Specialty CUT FLOWERS

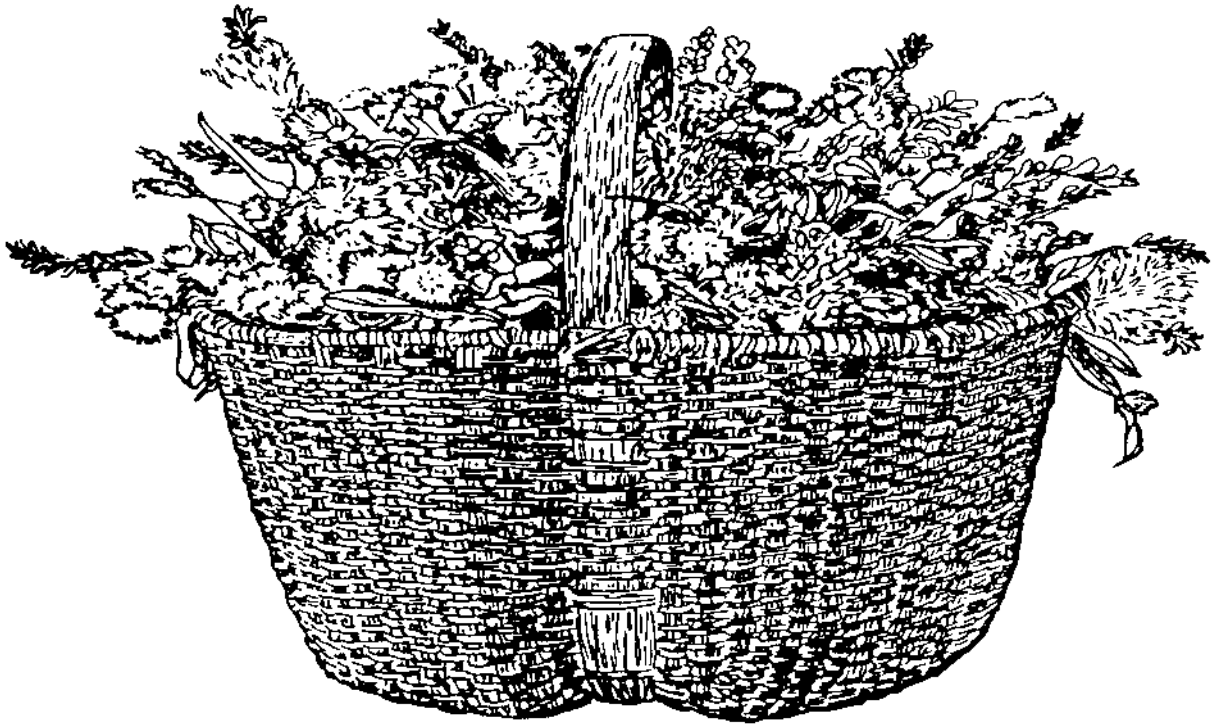
A COMMERCIAL GROWERS GUIDE

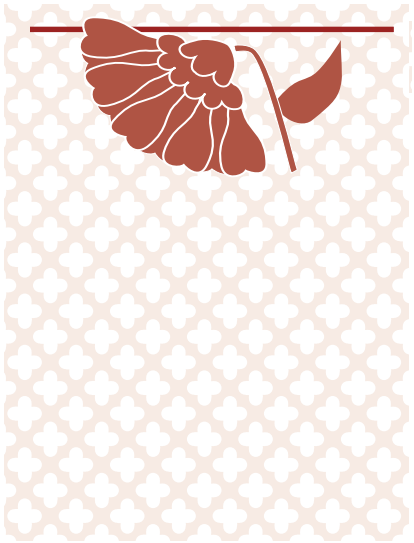
Kansas State University
Agricultural Experiment Station
and Cooperative Extension Service

Contents

“More than anything,
I must have flowers,
always, always.”

—Claude Monet





Introduction

Many agricultural producers in Kansas are considering alternative enterprises to increase their incomes. Field production of specialty fresh or dried cut flowers could be a profitable alternative crop in Kansas. Our state has a climate advantageous to production of many flowers, grasses, and grains for the floral and decorative crafts markets. Perennial flowers that are high in demand, such as Liatris, are native to Kansas and flourish in our climate and soils. National, regional, and local markets exist for high-quality specialty cut flowers. These markets can be served with Kansas-grown products.

The outdoor production of specialty cut flowers is an old segment of the floriculture industry currently in revival across the country. The market conditions, technology and varieties are new. As an emerging industry, it offers unique opportunities for those who enter. This publication discusses basic cut flower production factors. The term "cut flower" in this publication refers to all fresh and dried flowers, seed heads and stalks, and all plant parts used for floral and decorative purposes.

Choosing a Site

Most cut flowers prefer a location in full sun throughout the entire day. The field and soil should be well drained. Wind protection is highly desirable for all plants. Windbreaks serve to reduce water stress on plants and help prevent stem breakage and floral damage. It is important to consider any competitive effect which may occur from the roots of any plant used as a windbreak. The site should have sufficient cold air drainage to avoid recurring early or late season frosts. A source of irrigation water is essential. If animal foraging is a problem, fencing may be required.

Labor efficiency is a critical factor in choosing a site. Flower production requires intensive management. The site should have ready access for production equipment and removal and handling of the harvested product. Study the proposed site for ease in movement of materials and plants into it to begin production, within the site while producing and harvesting the crop, and of the harvested crop to storage and packing areas. The idea is to maximize efficiency of the labor required for all production and marketing functions.

If a pick-your-own marketing strategy is your choice, a site with easy access is critical. Easy access from public roads to parking areas and from parking to the fields will enhance the consumer's overall shopping experience.

Preparing the Bed

Plants should be grown in beds raised 4–6 inches to maximize drainage. Poorly drained soil should be corrected by placing drain lines 10–12 inches deep under the beds. Check for the existence of a hardpan in the soil. A deep-rooted cover crop such as alfalfa may help to break up the hardpan. A well-drained soil environment is essential for maximum root development and reduces the potential for root rot problems.

Organic matter should be incorporated into the beds to a depth of 10–12 inches. The addition of organic matter is best if incorporated in the fall, but can be done anytime before planting if the nitrogen status of the soil is monitored. Remember that for beds planted to perennials, it may not be possible to work additional organic matter deep into the soil until the plants are divided or replaced. For these beds, sufficient organic matter should be added initially to provide a soil structure with optimum aeration and drainage.

Always have the soil tested for nutrient content before adding any fertilizer to the planting bed. Production decisions made without adequate information are merely guesses and can be costly. If nitrogen levels are low and large amounts of organic matter have been added, an application of 20–45 pounds of actual nitrogen per acre prior to planting may be appropriate.

Marketing strategy, plant growth habit, and labor efficiency determine the ideal size of a planting bed. If a pick-your-own market strategy is the choice, beds should be narrow—about 2½–3 feet wide—so consumers easily can pick their flowers without damaging the crop. Bed length should be about 25 feet, with sodded aisles to provide customers with quick and clean access to any product they desire. Traditional production beds are 3–4 feet wide depending on the growth habit of the crop.

Bed width is set to allow maximum light penetration to the center of the bed and to facilitate harvesting. The wider a bed is, the better the ratio of production space to aisle space and the greater the return per acre. Tall, dense flower growth habits reduce the amount of light reaching lower leaves in the center of the bed. A worker can efficiently reach only 2 feet into a bed to make a proper cut and remove the flower without damage to the crop.

Bed length also is set to maximize the area in production versus the area in aisles. The limiting factor to bed length is labor efficiency. The maximum distance a worker should carry harvested flowers is about 50–60 feet. Planting beds should be 100–120 feet long.

What To Grow: The Ideal Crop

An ideal cut flower crop, either fresh or dried, would have the following characteristics:

- low cost of production—materials and labor
- high value and unlimited demand
- high production per square foot of bed space
- extended production and marketing season
- long productive life
- ability to sell fresh and to sell surplus as a dried or preserved floral product
- postharvest vase life of at least 7 days
- resistance to diseases and pests of all types
- resistance to heat and drought stress
- long stems (18 inches)
- easy harvest and handling
- aesthetically pleasing and/or fragrant flowers, foliage, or stems

No single species or variety of plant material will meet all of these criteria. They are presented here to provide a means of evaluating the relative desirability of producing a crop of a specific plant.

Definitions

Annual: A plant that lives, grows, and dies with a completed life cycle within a single year, usually blooms continually during its life cycle.

Biennial: A plant that normally requires two years to complete its life cycle. It will grow and produce leaves, but produces flowers and seed pods only after subsequently undergoing a cold period, usually the second year.

Perennial: A plant which has a life span of more than two years, but flowers for only a set period during the season.

Fresh Cut Flowers—Annuals

Ageratum houstonianum—Floss flower; in demand for blue flower; a variety to try is 'Blue Horizon.'

Ammi majus—Queen Anne's lace, snowflake; white lacy head can be dyed.

Antirrhinum majus—Snapdragon; tall spike required, varieties to try are Rocket and the Potomacs.

Callistephus chinensis—China aster; many cutting strains available, the Florett Series is an extra-double, large-flowered type. Caution: aster yellows, a disease transmitted by insects, is devastating and difficult to control.

Celosia cristata—Cockscomb, feather or plume Celosia; for the red crested flower try the Chief Series. The Sparkler Series is a red feather-type to try. Wheat celosia bear slender white plumes during summer heat and are rose tinted under cool nights of fall.

Centaurea cyanus—Cornflower, bachelors' buttons; frilly buttons of white, pink, and blue.

Centaurea americana—Cornflower; much larger flowers than *C. cyanus*, lilac-pink color.

Clarkia amoena—Godetia; try the Grace Series; prefers cool temperatures.

Consolida regalis—Larkspur; Giant Imperial Strain is the standard strain; try Qis Series and 'Blue Cloud.'

Dianthus barbatus—Sweet William; old types are biennials, new types act like true annuals; try the new Pride of Park Avenue Series.

Eustoma grandiflorum—Lisianthus, sweet lissies; Yodels are the standard variety but also try the Echo Series and the Heidi Series.

Gypsophila elegans—Annual baby's breath; most commonly grown are the large-flowered white form, but the smaller-flowered pink, rose, and purple also have a market. Recommended for fresh use only.

Helianthus debilis cucumerifolius—Sunflower; relatively small flower of yellow to white and shades of mahogany and rust. Try 'Sunbright' and 'Full Sun,' regularly branched plants which do not produce pollen. In our trials, pollen production has proven to be a quality objectionable to the consumer. Pollen shed from the vase causes a mess.

Iberis amara—Rocket candytuft; fragrant and early bloomer.

Limonium sinuatum—Annual statice; try Excellent Series, Qis Series, and the Turbo Series. Surplus production may be marketed in dried form.

Molucella laevis—Bells of Ireland; apple green "flowers" (calces); surplus production may be used in dried form.

Nigella damascena—Love-in-a-mist; delicate flowers for fresh use; allow surplus production to set fruit for sale as fresh material, further surplus fruit may be used in dried form.

Scabiosa atropurpurea—Pincushion flower; dense, rounded, rich colored, flower heads.

Zinnia elegans—Zinnia; several flower types and sizes available. Never water overhead; subject to leaf diseases. The dahlia-flowered 'Giant Mammoth,' the cactus-flowered 'Zenith' and the State Fair series are reported to be the best of the large flowering zinnias. Try the Pumila Series, Ruffles and Cut-and-Come-Again for smaller sized flowers.

Fresh Cut Flowers—Perennials

Achillea filipendulina—Yarrow, fernleaf yarrow; try 'Gold Plate' and 'Coronation Gold.' For other colors try 'Jambo' (soft yellow), 'Lilac Improved' (lilac pink), 'Lusaka' (pure white), 'Nakuru' (purple and white), 'Sawa Sawa' (dark purple), and 'Wesersandstein' (light pink).

Artemisia ludoviciana—White sage; grown for the silver-gray foliage which is used fresh or in dried form. 'Silver King' and 'Silver Queen' are standard cultivars.

Asclepias incarnata & *Asclepias tuberosa*—Butterfly flower; rose-purple and neon orange respectively; easy to grow, shippable, and long-lasting cut flowers.

Aster novi-belgii & *Aster ericoides*—Aster; hybrids of both species are good cut flowers; 'Monte Casino' is the standard variety grown, the Master Series is among the best of the new hybrids.

Astilbe—Astilbe, false spirea; requires moist soil in summer; color range of white, pink, red, and lavender.

Chrysanthemum x superbum—Shasta daisy; most popular from cuttings is 'T.E. Killin' and 'Alaska' from seed; prolific bloomers adaptable to most soils; plants are not long-lived without frequent division.

Echinops bannaticus, Echinops exaltatus, Echinops ritro, Echinops sphaerocephalus—Globe thistle; rich blue to very light blue; excellent producers for either fresh or dried markets; long-lived, but should not be transplanted.

Eryngium amethystinum & *Eryngium planum*—Eryngo, sea holly; easiest of the eryngo to grow; excellent fresh or dried; small silvery-blue to purple-blue flowers; try 'Donau,' 'Blue Star,' 'Blue Diamond,' 'Silver Stone,' and 'Fluella.' Larger-flowered types are *E. bourgatti* and *E. x zabelii*. *Eryngium alpinum* is the most difficult to grow, but is the largest-flowered with several great blue cones surrounded by prickly calyx frills.

Gypsophila paniculata—Perennial baby's breath; the standard "filler" of the floral industry; used fresh or dried; suited to dry, light, and slightly alkaline soils. Vegetatively produced plants have large, fully double flowers; 'Perfecta' is the standard. Can be seed grown, but will have smaller flowers and only a portion will have double flowers.

Liatris—Gayfeather, blazing star; one of the longest lasting and finest cut flowers; native to Kansas; well adapted to our climate and soils; long-lived plants. Produce for local markets only; over-supply in national market.

Paeonia—Peony; herbaceous types are among the choicest of fresh and dried cut flowers; extremely long-lived; short harvest season but can be stored cool and dry for up to 12 weeks. Kansas has a competitive advantage in the commercial production of peonies because of climate. Plants require 3–5 years from planting to reach productive potential. Demand currently exceeds supply for both fresh and dried flowers.

Platycodon grandiflorum—Balloon flower; large bellflowerlike blooms follow balloonlike buds; adapts to a wide range of soil types; will tolerate some shade.

Salvia farinacea—Blue salvia, mealycup sage; strong grower in extreme heat; can be used as fresh or dried material; try 'Victoria,' 'Catima,' and 'Blue Bedder.' Salvia is sensitive to methyl-bromide treated soil.

Scabiosa caucasica—Pincushion flower; a traditional florists' cut flower; easy to grow and adaptable to most soils; try 'Fama' and 'Complement,' lilac blue or white seed strains.

Solidago—Goldenrod; hybrids from Holland are better than our native species; easy, trouble-free,

and adaptable to most soils. Note: Goldenrod does not cause hayfever symptoms.

Fresh Cut Flowers—Bulbs

Allium—Flowering onion; all species are good fresh cut flowers; easy to grow and adaptable to any well-drained soil. The best species for cutting are: *A. aflatunense, A. caeruleum, A. giganteum, and A. spaerocephalum*.

Gladiolus—Gladioli; staggered planting for continuous harvest; plant new corms each year; dig and sell corms each fall. Standard item for florist and farmers' market sales. Try both standard and "baby" glads; the new hybrid Parigo Series is an intermediate type glad.

Lilium—Lily; the Asiatic and Aurelian hybrids along with the Oriental hybrids *L. auratum*, *L. rubellum*, and *L. speciosum* are best for commercial cut flower production. Try the white flowered Oriental hybrid 'Casa Blanca.'

Fresh Cut Flowers—Flowering Woody Stems

The stems of *Forsythia*, *Salix*, and *Chaenomeles* can be cut when dormant, held cool and forced into bloom as fresh flowers for late winter and early spring sales.

Dried Materials—Flowers and Miscellaneous Plant Parts

The following list of the top 30 flowers for drying is the result of a membership survey by the Association of Specialty Cut Flower Growers.

Achillea (yarrows)
Ammobium (herb)
Artemisia (silver king, queen, and annual Sweet Annie)
Branches of Plants (myrtle, cedar, willow)
Iberis sempervireas (candytuff)
Carthamus tinctorius (safflower)
Celosia cristata (cockscomb)
Consolida regalis (larkspur)
Daucus carota (Queen Anne's lace)
Echinops (globe thistle)
Eryngium (seaholly)
Eucalyptus
Chrysanthemum parthenium (feverfew)
Gomphrena golbosa (globe amaranth)
Grass and Grains (Wheat, black bearded and Durum; rye, oats, rice, buffalo, quaking, barley, canary, flax, hare's tale, milo, sorghum,)
Gypsophila perfecta & *G. paniculata* (baby's breath)
Helichrysum bracteatum (strawflower)
Helipterum manglesii (Rhodanthe)
Helipterum manglesii (Acroclinum)
Hydrangea
Lavandula (lavender)
Lepidium (peppergrass)
Limonium latifolia (latifolia)
Limonium caspicum (caspia)
Limonium sinuatum (annual sinuata)
Limonium suworowii (rattail)
Limonium tataricum (German)
Lunaria (money plant)
Nigella (love-in-a-mist, devil-in-the-bush)
Papaver somniferum (poppy pods)
Rosa (roses)
Tanacetum (tansy)
Xeranthemum (common immortelle)
Zea Mays (corn)

When choosing plants to grow, start with a test plot. Begin small and learn how to grow the plant and determine if it is suitable and economical to produce under your specific conditions. You should be able to produce a high-quality product before expanding production beyond the experimental stage. Keep a journal. You will find little or no information available on many plant materials you may wish to grow. Your experience will be useful for production decisions in subsequent seasons.

Foxtail, Milo, Wheat

Planting

When to Plant

Planting dates depend on your target market and on plant classification—whether it is an annual, biennial, or perennial. In general, the peak demand for the retail florist trade is from fall through Mother's Day. Field production of fresh cut flowers for this market should include planting for maximum harvest in the spring and fall seasons. Farmers markets typically operate from late spring until frost in the fall. Consistent production throughout this period is most desirable.

Annuals

Annuals are planted into the field as soon as the danger of frost is past. Using transplants will bring the crop into flower earlier and may return higher prices early on if you are able to harvest for the Mother's Day market. Sequential plantings may be required to assure a continuous supply of product throughout the market season. Staggered plantings—two weeks apart into July—are common for many annuals. Transplants may be used initially to hit the earliest possible market, with later plantings direct seeded. When choosing cultivars, be careful to select those suitable for cut flower production. Many annuals have been developed for use as bedding plants and are not suited for commercial cut flower production.

Biennials

Biennials should be planted in the fall to ensure an adequate cold treatment before regrowth starts in the spring. The overwinter cold treatment is required for more uniform flowering. If beds or plants are not ready for planting in the fall, some alternatives exist. Placing the plants into cold storage or spraying them with 500–1,000 parts per million of gibberellic acid will substitute for overwintering the plants in the bed. While these alternatives do promote flowering, production quantity and quality are reduced compared with fall-planted stock.

Biennials tend to bloom in a condensed time period. Staggered plantings typically will not result in staggered periods of bloom. Most biennials will bloom at the same time unless subjected to cold storage or gibberellic acid treatments. Some biennials are excellent cut flowers but because of this concentrated, all-at-once bloom habit, few are grown as commercial crops.

Perennials

Perennials are placed into categories based on the presence or absence of storage organs and whether they must be dug in the fall and replanted each spring.

1. cold-hardy plants which have storage organs and can remain in the ground for several years. If allowed to remain in place over winter, they typically will bloom at the same time. Extended bloom periods can be achieved by digging in the fall, placing in 40°F storage, and planting every 2–3 weeks beginning in mid-spring. Examples in this group are liatris and lilies.
2. nonhardy plants which have storage organs and **must** be dug each year. Continuous bloom periods are relatively easy to achieve by staggering the planting dates from spring through mid-summer. The additional labor required to dig, store, and replant increases their cost of production. The economics of producing each species should be analyzed before extensive production is undertaken. Examples in this group are anemones, dahlias, gladiolus, and ranunculus.
3. cold-hardy plants which have rhizomes or a clump-forming growth habit and may be left undisturbed for a few to several years before being divided. After the first year, plants in this category tend to bloom together, typically within a week or so of the same time each year. Bloom periods can be extended slightly through cultivar selection. Examples of plants in this group are peony and shasta daisy.

How to Plant

In general, transplants should be planted shallow, with the roots placed just below the soil surface. Planting too deep reduces oxygen exchange between the newly developing root system and the atmosphere, slowing growth. Too deep planting encourages the development of root and stem rots. The soil around the transplants should be firmed to remove large pockets of air but not so much so as to pack the soil. All plants should be watered as soon after planting as possible. Delaying the application of water to the newly planted crop may severely reduce overall production.

Plant Density

A closely spaced crop of annual flowers will usually produce more flowers over the growing season than a crop at wider spacing. The essential criteria in cut flower production is the number of flowers produced per square foot of bed space and **not** the number of flowers per plant. In general, the closer the spacing of annuals the more flowers produced. A 4- to 6-inch spacing within the row and 6–8 inches between rows is ideal for most annual flowers. This will vary depending on the growth habit of each species and on the specific environment of the planting site.

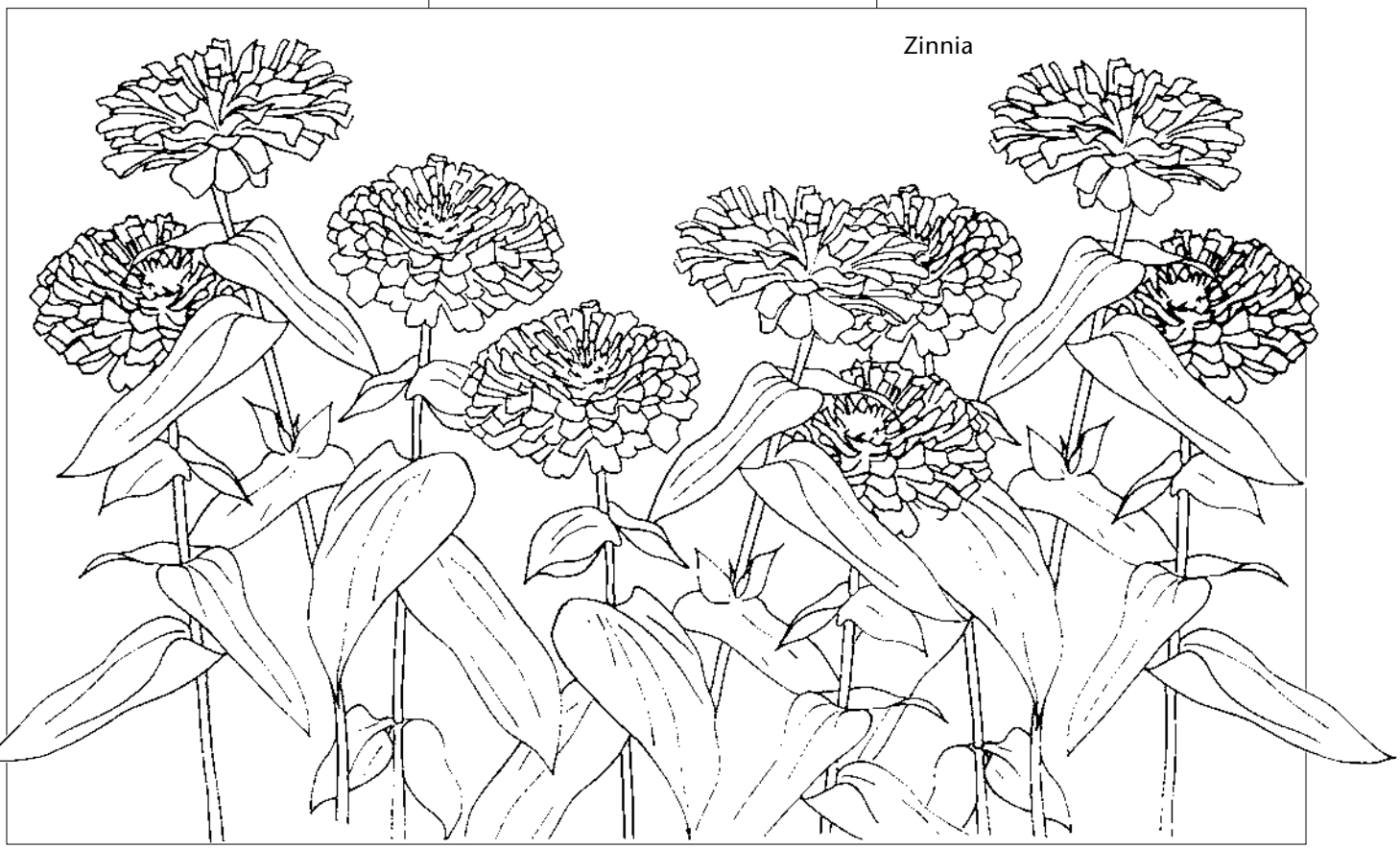
Perennials left in place each year have the potential to crowd each other to an extent that may reduce overall production in succeeding years. Plants that may be divided every 3 years (shasta daisy) may be planted closer than plants which may be divided every 20 years or more (peony).

In general, perennials are planted at about a 1-foot spacing, within and between rows. Peonies are planted 3 feet apart in a single row or staggered in a double row, with a 3-foot spacing within each row and 2 feet between rows. Plant density will vary depending on growth habit of individual species and the growing conditions.

It should be noted that closer spacings produce more flowers per square foot of bed, but also reduce air circulation within the bed. Poor air circulation could increase the likelihood of foliar diseases. If powdery mildew or leaf spot fungus is a common problem on a species you intend to produce, then a slightly wider spacing may be appropriate.

Crop Support

Some cut flowers may need support to ensure a high percentage of straight stems. A plastic or nylon material in rolls of either a 4- or 6-inch mesh is a popular supporting material. It is laid out horizontally and suspended above the bed by attaching to steel fence posts placed along the edges of the bed. Other methods exist and any method which produces the desired result with low cost and minimal labor is acceptable.



Zinnia

How to Grow

Specialty cut flowers are a high-dollar crop. Their value is measured in dollars per square foot, not dollars per acre. Withholding or delaying application of any input, which reduces flower production or quality, is false economy.

Watering

Specialty cut flowers grown in the field, for fresh or dried markets, will require more total water than many other field crops. To maintain floral quality and peak production, the plants must be watered frequently, sometimes daily with some soil types. A water source of sufficient volume and quality should be readily available to the production area. Growers in Kansas should not attempt to produce cut flowers without supplemental watering. Natural rainfall is not sufficient nor reliable. Without supplemental watering, production may not be economically realistic.

Overhead watering is not recommended. It may physically damage the flowers, cause spotting on the petals, splash soil onto the foliage, and promote the spread of disease. Some type of drip irrigation is recommended. It has the advantage of placing the water on the ground where it is needed and not on the flowers or foliage.

The basic principle in designing an irrigation system for cut flowers is to place the water uniformly around each plant. Spacing of irrigation lines depends on soil type and structure. Coarse, open soils require closer spacing than dense, fine soils. The irrigation system plan should be developed by a competent designer, with the grower having a thorough understanding of the system and its operation.

Irrigation should be scheduled based on the soil moisture status in the root zone. Proper irrigation management provides sufficient but not excessive water to the crop. Water stress will reduce production and quality of a crop. A consistently saturated soil will reduce growth and promote the development of root rot. The amount and frequency of water required will vary with the weather and stage of maturity of the crop.

Fertilizer

Before initiating any fertilizer program, always test the soil for nutrient content. The increased water requirement of cut flowers creates an increased requirement for fertilization. The application of fertilizer should coincide with crop needs. Higher rates are required in the initial phases of growth while you are building the size of the plants. Lower rates are required as a crop approaches harvest. For crops with a harvest that extends throughout the growing season, lighter and more frequent application of nitrogen may be necessary to reduce the nonproductive cycle between flushes of bloom. Nitrogen deficiency is the most common nutrient problem. Many growers incorporate 25–45 pounds of actual nitrogen per acre before planting. Minor element deficiencies are common in areas of Kansas with alkaline water or soils.

Weed Control

Weeds must be controlled in the field production of cut flowers. Competition with weeds reduces the quantity and quality of floral production. A bed full of weeds increases the time required to harvest, raising labor costs. Due to limited production of many species of specialty cut flowers, only a few herbicides are labeled for use. Contact your county

Extension agent for an update on herbicides labeled for flower production.

Weed barriers can be used. They have the added benefit of restricting soil splash onto foliage and flowers from rain and irrigation. The most common barriers in use are plastics and paper. The major disadvantage with plastic mulches may be in their disposal after removal from the bed. The barriers restrict water evaporation from the soil surface, reducing loss and maintaining a more consistent soil moisture content.

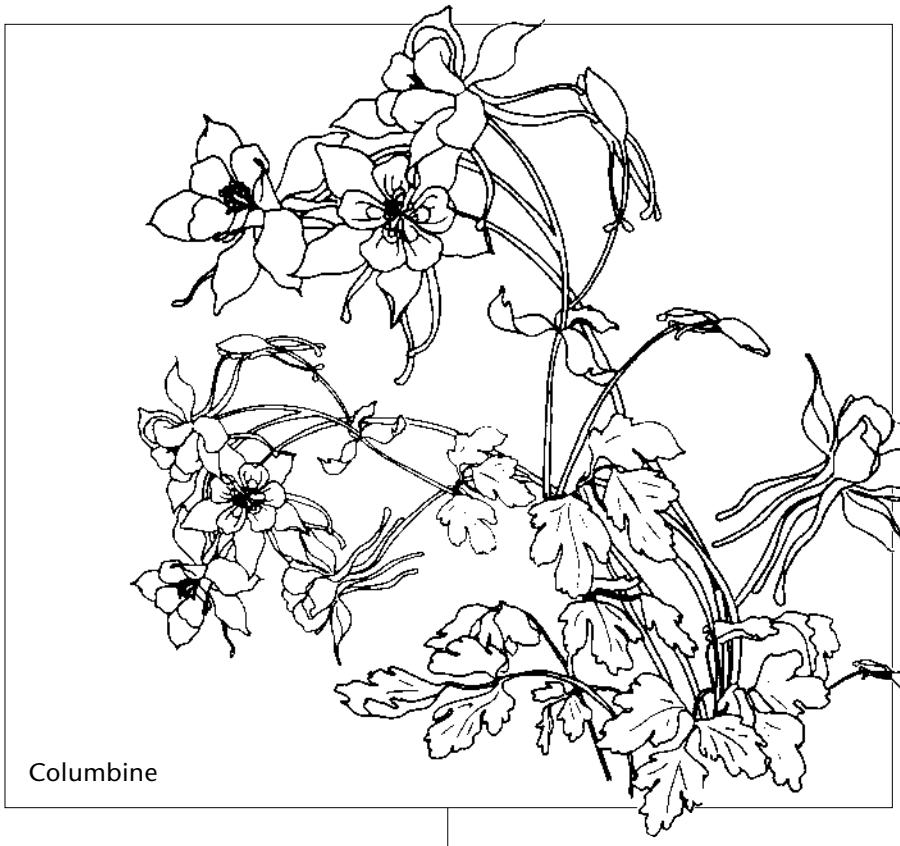
Straw and wood chips have been used as mulches to reduce weed competition, improve water retention, and reduce temperature fluctuations within the soil. Being organic materials, they slowly decompose and increase organic matter in the soil. They are applied in a 2- to 4-inch layer and must be reapplied each year.

A hoe and hand weeding are the best methods for control. Availability and cost of labor may be prohibitive in all but the smallest production situations.

Insect Control

Good cultural practices are the best insect control available. A healthy, actively growing plant is more resilient to insect attack. The ideal approach is a preventative program. Control insects early, when they are first detected. Do not wait until a serious infestation occurs. Less chemical can be applied to a smaller area to control these hot spots as they develop than would be required to spray the entire crop. Aphids, leaf hoppers, spider mites, and thrips are the most common insects encountered.

Integrated pest management (IPM) is the process of using all the different methods of controlling insects in an integrated approach. The main goal is to reach an acceptable level of insect control with minimal use of chemical pesticides. Monitoring insect species and keeping records as to insect numbers and location are integral parts of the program.



Columbine

Biological controls using parasites, predators, and pathogens can help keep insect levels in balance. They are especially useful when the grower specializes in only a few crops. Biologicals tend to be specific to an insect on a crop. It is easier to manage an insect on a crop than it is to manage several insects on a variety of crops.

All chemicals should be applied intelligently. Always apply at the lowest possible effective rate. Learn the life cycles of all insects associated with the culture of your crops. Know which stage of each insect's life cycle is susceptible to which chemical spray. Spray only when control is possible.

Disease Control

Foliar fungus diseases are the most serious disease problem on cut flowers. If mildew or other foliar diseases are a recurring problem, it might be wise to increase the spacing between plants slightly to improve air circulation around the foliage. Powdery mildew and black leaf spot are two of the most common foliar diseases. Botrytis attacks flowers during cool damp weather. Improper watering or frequent rains may cause some root rot problems. These can be minimized by planting on raised beds. Occasionally *Fusarium* and *Verticillium* wilt have become problems. Aster Yellows Virus can be devastating on susceptible crops.

The best approach to disease control is a preventative program. Manage the crop. Don't neglect it. Practice good sanitation; keep the field free of weeds and plant debris. Adjust planting density for each species to allow sufficient air circulation within the bed. Control leaf hoppers and thrips to reduce the potential for spreading virus. Rogue out diseased plants and remove from the production area. Table 1 describes diseases common to many flowering plants.

Table 1. Diseases Common to Flowering Plants

Host	Disease	Symptoms
Aster	Botrytis stem and petal rot (*Botrytis cinerea*)	Small brown to black lesions develop on the stems or petals. During humid weather, a dusty gray growth of the fungus covers diseased tissue.
	Rust (Several fungi)	Yellow, orange, or dark red pustules form on leaves. Severe infection may result in premature defoliation. Generally not a serious problem.
	Powdery mildew (*Erysiphe* sp.)	White powdery patches develop on leaf surface.
	Fusarium wilt (*Fusarium oxysporum f. callestephi*)	Young plants may develop a root and topple over. Older plants may be stunted and yellow, and eventually wilt and die. A brown discoloration can be found in the vascular system.
	Aster yellows (Mycoplasmalike organism)	Affected leaves develop yellowing of veins. Growing points turn light yellow-green and give rise to abnormal growth.
Canna	Bud rot (*Xanthomonas cannae*)	Infected leaves develop large irregular spots as they unfurl from the bud. The bacteria (which reside in the bud) also attack flower stems or petals.
Chrysanthemum	Leaf spots (*Alternaria* and *Septoria* sp.)	Small circular spots develop on leaves. Extensive spotting may cause premature defoliation.
	Botrytis blight (*Botrytis cinerea*)	Generally restricted to the greenhouse, this disease causes blighting of flower petals. A dusty, gray growth covers diseased tissue during humid conditions.
	Aster yellows (*Mycoplasmalike organism*)	See discussion under aster.
	Virus diseases	Several viruses affect chrysanthemum; includes mosaics, distortion, rosetting, and yellowing.
	Wilt (*Verticillium* sp. and *Fusarium* sp.)	Leaves turn yellow and die from the bottom of plant toward top. Infected plants are stunted or killed.
Cosmos	Powdery mildew (*Erysiphe* sp.)	White powdery growth on surface of leaves.

Host	Disease	Symptoms
Dahlia	Crown gall (*Agrobacterium tumefaciens*)	Large wartlike swelling forms on crowns of diseased plants.
	Wilt (*Fusarium* sp. and *Verticillium alboatrum*)	Lower leaves on affected plants turn yellow and wilt. Symptoms progress toward top of the plant. Brown or black streaks may develop in the vascular system. Plants are stunted or killed.
	Root rot (Various fungi)	Aboveground symptoms similar to wilt; however, roots are discolored and rotted.
	Powdery mildew (*Erysiphe* sp.)	White powdery growth on the surface of leaves.
Delphinium or Larkspur (*Delphinium*)	Stem rot (*Sclerotium* sp.)	Large, circular patches of plants may die during warm weather. Affected plants develop a serious root rot and collapse. Small, tan to brown, round fungal structures called sclerotia associated with dead plants.
	Powdery mildew (*Erysiphe* and *Sphaerothaeca* sp.)	White powdery growth on surface of leaves.
Gladiolus	Fusarium crown (corm) rot (*Fusarium oxysporum f. gladioli*)	During the growing season, leaves on affected plants turn yellow prematurely. During storage, corms develop a dry rot. Diseased corms produce spindly, weak plants the following year.
Hollyhock (Althlaea)	Rust (*Puccinia malvacearm*)	Small yellow spots appear on the upper surface of the leaves. Brick-red pustules or blisters form on the lower leaf surface.
Iris	Iris leaf spot (*Didymellina macrospora*)	Circular to oval straw-colored spots develop on leaves; spots surrounded by a brown to purple margin.
	Bacterial soft rot (*Erwinia caratovora*)	Leaves of affected plants develop a water-soaked appearance. Rhizomes develop a foul-smelling soft rot; the disease often follows injury caused by the iris borer.
	Scorch (Cause unknown)	Central leaves wither and die back from tips. Affected leaves may turn reddish-brown. Rhizome remains firm but center of roots rot leaving outer layer. Roots collapse and can easily be pulled from the rhizome.

Host	Disease	Symptoms
Lily (*Lilium*)	Botrytis blight (*Botrytis eliptica*)	Orange to reddish-brown circular spots on leaves, stems, buds, and flowers. Grayish fungal growth appears in spots during wet weather.
Marigold (*Tagetes*)	Aster yellows (*Mycoplasmalike organism*)	Affected leaves first develop yellowing along veins. Growing points turn light yellow-green and give rise to abnormal growth.
	Botrytis blight (*Botrytis cinerea*)	Browning and decay of flowers. Grayish fungal growth appears on infected petals during wet weather.
	Fusarium wilt (*Fusarium* sp.)	Discoloration and decay of root and lower stem. Interior of lower stem may have a pinkish-red discoloration.
Narcissus (Daffodil) (*Narcissus*)	Basal rot-bulb rot (*Fusarium oxysporum Penicillium* spp.)	A dry rot develops in roots, then spreads to center of bulb and out. Bulbs turn dark brown and pink (*Fusarium*) or bluish-green (*Penicillium*); fungal growth may form between scales.
Pansy (Viola, Violet) (*Viola*)	Anthracnose (*Colletotrichum violae-tricoloris*)	First symptoms are small spots on leaves with a dark margin. Spots enlarge and dark concentric rings develop within them. Spots on petals have a dark center and light brown border. Stem lesions are elongated, brown, and water soaked.
	Botrytis blight ***(Botrytis cinerea)***	Soft, slimy decay of leaves and flowers. Gray fungal growth develops on infected plant parts during wet weather.
	Rust *(Puccinia violae)*	Yellowish-orange spots on upper leaf surface; spots are pale green on underside of leaf. Petioles and stems may also be infected. Brown and black pustules develop later in growing season.
Peony (Paeonia)	Botrytis blight (*Botrytis cinerea*)	Sudden wilting of shoots. Brown or black rot can be seen at the base of stems, below ground. Grayish fungal growth visible on stems just above soil line. Infected flowers turn brown, and large, irregular brown areas develop on leaves. Fungal growth may also develop on infected plant parts.

Host	Disease	Symptoms
Peony *continued*	Phytophthora blight (*Phytophthora cactorum*)	Infected stems, leaves, blossoms, and buds are brown and leathery. Black cankers form on stems and cause them to fall over.
	Red spot, measles (*Cladosporium paeoniae*)	Small, dark red circular spots on leaves. Spots coalesce to form blotches that are dark purple on lower surface.
	Iron chlorosis	Interveinal yellowing of leaves. Scorching of leaf margins may occur in severe cases.
Phlox	Leaf spot (Several fungi)	Most spots appear as small, dark circular lesions on lower leaves. Some spots may have light centers. Spotting may cause drying and premature death of leaves.
	Powdery mildew (*Erysiphe cichoracearum* and *Sphaerotheca humili*)	White powdery growth on leaves.
Salvia	Powdery mildew (*Erysiphe* sp.)	White powdery growth on leaves.
Snapdragon (*Antirrhinum*)	Anthracnose (*Colletotrichum antirrhini*)	Sunken spots on older stems and leaves are pale yellow to gray with a brown border. Small black fruiting bodies of the fungus are visible within the spots.
	Powder mildew (*Oidium* sp.)	White powdery growth on leaves.
	Rust (*Puccinia antirrhini*)	Powdery orange pustules on leaves and stems. Later in the season pustules turn black. Plants wilt and die quickly.
Stocks (*Matthiola*)	Powdery mildew	White powdery growth on leaves.
Sweet Pea (*Lathyrus*)	Powdery mildew (*Microsphaeria* sp.)	White powdery growth on leaves.

Host	Disease	Symptoms
Tulip (*Tulipa*)	Botrytis blight (Fire) (*Botrytis tulipae*)	First symptoms are small brown spots on foliage and flowers. Spots enlarge and form blighted areas with a grayish center and dark margin. During wet weather, gray fungal growth may be seen in blighted areas. Stems may rot and small bulbs may be infected. Bulb lesions are yellow to brown and may contain small black fruiting bodies of the fungus.
Yucca	Leaf spot (*Kellermania anomala*)	Irregular brown spots on leaves.
Zinnia	Leaf spot-blight (*Alternaria zinniae*)	Small reddish-brown leaf spots with gray centers. Dark brown cankers may develop on stems and flowers may be spotted or blighted.
	Powdery mildew (*Erysiphe* sp.)	White powdery growth on leaves.

Harvest

Many authors have stated that flowers should be harvested at the peak of perfection. Although this advice seems straight forward, it is ambiguous considering the differences in flowers and concepts of peak of perfection. For the consumer, the peak of perfection is when the flower is showing its best color and form, and lasts the longest. For the grower, the wholesale broker and the florist, it is the stage when the flower will hold up in the marketing chain the longest and meet the expectations of the consumer.

Table 2 lists the optimal stage of development for harvesting a wide range of specialty cut flowers for the direct market. Flowers for wholesale markets should be less developed to allow for handling and shipping time.

For the longest vase life, flowers should be harvested in the morning before the heat of the day. The flowers are cooler and have more water in them. Less energy will be required to cool the flowers and wilting will be less of a problem. Flowers should be removed from the field as soon as possible and placed in a cooler at 40°F or a cool place that is less than 60°F until they can be sorted, graded, packaged, and shipped to market.

Special attention should be placed on harvest equipment. Knives or shears should be sharp so all stems can be cut cleanly. Dull cutting instruments can crush stems, restricting the flow of water into the stems and shortening the vase life of the flowers. Knives, shears, and harvest containers should be routinely disinfected before each use. A mild chlorine bleach solution (1:10) is adequate. Harvested flowers should be placed in tepid water (110°F) with a floral preservative added. When using a preservative, put flowers in plastic containers. Preservative chemicals may react with a metal container.

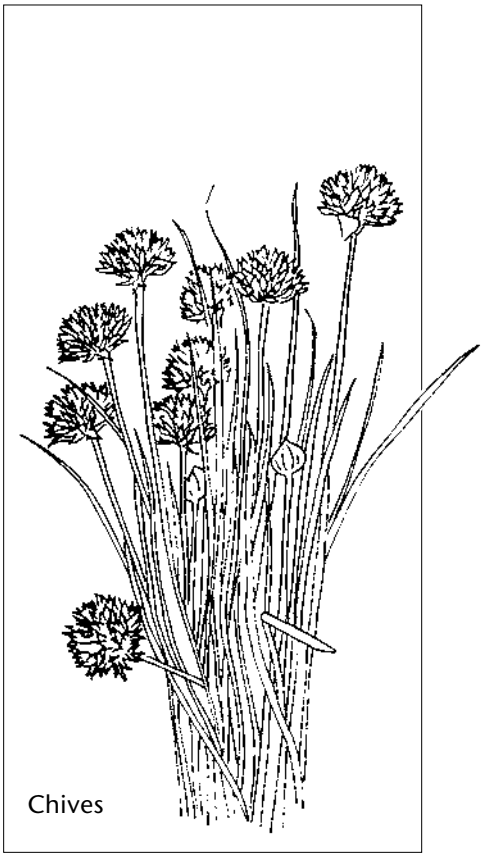
Floral preservatives have many components that lengthen the vase life of flowers. First, they acidify the water. Flowers keep longer in acid water (pH 3.5). Water tests should be conducted to determine the pH of your water. Most water in Kansas is hard or alkaline (pH > 7.0), especially city water. If your water is very hard, it may require additional acid.

Chemically softened water should not be used in any stage of cut flower production or handling. The high level of sodium in chemically softened water can be toxic to flowers. If large-scale production is being considered, installation of a water deionizer is recommended to ensure a reliable source of high-quality water.

Floral preservatives contain chemicals that stop or slow the growth of microorganisms. A low pH also retards microorganism growth. Microorganisms can plug the water-conducting channels—xylem—of the flower and cause decay.

Floral preservatives also provide food in the form of simple sugars, like sucrose. Providing the flower with food lengthens vase life and brightens the flower color.

Floral preservatives can be made from scratch, but beginners should use commercially prepared products until they become familiar with their crops' handling requirements and water quality.



Chives

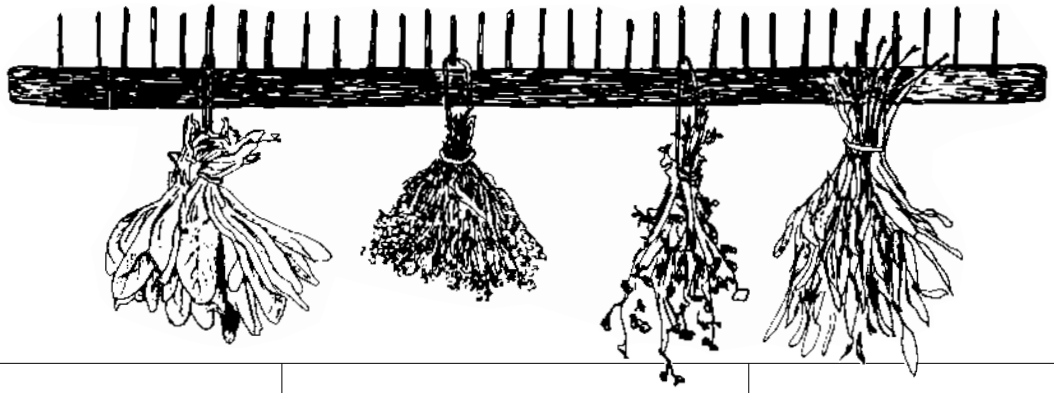
Table 2. Optimal Development Stage of Cut Flowers for Direct Sale

Common name	Species	Stage of development
Acacia	*Acacia* spp.	½ florets open
Yarrow	*Achillea filipendulina*	fully open flowers
True Monkshood, Officinal Aconite	*Aconitum napellus*	½ florets open
African Lily	*Agapanthus umbellatus*	¼ florets open
Allium, Ornamental Onion	*Allium* spp.	⅓ – ¼ florets open
Peruvian Lily	*Alstroemeria* hybrids	4–5 florets open
Hollyhock	*Althea rosea*	⅓ florets open
Joseph's Coat, Amaranth Fountain Plant, Tampala	*Amaranthus*	½ florets open
Poppy Amemone	*Anemone coronaria*	buds beginning to open
Anthurium	*Anthurium* spp.	spadix almost fully developed
Snapdragon	*Antirrhinum majus*	⅓ florets open
Columbine	*Aquilegia* hybrids	½ florets open
Astilbe	*Astilbe* hybrids	½ florets open
English Daisy, True Daisy	*Bellis perennis*	fully open flowers
Bouvardia	*Bouvardia* hybrids	flowers beginning to open
Calendula, Pot Marigold	*Calendula officinalis*	fully open flowers
China Aster, Annual Aster	*Callistephus chinensis*	fully open flowers
Camellia	*Camellia japonica*	fully open flowers
Canterbery Bells	*Campanula* spp.	½ florets open
Cattleya Orchid	*Cattleya* spp.	3–4 days after opening
Cockscomb	*Celosia argentea*	½ florets open
Bachelor's Button, Cornflower	*Centaurea* spp.	flowers beginning to open
Wallflower	*Cheiranthus cheirii*	½ florets open
Mums	*Chrysanthemum* spp.	fully open flowers
Hardy chrysanthemum	*Chrysanthemum morifolium*	
	Standard cultivars	outer petals fully elongated
	Spray cultivars	
	Singles	open but before anthesis
	Anemones	open but before disk flowers start to elongate
	Pompons & decorative	center of older flower fully open
Clarkia	*Clarkia elegans*	½ florets open
Kaffir, Lily, Clivia	*Clivia miniata*	¼ florets open
Larkspur, Annual Delphinium	*Consolida ambaigua*	2–5 florets open
Lily-of-the-Valley	*Convallaria majalis*	½ florets open
Coreopsis, Tickseed, Lance Coreopsis	*Coreopsis grandiflora*	fully open flowers
Spiral flag	*Costus* spp.	almost fully open flowers
Montebretia	*Crocosmia crocosmiflora*	½ florets open
Cyclamen	*Cyclamen persicum*	fully open flowers
Cymbidium Orchid	*Cymbidium* spp.	3–4 days after opening
Dahlia	*Dahia variabilis*	fully open flowers
Delphinium	*Delphinium* spp.	½ florets open
Dendrobium Orchid	*Dendrobium* spp.	almost fully open flowers
Sweet William	*Dianthus barbatus*	½ florets open
Carnation	*Dianthus caryophyllus*	
	Standard cultivars	half-open flowers
	Spray cultivars	2 fully open flowers

Common name	Species	Stage of development
Common Foxglove, Finger Flower, Purple Foxglove, Fairy Glove	*Digitalis purpurea*	½ florets open
Leopard's bane	*Doronicum causasicum*	almost open flowers
Globe Thistle	*Echinops ritro*	half-open flowers
Desert-candle, King's Spear	*Eremurus robustus*	½ florets open
Heather	*Erica* spp.	½ florets open
Flea Bane	*Erigeron* hybrids	fully open flowers
Sea Holly	*Eryngium* spp.	fully open flowers
Amazon Lily, Star of Bethlehem	*Eucharis grandiflora*	almost open flowers
Poinsettia	*Euphorbia pulcherrima*	fully extended bracts
Lisianthus	*Eustoma ressellianum*	5–6 open flowers
Freesia	*Freesia* hybrids	first bud beginning to open
Crown Imperial	*Fritillaria imperialis*	half-open flowers
Perennial Gaillardia, Blanket Flower	*Gaillardia x grandiflora*	fully open flowers
Annual Gaillardia, Blanket Flower, Indian Blanket	*Gaillardia pulchella*	fully open flowers
Gardenia	*Gardenia jasminoides*	almost fully open flowers
Transvaal Daisy, Gerbera, Baraberton Daisy, Veldt Daisy	*Gerbera jamesonii*	outer row of flowers showing pollen
Glads	*Gladiolus* cultivars	1–5 buds showing color
Climbing Lily	*Gloriosa superba*	almost fully open flowers
Perennial & Annual Baby's Breath	*Gypsophila* spp.	flowers open but not overly mature
Common Sunflower	*Helinathus annuus*	fully open flowers
Sunflower Heliopsis, Hardy Zinnia, Orange Sunflower, False Sunflower	*Heliopsis helianthoides*	fully open flowers
Christmas Rose, Winter Rose, Black Hellebore	*Helleborus niger*	half-open flowers
Daylily	Hemerocallis spp.	half-open flowers
Amaryllis	*Hippeastrum* hybrids	colored buds
Bearded Iris	*Iris germanica*	colored buds
Dutch Iris	*Iris hollandica*	colored buds
Corn Lily, African Corn Lily	*Ixia* spp.	colored buds
Kalanchoe	*Kalanchoe* hybrids	½ florets open
Torch-Lily, Common Poker Plant, Flame Flower	*Kniphofia uvaria*	almost all florets showing color
Sweet Pea	*Lathyrus odoratus*	½ florets open
Edelweiss	*Leontopodium alpinum*	fully open flowers
Tall Gayfeather, Blazing Star, Button Snakeroot	*Liatris spicata*	½ florets open
Tiger, Asiatic, Oriental lilies	*Lilium* spp.	colored buds
Statice, Sea-Lavendar	*Limonium* spp.	almost fully open flowers
Lupine	*Lupinus mutabilis*	½ florets open
Common Stock	*Matthiola incana*	½ florets open
Bee-Balm, Fragrant Balm, Oswego Tea	*Monarda didyma*	almost open flowers
Common Grape Hyacinth	*Muscari botryoides*	½ florets open
Garden Forget-me-Not, Woodland Forget-me-Not	*Myosotis sylvatica*	½ florets open
Daffodil, Narcissus, Jonquil	*Narcissus* spp.	"Goose neck" stage
Catmint	*Nepeta faassenii*	½ florets open

Common name	Species	Stage of development
Nerine	*Nerine bowdenii*	oldest buds almost open
Love-in-a-Mist, Devil-in-the-Bush,	*Nigella damascena*	open flowers
Chincherinchees, Sea Onion	*Ornithogalum* spp.	colored buds
Peony	*Paeonia* spp.	colored buds
Poppy	*Papaver* spp.	colored buds
Paphiopedilum Orchid	*Paphiopedilum* spp.	3–4 days after opening
Phalaenopsis Orchid	*Phalaenopsis* spp.	3–4 days after opening
Summer Phlox, Garden Phlox, Fall Phlox, Perennial Phlox	*Phlox paniculata*	½ florets open
Tuberose	*Polianthes tuberosa*	majority of florets open
Polyanthus Primrose	*Primula* spp.	½ florets open
Ranunculus	*Ranunculus asiaticus*	buds beginning to open
Common Mignonette	*Reseda ordorata*	½ florets open
Roses	*Rosa* hybrids	
	Red and pink cultivars	first 2 petals beginning to unfold, calyx reflexed below a horizontal position
	Yellow cultivars	slightly earlier than red and pink
	White cultivars	slightly later than red and pink
Black-eyed Susan, Yellow Oxeye Daisy, English Bulls-eye	*Rudbeckia* spp.	fully open flowers
Pincushion Flower	*Scabiosa* spp.	half-open flowers
Siberian Squill, Blue Squill	Scilla siberica	half-open flowers
Showy Stonecrop Sedum, Live-forever	*Sedum* spp.	fully open flowers
Goldenrod	*Solidago* spp.	½ florets open
Stephanotis, Wax Flowers	*Stephanotis floribunda*	fully open flowers
Bird-of-Paradise Flower	*Strelitzia reginae*	first floret open
African Marigold	*Tagetes erecta*	fully open flowers
Columbine Meadow Rue	*Thalictrum apguilegifolium*	½ florets open
Globeflower	*Trollius* spp.	half-open flowers
Nasturtium	*Tropaeolum majus*	fully open flowers
Common Garden or Late Tulips	*Tulipa gesneriana*	half-colored buds
Speedwell	*Veronica* spp.	½ florets open
Sweet Violet, English Violet, Garden Violet, Florists Violet	*Viola odorata*	almost open flowers
Pansy, Ladies Delight	*Viola x wittrockiana*	almost open flowers
Calla Lily	*Zantedeschia* spp.	just before the spathe begins to turn downward
Zinnia	*Zinnia elegans*	fully open flowers

Postharvest



Herbs

After flowers are removed from the field and placed in the packing shed, the stems should be cut under water. Stems will accept water as long as the xylem is not blocked. Air bubbles drawn up into the xylem when the stem was cut in the field can block the upward movement of water. The air bubble blockage may be eliminated by removing an inch of stem under water.

Fresh cut flowers are extremely sensitive to temperature and humidity. Because they have such a high surface-area-to-volume ratio, they can lose water and wilt quickly if not kept under low temperature and high humidity conditions. The flower tissue has a high metabolic rate, so cooler temperatures are necessary to slow metabolism. Most flowers should be stored at 32–35 °F and 90–95 percent relative humidity if they are to be kept awhile.

Flowers are sensitive to ethylene gas. Ethylene is produced naturally by flowers, but can come from other sources including decaying plant material, old flowers, ripening fruit, gasoline and propane combustion and welding. Careful selection of a location for the storage area away from motors and welding equipment is important. Sanitation and good inventory management should eliminate decaying plant material and old flowers. Flowers should not be stored in the same facility as ripening fruits and vegetables. Good air circulation in the storage area will help dilute any ethylene which may be present.

Some species are so sensitive to ethylene that you need to do more to protect them (Table 3). Silver thiosulfate (STS) reduces the harmful effects of ethylene and is available from most suppliers of commercial preservatives. Silver is a heavy metal that can pollute groundwater and soil. There are systems available to recycle the STS and recover the silver.

The stem tips of most spike type flowers will bend upward if laid horizontally. This is known as negative geotropism. Spike type flowers should be stored and shipped upright.

Bruising and breaking flowers reduces their aesthetic value and therefore their economic value. Wounds also allow entry of many disease organisms and increase ethylene production by the flowers. Careful handling to prevent damage is imperative to ensure a long-lived, high-quality flower.

Pulsing

Pulsing is a chemical treatment of flowers to prolong the vase life. The treatment is not continuous and typically lasts for 2–12 hours. Silver thiosulfate (STS), and 5–10 percent sucrose solutions are chemicals often pulsed into flowers. These solutions are put in the holding water and the flowers are held at various temperatures for a certain time period. Different species and different

cultivars require different pulse treatments. Although pulse treatments have not been determined for many specialty cut flowers, there are too many different treatments to cover in this publication.

Marketing and Selling

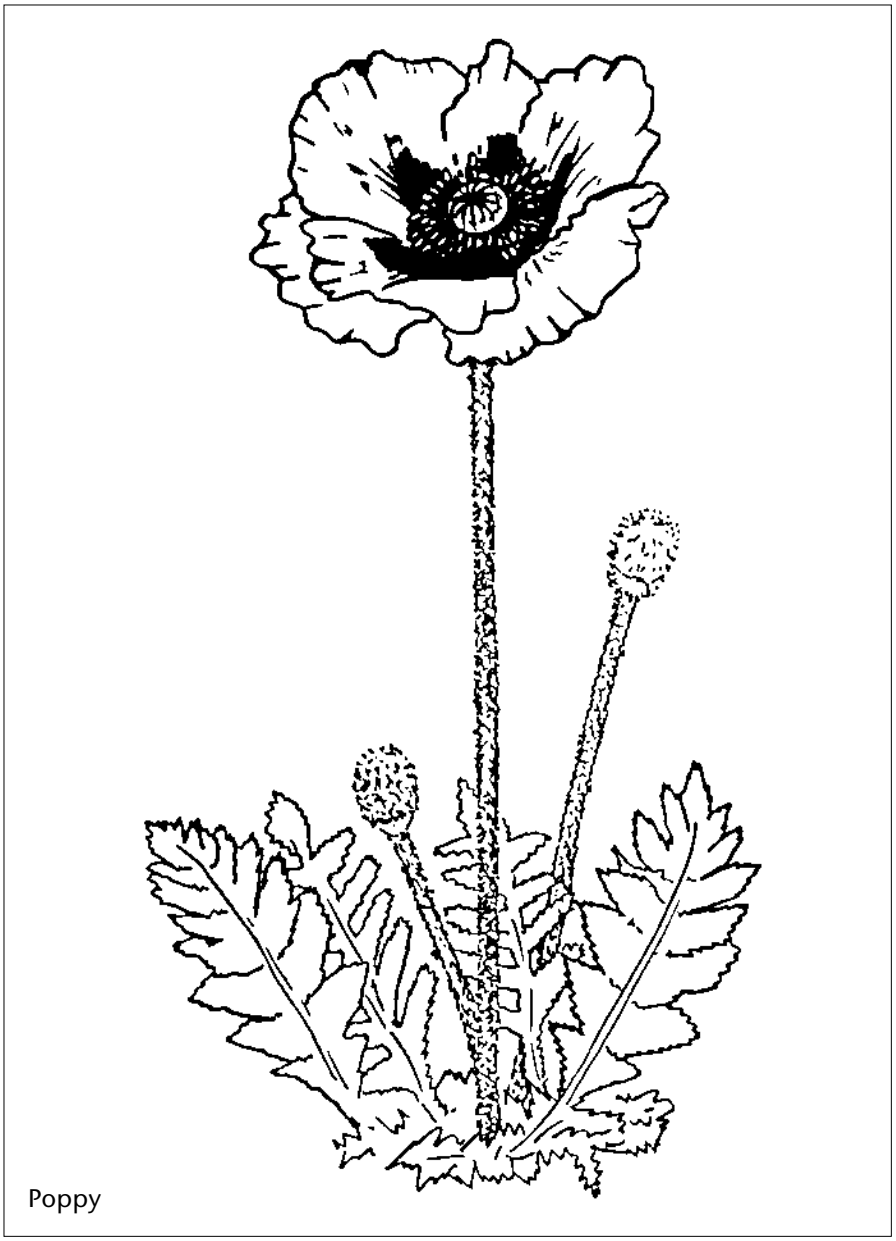
Flowers can be marketed to a flower wholesaler, a retail florist, or directly to the public at a farmers market or farm market. Each market has advantages and disadvantages. Direct to the public is the easiest market to enter. Sorting, handling, and packaging usually are minimal as is the capital investment. A wide variety of species and cultivars may be sold with success. The disadvantage is the volume of sales may limit the income.

Wholesalers will accept large volumes of flowers. You will have to package, sort, and grade flowers to their specifications, and they may not accept some specialty flowers. They set the price for your flowers. It takes awhile for the grower and wholesaler to develop a good working relationship.

Retail florists buy from wholesalers. If you market directly to the florist, you cut out the middleman and can get a higher wholesale price for your flowers. Florists may not be as concerned with packaging as wholesalers. Both florists and wholesalers will insist on high quality. Florists may be more interested in specialty flowers than wholesalers. You will have to deal with several florists to sell the same volume you would to a wholesaler. The market or markets you choose to enter must provide sufficient profit margins for you to stay in business.

Table 3. Flowers Particularly Sensitive to Ethylene

Agapanthus umbellatus	*Freesia* hybrids
Alstroemeria hybrid	*Solidago* spp.
Anemone spp.	*Kniphofia uvaria*
Astilbe spp.	*Lilium* spp.
Gypsophila spp.	*Aconitum napellus*
Bouvardia hybrids	*Phlox paniculata*
Campanula spp.	*Scabiosa* spp.
Dianthus spp.	*Rosa* Spp.
Centaurea cyanus	*Antirrhinum majus*
Delphinium spp.	*Matthiola incana*
Dendrobium spp.	*Lathyrus odoratus*
Eremerus robustus	



Poppy

Summary

Lavender, Goldenrod, Thistle

Recommendations

1. *Keep a journal.*
2. *Experiment with test plots, before expanding production.*
3. *Understand cut flowers are a high-value, intensively managed crop.*
4. *Understand that a high-quality product is essential for success.*
5. *Set prices to ensure profits. Price cutting without lowering costs can have a drastic effect on profitability.*

References

Aker, S.M. and W.E. Healy. 1988. "Producing Cut Flowers—General Field Crop Management." University of Maryland Cooperative Extension Service. Enterprise Guide of Southern Maryland Fact Sheet 468.

Dole, J.M. and M.A. Schnelle. "The Care and Handling of Cut Flowers." Oklahoma State University Cooperative Extension Service. OSU Extension Facts No. 6426.

Koch, Mark and Sally Nakasawa. 1991. "Top 30 Flowers For Drying." Association of Specialty Cut Flower Growers. The Cut Flower Quarterly, Vol. 3, No. 3.

Various issues of The Cut Flower Quarterly, a publication of the Association of Specialty Cut Flower Growers.

Ball Seed Co. production notes for cut flower growers.

Suppliers

Suppliers in this publication are listed for identification. No endorsement is intended, nor is criticism of similar suppliers not mentioned.

Cut Flower Seed

Ball Seed Co.
250 Town Road
West Chicago, IL 60185

W. Atlee Burpee Co.
50375 Park Ave.
Warminster, PA 18974

The Country Garden
Rt. 2
Crivitz, WI 54114

Express Seed Co.
201 West Main St.
Smethport, PA 16749

H.G. German Seeds
Box 398
Smethport, PA 16749

Germania Seed Co.
5952 North Milwaukee
Chicago, IL 60646

Gloeckner
15 East 26th St.
New York, NY 10010

Johnny's Select Seeds
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L. Daehnfeldt
P.O. Box 15 DK-5100
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Northrup King Seed Co.
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9586 Deereco Rd.
Timonium, MD 21093

Park Seed—Wholesale
HG6 Cokesbury Rd.
Greenwood, SC 29647–0001

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FAX 914-469-2015

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FAX 209-668-7928

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Oxnard, CA 93034
805-986-8265
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717-349-2789

IPM Laboratories, Inc.
Main St.
Locke, NY 13092–0099
315-497-3129

Organic Control Inc./ORCON
5132 Venice Blvd.
Los Angeles, CA 90019
213-937-7444
FAX 213-937-0123

Hydro-Gardens, Inc.
Colorado Springs, CO
719-495-2266

Gerhart Inc.
North Ridgeville, OH
216-327-8056

Necessary Trading Co.
New Castle, VA
703-864-5103

Biotactics
Riverside, CA
714-685-7681

Applied Bionomics
Sidney, British Columbia,
Canada
604-656-2123

Richters
Goodwood, Ontario,
Canada
416-640-6677

Koppert B.V.
The Netherlands
31-189140444

Brinkman B.V.
The Netherlands
31-174811333

Soluble Organic Fertilizers

Seagro Corporation
3601 10th SE.
East Wenatchee, WA 98801
509-884-1600
(fish-based)

California Spray Dry Co.
P.O. Box 5035
Stockton, CA 95205
209-948-0209
(spray-dried blood)

ENP Inc.
P.O. Box 218
Mendota, IL 61342
800-255-4906
(fish-based)

American Meat Protein
2515 Elwood Drive
Ames, IA 50010
515-292-1021
(spray-dried blood)

Containers, Harvest, Holding, Packing

Lomey Mfg. Corp/Spotless Group
P.O. Box 5314
Asheville, NC 28813
1-800-423-2314
FAX 704-626-9210

Epic Products Inc.
17395 Mt. Hermmann
Fountain Valley, CA 92708
714-641-8194
FAX 714-641-8217

Moore Paper Boxes, Inc.
2916 Boulder Ave.
Dayton, OH 45414

Boas Box Co.
5610 Lancaster Ave.
Philadelphia, PA 19131
215-477-7700
FAX 215-477-1240

Seeding and Planting Equipment

Cole Manufacturing Co.
Box 9216
Charlotte, NC 28299
(Planet Jr. Seed Drill)

Earthway Products
P.O. Box 547
Briston, IN 46507
(garden planters)

Tillage and Bedding Equipment

Ahrens Nursery
Rt. 1
Huntington, IN 47542
812-683-3055

Kennco Mfg. Inc.
Box 1158
Ruskin, FL 33570
813-645-2591

Guy Farm Equip. Co.
15219 Hwy. 14
Woodstock, IL 60098
815-338-0600

Lely Corporation
Box 1060
Wilson, NC 27893
919-261-7050

Transplanting Equipment

Ellis Manufacturing Co.
Box 246
Verona, WI 53593

Mechanical Transplanter
Box 1008B
Holland, MI 49423

Speedling Manufacturing
Box 283
Sun City, FL 33586

Holland Transplanter Co.
510 East 16th St.
Holland, MI 49423

Powell Manufacturing Co.
P.O. Drawer 707
Bennetsville, SC 29512

Irrigation Equipment

American Plant Products
9200 NW. 10th
Oklahoma City, OK 73127
1-800-654-4583

Smith Irrigation
Box 232, North Main St.
Kensington, KS 66951

Good Earth Gardens
Jerry Edson
Rt. 1, Box 139
Clearwater, KS 67026
316-773-1494

Kansas City Cut Flower Farms
Ethan Kayes
4223 Gibbs Road
Kansas City, KS 66106
913-432-1330

Chesmore Seed Co.
1302 South 4th
St. Joseph, MO 64501
816-279-0865

General Materials

Century Florists Supply Co.
Main Office: P.O. Box 325
Detroit, MI 48232–2562
313-872-0300
FAX 313-872-7907
Midwest Office: P.O. Box 411807
Kansas City, MO 64141–1807
816-474-3610, FAX 816-471-2733

Craftware Pottery
Mary Beavers
233 North 19
Lincoln, NE 68503
402-474-1622

Clifford Sales & Marketing
Nick Clifford
44 Granada Way
St. Louis, MO 63124
314-432-5806

McHutchison Co.
Vaughn N. Fletcher
418 Kingsley
Liberty, MO 64068
816-781-1818

American Plant Products
Rod Lewis
9200 NW. 10th St.
Oklahoma City, OK 73127–9722
405-787-4833

Swecker–Knipp Inc.
Dennis Whitegon
900 NW. Jackson
Topeka, KS 66608
785-234-5652

Gard'N-Wise Distributors
1515 East 29th St. North
Wichita, KS 67219
316-838-1474

Temkin Int., Inc.
21007 Superior St.
Chatsworth, CA 91211
818-709-1066
(sleeves)

TENAX Corporation
8291 Patuxent Range
Jessup, MD 20794
800-356-8495
Fax: 301-725-5910

Premier Brands Inc.
Tobin Standard
Dan O'Meara
931 West 8 St.
Kansas City, MO 64101
816-842-3838

Ball Seed Co.
P.O. Box 335
West Chicago, IL
800-323-BALL
FAX 800-234-0370

A.H. Hummert Seed
Sheryl Shaefer
2746 Chouteau Ave.
St. Louis, MO 63103
314-771-0646

Vaughan Seed CO.
Joe J. Rawley
Box 3473
Lawrence, KS 66046
785-843-8080

Wheeler Arts
Dept. CFQ
66 Lake Park
Champaign, IL 61821–7101
217-359-6816
FAX 317-359-8716

Stuppy Greenhouses
Bruce Holden
P.O. Box 12456
1212 Clay St.
North Kansas City, MO 64116
800-877-8025

Nexus Greenhouse
10983 Leroy
Northglenn, CO 80233
303-457-9199

Recommended Reading

Flowers for Sale: Growing and Marketing Cut Flowers—Backyard to Small Acreage; A Bootstrap Guide. Lee Sturdivant. San Juan Naturals. P.O. Box 624S. Friday Harbour, Washington 98250.

A thorough introduction to the commercial cut flower business. Includes a step-by-step plan for starting a flower growing and selling business.

Fresh (Cut) Flowers for Designs. Postproduction Guide I. Care and Handling. Retail and Consumer Care Information. John N. Sacalis. Pfeifer Printing Co., Columbus, OH.

Rodale's Illustrated Encyclopedia of Herbs, Rodale Press.

Ball Red Book. (15th edition) Vic Ball, editor. Geo. J. Ball Publishing. 622 Town Road, West Chicago, IL 60185-2698.

The basic book on greenhouse growing written for growers.

Care and Handling of Flowers and Plants. (2 volumes) 1985. C.L. Holstead. The Society of American Florists.

The Complete Book of Cut Flower Care. 1988. M.J. Vaughan. Timber Press. Portland, OR.

Handling, Precooling, and Temperature Management of Cut Flower Crops for Truck Transportation. 1979. Roger E. Rij, James F. Thompson & Delbert S. Farham. USDA-SEA AAT-W-5.

Alberta Supernaturals. Buck Godwin. Available from Olds College Bookstore. Olds College, Olds, Alberta, CANADA TOM 1PO ($8, including postage).

The best book for the large-scale grower of drying flowers (statice, strawflowers, grains, and much more).

Commercial Field Production of Cut and Dried Flowers, (Proceedings from a National Symposium sponsored by the CACP and ASHS).

Includes marketing, cooperatives, costs, propagation, selecting a crop, woodies, grasses, weeds, diseases and pests of everlastings, post-harvest, annuals, and wildflowers. Available for $25, payable to the University of Minnesota. Send to Extension Special Programs, 405 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108.

Commercial Flower Forcing, A. Laurie, D.C. Kiplinger, and K.S. Nelson. McGraw–Hill.

Basic guide to greenhouse production of out-of-season materials.

Commercial Flower Growing. John P. Salinger. Butterworths Horticultural Books.

The closest thing to a complete text on field production of flowers and although it was written in New Zealand, it adapts fairly well to American conditions (much of the bibliography is Californian).

The Complete Book of Cutflower Care. Mary Jane Vaughan. Timber Press.

The most comprehensive-yet-concise guide to postharvest handling and care for growers, wholesalers, and retailers.

Identification of Insects and Related Pests of Horticultural Plants—A Pictorial Guide. Ohio Florists Association.

An unbound, 48-page compilation illustrating the different life stages and crop damage of major insect, mite, and related pest groups. Describes stages for effective pesticide use. Color pictures. Send $25 to Ohio Florists Association, 2130 Stella Ct., Columbus, OH 43215–1033.

Diseases and Pests of Ornamental Plants. Pascal P. Pirone. Wiley–Interscience.

Florist Crop Production and Marketing. Kenneth Post. Orange–Judd Co. Out of print, but copies are available from The American Botanist Booksellers, P.O. Box 143, 9526 Lexington Ave., Brookfield, IL 60513.

The former standard of the industry, sometimes out of date, but still a detailed and worthy volume.

Park's Success With Seeds. Park Seed Co. P.O. Box 46, Greenwood, SC 29648–0046.

Simple yet the most comprehensive guide to seed propagation.

Postharvest Handling and Storage of Cut Flowers, Florist Greens, and Potted Plants. J. Nowak and R.M. Rudnicki. Timber Press. Portland, OR.

A comprehensive, text-book approach to this subject.

Specialty Cut Flowers (Proceedings from the 2nd National Conference of the ASFG).

Includes wholesale distribution, trends, marketing, costs, getting started, new varieties, callas, iris, bulbs, statice, IPM, perennials, everlastings, and woodies. Available for $25 ($20 to members) from the ASCFG.

Specialty Cut Flowers (proceedings from the 3rd National Conference of the ASCFG).

Includes aster, yarrow, post-harvest, woodies, IPM, delphinium, co-operatives, new varieties, auctions, larkspur, stock, everlastings, customers, computers. Available for $25 ($20 to members) from the ASCFG.

Ornamental Grasses, The Amber Wave. Carole Ottesen. McGraw–Hill. $29.95.

A general overview plus details on the production and uses of over 70 varieties. Highly useful appendices.

Ornamental Grasses and Grasslike Plants. A.J. Oakes. Van Nostrand Reinhold, 1990. ISBN 0-442-23931-9. $68.95 approx.

Comprehensive examination of grasses and their production.

Ornamental Grasses R. Grounds. Van Nostrand Reinhold, 1979.

Dried Fresh Flowers from Your Garden. Elizabeth Bullivant. Pelham Books/Stephen Greene Press. London, UK. $31.95.

Reference with imaginative ideas on uses for flowers. Informative chapter on hydrangeas.

The Encyclopaedia of Everlastings. The Complete Guide to Growing, Preserving, and Arranging Dried Flowers. Barbara Radcliffe Rogers. Weidenfeld & Nicholson.

Lists each species with information on hardiness, color, height, and uses in arrangements.

The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks. Ag Handbook 66. 1990. USDA Agricultural Research. U.S. Government Printing Office, 1305 SW. 1st, Portland, OR 97201. $7.00.

Concise descriptions of conditions required for best shelf life.

Refrigeration and Controlled Atmosphere Storage for Horticultural Crops. Northeast Regional Agricultural Engineering Service. #22. 1990. Cooperative Extension, 152 Riley–Robb Hall, Cornell University, Ithaca, NY 14853. $5.25.

Construction diagrams for cold storage and controlled atmosphere facilities.

Marketing of Floricultural Products in the United States, An Annotated Bibliography. Susan C. Whitmore and Henry Gilbert. USDA, National Agricultural Library. Bibliographies and Literature of Agriculture, Number 66. USDA's NAL, Beltsville, MD 20705.

A comprehensive list of journals, books, newsletters, associations and government reports on marketing. Includes addresses for national market price reports.

Holland Bulb Forcers Guide. (4th edition) A.A. DeHertogh. International Flower Bulb Center, Hillegom, Netherlands.

The basic reference for flower production from bulbs.

Potpourri . . . Easy as One, Two, Three! Dody Lyness. Berry Hill Press. 7336 Berry Hill #8, Palos Verdes, CA 90274. $6.95.

Resource for fragrance crafters and dried floral designers.

Ball Culture Guide: The Encyclopedia of Seed Germination. Ball Seed Co. 622 Town Road, West Chicago, IL 60185. $27.

Provides information on germination, lighting, crop time, field production, and varieties.

Kieft's Growing Manual. Kieft Bloemzaden BV. Blokker, Holland. Available from ASCFG. $10.

For annual, biennial, and perennial cut flowers and ornamental grasses grown from seed.

Everlasting Flowers for Pleasure and Profit. Jeannette Verhelst. $11.00. Jeannette Verhelst, Box 178, Radville, Saskatchewan, Canada, SOC2GO.

Excellent resource written by a grower for growers.

Manual of Herbaceous Ornamental Plants. Steven M. Still. Stipes Publishing Co. 10–12 Chester St., Champaign, IL 61820.

The reference for descriptive information on herbaceous plant materials.

Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation, and Uses. Michael A. Dirr, Stipes Publishing Co., 10-12 Chester St., Champaign, IL 61820.

The reference for descriptive information on woody plant materials.

Competitive Advantage. Michael E. Porter. The Free Press a Division of Macmillan, Inc. 866 Third Avenue, New York, NY 10022.

How to create and sustain a competitive advantage.

Production and Operations Management. Norman Gaither. CBS College Publishing. 383 Madison Avenue, New York, NY 10017.

A basic, introductory book on operations management: planning products, processes, and facilities. How to plan and control operations for productivity and quality.

Directories

A membership directory of wholesale florists and florist suppliers is available from **WF & FSA,** P.O. Box 7308, Arlington, VA 22207, 703-241-1100.

"Floral Marketing Directory & Buyer's Guide" is available from the Floral Marketing Division of the Produce Marketing Association, P.O. Box 6036, Newark, DE 19714–6036, 302-738-7100 ($25 for PMA members, $50 for nonmembers).

Magazines, Bulletins, Newsletters

"Growing for Market." Lynn Byczynski, editor. Fairplain Publications. P.O. Box 365, Auburn, KS 66402. $24.

A monthly journal of news and ideas for market gardeners. Articles on crop culture, handling, marketing, merchandising, and profiles of successful growers provide subscribers with timely information and ideas.

"Supermarket Floral" magazine is a free monthly publication from The Packer. P.O. Box 2939, Shawnee Mission, KS 66201, 800-255-5113.

Covers all aspects of the supermarket floral department.

"Potpourri Party-Line." Dody Lyness, editor. Berry Hill Press. 7336 Berry Hill #8, Palos Verdes, CA 90274.

A quarterly publication tailored to the interests of fragrance crafters and dried flower designers. Current trends in herbal growing, floral trends, recipes for scented potpourri mixtures, and drying techniques. Articles are slanted toward the interests of home-based businesses.

"Florist Review" magazine keeps you in touch with the retail trade. Florist Publishing Co. 111 North Canal St., Suite 545, Chicago, IL 60606, 312-782-5505.

"Flowers &" is published monthly by Teleflora for retailers in "the business of flowers." Write to Teleflora, Teleflora Plaza, Suite 260, 12233 West Olympic Blvd., Los Angeles, CA 90064.

"American Vegetable Grower" magazine offers articles on practices well suited to the field flower grower. Meister Publishing Co. Willoughby, OH 44094.

The USDA issues bi-weekly reports on cut flower prices in various centers across the country. Available from Federal–State Market News, 630 Sansome St., Rm. 727, San Francisco, CA 94111.

"Forcing Flower Bulbs" includes information on growing bulbs for cut flowers. The pamphlet is available from Leo Berbee Bulb Co. 18443 S.R. 4 N., P.O. Box 370, Marysville, OH 43040, 513-642-0511.

"Cut Flowers: Production and Marketing." C. Kopolow. January 1989. 7 pages. Send a self-addressed, gummed label to Agri-Topics, National Agricultural Library, Room 111, 10301 Baltimore Blvd., Beltsville, MD 20705.

"Dried Flowers." C. Kopolow. November, 1989. 8 pages. Send a self-addressed, gummed label to Agri-Topics, National Agricultural Library, Room 111, 10301 Baltimore Blvd., Beltsville, MD 20705.

"Herbs." S. Whitmore and H. Shimizu. December 1989. 6 pages. Send a self-addressed, gummed label to Agri-Topics, National Agricultural Library, Room 111, 10301 Baltimore Blvd., Beltsville, MD 20705.

"Peonies." J. MacLean and S. Whitmore. n.d. 4 pages. Send a self-addressed, gummed label to Agri-Topics, National Agricultural Library, Room 111, 10301 Baltimore Blvd., Beltsville, MD 20705.

Cornell Recommendations for Commercial Floriculture Crops, Part 1: Cultural Practices. Part 2: Disease, Pest, and Weed Control. Cornell Cooperative Extension, Ithaca, NY 14853.

Organizations

Calla Lily, Violet, Tulip

The Association of Specialty Cut Flower Growers is a national network of commercial field growers. The Association's basic purpose is to provide cultural, technical, and marketing information through conferences and a quarterly bulletin.

For further information, contact Judy Laushman, Executive Director, ASCFG, 155 Elm St., Oberlin, OH 44074, 216-774-2887.

The Kansas Greenhouse Growers Association is an organization of growers providing support to the Kansas floriculture industry, and offering educational opportunities through their annual seminars, trade show, and growers school. A bi-monthly newsletter keeps members up-to-date on issues affecting the industry. For more information or to join the KGGA, contact Alan Stevens, KGGA Executive Secretary, 216 Waters Hall, Kansas State University, Manhattan, KS 66506–4029.

The International Freeze-Dry Floral Association emphasizes the promotion, marketing, and use of freeze-dried florals. Contact the IFDFA at P.O. Box 71272, Clive, IA 50325.

Alan B. Stevens
Extension Specialist
Floriculture & Ornamental Horticulture

Karen L. B. Gast
Extension Specialist
Postharvest & Marketing

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