Section 15

Gerbera

Marlin N. Rogers, Professor Emeritus, University of Missouri
Benny O. Tjia, formerly of the University of Florida

Gerbera, known as the Transvaal or Barberton Daisy, is native to the Transvaal area of South Africa. The plant was first contributed to the Durban Botanic Garden by the Honorable Robert Jameson, a Scotsman, who had settled in Durban in 1856. Early in the 1880s, he collected specimens of the "new" plant and gave them to the Botanic Garden. John Medley Wood, curator of the Garden, sent specimens to Harry Bolus in Cape Town for identification. Shortly thereafter, Bolus sent dried specimens to the herbarium of the Royal Botanic Gardens, Kew, with the suggestion that the species should be named *Gerbera jamesonoii.* In 1888, Wood sent live plants to Kew; in 1890, additional plant material reached the Cambridge Botanic Garden, where Richard Irwin Lynch, a local horticulturist spent 30 years carrying out a breeding program that resulted in many quality improvements. Commercial plant breeders became interested in the plants; and in 1912, two large exhibits of hybrid gerberas were shown at the Royal Horticultural Society in Chelsea. Later, gerberas were taken to the Netherlands, where much of the modern breeding work has been carried out.

Initially, the plant was grown almost exclusively for use as a cut flower; but other types with short flower stems were developed around 1980, properly proportioned for use as potted plants. The 'Happipot' strain, introduced by the Sakata Seed Company in Japan, was one of the first such strains. These plants were short enough to be in good proportion when grown in 5- to 6-inch pots, but they produced only one or two flowers at a time and were available only in mixed colors.

Later, Sunshine Research and Development in Florida developed types with more flowers simultaneously in bloom. By marketing them as tissue-cultured propagules, the firm was able to provide homogeneous plant material. Earl J. Small Company also introduced a smaller line of plants suitable for 4-, 5-, or 6-inch pots – named the 'Small' pot gerberas. Other introductions included the 'Parade Mix' seed-propagated strain from the Express Seed Company and the 'Nain Series,' produced by Fukukaen's Nursery in Nagoya, Japan.

In Denmark, Gunnar Larsen was also breeding pot gerberas, with the goal of producing F_1 hybrid types that could be grown as small (4- to 5-inch) potted plants. We saw this material during a visit in 1987, and were highly impressed by the uniformity of color, timing, and plant growth habit in the plant material being grown. Based on what has already happened, we expect to see dwarf plants in a full array of colors with many flowers opening simultaneously to be available soon for widespread use (Figure 15-1).

Figure 15-1. New gerbera varieties yield quality potted crops.

Crop Culture

Propagation

Two major commercial methods of propagation are currently in use: seed and tissue culture. Gerberas produce relatively large seeds that germinate easily under proper conditions and grow quickly into plants large enough to transplant into their final flowering containers. Breeding completely homogeneous F_1 strains that have plants identical in color, size, growth habit, and other factors is a technically difficult operation. However, a number of such variety groups are available in the market, and many gerbera producers rely on them. Cost of the seeds may vary from about $5 to $50 per 100, depending upon the source. At the high end of the cost scale, the cost of each propagule is similar to those produced by the second main propagational method, tissue culture. If and when plant breeders bring on-line cultivars propagated from F_1 hybrid seed with the physical characteristics desired by the consumer public, we would expect this method of propagation to be very competitive with tissue culture on a cost basis. This could very well become the primary method of gerbera reproduction in the future.

Plants produced by tissue culture techniques are genetically identical, and therefore give the grower specimens that will be essentially identical in growth habit, timing, flower color, size, and other factors. For a potted plant producer, these are normally considered desirable and important traits. The propagational technique itself is highly technical and usually carried out only by specialists, but the process has become quite routine and economical. Propagules are now readily available to the general flower producer at affordable prices.

Growing Media, Water Quality, and Fertilization

The ideal growing media for potted gerberas should be pathogen-free. One of the most severe disease problems of this plant is caused by the water-mold root-rot fungi, *Pythium* and *Phytophthora*, which normally develop on unpasteurized growing media components.

In addition, gerberas require growing media that is well balanced for air-holding and water-holding capacity. This quality is normally introduced by a high level of organic matter in the mix. Most commercially prepared, peat moss-based mixes are satisfactory, except possibly those containing high proportions (greater than 20 percent) of bark. Most peat moss-based growing media are prepared from pathogen-free materials and do not require steam or chemical pasteurization before use. If potted gerberas were to be grown in soil-based growing media, pasteurization of the mix before use is essential to ensure freedom from water-mold fungi.

To ensure maximum availability of all essential mineral elements, the pH of the mix should be adjusted into the 5.5 to 6.5 range by adding limestone to raise pH levels, or adding acidifying substances such as sulfur or iron sulfate to lower pH levels. Lower than optimum levels interfere with the uptake of elements such as calcium, magnesium, and potassium by the plants. pH levels higher than optimum interfere with the uptake of many of the trace elements such as iron, manganese, copper, and zinc, and the plants may show foliar mineral deficiency symptoms.

If the water supply is highly alkaline, continued use can cause a gradual increase in the pH levels of the growing media, which can result in mineral deficiency symptoms in the crop. Under these conditions, it is desirable to consider installing water acidification equipment to offset the alkalinity of the water.

Gerberas are not nearly as "picky" about their mineral diet as other flower crops grown in greenhouses. They normally thrive in today's greenhouse, where automatic, continuous liquid fertilization is carried out with fertilizer injectors, applying nitrogen and potassium at concentrations of 200 to 250 ppm of each in the water supply. If one is using pure chemical sources for nitrogen, phosphorus, and potassium to prepare the injector solutions, one will need to include a source of trace minerals such as STEM or another similar proprietary mixture into the stock solutions as well. Most of the commercially-prepared, water-soluble fertilizers developed specifically for continuous liquid fertilization of greenhouse crops, already have the trace elements included, but one should read the label for verification. If they are already included, they should not be added unless you are specifically advised by qualified consultants or advisers. Trace element toxicities can occur very quickly when higher than essential quantities are present.

Irrigation

Potted gerberas, like most other potted plants, grow best when moisture levels are maintained uniformly. Severe drying out, to the point that the plants wilt between waterings, should be avoided. Also, the crowns and leaves of the plants should not be wet excessively. Capillary tube watering, drip irrigation, or flooding of the bench from below are normally preferred to overhead watering such as sprinkler irrigation, or hose watering. Excessive dampness around the leaves and crowns encourages the development of *Botrytis* gray mold, powdery mildew, and crown rot – all of which can almost be eliminated by careful moisture and humidity control around the young, growing plants.

Growing Temperatures

Research has shown that some physiological growth responses in gerbera are more correlated with air temperatures, while others are most closely related to soil temperatures (Table 15-1).

Low night temperatures (less than 55°F) during winter favor the production of vegetative side shoots in the crown of the plant, which give rise to additional flowers as spring progresses. In Florida, where summer night temperatures seldom go below 70 to 75°F, late summer and early fall flower production is sharply restricted. Most successful growers in North America attempt to maintain night temperatures of 60 to 63°F and day temperatures of 70 to 75°F. In northern latitudes with restricted winter sunlight, night temperatures near 55°F are not uncommon. At such night temperatures, however, growth rates are restricted unless soil temperatures are maintained near 70°F. If the greenhouse is equipped with soil heating technology, you can significantly save on total heating costs without reducing gerbera growth rate.

Light Responses

Photoperiodic Responses. Gerberas appear to respond only slightly to photoperiod. Some of the newer cultivars may be showing slight photoperiodic responses; but few, if any, commercial North American producers currently provide special daylength treatments to regulate the normal flowering of the plant.

Cumulative Light Energy Effects. Gerberas are classified as sun plants and perform best under full sun in northern U.S., Canadian, and European greenhouses during late fall, winter, and early spring. During spring, summer, and early fall, 25 percent shade enhances leaf color, overall growth, and general flower quality.

In warm, bright production areas such as Florida, optimum growth and flower yield are achieved under 20 to 30 percent shade year-round. Plants so shaded should develop darker green leaves and slightly larger flowers than those grown under full sun.

Gerberas respond to high intensity supplemental lighting in northern growing regions. In areas such as Ontario and British Columbia, significant winter growth increases have occurred when supplemental, high-pressure sodium vapor lighting (300 to 500 footcandles, 16 to 24 hours per day) was provided from October to March. This is due to photosynthetic enhancement and is not a photoperiodic response. The above preliminary research results indicate that further work needs to be done in this area, since this technology appears to have a good potential for favorable cost/benefit effects.

Carbon Dioxide Enrichment

Experiments carried out in Ontario indicated that increasing carbon dioxide levels to 600 to 800 ppm around the plants increased stem length and flower weight, but not yield, in cut flower gerberas. When carbon dioxide enrichment was combined with high intensity lighting, stem length, flower weight, and yield all increased. Flower keeping quality was also enhanced.

Studies in the Netherlands have shown that raising carbon dioxide levels higher than 800 to 1,000 ppm can be damaging and cause toxicity symptoms in certain cultivars. Therefore, it is recommended that unless growers know the cultivars they are growing are not damaged by enhanced carbon dioxide levels, they should not apply levels higher than 800 to 1,000 ppm. We are not aware of specific carbon dioxide enrichment research on potted gerbera production, so the results with these cultivars could be somewhat different from that previously reported with cut flower types.

Spacing

The foliage of pot gerberas tends to spread, and plants need enough space that leaves from adjacent plants do not overlap excessively. Finishing spacings of about 14 by 14 inches for 6-inch pots; 11 by 11 inches for 5-inch pots; and 9 by 9 inches for 4-inch pots is about right. One or two intermediate spacings (depending upon total cropping time) should be scheduled from potting to sale to achieve high quality plants and efficient use of greenhouse space.

Table 15–1. Some gerbera growth responses are more correlated with air temperatures; others with soil temperatures.

A. Growth responses affected mainly by ***air*** temperatures.
   1. Length of time from appearance of flower bud to its maturity.
   2. Rate of flower stem elongation during *early* stages of growth.

B. Growth responses affected primarily by ***soil*** temperatures.
   1. Interval between the appearance of successive buds.
   2. Final flower stem length.
   3. Rate of flower stem elongation during *late* stages of growth.

Pinching

Since the natural growth habit of this plant is to form a rosette of leaves, from which arise the flowering stems, no manual or chemical pinching is normally necessary.

Chemical Growth Regulation

Perfectly saleable plants can be grown without growth retardants, but their use experimentally has shown that they may sometimes provide benefits (Table 15-2).

Ancymidol (A-Rest™) is effective on pot gerberas and may be applied either as a spray or as a soil drench (Table 15-3). An application of 0.125 to 0.25 milligram active ingredient to a 6-inch pot as a soil drench two to four weeks after potting will shorten leaf petioles about 20 percent and flower stems about 40 percent. The same material may be applied as a foliar spray at the rate of 33 to 66 ppm to produce similar effects. One application should be sufficient. In high-light areas such as Florida, growth retardant application is most beneficial when applied to plants being grown under 30 percent to 50 percent shade.

Scheduling

Plants grown during the high-light parts of the year become saleable 8 to 10 weeks after potting. Plants potted between October and January will require an additional three to four weeks to reach saleable maturity.

Common Insect Problems

Because of the frequent changes in state and federal rules and regulations controlling the use of chemical pesticides on greenhouse crops today, we will not attempt to make specific recommendations for the chemical control of the different insect pests on gerbera. Growers must make it a part of their day-to-day operational procedures to keep up with the latest recommendations provided by technical advisors who keep abreast of current developments in the field. In many cases, however, regulation of the greenhouse environment and the cultural practices used can significantly enhance or reduce the spread and invasion of insect pests and disease pathogens. Since these are the kinds of things that good growers do as a matter of course, they are mentioned only as reminders that can provide a great deal of help in keeping these problems under control.

In addition, more and more of our routine greenhouse insect control today involves the introduction of natural enemies and predators of pest species into our commercial production greenhouses. This, like the use of chemical pesticides, is a rapidly changing field and requires direction and assistance from highly trained and knowledgeable technical advisors or consultants.

Aphids. Aphids, or "plant lice" are small (generally less than 0.125 inch long), soft-bodied insects, and may be yellow, green, or black in color. The most common greenhouse pest is the green peach aphid, *Myzus persicae*. They feed on young leaves and stems, causing stunted and distorted plant growth. The first obvious indication of an aphid infestation may be drops of "honeydew" which they excrete, or the unsightly accumulation of cast-off skins that stick to the leaves. In addition to the physical damage they cause, aphids are also

Table 15-2. Beneficial effects of chemical growth retardants on pot gerberas.

The use of chemical growth retardants:

1. shortens lengths of leaf petioles and flower stems, making plants more bushy and compact,
2. causes leaves to be darker green and more attractive,
3. permits closer spacing and increases production per unit area, and
4. facilitates easier handling and reduces shipping damage.

Table 15-3. Preparation of A-Rest™ treatment solutions.

1. *Drench.* Dilute 1 fluid ounce A-Rest™ concentrate in 2 gallons of water. Apply 4 fluid ounces of this solution to a 6-inch pot to add 1/8 mg active ingredient per pot. If you wish to apply 1/4 mg, mix 2 fluid ounces of concentrate in the 2 gallons to start.
2. *Spray*. Add 16 fluid ounces of A-Rest™ into one gallon of final solution. This gives a concentration of 33 ppm. Double the amount of A-Rest™ for 66 ppm. Spray evenly on the foliage until it glistens. Each gallon of spray should treat 200 square feet of bench area when the plants are grown pot to pot.

known to be one of the principal vectors (carriers) of plant viruses from one plant to another.

Thrips. Thrips are small, slender, usually dark-colored insects, about 0.0625 inch long at maturity, with fine, feathery wings. They feed on foliage, stems, and especially flowers. Affected foliage may appear to be ragged, scarred, and deformed. Stippling or silvering may be present on the leaves, along with an unsightly residue of tiny black drops of excrement left by the pests. Thrips have rasping mouth parts that abrade the surface of flower petals or leaves that release plant sap, which is then sucked up by the insect. This rasping injures the plant tissue, leaving brownish streaks on light colored flower petals, or whitish or silvery streaks on foliage or dark-colored flower petals. Like aphids, thrips can also carry certain plant viral diseases.

Thrips breed freely on various grasses and weeds, usually outside the greenhouse, and then migrate or are drawn inside in the strong air currents associated with fan-powered, greenhouse ventilation systems. Early summer is the worst part of the year for this migration and is the time to be especially vigilant. Many florists have installed fine-meshed, plastic screening over the air intake areas of their greenhouse ventilating systems – with pore sizes small enough to successfully prevent these small insects from entering into their greenhouses.

Whiteflies. Greenhouse whiteflies are not flies at all, but close relatives to scales, mealy bugs, and aphids. Whiteflies are tiny (about 0.0625 inch long) and resemble small white moths. Large numbers cause reduced plant vigor, chlorosis, and yellowing of the foliage. Like aphids, they also excrete large quantities of honeydew, which leads to the development of dark-colored areas of sooty mold on the foliage.

Whitefly eggs hatch into crawlers, which move about and feed on the leaf through their piercing-sucking mouthparts. Soon they molt, losing their legs in the process. The resulting larvae are flat, closely appressed to the leaf, and are oval in shape, and transparent to light green in color. They resemble pale green scales and have white, wavy threads radiating from their bodies. When mature, this scale-like stage becomes quiescent and is then termed a pupa, from which the adult later emerges.

Some level of whitefly management can be obtained through introducing into your greenhouse, the Encarsia wasp *(Encarsia formosa)*, which parasitizes the late larval-pupal stage of the whitefly very effectively. Encarsia is now available for purchase from specialized suppliers.

Leafminers. Gerbera is one of the more favored hosts of the serpentine leafminer, *Liriomyza trifolii*. This pest is a special problem for the potted plant grower, because he sells the entire plant, including the foliage. The serpentine mines, or the brownish blotches on the foliage, quickly render the potted plant unsaleable. The larval stage feeds on cells between the upper and lower epidermis of the leaf, leaving the typical serpentine tunnels in the leaf. Again, it is difficult to control this pest with chemicals alone. Cultural pest control practices such as mowing grass and weeds around the greenhouse and greenhouse screening can also be helpful.

Common Disease Problems

Crown or Root Rot. The causal fungus, *Phytophthora cryptogea,* attacks the crown and root system of the plant, causing a wet decay which results in wilting, drying, and browning of the foliage. The entire plant may be killed within two weeks after the initial attack of the fungus. The disease is most severe when the growing media is poorly drained and constantly wet. The fungus is very widespread in greenhouses, so good sanitation is necessary. If pathogen-free, tissue-cultured propagules are planted in clean, pathogen-free growing media and the pots placed on clean greenhouse benches, the disease will rarely become a major problem. Good greenhouse sanitation can virtually eliminate the problem. Chemical, soil-drench fungicides can be of limited usefulness in emergency situations.

***Botrytis* Blight.** This disease, caused by the fungus *Botrytis cinerea*, frequently occurs in gerberas. The pathogen tends to colonize any senescent or dead leaf, stem, or flower tissue present in the greenhouse. Under fluctuating relative humidity conditions, it produces millions of airborne spores, which float around in the greenhouse and settle on gerbera flowers and leaves to begin further rounds of the life cycle. If moisture films form on susceptible tissue for only a few hours, these spores will germinate and initiate new infections; and another generation of the fungus occurs.

Here again, cultural and environmental control measures are the first line of defense. Rigid greenhouse sanitation, in which all senescent, dead, and decaying plant tissue is cleaned up and removed from the area, is of prime importance. Old, past-prime flowers on the growing plants should also be removed from the greenhouse as they develop.

Careful temperature and relative humidity control in the growing structure is also important, since the development of the fungus is so closely affected by the temperature and moisture conditions at the leaf and flower surfaces, where the airborne spores have settled.

Powdery Mildew. Powdery mildew does not occur frequently or severely on gerberas grown in North America except in Florida, where naturally high humidities prevail for most of the year. Most cultivars are susceptible. It becomes a problem during cool spring and fall periods when plants are crowded and leaves overlap, air circulation is poor, and high relative humidity prevails. Good greenhouse heating and ventilation practices are the main weapons that can be used to hold relative humidity levels down. Removal of old, overlapping, senescent leaves from the growing plants can also be helpful in reducing places where the disease can get started. The practices used to prevent problems from *Botrytis* blight will also reduce potential problems from powdery mildew.

Future Prospects For Potted Gerberas

We think this crop has potential for expanded production in the years ahead. Plant breeders in several different parts of the world are very interested, which should ensure that continuing genetic improvements will become available for general use.

The crop already excels in the wide array of brilliant colors available. It is spectacular wherever it is used and draws instant attention. Additional bicolored and "dark-eyed" cultivars will be forthcoming. We expect to see further developments and new variations in flower form – crested and anemone-flowered types among others.

It may be possible in the future for plant breeders to develop cultivars more responsive to temperature and daylength for floral initiation and development, making it possible to flower the plants on strictly programmed schedules like those now used for chrysanthemums.

We may also see increased use of the plant in outdoor areas – in planters, on patios, around pools, and in perennial borders. It seems ideal for use in semi-public locations around large apartment complexes and shopping malls.

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