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Effect of Milagrow and Bulb Storage Durations on the Vegetative Growth, Floral Traits, and Bulb Yield of Hymenocallis

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Abstract: This study was conducted as a pot experiment at the nursery of the Ornamental Plants and Landscape Gardening Research Department, Horticulture Research Institute (HRI), Agricultural Research Center (ARC), Giza, Egypt, during two successive seasons (2022 and 2023)."The study aimed to investigate the effects of different concentrations of 'Milagrow' (a commercial formulation containing Brassinosteroids (BRs), Phosphorus, Potassium, and Boron) and various bulb storage periods at 5°C before planting on the flowering and bulb production of *Hymenocallis speciosa* plants." The experiment included two factors. The first factor was the duration of the bulb storage period before planting (0, 25, 35, and 45 days). The second factor was the concentration of the plant stimulant (Milagrow) consisting of [Brassinosteroid (BRs), Phosphorus, Potassium, and Boron] as a soaking solution before planting at 0, 50, 100, and 150 ml/l. The treatments laid out in a factorial experiment using a complete randomized design (CRD). The results revealed that cold storage of Hymenocallis bulbs for 35 days at 5ºc before planting, combined with dipping the bulbs in 100 ml/l of the plant stimulant (Milagrow) containing [BRs, Phosphorus, Potassium, and Boron] resulted in significant improvements in vegetative growth, flowering, bulb production, and the chemical contents of Hymenocallis bulbs.

Key words: *Hymenocallis speciosa Salips*, storage period, milagrow, Spider lily.

1. Introduction

Hymenocallis, commonly known as spider lily, belongs to the Amaryllidaceae family and comprises approximately 30-40 species native to the Americas, ranging from the southern United States to the Andes "*Hymenocallis speciosa* has gained significant attention in ornamental horticulture due to its striking white, fragrant flowers that bloom during the summer and retain their scent post-desiccation. This perennial bulbous species is characterized by evergreen foliage and large flowers, often reaching 23 cm in length, featuring distinctive narrow petals and a prominent central cup."Despite its ornamental value, commercial production of *H. speciosa* is limited by inconsistent flowering, bulb dormancy, and low propagation efficiency."

Bulb dormancy regulation represents a critical factor in the production cycle of ornamental bulbous plants. Cold storage treatments have been widely employed to break dormancy and synchronize flowering in various bulb species. According to **Kim and Oh (2021).** low-temperature storage facilitates the hydrolysis of starch into sucrose within bulb tissues, providing essential energy reserves for subsequent sprouting and flowering. However, the optimal storage duration and temperature vary significantly among species and even cultivars, requiring species-specific protocols **(Yu *et al*., 2022).** In related Amaryllidaceae species, cold storage at 5°C for 3-5 weeks has demonstrated positive effects on flowering quality and timing **(Wu *et al*., 2023).** Nevertheless, excessive cold storage duration may lead to deterioration of bulb quality and reduced flower longevity, high lighting the need for precise optimization **(Deng *et al*., 2023).**

Brassinosteroids (BRs), a class of polyhydroxylated steroidal phytohormones, have emerged as promising plant growth regulators in ornamental horticulture. Recent research has demonstrated that exogenous BRs application enhances cell division and elongation, stimulates flower bud differentiation, and improves carbohydrate assimilation and ATP activity in various ornamental species **(Chen *et al*., 2022and Wang *et al*., 2023).** Milagrow, a commercial plant growth regulator containing brassinosteroids (BRs) combined with essential mineral nutrients phosphorus, potassium, and boron. It has shown particular promise in enhancing growth and flowering responses in bulbous ornamentals The synergistic effects of BRs with mineral nutrients may be especially beneficial for bulbous plants like *H. speciosa*, which require balanced nutrition for optimal flower development and daughter bulb formation **(Liu *et al*., 2023).**

Phosphorus plays a crucial role in energy transfer and flower development in plants, while potassium enhances stress tolerance and improves overall plant **(Khan *et al*., 2023).** Boron, though required in smaller quantities, is essential for cell wall formation, pollen germination, and sugar transport within the plant **(Cui *et al*., 2023).** The combined application of these elements with brassinosteroids may create a synergistic effect that addresses multiple physiological requirements simultaneously.

Despite advancements in bulb storage and growth regulator applications, research specifically targeting *H. speciosa* remains limited. Previous studies have primarily focused on more commercially established bulb species such as lilies, narcissus, and tulips **(Zhang *et al*., 2022).** "However, the interaction between pre-planting cold storage duration and brassinosteroid-based treatments has not been systematically investigated *in H. speciosa* under controlled conditions. Elucidating these interactions could provide valuable insights for optimizing production protocols and enhancing the commercial viability of this ornamental species".

Therefore, this study aims to investigate the effects of different cold storage durations (0, 25, 35, and 45 days at 5°C) combined with varying concentrations of plant stimulant (Milagrow) containing (BRs, phosphorus, potassium, and boron) on the growth, flowering, and bulb production of *Hymenocallis speciosa*. The findings will contribute to developing evidence-based protocols for commercial production of this attractive ornamental species while addressing knowledge gaps in the physiological responses of Amaryllidaceae bulbs to integrated dormancy-breaking and growth-promoting treatments.

2. Materials and Methods

2.1. Experimental site and plant materials

This study was carried out at the nursery of the Horticulture Research Institute, Agriculture Research Center, Giza, Egypt during the two successive seasons of 2024 and 2025. The experiments included two different factors, i.e. bulb storage days before planting (0, 25, 35, 45 days) in cold storage at 5°C. The second factor was soaking the bulbs 24 hours before planting in (Milagrow) compound at different levels (0, 50, 100, 150 ml/l) obtained from Ijara Company, Cairo; its composition was 0(.2% Brassinosteroids, 2% phosphorus, 10% potassium and 3% Boron). Treatments were arranted in a factorial experiment with three replicates. Each replicate contained 15 bulbs.

2.2. Trial procedures and sampling

Initially, bulbs of Hymenocallis were planted on March 15th in both seasons in plastic pots of 30 cm diameter, filled with a medium that contained clay and sand (1:1) by volume of about 7.5 kg. The analysis of growing media like in Table (1). Bulbs' weight were about 110 g, 4 cm in diameter and 20 cm in circumference. Physical and chemical characteristics of the growth medium used in this study are summarized in Table (1). Standard agricultural practices, including weeding and pest control, were performed as required. Fertilization was applied using a complete fertilizer (Kristalon, 20:20:20 NPK) at a rate of 2 g/L, delivered at [mention frequency, e.g., 15-day intervals] throughout the growing season.

2.3. Assessments

Plant pigments

Total chlorophyll (a + b)

Total chlorophyll (a + b) of leaf samples was extracted using acetone (80%) and determined at the absorbance of 663 nm wave length for chlorophyll a, while chlorophyll b was measured at 645 nm according the method described by **Wang (2004).**

Measurements recorded

Flower characteristics

Number of days from planting to flowering, stem length (cm), stem diameter (mm) number of flowers/plant, flower diameters (mm), flower weight (g).

Vegetative growth and root characteristics:

Plant height (cm), fresh weight of plant (g), No. of leaves/plant, root length (cm.), fresh weight of roots (g).

Bulbs and bulbs productivity

Bulb circumference (cm.), fresh weight of bulb (g.), number of the new bulbs/plant (bulbs yield), No. of bulblets/polt (bulblets yield), fresh weight of bulblet (g.) and, circumference of bulblets (mm).

Chemical composition

Chlorophyll (a and b) and total carotenoides content (mg/g fresh weight) were determined in the plant fresh leaves of the different treatments according to **Lichtenthaler and Well burn (1985).** Total carbohydrates in dried bulbs were determined according to **Herbert *et al*. (1971).** Additionally, the percentages of nitrogen [N%] content was estimated using the method of **Pregl (1945).** Phosphorus (P %) was determined according to **Luatanab and Olsen (1965).** and potassium [K%] was determined as described by **Jackson (1973).**

The experiment design and treatment

The experimental design was two factorial complete randomized design (RCD) with 3 replicates employced in two seasons. Each replicate contained 15 bulbs, and replicated three times (5 bulbs /replicate) for every experimental.

Statically analysis

Data were then tabulated and statistically analyzed using **SAS program (1994.)** and means were compared by L.S.D. method according to **Snedecor and Cochran (1980).**

Table (1). Characters of growing media, both chemical and physical (A)

Soil of clay/sand lexture%			pH	EC (ds/m)	S.P.	Elements (ppm)						
Clay	**Sand**	**Silt**				**N**	**P**	**K**	**Fe**	**Mn**	**Zn**	**Cu**
45.80%	30.1%	2.25%	7.50	2.80	33.80	90.7	19.1	25.4	5.2	9.0	5.6	3.2

Cationsmeq/l				Anions meq/l		
Na^+	**Ca^{++}**	**Mg^{++}**	**K^+**	**HCO^{-3}**	**Cl^-**	**SO^{-4}**
6.3	5.15	2.9	5.10	5.71	6.95	6.42

3. Results and Discussion

Plant height

Results in Table (2) reveal that plant height was significantly influenced by the studied treatments; the minimum plant height was recorded at 25 days of cold storage, which stands in contrast to Khan *et al*. (2013) who observed enhanced growth with shorter storage durations (30 days). On the other hand, the application of the plant stimulant at 100 ml/L yielded the highest plant height, suggesting a synergistic effect of the stimulant's components on cell elongation and vegetative development. **Ghoneim (2016)**. on pelargonium plants found that treating with foliar spray of Milagrow at 8 ml recorded taller plants. However, the interaction recorded the highest value for 100 ml/l milagrow with 35 days storage in both seasons.

Stem weight

Regarding vegetative growth, the minimum stem weight was recorted for bulbsstored for 25 days. Among the 'Milagrow' treatments, the concentration of 100 ml/L was the most effective, as shown in Table 2. Furthermore, the interaction between storage duration and stimulant concentration revealed that plants treated with 100 or 150 ml/L of Milagrow and stored for 35 days achieved the highest stem weight in both seasons. These results underscore that storage duration plays a critical role in determining plant vigor and biomass accumulation.

Number of leaves/ plant

Data registered in Table (3) demonstrated an increase in values of number of leaves/ plant in two seasons for milagrow treated plants. Meanwhile, the effects of storage in treatments of 45 days recorded the lowest number after control, in the interaction 100ml/l mil grow with 35 days recorded the highest number in the first season but100/150 ml/l in the second one**. Chaithra *et al*. (2020).** indicated that messecity of storage conditions for enhance growth in ornamental plants.

Leaves area

Bhat and sheik (2015). showed that the lowest value after 25 days storage and the short term storage [up to 21 days) for gladiole correlates with enhanced leaf quality at the highest level of 100 ml/l milagrow, meanwhile the interaction 100and150ml/l milgrow with 35 days storage gave the best record of the leaf area in both seasons. **Kauschmanloggation *et al*. (1996).** recorded that millagrow play important role in the control of cell division and

Data in Table (3) the effect of Millagrow on vegetative parameters may be due to the improvement of cell growth. Differentiation divison and enlargement alteration of membrane potential, and metabolism of nucleic acid and protens. **Dehghan *et al*. (2020)**. fond that storage 35 days with gibberellic acid 150ppm gave significal effect in all vegetative growth traits.

Table (2). Effect of storage period and different concentrations of milagrow (Br + some essential elements) and their interaction on Plant height (cm.) and stem weight (g.) of *Hemenocallis sp.* during the two seasons (2022 and 2023)

	Storage days (B)									
Chemical treat. (A)	Control	25	35	45	Mean	Control	25	35	45	Mean
	Plant height (cm.)					Stem weight (g.)				
	1st season									
Control	32.00	34.00	35.00	32.50	33.37	26.25	28.58	36.38	30.89	30.53
50 ml/ l	35.00	37.00	48.00	36.00	39.00	30.80	33.62	36.40	30.35	32.79
100 ml/ l	45.00	47.00	53.00	49.00	48.50	37.51	41.20	48.82	41.34	42.22
150 ml/ l	42.00	46.00	49.00	42.00	44.75	31.31	39.34	45.73	37.64	38.51
Mean	38.50	41.00	46.25	39.88		31.47	35.69	41.83	35.05	
LSD at 0.05	A= 1.489 B= 1.489 A×B= 2.109					A= 1.030 B= 1.030 A×B= 2.578				
	2nd season									
Control	34.00	36.00	37.00	35.00	35.50	27.28	29.45	37.50	31.75	31.50
50 ml/ l	39.10	41.00	54.50	46.50	45.28	31.65	36.35	31.12	24.10	30.81
100 ml/ l	53.30	55.00	66.89	60.00	58.80	37.82	41.50	48.95	41.45	42.43
150 ml/ l	42.59	44.23	51.95	42.50	45.32	31.65	39.81	46.23	39.67	39.34
Mean	42.25	44.06	52.59	46.00		32.10	36.78	40.95	34.24	
LSD at0.05	A= 1.612 B= 1.612 A×B= 2.471					A= 1.235 B= 1.235 A×B= 2.780				

Table (3). Effect of storage period and deferent concentrations of milagrow and their interaction on number of leaves/plants & leaf area (cm^2) of *Hemenocallis sp.* during the two seasons (2022 and 2023)

	Storage days (B)									
Chemical treat. (A)	Control	25	35	45	Mean	Control	25	35	45	Mean
	Number of leaves/plants					Leaves area $(cm.)^2$				
	1st season									
Control	10.00	12.00	12.80	11.50	9.50	91.00	100.13	113.50	102.55	101.80
50 ml/ l	12.00	13.50	14.20	13.29	11.55	103.52	108.45	140.84	126.48	119.82
100 ml/ l	16.00	17.00	18.50	11.00	15.55	138.4	148.20	159.12	141.87	146.90
150 ml/ l	13.00	15.00	16.00	14.30	14.25	121.52	127.84	151.60	141.83	136.95
Mean	12.75	14.38	15.38	12.52		114.65	121.16	141.27	128.18	
LSD at 0.05	A= 1.017 B= 1.017 A×B=1.782					A= 2.370 B= 2.370 A×B= 4.875				
	2nd season									
Control	11.50	13.20	13.60	12.63	12.73	92.00	100.5	114.34	103.05	102.47
50 ml/ l	15.00	13.00	16.60	14.50	14.78	106.56	110.90	142.96	127.60	122.00
100 ml/ l	16.05	19.00	18.00	17.00	17.51	138.96	149.88	159.20	141.38	147.36
150 ml/ l	14.80	15.60	16.55	14.50	15.36	126.06	128.96	158.40	150.85	139.82
Mean	14.34	15.20	16.19	14.66		114.88	122.56	143.73	130.72	
LSD at 0.05	A= 1.119 B= 1.119 A×B= 1.832					A= 2.636 B= 2.636 A×B= 5.045				

Number days from planting to flowering

Data presented in Table 4 indicate that various Milagrow levels succeeded in inducing earlier flowering compared to the control. The earliest flowering was recorded in bulbs stored for 35 days and treated with 100 ml/L Milagrow, which proved to be the superior treatment for accelerating the flowering date across both seasons. These results are in harmony with **Kandil *et al*. (2007)**. who found that biostimulants promote early blooming in *Rosa hybrida*. Furthermore, the influence of storage duration on flowering precocity aligns with the findings of **Dogra *et al*. (2010) and Khan *et al*. (2013)**. who reported that optimized cold storage periods significantly reduce the days to flowering by triggering the necessary physiological transitions**.**

Number of flowers/plant

Data given in Table (4) indicated that storage of 35 days was the best treatment in storage. on the other hand, milagrow treatment100m/l showed height effect for increasing number flowers in the two seasons, milagrow100ml/lwith35 days occupying the first rank in this regard in both seasons. Cold storage enhances growth, flowering date, and spike quality in Freesias and gladiouls **Khan *et al*. (2013)** and **El-Bably (2016**). for tuberose.

Flower weight

The results listed in Table (4) revealed that the storage of 35 days gave the highest value. However, 100 ml/l gave the highest reced from the interaction, treatment 100 ml/l with 35 days storage gave the second values in the two seasons.

Table (4). Effect of storage period and deferent concentrations of milagrow and their interaction on number of days from planting to flowering, number of flowers/ plant and flower weight (g) of *Hemenocallis sp.* during the two seasons (2022 and 2023)

	Storage days (B)									
Chemical treat. (A)	Control	25	35	45	Mean	Control	25	35	45	Mean
	Number of days from planting to flowering					Number of flowers/spike				
	1st season									
Control	116.5	120.5	111.6	120.7	117.33	11.00	12.00	12.56	10.75	11.58
50 ml/ l	116.2	112.5	111.6	116.0	114.08	12.01	12.55	13.66	12.85	12.77
100 ml/ l	113.5	100.4	98.72	101.6	103.56	13.50	15.55	16.60	14.50	15.04
150 ml/ l	111.7	106.4	103.2	105.6	106.73	12.50	13.30	.13.80	13.10	13.18
Mean	114.30	109.95	106.28	110.98		12.25	13.35	14.16	12.80	
LSD at 0.05	A= 4.336 B= 4.336 A×B= 10.435					A= 0.224 B= 0.224 A×B= 0.454				
	2nd season									
Control	116.52	120.6	116.3	122.8	119.06	11.01	12.6	12.50	12.25	12.06
50 ml/ l	116.3	112.5	111.8	116.5	114.28	12.10	12.60	13.70	12.6	12.75
100 ml/ l	113.4	100.4	98.75	101.4	103.49	13,50	15.50	16.60	14.60	15.05
150 ml/ l	111.8	106.5	103.3	105.5	106.78	12.58	13.4	13.90	13.20	13.27
Mean	114.51	110.00	107.53	111.55		12.30	13.53	14.18	13.16	
LSD at 0.05	A= 5.445 B= 5.445 A×B= 10.930					A= 0.265 B= 0.265 A×B= 0.618				

Stem length

Obviously, plants received 25 days storage gave the lowest length spike of flowers, on the other side indicated the great influence plants with 100 ml/l milagrow and the same spike flower, the interaction of 100 ml/l with 35 day storage in the both seasons as data in Table (5). **Rehaman *et al*.**

(2019) observed ont the timing of gibberellic acid application about storage coditions significantly affected the growth parameters of gladiolus, including stem height.

Stem diameter

Stem diameter of control and 45days storage recorded the leas effect while the storage and milagrow100 and 150 ml/l was mastery in proving stem diameter in the two seasons, the interaction showed clearly the superiorly of 100 and 150ml with 35 days storage as in Table (5).

Diameter of flower (flower diameter)

Data presented in Table 5 indicate that Milagrow treatments at 100 ml/L significantly increased flower diameter (mm) in both seasons. Conversely, the control (0-day storage) recorded the lowest values. The interaction between 100 ml/L Milagrow and 35 days of storage yielded the highest flower diameter across both seasons. This enhancement may be attributed to the role of Milagrow in promoting petal growth through cell expansion. In this context, **Hugan *et al*. (2017)**. found that brassinolide (BL) promotes petal growth in *Gerbera hybrida* by elongating cells in the central and basal regions of the petals. Furthermore, Milagrow application could be correlated with an increased photosynthetic rate, as suggested by **Fariduddin *et al*. (2014).** These findings also align with previous reports indicating that 35 days of storage combined with growth regulators improves overall floral characteristics."

Table (5). Effect of storage period and different concentrations of milagrow (and their interaction on stem length (cm.), stem diameter (mm.) and flower diameter (mm.) of *Hemenocallis sp.* during the two seasons (2022 and 2023)

	Storage days (B)														
Chemical treat. (A)	**Cont.**	**25**	**35**	**45**	**Mean**	**Cont.**	**25**	**35**	**45**	**Mean**	**Cont.**	**25**	**35**	**45**	
	Stem diameter (cm.)					**Flower diameter (cm.)**					**Stem length (cm.)**				
	1st season														
Control	1.29	1.43	1.52	1.40	1.41	20.18	21.94	24,03	22.05	22.16	30.00	34.13	37.06	32.50	33.42
50 ml/ l	1.79	1.93	2.33	2.23	2.07	22.20	23.15	25.13	20.00	22.62	34.00	39.60	41.20	46.55	40.34
100 ml/ l	2.02	2.33	2.55	2.41	2.33	23.81	24.95	26.95	25.50	25.30	44.50	50.50	57.50	49.10	50.40
150 ml/ l	1.98	2.02	2.25	2.03	2.07	22.42	23.96	24.94	23.59	23.73	41.12	44.00	55.50	23.00	40.91
Mean	1.77	1.93	2.16	2.02		22.15	23.50	25.26	22.78		37.41	42.05	47.82	37.79	
LSD at 0.05	A= 0.226 B= 0.226 A×B= 0.421					A= 0.472 B= 0.472 A×B= 1.054					A= 0.745 B= 0.745 A×B= 1.680				
	2nd season														
Control	1.31	1.45	1.54	1.41	1.43	20.19	21.96	24.05	22.04	22.06	30.50	34.50	37.60	32.00	33.65
50 ml/ l	1.80	1.95	2.34	2.23	2.08	22.25	23.14	25.15	20.01	22.64	34.50	39.50	41.50	46.06	40.39
100 ml/ l	2.03	2.21	2.56	2.42	2.34	23.80	24.97	26.96	25.52	25.30	44.20	50.01	57.6	49.80	50.40
150 ml/ l	1.99	2.03	2.26	2.02	2.08	22.44	23.98	24.96	23.66	23.76	41.50	44.50	55.00	45.50	46.63
Mean	1.78	1.91	2.18	2.02		22.17	23.51	25.28	22.81		37.68	42.13	47.93	43.48	
LSD at 0.05	A= 0.243 B= 0.243 A×B= 0.480					A= 0.523 B= 0.523 A×B= 1.120					A= 0.934 B= 0.934 A×B= 1.952				

Root length

Data illustrated in Table (6) recorded that the longest root in 35 days storage and recorded the number in milagrow 150 ml/l and the interaction recorded 100 ml/l with 25 days storage and100/150 with35days the highest value in this in two seasons. Gladiolus cormes stored for 30 days sprouted earlier than those stored longer **Khan *et al*. (2013).**

Root fresh weight/plant

"Data presented in Table (6) indicate that root fresh weight (g) increased progressively with the application of Milagrow at 100 ml/l. Conversely, the lowest values were observed in the control group with a 25-day storage period. Regarding the interaction effects, the combination of 100 ml/l Milagrow and a 35-day storage period yielded the highest root fresh weight across both seasons. This enhancement may be attributed to the role of biostimulants in fostering hormonal equilibrium, which boosts metabolic pathways conducive to root development **Ge *et al*. (2023)**.

Table (6). Effect of storage period and deferent concentrations of milagrow and their interaction on root length (cm.) and root fresh weight/plant (g.) of *Hemenocallis sp.* during the two seasons (2022 and 2023)

	Storage days (B)									
Chemical treat. (A)	Control	25	35	45	Mean	Control	25	35	45	Mean
	Root length (cm.)					Root fresh weight/plant (g.)				
	1st season									
Control	38.00	46.50	49.00	40.00	43.38	95.00	101.00	111.00	98.00	101.25
50 ml/ l	43.20	52.00	56.50	44.90	49.15	103.00	131.00	170.00	158.00	140.50
100 ml/ l	51.00	59.00	59.00	52.50	55.38	140.00	162.50	193.00	180.00	168.75
150 ml/ l	58.00	52.00	59.50	49.00	54.63	113.00	150.00	183.00	163.00	152.25
Mean	47.55	52.38	56.00	46.60		112.75	136.13	164.25	149.75.	
LSD at 0.05	A= 1.532 B= 1.532 A×B= 2.371					A= 2.752 B= 2.752 A×B= 4.533				
	2nd season									
Control	39.00	47.00	49.50	41.00	44.13	96.00	102.00	112.00	101.50	102.88
50 ml/ l	43.00	52.50	56.00	45.00	49.13	103.00	131.00	170.00	157.00	104.25
100 ml/ l	51.00	59.30	59.30	48.00	55.58	140.00	162.50	195.00	181.00	169.63
150 ml/ l	58.00	52.00	60.00	50.00	55.00	114.00	151.00	184.00	165.00	153.50
Mean	47.75	52.70	56.20	46.00		113.25	136.63	165.25	151.13	
LSD at 0.05	A= 1.746 B= 1.746 A×B= 2.655					A= 2.923 B= 2.923 A×B= 4.831				

Bulbs weight/ plant

It is evident from data exhibited in Table (7) that storage of 45 days recorded the lowest value 100and 150ml/l milagrow significantly increased it, as well as 35 day storage gave. The matter of the interaction 100 and150 ml/l with 35 days storage gave the highest values in both seasons**. Khan *et al*., (2013**). and **El- Bably (2016).** recorded thah the optimal storage temprerature and duration depend on species, with some benefiting from alternating tempreture.

Bulbs number

All of the treatment storage period or milagrow and the interaction had non-significantl effect on this trait as the data in Table (7).

Bulbs circumference

Data illustrated in Table (7) recorded that bulbs circumference in both season was progressively increased by milagrow while bulbs received 45 day storage gave the lowest value after the plant of control. Meanwhile, the interaction of 35 day storage with 100 ml/l milagrow recorded the highest value in both seasons.

Table (7). Effect of storage period and deferent concentrations of milagrow (Br + and their interaction on Bulbs fresh weight/plants (g.), number bulbs/plants & bulb circumference (cm.) of Hemenocallis *sp.* during the two seasons (2022 and 2023)

	Storage days (B)									
Chemical treat. (A)	Control	25	35	45	Mean	Control	25	35	45	Mean
	Number of bulblets					Number of bulbs/plants				
	1st season									
Control	Control	25	35	45	Mean	1.00	1.12	1.17	1.02	1.09
50 ml/ l	1.50	1.65	1.97	1.60	1.68	1.23	1.27	1.53	1.23	1.32
100 ml/ l	1.89	2.03	2.33	2.20	2.11	1.52	1.63	1.88	1.68	1.68
150 ml/ l	3.00	3.07	3.33	3.05	3.11	1.46	1.53	1.69	1.53	1.55
Mean	2.03	2.13	2.80	2.41	2.34	1.30	1.39	1.57	1.37	
LSD at 0.05	A= 0.232 B= 0.232 A×B= 0.412					A= 0.189 B= 0.189 A×B= 0.327				
	2nd season									
Control	1.51	1.66	1.97	1.61	1.69	1.00	1.12	1.17	1.02	1.09
50 ml/ l	1.89	2.04	2.33	2.21	2.12	1.23	1.27	1.53	1.23	1.32
100 ml/ l	3.01	3.09	3.35	1.89	2.84	1.52	1.63	1.88	1.68	1.68
150 ml/ l	2.04	2.15	2.83	2.42	2.36	1.46	1.53	1.69	1.53	1.55
Mean	2.11	2.24	2.62	2.03		1.30	1.39	1.57	1.37	
LSD at 0.05	A= 0.260 B= 0.260 A×B= 0.489					A= 0.189 B= 0.189 A×B= 0.327				
	Number of bulblets					Bulblets fresh weight/plant (g.)				
	1st season									
Control	Control	25	35	45	Mean	15.50	15.93	20.60	16.00	17.00
50 ml/ l	1.50	1.65	1.97	1.60	1.68	20.10	25.50	27.00	26.50	24.77
100 ml/ l	1.89	2.03	2.33	2.20	2.11	31.50	33.22	35.13	33.80	33.41
150 ml/ l	3.00	3.07	3.33	3.05	3.11	22.88	28.94	31.83	30.81	28.62
Mean	2.03	2.13	2.80	2.41	2.34	22.50	25.89	28.64	26.78	
LSD at 0.05	A= 0.232 B= 0.232 A×B= 0.412					A= 1.021 B= 1.021 A×B= 1.808				
	2nd season									
Control	1.51	1.66	1.97	1.61	1.69	15.52	15.95	20.63	16.40	17.13
50 ml/ l	1.89	2.04	2.33	2.21	2.12	20.12	25.50	27.50	26.27	24.85
100 ml/ l	3.01	3.09	3.35	1.89	2.84	31.53	33.50	35.22	33.50	33.44
150 ml/ l	2.04	2.15	2.83	2.42	2.36	22.89	28.95	31.85	30.83	28.63
Mean	2.11	2.24	2.62	2.03		22.52	25.98	28.80	26.75	
LSD at 0.05	A= 0.260 B= 0.260 A×B= 0.489					A= 1.212 B= 1.212 A×B= 1.989				

Bulblets weight/plant

As shown in Table (8), most treatments significantly increased bulblet weight; however, the 45-day storage period showed no significant difference compared to the untreated control. The 35-day storage duration yielded the highest values, while 100 ml/L was the most effective Milagrow concentration. Regarding the interaction, the combination of 35 days of storage with 100 ml/L Milagrow resulted in the maximum bulblet weight across both seasons, representing the superior treatment in this study."

Table (8). Effect of storage period and different concentrations of milagrow and their interaction on bulbs fresh weight/plants (g.), number of bulblets/plants & bulblets circumference (cm.) of *Hemenocallis sp.* during the two seasons (2022 and 2023)

	Storage days (B)									
Chemical treat. (A)	Control	25	35	45	Mean	Control	25	35	45	Mean
	Bulbs fresh weight/plants (g.)					Number of bulbs/plants				
	1st season									
Control	110.10	123.00	133.50	118.00	121.15	1.00	1.12	1.17	1.02	1.09
50 ml/ l	116.00	125.00	142.00	122.00	126.25	1.23	1.27	1.53	1.23	1.32
100 ml/ l	145.50	150.50	161.70	158.00	153.93	1.52	1.63	1.88	1.68	1.68
150 ml/ l	143.20	148.00	158.00	146.00	148.80	1.46	1.53	1.69	1.53	1.55
Mean	128.70	136.63	148.80	136.00		1.30	1.39	1.57	1.37	
LSD at 0.05	A= 3.213 B= 3.213 A×B= 5.890					A= 0.189 B= 0.189 A×B= 0.327				
	2nd season									
Control	111.50	123.00	134.00	117.50	121.50	1.00	1.12	1.17	1.02	1.09
50 ml/ l	116.30	126.20	144.00	113.50	125.00	1.23	1.27	1.53	1.23	1.32
100 ml/ l	144.50	151.50	163.00	159.00	154.50	1.52	1.63	1.88	1.68	1.68
150 ml/ l	145.00	149.00	160.60	147.00	150.40	1.46	1.53	1.69	1.53	1.55
Mean	129.33	137.43	150.75	134.25		1.30	1.39	1.57	1.37	
LSD at 0.05	A= 4.254 B= 4.254 A×B= 6.458					A= 0.189 B= 0.189 A×B= 0.327				
	Bulb circumference (cm.)					Bulblets fresh weight/plant (g.)				
	1st season									
Control	22.00	23.30	25.60	23.10	23.00	15.50	15.93	20.60	16.00	17.00
50 ml/ l	23.60	24.90	26.30	24.98	25.00	20.10	25.50	27.00	26.50	24.77
100 ml/ l	26.70	27.50	28.50	27.60	27.58	31.50	33.22	35.13	33.80	33.41
150 ml/ l	25.03	26.60	27.00	26.80	26.36	22.88	28.94	31.83	30.81	28.62
Mean	24.33	25.58	26.85	25.62		22.50	25.89	28.64	26.78	
LSD at 0.05	A= 0.452 B= 0.452 A×B= 0.812					A= 1.021 B= 1.021 A×B= 1.808				
	2nd season									
Control	22.30	23.35	25.70	23.22	23.64	15.52	15.95	20.63	16.40	17.13
50 ml/ l	23.65	24.92	26.55	24.99	25.03	20.12	25.50	27.50	26.27	24.85
100 ml/ l	26.73	27.55	28.56	27.63	27.62	31.53	33.50	35.22	33.50	33.44
150 ml/ l	25.33	26.63	27.50	26.50	26.49	22.89	28.95	31.85	30.83	28.63
Mean	24.50	25.62	27.07	25.59		22.52	25.98	28.80	26.75	
LSD at 0.05	A= 0.514 B= 0.514 A×B= 0.890					A= 1.212 B= 1.212 A×B= 1.989				

Number of bulblets/plant

Data presented in Table (8) indicate a significant effect on the number of bulblets produced per plant (bulblet yield) across both seasons. The lowest yield was observed in the non-stored bulbs (0-day storage). Conversely, the highest values were achieved through the interaction between 35 days of storage and 100 ml/L Milagrow, which proved to be the superior treatment in both seasons.

Bulblet circumference

Data given in Table (8) indicated that applying storage or milagrow gave to best bulblets circumference, there were niglible differences in this value in two seasons. Cold storage of bulbes generally accelerated flowering and improved various growth parameters. which reflected in bulblets yields and weights. The combination of milagrow and cold storage treatment can morphological characteristics and physiological traits in some species as reported that **Khan *et al*. (2013).** and **Bably (2016).**

Chlorophyll a+b (mg/g.f.w)

The data presented in Figure (1) indicate a significant increase in total leaf chlorophyll content in response to the treatments. Specifically, the interaction effects demonstrated that plants stored for 35 days and treated with 150 ml/L Milagrow achieved the highest chlorophyll levels in both seasons. In contrast, the lowest values were recorded in the control group (0 ml/L Milagrow) with a 45-day storage period.

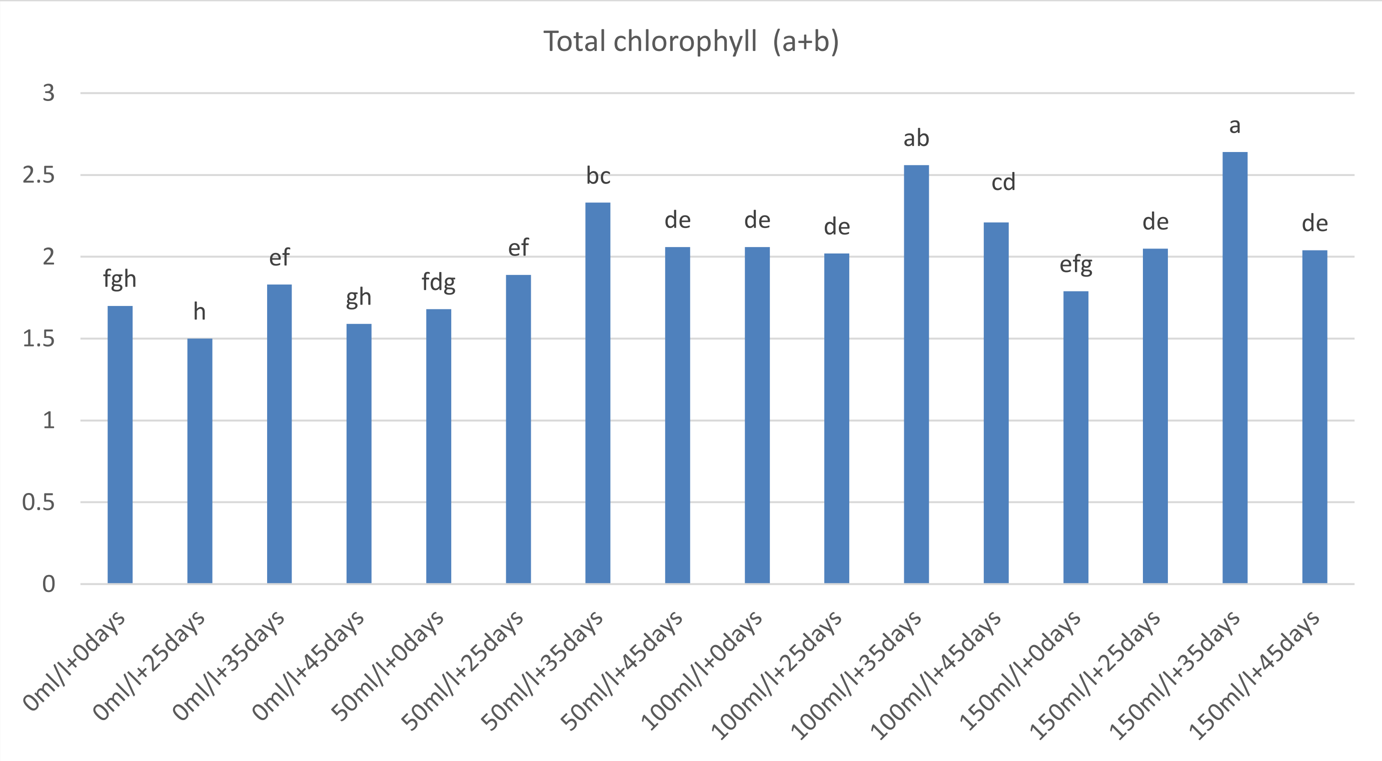

Fig. (1). Effect of interaction between storage period and different concentrations of milagrow on total chlorophyll (a+b) (mg/g f.w) on leaves of *Hemenocallis sp.* during season (2022/2023)

Means having the same letter are not significantly differed at 0.05 level of probability according to Duncan's Multiple Range Test (Duncan, 1955).

Carotenoids (mg/g.f.w)

The recorded data in Figure (2) showed that treating plants with 35 days gave the highest value in storage of carotieondes content in two season. His application of Milagrow at 100 ml/L significantly increased the leaf carotenoid content. Regarding the interaction, the combination of 100 or 150 ml/L Milagrow with a 35-day storage period proved to be the most effective treatment. Conversely, the lowest values were recorded in the control (0 ml/L) under both 45-day and 0-day storage durations in both seasons. These results indicate that Milagrow enhances chlorophyll and carotenoid concentrations, even in stunted plants, similar trends were observed by **Mohmed (2020).** on Dutch fennel. Furthermore, the increase in chlorophyll content associated with higher biostimulant levels, as noted by **Yadava *et al*. (2016)**. reinforces the conclusion that Milagrow can effectively replace traditional chemical fertilizers while maintaining environmental sustainability.

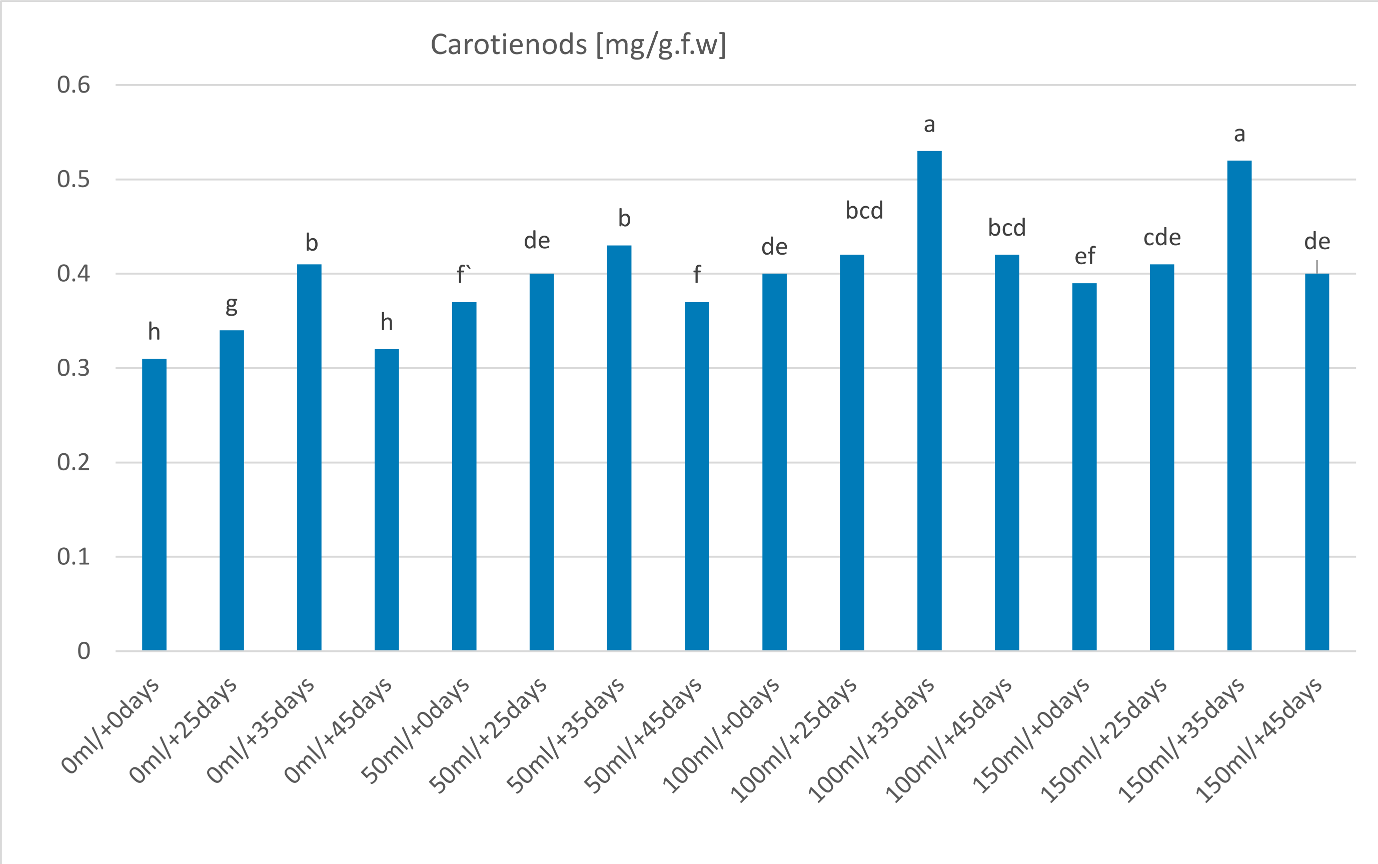

Fig. (2). Effect of interaction between storage period and different concentrations of milagrow (Br + some essential elements) on Carotenoids [mg/g.f.w] on leaves of *Hemenocallis sp.* during season (2022/2023)

Means having the same letter are not significantly differed at 0.05 level of probability according to Duncan's Multiple Range Test (Duncan, 1955).

Effect of interaction between storage period (days) and milagrow (ml/l) on total carbohydrate (%) of *Hymenocallis sp*. during season (2022-2023)

Data presented in Figure 3 elucidate a significant effect on total carbohydrate accumulation in newly developed bulbs. The application of Milagrow at 100 ppm, followed by a 35-day storage period, resulted in the highest carbohydrate content across both growing seasons. It is well-established that low-temperature storage facilitates starch degradation and enhances sugar accumulation, which are vital processes for breaking bulb dormancy. These findings are in agreement with **Zhang *et al*. (2011)**. and **Yu *et al*. (2022)**. who reported that cold storage induces starch breakdown and increases sucrose levels, typically peaking around 60 days. This metabolic shift is crucial for providing the necessary energy for subsequent bulb growth and development."

The study revealed that the addition of Milagrow significantly increased the mineral concentrations (N, P, and K) in the bulbs compared to other treatments. The lowest values were obtained in the control treatment, while the most favorable results were observed with the combination of 35 days of cold storage and Milagrow at 100 ppm. This effect may be attributed to the role of Milagrow in promoting cell division and elongation. Furthermore, the product contains a comprehensive range of essential nutrients (N, P, K, Mg, Fe, Cu, Mn, B, and Mo), amino acids, vitamins, and natural growth regulators, including cytokinins, auxins, and gibberellins. These findings are consistent with **Begum *et al*. (2018).** who highlighted the biostimulatory effects of such formulations on plant mineral uptake and physiological development."

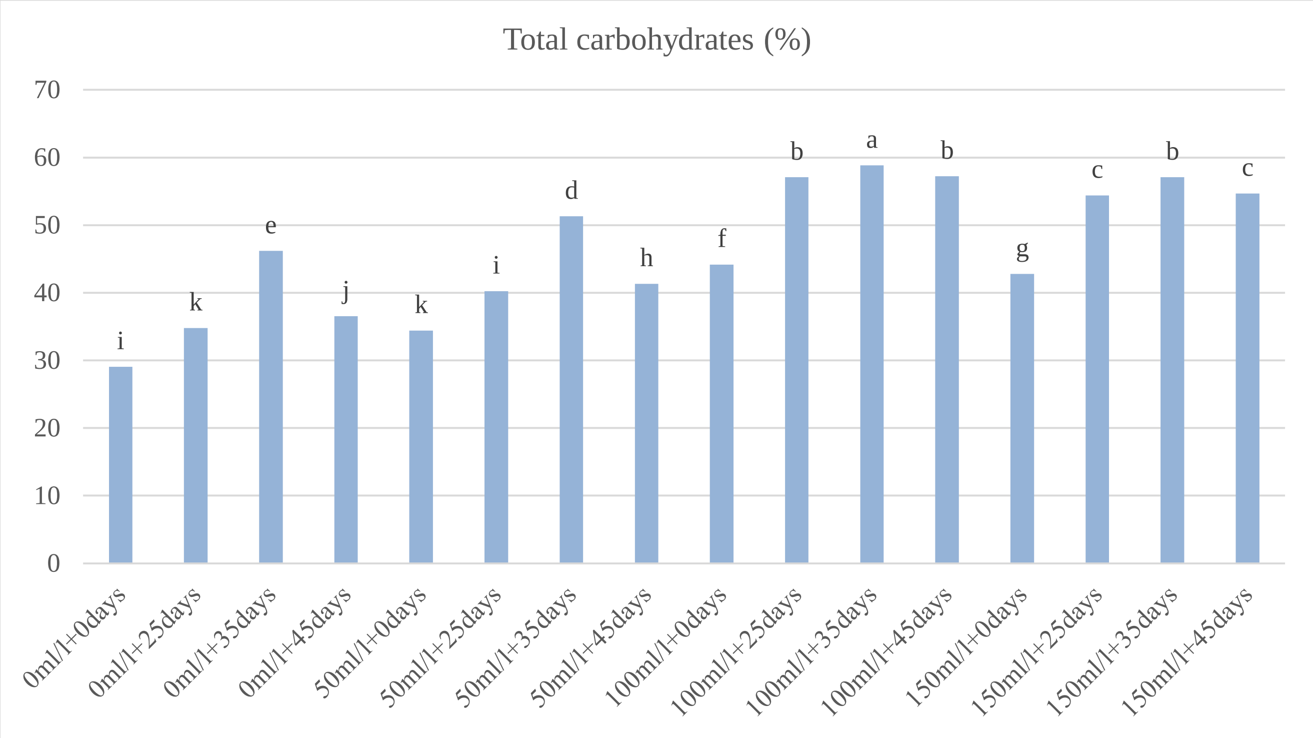

Fig. (3). Effect of interaction between storage periods (days) and milagrow (ml/l) on total carbohydrates (%) of *Hemenocallis sp.* during season (2022/2023)

Means having the same letter are not significantly differed at 0.05 level of probability according to Duncan's Multiple Range Test (Duncan, 1955).

4. Conclusion

In conclusion, adopting eco-friendly applications in agriculture has become both a priority and a necessity. This study demonstrates that the application of Brassinosteroids (BRs) at 100 ppm, combined with a bulb storage duration of 35 days at 5°C, significantly enhances the growth, flowering, and bulb productivity of *Hymenocallis speciosa*. These findings provide valuable insights for horticulturists and researchers aiming to optimize cultivation practices, suggesting that BRs serve as an effective tool for improving plant performance under specific storage conditions.

Fig. (4). Effect of interaction storage period and different concentrations of milagrow on leaves N (%), P (%), and K (%) contents of *Hemenocallis sp.* during season (2022/2023)

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تاثير الميلاجرو ومده تخزين الابصال علي النمو الخضري والصفات الزهريه وانتاجيه ابصال الهيمينوكالس

مجدي عزمي برسوم - وليد محمد بازرعه - جورجينا وهيب رزق - ترتيل محمد امام

أُجريت هذه الدراسة كتجربة في أصص في مشتل قسم بحوث نباتات الزينة وتنسيق الحدائق، بمعهد بحوث البستنة، التابع لمركز البحوث الزراعية، الجيزة، مصر، خلال موسمين متتاليين (2022 و2023). هدفت الدراسة إلى بحث تأثير تراكيز مختلفة من مُنتج "ميلاجرو" (تركيبة تجارية تحتوي على براسينوستيرويدات، وفوسفور، وبوتاسيوم، وبورون) وفترات تخزين مختلفة للأبصال عند درجة حرارة 5 مئوية قبل الزراعة على إزهار وإنتاج أبصال نبات الهيمينوكاليس سبيسيوزا. شملت التجربة عاملين: الأول هو مدة تخزين الأبصال قبل الزراعة (0، 25، 35، و45 يومًا). كان العامل الثاني هو تركيز مُحفز نمو النبات (ميلاجرو) المُكوّن من[براسينوستيرويد (BRs) والفوسفور والبوتاسيوم والبورون]كمحلول نقع قبل الزراعة بتراكيز 0 و50 و100 و150 مل/لتر. صُممت المعاملات في تجربة عاملية باستخدام تصميم كامل العشوائية (CRD) أظهرت النتائج أن التخزين البارد لأبصال الهيمينوكاليس لمدة 35 يومًا عند 5 درجات مئوية قبل الزراعة، بالإضافة إلى نقع الأبصال في 100 مل/لتر من مُحفز نمو النبات (ميلاجرو) المُحتوي على [BRs] والفوسفور والبوتاسيوم والبورون، أدى إلى تحسينات ملحوظة في النمو الخضري والإزهار وإنتاج الأبصال والمحتوى الكيميائي لأبصال الهيمينوكاليس.