

## Commercial Specialty Cut Flower Production

# ZINNIAS



Zinnias are popular in flower gardens because of their large, colorful blooms and their ability to withstand hot summer temperatures. Recently, new hybrid zinnia cultivars have attracted attention as a cut flower crop.

Zinnia color ranges from crimson to dark purple. Solid colors are the most popular, though there is interest in the variegated forms. Zinnias also display great variety in shape and size, growing from 3-30 inches high. The three types of flowers—pompon, cactus and dahlia—all have flower diameters that range from under 2 inches to more than 4 inches.

Native to Mexico, modern garden zinnias have been developed primarily from one species, *Zinnia elegans* Jacq., named after Johann G. Zinn, professor of botany at Gottingen. There are now 16-20 species, mostly annuals, in Mexico, Texas, New Mexico, Colorado and Chile. The other two species, *Z. angustifolia* and *Z. haageana*, are compact, have smaller flowers and are not really useful as a cut flower.

### Varieties to Grow

*Z. elegans* cultivars:

'Cactus-Flowered' (3,000-4,000/oz.) —24"; mix of colors; quilled blooms.

'Candy Cane' —17"; pink, rose and cerise stripes on white, gold blooms striped or flecked orange-scarlet; double and semi-double blooms.

'Cut-N-Come Again'— 24-36"; scarlet, pink, yellow, salmon, white, others; double blooms.

'Dahlia Flowered' (3,800/oz.) — 30"; mix of colors; double blooms.

'Lilliput' (4,800/oz.) — 18-24"; mix of colors; pompon blooms.

'Pumila' (4,000/oz.) — 24-30"; mix of colors; double blooms.

'Rose' — 20-22"; rose-pink with a touch of salmon; double and semi-double, dahlia-type blooms.

'Rose Pinwheel' —12"; pink, deep rose; daisylike blooms.

'Ruffles' (2,700-3,100/oz.)— 24-30"; scarlet or mix of colors; double blooms.

'State Fair' (2,440/oz.) — 30-36"; mix of colors; double blooms.

'Sunbow' — 18-20"; range of colors; double blooms.

'Whirligig' — 20"; bicolored yellow-crimson, red-white, pink-white, cream-rose, bronze-red, others; double blooms.

'Yellow Marvel' — 15"; yellow; dahlia blooms.

### Cultural Requirements

**Planting.** Zinnias are grown from seeds (3,000-6,000 seeds/oz.), germinating in 5-7 days at 75°F. Zinnias grow poorly and become chlorotic at temperatures below 60°F. Ideal soil temperature for zinnia production is greater than 70°F.

Zinnias are short-day plants for flower-bud initiation, which means that they initiate vegetative growth when the days are long—dark period 10 hours or less—and flower development when the days are shorter. Stem length and flower size increase with day length and temperature, the greatest profusion of blooms occurring when daylight is less than 14 hours.

Small plants can be produced in a greenhouse and transplanted into the field to gain an earlier harvest advantage. Make sure that the germination medium is sterile, loose and well-drained, with a pH of about 6-6.5. Do not add a surfactant to the germination medium;

---

---

it can cause losses in germination and reduced plant vigor. Light has no effect on germination. Production time is about 34 weeks.

Seed is commonly planted directly in the field in May. Space plants 6 inches apart within the row, and space rows 12 inches apart. Schedule sowing dates according to the desired time of flowering. When soil temperatures are above 70°F at planting, time from seeding to first harvest is about 6-7 weeks.

Zinnias grow and produce a flower on the end of the stem. When this first flower is harvested, there will be a time lag until branches form, grow and produce new flowers. During this period, no flowers will be available for sale. To overcome this, make plantings at intervals to provide a continuous harvest of blooms for sale.

The medium-flower varieties such as 'Pumila', 'Ruffles' and 'Cut-N-Come Again' need to be planted in two seedings spaced 2-3 weeks apart, depending on soil temperature at seeding. The large-flower types like 'State Fair' require several successive plantings. The second planting should be 2 weeks after the first, with additional plantings spaced a week apart. Research in Kansas has shown that about 7-8 plantings are required to provide consistent production. This has a secondary benefit: The later plantings seem to have fewer diseases late in the harvest season.

**Watering.** Kansas growers should not attempt to produce specialty cut flowers without providing supplemental irrigation. The dollar value of the crop and demands of the market are such that it is foolish to attempt production under natural rainfall in Kansas. Overhead watering is not recommended. It may damage the flowers, cause spotting on the petals, splash soil onto the foliage and promote the spread of disease.

Overhead watering will subject zinnias to mildew. Drip irrigation is recommended because it places the water on the ground where it is needed, not on the flowers or foliage.

The amount and frequency of water required will vary with the weather and maturity of the crop. Base the irrigation schedule on the soil moisture status in the root zone, and irrigate to provide sufficient but not excessive water. Insufficient water will reduce crop production and quality, whereas a consistently saturated soil will reduce growth and promote development of root rot.

**Fertilizer.** Before initiating a 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. In general, 11/2-2 pounds of actual nitrogen per 1,000 square feet of

production bed space per year from a 1-1-1 fertilizer is adequate. If soil test results indicate adequate phosphorus and potassium, then ammonium nitrate should be used in place of the complete fertilizer. Apply a portion of the fertilizer at planting, some in late June and a final application about August 1. Sandy soils will require an additional fertilizer application—the same total amount spread over four applications.

Low levels of boron in the soil may cause terminal bud blasting and slow branch development. High levels of boron may delay flowering 12-15 days.

It is important to note that a plant being grown for a cut flower crop has a higher nitrogen requirement than the same plant being grown for its flower color display in the garden. For a cut flower crop, harvesting removes the stems, each as long as possible, and all attached foliage as well as the flower. In addition to promoting flowering, it is important to promote growth of new branches with sufficient length to be commercially marketable. Traditional recommendations for fertilizers with ratios either balanced or favoring phosphorus and potassium over nitrogen for flowers do not necessarily apply to commercial cut flower production.

**Weed Control.** Growers must control weeds in the production of zinnias, as competition with weeds reduces the quantity and quality of floral production. A bed full of weeds also increases the time required to harvest, raising labor costs. Several options are available to combat weed growth: herbicides, barriers or mulches, and hoeing and hand-weeding.

Due to limited production of many species of specialty cut flowers, only a few herbicides are labeled for use. In 1993, surflan (oryzalin), XL (benefin + oryzalin), Dacthal (DCPA), Fusilade (Fluazilop-P), Pre-San (benzenesulfonamide), Pennant (Metolachlor), and Poast (Sethoxydim) are labeled for weed control with zinnias.

Weed barriers and mulches prevent weed growth and restrict soil splash on foliage and flowers from rain and irrigation.

While hoeing and hand-weeding are excellent methods for weed 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. A healthy, actively growing zinnia plant is more resilient to insect attack. The ideal approach is a preventive program.

Control insects early, when they are first detected; do not wait until a serious infestation occurs. Less chemical can be applied to spots as they develop than would be required to spray the entire crop.

---

Primary insect concerns on zinnias are aphids, thrips, caterpillars and stem miners. Stem miners may cause plants to wilt due to their tunneling up the stem and disrupting water movement within the plant.

**Disease Control.** Diseases often reduce the quantity and quality of zinnia flowers and sometimes cause significant plant mortality. Some diseases, such as powdery mildew, *Alternaria* leaf blight, and aster yellows are perennial concerns, while others may be sporadic. The table lists some of the more common zinnia diseases, with symptoms and control. Certain plant diseases are difficult to identify by field symptoms. Be sure to consult a plant pathologist for accurate disease diagnosis before applying any fungicides.

Zinnia diseases usually can be controlled with sound cultural management and chemicals. Use only clean, high-quality seed. For greenhouse germination, plant seeds in a high-quality, pathogen-free soilless mix. It may be advisable to treat seed with a fungicide dust (captan or thiram) for direct seeding in the field. If possible, sow the seed on a slightly raised bed with drip irrigation. Avoid overhead watering, and keep plants adequately spaced for good air circulation. Overcrowding may result in plant losses from powdery mildew and other fungal and foliar blights. Water the plants early in the day to permit good foliage drying before nightfall. Closely monitor plants for signs of diseases or insect activity. Remember that aphids, leafhoppers and thrips may transmit viruses. Keep fields as weed-free as possible to control insects and viruses. Rotate planting beds in the field annually to avoid buildup of soilborne fungal pathogens and nematodes.

Routine fungicide applications may be necessary to control powdery mildew on susceptible varieties of zinnia. Control is much more effective if fungicides are applied before mildew symptoms are apparent. Other fungal diseases may be controlled with curative fungicide

applications beginning as soon as symptoms develop. Don't wait until plants are severely blighted to start applying fungicides. The table lists fungicides currently labeled for control of specific diseases. Be sure to diagnose the disease correctly, and follow all instructions on the fungicide label.

### Yields

Higher plant densities — closer spacing — results in higher yields per square foot of production space. Six-, eight-, ten- and twelve-inch spacings were studied at the Kansas State University Ashland research farm near Manhattan. In all comparisons, closer spacing produced more marketable stems per square foot of production space than wider spacings.

The 'Pumila', 'Ruffles' and 'Cut-N-Come Again' varieties can be expected to yield an average of 3.1 stems per square foot per week beginning about August 15 from a June 1 seeding, while 'State Fair' can be expected to yield about 1.3 stems. The June 1 seeding will yield its first stems in early to mid-July and recycle back into bloom in the middle of August. A May 15 seeding will begin to bloom about 7-10 days earlier.

Yields expressed here were produced under experienced care using drip irrigation with soluble fertilizer injected in the water. Soil type and weather conditions will affect the production level. The only thing consistent about the weather in Kansas is that it is always changing.

### Harvest

#### Fresh Zinnias

Standard Fresh Cut Flower Harvest Requirements:

- Harvest stems during the cool part of the day— morning or late in the day — when plants and flowers are free from dew and moisture.
- Harvest when flowers are fully open.
- Use clean, disinfected harvest containers and cutting utensils.
- Cut stems as long as possible, but leave enough nodes to ensure future production.
- Strip excess and damaged foliage from the stems in the field.
- Place newly harvested stems in commercial floral preservative or acidified — pH 3.5 citric acid works well — clean water.
- Remove stems from the field as soon as possible to cold storage or a cool, shady place until ready for grading and processing.

Fresh zinnias are more durable than gerbera daisies and provide a good substitute. The flowers are similar in



---



---

## Zinnia Diseases

---

Leafspots and Blights	Symptoms	Control
Alternaria zinniae	Small, reddish-brown leaf spots with gray centers. Dark brown cankers may develop on stems, and flowers may be spotted or blighted.	Provide proper plant spacing and good air circulation. Apply maneb, mancozeb, iprodione or chlorothalonil at 7- to 10-day intervals.
Bacterial leafspot (Xanthomonas sp.)	Small, water-soaked spots with yellow halo. Difficult to diagnose without professional help.	Keep plant surfaces dry by providing adequate circulation. Fungicides are not effective in controlling this disease.
Botrytis cinerea	Commonly a greenhouse concern. Large areas of petals, leaves and stems turn brown. Affected plant parts develop a dusty gray covering during humid conditions.	Provide proper plant spacing and good air circulation. Avoid overhead watering. Apply maneb, mancozeb, vinclozolin, iprodione or chlorothalonil at 7- to 10-day intervals as needed.
Other leafspots: Ascochyta sp. Cercospora zinniae Cibinia sp. or Ovulina sp. Corynespora sp. Curvularia sp. Entomosporium sp. Septoria sp. Helminthosporium sp. Volutella sp.	Several other fungi may cause leaf spotting. Consult a diagnostic lab for proper identification of the pathogen.	Leaf spotting fungi can be partially controlled by proper plant spacing and adequate air circulation. Several fungicides, including chlorothalonil, iprodione, maneb, mancozeb and thiophanatemethyl, are effective in controlling certain leaf spot diseases. Consult a plant pathologist for accurate diagnosis and chemical control recommendations.
Powdery mildew (Erysiphe cichoreacearum)	White, powdery growth on the leaves. It is more prevalent in late summer and early fall.	Preventive fungicide applications are necessary for adequate control of powdery mildew. Apply chlorothalonil, fenarimol, sulfur, triforine, triadimefon or thiophanate-methyl at 7- to 30-day intervals. Triadimefon may cause flower stalk length reduction.
<hr/> <b>Root Rots</b> <hr/>		
Pythium sp. Phytophthora sp.	Dark discoloration on roots and lower stem. In low, wet areas, plants may fail to emerge. Stunted plants turn yellow, wilt and die. Consult plant pathologist for proper identification.	Plant on raised bed to allow for good drainage. Preplant dressings of ethazole or metalaxyl will help suppress damping-off or root rot in problem areas. Soil drenches of ethazole or metalaxyl or foliar sprays with fosetyl-Al will help control root rot after seeding.

---



---

### Zinnia Diseases (Continued)

---

<u>Disease</u>	<u>Symptoms</u>	<u>Control</u>
Fusarium sp. Rhizoctonia solani Thielaviopsis sp.	Dark discoloration on roots and lower stem. Poor seeding emergence. Older plants may be stunted, wilt and die. Young plants damp off, stunted old plants turn yellow, wilt and die. Consult plant pathologist for proper identification.	Start with clean seed or transplants. Apply PCNB, iprodione or thiophanate-methyl as soil drench to control root rot phase.
<hr/>		
<u>Wilts</u>		
Fusarium oxysporum	A brown discoloration can be found in the internal vascular tissue of stem. Leaves turn yellow progressively from the bottom of the plant to the top. Infected plants are stunted or killed.	There is no chemical control of this disease. Rotate location of planting beds.
<hr/>		
<u>Viruses and Mycoplasma-like Organisms</u>		
Beet Curly Top Virus Cucumber Mosaic Virus Tobacco Etch Virus Tomato Spotted Wilt Virus	Yellowing, plant stunting, mottling, mosaic, vein clearing, necrotic etching, ringspots, shortened internodes.	There are no chemical controls once plants are infected. Maintain a good weed (alternate host) and insect (vector) control program. Rogue infected plants immediately.
Aster Yellows Mycoplasma-like Organisms	Stunting, shortened internodes yellowish-green, deformed flower heads; yellow foliage.	Rogue infected plants. Apply a systemic insecticide at planting.
<hr/>		
<u>Nematodes</u>		
Foliar Nematode (Aphelenchoides ritzemabosi)	Stunting, foliar browning, bud deformity.	Test soils for presence of root knot or lesion nematodes or foliage for foliar nematode. Rotate or fumigate infected soils.
Root Nematodes Meloidogyne incognita Pratylenchus spp.	Foliage yellowing, wilting, plant stunting; poor root development, root galls (M. incognita), dark root lesions (Pratylenchus spp.).	

---

shape and form, but zinnias do not suffer from bent neck or require special postharvest handling. Zinnias can be stored up to 4 days at 36-40°F without affecting vase life. Vase life is about 5-7 days.

#### Dried and Preserved Zinnias

- Harvest as you would for fresh zinnias.
- Harvest when flower heads are fully open.
- Remove foliage and stems in the field if flowers are to be processed immediately.
- If flowers cannot be processed immediately for drying, handle them like fresh material until they can be processed properly.

#### Postharvest

##### Fresh Zinnias

- Strip leaves from the bottom half of the stem.
- Grade by stem length and flower size.
- Bunch by buyer's specifications.
- Recut stems under water to a uniform length.
- Store graded and bunched stems in clean, disinfected containers in commercial floral preservative.
- Store at 36-40°F with 85-90 percent relative humidity.

##### Dried and Preserved Zinnias

Zinnias can be dried successfully and used in various ways. Available in a wide range of colors and sizes, they provide a round flower shape that few dried flowers do. Except for the deep reds and scarlets — which usually turn an undesirable black-red — most colors dry well.

Surround-and-Cover method:

- Remove most of the stem because the flowers dry most efficiently in shallow containers.
- Choose a drying substance such as white cornmeal, sand, borax, kitty litter, silica gel or a specially formulated product. Do not choose something that will soil the flowers or be difficult to remove.
- Place the flowers with stems removed on a thin layer (1/2-3/4 inch) of drying substance in a container 3-4 inches deep.
- Carefully pour the drying substance over, around and through the petals to cover the flowers.
- Specific instructions regarding light, temperature and drying time will vary with the drying material. Books describing the handling methods for each material on the market are available. (See References.)

The surround-and-cover drying method preserves the flower shape best. Hanging zinnias upside down can cause the petals to reflex inward and lose the desired

round, daisy shape. Drying upright, zinnia stems often lack the strength to support the flowers as they dry. The succulent nature of the flower prohibits the use of glycerine for drying.

Because most of the stem is removed in the surround-and-cover method, many short-stemmed cultivars that are unsuitable for the fresh cut flower market can be used for drying. To use these short-stemmed dried flowers, the designer will either wire them or attach them using a hot glue gun.

#### Packaging and Packing

Packaging and packing will depend on your buyer's specifications. Local consumers, retail florists or wholesalers selling directly to retail florists often will accept flowers delivered in buckets of floral preservatives. Flowers for regional, national and international markets are packed dry in boxes. Standard flower boxes are 21 inches wide and 12 inches deep with length ranging from 42-57 inches. They are often insulated. Most fresh specialty cut flowers are air freighted to market because of their short vase life and high value.

Dried materials are very fragile and crush easily unless well-cushioned. Do not overfill boxes. Sleeve small bunches with cellophane or similar material to prevent abrasion among the dried materials. Use a packing material such as Styrofoam shells or peanuts as a cushion layer in the bottom of the box. There are no standard container dimensions for packing dried materials, but the buyer may have specific requirements. The buyer will require the dried material to be packed well enough to arrive in good condition.

#### Marketing

It is important to identify and organize market strategies before investing in seed, plants or equipment. Knowing how and where to sell the product is crucial to the success of a business. Be flexible, and determine more than one outlet; have a backup plan. The goal is to create a successful, profitable and sustainable business.

Zinnias are usually marketed fresh, although some individuals will use dried flowers. The round, daisy shape of zinnias is desirable in design work.

##### Market Outlets

Local, direct retail markets:  
farmers markets  
roadside markets  
restaurants  
caterers

---

---

Local wholesale markets:

florists  
grocery stores  
flower brokers  
entrepreneurs

Regional/national/international wholesale markets:

cooperatives  
flower brokers

Although there are many other market options, zinnias are very popular at farmers markets. They seem to sell well wherever fresh local produce is sold directly to the public. The medium-sized and small button types are good additions to mixed fresh bouquets. The large 'State Fair' types seem to sell best as single items.

Zinnias are marketed in forms ranging from fresh or dried mixed bouquets for direct retail sales, to dried and dyed materials that are used in making decorative items such as wreathes, arrangements and swags.

## References

- Boyle, Thomas H. and Dennis P. Stimart. 1983. Developmental Responses of Zinnia to Photoperiod. J. Amer. Soc. Hort. Sci. 108(6):1053-1059.
- Boyle, Thomas H., Dennis P. Stimart and Marla S. McIntosh. 1986. Seasonal Variation in Vegetative and Reproductive Development in Zinnia *elegans* Jacq. J. Amer. Soc. Hort. Sci. 111(2): 260-266.
- Healy, William E. 1990. Producing Cut Flowers: Cut Zinnias. Horticulture Production Information Sheet. University of Maryland Cooperative Extension Service.
- Jacobs, Betty E.M. Flowers that Last Forever, Growing, Harvesting and Preserving. A Garden Way Publishing Book, Storey Communications, Inc., Pownal, VT.
- Moffit, Roberta. 1989. The Step-by-Step Book of Preserving Flowers, 4th ed. P.O. Box 3597, Wilmington, DE 19807.
- Whitlock, Sarah and Martha Rankin. Dried Flowers, How to Prepare Them. Dept. 23, Dover Publications, Inc., 31 East 2nd Street, Mineola, NY 11501.

Brand names appearing in this publication are used for product identification. No endorsement is intended, nor is criticism of similar products not mentioned.

---

---

**About the authors:**

**Susan Stevens** is a horticulture research assistant; **Alan B. Stevens** is Extension Floriculture and Ornamental Horticulture Specialist; **Karen L.B. Gast** is Extension Post Harvest and Marketing Specialist; **Judith A. O'Mara** is Extension Diagnostician; **Ned A. Tisserat** is Extension Plant Pathology Specialist; and **Robert Bauernfeind** is Extension Entomology Specialist



COOPERATIVE EXTENSION SERVICE, MANHATTAN, KANSAS

MF-1079

August 1993

Issued in furtherance of Cooperative Extension Work, acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, and United States Department of Agriculture Cooperating, Richard D. Wootton, Associate Director. All educational programs and materials available without discrimination on the basis of race, color, national origin, sex, age, or disability.  
File Code: Horticulture 11 (Commercial) JH8-93-2M