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G Jyothi
Assistant Professor, Collage of Horticulture, Rajendranagar, SKLTSHU, Hyderabad, Telangana, India

Dr. A Girwani
Associate Professor, Dean COH, Rajendranagar, SKLTSHU, Hyderabad, Telangana, India

Dr. P Prashanth
Collage of Horticulture, Rajendranagar, SKLTSHU, Hyderabad, Telangana, India

Dr. P Saida Naik
Collage of Horticulture, Rajendranagar, SKLTSHU, Hyderabad, Telangana, India

Dr. Srinivasa Chary
Collage of Horticulture, Rajendranagar, SKLTSHU, Hyderabad, Telangana, India

Corresponding Author:
G Jyothi
Assistant Professor, Collage of Horticulture, Rajendranagar, SKLTSHU, Hyderabad, Telangana, India

Effect of sucrose on physical factors in enhancing the vase life of gypsophila (*Gypsophila paniculata*) CV. crystal white

G Jyothi, Dr. P Prashanth, Dr. A Girwani, Dr. P Saida naik and Dr. Srinivasa Chary

Abstract
An experiment was conducted to study the effect of different concentrations of sucrose on vase life of gypsophila flowers at Floricultural Research Station, SKLTSHU, Rajendranagar, Hyderabad during 2019-2020 and 2020-2021. The results of the experiment revealed that, water uptake (g/f), transpirational loss of water (g/f), water balance (g/f), and vase life (days) differed significantly due to various concentrations of sucrose (1%, 2%, 3%, 4%, 5%, 6% and distilled water (control). Among the different concentrations of sucrose, the treatment, (T_5) sucrose at 5% concentration recorded the best results for almost all the parameters studied and resulted with mean maximum water uptake (9.43 g/f), transpirational loss of water (14.60), water balance (3.82 g/f), and vase life (8.33 days) and is economical though (T_6) sucrose at 6% concentration also recorded higher values which are on par with each other.

Keywords: Sucrose concentrations (%), water uptake, transpirational loss of water, water balance, vase life and gypsophila flowers CV. crystal white

Introduction
Gypsophila **(***Gypsophila paniculata* L.) is commonly called as Baby's-breath' which belongs to caryophyllaceae family and is native to Central and Eastern Europe. It is an extremely hardy perennial plant having deep tap root system. Flowers are numerous produced usually in profusely branched panicles. The light airy mosses of small white to pink flowers of gypsophila makes good contrast to large flowers in bouquets as flower filler which had great value as cut flower in floristry. It is one of the top ten international cut flowers. Extract from the roots of Gypsophila have been used as a gold polish and fabric softener and also been used to prepare foods such as herbal cheese and ice cream (Korkmaz and Ozcelik, 2011) [6]. Crude extracts from Gypsophila species are cytotoxic to tumour inducing macrophage cell lines and may be useful in fighting cancer (Gevrenova *et al.*, 2014) [4].

Materials and Methods
The experiment was carried out at Floricultural Research Station, Rajendranagar, Hyderabad, during the years 2019 and 2020 with different concentrations of sucrose consists of 1%, 2%,3%, 4%, 5%, 6% and distilled water (control) to find out the efficacy on extending the vase life of gypsophila flowers. Uniform spikes of 60 cm length with more than 75% open florets were harvested and used in this study. The harvested spikes were placed in 500 ml glass bottles with 200 ml of sucrose solutions at varying concentrations of 1%, 2%, 3%, 4%, 5%, 6% and distilled water (control) to carry out the vase life studies.
Data related to water uptake (g/f), transpirational loss of water (g/f), water balance (g/f),fresh weight change (%) and vase life (days) vase life was recorded and statistically analysed using OPSTAT software and the difference of means was compared at five per cent level of significance.

Results and Discussion
Water uptake (g/f)
The gypsophila flowers treated with different sugar concentrations differed significantly for water uptake. (Table 1 and fig.1). Significantly highest mean water uptake was observed with the treatment (T_5) Sucrose at 5% on 2nd day (11.67g/f), 4th day (9.66 g/f), and 6th day (6.97 g/f) and over all mean (9.43 g/f) which is on par with (T_6) sucrose at 6% on 2nd day (11.52 g/f), 4th

day (9.18 g/f), and 6th day (6.52 g/f) and over all mean (9.07 g/f) and superior to all other treatments. However, the treatment, (T_7) control (distilled water) recorded significantly lowest water uptake on 2nd day (5.33 g/f), 4th day (4.21g/f), and 6th day (2.67g/f) and over all mean (4.07 g/f). The treatment (T_4) Sucrose at 4% (4.72 g/f), (T_5) Sucrose at 5% (5.68 g/f), and (T_6) Sucrose at 6% (5.37 g/f) recorded water uptake up to 8th day and there was a gradual decrease of water uptake from 2nd day to 8th day of vase life study of gypsophila cut flowers. This might be due to more vascular occlusions at the lower concentrations and also in control by microbes resulted in disturbed water relations which leads to low water uptake compared to higher concentrations of sucrose in gypsophila flowers. Evans and Reid (1986) suggested that sucrose treatment leads to increase the soluble sugar content, as well as lowers the osmotic potential in the cells, there by promoting a water flux which drives in turn cell expansion.

Table 1: Effect of different concentrations of sucrose on water uptake (g/f) of gypsophila cut flowers cv. crystal white

Treatments	Water uptake (g/f)				
	2nd day	4th day	6th day	Mean	8th day
T_1-Sucrose @1%	6.83 e	4.82 e	4.34 d	5.33	-
T_2-Sucrose @2%	8.16 d	6.35 d	4.83 c	6.45	-
T_3-Sucrose @3%	9.17 c	7.24 c	5.01 c	7.14	-
T_4-Sucrose @4%	10.50 b	8.35 b	5.51b	8.12	4.72
T_5-Sucrose @5%	11.67 a	9.66 a	6.97 a	9.43	5.68
T_6-Sucrose @6%	11.52 a	9.18 a	6.52 a	9.07	5.37
T_7-Distilled water (Control)	5.33 f	4.21f	2.67 e	4.07	-
S. Em±	0.19	0.17	0.16		0.11
CD (P =0.05)	0.58	0.51	0.49		0.33

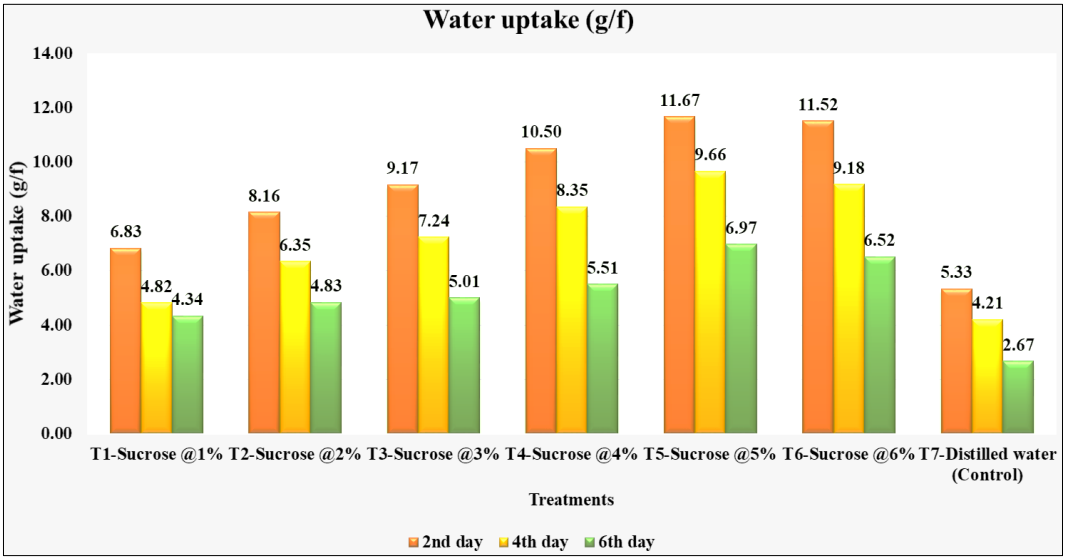

Fig 1: Effect of different concentrations of Sucrose on water uptake (g/f) of gypsophila cut flowers cv. crystal white

Transpirational loss of Water (g/f)

The gypsophila flowers held at different concentrations of sucrose differed significantly on transpirational loss of water (table 2 and fig.2) with highest mean TLW was recorded in the treatment (T_5) sucrose at 5% on 2nd day (15.98 g/f), 4th day (14.67 g/f), and 6th day (13.17 g/f) and over all mean (14.60 g/f) which is on par with (T_6) sucrose at 6% on 2nd day (15.45 g/f), 4th day (14.32 g/f), and 6th day (13.10 g/f) and over all mean (14.29 g/f) and superior to all other treatments. However, the treatment, (T_7) control (distilled water) recorded significantly lowest TLW on 2nd day (8.33 g/f), 4th day (7.17 g/f), and 6th day (6.15g/f) and over all mean (7.22 g/f). The treatment (T_4) Sucrose at 4% (10.83 g/f), (T_5) Sucrose at 5% (12.33 g/f), and (T_6) at Sucrose 6% (12.26 g/f) recorded TLW up to 8th day and there was a gradual decrease of TLW from 2nd day to 8th day of vase life study of gypsophila cut flowers. This might be due to increased uptake of sucrose solution and its effect on stomatal opening due to increase in osmotic concentrations (Eason *et al*., 1997) [1]. Similar findings were also reported by Murali (1990) [7] and Nijasure *et al*. (2004) [8] in cut gladiolus.

Table 2: Effect of different concentrations of Sucrose on transpirational loss of water (g/f) of gypsophila cut flowers cv. crystal white

Treatments	Transpiration loss of water (g/f)				
	2nd day	4th day	6th day	Mean	8th day
T_1-Sucrose @1%	11.33 e	9.33 e	8.43 e	9.70	-
T_2-Sucrose @2%	12.17 d	10.67 d	9.33 d	10.72	-
T_3-Sucrose @3%	13.33 c	11.50 c	10.17 c	11.67	-
T_4-Sucrose @4%	14.17 b	12.83 b	11.33 b	12.78	10.83
T_5-Sucrose @5%	15.98 a	14.67 a	13.17 a	14.60	12.33
T_6-Sucrose @6%	15.45 a	14.32 a	13.10 a	14.29	12.26
T_7-Distilled water (Control)	8.33 f	7.17 f	6.15 f	7.22	-
S.Em±	0.20	0.23	0.18		0.12
CD (P =0.05)	0.61	0.70	0.55		0.35

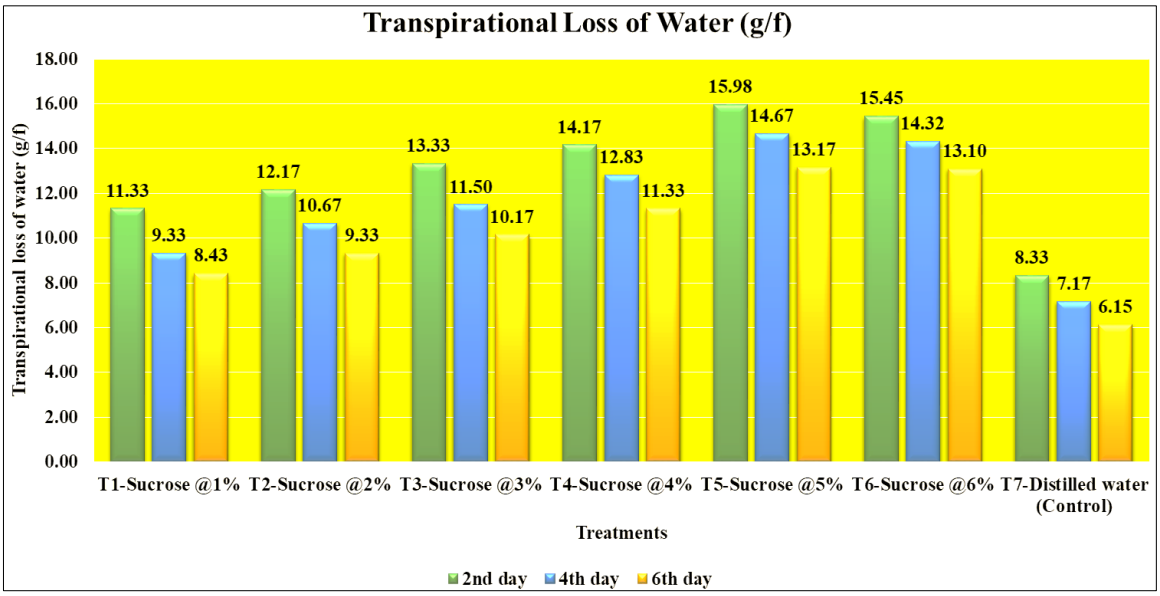

Fig 2: Effect of different concentrations of Sucrose on transpirational loss of water (g/f) of gypsophila cut flowers cv. Crystal white

Water Balance (g/f)

There were significant differences due to treatments for water balance.(table.3).The highest mean for Water balance was recorded in the treatment (T_5) Sucrose at 5% concentration on 2nd day (5.15 g/f), 4th day (3.16 g/f), and 6th day (3.14 g/f) and over all mean value (3.82 g/f) which is on par with (T_6) Sucrose at 6% concentration on 2nd day (5.11 g/f), 4th day (3.14 g/f), and 6th day (3.09 g/f) and over all mean value (3.78 g/f) and superior to all other treatments. However, the treatment, (T_7) control (distilled water) recorded significantly lowest water balance on 2nd day (4.45 g/f), 4th day (1.97 g/f), and 6th day (1.26 g/f) and over all mean value (2.56 g/f). The treatment (T_4) Sucrose 4% (1.96 g/f), (T_5) Sucrose 5% (2.36 g/f), and (T_6) Sucrose 6% (2.31 g/f) recorded WB up to 8th day and there was a gradual decrease of WB from 2nd day to 8th day of vase life study of gypsophila cut flowers. Water balance is a major factor influencing the quality and longevity of cut flowers. The increased water balance is due to increased water uptake and transpirational loss of water recorded by the same treatment. Sucrose helps in improving the water balance of cut flowers by affecting the osmotic potential of cut flowers. These results are in agreement with Halevy *et al.*, (1978) [5] in carnations, chrysanthemum and roses.

Table 3: Effect of different concentrations of sucrose on water balance (g/f) of gypsophila cut flowers cv. crystal white

Treatments	Water balance of flower tissues (WB) (g/f)				
	2nd day	4th day	6th day	Mean	8th day
T_1-Sucrose @1%	4.80 c (0.80)	2.03 d (-1.97)	1.05 e (-2.95)	2.63 (-1.37)	-
T_2-Sucrose @2%	4.55 e (0.55)	2.05 d (-1.95)	1.55 d (-2.45)	2.72 (-1.28)	-
T_3-Sucrose @3%	4.64 d (0.64)	2.16 c (-1.84)	1.95 c (-2.05)	2.92-(1.08)	-
T_4-Sucrose @4%	4.92 b (0.92)	2.86 b (-1.14)	2.15 b (-1.85)	3.31 (-0.69)	1.96 (-2.04)
T_5-Sucrose @5%	5.15 a (1.15)	3.16 a (-0.84)	3.14 a (-0.86)	3.82 (-0.18)	2.36 (-1.64)
T_6-Sucrose @6%	5.11 a (1.11)	3.14 a (-0.86)	3.09 a (-0.91)	3.78 (-0.22)	2.31 (-1.69)
T_7-Distilled water (Control)	4.45 f (0.45)	1.97 e (-2.03)	1.26 f (-2.74)	2.56 (-1.44)	-
S. Em±	0.02	0.01	0.02		0.02
CD (P=0.05)	0.06	0.03	0.06		0.05

Table 4: Effect of different concentrations of sucrose on vase life (days) of gypsophila cut flowers cv. crystal white

Treatments	Vase life of flowers (days)
T_1-Sucrose @1%	4.21 d
T_2-Sucrose @2%	5.32 c
T_3-Sucrose @3%	5.95 c
T_4-Sucrose @4%	7.13 b
T_5-Sucrose @5%	8.33 a
T_6-Sucrose @6%	7.02 b
T_7-Distilled water (Control)	4.17 d
S. Em±	0.34
CD (P =0.05)	1.02

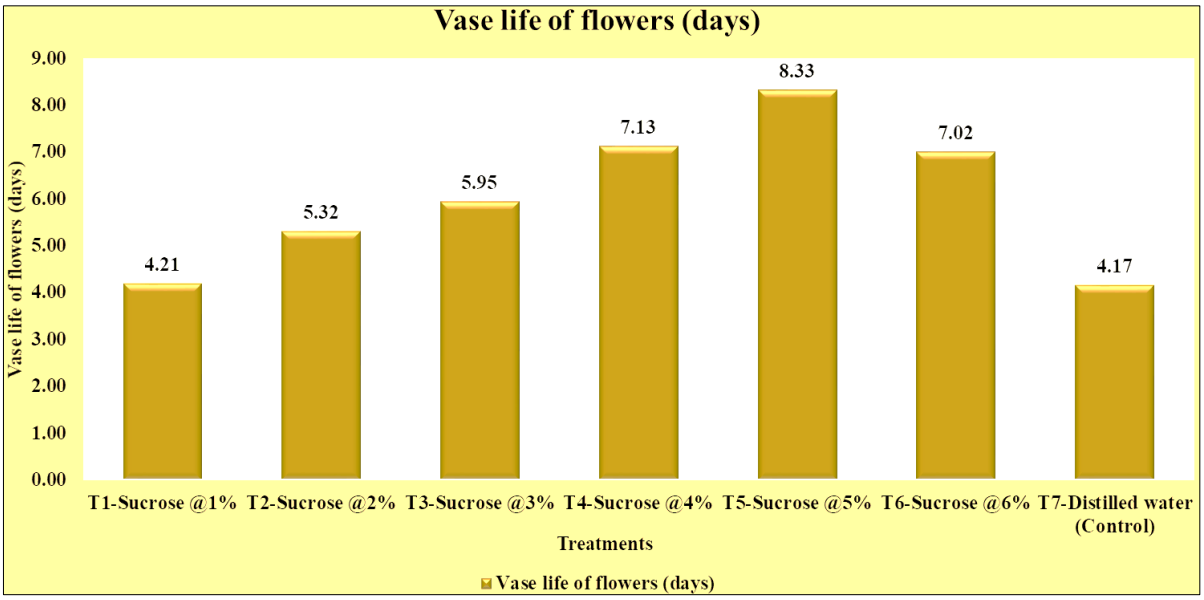

Fig 3: Effect of different concentrations of sucrose on vase life (days) of gypsophila cut flowers cv. crystal white

Vase life of flowers (days)

The gypsophila flowers treated with different concentrations of sucrose differed significantly among the treatments (table 4). The highest mean values was recorded in the treatment (T_5) at sucrose 5% (8.33 days) followed by (T_4) at sucrose 4% (7.13 days) which is on par with (T_6) sucrose at 6% (7.02 days) and lowest was recorded in the treatment (T_7) control (4.17 days) which is on par with the treatment (T_1) sucrose at 1% (4.21%). The remaining treatments recorded intermediate values which were on par with each other. This extension of vase life of gypsophila flowers in the treatment (T_5) may be due to better water relations, maximum water uptake, water balance, minimum physiological loss in weight and also probable use of sucrose as carbohydrate source, when the natural carbohydrates are depleted sugar is used as a substrate of respiration. Sucrose also serves as a building block needed for growth processes associated with flower opening and provides sufficient intercellular carbohydrate reserves to ensure prolonged vase life. These results are in agreement with Garibaldi and Dembrogio (1989) [3] in gerbera cut flowers.

Conclusion

Among the different concentrations of sucrose, the treatment, (T_5) sucrose at 5% concentration recorded the best results for almost all the parameters studied and resulted in higher vase life (8.33 days) and is economical though (T_6) sucrose at 6% concentration also recorded higher values which are on par with each other.

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