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Technical Article

Effect of hydration in vase life of two *Heliconia* cultivars

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Abstract

Ensuring extension of the vase life of Heliconia commercial stems is essential for the consumer acceptance process. For this, the objective of this research was to evaluate the effect of hydration on the vase life of two Heliconia cultivars. The experimental design was in randomized blocks with subdivided plots (cultivar x hydration) with 6 replicates, being cultivars x hydration: no hydration (control), water hydration and hydration + sugar. The results considering cultivars as a factor showed a statistically significant difference ($P \leq 0.05$). According to the comparison of means ($P \leq 0.05$), the *Heliconia psittacorum x spathorcinata* tropics showed the best response. Both hydration and interaction between cultivars, showed no significant differences ($P \leq 0.05$). Hydration did not guarantee a greater number of days of durability, so it is a good alternative, the use of dry treatment and the reduction on the excessive water use, according to the results obtained in this study.

Keywords: *Heliconia psittacorum, Heliconia wagneriana*, hydration, commercial stem

Resumo

Efeito da hidratação na vida de vaso de duas cultivares de Heliconia

Assegurar a extensão do período de durabilidade de hastes comerciais de Heliconia é fundamental no processo de aceitação do consumidor final. Para isso, o objetivo da pesquisa foi avaliar o efeito da hidratação na vida dos vasos de duas cultivares de Heliconia. Foram utilizados delineamentos experimentais de blocos ao acaso com parcelas subdivididas (cultivar x hidratação) com 6 repetições, sendo cultivares x hidratação: sem hidratação (controle), com hidratação (água) e com hidratação + açúcar. Os resultados analisando as cultivares como fator mostram uma diferença estatisticamente significativa ($P \leq 0,05$). De acordo com a comparação das médias ($P \leq 0,05$), a *Heliconia psittacorum x spathorcinata* tropics tiveram a melhor resposta. Tanto a hidratação quanto a interação entre cultivares e o regime hídrico não mostraram diferenças significativas ($P \leq 0,05$). A hidratação não garantiu um maior número de dias de vaso, por isso é uma alternativa o tratamento a seco e a redução no uso excessivo de água, de acordo com os resultados obtidos nesse estudo.

Palavras-chave: *Heliconia psittacorum, Heliconia wagneriana*, hidratação, haste comercial

Introduction

Heliconia is an ornamental variety of exotic elegance. Its use in flower arrangements is attractive to the consumer mainly because of its color and shape. This species was introduced into the flower trade in recent decades (Cantor et al., 2014). The production of export-oriented cut flowers has spread rapidly, which has led to significant changes in the agricultural base and economic composition of the agricultural producing regions and municipalities (Patel-Campillo, 2010).

These changes are mostly more demanding in agricultural activities. Mainly those related to agronomic problems that are generally in the production stage and that have a strong impact on the quality of the commercial stem (Rodrigues et al., 2005; Beckmann-Cavalcante et al., 2011; Linares-Gabriel et al., 2018), for example organic, mineral and organomineral fertilization. Heliconias require shade percentages since they are C_3 plants (Peña-Salamanca et al., 2013), so the shading conditions are indispensable (Souza et al., 2016). Water supply is key in the production process. According to Díaz et al. (2008) 2 to 5 L m^2 day^{-1} of irrigation in heliconias is recommended, according to the state of the crop and time of year. Management in general is essential, both for the care of pests and diseases of this crop (Sardinha et al., 2012; Bittar et al., 2018). In addition to requirements in the marketing process, such as size and weight and post-harvest handling such as storage temperature (Pizano, 2005).

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The selection criteria established by the producers are indispensable to make the tropical flower sector more sustainable, profitable and competitive in the tropical floriculture sector (Loges et al., 2015) The challenges encountered by the producers involve propagation, control of flowering, adequate useful life of the vase, among others (Pizano, 2005).

The post-harvest longevity of Heliconia cut flowers is an important factor for the success of commercialization (Leite et al., 2015). Our work is oriented to postharvest Heliconias. Some authors have conducted research regarding this related to symptoms of senescence and vase life (Leyva-Ovalle et al., 2011; Bañuelos-Hernandez et al., 2016). Considering that the market for these flowers requires procedures to improve the vase life, which do not require much time and capacity to be applied and besides being economical (Quiceno and Giraldo, 2006). It was considered to use water as a humectant solution. The objective was to evaluate the effect of hydration on the vase life of two Heliconia cultivars.

Materials and methods

The floral stems used for the experiment were obtained from a 3-year-old culture of the cultivars *Heliconia wagneriana* cv. Peterson and *Heliconia psittacorum x spathorcinata tropics*, which is established on a clay-textured soil. Site with coordinates 17.80° NL, 94.91° WL and 40 meters above sea level. It presents a subhumid warm climate of type Aw_1, according to García (1998).

The harvest was made on March 27, 2018 from 7-9 a.m. The inflorescences were cut 5 cm from the base. The harvest characteristics of the inflorescences are shown in Table 1.

Table 1. Harvest characteristics of the flower stems

Cultivars	Floral stem length (average cm)	Number of bracts
Heliconia psittacorum x *spathorcinata tropics*	130.8	3.4
Heliconia wagneriana cv. Peterson	106.1	7.2

After cutting, the inflorescences were moved to a shaded place for their conditioning. Initially they were placed in 20 L containers filled with water at 70% capacity. Afterwards, the inflorescences were washed using a sponge and water by rubbing it gently and removing any foreign material that it brings from the field. The inflorescences were disinfected through horizontal immersion for about 3 minutes, dried in the open air and finally transferred to the make-up, with mineral oil (for aesthetics of floral stems) and allowed to dry. In the drying of the water and the make-up the inflorescences were placed downwards, according to Quiceno and Giraldo (2006).

Experimental design and treatments

For the experimental design, a randomized complete block design was used, with an arrangement of divided plots (cultivars x hydration) and six repetitions. The factors are: cultivars (*Heliconia psittacorum x spathorcinata tropics* and *Heliconia wagneriana cv*. Peterson) and hydration (without hydration, with hydration (only water) and with hydration + sugar (water + sugar 10%). An inflorescence per experimental unit was used, giving a total of 36 (Figure 1).

The treatments consisted of: not providing hydration, hydrating the stem (tap water was used to cover 10 cm of the floral stem) and hydrating the stem supplemented with the 10% sucrose (Costa et al., 2015).

The vase days in inflorescences of *Heliconia psittacorum x spathorcinata tropics* and *Heliconia wagneriana* cv. Peterson was evaluated. During the measurement of the variable, the scale of Castro et al. (2007): the score of 0 (zero), excellent overall appearance (aspect freshly harvested); score 1 (one), good general appearance (signs of senescence not very characteristic, with loss of brightness); and score 2 (two) - regular general appearance (with onset of withered or with discrete darkening of the bracts). The above was used to determine the maximum number of vase days using the score 2.

Statistical analysis

For analysis of variance and comparison of means with Tukey ($P \leq 0.05$), statistical package Statistical Analysis System (SAS, 2014) was used.

Figure 1. Topological arrangement of the treatments: *Heliconia psittacorum x spathorcinata tropics* (column A) without hydration, B) with hydration and C) with hydration + sugar). *Heliconia wagneriana* cv. Peterson (column D) without hydration, E) with hydration and F) with hydration + sugar).

Results And Discussion

For cultivars, the results show a statistically significant difference ($P \leq 0.05$). According to the comparison of means ($P \leq 0.05$), *Heliconia psittacorum x spathorcinata tropics* had the best response (Table 2). In hydration no significant differences were found ($P \leq 0.05$). In the same way, no significant statistical difference was found for the interaction between factors (cultivars x hydration) (Table 3).

Table 2. Levels of significance and comparison of means for the variable evaluated in Heliconia.

Treatment (A)	Days in vase
Heliconia psittacorum x *spathorcinata tropics*	26.5 a[z]
Heliconia Wagneriana cv. Peterson	9.0 b
Level of significance	*0.0001**
Treatment (B)	
Without hydration	19.25 a
With hydration (only water)	17.66 a
With hydration + sugar (water + sugar)	16.33 a
Level of significance	*0.1382*

[z]Means with the same letter within each column do not differ statistically (Tukey, $P \leq 0.05$).

* $P \leq 0.05$

The findings are attributable in the first instance to the length of the stems of both cultivars. For example, *Heliconia psittacorum x spathorcinata tropics* measured 130.8 cm compared to the 106.1 cm of *Heliconia wagneriana* cv. Peterson. Another reason among the cultivar differences is the number of bracts. For *Heliconia psittacorum x spathorcinata tropics* on average it was 3.4 and 7.2 for *Heliconia wagneriana* cv. Peterson, reason attributable to the greater absorption of water so that transpiration is greater in *H. wagneriana*. As with the presence of leaves increases respiration, however, does not mean that there is significant release of ethylene (Bañuelos-Hernandez et al., 2016).

For this study, the maximum vase days were 26 for *Heliconia psittacorum x spathorcinata tropics*. The previous corresponded to a regular general appearance (with the onset of wilting or with discreet darkening of the bracts): this appearance of the floral stems corresponded to score two, described in the methodology. Ribeiro *et al.* (2010) have found that the 20% sucrose solution was the best treatment, increasing the shelf life of 20 days after harvest by 50%. Amaral et al. (2015) mention that when the water is not removed, the post-harvest longevity of stems reached for the first time discreet darkening of the bracts, with an average of 10 days after harvest.

Costa et al. (2015), evaluated the postharvest quality of *Heliconia wagneriana* and found that the stems subjected to pulses with 10% sucrose for 60 minutes allowed the stems to reach 20 days of longevity; being 20% longer than the control, showing the color and brightness appropriate to quality standards. It is worth mentioning that in this investigation, sucrose was constant throughout the evaluation period and that a previous treatment of disinfection and makeup of the inflorescences was carried out (Quiceno and Giraldo, 2006).

Leyva-Ovalle et al. (2011) found in *Heliconia psittacorum x spathorcinata tropics* that during the first 24 hours, Heliconia stems lost on average less than 5% of their weight and stems rose more than 11%. They also mention that the symptoms of senescence were more evident just after 168 hours from the beginning of the experiment. Hence the combinations of Carbopol 940® polymer and preservative solutions were not effective in extending the life of the vase. The number of days in vase and the quality of the flower stems, is a function of a good management in the production process where fertilization covers an important requirement, so doses of nitrogen and potassium are suggested as they provide a better quality of the floral stems of Heliconias and consequently a greater longevity (Amaral et al., 2015). Albuquerque et al. (2014) affirm that the burning of bracts is smaller when sodium silicate is applied at a dose of 550 mg dm^{-3}.

Longevity is the external expression by the death of tissues in the floral stem and is translated into the number of days of life. As observed by Ribeiro et al. (2010), the longevity was expressed in the first 8 days in *Heliconia rauliana* under different maintenance solutions and for the control treatment (distilled water only, without renewal). The lack of water renewal manifested floral odors and presence of damage at the base of the stem. It is in agreement with Amaral et al. (2015) study, which they observed in the course of the experiment that the treatment without renewal of water appeared necrotic and with bad odor, which can be an indicative of proliferation of bacteria or presence of mucilage. They affirm that the change of the water avoids that accumulation of these materials occurs around the cut of the floral stems.

What distinguish a commercial stem from Heliconias will depend on the physical aspects and the number of days. Cantor et al. (2014) mention that the Heliconias have good resistance and they are conserved a maximum of 15 days in vase. They emphasize that the florists do not give a special treatment to the floral stems, they only hydrate them in the period of storage, so they have a short period of life. Linares-Gabriel et al. (2017) highlights in their study that florists allude that the shelf life of the Heliconias is 11 days on average, with a minimum of five and a maximum of 15 days, they do not know the cutting time, so they do not identify if this affects the quality of the flower.

Table 3. Level of significance and comparison of means for the variable evaluated in Heliconia

Factors A x B	Levels	Days in vase
Heliconia psittacorum x *spathorcinata tropics*	Without hydration	28.5 a*
	With hydration (only water)	27.6 a
	With hydration + sugar (water + sugar)	23.3 a
Heliconia Wagneriana cv. Peterson	Without hydration	6.8 a
	With hydration (only water)	10.8 a
	With hydration + sugar (water + sugar)	9.3 a
Level of significance		*0.0494*

*Means with the same letter within each column do not differ statistically (Tukey, $P \leq 0.05$).

Conclusions

Heliconia psittacorum x spathorcinata tropics presents higher vase days compared to *Heliconia wagneriana cv.* Peterson. Hydration did not ensure greater vase days so an alternative is dry treatment and decrease the excessive use of water, this according to what was found in the study. Vase life is not determined by the interaction of cultivation and hydration, it is important to consider the characteristics of the cultivars, so detailed studies are necessary.

Author Contribution

A.L.G. 0000-0002-3825-5450: Contributed to the design of the research, data processing and writing of the manuscript. N.R.O 0000-0001-8694-5870: Contributed to the data processing and writing of the manuscript. M.A.H.C 0000-0002-9711-7971: Contributed to the design of the research, data processing and writing of the manuscript.

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