing	
P ₁	G. Mean
5.65	4.54
4.07	3.65
5.57	5.01
5.09	4.73
NS	
8.66	7.82
10.49	9.03
7.61	7.74
8.92	8.20
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H, S₂ = 6 day cold

l of cold storage ant. The pulsed in cold storage gher content of 3/g) while the r 3 days in cold st (5.68 mg/g). etween storage e revealed higher t fully opened d to the protein ge (4.62) for 3 ant interaction ages of floret n content was bud stage of 20 kes.

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reported by Murali and Reddy (1993). The results of the present investigation reveal that the floret opening is an outcome of increase in osmoticum due to the accumulation of soluble sugars. Pulsing with sucrose helps to increase the endogeneous level of soluble sugars and soluble proteins which in turn provide energy as well as the required osmoticum for floret development and floret longevity.

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