Genotype interaction x *Helianthus* post-harvest longevity

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ABSTRACT

The post-harvest longevity of six sunflower genotypes developed by Embrapa Soybean was assessed by comparing the control T1 (stems in water) with six pulsing treatments with sucrose, T2 to T6, (20, 40, 60, 80, 100 gL^{-1}) and T7, sucrose (40 gL^{-1}) associated with 200 mgL^{-1} 8-HQC. After pulsing treatment for 24h, the inflorescences were placed in a maintenance solution with 20 gL^{-1} sucrose and assessed daily by score criteria, defined to quantify the longevity in number of vase days. The pulsing treatments promoted longevity in various ways among the genotypes tested. The best treatments were: T5 and T6 (genotype 153); T3 and T7 (genotype 101); T6 (genotype 181); T7 (genotype 127); T4 and T5 (genotype 140) and T4 (genotype 114). Longevity was increased by two to three days in these treatments compared to the control.

KEY WORDS: Cut flowers, Conservation, *helianthus*, 'Pulsing´ With Sucrose.

INTRODUCTION

Ornamental plants and cut flowers in particular are considered highly perishable products when manipulated during the harvest, transport and storage operations (Vieira, 1997). In Brazil, where planned production and commercialization infrastructure are beginning to be implanted, losses are often greater than 40% accounting for high economic setbacks (Castro and Honório, 1992).

Cut flowers deteriorate similarly to fruit and vegetables from the point of view of catabolic physiological processes (Hardenburg et al., 1988) and their stored reserves that consist mainly of carbohydrates are gradually exuded by this process. As longevity is often determined by the rate of use of these supplementary reserves, the flowers fade from their exhaustion.

Flower post-harvest longevity can be improved by treatment with preserving solutions that maintain stem quality and prolong the vase life such as sucrose and hydroxyquinoline, 8-HQC (Halevy and Mayak, 1979). The "pulsing" treatment is an efficient procedure to increase cut flower longevity and quality. It is low cost, of short duration (12-14 h) and easily applied, saturating the tissues with sugars and other chemical compounds whose effects can last for the duration of cut flower's life, even after transference to water or maintenance solution (Halevy and Mayak, 1981). Specific formulations have been developed for different flower species and in some cases for different cultivars (Kofranek and Halevy, 1972). Sucrose is the main ingredient of the various "pulsing" solutions, used frequently in higher concentrations than in the preserving formulations. Optimum concentrations vary from 20% or more for gladioli and gerberas, 10% for carnations, 2 to 5% for roses and chrysanthemums (Mayak et al., 1973; Nichols, 1973; Halevy and Mayak, 1974; Van-Meeteren, 1981). In addition to acting as respiratory substrate, the sucrose has a marked influence on the turgidity that is necessary for flower bud development and for continuing the cut flower metabolic activity because it favors the water balance in the flowers (Castro, 1984) by accumulating in the petals and increasing the solute concentrations and maintaining turgidity.

Other frequently used components in "pulsing" solutions are 8-hydroxyquinoline, mainly the sulfates (HQS) and citrates (HQC) at concentrations of 200 to 600 ppm (Halevy and Mayak, 1981). Besides being a wide spectrum bactericide and fungicide, it was demonstrated that hydroxyquinoline reduced the physiological block in the stems in sterile tissues. This effect is related to the chelation properties of the quinoline esthers that can form chelates with metal ions from enzymes active in the stem block development (Marousky, 1972). Furthermore, these substances can increase flower longevity by acidifying the water.

The literature on sunflower post-harvest management

is scarce (Jones et al., 1993; Gonzaga et al., 2001; Redman et al., 2002). The objective of this study was to assess the post-harvest longevity of six sunflower genotypes developed by Embrapa Soybean.

MATERIAL AND METHODS

The sunflower inflorescences used in this study were ceded by Embrapa Soybean which developed sunflower cultivars (*Helianthus annuus*, L.) Asteraceae, using the traditional plant breeding method, in nine color tones ranging from wine and rust to lemon yellow. With specific characteristics to meet the requirements of the floriculture market with varying stand, smaller inflorescence diameter and no pollen, the nine varieties can be cultivated in any region of Brazil throughout the year and withstand climatic conditions in open fields so there is no need for large investments in greenhouses, as in the cultivation of some flowers (Castiglioni et al., 2001).

The six sunflower genotypes assessed were: 101, 140, 153, 114, 181, 127. The inflorescences were harvested in the experimental field at Embrapa Soybean in Londrina-PR, latitude 23°22´south, longitude 51°10´west, and altitude 585m. They were harvested in October and November 2001, always at 8:00 a.m. and 9.00 a.m. The harvest point ranged from R4 stage (first stage of the florescence, closed bud, when the flower head presents the first petaled flowers) and stage R5.1 (when 10% of the flower head flowers are open) according to Castiglioni et al. (1997). While still in the field, the inflorescences were placed in buckets with artesian well water and transported at a mean ambient temperatures of 25° C to the Plant Pathology Laboratory at the Department of Agronomy at Londrina State University.

The base leaves were removed, leaving the three leaves closest to the flower head. The stems were cut under water at an angle of 45° to a length of 50 cm. After standardization the stems were submitted to the various "pulsing" treatments for 24 h, mean temperature 25°C, 60% relative humidity, 1500 lux luminosity. The treatments were the following: T1 control (deionized water); T2 to T6 "pulsing" with sucrose (20, 40, 60, 80 and 100 gL^{-1}) respectively and T7, "pulsing" with sucrose (40 gL^{-1}) + 200 mgL^{-1} hydroxyquinoline citrate. Two drops of sodium hypo chloride (2.0 - 2.5%) were added to the solutions of all the treatments.

After "pulsing" treatment the inflorescences were placed in the maintenance solution with sucrose (20 gL^{-1}) and the control was placed in water. The solutions were renewed every two days. Daily assessments were made with scoring criteria (Castro, 1984; Gonzaga et al., 2001) defined to compare and ascertain the conservation of the visual aspects necessary for commercialization and the inflorescence longevity was measured in number of vase days with score superior or equal to two. The score criteria were, score 3 = inflorescence with perfect characteristics for commercialization, turgid, attractive and without spots; score 2 = inflorescence with two wilted or spotted petals but still with commercial quality; score 1 = inflorescence with petal fall, not suitable for commercialization and score 0 = inflorescence with dried or no petals. The scores were submitted to statistical analysis by the Kruskal-Wallis method according to Ayres et al. (2000) and the mean ranks compared at the level of 5% significance. A randomized complete block design was used with four replications and three inflorescences per replication.

RESULTS AND DISCUSSION

Table 1 shows that the genotype x treatment interaction was not significant in the first two days, when the inflorescences presented maximum scores without variations. The genotype x treatment interaction was significant ($p<0.01$) after the third day until the seventh day when, because of the low scores demonstrating the end of senescence, the genotype x treatment interaction was again not significant on the eighth day. As the genotype x treatment interaction was significant ($p < 0.01$) in the interval between the third and seventh day, it was shown that the genotypes responded differently to the treatments.

Tables 2 to 7 show the results obtained in the experiments for post-harvest longevity of the six sunflower genotypes tested.

Table 2 shows that the longevity of genotype 153 was eight days with treatments T5 (80 gL^{-1} sucrose) and T6 (100 gL^{-1} sucrose). The control longevity was six days, the shortest observed among the treatments. After the eighth day all the treatments presented scores less than two.

For genotype 101, Table 3, the control T1 obtained the minimum score on day five. The best treatments for longevity were T3 (40 gL^{-1}) and T7 (40 gL^{-1} sucrose + 200 mgL^{-1} hydroxyquinoline) that lasted

eight days. After the eighth day all the treatments scored less than two.

Table 4 shows that best treatment for genotype 181 was T6 (100 gL^{-1} sucrose) that provided longevity of seven days, compared with four days for the control and treatments T2 (20 gL^{-1} sucrose), T3 (40 gL-1 sucrose) and T4 (60 gL^{-1} sucrose). The treatment with hydroxyquinoline and sucrose, T7, did not differ statistically ($p>0.037$) from the control that lasted four days. After the seventh day all the treatments scored less than two.

Significant differences were observed for genotype 127, Table 5, after the sixth day. The control treatment provided longevity of six days and the longest longevity, eight days, was reached by the inflorescence in T7, treated with hydroxyquinoline. After the eighth day the inflorescences scored less than two in all the treatments.

Table 6 shows the results obtained for genotype 140. The best treatments for longevity were T4 and T5, sucrose at 60 gL^{-1} and 80 gL^{-1}, respectively that provided longevity of seven days. The control treatment provided longevity of five days that did not differ statistically ($p>0.046$) from T6 (100 gL^{-1} sucrose) and T7, the treatment with hydroxyquinoline. After the seventh day all the treatments scored less than two.

Table 7 shows the results obtained for genotype 114.

Table 1. Results obtained with analysis of variance of the post-harvest longevity of new sunflower genotypes developed by EMBRAPA/soybean submitted to different "pulsing" treatments.

Source of Variation	Gl	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Genoype	5	ns	ns	1/	1/	1/	1/	1/	ns
Treatment	6	ns	ns	1/	2/	2/	1/	1/	ns
Genotyope x treatment	30	ns	ns	1/	1/	1/	1/	1/	ns

1/ significant ($p<0.01$); 2/ significant ($p<0.05$); ns: not significant

Table 2. Results obtained with the sucrose and hydroquinol treatments to promote post harvest longevity in the 153 sunflower genotype.

"pulsing" treatment 24 h	1	2	3	4	5	6	7	8
					(days)			
(2/Suc./8-HQC) (gL^{-1}/mgl^{-1})					(mean note)			
T1 (0/0)	3.00	3.00	3.00	3.00	2.86	2.29	1.64	1.29
T2 (20/0)	3.00	3.00	3.00	3.00	3.00	2.79	2.07	1.79
T3 (40/0)	3.00	3.00	3.00	3.00	3.00	2.79	2.36	1.57
T4 (60/0)	3.00	3.00	3.00	3.00	3.00	2.86	2.50	1.86
T5 (80/0)	3.00	3.00	3.00	3.00	3.00	2.93	2.43	2.21
T6 (100/0)	3.00	3.00	3.00	3.00	3.00	3.00	2.86	2.29
T7 (40/200)	3.00	3.00	3.00	3.00	3.00	2.86	2.79	2.14
					(mean post)			
T1	n.s	n.s	n.s	n.s	n.s	25.00 b[1]	25.43 c	26.86 c
T2	n.s	n.s	n.s	n.s	n.s	49.50a	39.25 bc	45.75abc
T3	n.s	n.s	n.s	n.s	n.s	49.50a	48.46ab	38.57 bc
T4	n.s	n.s	n.s	n.s	n.s	53.00a	53.07ab	49.00ab
T5	n.s	n.s	n.s	n.s	n.s	56.50a	50.11ab	61.82a
T6	n.s	n.s	n.s	n.s	n.s	60.00a	66.57a	65.07a
T7	n.s	n.s	n.s	n.s	n.s	53.00a	63.61a	59.43ab
H					12.13	26.87	25.25	23.38
P					0.0592	0.0002	0.0003	0.0007

[1]Mean ranks followed by the same letter do not differ by the Kruskal-Wallis test at 5% significance; 2/ Suc: Sucrose.

The best treatment was T4 (60 gL^{-1}) that prolonged inflorescence longevity for eight days. The control obtained 5-day longevity, the same provided by T6 (100 gL^{-1}). After the eighth day all the treatments scored less than two.

According to the results in Tables 2 to 7, the use of sucrose was effective in increasing longevity, providing better scores for all the genotypes tested (2-3 days longer) when compared with the control. The best treatments with only sucrose were those with higher concentrations, that is, from 60 gL^{-1} to 100 gL^{-1} (T4, T5 and T6) as shown in the Tables (2, 4, 6, and 7) and no statistically significant differences were observed among them. However, with a slightly lower concentration of sucrose (40 gL^{-1}), associated to hydroxyquinoline (200 mgL^{-1}), treatment T7 was among the best, promoting longevity in most of the genotypes assessed (153, 101, 127 and 114).

Under field conditions, with intact plants, flower head opening and flower development require energy apparently supplied by the carbohydrate reserves present in the leaves and probably the stem and roots. In cut flowers, however, the carbohydrate supply by the leaves and stem alone seems insufficient for flower head opening and development of the many flowers, as reported by Han (1992) in studies with *Liatris spicata* (Asteraceae) inflorescence where she observed that the leaf darkening process, induced by low carbohydrate levels, was retarded or even eliminated when sucrose was added to the vase solution or the stems were annealed below the flower head. In this experiment with sunflowers, the symptoms of darkening and spots on the leaves appeared in the control treatment before any alterations were observed in the inflorescence.

Further according to Han (1992) the absence of sucrose in the vase solution permitted that only 25% of the flower of the inflorescence reached anthesis and that most of them opened partially. The addition of 2,5% to 5% sucrose in the vase solution significantly increased the post harvest quality and doubled the vase life of the inflorescence. In this experiment with the ornamental sunflower genotypes, sucrose supplied by "pulsing" at concentrations from 60 gL^{-1} to 100 gL^{-1}, or 40 gL^{-1} associated to 200 mgL^{-1} (hydroxyquinoline) promoted 2-3 days more longevity more than the control. In a study using *Helianthus,* Gonzaga et al. (2001) observed that the continuous supply of sucrose at 4% in the maintenance solution increased by up to five days the vase life of inflorescences compared to the control. On the other hand, Redman et al. (2002)

Table 3. Results obtained with the sucrose and hydroxyquinoline treatments to promote post-harvest longevity in the 101 sunflower genotype.

"pulsing" treatment 24 h	1	2	3	4	5 (days)	6	7	8
(Suc./8-HQC) (gL^{-1}/mgl^{-1})					(mean note)			
T1 (0/0)	3.00	3.00	3.00	2.33	2.00	1.67	1.22	0.89
T2 (20/0)	3.00	3.00	3.00	2.33	2.22	2.00	1.78	1.33
T3 (40/0)	3.00	3.00	3.00	2.78	2.67	2.44	2.33	2.11
T4 (60/0)	3.00	3.00	3.00	2.11	1.89	1.67	1.44	1.33
T5 (80/0)	3.00	3.00	3.00	2.33	2.11	2.00	1.56	1.22
T6 (100/0)	3.00	3.00	3.00	2.67	2.44	2.33	2.00	1.78
T7 (40/200)	3.00	3.00	3.00	3.00	2.89	2.78	2.56	2.22
	(Mean post)							
T1	ns	ns	ns	26.33 bc	23.11 c	20.66 c	18.22 d	19.72 c
T2	ns	ns	ns	26.33 bc	29.44 bc	28.61 bc	30.38 bcd	28.22abc
T3	ns	ns	ns	40.11ab	41.00 ab	39.38ab	42.55ab	41.55ab
T4	ns	ns	ns	21.22 c	22.16 c	23.38 bc	24.27 cd	27.77abc
T5	ns	ns	ns	26.33 bc	26.27 bc	28.61 bc	25.61 cd	26.50 bc
T6	ns	ns	ns	36.66abc	34.66 abc	36.00abc	35.61abc	35.83abc
T7	ns	ns	Ns	47.00a	47.33a	47.33a	47.33a	44.38a
H				18.53	17.79	16.74	19.79	13.76
P				0.005	0.0068	0.0103	0.003	0.032

[1/] Mean ranks followed by the same letter do not differ by the Kruskal-Wallis test at 5% significance; 2/ Suc: Sucrose

Table 4. Results obtained with the sucrose and hydroxyquinoline treatments to promote post harvest longevity in the 181 sunflower genotype.

"pulsing" treatment 24 h	1	2	3	4	5	6	7
					(days)		
(Suc./8-HQC) (gL^{-1}/mgl^{-1})				(mean note)			
T1 (0/0)	3.00	3.00	2.50	2.36	1.93	1.43	1.14
T2 (20/0)	3.00	3.00	2.14	2.00	1.71	1.71	1.21
T3 (40/0)	3.00	3.00	1.79	1.64	1.36	1.36	1.21
T4 (60/0)	3.00	3.00	2.21	2.07	1.86	1.64	1.36
T5 (80/0)	3.00	3.00	2.57	2.43	2.14	1.93	1.64
T6 (100/0)	3.00	3.00	2.71	2.50	2.43	2.29	2.21
T7 (40/200)	3.00	3.00	2.64	2.50	2.00	1.64	1.07
				(mean post)			
T1	n.s	n.s	51.75ab	n.s	n.s	38.71 b	40.85 b
T2	n.s	n.s	44.92ab	n.s	n.s	50.78ab	43.46 b
T3	n.s	n.s	32.10 b	n.s	n.s	38.14 b	44.17 b
T4	n.s	n.s	43.82ab	n.s	n.s	47.85ab	48.39 b
T5	n.s	n.s	54.85a	n.s	n.s	56.92ab	56.67ab
T6	n.s	n.s	61.07a	n.s	n.s	68.28a	74.82a
T7	n.s	n.s	57.96a	n.s	n.s	45.78 b	38.10b
H			12.67	9.53	12.27	13.49	19.30
p			0.048	0.14	0.056	0.035	0.0037

[1/] Mean ranks followed by the same letter do not differ by the Kruskal-Wallis test at 5% significance; [2/] Suc: Sucrose.

observed that an increase in the sucrose concentration from 0% to 4% or 8% decreased the vase life of *Celosia* and *Helianthus* but were optimum concentrations for *Achillea.* Several authors have reported the beneficial effects of sucrose on the post harvest of several types of flowers such as *chrysanthemums*, h*elianthus,* and p*enstemon* (Gladon and staby, 1976; Moraes, 1997; Gonzaga et al., 2001). Borochov and Keren-Paz (1984) observed that pulsing with sucrose at 5% increased the inflorescence length and improved the esthetic value of the *Liatris* stems harvested at the closed bud stage. According to Marousky (1972) exogenous sucrose supplies the natural carbohydrate demand of the cut flowers and decreases or prevents proteolysis. The transferred sugar accumulates in the flowers and leaves, increasing their osmotic concentrations and favoring greater absorption capacity of the solutions and consequently maintenance of the petal turgidity, preserving the volume of dry matter and the level of respiratory substrates (Castro, 1984; Doi and Reid, 1995).

Treatment 7 was the best for promoting longevity in genotypes 101 and 127, Tables 3 and 5, respectively. There were no indications of phytotoxicity in any of the genotypes tested, which is in line with Redman et al. (2002) who observed positive effects of hydroxyquinoline in the vase life of *Helianthus* and *Weigela* stems. Gladon and Staby (1976) obtained optimum results in *Chrysanthemum* bud opening and vase life with the combination of 2% or 4% sucrose and 200 mgL^{-1} of hydroxyquinoline although concentrations of over 400 mgL^{-1} of hydroxyquinoline caused phytotoxicity in the stems and leaves. According to Halevy and Mayak (1981) part of the beneficial effects of hydroxyquinoline on the water balance can be attributed to stomata closure promotion, although concentrations of over 200 mgL^{-1} were toxic in *chrysanthemums*. Other combinations should be assessed in the *Helianthus* genotypes because of the different responses obtained to hydroxyquinoline in other flowers to find a specific protocol for each genotype.

The 24 h "pulsing" treatments with sucrose alone or associated with hydroxyquinoline promoted longevity in various ways among the tested genotypes. Thus, according to Tables 2 to 7, the best treatments were T5 and T6 (genotype 153), T3 and T7 (genotype 101), T6 (genotype 181), T7 (genotype 127), T4 and T5 (genotype 140) and T4 (genotype 114).

Regarding the different longevity results of the sunflower inflorescences observed among the

Table 5. Results obtained with the sucrose and hydroxyquinoline treatments to promote post harvest longevity in the 127 sunflower genotype.

"pulsing" treatment 24 h	1	2	3	4	5 (days)	6	7	8
(Suc./8-HQC) (gL^{-1}/mgl^{-1})					(mean note)			
T1 (0/0)	3.00	3.00	3.00	3.00	3.00	2.50	1.92	1.33
T2 (20/0)	3.00	3.00	3.00	3.00	3.00	2.18	1.55	1.36
T3 (40/0)	3.00	3.00	3.00	3.00	3.00	1.75	1.42	1.00
T4 (60/0)	3.00	3.00	3.00	3.00	3.00	2.08	1.58	1.08
T5 (80/0)	3.00	3.00	3.00	3.00	3.00	2.00	1.58	1.08
T6 (100/0)	3.00	3.00	3.00	3.00	3.00	1.92	1.92	1.17
T7 (40/200)	3.00	3.00	3.00	3.00	3.00	2.50	2.42	2.00
					(mean post)			
T1	n.s	n.s	n.s	n.s	n.s	56.45a	47.79ab	45.66ab
T2	n.s	n.s	n.s	n.s	n.s	40.62ab	32.58 b	43.12ab
T3	n.s	n.s	n.s	n.s	n.s	29.62 b	30.62 b	33.62 b
T4	n.s	n.s	n.s	n.s	n.s	40.58ab	36.87 b	36.16 b
T5	n.s	n.s	n.s	n.s	n.s	38.87ab	36.87 b	36.79 b
T6	n.s	n.s	n.s	n.s	n.s	34.87 b	49.37ab	39.95 b
T7	n.s	n.s	n.s	n.s	n.s	56.45a	63.37a	62.16a
H						17.76	21.05	16.56
p						0.0069	0.0018	0.011

[1]Mean ranks followed by the same letter do not differ by the Kruskal-Wallis test at 5% significance; [2/] Suc: Sucrose.

Table 6. Results obtained with the sucrose and hydroxyquinoline treatments to promote post harvest longevity in the 140 sunflower genotype.

"pulsing" treatment 24 h	1	2	3	4	5 (days)	6	7
(Suc./8-HQC) (gL^{-1}/mgl^{-1})					(mean note)		
T1 (0/0)	3.00	3.00	3.00	3.00	2.22	1.89	1.56
T2 (20/0)	3.00	3.00	3.00	3.00	2.44	2.11	1.78
T3 (40/0)	3.00	3.00	3.00	3.00	2.56	2.00	1.44
T4 (60/0)	3.00	3.00	3.00	3.00	2.67	2.44	2.11
T5 (80/0)	3.00	3.00	3.00	3.00	2.89	2.56	2.22
T6 (100/0)	3.00	3.00	3.00	3.00	2.33	1.56	1.22
T7 (40/200)	3.00	3.00	3.00	3.00	2.44	1.89	1.56
					(mean ranks)		
T1	n.s	n.s	n.s	n.s	n.s	27.66ab	28.72abc
T2	n.s	n.s	n.s	n.s	n.s	33.00ab	32.94abc
T3	n.s	n.s	n.s	n.s	n.s	30.66ab	26.50 bc
T4	n.s	n.s	n.s	n.s	n.s	41.11a	41.77ab
T5	n.s	n.s	n.s	n.s	n.s	43.88a	43.88a
T6	n.s	n.s	n.s	n.s	n.s	20.00 b	21.44 c
T7	n.s	n.s	n.s	n.s	n.s	27.66ab	28.72abc
H					9.34	13.22	12.76
P					0.155	0.0397	0.046

[1] Mean ranks followed by the same letter do not differ by the Kruskal-Wallis test at 5% significance; [2/] Suc: Sucrose.

Table 7. Results obtained with the sucrose and hydroxyquinoline treatments to promote post harvest longevity in the 114 sunflower genotype.

"pulsing" treatment 24 h	1	2	3	4	5	6	7	8
(Suc./8-HQC) (gL^{-1}/mgl^{-1})					(days)			
					(mean note)			
T1 (0/0)	3.00	3.00	3.00	2.50	2.13	1.63	1.13	0.38
T2 (20/0)	3.00	3.00	3.00	2.63	2.25	2.00	1.75	1.50
T3 (40/0)	3.00	3.00	3.00	2.88	2.88	2.63	2.25	1.63
T4 (60/0)	3.00	3.00	3.00	3.00	3.00	3.00	2.88	2.63
T5 (80/0)	3.00	3.00	3.00	2.63	2.25	2.13	1.75	1.00
T6 (100/0)	3.00	3.00	3.00	2.50	2.00	1.88	1.38	0.88
T7 (40/200)	3.00	3.00	3.00	3.00	2.88	2.75	2.38	2.00
					(mean ranks)			
T1	n.s	n.s	n.s	n.s	18.37 c	14.50 d	14.43 d	13.37 d
T2	n.s	n.s	n.s	n.s	21.75 c	21.50 cd	24.87 bcd	29.62 bc
T3	n.s	n.s	n.s	n.s	38.62ab	35.50abc	34.12abc	31.25abc
T4	n.s	n.s	n.s	n.s	42.00a	44.50a	45.68[a]	45.75a
T5	n.s	n.s	n.s	n.s	23.43 bc	25.50 bcd	24.87 bcd	22.37 bcd
T6	n.s	n.s	n.s	n.s	16.68 c	19.50 d	19.06 cd	20.50 cd
T7	n.s	n.s	n.s	n.s	38.62ab	38.50ab	36.43ab	36.63ab
H				11.80	27.27	26.49	23.52	22.19
P				0.0665	0.0001	0.0002	0.0006	0.0011

[1] Mean ranks followed by the same letter do not differ by the Kruskal-Wallis test at 5% significance; [2/] Suc: Sucrose.

genotypes assessed, according to Tables 2 to 7 there are reports that several cut flower cultivars of the same species that varied considerably for longevity (Halevy and Mayak, 1979). Such cultivars should be assessed under controlled conditions as several factors affect the vase life of cut flowers and some do not depend on the flower itself, such as water stress or high temperatures (Mayak et al., 1973). For Han (1992) who assessed "pulsing" with sucrose on *Liatris spicata,* the differences in longevity were attributed to genetic variability and pre-harvest conditions.

CONCLUSIONS

The 24h "pulsing" treatments with sucrose alone or associated with hydroxyquinoline promoted longevity in several ways among the tested genotypes. The best treatments were T5 and T6 for genotype 153 (80 gL^{-1} and 100 gL^{-1} sucrose, respectively); T3 and T7 for genotype 101 (40 gL^{-1} sucrose and 40 gL^{-1} sucrose + 200 mgL^{-1} hydroxyquinoline); T6 for genotype 181 (100 gL^{-1} sucrose); T7 for genotype 127 (40 gL^{-1} sucrose + 200 mgL^{-1} hydroxyquinoline); T4 and T5 for genotype 140 (60 gL^{-1} and 80 gL^{-1} sucrose, respectively) and T4 for genotype 114 (60 gL^{-1} sucrose).

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RESUMO

Interação genótipo x longevidade pós-colheita em girassol

A longevidade pós-colheita de seis genótipos de girassol, desenvolvidos pela Embrapa Soja, foi avaliada, comparando-se a testemunha, T1 (hastes na água) com seis tratamentos de "pulsing" com sacarose, T2 a T6, (20, 40, 60, 80, 100 gL^{-1}) e T7, sacarose (40 gL^{-1}) associada a 200 mgL^{-1} de 8-HQC. Após o tratamento de pulsing por 24 h, as inflorescências foram colocadas em solução de manutenção com sacarose 20 gL^{-1} e avaliadas diariamente sob critérios de notas, definido para quantificar a longevidade em número de dias de vaso. Os tratamentos de "pulsing" promoveram a longevidade de maneira diversa entre os genótipos testados. Os melhores tratamentos foram: T5 e T6 (genótipo 153); T3 e T7 (genótipo 101); T6 (genótipo

181); T7 (genótipo 127); T4 e T5 (genótipo 140) e T4 (genótipo 114). Nestes tratamentos a longevidade foi aumentada de 2 a 3 dias, quando se comparou à testemunha

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