Postharvest technology course Horticulture (6) (floriculture)

by

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2020

Lecture 9

INTRODUCTION

The cut flower industry is expanding worldwide, and Egypt is activity seeking to generate new market for its unique geographical location near the high-volume markets of Europe.

The postharvest life of flowers is strongly dependent on production practices as well as proper postharvest treatments, cut flowers should be able to withstand periods of storage that allow for extended sales periods and facilitate long distance shipping.

Growers are heavily reliant on technologies that maintain the quality of postharvest produce during transportation.

Egypt must therefore take a leading role in the development and marketing of technologies that provide Egyptian producers a competitive advantage over their foreign counterparts.

The longevity of cut flower spikes (days) was determined when the wilted florets reach 75% from the number of total florets on the spike.

Floret wilting percentage was calculated as a percentage of wilted florets from all the opening florets on the cut spikes from the treatment and at the end of experiment.

Stage of flower development at harvest

Flowers maintain a fresh appearance much longer if they are harvest appropriate stage of development. In general, flowers cut at more advanced phases of development have a shorter vase life than younger flowers. The optimal phase of flower development for harvest depends upon the plant species, the cultivar, the season, the distance to the marketplace, and consumer preferences. Flower destined for direct sale are usually harvested at more advanced stage of development than flower destined for longer transport or storage. Chrysanthemum cut flower spikes (*Dendranthema grandiflorum* kitam. belongs

to Family: Compositae (Asteraceae) The flower spikes were harvested morning, (at outer petals fully open but before disk flowers start to elongate). The flower spikes of *Polianthes tuberose* were harvested at the second floret opening stage. The flower spikes of Strelitzia were harvested in early morning at the first floret opening stage (beginning of showing color).

Special requirements concerning the phase of development for flower destined for long distance transport or prolonged storage. further development of flowers and vase life after harvest depend to a great extent upon the carbohydrates and other synthases in plant tissues.

Many flower species may have harvested at less advanced stages in summer than in winter with the assurance that they will develop properly in the vase, here too, there are significant variations among species and cultivars within a species.

Roses cut too early often suffer from bent neck which is caused by insufficient maturity and hardening of the vascular tissues.

In recent years special methods have been developed for the postharvest handling of the flower cut in bud.

Such bud is treated with special chemical formulations containing nutrients and substances to control decremented microorganisms.

Time of Harvest

Optimal time of harvest is a compromise among various conflicting factors. Morning cuttings have advantages of better turgidity, but at the same time, flower which may be still wet with dew are more susceptible to postharvest fungal infection. Also, because wet flowers are more subject to attack by gray mold and other fungal disease, harvesting should be delayed until dew rain or moisture has dried. Evening cutting has advantage in terms of higher carbohydrates concentration in flowering stems. If, however harvested flowers are placed directly in a floral preservation solution containing sugar, the time of cutting is not important. Harvesting at high temperature and high light intensity, should be avoided.

Mode of Harvest

Sharp tools should be used for removing flowers from the mother plant. The crushing of a stem at the cut should be avoided, as this causes the exudation of sugar containing sap which encourage the development of microorganisms which may be turn cause stem plugging.

Flowers cut usually cut close to the soil to provide the longest stem possible. this is often associated with decreased water absorption by the hardened lower part of the stem, resulting in shorter vase life. It is better to cut flowers in the less hardened portion of the stem.

Special attention must be paid to those flower species in which milky sap (latex) is exuded form the cut surface (Dahlia, Euphorbia). Latex coagulate on the cut surface preventing water absorption. The stem end should be treated with hot water 85-90 °C for a few seconds after each recutting or warm water 40-50 °C for 30 minutes and the stem end of flowers soaking of absolute ethanol 95 % for 5 minutes after recutting.

Temperature after Harvest

Ambient temperature is the most important factor affecting postharvest flower quality.

Higher temperatures accelerate floral development and senescence.

Lower temperature slow down the respiration rate and the utilization of carbohydrates and other storage materials in plant tissues. At lower temperatures, flowers produce less ethylene, and the sensitivity to ethylene present in the ambient atmosphere decreases. Lower temperature also retarded water loss and development of microorganisms.

After harvest flowers should be transferred with minimum delay from greenhouse to the cool storage room. Cut flowers originating in a temperature zone are best stored at a temperature slightly higher than the freezing point of plant tissues.

Flowers originating in tropical regions are often sensitive to low temperature and must be stored at temperatures between 8-15 °C. Tropical flowers at too low a temperature may cause discoloration and deterioration or the failure of flower bud to open upon removal from storage.

Humidity after harvest

Cut flowers contain a considerable amount of water if they are subjected to postharvest conditions with low humidity, they will lose water easily, leading to a reduction in their initial fresh weight.

Flowers that have lost 10-15 % of their fresh weight are usually wilted.

This is related to the fact that the content of water vapor in intercellular spaces is close to 100 %, whereas the content of water vapor in ambient conditions is usually much lower.

Thus, flowers will lose water more slowly under conditions of high relative humidity.

It is not possible to completely eliminate the transpiration of water from cut flowers, but water loss can be reduced by increasing the relative humidity (RH) in grading and packing areas and in storage rooms and by lowering the temperature and limiting air circulation.

High humidity and relatively high temperatures increase the risk of infection by fungal and bacterial diseases. Overall it is best to maintain postharvest storage conditions of high ambient humidity, low temperature and moderate air circulation.

Light

Lack of light during long distance transport or prolonged storage accelerates the yellowing of leaves of chrysanthemum, dahlia, gladiolus.

After cutting flowers are usually stored and transported under low light intensity or total darkness. High light intensity is required only for the opening of flowers cut at the bud stage.

Lecture 10

Main component of floral preservatives

- **Most floral preservatives contain carbohydrates, germicides, ethylene inhibitors, growth regulators and some mineral compounds.**

1- Carbohydrates the main source of nutrition fore flowers and the main source of energy necessary for maintaining all biochemical and physiological processes after separation from the mother plant.

- Sugars support the processes fundamental for prolonging vase life.
- Such as maintaining mitochondrial structure and functions.
- Improving water balance by regulating transpiration and increasing water uptake.
- Sucrose is the sugar most often used in floral preservatives, but in some formulations glucose and fructose may also be used.
- All sugars present in floral preservatives make excellent media for the growth microorganisms which plug water vessels in a stem, therefore sugars must be combined with germicides in the preservative mixture.

2- Germicides

- Microorganisms which grow in the vase water include bacteria, yeasts and molds. These are harmful to cut flowers through their development in and their consequent blockage of the xylem. They also produce ethylene and toxins which accelerate flower senescence.

- The chemicals most commonly used in floral preservatives are salts of 8-hydroxyquinoline (8-HQ) In some flowers, at highest concentrations, these substances may be harmful, causing leaf injury, browning of the stem, and yellowing of white petals
- Silver salts, mainly silver nitrate is effective bactericide. Silver nitrate is often supplied in vase solutions for the extension of flower life. Silver nitrate however has two main disadvantages: It reacts with the chlorine present in tap water, and it is oxidized by light. It must therefore be dissolved only in distilled or demineralized water in glass plastic containers, never in metallic containers. Solutions of silver nitrate should be protected from exposure light.
- Silver thiosulghate (STS) is a very potent inhibitor of ethylene action in plant tissues. It also provides some antimicrobial activity inside the plant tissues but not in the vase water.
- **Preparation of STS solutions proceeds as follows:**

  1- Dissolve 0.079 g $AgNO_3$ in 500 ml of deionized water.

  2- Dissolve 0.462 g $Na_2S_2O_3$ X $5H_2O$ in 500 ml of deionized water.

  3- Pour Ag NO_3 solution into $Na_2S_2O_3$ X $5H_2O$ solution while stirring. The concentration of silver is 0.463 mM.

  4- The STS solution is now ready to use. If not used immediately, the solution may be kept in a dark glass or plastic container at 20-30°C, un total darkness for up to 4 days.

- Some floral preservatives include thiobendazole (TBZ) or quarternary ammonium compounds. These are more stable in hard water than 8-HQ salts, slow release chlorine compounds, or aluminum sulphate.

Name of compound	Commonly used symbol	Range of concentration
8-hydroxyquinoline sulphate	**8-HQS**	**200-600 ppm**
8-hydroxyquinoline citrate	**8-HQC**	**200-600 ppm**
Silver nitrate	**$AgNO_3$**	**10-200ppm**
Silver thiosulghate	**STS**	**0.2-4 mM**
Thiobendazole	**TBZ**	**5-300 ppm**
Quarternary ammonium salts	**QAS**	**5-300 ppm**
Slow release chlorine compounds	**-**	**50-400 ppm**
Aluminum sulphate	**$Al_2(SO_4)_3$**	**200-300 ppm**

- **Growth regulators**

Growth regulators are also used in floral preservatives. These consist of synthetic growth hormones as well as substances to prevent the action of hormonal substances produced endogenously.

They may be applied to cut flowers alone or mixed with other substances. Growth regulators may initiate, accelerate, or inhibit various biochemical and physiological processes in plants. It is possible to delay the senescence process of cut flowers by applying plant hormones or synthetic growth regulators.

Growth regulators used to prolong the vase life of cut flowers are presented in this table.

Name of compound	Commonly used symbol	Range of concentration (ppm)
1- Cytokinins **- 6- benzylamino purine** **- kinetin**	**BA** **KI**	**10-100** **10-100**
2- Auxins **- Indole -3- acetic acid** **- α- naftyl acetic acid**	**IAA** **NAA**	**1-100** **1-50**
3- Gibberellins **- Gibberellic acid**	**GA**	**1-400**
4- Abscisic acid	**ABA**	**1-10**
5- Growth retardant **- Daminozide** **- Chlormequate**	**B-9** **CCC**	**10-500** **10-50**
6- Ethylene inhibitors **- Aminooxyacetic acid** **- Aminoethoxyvinyl glycine** **- Methaoxyvinyl glycine**	**AOA** **AVG** **MVG**	**50-500** **5-100** **5-100**

- Among these growth regulators, cytokinins are most often used to prolong flower longevity of carnations by decreasing the sensitivity of flowers to ethylene and by inhibiting ethylene production. The same hormones have been found to delay senescence in roses, irises, and tulips and increase tolerance to chilling in cut flowers of anthurium. Cytokinins used in spray or dip treatment inhibt the yellowing of the leaves of stock, and gladiolus.
- The application of cytokinins to flowers is especially recommended before extended storage or transportation in order to reduce chlorophyll loss in the darkness.

- Auxins are seldom used in floral preservatives. In carnations, auxins accelerate ethylene production by flowers and cause rapid senescence. In some cases, however auxins can delay senescence and flower drop.
- Gibberellins do not profoundly affect cut flower life. Gibberellic acid was found to accelerate flower opening in carnations cut in the bud. Treatment with GA inhibit chlorophyll loss in the leaves of alstroemeria and lilies and in some other plants stored or transported for long periods.
- **Growth retardants** are often used to extend the life of cut flowers. These compounds retard plant elongation. Growth retardants inhibit the biosynthesis of gibberellins and other metabolic processes in plants. Thus, they increase flower tolerance to environmental stress.
- **Ethylene inhibitors** the third category of growth regulators slow ethylene production in plant tissues. The application of AVG, MVG and AOA to many cut flowers has proved to beneficially affect their vase life.
- Other life extending compounds

  Many other compounds are widely used to extend the vase life of cut flowers. The most important of these are various organic acids such as citric acid, iso- ascorbic acid, tartaric acid and benzoic acid. Citric acid is the most widely used to decrease the PH of water, improve water balance and reduce stem plugging. Citric acid improves the quality of cut roses and many other flowers.