Forcing Guide / Post Harvest Treatment

International Flower Bulb Centre

1. Quality

Maintaining quality

Regardless of the quality of the flowers harvested by the grower, whether or not the user will be able to enjoy them will depend on the post-harvest treatment of the flowers by the producer, the wholesaler, the industry and, last but not least, the consumer himself. On their way from the producer to the consumer, the wrong treatment may affect even the best flowers in quality and ornamental value.
Maintaining the quality is therefore of paramount importance and the producers play an important role in this. Not only must they ensure optimum quality in the distribution chain, but they must also keep the consumers up-to-date on the correct treatment of the flowers.
The following factors are decisive for ensuring optimum quality of (bulb) flowers.

Quality factors: Harvesting stage

For the proper development and opening of flower buds, the flowers must have sufficient nutrients available to them. At harvest, the plant stores these nutrients mainly in its stem. It appears that the stage of development attained by the flower at harvest is a deciding factor in the amount of reserve nutrients it has available. Flowers harvested when immature do not contain enough nutrients for satisfactory flower development. In this case, administration of nutrients for cut flowers at the various stages within the distribution chain can, nevertheless, considerably aid the flowering process. In the case of flowers that are harvested when too immature, however, the lack of reserve nutrients is so great that satisfactory flowering is no longer possible. With bulb flowers, the possibility exists for harvesting the bulb, corm or tuber along with the flower so that the flow of nutrients can continue for some time. This method is used chiefly when the flowers must be stored for longer periods (weekend storage).

Quality factors: Storage environment

After harvesting, the flower is cut off from its supply of water, nutrients and hormones. Meanwhile, ethylene, air, bacteria, fungi, soil and fertilizers can come into contact with the cut surface and cause problems. Maintaining the proper environmental conditions can prevent or limit many problems.

Temperature
Low temperatures after harvesting extend the vase life of the flower by reducing its level of respiration, limiting its loss of water, and restricting the flower's ethylene production and its susceptibility to the effects of ethylene.
The temperature affects the flower's level of respiration and thus its use of its reserve nutrients. It is recommended, therefore, to lower the temperature of most flowers as quickly as possible to between 0-5°C. At a temperature of 2°C, for example, many flowers use one-tenth of the amount of sugars that they use at 20°C. Ethylene damage is also limited by a reduction in temperature. Flowers with a product temperature of 20°C, for example, are 1000 times more susceptible to ethylene damage than when they have a product temperature of 2°C.

Humidity
Storage of the flowers in 'dry' air causes a loss of moisture accompanied by a loss of weight. This leads ultimately to the reduced keeping quality of the flower.
Flower blasting can be prevented by maintaining a sufficiently high relative humidity (90-95%) in the flower storage room. A higher RH would prevent a reduction in keeping quality due to

moisture loss but can cause the development of Botrytis in the flower. This is because Botrytis spores germinate in the water that forms droplets on the flowers at such a high RH. Only when using cold-storage rooms with the Fylacell system (constant low temperature with a high RH) is an RH of 98-99% feasible.
The use of a suitable packaging and packaging material can also limit loss of moisture.

Air composition
To prevent ethylene damage (rapid aging of the flowers) avoid high concentrations of ethylene developing in the air surrounding the flowers. A high concentration of ethylene can be produced by ethylene-generating machines and products such as ripening fruit and vegetables as well as damaged flowers (including damaged leaves and old flowers). For this reason it is important not to store and transport these machines and products in the same areas and/or packaging as the flowers destined for sale. Reducing the concentration of ethylene is also possible by ventilating the area and using ethylene scrubbers.

Quality factors: Water

From the time the flower is harvested, the supply of water from its roots is stopped. Evaporation through the leaf, stem and flower, however, continues. If the loss of water is not supplemented, the flower and leaf become limp; with large moisture losses, irreversible damage can even occur. Therefore, always put the flowers in clean water immediately after harvesting. Problems involved in proper water absorption can be caused by the water being polluted by bacteria and by not trimming the stems before putting them in water. For this reason, always make sure the buckets are clean, provide fresh water daily and add a bactericide to the water if possible, and always trim the flowers. The flowers can also be supplied with growth agents, which they no longer receive via their roots, via the water. In this way, possible leaf yellowing can be prevented. It is also possible to add agents such as silver thiosulphate to the water to protect the flower from the negative effects of ethylene.

Quality factors: Length of time

The length of time to be bridged depends on various factors such as: the day of harvesting (weekend?), the demand, and the distance between producer and consumer. The length of time itself has a negative effect on the nutrient supply, desiccation, ethylene susceptibility and harm due to fungi and bacteria. The length of time it takes to get to the consumer should thus always be kept to a minimum, even when the storage temperature is optimal. The more time is wasted, the more the flowers suffer.

Quality factors: Packaging

As far as quality control is concerned, the function of packaging, whether it be a sleeve or a box, is to protect the flowers from mechanical damage. Remember that wrapping or boxing too tightly can in itself cause damage to the product.

2. Special pointers for post-harvest treatment

Tulips

At the time of harvest, tulips must show a definite amount of color, and the tips of the flower petals must yield a bit to the touch. Cultivars belonging to the Darwin hybrids can be harvested when somewhat less mature but must still display a substantial amount of color.
Tulips must be placed quickly in a temperature of 1-2°C after harvesting by putting them in a cold-storage room. Next, the tulips can be bunched, then put in cold water for about an hour, and then put back in the cold-storage room, either in water or standing dry in a vertical position. For weekend or longer storage periods, it is best to store the flowers, with bulbs attached, in a vertical position in the cold-storage room. Work is being done on developing a suitable pre-treatment agent for tulips, but this has not yet yielded satisfactory results.

Cut hyacinths

Cut hyacinths are harvested along with the bulb just as the flower cluster displays color and when an individual bell comes loose from the stem. After harvesting, the bulb is removed but in such a way that the lowest part of the stem is still attached to the basal plate of the bulb. By leaving the basal plate attached to the stem, the flowers open better in the vase, and the flower's keeping quality is even extended. Neither should the retailer nor the consumer remove the basal plate.
After removing the bulbs, it is important to rinse off the stems with clean water to prevent the growth of bacteria. This is followed by grading the flowers according to length. After grading, the hyacinths are bunched five stems to the bunch and stored dry (maximum of 3 days). As far as quality is concerned, however, it is preferable to store them in clean water with the possible addition of a single tablet of chloramine T (e.g., Florissant 500) per four liters of water. In case the flowers must be stored, this can only be for a short time (max. 3 days) in a cold-storage room kept at 2°C.

Narcissi

The correct harvesting stage for narcissi harvested before mid-January and for double narcissi is when the bud has started to open. After mid-January, harvesting can be done a bit earlier, preferably when the bud is completely filled out. After harvesting, the flowers can be stored for a maximum of 3 days, preferably in cold water at a temperature of 1-2°C under conditions of high humidity. When the air in the room has a high RH, the spathe remains supple and does not create problems associated with opening.

Lilies

In general, lilies are harvested when the lowest bud displays a definite color. When the inflorescence contains many buds, as is sometimes the case with the cultivar 'Apeldoorn', the lowermost whorl of buds should display color. In the Netherlands, producers are required to pre-treat a large percentage of the Asiatic hybrids with a silver thiosulphate solution (0.2 mM $AgNO_3$ and 1.6 mM $Na_2S_2O_3$ per liter of deionized water). This solution provides protection against ethylene and postpones the appearance of leaf yellowing, especially when gibberellin GA is also added.
These agents are supplied in a combined form by such companies as Pokon and Chrysal under the name of LVB; the stability of this solution, however, is limited to just over six months. It is

safer to combine the flower conditioners yourself by mixing Chrysal AVB (silver thiosulphate) and Chrysal SVB (gibberellin).
The pre-treatment can take place in the cold-storage room; the effectiveness of the silver preparation used for pre-treatment lasts a minimum of 4 hours and a maximum of 72 hours. The effectiveness of solutions containing gibberellin is about 20 hours. As a rule of thumb, letting the flowers stand overnight in the combined flower conditioner provides a very satisfactory result.

Gladioli

Gladioli are harvested when the lowermost bud of the inflorescence displays a definite color. Afterwards, the flowers must be processed as quickly as possible. They must be kept constantly in a vertical position during storage (throughout the entire distribution chain), preferably in water at 2°C in a storage cell at a temperature of 2-5°C. For weekend storage it is preferable to store the flowers with corm attached. It is possible to provide gladioli with a storage nutrient, especially if harvested when immature. For this, the flowers are stored at 20°C for 20 hours in a solution containing 10% sugar (for large-flowered gladioli) or 20% sugar (for small-flowered gladioli) plus 300 ppm 8 hydrozyquinoline sulphate, 30 ppm silver nitrate and 50 ppm aluminum in the form of aluminum sulphate. Clonisol stops bacterial growth, silver nitrate promotes proper transport and cell pressure and aluminum sulphate helps to precipitate phenol combinations.
When the risk of bacteria development in the water is thought to be great, chloramine T can be added to the water (1 tablet-50 ppm Cl2 per 4 litres of water). One of the brand names for this flower conditioner is Florissant 500.

Iris

The maturity of iris at the time of harvesting depends on the season and the cultivar. During the winter period, the cultivars ‘Prof. Blaauw’ and ‘Blue Magic’ must be harvested when the blue tip has emerged 4 cm from the spathe. For other cultivars, a colored tip of 2 cm is sufficient. Flowers harvested during other periods of the year can be harvested with a colored tip measuring 1 to 2 cm in length. After harvesting, iris, too, must be processed as quickly as possible and placed in cold (2°C) water in a cold-storage room at a temperature of 1-2°C. Storage in water encourages the opening of the flowers when they reach the consumer. A high RH in the cold-storage room also encourages the opening of iris flowers and their color development.