STABY

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Post Harvest Handling of Cut Flowers

Thomas M. Blessington, Regional Specialist Central Maryland Research and Education Center
University of Maryland Cooperative Extension Service Ellicott City Maryland 21042

A fresh flower is still a living specimen even though it has been cut from the plant. Its maximum potential vase life, although acceptable in the marketplace, is short. There are many impinging forces that can interact to reduce fresh-flower vase life. As an industry, we need to be more successful in preserving the potential life of fresh flowers. However, there are well-known solutions for the bulk of this problem. First, we need to take a look at why there is such a decline in the vase life of fresh flowers.

VASE LIFE

Cultural Influences:

Basically, those forces which improve crop quality before and after harvest usually improve vase life. Light intensity is very important. A crop grown under low light, such that light is a limiting factor for photosynthesis, will be low in carbohydrate content. Respiration continues after the flower is harvested, but little photosynthesis occurs, because light is limited in the packing house, florist shop, and consumer's home. When carbohydrates are low, respiration is very low and flower senescence (deterioration) occurs. Optimum light intensity during growth of the crop is very important to vase life. Temperature also influences photosynthesis and respiration, which in turn influence carbohydrate accumulation. During hot periods of the year, crops sensitive to high temperatures, have shorter vase lives because flowers contain low carbohydrate levels. When the temperature is raised to an adversely high level to force earlier flowering, the same problem occurs. Nutrition of the crop likewise has an effect on flower longevity. Shortages or toxicities of nutrients that retard photosynthesis will reduce vase life. Deficiencies in a number of nutrients, including nitrogen, calcium, magnesium, iron, and manganese, result in a reduction in the chlorophyll content, which in turn reduces photosynthesis. The net result is a low carbohydrate supply for the flower. High levels of nitrogen at flowering time can have an adverse effect on keeping quality. Diseases and insects reduce the vigor of the plant, directly reducing vase life. Diseases also reduce vase life indirectly: injured tissue releases large quantities of ethylene gas, which hastens senescence or deterioration of the flower.

Cause of Vase-Life Decline:

Fresh flowers deteriorate for one or more reasons. Five of the most common reasons for early senescence are:

1. Inability of stems to absorb water due to blockage
2. Excessive water loss from the cut flower
3. A short supply of carbohydrate to support respiration
4. Diseases
5. Ethylene gas

Inability to absorb water is a very common reason for premature wilting. The water-conducting tubes in the stem (xylem) become plugged. Bacteria, yeast, and/or fungi living in the water or on the flower or foliage proliferate in the containers holding the flowers. These microorganisms and their chemical products plug the stem ends, restricting water absorption. They continue to multiply inside and eventually block the xylem tubes. Chemical blockage also can occur. Chemicals present in some stems, upon cutting, change into a gumlike material which blocks the end of the stem.

Excessive water loss from flowers can lead to wilting and reduction in quality and vase life. After harvest, flowers should be removed from the field or greenhouse and refrigerated as soon as possible. Leaving the flowers out of water, in warm air or in warm drafts such as from a heater, causes considerable damage. Flowers should be in water and under cool temperatures as much as possible from the *time* they are cut until they reach the final customer.

Low carbohydrates are another reason for flower deterioration. A low carbohydrate supply can occur as a result of improper storage temperature and handling. Respiration continues to be governed by temperature after harvest. Low temperatures reduce respiration and conserve carbohydrates, thereby prolonging quality and vase life. Each of the many stages in the marketing channel must be watched. Flowers should be placed in cold storage as soon after harvesting as possible. They should be refrigerated during surface transport and during holding periods at the wholesaler and retailer. Serious damage occurs when flowers are left on a heated loading dock at the motor or air freight terminal or when they are left sitting in a hot warehouse for a day or so.

The harmful effect of ethylene. Fruits, especially apples, give off large quantities of ethylene gas, making it inadvisable to store lunches containing fruits in coolers. Ethylene is evolved from plant tissue, particularly injured and old plant tissue. The cooler should be kept clean of plant debris such as cut stems and leaves that might accumulate on the floor. Old unsalable flowers should be discarded. Ethylene gas has many deleterious effects. Generally it causes premature deterioration of flowers. Ethylene can cause flower wilting and is generally not reversible.

Preservatives for Extending Vase Life:
Floral preservatives perform three functions:

1. Provide sugar (carbohydrate)
2. Supply a bactericide to prevent microbial growth and blockage of the water-conductive cells in the stem
3. Acidify the solution

The most popular preservatives today contain 8-hydroxyquinoline citrate (8-HQC) and sucrose (common table sugar). The 8-HQC is a bactericide and an acidifying agent. Besides suppressing bacterial development and lowering the pH, 8-HQC also prevents chemical blockage, thus aiding in the absorption of water. Sucrose taken up by the stem maintains quality and turgidity and extends vase life by supplementing the carbohydrate supply.

There are a number of commercial preservatives on the market, including such products as Floralife®, Petalife®, Oasis®, Rogard®, and Everbloom®. These work well. One can also purchase 8-HQC under the name oxine citrate from florist supply companies and add sucrose to make the preservatives.

The bactericide 8-HQC is not totally effective in preventing the buildup of bacteria in floral solutions. Chlorine is a very effective bactericide but dissipates quickly from solution unless provided in a slow-release form. Two slow-release forms sold extensively in products including bleaches, deodorizers, detergents, dishwashing compounds, and swimming-pool additives are DICA (sodium dichloroisocyanurate) and DDMH (1,3-dichloro-5,5-dimethyhydantoin). Both are highly effective bactericides for floral preservation. Each is used at a concentration of 300 ppm(0.41 oz/10 gal) in the place of 8-HQC DICA or DDMH is used with sucrose at a concentration of 2 percent (27 oz/10 gal). These chlorine compounds will bleach stems and leaves immersed in the preservative solution. They may also injure outer petals. These disadvantages are outweighed by the superior bactericidal effects of these materials.

Floral preservatives are very effective in maintaining quality and extending longevity. On the average, they can double the vase life of cut flowers when compared to water. Snapdragons with a life expectancy of five to six days last up to twelve days in preservatives.

REFRIGERATED STORAGE

The most common system for handling harvested flowers is refrigerated storage, which involves the following steps:

1. Flower stems should be cut with a sharp knife or shears to prevent crushing of stem and water-conduction cells.

2. The cut flowers should be placed in a preservative solution as soon as possible to prevent wilting. The flowers should not be allowed to be out of water while they are waiting to be transferred to the storage or grading rooms. If cut in the field, buckets containing solution can be brought out on trailers to hold the harvested flowers. Flowers cut in the greenhouse should not be left in the sun or out of water for more than a few minutes. One person should be assigned to carry these flowers to the grading room or storage cooler immediately.

3. As soon as flowers arrive at the storage room they should be placed in preservative solution inside the refrigerated storage room. If wilted, they should be placed in a warm preservative solution at room temperature until turgid. They should then be placed in the cooler.

4. The temperature of the refrigerated room should be 33 - 40 F. The lower the temperature, the better, because the respiration rate falls off with diminishing temperature. Low respiration rates have an effect similar to that resulting from adding sucrose to the preservative solution in that they conserve carbohydrates within the flower. A temperature range of 35 - 40 F is usually encountered in flower coolers.

5. Air should be gently circulated inside the cooler only to the extent necessary to insure uniform temperatures in all areas. Unprotected flowers placed in a direct air stream will be desiccated. Flowers immediately adjacent to a cooling coil may freeze even though the air temperature is above freezing. Since the coil itself is below the freezing point, radiant heat is lost from the flower to the coil, and the flower can be colder than the surrounding air.

6. Potential sources of ethylene gas should be avoided by keeping fruit and vegetables out of the cooler. Discard old flowers. Wash the inside of the cooler periodically.

7. Replace the preservative solution at two-to seven-day intervals. The preservative should be checked periodically for bacterial growth, which is apparent when the solution becomes cloudy. In spite of the bactericides in preservatives, microorganisms will develop and need to be eliminated periodically. To accomplish this, wash the buckets with a disinfectant such as bleach.

The wholesaler and retailer should hold the flowers under refrigeration. Whenever possible, flowers should be transported under refrigeration. Encourage the wholesaler and retailer to cut one-half inch from the base of the stems whenever it has been necessary to leave the flowers out of water for a period of time and then to place them in warm water at a cool air temperature to avoid the ends of the stems drying out and restricting water movement. Use a preservative solution throughout the entire marketing channel.

DRY STORAGE

Flowers can be held in refrigerated storage for one to three weeks, depending on the species. Refrigerated storage is more generally used as an aid for maintaining quality as flowers pass through the market channel. Dry storage is used when flowers must be held for periods longer than one to five days.

Only the best-quality flowers should be dry stored. Those of poor quality will have a short vase life when they are removed from storage. Flowers should be cut and packaged for storage immediately without being placed in water. Standard cardboard flower boxes are suitable, but a lining of polyethylene film should be placed in them to cover the flowers and seal in moisture. Desiccation can be a problem in long-term storage, especially when an absorbent container such as cardboard is used.

A common problem of dry storage is the presence of free water on the flowers, which encourages the development of disease. While flowers freeze only at temperatures below 29 F, the free water will freeze at 32 F. Resulting ice crystals on the petals can be injurious. Boxes and flowers packed at warm temperatures develop condensation (free water) as the plants and air inside are cooled. Because of the polyethylene barrier, the water cannot escape. Disease, enhanced by this moisture, is a common cause of failure in dry storage. Boxes of flowers should be cooled open in a 38 - 40 F cooler, then sealed and placed in a 31 cooler.

Most flowers freeze at 27 - 29 F , so it is essential that the temperature stay above this point. Flower life expectancy is lessened at 33 F and drops rapidly at temperatures above that point. Many of the failures of this system have been due to high temperatures or fluctuating temperatures. Since the dry storage cooler should not be open too often, another cooler is needed for regular refrigerated storage. The 31 F cooler is often built inside the 35 - 40 F cooler to provide for a more uniform temperature.

Space should be left between boxes of flowers when they are placed in storage initially. Respiration is occurring, and this produces heat. A large stack of boxes can generate enough heat and provide sufficient insulation to prevent thorough cooling of the inner flowers. Leave space between each stack of boxes and between every other box in a stack to permit the absorption of heat by circulating cool air. Flowers removed from dry storage need to be hardened. Cut one-half inch from the bottom of each stem. Place the flower in a preservative solution inside a 38 - 40 F cooler. Allow the flowers to become fully turgid before marketing them; this will take 12 to 24 hours. When properly handled, dry stored flowers should have reasonable quality and the same longevity as fresh flowers. Poor temperature control or disease will decrease quality and longevity.

Dry storage is used only to a limited degree by the industry and works best with chrysanthemums. Chrysanthemums, carnations, and roses are the crops to which it is primarily applied. Much more potential exists here than is being realized. The main reason for its low level of acceptance has probably been failures due to poor handling of the system.

BUD HARVESTING

Bud harvesting is a procedure that is used infrequently but is fairly well proven and has a tremendous potential. Carnations and chrysanthemums can be harvested and shipped in the bud stage, which cuts down greatly on their volume and hence lowers the cost of shipping. The wholesaler may then store the buds or open them immediately for resale. Once open, the flower has at the least the same vase life potential as a flower cut mature.

Bud harvesting enables a grower to produce more crops per year in the greenhouse space. There is a significant increase in net return to the grower. There are other advantages to this system. Buds are more immune to handling injuries and ethylene toxicity, making a higher-quality final product possible. As in the case of mature harvested flowers, buds will dry store very well, enabling one to build up the inventory for higher-priced market dates. Bud harvesting is not a new concept for all crops, since roses, *gladiolus*, *iris*, tulips, peony, etc., have always been cut in the bud stage.

When needed, buds are removed from the storage box, one-half inch of stem is cut off, and they are placed in a floral preservative solution. The buckets of buds are held in an opening room at 70 - 75 F until the buds are fully open. A low light intensity is provided in the opening room. The open flowers may be held under refrigeration in the preservative solution or they may be sold directly. The quality and longevity of these flowers has been reported to be superior to those harvested at maturity.

Bud harvesting is becoming important. Growers who ship flowers great distances recognize its value and find it necessary to use this system. Greater cooperation among growers, wholesalers, and retailers will foster it even more.