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EFFECT OF PULSING SOLUTION, SIMULATE TRANSPORT AND HOLDING SOLUTION ON KEEPING QUALITY OF *Gypsophila paniculata* L. CV " PERFECTA " CUT FLOWERS

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ABSTRACT

Pulsing cut *Gypsophila paniculata* L. cv " Perfecta " stem with only 5% of buds open in STS 1:4 mM for 30 min or GA_3 at 25 ppm for over night before storage at 5 ^{0} C for several durations as simulate transport reduced days required to marketable stage and wilting flowers during shelf life period. Also these treatments promoted buds opening, prolonged display life, improved water uptake and water balance and maintaining carbohydrate level at the end of vase life as compared to Ki at 5 ppm and control (D.W) treatments, respectively.

The increased storage period was negatively effective on most parameters studied. On the other hand, display life after the end of storage period at 5 ^{0} C for 15 days was recorded (12.45 and 12.72 days) as compared to (13.63 and 13.65 days) for the control without any treatment in the two seasons, respectively. These led to say that, this period (15 days) is suitable for maintaining price of gypsophila cut flowers.

Maintaining quality of cut flowers at ambient environmental of lab at 18 ^{0}C ± 2 and 50-55 RH after the end of storage periods was by holding flowers in holding solution containing sucrose + 8-HQS + Tween –20. This treatment showed highly significant in enhancing parameters of gypsophila cut flowers, during observation time in lab.

INTRODUCTION

Gypsophila paniculata L., Common Name: Baby's breath, is an important floral crop used as a filler flowers in fresh and dried arrangements. Gypsophila has an inflorescence bearing a large number florets in large delicate clusters, which show a sequential development with young immature buds, opening flowers and open flowers of different physiological ages. The quality of gypsophila flowers is susceptible to deterioration and senescence because the lack of a natural protection to prevent hydric stress after the cut. The relatively poor vase life of fresh gypsophila is due to improper postharvest handling (Rudnicki *et al.*, 1986).

Flowers cut at the bud stage are less susceptible to damage during harvesting and handling, also maintain flowers quality than those cut at fully open stage. This allows more flexibility in the marketing program. Reid and Evans (1986) found that, flower buds are less sensitive to ethylene action and production.

Inflorescence of gypsophila harvested immature with only 5% of bud open failed to develop and wilted unless placed them in a preservative solution (Farnham *et al.*, 1978). Bud opening solutions have been formulated for use on a number of cut flowers species. Some preservative solutions made up of sucrose, bactericide and silver thiosulfate (STS) improving bud opening, displaying life and delaying flowers senescence (Awad *et al.*, 1986 on some cut flowers and Barendse, 1986; Downs *et al*, 1988 and Doi *et al.*,

1999 a & b on gypsophila cut flowers). Sugar is often added to vase water to prolong the vase life of cut flowers (Halevy and Mayake, 1979) and promote flowers bud opening, when cut at early bud stage (Paulin and Jamin, 1982; Goszczynska and Rudnicki; 1988 and Ichimura and Hiraya, 1999). Early senescence is known to be related to ethylene expoure and endogenous ethylene production (Van Doorn and Reid, 1992). STS has been shown to delay and /or prevent the negative effect of endogenous and exogenous ethylene on the keeping quality of cut flowers. But also, it is used as a bactericide. El-Saka (2002) found that, STS treatment was more effective on reducing ethylene production from snapdragon flowers as compared to Ag No3 treatment. Abdel Kader and Rogers 1986 showed that, 8-Hydroxy quinoline sulfate (8-HQS) eliminated bacterial growth that was as principal reason for reducing water uptake.

The storage of cut flowers make it possible to adjust the supply to market demands. Moreover, it is possible to accumulate large quantitative of cut flowers for a single shipment and / or the ability to preserve seasonally product flowers extends the period of their distribution to the market and to the consumers. It is also important for flowers bound for export since it facilitates long distance transportation by truck and sea shipment.

The aim of this study was to investigate the range of responsibility of gypsophila fresh cut flowers for storage at 5° C for several duration as simulate transport by cool truck (in order to minimize transportation costs). Using pulsing solution before storage periods for maintaining flower quality during transpiration. Also, using holding solution at the end of storage period to improved flower quality during shelf life.

MATERIALS AND METHODS

I. Plant material:

Gypsophila paniculata L. cv ' Perfecta' belongs to Family: Caryophyllaceae. Uniform flowers were harvested in the early morning, at the tight bud stage with only 5% buds open, from the Rodoflor Farm, Imbaba, Giza. Flowers were transported with ice gel bags inside icebox to the Postharvest Lab, Flor. Dept. Hort. Res. Inst. The experiment started on November 1st in two successive seasons. of 1999 and 2000.

II. Treatments:

A. Pulsing solution: All flowers were divided to equal and similar four groups and were pulsed in various chemical solutions for over night before storage periods:

1-First group was pulsed in distilled water (D.w) as a control treatment.
2-Second group was pulsed in sliver thiosulphate (STS) 1:4 mM for 30 min then rinsed to D.w .
3-Third group was placed in gibberellic acid solution (GA_3) at 25 ppm.
4-Fourth group was pulsed in kintein solution (Ki) at 5ppm.

All groups were performed in an ambient Environment Lab at 18 ^{0}C ± 2, 50-55 RH and 24 hr lighting by fluorescent lamp at 1000 Lux.

B. Storage period as simulate transport: All groups mentioned above were packaged; every nine stems were wrapped by tissue paper and were packed in cardboard boxes (102 X 50 X30cm), then were moved to room storage at 5 ^{0} C for several durations (in order to simulate transport) : at time 0.0 , 5 and 15 days.

C. Holding solution: After the end of storage period, flower stems were held in different vase solutions;

1-Distilled water (D.w) (pH = 6.6) as a control treatment.

2-Holding solution (H.S) (pH = 4.5). This solution contained 50g/L sucrose + 200 mg /L 8- Hydroxy quioline sulphate (8-HQS) + 1 ml /L Tween-20.

*Three flowers were held in a jar 500ml containing 300ml solution at ambient Environment Lab as was mentioned above.

III. The experimental design: 4 treatments for pulsing solution X 3 treatments for storage periods X 2 treatments for holding solution = 24 treatments. These treatments were arranged as complete randomized block. Each treatment had three replicate and three flowers per replicate. The experiment was repeated three times in each season.

IV. Measurements:

- Number of days required to marketable stage with 25% buds open.
- Display life (Vase life) was considered to be terminated when 75% of the flowers had wilted.
- The number of open flowers and of wilting flowers was recorded as a percentage during shelf life periods.
- Water uptake and water balance during shelf life periods (Water balance = Water up take-Water loss).
- Total and reducing sugars at the end of vase life were determined according to Forsee 1938.

V. Statistical:

The results were statistically analyzed as factorial experimental, according to Thomas and Hill (1978). Using least significant difference test (L.S.D) at 5 and 1 % compared the treatment means.

RESULTS

Reducing days required to marketable stage (25% open flower), increasing flower opening percentage, delaying wilting flowers; improving water uptake and water balance during shelf life periods; all these increases displaying life (vase life) of gypsophila cut flowers were affected by pulsing solutions, but also it interacted with storage periods (as simulate transport) and holding solution.

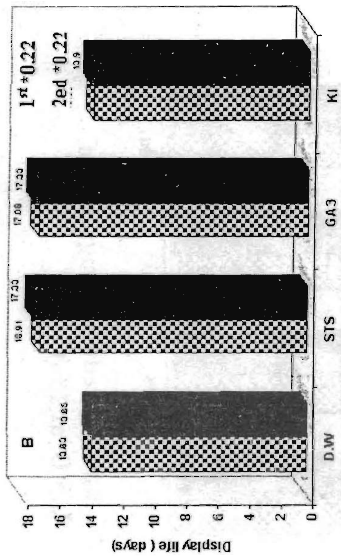
The number of days required to reach marketable stage was the range between 3-5 days with number treatments mentioned above. This result is in agreement with Dio *et al* (1999,b) on gypsophila cut flowers, who mentioned that stems were pulsed in STS 0.2 mM then continuos supply of 4% sucrose + 0.26 mM 8- HQS enhanced buds opening and inhibited the occurrence of flowers browning even under an inductive stress of 25 ^{0} C. Also showed that days between cutting flowers at the stage from the time when

the terminal floret had just opened to the marketable stage with 30% of open buds were 5 and 3 days at 20 and 25 ^{0} C, respectively.

Concerning pulsing solution treatments (D.w, STS, GA_3 and Ki) before storage at 5 ^{0} C for different periods i.e. 0-time, 5 and 15 days, it was clear that STS and GA_3 treatments recorded high significantly reduced the number of days required to marketable stage (Fig. 1), highly significant increase in vase life to 16.99 and 17.33 days for STS and 17.08 and 17.33 for GA_3 in the two seasons, respectively (Fig.1). Moreover, showed highly significant increase in buds opening until 9th days and highly significant decrease in flowers wilting, until 15thdays during shelf life periods (Fig. 2). On the other side, it recorded highly significant values in enhancing water uptake and water balance until 14th days (Fig, 3). In the same time, it maintained the level of carbohydrate until the end of vase life (Fig 4) as compared to Ki and control (d.w) treatments, respectively.

Regarding storage periods at 5 ^{0} C in order to simulate transport, it was obvious from Figs. 5,6,7 and 8 that, the length of cold storage period was negatively effective on most postharvest parameters under investigation. However, with the increased storage period, the number of days to marketable stage decreased, but also, it accelerated wilting. On the other hand, display life of flowers after the end of storage period at 5 ^{0} C for 15 days recorded 12.45 and 12.72 days as compared to 13.63 and 13.65 days for the control treatment in the two seasons, respectively.

Flowers were held in holding solution containing 50 g/L sucrose +200 mg /L 8-HQS + 1m/L Tween –20 recorded more significant effect in keeping quality of flowers and in enhancing parameters of gypsophila fresh cut flowers as compared to flowers be held in D.W (control) treatment (Figs. 9,10,11 and 12).



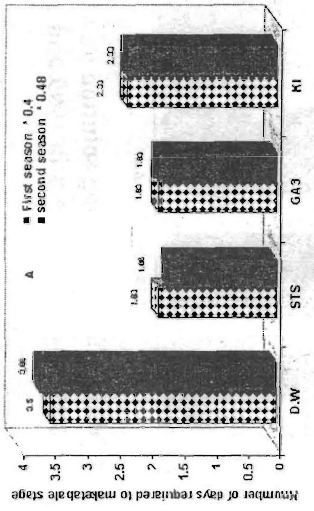
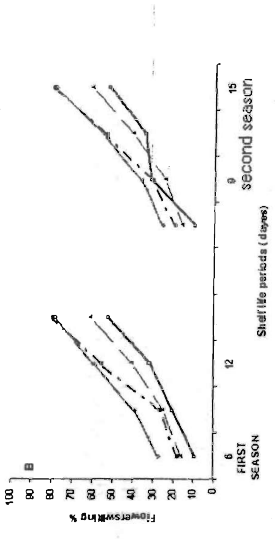


Fig.1. Main effect of pulsing solution on (A) number of days required to marketable stage and (B) display life (days) of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)



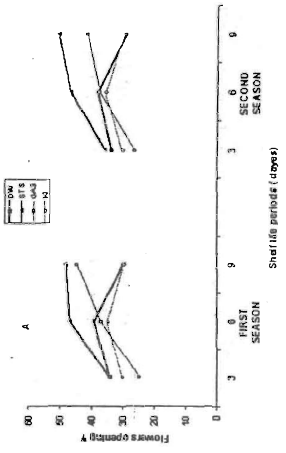


Fig. 2. Main effect of pulsing solution on (A) flowers opening % and (B) flowers wilting% of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)

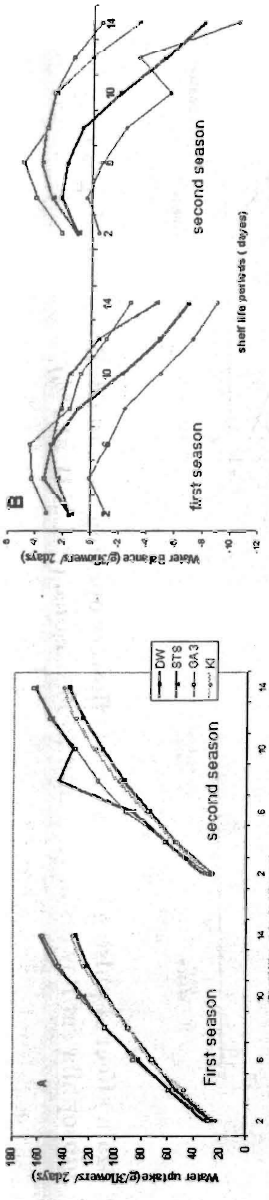


Fig. 3. Main effect of pulsing solutions on (A) water uptake (g/3flowers/2days) and (B) water balance (g/3flowers/2days) of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)

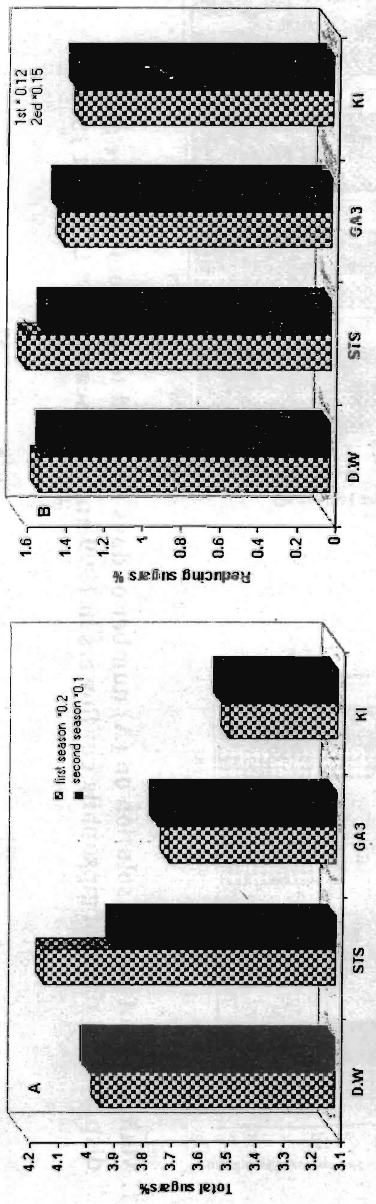


Fig. 4. Main effect of pulsing solution on (A) total sugars % and (B) reducing sugars% of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)

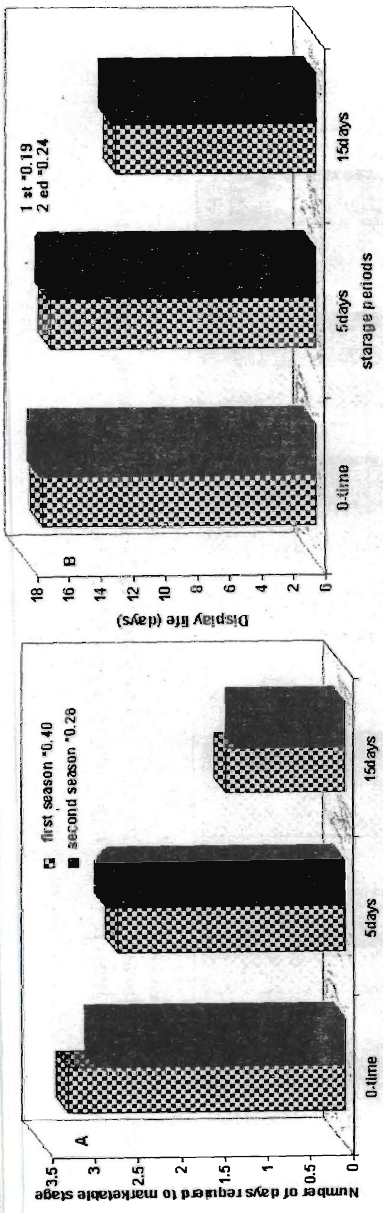


Fig.5. Main effect of storage periods(days) on (A) number of days required to marketable stage and (B) display life (days) of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)

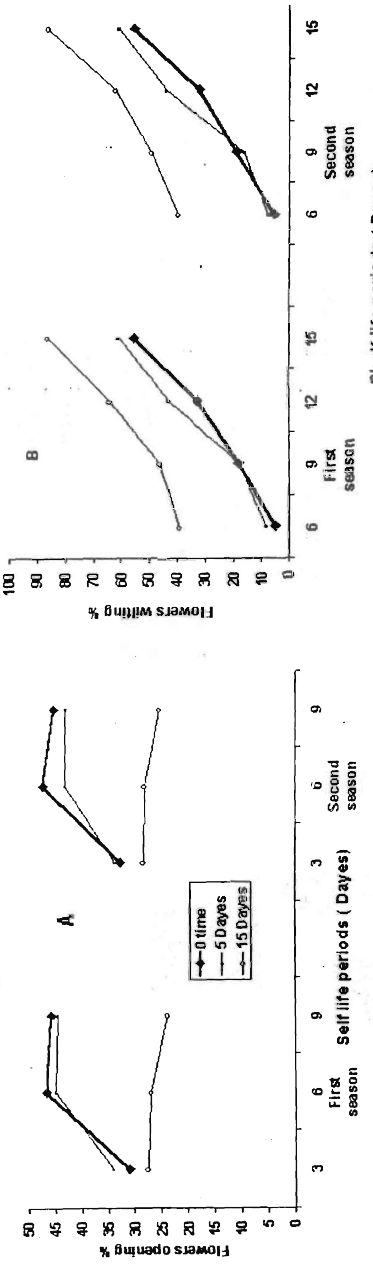


Fig. 6. Main effect storage periods(days) on (A) flowers opening % and (B) flowers wilting% of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)

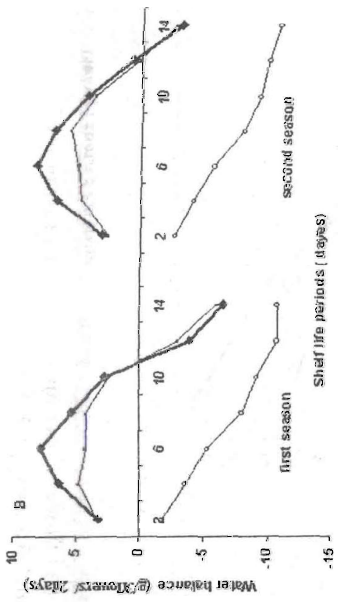


Fig.7.. Main effect of storage periods(days) on (A) water uptake (g/3flowers/2days) and (B) water balance (g/3flowers/2days) of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)

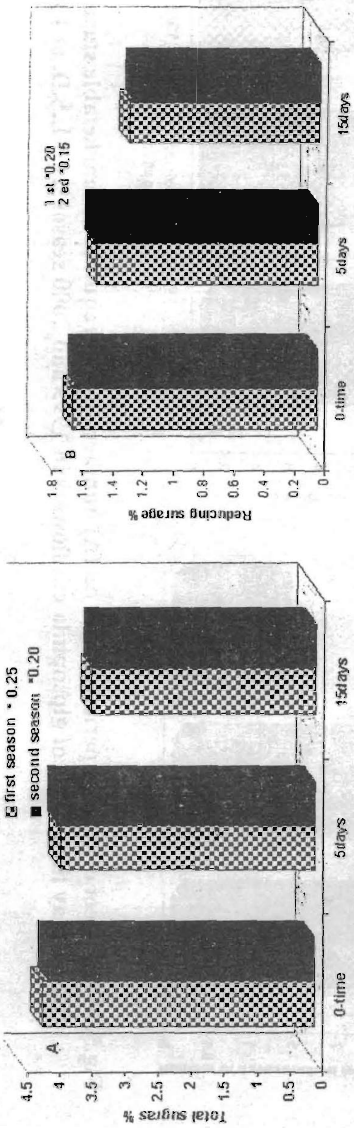
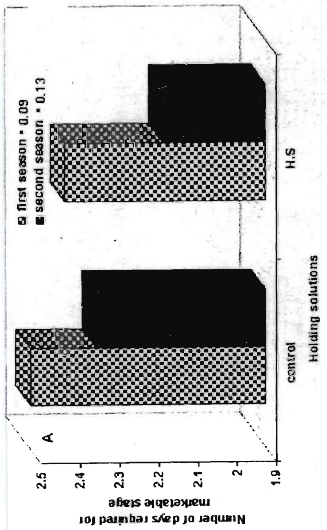


Fig.8. Main effect of storage periods(days) on (A) total sugars % and (B) reducing sugars % of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)



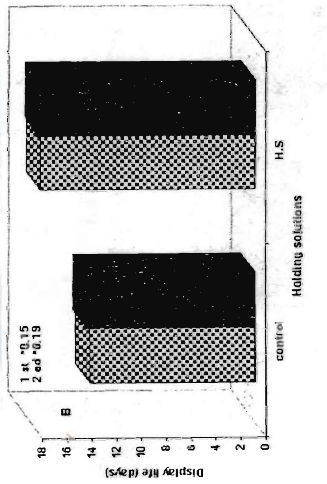
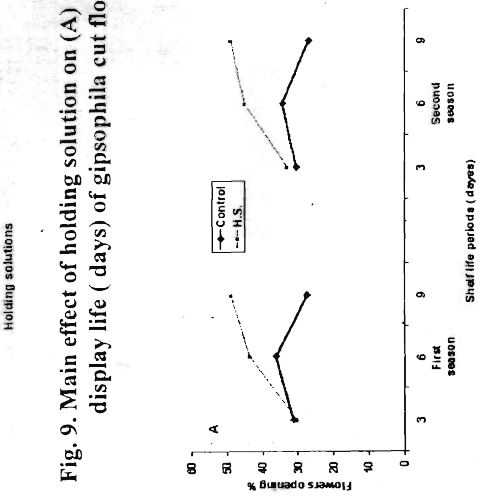


Fig. 9. Main effect of holding solution on (A) number of days required to marketable stage and (B) display life (days) of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)



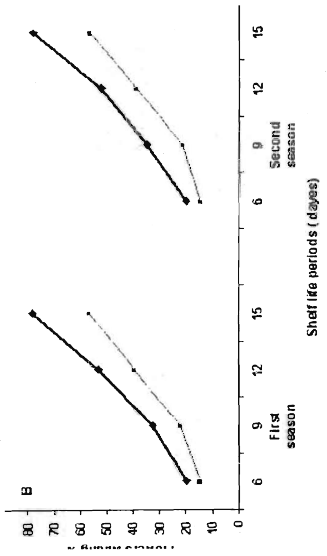


Fig. 10. Main effect of holding solution on (A) flowers opening % and (B) flowers wilting% of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)

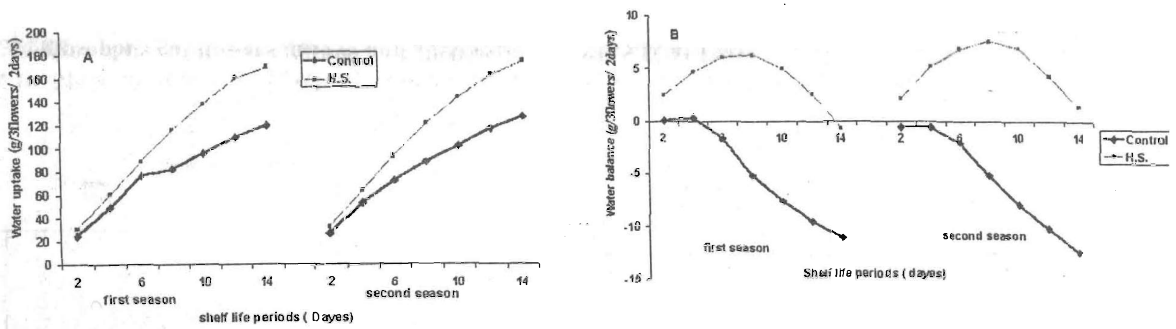


Fig11. Main effect of holding solution on (A) water uptake (g/3flowers/2days) and (B) water balance (g/3flowers/2days) of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)

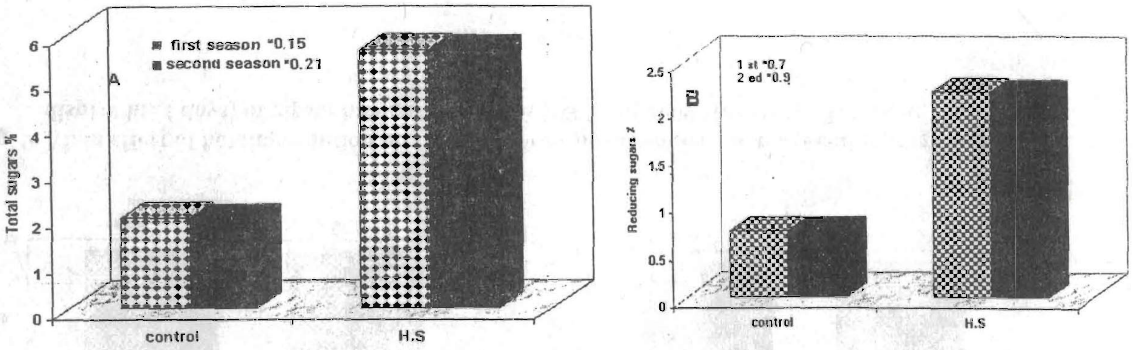


Fig.12. Main effect of holding solution on (A) total sugars % and (B) reducing sugars % of gipsophila cut flowers in 1999 and 2000 seasons. (* L.S.D. at 1%)

DISCUSSION

The obtained results pointed out that, STS treatment improved buds open and flower quality, this is in agreement with Newman *et al.* (1998), Tandler *et al.* (1986) and Van – Doorn and Reid, (1992) who maintained that, products containing adequate concentrations of silver consistently extended the display life of gypsophila flowers. Also Results showed that STS treatment improved water uptake and water balance. This is in agreement with Fujino *et al.* (1983). The increased water uptake and enhanced water balance were due to the increase in florescence fresh weight during shelf life periods. Halevy and Koflranek (1977) recorded that, this may have been due to slivers report biocidal activity.

The results showed that GA_3 played an important role in enhancing flower quality. GA_3 treatment increased buds open. This is in agreement with El-Saka *et al* (1994) on bird –of-paradise and Steinitz and Cohen (1982) on stalks of static. The plant growth regulators have marked affect on opening of cut flowers. Gibberellin might be expected to affect flower opening, involving growth of petals or subtending tissue. There are hormanal balance between GA and ethylene levels. The increased GA level promoted buds open, but ethylene showed reflex action. Flowers exhibited varying degrees of sensitivity to ethylene. Ethylene is known to prevent open buds of gypsophila. Thus, GA_3 and STS treatments are more effective in inhibiting ethylene action and production.

Sucrose is often added to vase solution in order to prolong vase life of most cut flowers and improve flower quality. The results showed the similar trend. This may be due to the requirement of sugar for respiration and the synthesis of organic materials, as well as for maintaining osmotic potential in petal cells (Borochov and Woodson 1989).

Adding 8-HQS to the holding solution as well as, bactericide and reducing pH of solution, which improved the solution absorption. This positively affected the postharvest parameters under study.

Concerning wetting agent at a low concentration greatly improved hydration of flowers. Tween–20 was reported to dramatically prevented stem break of gerbera flower, if added to the antimicrobial pulse treatment (Van-Meeteren, 1978). Also, Durkin (1981) mentioned that wetting agent by reducing the surface tension of water, overcomes the air embolism problem enhances the rate solution penetration, which is the first logical step to establishing a continuous water column within the flowers stem.

The results under discussion showed that the treatments used in this experiment increased buds open of gypsophila flowers cut at 5% buds open. However, De-Barrera and Arenes (1999) mentioned that the optimum harvest time was 50% buds open in every shoot of three *Gypsophila paniculata* " Perfacta " clones. This indicated the importance of the mentioned treatments and the used system.

Recommendations

Pulsing flowers in STS 1:4 mM for 30 min or GA_3 at 25 ppm for over night before storage at 5 °C for different durations up to 15 days. After that flowers

were held in holding solution containing 50g/ L sucrose 200 mg /L 8 HQS + Im l/L Tween – 20 in order to improve flowers quality and maintain flowers price.

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تأثير محلول الغمس ومحاكاة ظروف النقل ومحلول الفازة علـــى جـودة أزهـار الجبسوفيلا صنف برفكتا

ماجدة السقا* – على معوض** – عبد الرحمن عوض** – أسامة عبد الصادق*
* معهد بحوث البساتين – قسم الزينة – معمل تداول الزينة
** جامعة الزقازيق – كلية الزراعة – قسم البساتين

أجرى هذا البحث بمعهد بحوث البساتين بـــالجيزة خـلال عـامين متتـاليين ١٩٩٩-٢٠٠٠على أزهار الجيسوفيلا صنف برفكتا .حيث قطفت الأزهار عند تفتح ٥% من الـــبراعم الزهرية.

تم غمس السيقان الزهرية في أي من:-

محلول ثيوسلفات الفضة ١ – ٤ ملليمول لمدة ٣٠ دقيقة أو محلول حمض الجـــيريلك ٢٥ جزء/مليون أو محلول الكينتين بتركيز ٥ جزء في المليون لمدة ليلة قبل التخزيـــن (محاكـاة الشحن) على درجة ٥°م لفترات مختلفة. وكانت أهم النتائج:

اختزال عدد الأيام التي تحتاجها البراعم للوصول إلى مرحلة التسويق التجاري وتـــم تحديدها ٢٥% و زيادة عمر الأزهار في الفازه مع تحسين النسبة المئوية للتفتح وأيضـــا اخـتزال النسبة المئوية للأزهار الذابلة خلال فترة ملاحظة الأزهار بعد الشحن وتحسين النسبة المئوية للتفتح خلال فترة ملاحظة الأزهار بعد الشحن و أيضا تحسين امتصاص الماء والاتـــزان المـائي و المحافظة على مستوى الكربوهيدرات حتى نهاية عمر الأزهار في الفازه وذلك بالمقارنة بمعاملـة كل من الكينيتين ٥ جزء / مليون ومعاملة المقارنة (ماء فقط).

كانت زيادة فترة التخزين ذو تأثير سلبي على معظم الصفات تحت الدراسة لكن مـن جانب آخر سجلت معاملة استمرار التخزين حتى ١٥ يوم ١٢,٤٥ – ١٢,٧٢ يوم بالنسـبة لعمـر الأزهار في الفازه بالمقارنة بمعاملة الكنترول (بدون أي معاملة) حيث سجلت ١٣,٦٣ – ١٣,٦٥ يوم خلال الموسمين على التوالي هذا يدفعنا إلى القول بأن هذه المعاملة قد تكون مناسبة للحفاظ مع سعر أزهار الجيسوفيلا المقطوفة

تم الحفاظ على جودة الأزهار تحت ظروف المعمل ١٨± ٢° م و ٥٠ – ٥٥ % رطوبة نسبة بعد نهاية فترة التخزين وذلك بوضع الأزهار في محلول مكون مـــن الســكروز + ٨ هيدروكسى كينولين كبريتات + التوين٢٠ وقد سجل هذه المعادلة معنوية عالية في تحسين صفـــات أزهار الجيسوفيلا خلال فترة ملاحظاتها في المعمل .