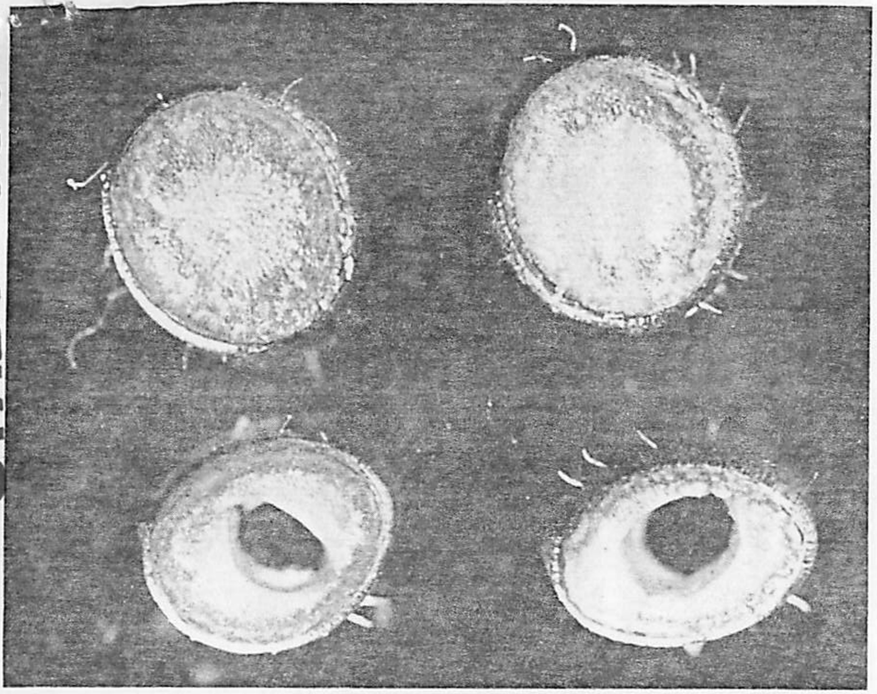

Figure 9.4 Cross sections of a snapdragon stem showing "hollow stem" (lower) and a normal stem (upper). (From McLaughlin reference 8).

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BING '62 6 weeks storage 31F

CHAPTER 10 STORAGE AND HANDLING OF FLOWERS

ARTHUR BING

After all the effort that goes into producing a good crop of snapdragons on the bench, there is still the task of placing the flowers into the hands of the consumer when he wants them and in the best possible condition. Important considerations are stage of development, time of cutting, bending of the tips, packaging and shipping containers, insulation, shattering (flower drop), conditioning, and low temperature storage. All these factors must be understood by the grower, wholesaler, and retailer to satisfy the retail customer sufficiently that he will buy snapdragons again and again. Repeat buying by the consumer is what will keep the sales volume and price where the grower can make money.

Time of Cutting

Snapdragons are usually cut when there are 6-10 florets open on the spike. If snaps are cut too tight, the later opening flowers do not have good color and are smaller. Snaps can not be cut in a relatively tight condition as can some other flowers such as gladiolus and carnations and still be the top quality and bring top price when sold. When snaps are cut, the bottom floret is about one week old. Delaying the cutting too long, will result in spikes that will soon have the bottom floret drying up especially if held in low temperature storage. It takes a good man to go through a bench of snaps and pick them at the peak of condition.

Bending of Tips

When snapdragon cut flowers are placed in other than an upright position, the tips bend upwards, nearly 90° from a horizontal position. They start bending up in 15 to 30 minutes, with almost complete bending in 8 hours, and complete bending in 12 hours (17). This bending occurs if the flowers are laid flat in packing box or if they are not upright in a flower arrangement. Bennett and Smith (3) found it may be possible to reverse the natural upward bending by spraying the foliage below the flowers with trichlorophenoxypropionic acid. Teas and Sheehan (17) reduced the bending to 14° by using a spray of n-1-napthylpthalamate (NP). They produced little effect with sprays of indoleacetic acid (IAA), 2, 4-dichlorophenoxyacetic acid (2,4-D), or gibberellic acid. These experiments showed that it may be possible to counteract bending by the use of chemicals. However, it may be difficult to apply this information to the many varieties and growing conditions that exist.

Packaging

Bending of stem tips is one reason why snapdragons are not shipped long distances in containers that will hold the flowers in a horizontal position. Several of the better growers are shipping in upright hampers such as are used for gladiolus. Paul Newman (16) describes a container and packing method that he uses:

"The hamper we have had made for us by an area paper box manufacturer is 16 by 16 inches on the horizontal, giving it greater stability vertically, and either 3 or 4 feet in height. The hamper has full flap covers top and bottom and is manufactured from 200-pound test corrugated paper board."

"At the time of manufacture, hand-holds are cut one third of the distance from the top on two opposite sides. One-inch slits are cut on all four sides top and bottom where the hamper body and full flap covers intersect. Printing is placed on the body of the hamper with an arrow, "THIS END UP.""

"The hand-holds, arrow, and printing assure the handling of the hamper in an upright position during shipping. The slits referred to are placed so the anvil of a deep throated stapler can be readily inserted through them so the flap cover may be stapled tightly closed."

"The packing of snaps for shipment is as follows: Each unit of snapdragons (a unit is one dozen stems) is wrapped about the heads, as is common practice today, with wax or parchment paper or one of the cellophanes. All units are then wrapped together in large sheets of Kraft paper lined with sheets of newsprint, determined by the minimum temperatures expected while the shipment is in transit. We use no newsprint when temperatures are above freezing, and use ten sheets thickness during winter or for temperatures to −10°F."

"After the units are wrapped together, they are dropped into a hamper in the bottom of which there is a layer of crumpled newsprint which acts as a cushion and absorbs excess water. The top of the wrap is then folded over and in. The hamper flaps are stapled and the hamper is ready for shipment."

Some growers are using second hand gladiolus hampers. The hampers are laid on their side. The side is cut open to form a flap. The bunches of flowers are laid in the box with paper wrapping, all stem bases close to the bottom end of the box. Snapdragons can be easily damaged by dropping them through the top of an upright hamper. The flap is stapled shut and the box stood on end.

The boxes must be in an upright position practically all the time to avoid tip bending.

Another important consideration is the size of container. It should be one that requires the least handling of the flowers from the original packing to the retail sale. Wholesalers are finding it costs too much money to do any extra handling of cut flowers. Smaller containers that will move to the retailer as units will save on wear and tear of the flowers. However, increased shipping costs may result per dozen of snapdragons.

Insulation

When the outside temperature drops below freezing, it is usually necessary to insulate the boxes. Standard practice is to use up to 10 layers of dry newspaper. Furuta (7) reports that layers of newspaper are one of the most efficient means of insulating flower boxes. Wet newspaper is a poor insulator compared to dry newspaper. The bottom of the box and ends tend to cool off first so be sure and insulate the bottom and ends most of all.

Shattering—Flower Drop

One of the greatest troubles with snapdragons is the shattering or dropping of florets. If bees pollinate snapdragon flowers, the florets drop. If snapdragons are stored or shipped with fruits or vegetables, especially apples, the florets on many varieties fall off. Ethylene gas is produced in sufficient quantities by many fruits and vegetables (14). Research has shown that exposure to ethylene gas causes the florets to fall off the stem. Ethylene gas is in illuminating gas. This gas occasionally finds its way into a greenhouse or a retail flower shop because of a leak in a gas main from which the gas seeps underground and by chance comes up in a greenhouse. This more frequently happens when the ground is frozen in the winter and the only open soil is in a greenhouse. Fungi can produce ethylene gas. Botrytis which is common on dying snapdragon foliage was found by Williamson (19) to produce enough ethylene gas to produce typical growth effects on pea seedlings grown in the dark.

Fischer (6) found that snapdragon stems themselves produced sufficient ethylene to cause flower drop. By enclosing cut snapdragons under glass jars at room temperature, he was able to cause flower drop in jars where there was no change of air for 3-4 days. Changing the air constantly or recirculating the same air througth brominated activated charcoal, prevented flower drop (Figure 10.1).

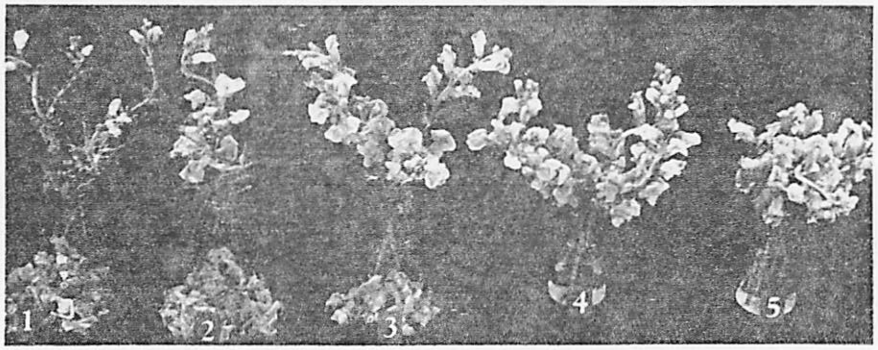

Figure 10.1 Snapdragons exposed to 1) an air tight container—carbon dioxide removed (96% drop). 2) an air tight container (60% drop). 3) an air tight container—carbon dioxide added (18% drop). 4) an air tight container—carbon dioxide removed brominated charcoal added (1% drop). 5) an air tight container brominated charcoal added (0% drop). (From Fisher reference 6).

Snapdragon shattering from pollination or exposure to ethylene has been found by Haney (10) and Duffet (5) to vary considerably between inbred varieties. There was a correlation between flower drop from pollination and from exposure to ethylene. Haney (9) mentions a demonstration where the shattering tendency of snapdragon varieties was tested by exposure of the varieties to ethylene for 48 hours at room temperature. Of the 28 expected shatterers, 24 shattered; of the 24 expected nonshatters, 22 did not shatter. This is a very close correlation. Haney (8) reports that shattering is dominant to non shattering and that inbreds can be separated into two distinct groups by their response to ethylene. The test was exposure for 48 hours in a closed container with a ripe apple. Haney (11) believes that ethylene tolerance is conditioned by two major recessive factors linked with late flowering in addition to minor as yet unidentified factors.

Yoder Brothers have used this method in their breeding program for selecting more shatter proof varieties. Below are some of their ratings as reported in their Growers Circle (5).

Highly Shatterproof

#2 Crystal White, Delaware, Florida, Indiana, Kentucky, Nashua, New York, Ohio, Rosebud, Summer Jewel, Swaps, Tennessee, Twenty Grand, Vermont, Virginia, White Knight, White Skies, Utah

Moderately Shatterproof

Albion, Apollo, Citation, Colorado, Texas, Top Flight

Not Shatterproof

Arizona, Broker's Tip, Cavalcade, Dark Star, Gallant Fox, Gay Time, Kansas, Maine, Native Dancer, Nevada, War Admiral, Whirlaway, Wintergreen, Wisconsin

Haney (8) also lists some varieties he found tolerant to ethylene plus varieties shown to be tolerant in tests carried on by others.

Holders

Armstrong's White, White 1, Junglewood Lemon, Junglewood White, Margaret, Cheviot Maid #33, Daybreak, Peggy Schumann, Windmiller's Lilac

Shatterers

White Cheviot Maid, White Wonder, Yuletide, Madeline, Ball Gold, Carol Jean, Ethel, Gilbert's Yellow, Rockwood's Winter Yellow, Rockwood's Early White, Gilbert's Bronze, Lady Dorothy, Helen Tobin, Rose Queen, Rockwood Pink Supreme, Red Lips, Scarlett O'Hara, Schisler's Red

Double snapdragons do not shatter. Kofranek (13) reports that the double flowers do not "shell" off because they lack the sexual parts and because the numerous petals are held tightly within the calyx. When he exposed single and double varieties to ethylene, the singles dropped over 70% of the florets within 72 hours while the doubles lost none.

Conditioning

Cut snapdragons depend upon their stored supply of carbohydrates to support their life processes which continue after the flowering stem is cut from the plant and removed from the sunlight which furnishes the energy for carbohydrate manufacture in the plant. Flowers cut after clear weather are

more likely to keep longer than those cut after a period of cloudy weather. Sugar added to the water and picked up by the stem adds to the period of usefulness of the flower. Aarts (1) found sucrose at 4% to be the optimum amount added. Silver nitrate .003% was used at a bactericide along with the sucrose. Flower life was increased from 10 to 13 days. The sooner after cutting sugar was added, the more effective the treatment. Flower preservatives have sugar included as one of their principle ingredients.

Does the fertility of the soil affect the keeping quality of the flowers? Mastalerz (15) could find no conclusive evidence that soil nitrate level affects keeping quality and recommends growing the snapdragons at the nitrate level best suited for good growth.

A common cause for short life of cut snapdragons is wilting of the cut flowers because of a lack of water. Water is absorbed through the cut base of the stem. There is no appreciable amount of water picked up through the side of the stem. Placing stems in deep water does not directly help in water absorption. The water must be absorbed through the cut ends of the stems. Any obstruction of this cut end could cause a deficiency of water in the stem and cause wilting or even death. The usual cause of stem plugging is bacteria and products they may form or other foreign matter in the water. Air bubbles are not important in preventing water absorption. An excellent report on the subject of keeping quality is given by Aarts (2). The proper precedure is to always use clean containers. Do not place stems with dead leaves in the water and use one of the flower preservatives which have a bacteriacide as one of the ingredients.

Many chemicals have been tested for their ability to prolong the life of cut flowers. Kelly and Hammer (12) report that cupferron, a chelating agent, and maleic hydrazide, a growth regulator, prolonged the life of snapdragons 2-4 days.

When flowers are cut, their stems should be placed in warm water containing a suitable flower preservative and held at 40-50° for 6-8 hours to harden them before shipment.

Low Temperature Storage

The physiological processes that cause aging of cut flowers are slowed up by low temperature and low available moisture. The minimum temperature at which cut flowers can be held without permanent injury to the tissue is usually 31°F. Snapdragon foliage and stems are rather tolerant to low temperatures. The freezing point of the flowers is reported by Whiteman (18) to be lowest 30.1°F, average 30.3°F, and highest 30.4°F. There are several reports (4) (20) that snapdragons can not be stored over 3-6 days and not to be stored below 40°F. Mastalerz (15) and Haney (11) report that some varieties can be held at 31°F for two weeks and possibly longer without appreciable loss in effective life. Haney (11) reports that genetical variation exists such that spikes of some varieties can tolerate 31° for 6 weeks and survive normally afterwards.

Mastalerz (15) points out that if spikes are cut after the bottom floret is over one week old, the lower florets will probably shrivel up in storage or soon afterwards. He also noted that the spikes continue to develop in storage and later flowers are lighter in color so it is important not to cut the spikes too tight. Table 10.1 from Mastalerz (15) shows that storage for 22 days did not reduce the effective life of snapdragon varieties Ball Hybrid No. 2, Christina, or Dorcas Jane:

Table 10.1. The length of the conditioning period and the life of snapdragon cut flowers. (From Mastalerz reference 15).

Variety	Date of Conditioning	Number of Days at 31°F	Life of Conditioned Flowers, Days	Life of Non-Conditioned Flowers, Days
Ball Hybrid No. 2	5/8/51	22	10	10
	5/8/51	37	4	10
	5/8/51	53	0	10
Christina	5/11/51	24	11	12
	5/11/51	50	0	12
Dorcas Jane	11/5/51	22	10	10
	11/5/51	35	4	10
	11/20/51	21	9	10
	11/20/51	37	3	10
	4/12/52	23	6	8
	4/12/52	35	2	8

At low temperatures ethylene is not much of a problem.

For effective use of low temperature (31°) storage follow these steps:

1. Harvest only top quality for storage.
2. Cut flowers that are fairly well open usually with 6-8 florets, but the bottom floret not over one week old.
3. Do not place stems in water.
4. Grade, bunch, wrap, and place upright in moisture proof containers.
5. Hold at 31°F for up to two weeks. Temperature must be held constant.
6. Remove flowers 6-8 hours before use or packing for shipment.
7. Place immediately in 100-110°F water containing flower preservative.
8. Place container in draft free 40-50° room for 6-8 hours.
9. Remove flowers to room temperature for further use.

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