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Enhancing Longevity: Extending the Vase Life of *Asparagus setaceus* (*syn. plumosus*) with Chemical Preservatives

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ABSTRACT

Asparagus setaceus, also known as *Asparagus plumosus*, is a popular cut filler due to its delicate, feathery foliage and versatility in floral compositions. However, its tender nature makes it prone to mechanical damage, pests, and diseases, which affect its post-harvest quality and vase life. Hence, the present study was conducted at the College of Horticulture, Bagalkot, Karnataka, during 2018-2019 to device the methods of extending vase life of *Asparagus setaceus* using chemical preservatives. Uniform, pest-free foliages were harvested for quality assessment. To improve longevity, chemical preservatives were used to maintain freshness and enhance water uptake, thereby increasing market value. The study tested six treatments: distilled water (control), 10% sucrose + 100 ppm 8-HQC, 10% sucrose + 200 ppm 8-HQC, 10% sucrose + 25 ppm BA, 10% sucrose + 0.5% boric acid, and 10% sucrose + 25 ppm BA + 0.5% boric acid. The experiment was conducted under ambient conditions, assessing parameters such as initial fresh weight, vase solution absorption, physiological weight loss, and vase life. Results revealed that the combination of 10% sucrose + 25 ppm BA + 0.5% boric acid (T6) resulted in the highest initial fresh weight, the greatest vase solution uptake, and the longest vase life (8.45 days). This treatment minimized weight loss and maintained the foliage's aesthetic quality. In contrast, treatments with distilled water or minimal additives showed shorter vase life and greater weight loss. The study concludes that the combination of 10 % Sucrose + 25 ppm BA + 0.5 % Boric acid effectively extends the vase life of *Asparagus setaceus*, making it a recommended preservative solution for the floriculture industry.

Key Words: *Asparagus setaceus,* Longevity, Pulsing, Sucrose, Boric Acid, Vase Life.

INTRODUCTION

Cut greens are essential in the floriculture industry, adding texture, depth, and natural appeal to floral arrangements. Their affordability makes them widely accessible for florists and consumers, enhancing both everyday displays and large-scale events. (Shirin *et al,* 2011). Cut greens are valued for their longevity, maintaining freshness and vibrancy in floral arrangements. Their varied shapes, textures, and lush green hues enhance the visual appeal, adding depth and contrast to floral designs. (Patel *et al,* 2016). *Asparagus setaceus* (also known as *Asparagus plumosus*) is a captivating filler foliage often used in floral arrangements. Belonging to the Liliaceae family, it is commonly called the asparagus fern due to its delicate, feathery leaves, which are actually modified stems or branches (Safeena *et al,* 2014). *Asparagus setaceus* is a popular ornamental plant renowned for its delicate, feathery foliage and versatility in floral arrangements. Native to South Africa, it is commonly used as a filler in bouquets and floral designs due to its graceful appearance and adaptability to various conditions. This plant is characterized by its fine, fern-like leaves and can be grown both indoors and outdoors, making it a favored choice among florists and horticulturists. Its ability to retain freshness and its aesthetic appeal contribute significantly to its value in the floral industry.

Due to their delicate nature, cut greens are vulnerable to damage, pests, and diseases, affecting their post-harvest quality. Chemical preservatives, including carbohydrates, growth regulators, and germicides help enhance vase life by improving water absorption, reducing ethylene effects, and slowing senescence (Kumar and Singh, 2022). These treatments ensure cut greens remain fresh, cost-effective, and visually appealing in floral

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arrangements. According to Chutichudet *et al* (2011), extending the vase life of cut flowers relies on several key factors, including carbohydrates, preservatives, growth regulators, germicides, and organic acids. These substances impact critical physiological and biological processes, significantly improving post-harvest quality and longevity. Their effects include regulating water balance (absorption and transpiration) and modulating ethylene production, which is known to hasten flower aging. Thus, cut greens are indispensable in the floricultural industry, providing a cost-effective, long-lasting, and visually enriching component to floral arrangements and bouquets. Floral preservative solutions with surfactants and antimicrobial effects enhance water uptake and rehydrate cut flowers, maintaining their freshness and turgor, especially when stored or transported at ambient temperatures (Madhubala *et al,* 2022). In light of these observations, this research aimed to assess how different chemical preservatives, used in holding solutions, influence the postharvest longevity of *Asparagus setaceus*.

MATERIALS AND METHODS

The current investigation was conducted between 2018 and 2019 at the Department of Floriculture and Landscape Architecture, UHS, Bagalkot. A completely randomized design was used for the experiment, which included six treatments and three replications. T1: Distilled water; T2: 10% Sucrose + 100 ppm 8-HQC; T3: 10% Sucrose + 200 ppm 8-HQC; T4: 10% Sucrose + 25 ppm BA; T5: 10% Sucrose + 0.5% Boric acid; and T6: 10% Sucrose + 25 ppm BA + 0.5% Boric acid. Cut foliages of uniform size, free of pests and diseases, were selected and harvested to evaluate the keeping quality. Immediately following harvest, the cut foliages were transported to the laboratory for treatment. The experiment was conducted at ambient conditions in the laboratory, with a relative humidity of 55-60%.per cent and at a temperature of $25^{\circ}C$ to $30^{\circ}C$.

Observations recorded

Initial fresh weight (g): The initial fresh weight (recorded in grams) was measured as the difference in weight between: The complete setup (bottle + water + plant material) and the control (bottle + water alone) at the beginning of the vase life study.

Weight at senescence (g): At the conclusion of the experiment, the final weight at senescence was calculated by subtracting the weight of the glass bottle with water from the total weight of the bottle containing both water and cut Asparagus/Dracaena leaves, with all measurements recorded in grams.

Quantity of vase solution absorbed (g): The net change in vase solution weight was calculated by subtracting the final weight from the initial weight, with results reported in grams

Physiological loss in weight (%): Physiological weight loss percentage was computed using the formula

$$PLW = \frac{IWa - FWa}{IWa} \times 100$$

where IWa = Initial Weight of Asparagus, FWa= Final Weight of Asparagus

Vase life (days): The vase life duration of cut Asparagus foliage was quantified by recording the number of days the material-maintained freshness in the preservative solution.

Colour of the foliage (L*, a*, b*): Foliage color was quantified using a ColorFlex EZ colorimeter (Model CFEZ 1919, HunterLab, Reston, VA) equipped with a 45 mm aperture. Following calibration with standard black and white reference tiles, color values were recorded in the CIE Lab* system, where L* represents lightness, a* indicates red-green chromaticity, and b* denotes yellow-blue chromaticity

RESULTS AND DISCUSSION

Initial fresh weight (g)

The data (Table 1) show how the application of several chemical preservatives affected the initial fresh weight of *Asparagus setaceus* syn. *plumosus*. It was found that the asparagus's initial fresh weight varied very little. The treatment with the highest initial fresh weight (8.66 g) was 10% sucrose + 25 ppm BA + 0.5% boric acid, followed by 10% sucrose + 0.5% boric acid (8.44 g). 5.66 g *i.e.,* minimum initial fresh weight was measured in 10% sucrose + 0.5% boric acid (T5). A 10% sucrose + 25 ppm benzyl adenine (BA) + 0.5% boric acid solution promoted the highest initial fresh weight because sucrose provides a significant energy source, BA acts as a growth regulator that enhances cell division and expansion, and boric acid supports improved water uptake and cell wall stability. This synergistic effect leads to better hydration, increased cell size, and overall improved fresh weight of the flowers (Kamenetsky and Galili, 2011).

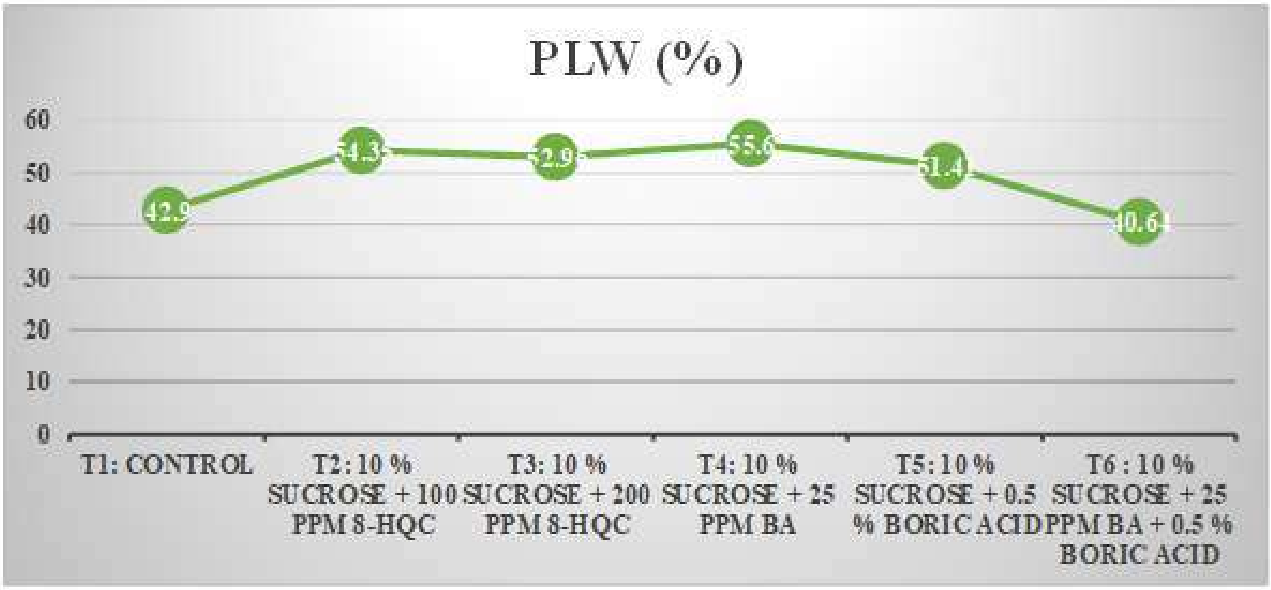

Fig 1: Physiological loss in weight of *A. setaceus (syn. plumosus)*

Weight at senescence (g)

The constant preservation of fresh weight and progressive decrease in fresh weight is an important prerequisite for extending the vase life of any cut foliage. Different pulsing chemicals have an impact on the ultimate fresh weight of *Asparagus setaceus* syn. *plumosus*. When combined with other preservatives, such as 10% sucrose + 25 ppm BA + 0.5% boric acid, the largest weight at senescence was reported (5.14 g), followed by 10% sucrose + 0.5% boric acid (4.82 g) (Table 1). It was lowest for cut foliages treated with 10% sucrose + 0.5% boric acid (T5) (2.75 g), which could be attributed to a decrease in water intake. This decline in water intake is caused by microbes blocking the vascular bundle. Sugar was mixed with germicides such as BA and Boric acid to prevent. Sugar would also enhance the effect of cytokinin, which delays the senescence in in rose (Mayak and Dilley, 1976). These results are in agreement with the findings of Knee (2000).

Quantity of vase solution absorbed (g)

Significant variations were noted among the chemicals used (Table 1). The highest volume of vase solution absorbed was 5.47 g with the treatment of 10% Sucrose + 25 ppm BA + 0.5% Boric acid, followed by 4.05 g with 0.5% Boric acid. The lowest absorption, 0.88 g, was recorded with distilled water. This may be attributed to the antimicrobial properties of the treatments, which help prevent the plugging of vascular bundles and improve water uptake. (Safeena *et al,* 2014). Similar results were reported in Solidago flowers (Hassan, 2005).

Physiological loss in weight (%)

The pulsing treatments had a notable impact on the physiological weight loss over the vase life of *Asparagus setaceus* (syn. *plumosus*) as shown in Table 1. Treatment T6 (10% Sucrose + 25 ppm BA + 0.5% Boric acid) achieved the lowest physiological weight loss at 40.64%, followed by T5 (10% Sucrose + 0.5% Boric acid) with 42.90%. The highest physiological weight loss of 55.60% was observed with treatment T4 (10% Sucrose + 25 ppm BA).

Vase life (days)

As shown in Table 1, different chemical treatments significantly influenced the vase life of *Asparagus setaceus* (syn. plumosus). Among the tested solutions, the combination of 10% sucrose, 25 ppm benzyladenine (BA), and 0.5% boric acid (T6) proved most effective, extending vase life to 8.45 days. This was closely followed by the treatment containing 10% sucrose and 0.5% boric acid, which maintained foliage freshness for 8.02 d. In contrast, cut stems placed in distilled water (control) exhibited the shortest longevity, lasting only 6.28 d. The superior performance of BA-containing treatments may result from its dual function in acidifying the solution and suppressing microbial development (Reddy, 2004). Sucrose likely contributes to longevity by serving both as an osmotic regulator and metabolic energy source for cellular maintenance and structural integrity (Gowda and Gowda, 1990; Murali *et al,* 1991).

Color parameter analysis: The CIELAB color space measurements revealed the following characteristics:

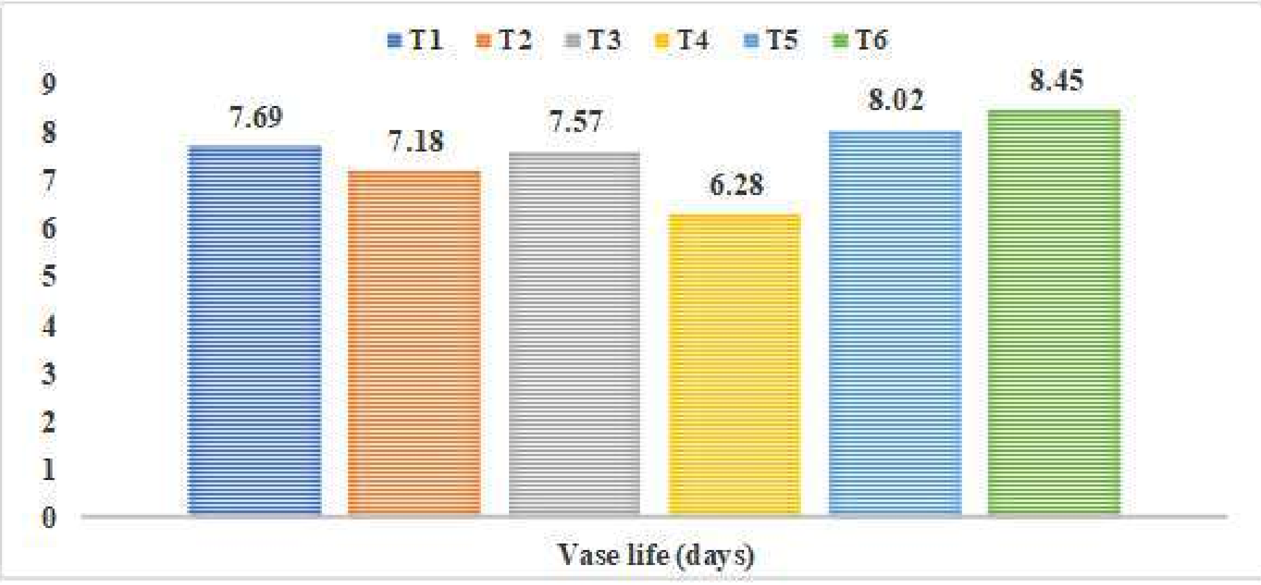

Fig 2: Vase life attributes of *A. setaceus (syn. plumosus)*

1. **Lightness (L*):** Ranging from 0 (absolute black) to 100 (pure white), the L* values demonstrated the relative brightness of the foliage.
2. **Green-red spectrum (a*):** All treatments showed negative a* values, confirming the dominant green coloration of the foliage, as negative values indicate green tones while positive values would suggest red hues.
3. **Yellow-blue spectrum (b*):** This axis measured color variation between yellow (positive values) and blue (negative values).

Temporal color changes: Throughout the experimental period, all color coordinates (L, *a*, and b*)* exhibited progressive increases. This upward trend in a values (toward less negative numbers) particularly indicated a gradual reduction in green intensity, suggesting chlorophyll degradation or color fading over time.

Instrumental colour *L value of cut foliage**

Instrumental colour *L** values of cut foliage's did not reveal significant differences among the treatments during vase life period (Table 2). There was a increase in *L** values with the period in vase life solutions in all the treatments. However, it was minimum in T_1 (16.58). A maximum *L** value among the treatments was noted in T_6(18.52). Similarly at the end of vase life period, it was minimum in T1 (22.38) and the maximum *L** value among the treatments was noted in T_6(25.83). The increase in L* values over time indicates that the cut foliage of Asparagus became lighter or brighter during the vase life period in all treatments. The consistent trend of T1 having the lowest L* values and T6 having the highest suggests a relative difference in the effectiveness of the treatments in influencing the lightness of the foliage. Understanding these changes is crucial for assessing the visual quality and marketability of the cut foliage. The lightness (L* value) is a key factor in the visual appeal of the foliage, which can affect consumer preference and satisfaction.

Instrumental colour *a value of cut foliage**

Similar to *L** value, instrumental colour values for *a** value in Asparagus were also non-significant among the treatments doing vase life period under ambient conditions (Table 2). The *a** values were seen to be negative and found to increase gradually in all the treatments during vase life period. Minimum *a** value was noted in T1 (-7.25) in initial stage. On the contrary, maximum *a** value among the treatments were recorded in T_6(-3.89). Similarly at the end of vase life period, it was minimum in T1 (-4.13) and the maximum *L** value among the treatments was noted in T6 (0.87). Throughout the vase life period, the green coloration of the Asparagus (indicated by the negative a* values) diminished in all treatments. However, the degree of this change varied among treatments, with T1 maintaining a stronger green color initially and at the end compared to T6, which showed a significant shift towards a less green or more neutral color. This information can help in understanding the visual quality and shelf life of Asparagus under different treatment conditions, which is crucial for both

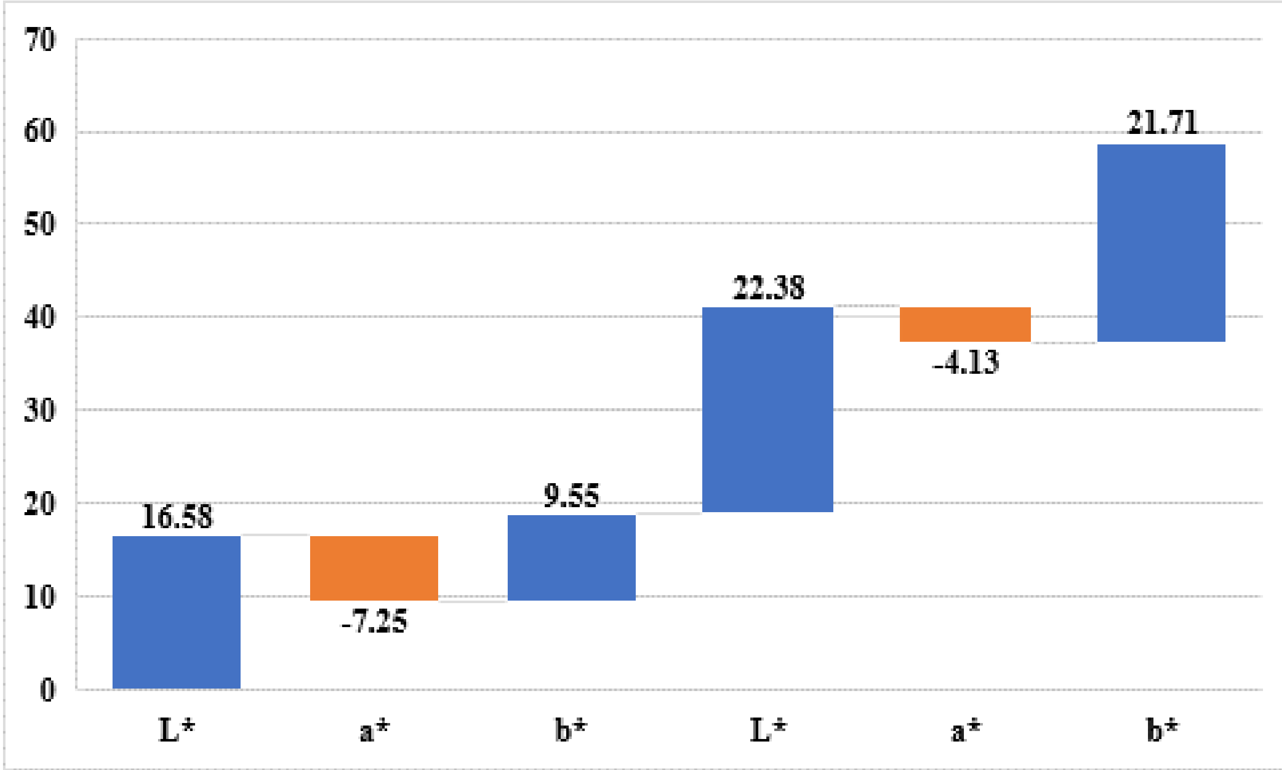

Fig 3: Effect of chemical preservatives on L*, a* and b* colour values of *A. setaceus (syn. plumosus)*

Table 1: Vase life attributes of *Asparagus plumosus* as influenced by chemical preservatives.

Treatment	Initial fresh weight (g)	Weight at senescence (g)	Quantity of vase solution absorbed (g)	PLW (%)	Vase life (days)
T_1: Control	8.44	4.82	0.88	42.90	7.69
T_2: 10 % Sucrose + 100 ppm 8-HQC	7.01	3.20	3.20	54.35	7.18
T_3: 10 % Sucrose + 200 ppm 8-HQC	7.76	3.65	3.65	52.96	7.57
T_4: 10 % Sucrose + 25 ppm BA	7.50	3.33	2.78	55.60	6.28
T_5: 10 % Sucrose + 0.5 % Boric acid	5.66	2.75	4.05	51.41	8.02
T_6: 10 % Sucrose + 25 ppm BA + 0.5 % Boric acid	8.66	5.14	5.47	40.64	8.45
Mean	7.50	3.82	3.34	49.47	7.53
S.Em ±	0.54	0.15	0.18	0.41	0.41
CD (0.01)	1.64	0.47	0.55	1.25	1.24

producers and consumers interested in the aesthetic and freshness of the produce.

Instrumental colour *b value of cut foliage**

The data on *b** value was found to increase gradually along the period of storage in all the treatments (Table 2). There were no significant differences among the treatments with respect to the *b** values during vase life period. However, *b** value was minimum noted in T1 (9.55) in initial stage. A maximum *b** value on the other hand was noted in T6 (12.75). Similarly at the end of vase life period, it was minimum in T1 (21.71) and the maximum *L** value among the treatments was noted in T6 (33.63). The increasing b* values over time suggest that the Asparagus became more yellow during the vase life period in all treatments. The initial and final b* values highlight the differences in the extent of yellowness between the treatments, with T1 consistently showing the least yellowing and T6 the most. Understanding these changes is important for assessing the visual quality and freshness of *Asparagus* under different storage conditions. The yellowness (b* value) is a key

Table 2: Effect of chemical preservatives on L*, a* and b* colour values of *Asparagus plumosus* during vase life period.

Treatment	Leaf colour					
	Vase life days					
	Initial			Final		
	*L**	*a**	*b**	*L**	*a**	*b**
T_1: Control	16.58	-7.25	9.55	22.38	-4.13	21.71
T_2: 10 % Sucrose + 100 ppm 8-HQC	18.52	-7.06	11.25	25.48	-3.93	25.99
T_3: 10 % Sucrose + 200 ppm 8-HQC	17.56	-4.23	10.47	24.71	-1.69	24.32
T_4: 10 % Sucrose + 25 ppm BA	17.45	-3.89	10.58	24.36	-1.87	21.96
T_5: 10 % Sucrose + 0.5 % Boric acid	15.88	-4.92	12.51	23.14	-0.99	31.93
T_6: 10 % Sucrose + 25 ppm BA + 0.5 % Boric acid	18.72	-3.89	12.75	25.83	0.87	33.63
Mean	18.78	-5.24	11.83	18.47	-1.96	23.26
S.Em±	-	-	-	0.94	0.11	1.28
C.D. @1%	-	-	-	2.86	0.34	3.92

factor in the visual appeal and perceived freshness of the produce, influencing consumer preferences and marketability. Increase in lightness and yellowness and decrease in greenness, might be due to degradation of chlorophyll pigments which are responsible for green colour of foliages. Similar results were also obtained by Ji *et al* (2015).

CONCLUSION

The data indicated that treating *Asparagus setaceus* syn. *plumosus* with 10% sucrose and 0.5% boric acid results in the highest initial fresh weight and the greatest weight maintenance at senescence. This combination was particularly effective for initial hydration and weight retention, ensuring the foliage appears fresh and full soon after being cut. However, a more effective treatment for overall vase life involves a combination of 10% sucrose, 25 ppm benzyl adenine (BA), and 0.5% boric acid. This mixture maximized vase solution absorption, ensuring the cut foliage remains well-hydrated. Additionally, it minimized percentage weight loss (PLW), crucial for maintaining the aesthetic quality over time. The inclusion of BA significantly extended the vase life, making this combination the most comprehensive for maintaining cut flower quality. Thus, while sucrose and boric acid alone were effective for initial weight maintenance, adding BA optimizes hydration, reduced weight loss, and extended the longevity of the cut foliage. This combination can be recommended for achieving the best overall results in maintaining the quality of *Asparagus setaceus* syn. *plumosus*.

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