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Ethylene, Water and Sugar - An Influence in Vase Life of Cut Flowers

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Abstract

Vase life quality of cut flowers is one of the important factors for customer satisfaction and purchase. In recent years, international trade of cut flowers have expanded and high quality of flowers have preferred to extend postharvest longevity and increase marketability and economic value. The major factors during both production and postharvest stages that influence vase life are water relations, carbohydrates and ethylene. Many flowers are sensitive to ethylene and cause disorders like sleepiness, epinasty *etc.,* Mostly, vase life is determined by rate of transpiration and type of sugars (solutes) present. If water is imbalanced through transpiration, results in drooping and premature wilting which makes unpreferable to consumers. This paper highlights ethylene, water relation and sugar influence in vase life of flowers.

Introduction

About 20% of fresh flowers lose their quality while passing through the market (harvest, packaging, transportation and sale) and large deal of remaining flowers are sold at low quality conditions which results in dissatisfying the consumers due to physiological and pathological problems during the Postharvest handling.

Vase Life

Vase life is the period during which a cut flower or cut foliage retains its appearance in a vase. This is a major consideration in identifying plant species suitable for use in floristry, plants with a long vase life being far more desirable than those with a short vase life. Short Vase life is related to wilting, ethylene production and vascular blockage by air and microorganisms.

Ethylene - Flowers

Ethylene is "silent killer" of fresh cut flowers. It is a natural plant hormone that regulates many plant functions, *e.g.,* fruit ripening and plant senescence. However, when plants are exposed to external ethylene from sources *e.g.,* truck exhaust, heaters, cigarette smoke and in ripening fruits, flowers, buds, and leaves of cut flowers which can be adversely affected. Buds and flowers can turn yellow, wilt, and/or drop. Buds may fail to open and flowers die prematurely. Thus, ethylene is a major cause for premature senescence in cut flowers.

Role of Ethylene

Ethylene is an odorless and colorless gas produced by cut flowers, foliages, ripening fruits and vegetables, bacteria and decaying plant materials. Different varieties of flower have different level of sensitivity to ethylene, ranging from very high sensitivity to low sensitivity. Mostly, ethylene

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sensitive flowers which are at harvesting stage are treated with ethylene to reduce their sensitivity. The flowers should not be treated to high levels of ethylene since it causes toxicity. While giving ethylene to flowers, the amount of ethylene in the atmosphere should be considered since our surrounding atmosphere contains some amount of ethylene (Valentina Scariot *et al.,* 2014).

Flowers highly sensitive to ethylene: Alstroemeria, Antirrhinum, Bird of Paradise, Carnation, Daffodil, *Euphorbia*, Freesia, Gardenia, Hibiscus, *Lilium*, Nerium, Petunia.

Flowers insensitive to ethylene: Anthurium, Asparagus, Aster, Chrysanthemum, Day lily, Larkspur, Gladiolus, Gerbera, Baby's breath, Iris, Orchids, Rose.

Effects of Ethylene

Epinasty in Poinsettia

Poinsettias are very sensitive to ethylene gas. Exposure to the gas produces bent, twisted petioles and droopy bracts. Upward vertical reorientation of the normally horizontal bracts of poinsettia plants cause drooping of the bracts upon removal of the force holding the bract in a vertical position. It has recently been concluded by several workers that an endogenous production of ethylene in response to the bending stress during reorientation causes this epinastic response. When the petioles were restrained vertically downwards, they caused a slight, but significant, epinasty.

Removal of bract blades prevented the epinastic response of the petiole and the response was restored by applying indole-acetic acid to cut petiole end. Redistribution of auxin appears to be responsible for both the epinasty and the increased ethylene production of reoriented poinsettia bracts (Michael, S Reid *et al.,* 1981).

Sleepiness in Carnation

Carnations are susceptible to flower damage when exposed to relatively low ethylene levels. Sources of ethylene that may cause injury include automobile exhaust, fruits, flowers, diseased or injured tissues, burning or decaying organic matter, growth regulators, and improper vented or adjusted greenhouse heaters.

The term "sleepiness" as applied to flowers is usually confined to carnations. It is characterized by a partial closing of the flower due to an incurving or curling of the petals. This condition progresses until the flower is frequently almost closed. The outer petals are markedly curled and usually show a drying and darkening along the margins. The flowers do not recover after so that the flower losses its market value.

Remedy for Ethylene Injury

External ethylene sources should be avoided to enhance life of ethylene-sensitive flowers. Ethylene Scrubbers like Potassium Permanganate should be used to overcome injury.

Treating flowers with anti-ethylene compounds like 1-MCP and Silver thiosulphate can reduce the ethylene injury in flowers. The compound, 1-Methyl-cyclopropene (MCP), acts as a binding site competitor and is very promising in postharvest treatment for both potted plants and fresh cut flowers. MCP is a gas, similar to ethylene. When plants are pre-treated with MCP and exposed to ethylene-polluted environments, MCP appears to give ethylene protection (Valentina Scariot *et al.,* 2014).

Effect of Water in Vase Life

Not all tap water is suitable for flowers, only clean and pure water is preferable. As examples: Sodium, present in high concentrations in soft water, is toxic to roses and carnations. Fluoride, added to drinking water for dental health, is harmful to gerbera, gladiolus and freesia. In many areas, drinking water contains high levels of minerals. These dissolved minerals will block the flower stems and prevents water uptake.

High quality water for flowers should be slightly acid having a pH factor of between 3.0 and 4.5. Therefore, tap water is used in neutral form to avoid the problem. Water which is acidic in nature should be used so that the vase life of the flower is maintained.

TDS (Total Dissolved Solids) refers to the measurement of water salinity, total dissolved solids or soluble elements in water. The dissolved solids in water include magnesium, sodium, calcium, chlorides, and sulfates. High quality water for flowers should have a TDS measurement of less than 200 ppm.

Role of Sugar

Sugars are main sources of food for flowers and required for carrying out all biochemical process after detachment from plant. Sucrose is most widely used floral preservative which maintains the pool of dry matter and respirable substrates in flower petals. Exogenous sucrose replaces the depleted endogenous carbohydrates utilized during post harvest life of flowers. It gets accumulated in flower tissues, increases their osmotic concentrations and improves their ability to absorb water and maintain turgidity.

Sugars play important role in plants as substrate for respiration and cell wall as well as osmolytes. Since the amount of sugar contained in cut flowers is limited, the addition of sugars such as sucrose to vase water is effective in improving the vase life of some cut flowers.

Addition of sugars in vase water not only extends the vase life of cut flowers but also promotes flower opening. A large amount of soluble carbohydrates is required for flower bud opening as substrates for cell walls and respiration as well as for their osmotic properties.

Furthermore, the expression of the flower color is improved by treatment with sugars in some cut flowers such as carnation and rose. Effects of sugars on the extension of the vase life of cut flowers are considered to be associated with the improvement of the water balance.

Table 1: Storage Temperature of Various Flowers

Flowers	Storage Temperature (°C)	Period of Storage
Alstroemeria	3-5	3 days
Anthurium	13	3-5 weeks
Antirrhinum	1-4	3 weeks
Bird of Paradise	22	30 days
Calendula	3-5	3-6 days
Carnation	3-4	3 weeks
China Aster	2-4	7-14 days
Chrysanthemum	-0.5 to 0	3-5 weeks
Dahlia	3-5	3-5 days
Gerbera	2	2 days
Gladiolus	3-4	2-3 weeks
Lily	0-1	6 weeks
Orchids	8-13	10-14 days
Cattelaya	8-10	10-14 days
Cymbidium	1-4	2 weeks
Dendrobium	5-7	10-14 days
Rosa hybrida	2-5	5 days
Tuberose	7-10	3-5 days
Tulip	-0.5 to 0	2-3 days

Beneficial effect of sugars during senescence of many types of cut flowers namely Sweet pea, Larkspur, Gentian, Snapdragon, Rose and Oncidium has been attributed to the suppression of ethylene biosynthesis or sensitivity to ethylene. Exogenous sugars extended the vase life of several cut flowers; namely *Limonium,* Spray carnations, *Liatris spicata*, Sweet pea, Larkspur, Snapdragon, Carnation, *Eustoma*, Rose and Oncidium (Umed Kumar PU *et al.,* 2003).

Conclusion

Government of India has accorded floriculture as 100% export oriented status. Owing to steady increase in demand of flower, floriculture will become one of the important Commercial trades in Agriculture. Indian floriculture industry has been shifting from traditional flowers to cut flowers for export purposes. The liberalization of industrial and trade policies paved the way for development of export-oriented production of cut flowers. It has been found that commercial floriculture has higher potential per unit area than most of the field crops.

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