Quality management of tropical plants [1]

GLÁUCIA MORAES DIAS[2]*

ABSTRACT

The climatic characteristics of the country favor the cultivation of tropical flowers. The continued expansion of this market is due the beauty, exoticit nature and postharvest longevity of flower. However, little is known about the postharvest of tropical plants. Therefore, this paper provides information on harvest, handling and storage of cut tropical plants.

Keywords: postharvest, storage temperature, conditioning solution.

RESUMO

Manutenção da qualidade de plantas tropicais

As características climáticas do país favorecem o cultivo de flores tropicais A continua expansão deste mercado é devido à beleza, exoticidade e longevidade pós-colheita das hastes florais. No entanto, pouco se sabe sobre a pós-colheita de plantas tropicais. Portanto, este artigo fornece informações sobre colheita, manuseio e armazenamento de plantas tropicais cortadas.

Palavras-chave: pós-colheita, temperatura de armazenamento, solução conservante

1. INTRODUCTION

Brazil has great potential to increase its production and export flowers and ornamental plants, moving about U$ 5.22 billion/year (JUNQUEIRA and PEETZ, 2014). The climatic characteristics of the country favor the cultivation of tropical flowers, thus contributing to the ornamental plant agribusiness. The continued expansion of this market is a function of beauty, exoticity and postharvest longevity of flower stalks, coupled with the tropical climate of the country, which provides conditions for flowers production, foliage and other derivatives. When it is mentioned tropical plants, the product may be different parts of the plant; from flower, orchid inflorescences, to the bracts set that are often called flowers, for example, heliconia and ornamental ginger. Leaves (such as palm), fruits (ornamental pineapple, achiote) and even stems, as is the case of Costus, are also used in floral arrangements. Therefore, all post-harvest operations in tropical plants must be modified according to the product used.

Care in harvesting x postharvest quality

Flowers should be harvested preferably early in the morning, since the temperature is lower and plants have an increased water content at this time; the rest of the day should be reserved for handling them. The harvest of tropical plants is performed manually, using sharp tools like knife, scissors.

The definition of harvest date is critical for maximum quality maintenance and is dependent on the species under study. An early harvest leads to losses and a late harvest also, compromises product quality maintenance for a long period and, in both cases, longevity is reduced. Most of the time when the harvest date is not ideal, the marketed product has a short life span, causing dissatisfaction of the consumers. Therefore, the ideal harvest date is when flowers are cut before their full development, but have full quality maintenance. Flower of *Strelitzia reginae* have greater longevity when harvested with enclosed buds, compared to those harvested with the first floret beginning to open (QUEIROZ et al., 2015). It is important to emphasize that each cultivar has its own characteristics that must be analyzed and considered separately to maintain high quality and longevity at postharvest. The harvest date is also influenced by the distance of the market and consumer preference. In Brazil, anthurium is harvested when half or three quarters of the spadix shows color changes (DIAS et al., 2012). In some countries, producers harvest anthuriums with 4/5 of the spadix with mature flowers, while producers in Hawaii harvest the stalk when 3/4 of the flowers on the spadix are open. However, the same producers use flower stalks with 1/3 of the spadix with open flowers for exportation (REID and DODGE, 2001).

All the effort in plant cultivation can be lost when we do not give the proper attention to stages of harvest, handling and storage of the product. Tropical species must be carefully handled to avoid mechanical damage, thus maintaining the initial quality. Improper handling can damage and cause dark spots in the commercial product. The care with hygiene should start with pruning shears and continue throughout all post-harvest stages. Regular cleaning with detergents containing germicides including shelves, containers and storage rooms is recommended, for the control of microorganisms (DIAS-TAGLIACOZZO and MOSCA, 2007). All damaged material or those presenting phytosanitary problems must be discarded during the selection phase, since flowers and infected foliage can contaminate their peers that will be stored. Thus, only high

[1] Received in 30/08/2016 and accepted in 03/10/2016

[2] Instituto Agronômico (IAC), Campinas-SP, Brazil. *Corresponding author: glaucia@iac.sp.gov.br

quality products should be stored. The process of packing cut flowers must occur before storage. The packages have the function to minimize mechanical damage and/or water loss by the flowers during storage and transport. Flower stalks must be bound, but not excessively, so as not to favor the growth of microorganisms and slow cooling. Packaging depends on the type of storage, the means of transport and especially the species being conditioned. Loges et al. (2005) recommend the following for maintaining the quality of tropical flower stalks, whose beauty is in their bracts: 1- the period between harvesting and transportation to the packing house should be around 30 minutes; 2- in the packing house, stalks must be cooled for 15 minutes to 1 hour; 3. Clean and control insects before hydration; 4- they should be hydrated for a period of 30 minutes to 2 hours; 5- hydration should be followed by drying and subsequent packing in cardboard boxes.

Care storage

Storage is responsible for maintaining the balance between the distributor and the consumer market and, its goal, is to maintain quality for commercialization. Cold storage is a way to delay senescence and consequently extend the product life span, since respiration and transpiration rates, as well as infections, are reduced. The reduction in the temperature of the products immediately after harvest is advisable to remove field heat; in the case of tropical plants, it is recommended to soak the stalks in water to remove field heat, since low temperatures can cause unrecoverable damage.

Respiration rate is inversely proportional to flower quality; the respiration process may increase between two to three times every 10 degrees. Therefore, the recommended is storage at the lowest possible temperature. Since tropical flowers are sensitive to low temperatures, the recommended storage ranges around 13 ºC. Lower temperatures may cause chilling injuries and, in tropical flowers stored at temperatures below 10 ºC, quality maintenance does not occur.

Temperature fluctuations within storage rooms must be kept to a minimum to prevent damage to stored flowers. Moisture loss can lead to flower wilting; therefore, flowers should be stored in environments with high relative humidity. A relative humidity of 90-95% is recommended in cold storage; this value is also recommended for tropical plants, always associated to the ideal temperature of each species.

Physiological factors in postharvest

What causes product depreciation are the signs of senescence that arise after the cutting, evidenced by wilting, brightness loss and color changes in flowers and foliage. The water balance involves physiological processes of absorption, transport, water loss, and tissue capacity to retain it. In addition, all these physiological processes are interrelated and directly affect flower turgescence or cut foliage. Water with alkaline pH decreases mobility in the stem and, consequently, flower stalks kept in this kind of water have shorter longevity than those maintained in acidic solutions (HANDERBUG et al., 1990). The first measure to be taken for the quality maintenance of tropical plants is the quality of water and its composition, once it directly affects flower longevity.

Preservative solutions are globally known and formulas are made of water, sugars, germicides and, in specific cases, but also there is the addition of other chemicals. Sugars are very important for the longevity of flower stalks and their use in preservative solutions is a widely used practice. In general, the optimum sugar concentration ranges with the treatment to be used and the species to be preserved. Carneiro et al. (2014) studied torch ginger postharvest and observed that plants submitted to pulsing for 24 hours with a concentration of 20% sucrose had greater longevity, compared to control plants. However, Dias and Castro (2009) studied *Zingiber spectabile* using pulsing solutions for 24 hours at concentrations of 2, 4, 8, 16 and 32% sucrose and these treatments had no effect on the postharvest life of this species. Pulsing solutions with sucrose also had no effect on quality maintenance of different anthurium varieties improved at the Agronomic Institute of Campinas, SP, Brazil (DIAS-TAGLIACOZZO, 2004). It is generally observed that preservative solutions have no effect in tropical plants, whose beauty is in their bracts.

Senescence is the final development phase of the flower or foliage deterioration and is related to processes that lead to cellular disorganization. This phase may be spontaneous, a natural process of plant development, or triggered by external agents such as the cutting of stalks or substances as ethylene. Ethylene has marked effects on the induction of senescence, abscission and wilting of flowers that have some sensitivity to the action of this hormone. (SEREK et al., 2006). In general, heliconias are less sensitive to ethylene. For example, in inflorescences of heliconia 'Golden Torch', senescence anticipation occurs only when high doses of ethephon are used (100 and 1,000 mg L^{-1}); therefore, the application of ethylene inhibitors in the postharvest of this species is not justified (SOUZA et al., 2014). However, for the tropical orchid *Epidendrum ibaguense*, the use of ethylene inhibitors is recommended (SANTOS et al., 2012).

Most products used to extend flower life have phytohormones. The most widely used and studied is gibberellic acid: in addition to playing an important role in controlling plant growth and development, it also contributes to delay the yellowing of flower stalk leaves. Robles et al. (2008) found that *Cyperus articulatus* stalks, hydrated immediately after harvesting, put in pulsing solution with gibberellic acid (GA3) at a concentration of 100 mg L^{-1} for 24 hours, and increased the longevity of these ornamental stalks in one week. The use of gibberellic acid in the pulsing solution also had a positive effect on the visual appearance of *Heliconia bihai* (GUIMARES et al., 2014). Another phytohormone used is cytokinin. Dias-Tagliacozzo et al. (2003) studied red ginger flowers, and found that cytokine (200 ppm), associated to sucrose, increased the longevity of flower stalks, when compared to the treatment in which cytokinin was used alone, indicating that different substances must be tested together.

All the examples in the text show that specific formulations of preservative solutions are necessary for each species under study.

REFERENCES

CARNEIRO, D.N.M.; PAIVA, P.D.O.; CARNEIRO, L.F.; RODRIGUES, R.S.; LIMA L.C.O.; DIAS, G.M.G.; PEDROSO, R.G.A.V. Estádios de abertura floral e condicionamento em inflorescências de bastão-do-imperador. **Revista Brasileira de Horticultura Ornamental**, v.20, n.2, 2014 DOI: <http://dx.doi.org/10.14295/rbho.v20i2.578>

DIAS, G.M.; TOMBOLATO, A.F.C.; LEME, J.M.; MOSCA, J.L. Pós-colheita. In: CASTRO, A.C.R.; TERAO, D.; CARVALHO, A.C.P.P.; LOGES, V. (Org.). **Antúrio**. v. 1, 1 ed. Fortaleza: Embrapa, 2012. p. 131-145.

DIAS-TAGLIACOSO, G.M.; CASTRO, C.E.F. Longevidade pós-colheita de *Zingiber spectabile* Griff. **Revista Brasileira de Horticultura Ornamental**, v.15, n.2, p.127-131, 2009. DOI: <http://dx.doi.org/10.14295/rbho.v15i2.493>

DIAS-TAGLIACOZZO, G.M. Pós-colheita de antúrio. **Revista Brasileira de Horticultura Ornamental**, v.10, n.1/2, p.46-48, 2004.

DIAS-TAGLIACOZZO, G.M.; MOSCA, J.L. Pós-colheita de flores e Folhagem. **Revista Brasileira de Horticultura Ornamental**, v.13, p.209-219, 2007.

DIAS-TAGLIACOZZO, G.M.; ZULLO, M.A.; CASTRO, C.E.F. Caracterização física e conservação pós-colheita de alpínia. **Revista Brasileira de Horticultura Ornamental**, v.9, n.1, p.17-23, 2003. DOI: <http://dx.doi.org/10.14295/rbho.v9i1.161>

GUIMARES, A.A., FINGER, F.L., SILVA, T.P., BARBOSA J.G. Avaliação da solução de pulsing com ácido giberélico na vida de vaso de *Heliconia bihai* **Revista Brasileira de Horticultura Ornamental**, v.20, n.2, 2014 DOI: <http://dx.doi.org/10.14295/rbho.v20i2.588>

HARDENBURG, R.E., WATADA, A.E., WANG, C.Y. **The commercial storage of fruits, vegetables and florists and nursey stocks**. Washington: Agricultural Handbook, 1990. 130p.

JUNQUEIRA, A.H.; PEETZ, M.S. O setor produtivo de flores e plantas ornamentais do Brasil, no período de 2008 a 2013: atualizações, balanços e perspectivas. **Revista Brasileira de Horticultura Ornamental**, v.2, p.115-120, 2014. DOI: <http://dx.doi.org/10.14295/rbho.v20i2.727>

LOGES, V.; TEIXEIRA, M.C.F.; CASTRO, A.C.R., COSTA, A. Colheita, pós-colheita e embalagem de flores tropicais em Pernambuco. **Horticultura Brasileira,** v.23, n.3, p.699-702, 2005.

QUEIROZ, S.J.; DIAS, G.M.; TOMBOLATO, A.F.C. Evaluation of postharvest technology on bird-of-paradise. **Acta Horticulturae**, v.1060, p.207-2120, 2015.

REID, M.S.; DODGE, L. 2001. **Anthurium: Recommendations for maintaining postharvest quality**. Disponivel em: <http://rics.ucdavis.edu/postharvest2/ProduceFacts/Orn/anthu.shml>. Aceso em: 14 de dezembro de 2015.

ROBLES, R.C.; DIAS-TAGLIACOZZO, G.M.D.; MATTHES, L.A.F.; MAY, A. Pós-colheita de *Cyperus articulatus* (priprioca). **Revista Brasileira de Horticultura Ornamental**, v.14-1, p.67-76, 2008.

SANTOS, J.S.; FINGER, F.L.; MAPELI, A.M.; KARSTEN, J.; MENDES, T.DC.; BARBOSA, J.C. Longevity of *Epidendrum ibaguense* inflorescences influenced by the storage temperature and ethylene inhibitor. **Brazilian Archives of Biology and Technology**, v.55, n.2 , p.205-212, 2012. DOI: <http://dx.doi.org/10.1590/S1516-89132012000200004>

SEREK, M.; WOLTERING, E.J.; SISLER, E.C.; FRELLO, S.; SRISKANDARAJAH, S. Controlling ethylene responses in flowers at receptor level. **Biotechnololy Advances**, v.24, p.368-381, 2006. DOI: <10.1016/j.biotechadv.2006.01.007>

SOUZA, O.S.; LIMA, M.A.C.; FINGER, F.L.; OLIVEIRA, A.H.; BARBOSA, J.G. Longevidade e sensibilidade de helicônias 'Golden Torch' ao etileno exógeno. **Revista Brasileira de Horticultura Ornamental**, v.20, n.1, 2014. DOI: http://dx.doi.org/10.14295/rbho.v20i1.479