

THE INSIDER'S GUIDE
TO CUT FLOWER
DAHLIAS

BY LANE GREER

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Thank you to Patricia Banner, John Dole, Judy Laushman, Holly Pasmore, Vicki Stamback, Linda Twining, Bob Wollam, and the many other ASCFG members who offered information and advice, for their assistance with this project.

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Published in 2012 by the
Association of Specialty Cut Flower Growers, Inc.

The ASCFG is a non-profit trade association which provides production and marketing information to field and greenhouse growers.

ISBN-13:978-0-615-57887-3

The Insider's Guide to Cut Flower Dahlias

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INTRODUCTION

Cut dahlias are ideal for late summer and fall sales when many other cut flower crops are no longer productive. Flowers don't ship well, making them excellent choices for local markets. The Karma series is generally considered one of the best for cut flower production. Many growers produce dahlias in protective structures, which provide longer stems and earlier production. Dahlias have a relatively short vase life.

Growers should consider two issues before deciding to grow cut dahlias. The first is soil. Dahlias require good drainage and slightly acid soil pH (around 6.5) with some organic matter. Heavy clay that holds a lot of water will not work and should be amended.

The second is water. Dahlias love water, and they want a consistent supply. Drip irrigation is best, but overhead is better than nothing. Install drip irrigation lines before or at planting. It is preferable to mulch to conserve water and keep roots cool, but it's not absolutely critical.

CULTIVARS

Dahlias are available in every color except blue, green, and brown. There are even some very dark reds that look almost black. Be aware that any cultivar has a certain color range. The catalog picture can look quite different from the actual flower, and you will probably see color differences depending on the season (spring vs. fall, for instance). Dahlias range from 2 to 16 inches in diameter, but most cut flower varieties are between 3 and 10 inches across. Flower forms are separated into open-centered (some of which are known as singles) and fully doubled; currently, doubles are the main form grown as cut flowers. The American Dahlia Society recognizes 18 classifications of dahlias, with most cuts falling into the following:

- Formal decorative - relatively flat petals (botanically known as ray florets) which all grow in the same direction and form a hollow globe.
- Informal decorative similar to formal decorative but with more pointed petals.

- Semi-cactus and cactus-even more pointed petals than informal decorative.
- Ball - petals curl up to form a rounder, ball-shaped flower, between 2 and 3.5" in diameter.
- Miniature ball - smaller than 3.5", good for bouquets.
- Pompon - even smaller than miniature balls.



Side view of 'Peaches 'n' Cream', a formal decorative type.

There is no correlation between classification and vase life; not all formal decoratives have longer vase life, for instance. A mix of colors, shapes, and sizes should be planted to meet customer needs. New growers are often surprised at the demand for small dahlias, which are useful for bouquets.

Thousands of dahlia cultivars exist and entire flower societies are devoted to the plant. However, most cultivars will not be productive enough for commercial cut flower production or have other issues, such as lateness to flower, short stems, and petal browning, that prevent them from being profitable.

The most commonly used dahlias for cuts are the Karma series. These tend to produce medium-to larger-sized, long-stemmed cut flowers. Most growers think that plants in a series are from

A Very Brief History of Dahlias

Dahlias are native to the mountains of Central America and Mexico, which helps to explain why they are not hardy in USDA Hardiness Zones colder than 7, but they like cool nights. Growers should be glad that dahlias were named for Anders Dahl, a Swedish botanist, rather than keeping their original Aztec name of cocoxochitl. From Mexico dahlias traveled to Madrid, and from there across Europe. Extensive hybridization occurred throughout the 19th and 20th centuries, so much so that there are now almost 50,000 named cultivars. Many hybrids were created in an effort to produce stable double forms. These doubles were the source of today's formal decorative and informative decorate types.

similar genetic backgrounds and will grow similarly. In fact, this is *not* the case; breeders select cultivars almost randomly to fit into a series, usually based on one attribute (such as flower size). Consequently, some Karma cultivars grow quickly while others are slower, some are early while others are late, some attract numerous insects while others are relatively pest-free. Karmas cost more, but they are generally more productive and begin to produce earlier in the season. Specific cultural information below comes from numerous growers around the country.

Karma series

‘Amanda’: Creamy center with rose tips. Short stems.

‘Bon Bini’: Yellow center with red tips. Long stems.

‘Choc’: Very dark red. Reports

on this cultivar vary across the country, from early- to late-flowering, and from short to good stem length. Most growers agree that it is not prolific, but customers like the color.

Corona series

Average to good producers, long stems, strong stems, good rebloom.

‘Corona’: Pale yellow center with peach or orange tips (appears apricot). Customer favorite, somewhat later to flower, slow to rebloom, aphid magnet.

‘Corona Pink’: Bright pink.

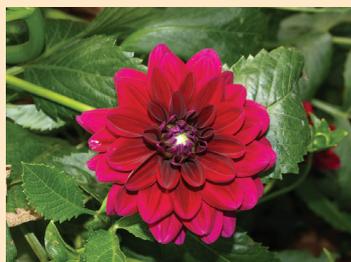
‘Corona Red’: Bright red. Color seems to fade out in late season.

‘Fiesta’: Yellow center with orange tips. New color, so not much is known about it yet.

‘Fuchsiana’: Same color as ‘Thalia’. Available as tubers only.



‘Lagoon’



‘Naomi’



‘Thalia’



‘Serena’

‘Irene’: Bright orange-red. Early to flower. Good for West Coast growers but “inconsistent” in Michigan. Flowers face out rather than up.

‘Lagoon’: Lavender to lavender-pink. Good producer in the Mid-Atlantic and upper Midwest. Highly susceptible to powdery mildew, shorter stems, not as prolific as some.

‘Maarten DeZwaan’: White. Longer stems than ‘Serena’, prolific.

‘Naomi’: Dark reddish-purple or dark red/burgundy. Customer favorite. Out-produces all other dahlias in the series and seems to perform well in most parts of the country. Resistant to powdery mildew, long stems, short vase life.

‘Prospero’: Pink. Good for West Coast growers, reported as average in the Midwest.

‘Royal’: Dark red. Large plants, late flowering, low to average producer.

‘Sangria’: Yellow center with pink tips. Customer favorite, long stems, comes into production slightly later in the season, average to good production, strong stems, long vase life, Japanese beetle magnet.

‘Serena’: White. Many growers report issues, such as shorter stems and a tendency for petals to brown on the edges, but they sell them because people want white flowers, especially for weddings.

‘Thalia’: Lavender-fuchsia. Long stems, later to flower, somewhat thin stems, highly susceptible to powdery mildew. Supposed to produce doubles but produces many singles (up to 95% for some growers).

‘Ventura’: Bright yellow. Long stems, average to good production, thin stems, insect magnet. Need to cut them tight.

‘Yin Yang’: Red and white bicolor. Tall stems, not prolific, Japanese beetle magnet.

Very large dahlias

Some growers offer the so-called dinner plate dahlias, which are over 10” in diameter. No one offers them exclusively, but they can constitute a small portion of sales and are good for calling attention to a market booth. Dinner plates last 3-5 days in a vase, 5-7 days if floating in a dish of water. Typical prices are \$3-5/ stem, depending on your market. A few recommended cultivars are:

‘Almand Joy’: Dark lavender with some white.

‘Bodacious’: Orange/yellow and red. Customer favorite.

‘Emory Paul’: Pink. Huge flowers (up to 14”).

‘Iceberg’: White with a touch of lavender.

‘Kidd’s Climax’: Pink with yellow base.

‘Papageno’: Yellow interior with muted pink tips.

Other dahlias

You can grow almost any dahlia for cuts, but some are better than others. Growers across the country have made the following observations.

‘A La Mode’: Orange with white tips. Recommended. Tips show browning when humidity is low, so cut tight and very early in the morning.

‘Amy K’: White to yellow base with pink tips. Recommended.

‘Bert Pitt’: Dark purplish-red base with white tips. Cucumber beetle magnet.

‘Blizzard’: Pure white. Long stems, large flowers, starts mid-summer, good producer.

‘Brookside Snowball’: White. Recommended. Highly susceptible to powdery mildew.

‘Cornel’: True red. Steady producer, good seller, fewer pests.

‘Crazy Legs’: Peachy pink. Not recommended.

‘Duet’: Reddish base with white tips. Productive, customer favorite.

‘Fire Magic’: Pinkish red similar to ‘Thalia’. Recommended.

‘Foxy Lady’: Muted pink with yellow base. Recommended.

‘Glory of Noordwijk’ (‘Noordwijk’s Glorie’): Orange. Not productive.

‘Intrigue’: Salmon pink. Not very productive.

‘L’Ancrese’: White. Recommended.

‘Maarn’: Peachy orange. Recommended, although color may wash out in hot climates.

‘MacAlister’s Pride’: Vibrant dark pink with yellow base. Recommended.

‘Nancilee’: Dark pink. Recommended.

‘Rebecca Lynn’: Pink. Recommended.

‘Rip City’: Dark burgundy, almost black. Prolific, good seller, fewer pests. Plants have a tendency to fall over.

‘Rose Toscano’: Peachy orange. Prolific, early, good seller, fewer pests.

‘Sophie K’: White. Good clear white but doesn’t like the heat. Insect magnet.

PROPAGATION

The usual method for propagating dahlias is to plant tuberous roots that look like runty brown sweet potatoes. Viable tubers must have an eye (a bud) in order to produce flowers later. Eyes are whitish or greenish bumps at the base of the plant/top of the tuber. Both growers and researchers have noted that small tubers do not create small plants later; one grower even prefers small tubers because they’re easier to plant and are more manageable later in the season.

However, almost all available Karma dahlias are sold as rooted cuttings. (It is now possible to buy a few Karma tubers.) Karmas are patented, and propagation by anyone other than a certified grower is prohibited. Bosgraaf Greenhouses is the only certified grower in the U.S. The two certified brokers (sellers) are Fred Gloeckner Co. and Germania Seed Co. (see Suppliers). One of the nice things about vegetative cuttings is that they are virus-free. This is especially important with dahlias, which are virus-prone. The breeding and patenting processes aren’t cheap, which is why Karma cuttings are more expensive.

Dahlias can be grown from seed. For seed-grown plants, Armitage and Laushman (2003) recommend the following:

1. Plant the seed and cover lightly with greenhouse media (sphagnum peat moss mix).
2. Water in and maintain 80-85°F and high humidity.

Stem cuttings may be taken of non-patented dahlias. Armitage and Laushman (2003) recommend this procedure:

1. Use the top of a stem with no flowers on it.
2. Take a cutting about 4" long, with two or three nodes.
Remove all flower buds.
3. Plant the cutting vertically in moistened greenhouse media (peat mix).
4. Use high humidity (such as a mist bench) and temperatures between 65 and 72°F for three to four weeks, until the cutting roots.
5. Remove it from the mist bench. Continue growing in the greenhouse until the cutting is ready to plant in a larger pot or outdoors.



To check for tuber viability, plant them in the greenhouse first. They will sprout in two to four weeks.

FIELD PRODUCTION

You will receive tubers or cuttings in the spring. Plant them in the field as soon as all danger of frost has passed. If you can't plant the cuttings immediately, you can store them in their shipping boxes at 45-50°F (Armitage and Laushman, 2003).

It's a good idea to plant both tubers and rooted cuttings indoors first.

Tubers. Often, growers plant tubers into pots or crates in the greenhouse preceding field planting. They have found that not all tubers are viable,

so this is an easy way to get a better stand in the field. Generally, two weeks is the length of time needed for sprouting, though some cultivars, and even some plants of the same cultivar, take four weeks.

Plant dahlia tubers in warm soil (60°F) or after the last frost date. Plant tubers horizontally 4-6” deep, 18-24” apart. Several growers have gone from 18” spacing to 24” spacing to provide better air flow around the plants and decrease pest problems later on, especially powdery mildew. Do not water in, or lightly water in if the soil is very warm and you expect high temperatures soon. Tubers will rot quickly and easily. If you are in a highly slug- and snail-prone area, apply bait at planting.

Begin regular watering only after the tubers send up shoots. By the same token, don’t apply mulch right away. Wait until the new sprouts are up.

Cuttings. Vegetative cuttings can be planted about two weeks earlier than tubers. They must be hardened off before being planted outdoors.

Year-Round Dahlias

Vicki Stamback in Stillwater, Oklahoma, grew dahlias in the field briefly, but they were a total failure, due to weeds, insects, wind, and especially heat. She has been growing in the greenhouse for five years and has dahlias in winter, when no one else does, even Dutch growers.

Tubers or cuttings can be planted any time during the year in protective structures. Vicki Stamback receives cuttings in August, plants in the greenhouse in September, and begins harvesting in November. She has good luck growing through winter, since insect pressures are lower (especially from spider mites), and the dahlias like the cooler weather.



Raised greenhouse beds keep tubers well drained.

GREENHOUSE PRODUCTION

Numerous growers have begun growing dahlias in protective structures, such as hoophouses, high tunnels, or unheated or low-heat greenhouses, for several reasons. In windy areas, field-grown plants fall over constantly, regardless of staking. Growers can plant earlier and start harvesting earlier in protective structures. In fall, plants in hoophouses survive early frosts well, continuing to produce for several more weeks. Most growers get longer stems from plants in protective structures.

A few growers have successfully grown dahlias in large (3-gallon or 12” diameter) pots. One Illinois grower plants tubers in March into 3-gallon pots, and then grows in a hoophouse with a gravel floor. She uses a soilless mix with 20% compost and drip irrigation. She fertilizes with fish emulsion every 2-3 weeks and topdresses with pelleted chicken manure. She gets production in June in Zone 4.

PINCHING AND DISBUDDING

Depending on the cultivar and amount of time in the greenhouse or field, plants will be anywhere from 4 to 8” tall when they are ready to pinch. Pinch out the top set of leaves and the stem – everything above the third or fourth node. Plants will begin to branch from that point.

Most growers pinch out the top of the plants at 3 nodes, though some pinch higher, at 4 nodes. This provides better cut stems. Non-pinched plants can grow very tall (over 7’), and produce more hollow stems, and with more stems falling over. Also, florists often prefer to work with smaller stems and smaller flowers for bouquet work. Pinching the terminal shoot results in lots of side shoots and more (but slightly smaller) flowers. Pinching will also delay flowering by 1 to 2 weeks.

At North Carolina State University, researchers found that unpinched plants produced one-inch longer stems and flowered two weeks earlier than pinched plants. Additionally, unpinched plants produced more stems, with ‘Naomi’ producing 36% and ‘Thalia’ producing 48% more marketable stems than pinched plants. However, growers who don’t pinch have noticed that their plants get very tall (too tall to harvest

easily), and they have more hollow stems early in the season. Hollow stems are more easily broken during harvest and transport, and by the florist or final consumer.

Another type of pinching is disbudding, when side flower buds are removed. Disbudding is highly labor intensive, and it's easy to break off the wrong bud, but to produce a small number of large terminal flowers, side shoots can be removed easily, thus allowing all the stem's energy to be directed to the one topmost flower. No growers have reported doing this, but it does work.

GROWING ON

Dahlia cuttings typically take 8 weeks to flower. Add one to two weeks if you pinch. Tubers flower 9-13 weeks after planting, depending on cultivar and temperature, although later planting usually results in faster flowering (Armitage and Laushman, 2003).

Young stems contain pith (white spongy material in the middle of the stem) but become hollow as they age. Flowers are terminal (borne at the top of the stem), with two side flowers emerging from the terminal node.



Stems become hollow as they age.

FLOWERING CONTROL

Dahlias are long-day plants that flower best when daylength is 13 to 15 hours. Short daylengths cause tuber formation rather than flower formation, and already formed flowers will not open under short days.



**Shade-grown (L) vs. full-sun plants
in Oklahoma.**

For late fall and winter production, it will be necessary to add lights. Incandescent light bulbs have been the standard type used, but are being phased out. Fluorescent bulbs are cooler, have a better spectral balance (more light in the blue range), and are more efficient (thus cheaper to run), but cost more initially. Lights can be

used to extend the day (turned on when the sun sets until approximately 10 pm), or used as night interruption (turned on during the middle of the night from 10 pm to 2 am). Timers are used to control the lights. Be sure to have at least 10 to 25 footcandles of light, when measured at the plant level.

TEMPERATURE/LIGHT

A perfect day for a dahlia would be around 80-85°F during the day, with night temperatures falling to 62-65°F. Higher daytime temperatures can reduce flower quality, and cooler night temperatures can slow down flower development. (Remember, the plant is originally from the mountains of Mexico, where day temperatures are warm but drop at night.)

All recommendations for dahlias are to plant in full sun (at least 8 hours per day). This is true for areas with cooler summers, like the Pacific Northwest. However, in areas with very high light (and heat), you may want to provide some shade.

In Zone 6b-7a Vicki Stamback had good results growing under 60% shade cloth. Her shade-grown plants grew faster and taller, were healthier, and produced flowers earlier than plants grown in full sun.

Lynn Trott, an organic grower in Toano, Virginia (Zone 7), states that afternoon shade is better for her dahlias.

In winter, Vicki keeps her greenhouses at 40°F at night and around 70°F during the day. She provides 14 hours of light with incandescent lights spaced every 4 feet on a string, about 10 feet above ground level. These lights come on at sunset, beginning in September.



A lighting system is necessary for winter production.

WATER/NUTRITION/SOIL

Dahlias need plenty of water during the growing season, but they hate wet feet. A common mistake of new growers is overwatering the tubers or new cuttings before they've started to grow. Usually, plants will need to be hand-watered while they are still young.

Underwatering during the growing season results in fewer flowers. Drip irrigation is recommended, since it can help keep diseases (especially powdery mildew) in check. When plants are about a foot tall, drip irrigation can be used.

Nitrogen is necessary, but overapplying it will result in weak stems and lots of leaves, with small or no flowers. Tubers which have received too much nitrogen will rot or shrivel during storage. Use lower nitrogen, high potassium (K), and high phosphorus (P) fertilizers, such as 0-20-20, 5-10-10, or 10-20-20. Apply fertilizer within 1 month after planting and repeat about 1 month later, or as indicated by soil tests.

Plants need more K when they begin to flower. Rock phosphate, fish meal, fish emulsion, and bone meal can provide phosphorus. Lynn Trott,

an organic grower, applies bone meal at ½ oz. per square foot about one month before planting, then topdresses with compost in midsummer and fall. Organic sources of potassium include wood ash, greensand, and sul-po-mag (sulfate of potash magnesia).

Vicki Stamback uses the 6-month formula of Osmocote at planting, then applies liquid feed and side-dresses as indicated by soil tests later in the growing season. She applies 20-20-20 or 10-30-20, based on weekly soil tests. She also applies bonemeal when planting tubers and when they cut plants back after Mother's Day.

Try to keep the soil pH around 6.0 to 6.5. Yellow foliage could indicate iron deficiency if pH is high (above 7.5).

SPACING AND SUPPORT

Most growers plant dahlias 18 to 24 inches apart with 18 to 24 inches between rows. Armitage and Laushman (2003) recommend planting 2' apart, to prevent tangled stems and diseases. Nonpinched plants can be spaced more closely than pinched plants.

Most growers must stake their dahlias. This can be done using netting, caging, or tying up in a stake-and-weave system. Many growers use Hortonova netting, but it can be difficult to cut stems through the netting without cutting the netting itself.

Caging and individually tying up plants are highly labor intensive, and these methods won't work for growers with more than a handful of dahlias. Caging and tying the plants will reduce sunlight reaching the bottom of the plant. Although this reduces blooms near the base of the plant, this is not a problem, since the better blooms are produced near the top of the plant. However, reducing airflow is a concern for most dahlias, since reduced airflow equals more powdery mildew (PM). For cultivars particularly prone to PM, you may want to use a different system from the rest of your dahlias.

Vicki Stamback has good luck using a stake-and-weave system. She places 4' rebar about every 4-5 plants and uses nylon baling twine

between the stakes. Plants are first tied when they are about one foot tall, then more twine is added every 8 to 12 inches up the rebar as the plants grow. A California grower sets his T-posts every 20 feet. Another grower buys stock panels 6 feet wide by 10 feet long. The ends are inserted into the ground to form a half moon aboveground.



Stake and weave system.

You can also make your own netting out of concrete reinforcement wire. The advantage is that this can't be damaged during harvest.

At Swan Island Dahlias in Canby, Oregon, plants are kept upright by hilling soil around the base of the plants, rather than netting.

DISEASE CONTROL

Powdery mildew (PM), is a common which makes the leaves look as though they've been lightly dusted with flour. PM is caused by a fungus which is most active when air temperatures are between 68 and 77°F and relative humidity is between 40 and 100%, so PM is worse when the weather is cool and wet. Lower light is also favorable to PM, and lower leaves become infected with PM before upper leaves. Swan Island Dahlia's preventative spray program begins in late July and continues throughout the growing season.

Some growers aren't worried about powdery mildew if it appears only on lower leaves, which are stripped off before sales. However, a heavy infestation of PM will affect



Powdery mildew.

plants' ability to photosynthesize. This creates a deficit of energy, so tubers are smaller as they enter winter. Smaller, less healthy tubers are less likely to return next year.

PM is especially bad in high tunnels, hoophouses, and greenhouse – anywhere there is reduced airflow. One grower, for instance, noticed that he had more powdery mildew where his supports were holding plants too tightly. Drip irrigation and good ventilation, aided by running greenhouse fans, will help keep PM in check.

Several landscape species, such as roses, euonymus, and crape myrtle are highly susceptible to powdery mildew. Don't plant dahlias near these species. Don't overfertilize with nitrogen, since this creates lots of lush growth, which is more susceptible to PM. Overhead irrigation can actually decrease PM, because spores cannot germinate while the plants are wet.

Broad-spectrum, conventional fungicides such as Benlate, Daconil, Funginex, and Fungonil control all fungal diseases. Sulfur can be used, but it often kills predatory mites which may be keeping spider mites under



Keep greenhouse fans running to alleviate powdery mildew.

control. Sulfur should be applied in hot weather; it is phytotoxic.

Other organic fungicides include Mildew Cure, which uses garlic and essential oils, and Remedy, which uses potassium bicarbonate (baking soda). Many growers have had good luck using homemade baking soda mixes. The typical formula is one tablespoon baking soda to one gallon water, plus a spreader-sticker like a couple of drops of dishwashing soap. A Pennsylvania grower had good success using a preventative milk spray (1 part whole milk to 9 parts water).

Lynn Trott does not use any synthetic pesticides and believes that having healthy soil creates healthy plants. She incorporates high levels of organic matter into her growing beds and has not had disease problems.

INSECT CONTROL

Several growers have noticed that some cultivars or colors suffer more from insects than others. Some pests, like Japanese beetles and grasshoppers, seem to be less prevalent in greenhouses or high tunnels, while others, like spider mites, are worse. Look at leaf undersides to see insects.

Spider mites are a problem for most dahlia growers, especially in hotter, drier climates and in greenhouses. You will first notice a stippling effect on leaves (looks like little yellow dots all over the leaves), followed by leaf browning. As mites progress, they form webs at plant terminals (the tops of stems). Spider mites are almost impossible to see with the naked eye, but are easily seen with a 10x lens. They are mostly found on the undersides of leaves, but in heavy infestations they can be found on the top sides, too.

Two-spotted spider mites, the most common, are yellowish with two dark brown spots on either side of their thorax (about halfway down the mite). In a greenhouse, they are impossible to eliminate and extremely difficult to control. Try miticides such as Akari 5SC, Avid, Sanmite, Shuttle, Hexygon, Judo,

and Floramite, or the only systemic miticide – Kontos. Swan Island Dahlias begins a preventative spray program in late July, using Malathion, Bon-Neem, and other miticides. Armitage (1997) states that southern growers will need to spray every two weeks. An integrated biological control plan can be effective. Biocontrols include predatory mites and lacewings.

Because mites (and thrips) are so small and hard to find, you can try this: Hold a piece of white paper under a leaf or flower. Tap the plant part several times. Mites and thrips will fall onto the paper and be easier to see.

Slugs and snails are problematic in cool, wet climates or in cool, rainy weather. They do most of their damage at night. Both pests eat holes in the foliage, but they will also eat emerging sprouts and even new stalks. Use slug bait to control them, starting at planting or up to two weeks after planting tubers. Reduce their habitat by eliminating their daytime hiding places, like the bottoms of boards or under rolls of weed mat. Water early in the day so surfaces dry out before dark. Hand-picking during

the night is effective, as are Bordeaux mixture (lime-sulfur) and pepper spray.

Cucumber beetles eat petals and pollen. Generally, pests seem worse on light-colored cultivars, and this holds true for cucumber beetles, so you will first see



Cucumber beetle.

damage on white and cream colors, then yellow, then every color. Cold, wet winters and springs help decrease the population. Vicki Stamback uses a vanilla spray consisting of 2 teaspoons pure vanilla extract per gallon water. She doesn't know if this kills or repels them, but the pests leave. She applies it twice per season, one week apart. A cucurbitacin lure will attract beetles. Neem or carbaryl (Sevin) are also useful. Biocontrols include lady beetles, lacewings, and parasitic nematodes. Cultural controls include mulching, which prevents adults from laying eggs near the crop, and using a trap crop like cucumber to lure beetles away from your dahlias. An entomopathogenic fungus sold as Mycotrol-O is also labeled for cucumber beetle.

Corn rootworm beetles. Northern corn rootworm, Western corn rootworm, and Southern corn rootworm (same as cucumber beetle) damage pollen and petals. All are worse in Corn Belt states. In some years, pest pressures are insurmountable and daily spraying with broad-spectrum insecticides will not stop the insects from taking over. See the recommended controls for cucumber beetles.

Grasshoppers are especially prevalent in the Midwest and upper Midwest. Damage looks like petals or leaves have had bites taken out of them. Vicki Stamback found that BrowseBan (a hot pepper spray used to repel deer) works, and that Mildew Cure (a fungicide containing garlic and essential oils) was effective early and late in the season, but not so much in mid-season. Try general pesticides such as Scimitar CS

or Orthene, but use a surfactant to get through the grasshopper's very thick cuticle. Otherwise, the pesticide will just slide off. In order to be effective, NoloBait, which contains a protozoan that parasitizes grasshoppers, must be applied on a very wide scale (read: county-wide).

Thrips. Symptoms include twisted petals or leaves, brown petal edges on lighter cultivars, and white spots on petals of dark cultivars. You may get some leaf yellowing or stippling, too. Thrips can be seen only with a hand lens. Use the white paper trick discussed above under spider mites. If in a greenhouse, use yellow sticky cards to monitor numbers. Make sure plants are well watered consistently. Although neem is registered for use on thrips, it is not usually very effective. Use spinosad (Conserve). For increased effectiveness, add brown sugar to the solution. Other controls are Avid and Pylon. Maine grower Matt Gerald used beneficials to control thrips in his high tunnels. Biocontrols include parasitic wasps and predatory mites.

Japanese beetles. If you live in an area with Japanese beetle pressures, you know that these pests will eat just about anything,

and dahlias are no exception. One grower cuts stems early and removes the damaged outer petals. Another grower noticed that Japanese beetles were much worse the season after a rainy August. In fall, apply beneficial nematodes (*Steinernema glaseri* and *Heterorhabditis bacteriophora*) and milky spore disease (*Bacillus popilliae*) to hold down next year's population. Reapply in mid-spring. If using Japanese beetle traps, place them as far away from the crop as possible.

Aphids feed on flower petals. Symptoms include leaf or petal curling, but other signs of aphids include honeydew (sticky substance) and sooty mold (dark patches) on leaves. You will often see aphids on the upwind edge of a field, so monitor those areas closely. Armitage (1997) states that aphids are one of the two insect pests that all dahlia growers face. It's a lot of work, but one of the best ways to control aphids is to hit them with a hard spray of water from the hose. Since aphids congregate near the growing points at the tops of stems, focus the water sprays there. Aphids also have several natural enemies, including ladybugs (ladybird beetles) and parasitic wasps, lacewing larvae, and hoverfly

larvae. High levels of nitrogen fertilizer will encourage aphids, so don't overapply. Chemical control methods include BrowseBan, neem, horticultural oil, insecticidal soap, Avid, and Orthene.

Caterpillars eat both petals and foliage. They create holes or areas that look like they're had a bite taken out of them. Hand-picking works with small infestations. Bt (*Bacillus thuringiensis*) is specific to caterpillars but must be reapplied often and when caterpillars are young. Neem/Azadiractin (Azatin, Ornazin, Molt-X) is also effective. *Trichogramma* wasps are the most widely available biocontrol.

Leafhoppers may be a pest in some years. Symptoms are usually seen as whitish leaf stippling. You can also see drying, yellowing, or browning of leaf margins or the entire leaf. Use sulfur, diatomaceous earth, horticultural oil, or a copper and pyrethrum mix. Insecticidal soap may

work on young leafhoppers. These insects are somewhat migratory, so an attack could last a couple of weeks and then the insects seem to disappear overnight.

Stem borers do just that—bore into the stem. You may see their brown frass (poop) and stems will wilt. The two most prevalent borers are corn borer (*Ostrinia nubilalis*) and stalk borer (*Papalipema nebris*). Contrary to popular opinion, systemic insecticides such as Orthene are not effective against borers. Stems with borers inside must be cut out and disposed of. To alleviate the situation for next year, apply beneficial nematodes (*Heterorhabditis bacteriophora* or *Steinernema* spp.) at planting time or immediately thereafter. Stalk borers are especially prevalent in fields with heavy weeds during the previous growing season. Use yellow sticky cards to catch adult moths before they lay eggs.



Frass and plant damage from caterpillars.

The Pesticide Treadmill

A typical field cut flower operation has a broad range of crops, mimicking a natural ecosystem with a mix of many plant species and insects. Within that ecosystem are insects that feed on plants and insects that feed on other insects. Conventional pesticides such as Orthene can be used to control problem insects, but can start growers on what is known as the pesticide treadmill. By applying a broad-spectrum insecticide, you kill not only all the “bad bugs”, but all the “good bugs” as well – those naturally-occurring parasites and predators present in every field or greenhouse, as well as pollinators like honeybees that are necessary for fruiting crops. Even “benign” products such as insecticidal soaps and oils can cause the pesticide treadmill. Use narrow-spectrum pesticides when possible and rotate them (especially those with the same mode of action). Sometimes growers have tried everything they can think of and nothing will work, and they feel that aphids, spider mites, and grasshoppers are carrying off their field. If the situation really is bad, a one-time shot of something like Orthene can eliminate everything and you can attempt to start over. But please reserve your use of harsh pesticides until you are positive you have no other choice. Try to figure out what went wrong and begin planning early to avoid repeating that mistake next year.

Greenhouse production provides additional challenges. Generally, far fewer crops are grown within a greenhouse than a field, reducing the ecosystem effect, and the greenhouse may be closed off from the outdoors, preventing the movement of naturally-occurring parasites and predators. We can replace some of the natural enemies, but it can be difficult to create the right balance, as some of the natural enemies have specific environmental needs. Thus, greenhouse growers tend to rely more on conventional pesticides than field growers. However, progress is being made in biological control of greenhouse pests, as evidenced by some of the growers comments listed above and by the amount of research results being produced.

Other possible pests include **earwigs** and **tarnished plant bugs**. You can use general pesticides such as diatomaceous earth (DE), pyrethrum, kaolin clay (Surround WP), copper, Bordeaux mix, insecticidal soap, or neem if pest numbers are high.

WEED CONTROL

Dahlias don't compete well with weeds; don't plant them in grass. Weed plants carefully, especially when they're young. Several growers report that they hand weed only, since herbicides are not dahlia-friendly. However, there is some research showing that a mixture of oryzalin and isoxaben is not harmful to dahlia (Armitage and Laushman, 2003).

OVERWINTERING

Leaving tubers in the ground: Dahlias may be left in the ground if the soil doesn't freeze down to where the tubers are growing (USDA Hardiness Zones 7-10). Night temperatures of 15°F will kill tubers in the ground.

Dahlias left in the ground over winter produce much larger plants the next year, produce cut stems earlier, and this method saves a lot of labor to boot. At North Carolina State University, overwintered tubers produced marketable stems beginning in mid-summer, while newly planted rooted cuttings did not produce cut stems until September. However, Armitage (1997) noted that some growers in Zones 7-10 see better results when lifting their dahlias annually.

Tubers left in the ground can rot, especially in climates that receive most of their rain during the fall and winter months, such as the Pacific Northwest. At Swan Island Dahlias in Oregon, plant debris is removed in November, and the entire area is then covered with plastic, and topped with organic mulch, which is pulled off in March. For not-so-soggy climates, skip the plastic and cover the bed with at least 6" of mulch, 9" is preferable. Pull back the mulch in mid-April and apply compost or fertilizer.

Tubers left in the ground can be dug up and divided in spring, after the sprouts have begun to emerge. To divide, separate the tubers by cutting them apart. Allow the cuts to suberize (heal over) for a day, then replant right away. If they are left out for longer, they will start to shrivel. Plants can also be divided in fall, although it can be difficult to find the eyes on the clumps, which are found at the base of the stalk. All new divisions need at least one eye to produce new shoots. Some growers wing it and simply divide the clump into two or four pieces, using a sharp knife or an ax.

Digging tubers in fall: In colder climates, you will want to dig up tubers in fall and store them over winter. To do this, wait until after the first hard frost, which should kill the above-ground foliage. Remove all the debris. Then, one to two weeks later, dig up the tubers with a spading fork. Clean them well. Cure tubers for a few days in a dry area before moving them into storage. Store them in a cool place (45-50°F) over winter. They can be stored in lightly moistened media such as vermiculite, shredded or crumpled news-paper, peat moss, sand, or even pet bedding material, in cardboard boxes or bulb crates. If the media is not damp, tubers will dry out. If too wet, they will rot. Check them periodically throughout winter.

If tubers are dug too early, they will not store well because they are too small and haven't stored enough energy. For most areas, even if there has been no hard frost by mid-November, you can go ahead and dig or mulch. Banner Flower Farm overwinters dahlias in a storage building kept at 40°F, where tubers are covered to prevent light from reaching them. Patricia Banner notes that some dahlias, especially newer cultivars, don't store well. She thinks this may be due to a latent virus.



Terminal node with two side flowers.

HARVEST

Harvest stage: Most growers harvest at the breaking stage, when the very first petals begin to open and the bud has good color. Vicki Stamback reports that dahlias grown in winter can be harvested much later, with most of the flower open, and still have excellent vase life. Some growers always cut stems when flowers are halfway or fully open, but NCSU researchers showed that flower buds cut at the breaking stage (with one petal open) and 50% color had the longest vase life. If cut at this stage, the flowers take 3-5 days to open fully. ‘Thalia’ lasted 12 days when placed in holding solutions containing either 2 or 4 percent sugar, but ‘Naomi’ cut at the breaking stage did not fully open and didn’t develop full color, no matter what they were held in (water, sugar solution, or commercial solution).

Location on plant: Always cut above a node. Which should be cut: only the terminal bud, or a longer stem that includes the two side buds? It depends on the plant and the market. If the terminal flower has a long stem and the side buds are short, cut the whole thing. If the terminal is long and side buds are long, cut

only the terminal stem. If your customers want really long stems, you may have to cut the whole stem regardless. Keep in mind that the terminal stem alone can be as long as 18 to 24 inches. Later in the growing season, you may notice that side bud stems grow shorter. Dahlias have a terminal node with two side buds.

If you don’t cut the terminal stem, you’ll get less branching. In other words, if you don’t cut the stem for sale, you’ll want to cut it out of the plant. One grower mentioned that she gives these short-stemmed flowers away at her farmers’ market, just to create excitement, and recommends that customers float the flowers in a bowl of water. After the terminal stem is cut, you can also cut stems farther down; these will often have an unopened bud above the open/opening flower. Deadheading spent or poorly opened flowers is also recommended.

Time of day: Harvest in morning, as early as possible. In a push, dahlias can be cut in the evening, but never, under any circumstances, during the hot part of the day. Despite recommendations in many books, most growers cut stems



into cool water, not hot. As with any cut stem, remove any foliage that would be under water. Dahlias must be harvest every other day, or every day during peak season.

Time of year: For spring-planted rooted cuttings growing in the field, expect to begin harvesting no earlier than mid-August. For growers in cooler climates, September is more likely. Flowers will continue to be produced until frost.

Dahlias grown in protective structures yield earlier harvest. For Banner Flower Farm in Michigan, this translates to harvest beginning the first week of June. Marc Kessler in California begins harvest in May.

Vicki Stamback begins harvesting her greenhouse-grown dahlias in November and sells them during Christmas, Valentine's Day, and Mother's Day. After Mother's Day, she cuts back the stems to a few inches and allows the plants to resprout. This is done for two reasons: when the weather gets hot, the stems get much shorter, and, she's concentrating on fall sales. Some of her first flowers will have short stems (8 inches), but florists will buy them because they have no other source of dahlias

during winter. Vicki says that, if the stem is long enough to stand up in the bucket, she'll cut it.

Postharvest handling: Most dahlias last about 5-7 days, although anecdotal evidence provides you'll hear vase life of 4-10 days, depending on which literature you pick up or whom you ask. Dahlias are not ethylene-sensitive, so treating with STS or 1-MCP does not lengthen their vase life.

Growers have reported that they cut stems into everything from tap water to Quick Dip to holding solutions. However, most have found that cutting into cool or warm (not hot) tap water, then moving cuts into a floral preservative in the cooler overnight, is best. NCSU research with Karma dahlias showed that commercial holding solutions such as Chrysal Professional 2 Processing Solution or Floralife Professional increased vase life. When 'Thalia' was cut fully open, it lasted one day longer in a holding preservative instead of water. If cut when the bud was breaking, the flower lasted 3-4 more days when a holding preservative was used.

Growers have other recommendations for specific situations:

For organic production: Lynn Trott immediately dips the stem into cool water, then strips off the lower third of the leaves before putting the stem back into water. She then fills the bucket to the brim and allows the flowers to sit for 1-2 hours.

For hot weather harvesting: Cut into tap water, recut and place in Quick Dip, then into warm water with preservative.

At Swan Island Dahlias, they harvest into very hot water (160-180°F) and leave the stems in this water for at least an hour, while the water cools down. From this treatment, stems last 4-6 days.

For transport: Vicki Stamback stated that she does not use floral preservative on her dahlias since she discovered that any preservative sloshed onto leaves and flowers during transport discolored them.

Some literature recommends searing the cut stem ends for a few seconds. This is impractical for most growers, and several have reported that it does not work.

When customers report short vase life:

- Check that harvesting and holding buckets are very, very clean.
- Place dahlias in the cooler overnight. For many growers, this has been key to good hydration.
- Recognize that late-season dahlias often have reduced vase life.
- Inform customers that dahlias last only 6-7 days at most.

Most flowers have decreased vase life when placed in floral foam like Oasis blocks, but NCSU researchers found that foam did not decrease vase life of Karma dahlias. Growers report that dahlias typically last 3 to 4 days in foam.

STORAGE

Dahlias can be put into cold storage, but this will reduce their vase life. NCSU researchers showed that ‘Thalia’ stored at 34°F for up to one week reduced the vase life from 8.4 to 6.6 days. Growers have reported holding dahlias in the cooler for a week, then using flowers for event work only. If dahlias must be held, they must be held in high humidity (Armitage and Laushman, 2003).

Never ship or transport dry.

SELLING AND MARKETING

Current (2010) prices average between 85 cents and \$1.75 per stem retail, about half that wholesale. Better prices can be obtained for early, organic, and dinner plate dahlias.

Competition will be almost exclusively from local sources. However, dahlias grow throughout most of North America. They are also grown commercially in Europe and Japan. Even though they will grow almost everywhere, they don't ship very well, so locally-grown dahlias should look much better than any shipped in.

MISCELLANEOUS PROBLEMS

Rootbound plants. When dahlias are held in pots or plug trays too long, they get rootbound and start to flower when only 12" tall. Other problems arise from rootbound plants as well.

Cultivar substitutions by suppliers. This does happen regularly, but many growers have found exciting new dahlias this way.

Frost protection for field-grown plants. A few growers have had good luck using overhead irrigation for frost protection. Virginia grower Andrea Gagnon saved her dahlias from early frosts this way. She said she lost a number of stems due to breakage, but the plants themselves survived long enough to produce more flowers and pay for the additional irrigation setup.

Other problems. Some problems reported by growers which seem to be breeding-related or supplier-related, are probably weather-related instead. In 2008, many experienced problems with their crops soon after planting, and the supplier was thought to be at fault. One grower speculated that the rapid weather shift that year, from quite cool to very hot, was probably the real reason for poor growth.



SUPPLIERS

Karma dahlia suppliers:

Bosgraaf Greenhouses is the only U.S. grower licensed to propagate Karmas, which were bred in the Netherlands. There are two brokers, Fred C. Gloeckner Co. and Germania Seed Co.

Bosgraaf Greenhouses
Hudsonville, Michigan
www.bosgraafgr.com
(616) 669-1106

It is possible to buy plants from Bosgraaf, but not online. Also, they won't ship when it's hot in your area.

Fred C. Gloeckner and Company
Harrison, New York
www.fredglockener.com
(800) 345-3787

Contact a representative for availability (not available online) Plants are sold unpinched, with 72 plants per tray. The minimum order is 4 trays (288 plants). There is also a sampler packet offering 6 trays of all cultivars. Plants are available from March 1 to June 1.

Germania Seed Co.
Chicago, Illinois
(800) 380-4721
www.germaniaseed.com
Offer rooted and unrooted cuttings. Ship from November to June. Minimum order is 8 trays

or rooted cuttings (576 plants) or 1200 unrooted cuttings.

GroLink
Oxnard, California
www.grolink.com
(805) 451-6319
Call for availability.

Tuber suppliers:

There are many, but growers have recommended these.

Banner Flower Farm
Allegan, Michigan
(269) 673-8714
www.bannerflowerfarm.com
Banner Flower Farm trials all its dahlias for cut flower production before offering them for sale. They will soon be offering heirloom types and hope to breed more dahlias suitable for cuts. They are ASCFG members and are VERY knowledgeable about cut dahlias. Offer wholesale prices.

Swan Island Dahlias
Canby, Oregon
(800) 410-6540
www.dahlias.com
Swan Island sells primarily to the public. They can offer advice on which cultivars make the best cuts, but they do not offer Karmas. No minimum order.

Ednie Flower Bulb
Freedom, New Jersey
(800) 24E-DNIE
www.ednieflowerbulb.com
Wholesaler offering Karma tubers
and many others. Minimum order
is 15 per cultivar.

Van Bourgondien
Virginia Beach, Virginia
(800) 622-9997
www.dutchbulbs.com
Offer Karma tubers and many others.
Retail only, no minimum order.

Ferncliff Gardens
Mission, British Columbia
(604) 826-2447
www.ferncliffgardens.com
Minimum order is \$30. Do not
offer Karmas.

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\$15.00
ISBN 978-0-615-57887-3
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