

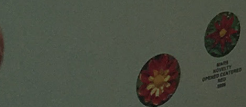
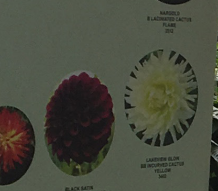
The Colorado Dahlia Society



Dahlia Culture

*A collection of articles by current
and past members*

COLORADO DAHLIA SOCIETY



SIZE	TOP #	FORM	Prod #
AA	0	0	
A	1	0	1
B	2	1	2
BB	3	2	3
BB	4	3	4
M	4	3	1
	1C	1	

OTHER COLORS	CCOLOR	LAZ 2 FT
FORM 1 1/2 x 4 1/2	WHITE	21
BA	YELLOW	22
BB	ORANGE	23
F	PINK	24
TE	DARK PINK	25
WL	RED	26
KK	DARK RED	27
PE	LAURENCE	28
AN	LAURENCE	29
HO	LAURENCE	30
CD	LAURENCE	31
OF	LAURENCE	32
Q	LAURENCE	33
3	LAURENCE	34
1	LAURENCE	35
1	LAURENCE	36
1	LAURENCE	37

A man in a light blue polo shirt and jeans is looking at the display board.

Two women wearing large straw hats and a blue sleeveless top are looking at the display board.



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1. *Selecting Dahlias to Grow*

By Louise Lawrence

A good place to start is with an understanding of the resources available to assist us in making choices and obtaining the tubers or plants we want. Then you may ask, “Which Ones Do I Choose”?

“[The Fabulous Fifty](#)” on the [American Dahlia Society’s website](#) is a good starting point. It provides a quick overview of the best of the various kinds and sizes of dahlias raised by most dahlia societies. It is a rank ordered list of those dahlias that received 50 or more blue and higher awards in all the shows conducted by dahlia societies affiliated with the American Dahlia Society. The list is maintained and updated annually by the American Dahlia Society. Pictures, their classifications, and, in some cases, brief descriptions of most of the dahlias in the “Fabulous Fifty” are available on this website.

Your local “garden centers” typically carry dahlia tubers with pictures shown on the packages. However, very few of the dahlias they carry are registered with the American Dahlia Society. Most of the dahlias they carry are not “show quality.”

A list of dahlia growers that sell dahlia tubers and/or plants are listed in the Supplier List on this site. An on-line version of the American Dahlia Society’s “[Classification and Handbook of Dahlias](#)” is also available

An on-line listing of local Dahlia Societies that are affiliated with the [American Dahlia Society](#) is available at <http://www.dahlia.org>. One of these societies may be near you, in which case you may wish to contact them for help. They will be pleased to get you started growing dahlias.

Which Ones Do I Choose?

For what purpose do you wish to grow dahlias? How much room do you have? Will you have beds to grow show dahlias or do you just want some foliage and cutting flowers to enhance your landscape. Different dahlia cultivars range in height from twelve inches to

seven or eight feet. One “tree dahlia” can reach twenty feet. Most plants are around three or four feet. My annual flower beds will be lined with border dahlias this year. Maybe they will be no taller than two feet with a profusion of blooms.

Buying dahlia stock is much like buying anything else—you get what you pay for. Needless to say, there are some really beautiful dahlias out there that are not on the Fabulous Fifty list. If you want to start with possible show winning blooms though, look at the blossoms pictured in the “Varieties Gallery.” You should also know that it is almost impossible to capture the true color of deep burgundy, reds, purples, and lavenders on film. Not very many flowers are the shocking pink you will see on the screen. Sometimes the description is not really what you think it should be because the number of colors allowed is very limited. You probably already know what your favorite flower color is. Or maybe you want the dahlias to carry out a color theme for your landscape. My favorites are deep, rich colors in large blossoms such as Spartacus and Islander. Phoenix is a real eye catcher and the color on screen is its true color. However, Phoenix may be seven feet tall. I also love light blends and incurved cactus varieties. “Light Blend” was totally meaningless to me before I studied the pictures. Most are pink/yellow or light yellow/orange. Camano Messenger is one of my favorites and I have yet to see a picture that accurately captures its depth and color. There are dark blends, bi-colors, variegated, and on and on.

Talk with someone who has grown dahlias—they all like to talk about them. The size of the plant and its blooms depend upon how well it likes where you place it and whether you do all the necessary pruning and disbudding to control growth. You probably will not have a ten inch bloom unless you prune everything off one branch except one bud. You must remove spent blooms and remove extra buds if you want the plant to blossom continuously. I suggest you start with a few plants of your favorite color, size of bloom, and a combination of formal decorative, informal decorative, and cactus varieties. Once you’ve grown a few, you’ll be hooked. We have trouble every year deciding what we will grow and I’d like to have one of everything. I know of no other more beautiful flower.

2. Propagation

There are three common (and some not so common*) ways to propagate dahlias:

1. [Propagation by Tuber Clump Division](#) (Section 14, page 87)

This section explains and illustrates how to divide tuber clumps for successful propagation by tuber clump division.

2. Propagation by Seed:

A. Cross Pollination, Collecting and Storing Seed.

B. [Growing Dahlias from Seed, By Don Mcallister](#) (Section 4, page 45)

3. Propagation by Cuttings ([Two Perspectives](#), page 3)

A1. Sprout Cuttings for Those Interested in Various Processes...By Ben Lawrence ([Discovering “What Works”](#) page 5)

This section explains and illustrates various methods of propagating by sprout cuttings. This year the focus is on increasing the percentage of successful propagations by sprout cuttings and comparing various growing mediums. As with tuber division, this method of propagation produces clones of the parent plant.

A2. Sprout Cuttings Without Frills or Special Facilities...By Calvin Cook ([“A No Frills Approach”](#) page 12) Calvin Cook demonstrates that sprout cuttings can be taken and grown with inexpensive, readily available equipment in your home. This approach also produces clones of the parent plant.

A3. [Sprout Cuttings: A Running Essay](#). ...By Tom Cleere (page 14)

B. [Leaf Cuttings](#)...By Ben Lawrence (page17)

This section explains and illustrates various methods of propagating by leaf cuttings. This year the focus is on increasing the percentage of successful propagations by sprout cuttings and comparing various growing mediums. Propagation by leaf cutting also results in clones of the parent plant.

*Uncommon ways of propagation are sometimes referred to as “Plants From Test Tubes,” “Micro Propagation,” and “Tissue Culture Propagation.” “Meristem Cloning” would also be considered uncommon.

Propagation by Cuttings: Two Perspectives

By Ben Lawrence and Calvin Cook

"If you have one tuber of a particular dahlia and you want to grow several plants of that dahlia without buying more tubers, propagation by taking either sprout cuttings or leaf cuttings may be for you. If you're one of those people who've come to believe that dahlia plants grown from cuttings produce better blossoms, taking cuttings may also be for you. If you are just curious about starting a plant by cutting off a sprig or a leaf and part of the stem and persuading it to grow, propagation by taking cuttings is certainly for you. I take cuttings because I am curious about the process and the results even though I do not really need the additional plants"...

Ben Lawrence

"As spring approaches, it is time to start thinking about taking dahlia cuttings. Taking cuttings is not very hard to do and it is fun to try. It seems that everyone has their own system for taking cuttings. My first step is to figure out what dahlias I want to take cuttings from and how many different dahlias I want to get started. After making my choices, I bring the tubers out of storage. Always choose healthy, firm tubers. I place the tubers in an open plastic bag in our home for about two weeks. This lets the tuber warm and start to grow. If they are started directly in the medium, it takes them longer to start growing. I bring them out of storage at the end of January or beginning of February"...

Calvin Cook

The first order of business in preparing to take cuttings is setting the tubers for growth. If you have lots of room, you can place each tuber directly in individual pots. However, if space is at a premium, you may set them up in a soilless potting mixture as shown in the picture on the right. Keep the potting soil slightly moist (not wet) at a temperature between 60 and 68 degrees fahrenheit. Some varieties will sprout rapidly— others may take up to 6 weeks...**Ben Lawrence**





Propagation by Cuttings: Two Perspectives (continued)

After the warming-up period in the plastic bag, I plant my tubers using a flat standard tray with drain

holes as shown in the adjacent picture. The growing medium is a soilless potting mix of peat/perlite. Several satisfactory mixes are readily available at your local garden center.

I label each tuber with an indelible pencil and a four inch white plastic label to prevent mix ups. The crown of each tuber is left barely exposed as the tubers are covered with more growing medium. They are then watered and placed on benches under fluorescent shop lights. We do not have a greenhouse—but with the shop lights, the spare room in our house works just fine. The temperature is the same as the rest of our house. The sprouting tubers are left in these trays and never moved until we are finished taking cuttings" **...Calvin Cook**

"When a tuber puts out a small sprout, as in the picture at the right, it is time to put the tuber in a pot. If you continue to let the sprout grow in this tray, the tuber will put out lots of roots and many may get broken in the process of planting the tuber in a pot. The pot should be large enough to allow the head of the tuber to be an inch or more below the rim" **...Ben Lawrence**

"Cover the tuber with a soilless potting mix so the top of the tuber is barely exposed with the sprout showing as in the picture on the right. It is advisable to select pots at least 4"x4"x5" even if the tuber would fit in a smaller pot. The plant will need space to allow its roots to grow freely" **...Ben Lawrence**

Decision Time

Now is the time to decide whether to take "sprout" cuttings or "leaf" cuttings and whether you wish to do some experimenting or just want to get some additional plants of your favorite dahlias. Should you decide to take leaf cuttings, you may find that one or more of the tubers you set up voluntarily produced two or more sprouts simultaneously. If that happens, you must decide to remove all but one sprout to produce a plant from which to take leaf cuttings. Of course you could dispose of the sprouts that you removed but alternatively you could make those extra sprouts into sprout cuttings.

Propagation by Sprout Cuttings: Discovering What Works

By Ben Lawrence

In this picture, the plant on the left is ready to be taken as a cutting. The plant on the right is too immature. However, I have taken cuttings when the sprout was very small. About half of them survived.

You can take sprout cuttings from plants much larger than the one on the left, but you must always include the top sprout as part of the cutting to be placed in the growing medium.

If your plant has put out laterals (i.e. the small sprouts growing out of each node have grown large and also have leaves and nodes) you can also take cuttings from the top part of the lateral just as though it were a stand alone plant.



This year I have attempted to maintain a very clean "cuttings" operation for two reasons. First, one commercial grower speculated that the main reason for a low survival rate when taking cuttings was contamination. In the past, about 70 percent of my sprout cuttings and only 50 percent of my leaf cuttings survived. Recalling how I did the cuttings in the past, I was convinced that contamination had to be a major factor. Second, in order to learn what variables (growing mediums, temperature, humidity, etc.) are important to survival when taking cuttings, it would be necessary to control contamination.*

**Clean—as in pasteurize, disinfect. This should kill most pathogens. However, it will not kill viruses.*

Propagation by Sprout Cuttings: Discovering What Works (continued)

When preparing to take a sprout cutting, sterilize the blade of the knife with a spray or two of alcohol. I also wear medical examination gloves. Gloves are not typically used for this procedure. My typical loss with sprout cuttings is about 30 percent. If I am correct about contamination, there should be a dramatic reduction in loss this year. Several thoughtful comments on this subject were sent to us by Gary D. Miner They are posted in "Send Your Tips..." They are worth reading.



When the sprout has developed at least one set of leaves in addition to the cotyledon pair (the first set of leaves to appear—soft succulent plain looking leaves) and the tip of the plant is beginning to open to display the second set of leaves, it is time to take the first cutting from the tuber. Cut the sprout about 1/16th of an inch above where it is attached to the tuber. This may leave a cut that is not smooth and clean—with rough edges. Gently holding the severed sprout, make a clean final cut about 1/16th of an inch below the bottom node—approximately where the knife blade is pointing in the picture.



Remove the two cotyledon leaves indicated in the picture to the right. Clean any other loose material or obvious contamination from the stem. (Dipping it in clean water is okay.)

Leave the tuber in the pot. If it is healthy, it will put out one and probably more sprouts in a few days. When they reach the appropriate size, you may take more cuttings. There is a limit however. If many cuttings are taken from the same tuber, it will become exhausted and die. You must limit the number of cuttings you take from a tuber, if you want it to eventually produce a plant.

The number of cuttings that can be obtained before a tuber becomes exhausted varies from cultivar to cultivar and tuber to tuber. Some tubers die after the first sprout is removed, others survive until 10 or 12 have been taken.



Propagation by Sprout Cuttings: Discovering What Works (continued)

Place the cutting in a container holding a solution of hormone root stimulant such as Hormex or Dip N' Grow. Follow the instructions on the bottle for recommended strengths. Cuttings left in the solution much longer than indicated in the directions may receive damaging acid burns. If possible, get a rooting hormone that includes a fungicide. Some say that the fungicide does more to increase rooting than the rooting hormone itself.

The time lapsed from when you first take the cutting until you place it in the root stimulant solution should not exceed a minute or two. If the cut stem is exposed to the air for longer periods, an embolism (air bubble) may form in the stem preventing the plant from taking up more water or nutrient.



Once the cutting has been in the rooting hormone the minimum required time, you are ready to put it into the growing medium. A quick overview of growing mediums is in order. Growing mediums used for growing cuttings should be the equivalent of “pasteurized”—harmful bacteria are killed (viruses are not killed). Such growing mediums include: play sand, potting mixes, vermiculite, perlite, and preformed cubes for growing cuttings such as Oasis.

Propagation by Sprout Cuttings: Discovering What Works (continued)

Gary Miner's suggestion of a mix of 1/3 play sand, 1/3 perlite, and 1/3 vermiculite struck a positive note with me. I recognized that it could overcome some of the difficulties of using play sand or perlite by themselves.

The pots shown on the right are filled with that mixture. I use a screw driver or some similar instrument, dipped in alcohol, to make the holes in the various mediums I have been trying. The hole should be large enough to accept the cutting without using force. The use of force may damage the end or sides of the cutting inviting infection causing bacteria.



Most cubes used for starting cuttings come with a hole predrilled in them. While a hole is predrilled, and while it is large enough for the typical sprout cutting, it is not large enough for most leaf cuttings. Therefore, it is a good idea to enlarge the holes so that the leaf cutting can be easily inserted without damaging the stem.

When the cutting has been in the solution for the specified length of time, remove it and immediately place it in the growing medium. Gently press the medium up against the stem to firmly hold the cutting in a vertical position. In the picture at the right, "Oasis" cutting cubes are being used.

Remember to put the name of the cultivar the cutting came from on a tag and place it next to the cutting.

The cubes or the potting medium should be watered so as to be moist (more than damp, not wet) to the touch. I find that the initial watering is sufficient until the cuttings have taken root.





Propagation by Sprout Cuttings: Discovering What Works (continued)

Next, you must find some way to keep the humidity around your cuttings fairly high. You can purchase expensive misting systems or use a standard tray "high dome" available at most hydroponic retail stores. The domes come equipped with small vents to cut open at the top, but you will need to bore five or six 3/8 inch holes in the side of the domes to allow sufficient air to circulate throughout the dome. The cuttings need air as well as moisture. If heavy condensation accumulates on the dome, the humidity is too high. The dome may need to be propped up a little to let in more air. The humidity should be kept as high as possible without any condensation so as to minimize fungal growth.

Your cutting should look similar to that shown on the right. The arrow designates the node from which the cotyledons were removed. Cuttings will vary in size depending on the cultivar, but the process by which you take the cuttings and the general appearance of the cutting are similar no matter the size.



Next, a good light and heat source is necessary. A greenhouse or well-lighted patio or sun porch will be sufficient provided you can maintain the temperature range at 68 to 72 degrees fahrenheit around your cuttings. In the picture on the right, the room temperature is maintained at 60 degrees and the four "cool white" fluorescent tubes above the plants provide enough heat to maintain the temperature in the domes at 70 degrees. Heating cables may also be used.

Your cuttings should not be fed until evidence of significant root growth is visible. Even then, only a very dilute solution of a high phosphate water soluble fertilizer (such as Shultz 10-60-10) should be used. Follow the instructions "for cuttings" that come with the fertilizer. Some people do not fertilize their cuttings until three or four weeks go past. (See Gary D. Miner for a different approach)





It takes three to four weeks for the cuttings to develop visible roots. If you use a soil-less growing medium in a two inch pot, the roots typically grow out of the holes in the bottom of the pot. The picture at the right illustrates the two types of root formations I have observed using Oasis cutting cubes. The plant on the left has produced roots at the point where the stem meets the planting medium (Oasis cube) and represents about 20% of rooted cuttings thus far. Its roots are not yet long enough for transplanting to a pot. Up to this point, the plant on the right is more typical. Its roots have emerged from the planting medium and the plant is ready to be transplanted to a pot.

Propagation by Sprout Cuttings: Discovering What Works (continued)

I place the Oasis cube with the rooted cutting in the potting medium so the cube is slightly covered and the node of the first two leaves is slightly above the top of the pot as shown at the right. During this process I distribute 1/2 tsp. of Osmocote 14-14-14 throughout the top half of the potting medium. I water the plant with a solution of Peters Soluble Trace Element Mix (STEM). The strength of this solution is 1/4 tsp. STEM per 25 gallons of water. This one-time feeding of Osmocote and STEM should last until planting outdoors. The STEM is necessary because this particular Osmocote contains no trace elements.

Transplanting the fragile rooted cutting requires considerable care. I use a soilless potting medium.

- 4 qts. Spaghnum Peat Moss
 - 2 qts. Vermiculite
 - 2 qts. Perlite
 - 1 tbs. Dolomitic Limestone
- The dolomitic limestone raises the pH to about 6.5.



Propagation by Sprout Cuttings: Discovering What Works (continued)

Since the cuttings have been under domes and artificial light and kept at 68 to 70 degrees fahrenheit, it will be necessary to harden the plants before moving them directly to the greenhouse or cold frame. The plants must be watered as needed—moist, not wet. Once watered, do not water again until the top 3/4 inch of soil is dry—then water again.

The plant pictured on the right is 10 weeks old—that is 10 weeks from the time the cutting was taken.

As of March 10, 1998, I have taken 204 sprout cuttings. Three cuttings died, two showed virus symptoms and were destroyed along with the mother tuber, and one was dropped and broken for a survival rate of 97.1 percent.

Given Gary Miner's comments, I am not able to assert that the rather dramatic increase in the survival rate (from 70% to 97%) was achieved as a result of preventing contamination. If all goes well, next year I plan to devise an experiment to determine the importance of the "clean cut/bad cut" variable.



Propagation by Sprout Cuttings: A No-Frills Approach



By Calvin Cook

Sprouts should appear in two to three weeks. Some dahlia varieties produce many sprouts, others produce very few.

Once the sprouts are up, they can be taken at almost any size—from 1" up. On average, I let the sprouts get about three inches tall. I use a razor blade to ensure a clean cut. Cut the sprout off as close to the crown of the tuber as possible, just below the node, as shown in the adjacent picture. A previous cutting has been taken from this tuber. The stub where it was removed is visible in the picture.

Next, the bottom part of the stem should be cleaned of extra leaves, dirt, or other foreign matter. In the picture to the right, the cotyledon leaves are being removed.

The picture below shows what the cutting should look like when it has been cleaned and is ready for dipping and planting.

When I have taken I grow the cuttings in 2 1/4"

pots—32 to a standard tray. Each pot is filled with a soilless growing medium.

A hole is made in the medium about the size of the stem of the cutting—a pencil works very well. I then put the cutting in the hole, press the medium firmly around the cutting, and water it very well. Since the cutting has no roots, it is important that the soil be wet. Never let the soil dry out. Next, label the cutting with the date and the name of the variety (cultivar).



Propagation by Sprout Cuttings:: A No-Frills Approach (continued)

When I have taken a tray of cuttings, a plastic cover is immediately placed over the top of the tray and it is placed under the lights. The cover keeps the humidity up and the lights keep the plants from getting tall and spindly. I use four foot shop lights with cool white fluorescent tubes.

Roots will develop within 1 to 4 weeks depending on the variety. Once the top of the cutting begins to grow, it has usually put out roots. I then remove the plastic cover allowing more light directly on the cuttings.

When the cuttings are well rooted, they are taken outside and put in a cold frame. I don't have room



inside for all the plants and they need sunlight. If the weather turns very cold (below freezing) the plants are temporarily taken inside. Whenever the temperature is above freezing, the plants are left in the cold frame.

The plants are fed "Miracle Grow" as soon as they are taken to the cold frame.

Using this procedure, my success rate with cuttings is about 85 percent.

I hope my explanations have been clear and helpful. Good Luck!

Propagation by Cuttings: A Running Essay

By Tom Cleere

I have found cuttings provide an inexpensive method to increase the number of plants in the garden and to supply high quality blooms for the exhibitor. Most tubers are capable of creating between 3 and 10 new plants each Spring. Often the cuttings are be shared with friends new to dahlia culture. Last year we sold over 150 cuttings to members of the Mid Island Dahlia Society.

For my own garden of 120 plants last year, approximately 45% were cuttings and the remainder were tubers. However my show results reflected 70% of ribbon winners originated from cuttings. I realize that one year may not be predictive of future results, but I shall monitor the 1999 garden to see if the trend continues. I will photograph and update the process in anticipation of a May planting date for my area (Long Island, NY). New information will be added to these pages approximately every two weeks, reflecting the current stage of activity necessary to produce cuttings.

Material needed now: Aluminum pans or seed trays.

Pro Mix or vermiculite. At the beginning of February I remove the tubers from storage. I fill either deep aluminum pans or plastic seed starting flats about 2" deep with Pro Mix, a product sold in 3.8 cubit foot bags usually in nurseries. The medium resembles a combination of peat moss, vermiculite, and seed starter. I've also used 2/3 vermiculite with 1/3 peat moss, with pretty much the same result. As long as the medium has the ability to stay damp (not wet), I have not noticed much difference in choices.

Examine the tuber to see if any eyes are recognizable. If so place on top of dampened mix so the eye or potential eyes are facing up. Press the tuber down into the medium until ½ buried.



Make sure each tuber is readily identifiable with
Propagation by Cuttings:: A Running Essay (contin-
ued)

a name tag or written on the tuber with indelible
ink.

I place the trays wherever space exists in the house.
Behind chairs, in spare room, etc.. Sunlight is not
important at this stage, warmth is.

I check the trays every 4 - 5 days and refresh the me-
dium with water if necessary to avoid it drying out.
That's about it for now. Find an easy chair and relax.
The fun starts in about 3 weeks.

The photograph on the right shows growth from
tubers in the tray. When the new shoots are about
six inches high, I begin to take cuttings.

As shown in the photo on the right, I use a razor
blade to cut the shoot leaving approximately 1/16"
growth on the tuber.





Propagation by Leaf Cuttings

By Ben Lawrence

This year I have attempted to maintain a very clean* “cuttings” operation for two reasons. First, one commercial grower speculated that the main reason for a low survival rate when taking cuttings was contamination. In the past, about 70 percent of my sprout cuttings and only 50 percent of my leaf cuttings survived. Recalling how I did the cuttings in the past, I was convinced that contamination had to be a major factor. Second, in order to learn what variables (growing mediums, temperature, humidity, etc.) are important to survival when taking cuttings, it would be necessary to control contamination.

Using the “leaf cutting” procedures described below, two experiments are underway. One experiment compares the leaf cutting survival rate of 96 split pair cuttings when grown in a commercial mix (Sunshine Basic Mix 2) on the one hand and when grown in “Oasis” cutting cubes on the other. A second experiment makes the same comparison with 32 split pairs between the commercial mix and an equal mix of playsand, vermiculite, and perlite. Taking advantage of the “split stem leaf cutting” procedure, one leaf, stem, and meristem from a node is placed in one medium and the other leaf, stem and meristem from the same node is placed in another medium.

Cuttings placed in “Oasis” resulted in a 97 percent success rate. Those placed in Sunshine Basic Mix 2 resulted in a 93 percent success rate. Those placed in “Oasis”, however, did not do very well later when planted in pots and then in the outside beds. The final result in the beds was only 62 percent success. Additionally, when tubers were harvested, the “Oasis” was in the approximate location of the eyes. It was difficult to remove, and appeared to stop the development of the eyes.

In comparing the sunshine mix with the sand, perlite, and vermiculite mixture, the Sunshine Mix 2 did better than in the first comparison, resulting in 96 percent success. The sand, perlite and vermiculite mixture achieved 91 percent success.

*Clean—as in pasteurize, disinfect. This should kill most pathogens. However, it will not kill viruses.

After the potted tuber has produced a plant with 4 to 6 sets of leaves and the “meristems” [groups of cells that form the very tip of any growth shoot of a plant] are visible between the stem and the leaf stalk, the plant is ready for leaf cuttings to be taken. Preferably, the meristems will be at least 1/4" long before taking cuttings. While topping the plant will speed up the growth of the meristems, they may not grow at the same rate. Consequently, the 1/4" length is desired but frequently not always possible. The plant on the right has at least seven pairs of leaves and three sets of meristems visible in the picture. Some people refer to meristems as “axils”. An axil is the angle between the stem and leaf stalk or the line of growth.





Propagation by Leaf Cuttings (continued)

We cut the plant as shown in the adjacent picture. A pair of leaves remain and typically a pair of meristems will grow from the crotch (axil) made by the junction of the stem and the petiole or leaf stalk.

In some cases, taking cuttings from the top of the plant downward is advantageous. That produces just two cuttings at a time, giving ample time to trim the leaves if necessary, dip the cutting in the rooting hormone, and insert it in the growing medium minimizing the possibility of an embolism forming in the stem. Sometimes the meristems at the upper nodes of the plant will be ready for cutting but the meristems at the lower nodes will be just barely visible. Taking a few cuttings from the top of the plant will stimulate the growth of the meristems at the lower nodes. Thus after taking a few cuttings involving the two upper nodes, the plant can be set aside to continue growing. A few days to a week later the meristems at the lower nodes of the plant will have developed and be ready for taking more cuttings.

We make the second cut as shown in the picture on the right.

The meristems referred to above are shown in the adjacent picture.

In the next few steps we are going to cut the stem in such a manner as to leave part of the stem attached to the petiole (leaf stalk). There are two methods of

making these cuts—the “heel cutting” method and the “split stem” method. The former requires considerable skill and we will not illustrate it here. When we have taken the cutting, we intend to plant it so that the meristem will grow into a regular dahlia plant.

If you start early enough, up to 30 leaf cuttings may be derived from one plant.

In most instances, no matter where you cut the plant off, another shoot will develop from the tuber or from a node on the stem so that the tuber will continue making a plant that can be transplanted into your dahlia garden.

In general, the stem below the node (to the left of the node which is to the left of the knife blade) should be as long as possible but not to extremes, say longer than one and one-half inches. As you can see, it is not always possible. Some cultivars leave 1/2” or less between nodes.



3. Soil Preparation for Growing Dahlias

Your dahlias will smile on you if you provide them with good soil and beds.

It is not feasible to provide a single recipe for soil preparation. Soils vary from region to region and locale to locale. There are already a number of documents available that give prescriptive advice about soil preparation * to prospective dahlia growers that will not be improved by our repeating or embellishing them. Later we hope to provide prescriptive advice on soil preparation. In this case, however, our approach is not prescriptive —rather it is educational. It is intended to help the user determine what must be done to his or her soil to make it more like the kind of soil dahlias prefer.

A “Table of Contents” follows. Part I deals with determining the kind of soil available in the garden plot. Part II is concerned with modifying the soil based on an outline of the kind of soil dahlias prefer. The final page provides a sequential check list for preparing the soil and beds for growing dahlias.

[Click here for reference to an excellent and thorough presentation on “Improving Your Garden Soil”](#)

Part I - Determining the Kind and Condition of the Soil

Part II - Modifying Soil and Making Beds To Grow Dahlias

Dahlias prefer soil that:

- is located in partial shade to full sunlight,
- contains a good amount of humus,
- drains well while holding sufficient moisture to sustain vigorous plant growth,
- is well aerated,
- has a pH around 6.5,
- is not contaminated,
- has a balanced supply of nutrients — nitrogen, phosphate, potassium, and micro elements,
- is uniform in texture and mix throughout the root zone, and
- has a regular source of fresh water.

Review our checklist for preparing soil and beds for growing dahlias.

Recommended Reading:

Improving Your Garden Soil, Ortho Books, Box 5047 San Ramon, CA 94583

* Prescriptive Guides to Growing Dahlias

Dahlias: A Monthly Guide, Puget Sound Dahlia Association, 1978

Guide to Growing and Caring for Dahlias, The American Dahlia Society

Dahlias pp. 275 - 282, Illustrated Guide to Gardening, Readers Digest, Pleasantville, New York 1991 ed.

Part I

Determining the Kind and Condition of Your Soil

Soil has five main components. 1) inorganic particles of rocks and minerals (sand, clay, and silt), 2) dead and decaying organic matter (humus), 3) water, 4) air, and 5) a community of living creatures, ranging from insects, earthworms, and fungi to microscopic bacteria, protozoa and viruses. The nature of a particular soil is defined by the quality and proportions of these five components.

To begin our investigation into the type of soil, we have we ask questions that will help us determine the texture of our soil. How does it feel and look; does it drain well?

A. Does our soil feel harsh and gritty? Do its particles barely hold together? Does water run through it freely? Are its particles quite large, but still granular in size? If so, our soil is predominantly “Sandy”.

B. Does our soil feel smooth and floury? Does it pack together somewhat when wet, but crumble to a floury condition when dry? Are its particles smaller than sand? Does water run through it more slowly than through sand? If so, our soil is predominantly “silt.”

C. Are the particles in our soil so small that the individual particle can barely be seen if at all? (1,000 times smaller than a grain of sand) Do the particles pack together in sticky clumps when wet? Do the clumps appear as stony clods when dry? Do the particles absorb moisture? Does water stand in puddles, draining extremely slowly? If so, our soil is predominantly “clay.”

Soil texture is said to be good when it contains a mixture of sand, silt, and clay in such well-balanced proportions that none predominates. A common name for such soil is “loam.” But soil may have good texture and still not be fit for cultivation. Soil “tilth” refers to the soil’s fitness for cultivation—the way in which particles of sand, silt, clay, and humus mix together when tilled to provide support, air, water and nutrients to plants.

These three classes of the texture of our soil are sufficient for amateur gardening. For a complete discussion

on soil texture types refer to *Ortho’s Improving Your Garden Soil*, p. 19.



Sand



Silt



Clay

Soil Preparation, Part I (continued)

Next we want to learn things about our soil that can only be determined by a soil test. There are soil test kits that can be used by almost anyone, but these are not reliable. Having soil tested by a local University Extension Office or soil laboratory is the best course of action. One must specify what information is to be provided when submitting soil for testing. The questions to be answered should include:

What is the pH of our soil?

Acid soil is a result of the decomposition of organic matter. A variety of acids are produced as organic matter decays. Alkali is a property of many of the inorganic elements in the soil. Therefore soil that does not contain organic matter is not acid—its pH is 7 or above.

Acidity and alkalinity are measured on the pH scale. This scale runs from 0 (pure acid) to 14 (pure lye). The neutral point is 7—neither acid or alkaline. The scale is geometric not linear. That is from pH 7 the amount of acidity or alkalinity increases in geometric progression. For example, pH 5 is 10 times more acid than pH 6 and pH 4 is 10 times more acid than pH 5 and so on. Similarly, pH 9 is 10 times more alkaline than pH 8 and pH 10 is 10 times more alkaline than pH 9. Since few plants will survive in soil more acid than pH 4 or more alkaline than pH 8, pH 4 to pH 8 is the range that concerns most of us as gardeners. As mentioned earlier, dahlias prefer a pH around 6.5 as do most plants.

What amounts of plant nutrients are in the soil?

Dahlias, as do other plants, need a number of nutrients for their growth and development — especially nitrogen, phosphorous, and potassium. Additionally, they need iron, calcium, magnesium, and a variety of nutrients referred to as trace elements. The latter are required in such small quantities that it is unlikely that they will be depleted from the soil. The soil test should give the amounts of

each of the major nutrients available in the soil.

Is the soil contaminated?

Salt contamination is not uncommon. Sodium chloride or salts of calcium, magnesium, or potassium can burn foliage and stunt growth. Tissue at the edge of the leaves turns yellow, then dies. These salts can come from natural soil minerals, polluted water, or over fertilization. Commercial or industrial pollution may occur in some cases.

The non-professional gardener is not likely to need the assistance of a horticulturist to interpret the results of the pH test. However, a horticulturist will be needed to interpret the results of all the other tests. The person who does the interpretation will need to know that dahlias will be grown in the soil prior to completing the interpretation.

Having decided the type and condition of your soil, you are ready to modify it to suit dahlias.

Part II

Modifying Soil and Making Beds To Grow Dahlias

1. Dahlias prefer a bed (and its soil) that is located in partial shade to full sunlight.

The gardener does not always have many options when it comes to choosing a site for a dahlia bed. The constraints of lot size, neighbor's trees, buildings, etc., leave very little flexibility. Nevertheless, dahlias prefer partial shade to full sunlight and will grow more robustly with adequate light.

The terms "partial shade" and "full sunlight" are ambiguous. I define "partial shade" as 8 to 11 hours of sunlight (no shading) per day. I define full sunlight as 11 to 14 hours of sunlight per day. As far as light is concerned, dahlias will do just fine if these guidelines can be followed.

Shading

While not impossible, making up for sunlight deficiency is impractical for outdoor dahlia beds. But reducing excessive sunlight (shading) is possible and in some cases advisable. For example, if full sunlight in Eugene, Oregon is 1.0, full sunlight in Longmont, Colorado is 1.3. I have no proof to support the size of the difference, but it is a fact that the sunlight in Eugene, Oregon is filtered through 5,000 more feet of atmosphere than the sunlight in Longmont, Colorado. Also, the additional atmosphere is denser than the atmosphere that filters sunlight reaching Longmont Colorado. If this hypothesis is accepted, then selecting a site for a dahlia bed or making a decision about providing shade or not, involves more than just location—altitude is also a variable to be considered.

Shading dahlias is done for at least two reasons. The shading most frequently practiced is to prevent blooms from fading. But it is the second reason that concerns us here. That is to protect the plant from

the problems of excessive sunlight—high temperatures, low humidity, and sun scald—and to keep the amount and intensity of sunlight in a range that promotes vigorous growth. Permanent or semi-permanent shading of the dahlia beds can help significantly, particularly if the shading is augmented by a misting system.

An example is shown in the picture at the right. The knitted netting is 30 percent shade cloth and it also serves to protect against moderate hail storms. This particular example uses pulleys and ropes so that the shade material can be rolled up and down at will.



2. Dahlias prefer soil containing good amounts of humus.

“Humus”— organic material, derived from animals and plants, that breaks down in the soil to a dark, gummy substance is the amendment by which faulty texture and tilth are best remedied. In sandy soils humus binds sand particles together retaining water that can be used by plants. In clay soils it keeps particles apart, allowing room for air and water.

How much composted material should be added to the soil?

Well-composted humus material may be added to the soil in large quantities without fear of injuring plants or retarding their growth. An annual application rate of 250 to 500 pounds per 1,000 square feet or a 2 to 4 inch layer tilled into the soil would not be too much.

Contrary to popular opinion, humus soil amendments (composted yard trimmings, composted manures, and sphagnum peat moss) are not an efficient source of nutrients for plants. In most cases, commercial fertilizers will be required to provide nutrients to dahlias. See Tables I and II.

What are good sources of humus?

Partially decomposed compost is an excellent source of humus. Some examples are shown in the pictures on the right. It is important that these wastes are partly decomposed before they are added to the soil. Composting will kill most harmful pathogens. Few nutrients are available to the plants until their form has been altered by decomposition.

Moreover, the micro organisms that cause decay, burn large amounts of nitrogen in the first stages of decomposition. If these wastes are to be used raw (without composting), nitrogen fertilizer must be added to the soil to compensate for the nitrogen used by the micro organisms. The amounts of nitrogen required will vary depending on the type of material. Moreover the amount of material to be applied will vary. The assistance of a horticulturist with expertise with composting and soil amendments should be sought.

Partially decomposed and aged barnyard manures are another good source of humus. As with compost, the partial decomposition of manures is important. Most harmful pathogens are killed by composting. In addition the strong odor from fresh manures is caused by excessive amounts of



Active compost pile



Grass Clippings



Composted yard trimmings



Shredded yard trimmings

Soil Modification, Part II (continued)

ammonia which is harmful to plant roots—aging and composting reduces the amount of ammonia. Aging also provides opportunity for the salts in manure to leach away. Most plants do not tolerate salt well. Feed lot and horse manures typically contain excessive amounts of salt. Dairy manures typically do not contain quite as much salt.

Canadian “sphagnum peat moss” is an excellent source of humus. However, avoid the use of “native” sedge peats. They cause more problems than they do good and most of it is just silt.

Sphagnum peat is a special case of humus. As it comes to the user it is essentially pathogen free and need not be composted. The Colorado State University Agriculture Extension service recommends the application of 3.5 cubic yards (uncompressed) of sphagnum peat per 1,000 square feet of soil tilled to a depth of six inches annually. If the tilling depth is greater, then proportionally more peat should be added.

Adding much larger quantities of peat, in one year, can result in excessive retention of salts from spent fertilizers. The peat may retain water with the salts. Very rapid surface drying may evaporate the water before it has time to drain away, leaving some salt on top of your soil rather than draining away with excess water.

As sphagnum peat is decomposed by micro organisms they burn large amounts of nitrogen which must be replaced. Adding 1/4 ounce of “Nitrogen” or 3/4 ounce 34 N fertilizer per square yard of soil will compensate.

Another important attribute of sphagnum peat moss is that it reduces the pH of soils to which it is added. For that reason it is particularly useful as an amendment to alkaline soils. The Reader’s Digest “Illustrated Guide to Gardening” claims that 50 pounds of peat moss added to 1,000 square feet of garden area will reduce the pH of the soil by about 1 point. I have found that it takes almost 100 pounds to reduce the pH by a point. Of course, how effective a substance is at reducing pH depends on where on the pH scale the soil is rated at the outset. The rate of pH reduction is not linear.

Sphagnum Peat Moss is sold by the “compressed” cubic foot. A common size is 3.8 cubic feet compressed. When uncompressed, that yields about 5.7 cubic feet.



Shredded hay



Sawdust



Composted and aged manure



Sphagnum Peat Moss -
Uncompressed

3. Dahlias prefer soil that drains well but holds sufficient water to support vigorous growth.

Different soil types vary in the way they drain and hold water.

As the figure on the right indicates, if one inch of water is applied to sandy soil, the water will quickly proceed downward for at least 12 inches leaving very little water held in the top several inches.

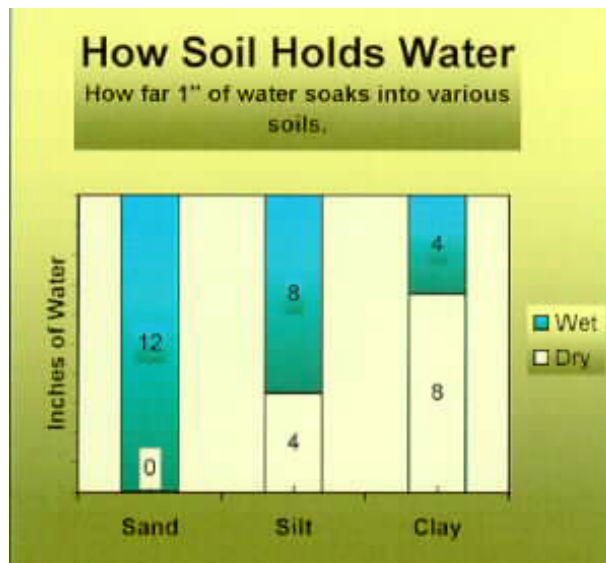
The same amount of water applied to silt soil will drain downward more slowly reaching down to 8 or 9 inches. Some water will be retained by the silt soil in the top layers. The rest will recede to the bottom of the root zone draining sufficiently to allow roots to obtain air. Through capillary action* plants can obtain water even though their roots are not in the water.

One inch of water applied to heavy clay soil will drain slowly to a depth of 4 or 5 inches. The water is retained entirely within the root zone, closing air pockets, depriving roots of access to air, and keeping the roots continually surrounded by water.

Adapted from "Improving Your Garden Soil", Ortho Books

What can be done to improve the drainage of heavy clay soil?

When humus is added to clay soil, the particles are pushed apart providing space for air and water. As spaces open up, water can continue to drain downward. It will take a good amount of humus to open up the clay soil sufficiently to ensure adequate drainage. If the humus is well composted you can apply large amounts without any problems. If the humus is sphagnum peat moss (not composted) applying large amounts can be damaging. However, two or three applications can be applied to the soil over the year allowing time between each application for the peat moss to decay in the soil. Once the peat moss has decomposed the danger of salt accumulations on the surface of the soil due to rapid drying is greatly



Adapted from "Improving Your Garden Soil", Ortho Books

reduced. Clay soils are typically alkaline having a high pH. Adding peat moss will provide the additional benefit of lowering the pH.

Dry Heavy Clay Soil

What can be done to improve the water retention of sandy soil?

When humus is added to sandy soil, it binds sand particles together retaining more of the available water. Large amounts of humus will be necessary. If the humus is well composted large amounts may be added without problems. If the humus is sphagnum peat moss, care must be taken not to add too much at one time. Sandy soil is likely to have a high pH. Adding peat moss would give the additional benefit of lowering the pH.

Sandy Soil

Since silt soil provides a balance between water drainage and retention, should humus be added?

If the soil is predominantly silt it will contain little humus. Humus should be added to improve the "tilth" of the soil.

"Tilth" refers to the soil's fitness for cultivation—the way in which particles of sand, silt, clay, and humus mix together when tilled to provide support, air, water and nutrients to plants.

Adding the recommended annual amount of compos



Sandy soil



Dry Heavy Clay Soil

Soil Modification, Part II (continued) greater benefits.

ted humus will provide reasonably good "tilth" immediately. More may be added, but will not produce

Predominantly Silt Soil

*While gravity causes water to drain down, capillary action may cause water to move from wet to dry even though that may be uphill. Within limits, when surface water evaporates, water from deeper in the soil is sucked up to the surface because of pressure differences.



Predominantly Silt Soil

Air in Soil

Well-aerated soils are essential for the health of dahlias. If soils are compacted or too wet, plants and the organisms that live below the ground are often deprived of the air they require. Usually aeration is not a problem as long as good soil tilth is maintained.

What can be done to improve the aeration of soil?

In predominantly "clay" and "silt" soils the enemies of aeration are insufficient humus, too much water (or poor drainage), and compaction.

If the soil contains little or no humus, the particles of clay and silt pack together tightly because of their size. The spaces between the particles are not large enough to hold adequate amounts of air.



Soil Modification, Part II (continued)

If the soil is too wet, the water fills up the airspaces and drives out the air. Additionally, as the water drains away the empty spaces are filled by particles since the air had previously been driven out—this action is referred to as "compaction".

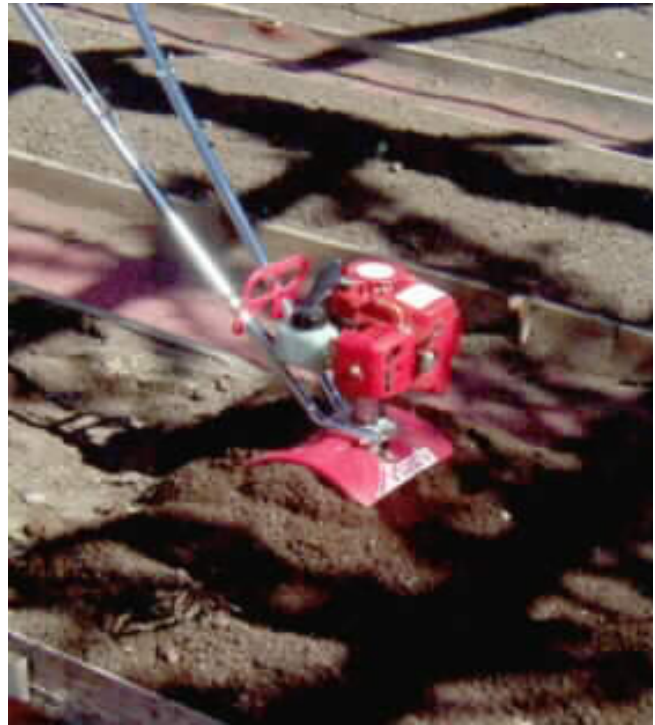
Compaction, of course, can also be caused by walking too close to the plants—the heavy weight on the soil presses it down driving out the air.

Once soil has compacted, very little can be done to restore adequate aeration until the plants are removed. The work required to aerate the soil will damage the plants. When the plants are removed (presumably in the fall at the end of the season) it is time to apply large amounts of composted humus, till the soil thoroughly, and assure that drainage is adequate.

To properly aerate soil for dahlias, the humus should be tilled into a depth of at least 10 inches—preferably twelve. The soil should be thoroughly mixed so that the various ingredients are uniformly mixed throughout the entire depth. Do not attempt to till when the soil is wet—the result would be compacted clods. The soil should be damp to moist. If the soil is dry, it may till, but the dry particles will tend to aggregate by size and not produce a uniform mixture with sizable air pockets. When the soil is damp to moist, tilling produces a mealy mixture. The different particles cling together lightly leaving large air pockets.

If preparing a dahlia bed results in the bottom of the bed being dug into clay or compacted subsoil, the bed will not drain adequately. The clay or compacted subsoil will form a trough. In some clays, the water may stay there for long periods. There are several ways to overcome this type of problem depending on the terrain in which the beds are located.

For example, building beds by terracing the side of a hill, building high raised beds in locations where the water table is high, and various combinations in between. When beds are terraced on the side of a hill, a drainage ditch should be built at the intersection of the back of each step and the riser for the next step. This will prevent excess water and fertilizer or salts from spent fertilizers from running onto the next lower bed.



Walkways and beds should be clearly demarcated. This reduces the chances of compaction by the gardener and visitors. In the picture on the immediate right, used red carpet marks the walkways. This also serves to keep walkways from being muddy during and after rains and to provide a sense of neatness.

Sandy Soil typically has plenty of air and airspaces since the particles are large and irregular—they do not fit together well and do not compact. However, if sandy soil is located in an area where the water table is high, high water can drive out all of the air.

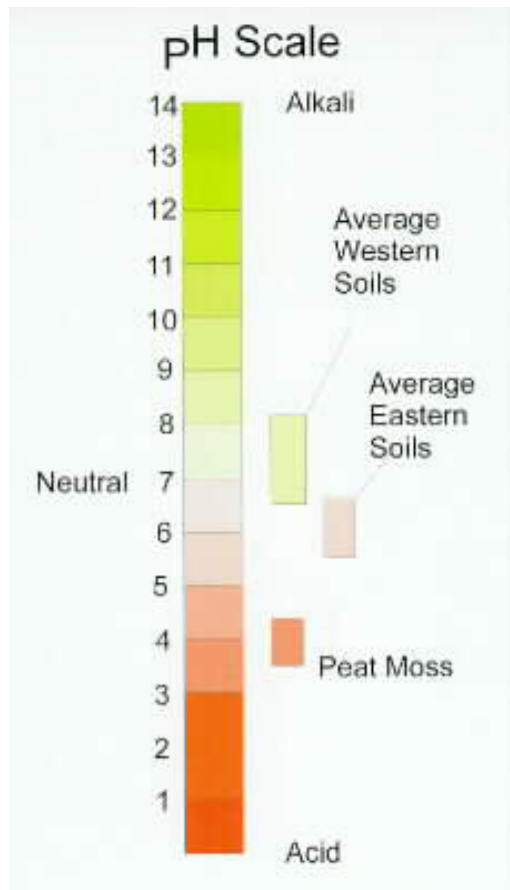
Raising the beds so that the bottom of the bed will be at least 2 or 3 inches above the high water table is about the only solution. Typically 12 inch high beds are necessary.

Soil Modification, Part II (continued)

5. Dahlias prefer soil that has a pH of 6.50

The pH Level: Acid or Alkaline

Acidity and alkalinity are measured on the pH scale. This scale runs from 0 (pure acid) to 14 (pure lye). The neutral point is 7—neither acid or alkaline. The scale is geometric not linear. That is from pH 7 the amount of acidity or alkalinity increases in geometric progression. For example, pH 5 is ten times more acid than pH 6 and pH 4 is 100 times more acid than pH 6 and so on. Similarly, pH 9 is ten times more alkaline than pH 8 and pH 10 is 100 times more alkaline than pH 8. Since few plants will survive in soil more acid than pH 4 or more alkaline than pH 8, pH 4 to pH 8 is the range that concerns most of us as gardeners. As mentioned earlier, dahlias prefer a pH of 6.5 as do most plants.



Sandy soil

A word of caution: whether the lowering or raising the pH, there is always the danger of doing to much. Use only as much adjusting material as is needed based on reliable soil tests.

What can be done to lower the pH?

Add chemicals that lower the pH.

Sulfur — Over a period of 4 to 6 months in the soil, sulfur turns to sulfuric acid lowering the pH. In sandy soils, 8 pounds of sulfur per 1,000 square feet will lower the pH by about one point. In heavy soils (clay/loam and clay) 25 pounds per 1,000 square feet is needed to lower the pH by one point. However, since the pH scale is geometric it would take more sulfur to move the pH from 8.5 to 7.5 than from 7.5 to 6.5 in any soil.

Note: In very alkaline heavy clay soils sulfur is said to produce gypsum as a by product. For this reason, some say that sulfur should not be used to lower the pH of very heavy clays. Others disagree. All written materials that I have reviewed advise its use. I have used it very conservatively for several years with no observed ill effects.

Aluminum Sulfate — Aluminum sulfate lowers the pH very effectively. So far, I have not heard of any bad side effects. However, it is expensive and only practical for small plots. The directions are typically on the bag.

Sulfur 90%

Aluminum Sulfate

Commercially prepared soil acidifiers — Companies prepare mixtures of sulfur, iron, and other chemicals specifically for reducing the pH of garden soils. They are effective but very expensive except when used on very small plots.

The pH can also be lowered using chemicals that result in two amendments to the soil. Two examples, Ammonium Sulfate and Iron Sulfate follow:

Ammonium Sulfate 21N; 24S — When put in the soil ammonium sulfate releases nitrogen (21%) and sulfur (24%). Thus the soil gets fertilized and at the same time the pH is lowered. This would be a good choice if the pH needed to be lowered at the same time as a nitrogen fertilizer was needed.



Sulfur 90%



Aluminum Sulfate



Soil Modification, Part II (continued)

Before using these dual function chemicals, calculations to determine the respective amounts of each substance that one will receive should be done. For example, if the pH of a very heavy clay soil was eight and the intent was to lower the pH to seven, 25 lbs. of sulfur would be needed for every 1,000 square feet. To get 25 lbs. of sulfur from this particular ammonium sulfate approximately 100 lbs. of ammonium sulfate would be required. The amount of sulfur in 100 lbs. of this ammonium sulfate is $24\% \times 100 \text{ lbs.} = 24 \text{ lbs.}$ At the same time, however, 21 lbs of nitrogen would be produced for every 1,000 square feet of soil ($21\% \times 100 \text{ lbs. of ammonium nitrate}$). That would be about three times a normal application of nitrogen. Will dual purpose chemicals of this sort are useful, attempting to use them in place of single purpose chemicals will result in serious problems.

Note the two pictures on the right. The same chemical can come in different colors as well as different forms (powders, granules, liquids). Keep them well marked when removing them from their original container.

Ammonium Sulfate — 21% N — 24% S

Ammonium Sulfate — 21% N — 24% S

Iron Sulfate - 31% Fe — When put in the soil releases iron (31%) and some unspecified amount of Sulfur. Any attempt to use this iron sulfate to reduce the pH, would result in toxic levels of iron in the soil.

Note the two pictures on the right: two similar chemicals but they look quite different. Fertilizers and other agricultural chemicals can not necessarily be identified by their color or form.

Iron Sulfate-Copperas is said to be faster acting than Iron Sulfate 31.



Ammonium Sulfate -- 21% N -- 24% S



Ammonium Sulfate -- 21% N -- 24% S



Iron Sulfate -- 31% Fe min.



Iron Sulfate-Copperas -- 21% Fe min.

Soil Modification, Part II (continued)

Some humus materials will also lower the pH of soil.

Sphagnum peat moss is acidic (see pH scale), and lowers the pH of soil in which it is mixed. Fifty to one hundred pounds of sphagnum peat moss per 1,000 square feet of soil is required to lower the pH about one point.



Sphagnum peat moss can be purchased by the cubic foot.



Sphagnum Peat Moss

Pine bark is also acidic and if prepared properly and mixed into the soil will also lower the pH of the soil. To decompose in a reasonable time frame, it must be shredded to a very small size. It is typically referred to as "pine bark soil conditioner." The current price in Longmont, Colorado is \$4.25 for 2 cubic foot.



Pine Bark Soil Conditioner

Note: By now the reader should have observed that sphagnum peat moss modifies soil in three ways:

- Lowers the pH,
- Adds humus to the soil, and
- Uses up nitrogen as it decomposes.



Chipped Pine Bark

Soil Modification, Part II (continued)

In most cases, soil contamination is a concern when breaking ground for a new garden. If the proposed garden plot has a healthy stand of weeds, it is probably safe to proceed without a soil test. While some types of industrial pollution could be present, it is not a concern as long as ornamentals and not food plants are to be grown.

If the proposed plot is bare or very sparsely populated with weeds or brush and prior knowledge does not provide a reason for the lack of fertility, a soil test is advised. Possible contamination types include: runoff from neighboring sites, industrial pollution, prior vegetative killer, prior over fertilization.

If an established garden loses its fertility, contamination from over fertilization, misuse of pesticides, or excessive or contaminated soil amendments should be suspected. Unless the cause is known, a soil test is in order. The garden pictured on the right flourished until 1997 when supposedly good compost was added from a nearby pig slaughter house. The contamination was so high that the salt was visible on the surface and the liquid smoke aroma, though feint, was clearly recognizable.

What can be done about soil contamination?

If a soil test indicates industrial pollution, call the EPA.

If it is determined that runoff from a neighboring site is the cause, hire a lawyer. Otherwise you are on your own.

If the soil test indicates the contaminate is water soluble, repeated flooding of the site may help — particularly if the contaminate is salt residue from fertilizers. If a second soil test indicates improvement, adding large amounts of composted humus will probably restore fertility quite rapidly.

If the contaminate is not water soluble, a soil expert should be consulted.

The final solution is to effectively replace the soil — build very high (at least 12" of soil) raised beds with a plastic sheet barrier at the bottom. The barrier may not always be necessary, but moisture and its contaminants move from wet to dry through capillary action possibly contaminating the new soil.



Canadian Thistle Patch



Runoff From Neighboring Farm
Salt Residue



Contaminated by Soil Amendment
From Pig Slaughter House
Salt and Liquid Smoke Residue

6. Dahlias prefer soil with a balanced supply of nutrients.

Based on the interpreted results of a soil test, nutrients (fertilizers) should be added to the soil when preparing the dahlia beds.

Most people cannot interpret the results of a soil test. They will need the help of someone who can to determine the amounts and kinds of nutrients to be added to the soil to bring those nutrients to a level that dahlias prefer. Even then, for those of us needing help, it is not an exact science. A specified nutrient, say "nitrogen", may be in the soil, but may not be available to the plants in the quantities required. Temperature, moisture, pH, and soil type all influence the amount of "nitrogen" that will be available to a plant at any particular time. The interrelationships are complex. That is one reason why there are so many commercial greenhouses. In a greenhouse, those variables can be controlled—outside in the field they cannot.

In the beginning the amateur dahlia grower either accepts the interpretation of the soil test results and adds fertilizer accordingly, or adds fertilizer based on other information or hunches. Over time, the amateur finds approaches that work for him/her—and it may be very good. Perhaps the particular set of conditions in his/her garden has been augmented to suit the dahlias preferences. Soil test based action is the best approach for the beginning grower.

If the soil test indicates the need for very small amounts of fertilizer, it is feasible to use natural organic materials (compost, manure etc.) to meet those needs. On the other hand, if the amounts of nutrients that must be added to the soil are large, inorganic chemical fertilizers will be needed.

Natural organic materials are not a significant source of nutrients, with the exceptions of bone meal and dried blood. See Tables I and II. The amounts of organic fertilizers required to provide plants with their needs are enormous. Table II shows this rather dramatically. For 100 square feet of soil, 3.2 ounces of superphosphate 45% is equivalent to 60 pounds of manure.

See Soil and Bed Preparation Checklist for discussion of when to fertilize.

Table I - Nutrient Content of Some Organic Materials

Materials	%Nitrogen	%Phosphate	%Potash	Availability
Steamed bone Meal	0.7-4.0	18-34	-----	slow-med
Dried Blood	12	1.5	0.57	med.-fast
Compost	1.5-3.5	0.5-1.0	1.0-2.0	slow
Cattle Manure	0.25-2.0	0.15-0.9	0.25-1.5	med.
Horse Manure	0.3-2.5	0.15-2.5	0.5-3.0	med.
Sheep Manure	0.6-4.0	0.3-2.5	0.75-3.0	med.
Swine Manure	0.3	0.3	0.3	med.
Poultry Manure	1.1-2.8	0.5-2.8	0.5-1.5	med.-fast
Peat	1.5-3.0	0.25-0.5	0.5-1.0	very slow
Sawdust	0.2	0.1	0.2	very slow
Milorganite	0.5	2-5	2	med.
Sewage Sludge (activated)	2-6	2-7	0-1	med.
Sewage sludge (digested)	1-3	0.5-4.0	0-.05	slow
Wood ashes	0	1-2	3-7	rapid

Source: Colorado State University Extension Service in Action Bulletin no. 7.217

Table II - Equivalent amounts of fertilizing materials (phosphate) per unit area.

Material	Acre	1,000 sq. ft.	100 sq. ft.
Super Phosphate 45%	87 lbs.	2 lbs.	3.2 oz.
Bone Meal 22%	175 lbs.	4 lbs.	6.5 oz.
Sewage Sludge	300 lbs.	7 lbs.	11.0 oz.
Manure	13 tons	600 lbs.	60 lbs.

Determining Fertilizer Requirements When A Professional Soil Test Has Not Been Done

In the event that a professional soil test has not been done, three other approaches to determining fertilizer needs are available.

1. Soil Test Kit

Purchase a soil test kit from a garden catalog sales company or a local garden center and do a soil test and interpretation using the instructions enclosed. Such tests are rough estimates, but better than nothing. The tests are easy to do and do not take much time. They are usually limited to testing for pH, Nitrogen, Phosphate, and Potassium.

Loading

2. Plant Nutrient Deficiency Symptoms

Based on observations of plants from the previous year, determine the nutrient deficiency from plant nutrient deficiency symptoms observed. See Reading Plant Health for Deficiency Symptoms for a comprehensive listing of nutrient deficiency symptoms. A major shortcoming of this approach is that the type of deficiency may be known, but how deficient it is will not be known.

Plant nutrient deficiency symptoms for "nitrogen", "phosphate", and "potassium" are:

Nitrogen Deficiency Symptoms

Symptoms are mostly generalized over whole plant; plant light green; lower leaves are yellow; growth is thin and slender; symptoms appear first on lower leaves and work upward.

Phosphate Deficiency Symptoms

Plant is dull green, often developing red and purple colors; lower leaves sometimes yellow, drying to greenish brown or black colors; growth is stunted.

Potassium Deficiency Symptoms

Symptoms are mostly localized; mottled or chlorotic leaves with small spots of dead tissue, usually at tips and between veins; leaf edges may roll up; squatty and stunted growth.



Ammonium Nitrate 34N



Super Phosphate 45P



Soluable Potash 60%

3. Guess

Guessing typically gives unsatisfactory results. Plants may grow, but frequently are not vigorous and produce small blossoms.

7. Dahlias prefer soil that is uniform in texture and mix throughout the root zone.

The root zone for dahlias is 10 to 12 inches — the depth to which tubers will reach in good soil.

Hand tilling for dahlia beds is hard work. Hand tilling to a depth of 10 inches involves double digging. Breaking up clods and thoroughly mixing in the amendments, pesticides, and fertilizers by hand will substitute for a very rigorous exercise routine.

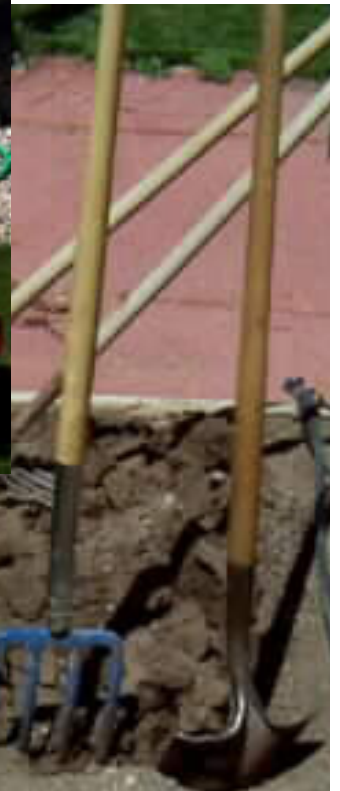
Walk behind rototillers (above) are the machine of choice for small plots. For narrow raised or physically demarcated beds a small machine such as the Mantis shown on the far right does an extremely fine job. Note the depth to which it can and does till — 10 inches.

Loading

Achieving Uniform Texture and Mix

Achieving uniform texture and mix is not just a matter of thoroughly stirring the soil. It is the time for amending the soil, applying fertilizer to bring the nutrient levels to the desired state, and adding soil based herbicides and insecticides if desired.

Soil amendments — compost, sphagnum peat moss, etc. should be distributed uniformly over the soil prior to tilling. Avoid unequal distribution.



Soil Modification, Part II (continued)

Fertilizers, herbicides and insecticides (if to be applied) require careful measurement and very careful distribution over the soil prior to tilling. Thorough tilling will not assure uniform texture and mix unless the amendments are distributed uniformly over the surface of the soil. Failure to have uniform distribution of fertilizers can cause damage to your plants.

Dividing a plot into several smaller parts and measuring the amount of fertilizer or pesticide to be distributed for each smaller part helps to achieve uniform distribution over the surface of the plot. Then when the soil and the various amendments are tilled to a depth of 10 inches, the resultant mix will be uniform throughout the bed.

Picking the time (or times)

Do not till (by hand or with machine) when the soil is too wet or too dry. If a handful of soil when squeezed barely retains its shape after opening your hand and crumbles when touched, its water content is right for tilling. Tilling when the soil is too wet leaves clods that when dried become hard. Tilling the soil when it is dry also leaves clods because the clods are too hard to be pulverized.

I like to till in amendments and fertilizers in the late fall. Then in the late winter or early spring I till again. Tilling disturbs insect larvae, aerates the soil, and promotes the health of micro organisms that improve the soil. If herbicides or insecticides are to be added to the soil, they should be added just prior to planting and raked or tilled into the soil following the instructions on the container.



Soil Modification, Part II (continued)

8. Dahlias prefer soil that has a regular source of fresh water.

Water and Dahlias

Dahlia plant foliage contains 75 to 80 percent water. Fast growing root and branch tips contain even more — 90 to 95 percent. They need water in their tissues to permit photosynthesis — the means by which nutrients are turned into new plant growth.

Transpiration — the evaporative cooler for plants

Water enters plants through their roots and evaporates through their leaves cooling the plant in the process. If water evaporates through the plants leaves faster than it is taken up by its roots, plants wilt as in the picture at the right. Without enough water plants become limp, the foliage turns yellow, and the plants become stunted as in the picture at the lower right. Water delivers nutrients to the plant. Moisture in the soil holds soluble nutrients, the only form of food that plant roots can use. This is the major way that plants get nitrogen and the only way they get phosphorus and sulfur. Water in the soil is a life support for micro-organisms beneficial to plants.



Soil Modification, Part II (continued)

Dahlias prefer soil that has a regular source of fresh water.

Evaluating Watering Systems

The best watering system is the one that meets your needs. Some people do not want an automatic watering system to preempt their enjoyment. They enjoy gazing at the beauty as they water it and help it grow.

Buckets and watering cans

Buckets and watering cans are inexpensive, convenient for mixing liquid fertilizers, and just right for small areas and container gardens.

On the other hand, they move limited amounts of water at any one time, are inefficient for large areas, and are labor intensive.

Hoses, hose-end nozzles, and other attachments

Hoses, etc. are comparatively inexpensive and probably owned already. They deliver the water to the desired location without significant labor

On the other hand, moving the hoses from one location to another is annoying if not labor intensive, and can waste a lot of water if not properly attended.

Drip irrigation systems

Drip irrigation systems efficiently bring water to the root zones of the plants and help prevent fungal diseases. They minimize evaporation and deliver water in prescribed amounts and rates. They save water and can be installed as a semi-permanent or permanent system and adapted to automatic timing control.

On the other hand, they are complicated to assemble. If a different physical layout for the plants is used in a subsequent year the developed system must be modified





Soil Modification, Part II (continued)

or discarded. Most water districts now require the use of a backflow preventer with a drip system. Soaker hose systems.

Soaker hose systems made from recycled rubber let water seep out of the entire length of the hose and do not siphon particles in when the water is turned off. They provide water to the root zone which helps prevent fungal diseases. They save water. Can be installed as a semi-permanent or permanent system and adapted to automatic timing controls.

Soaker hoses made of plastic materials can plug easily if the soil contains moderate amounts of silt. The siphon tendency of installed systems draws in silt particles plugging the water passage ways. Quality soaker hoses made of rubber are more expensive than others.



Automatically timed systems

Both drip systems and soaker hose systems can easily be adapted to automatic timers and electrically controlled valves.

Automatically timed watering systems, once installed, save labor, time, and water. Once the system has been calibrated, plants receive the correct amount of water at the appropriate time. They are efficient for large gardens and in situations in which labor to operate manual systems is not available.



On the other hand, such systems are expensive and must be manually controlled if it rains or there are periods of unexpected dryness.

Soil Modification, Part II (continued)

Check List for Soil and Bed Preparation

In the fall:

1. Determine the type and amount of amendments, pH adjusters, and fertilizers to be incorporated into the soil,
2. Spread them uniformly across the soil, and
3. Till the soil to achieve uniform texture and mix.

In the fall or winter:

4. Physically demarcate planting areas from walking areas using raised beds, carpet for walkways, or other physical boundaries, and
5. Level the planting areas.

In late winter or early spring two to four weeks prior to planting time:

6. determine the type and amount, if any, of insecticide and herbicide to be incorporated into the soil of the various beds,
7. Incorporate insecticide and herbicide, as determined in #6, into the soil to the depth recommended by the manufacturer, and
8. Prepare infrastructure for watering system (basic equipment and lines as necessary.)

At planting time:

9. Determine what additional ingredients are to be added for each planting,
10. Plant, and
11. Install distribution system for water if semi-permanent or permanent.

Happy Dahlia Growing!!!

4. *Growing Dahlia Seedlings*

Growing dahlia seedlings is an adventure. You are searching for treasure and 99.8% of the time you will come up empty handed. However, the anticipation and excitement are a thrilling addition to any dahlia season. And who knows, maybe that bud which is just opening will be another Edna C or Kidd's Climax.

In 1997 we had a banner seed production year and for the first time ever we were able to undertake growing a large number of seedlings. This is how we did it.

Seeds are started the first week in March in standard ten row tray inserts filled with a fine seed starting mix. Seeds are planted about 1 inch apart and covered to a depth of about 1/4 inch. Each planted row is watered as needed to keep the soil damp, but not soggy. Outside rows need water more frequently than inside rows.



Seeds will germinate in 7-21 days under a variety of conditions. Percent and speed of germination will be greatly increased by providing bottom heat. Heating cables are wonderful and the warm top of an old refrigerator or freezer will do almost as well.

When the plants have reached the point where they have two or more sets of true leaves (about five weeks) it is time to transplant.

In order to conserve effort, we let the plants stay a little longer in the seed trays, and transplant them directly into jumbo six packs filled with soilless potting mix. There are a number of good mix-your-own and pre-mixed potting soils. Our personal preference is Scotts/Sierra Metro Mix-350.



The jumbo six packs are filled and tamped using the bottom of another filled six pack.

A dibble is used to start a planting hole in each cell.





4. Growing Dahlia Seedlings (continued)

The hole is then firmed and enlarged using the traditional index finger. Hole should be large enough and deep enough to accept the root-ball of the seedling.



Seedlings are worked loose from the seed starting tray using a special little trowel (dibble.) Seedlings are always steadied and handled gently by one of the cotyledon leaves. The leaves lowest down on the seedling. This pair of leaves will die soon so if it is squeezed a little too hard it is not fatal to the seedling.



The seedling is then set into the preformed planting hole and gently pressed into place.



Four more weeks in a greenhouse or under bright lights gives a sturdy plant which is ready to transplant.

4. Growing Dahlia Seedlings (continued)

A bulb planter with a thumb activated dirt release is the ideal tool for making a hole for the root-ball coming out of the jumbo six packs.



After stirring a small handful of triple phosphate into the bottom of the planting hole, we put the seedlings in place, backfill and water individually.



In 1998 we planted 240 seedlings in an 18 by 36 foot community garden plot at the Boulder County Fairgrounds in Longmont, Colorado. The plants were planted 18 inches apart in staggered rows—9 inches on either side of a common soaker hose. Large plant cages in the middle and at the ends of each row provided the anchors for stringing up a seedling support system of poly-cord.



Each of the five blocks in the seedling plot was 6-1/2 feet by 18 feet and contained two double rows of 12 plants each for a total of 48 plants per block. Size of each block includes the carpeted path.

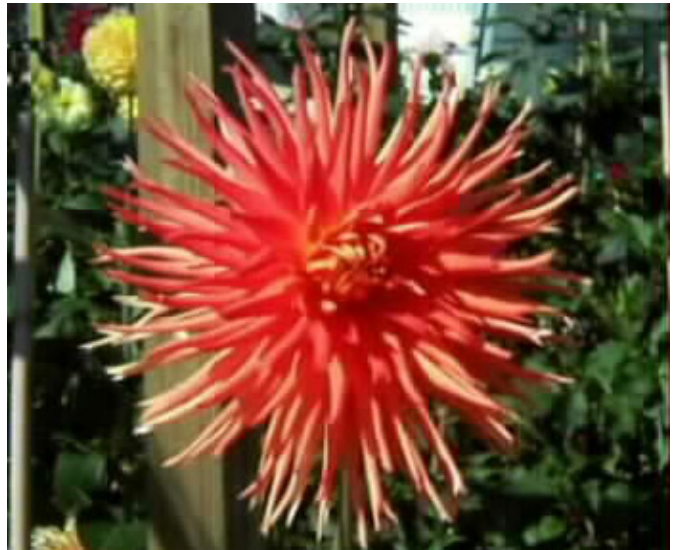
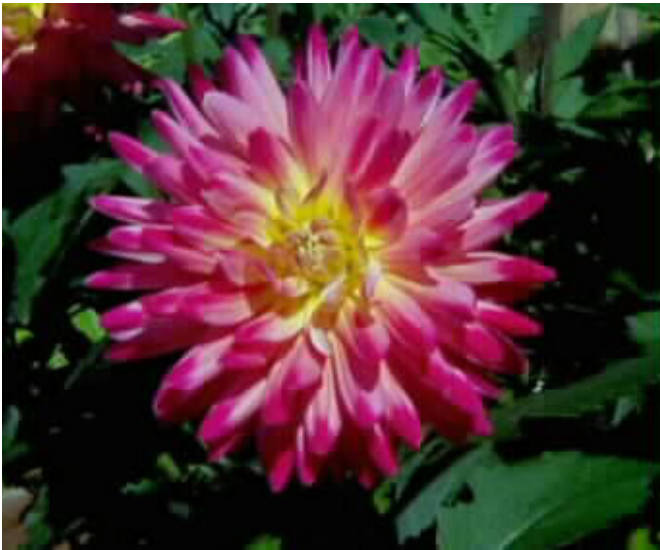
In the background against the fence is a half plot of 54 show dahlia plants which are grown for public exposure and seed production.

By early August the seedling patch was producing new blooms daily.



4. Growing Dahlia Seedlings (continued)

Our 1998 seedling patch provided many interesting blooms, and we even had some single bloom entries for our dahlia show. In the end, however, we saved only three out of 240 seedlings to raise again. Meanwhile, on the other side of the walkway the seed production in the show garden was terrible and amounted to under fifty seeds. Next year we will obviously be growing from purchased seed, and trying hard to improve both the quantity and quality of our seed production.



5. *Planting Tubers and Plants*

By Andy Anderson

Prior to planting, consideration should be given to the amount of space wanted between plants. The amount of space between plants may vary dramatically from a one plant situation in a bed with other flowers to a bed with nothing but dahlias. This topic is not discussed here.

Proceed to the place where the dahlia is to be planted and dig a hole at least six inches in diameter and twelve inches deep. There are lots of ways to dig a hole ranging from using one's hands to a gasoline powered post hole digger. The hand powered post hole digger works very well and eases the task if there are many dahlias to be planted.



With the exception of bonemeal I fertilize my dahlia beds at the time the soil is prepared. When planting I add a good handful (roughly 1/4 cup of bonemeal to the dirt removed from the hole.

Bonemeal does not leave a salt residue in the soil. Additionally, it is slow acting and lasts until shortly before bloom time. About a month before bloom, all plants receive a normal dose of water soluble 10-60-10 (Schult's Bloom).

When planting dahlias in beds with other flowers and the soil was not fertilized when it was tilled, I mix in fertilizer at the time of planting. Typically, I use a balanced fertilizer such as 10-10-10 granular or 14-14-14 Osmocote timed release. How much, depends on the soil test that I do just before planting. Unless the soil test specifically indicates that one or more micro nutrients is needed, I do not concern myself with them. Typically micro nutrients are available through the water, soil, or humus material.





5. Planting tubers and plants (continued)

Whatever is added should be mixed in thoroughly while the soil is removed from the hole. That way the plants roots or the tuber has immediate access to some of the fertilizer and as moisture seeps downward through the soil some is available later. This only works, of course, with non-water soluble fertilizers.



Fill the hole with the mixture of soil and fertilizer until the hole is about six inches deep. Then the tuber is placed in the bottom of the hole flat (on its side) with the eye pointing upward.



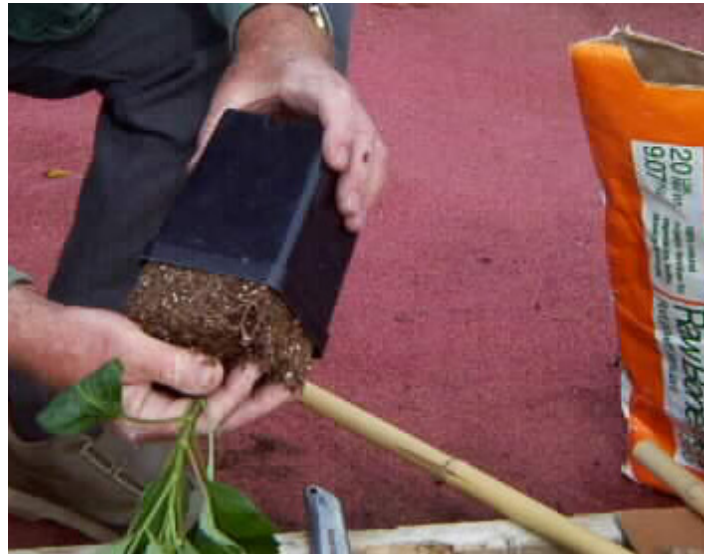
I then place a stake (the kind depends on the eventual means of supporting this dahlia) near the crown of the tuber. Doing so places the stake very close to the place where the sprout from the tuber will appear. As the sprout grows into the stem of the plant it can be secured to the stake with a tie.

5. Planting tubers and plants (continued)

Then I cover the tuber with about two inches of soil, leaving four inches to be covered later. As the sprout emerges from the soil, I apply more soil until the hole is entirely filled and the ground once again leveled.



When I set out plants that have been started in pots, the same procedure is followed until I have filled the hole until it is six inches deep. The plant is gently removed from the pot.



Using a utility knife the roots that have bound themselves to the surface formed by the soil and the pot are cut or broken to force them to put out new roots into the surrounding soil. In some cases, if this is not done, the roots will not cross that boundary and the plants' growth will be retarded.



5. Planting tubers and plants (continued)

As the plant is put in the hole, dirt should be added to or subtracted from the bottom so that the soil in the pot is about one inch below the surface of soil in the bed. A stake is placed in the hole as close as possible to the stem of the plant. This facilitates securing the stem to the stake with a tie.



Then the hole is filled until the soil surrounding the stem is level with the soil of the bed. A problem can be created if the plant is not marked with an identification tag. I use two—one in the soil next to the plant and one on the stake secured with a wire.

In the event that the soil is not moist when planting, water should be applied to the soil surrounding the plant out at least four inches from the stem.



6. *Dahlia Support Techniques*

1. A NO Stake NO Tie System By Don McAllister

A system particularly useful for supporting dahlia plants in an attractive floral garden.

2. Staking Dahlias

A pragmatic solution for supporting individual plants.

3. A Guy Wire Support System By Ben Lawrence

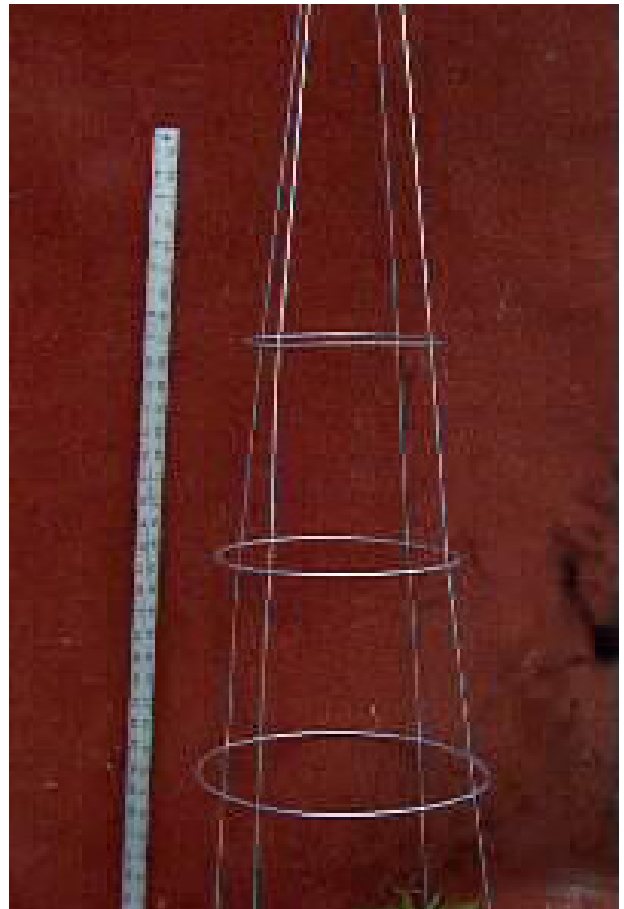
A pragmatic solution for supporting large beds of closely spaced dahlias plants.

Supporting Dahlias: A NO Stake NO Tie System

Many people find staking and tying dahlias to be a tedious task with a rather unsightly outcome. I number myself among these and over the years have developed a dahlia support system which requires no stakes, no ties and is nearly invisible when the dahlia plant reaches maturity.

The heart of this system is the common tomato or plant cage. With a couple of simple modifications these cages are altered to provide a vastly improved capacity to support large plants such as dahlias, cleomes, delphiniums, yarrow, hibiscus, tithonia and even top heavy tomatoes. In our own yard we also use various sizes of these converted cages to support mums, marigolds, fall asters and any other plant which might flop over in a heavy rain or strong wind.

For dahlias, I prefer to use what is commonly sold as a 42" plant cage with four rings and four legs. The distance from the bottom ring to the top ring is about 27" with an overall cage height of 42". The diameters of the rings themselves are 8, 10, 12, and 14 inches.

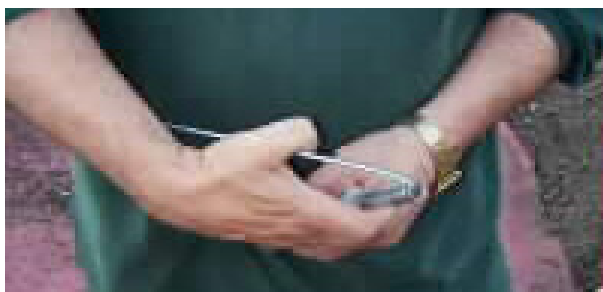
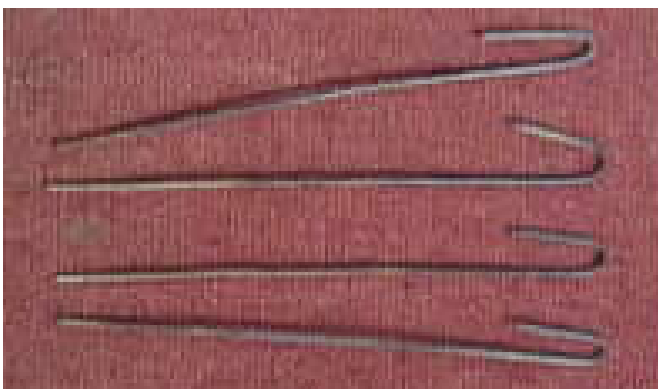


6. Dahlia Support Techniques (continued)

The first step in modifying the plant cages is to cut the legs off above the small ring. I use an inexpensive 8" mini bolt cutter for this purpose, and generally pump twice in severing each leg.

The second step of the modification process is to bend a hook into one end of these severed legs. For this purpose I use the wire tube out of an old lamp to grip the leg while I bend a hook into the end. Any small diameter metal pipe or tube will serve the same purpose.

The legless cage is now installed and centered over a dahlia plant, and any associated drip or soak irrigation, with the LARGE ring on the soil surface. The large footprint associated with having this large ring on the soil surface and the plant growing through the small ring at the top, act together to change the plant cage from a wobbling, top heavy ice cream cone into a mechanically sound plant support.





6. Dahlia Support Techniques (continued)

Next, the modified legs are driven into the soil with the hooked ends gripping the large ring and holding it to the soil surface. The modified legs should be inserted at an angle to resist the lifting forces from strong winds. (And yes; the hammer is a necessity in the clay soils we encounter in Colorado.)

Finally, an identification tag is attached to the top ring on the installed cage where it provides easy visibility to grower or visitor alike. The tag is attached using plastic coated twist ties cut long enough so they can be transferred directly to the root clump when it is dug in the fall.

Special Note: Anyone adopting the cage support system would be well advised to search for a hay hook or a long handled meat hook to use in the fall to pull the hook ended legs from the ground. The long handle really helps the back.

Notes on a Personal Practice

Due to our short growing season in Colorado, we personally take some gambles with the weather and set out started dahlia plants about May 15th. To manage the risks associated with this practice we cover the modified dahlia cages with a florist product called plant sleeves held in place with clothes pins. The plant sleeve is no wall-of-water, but it does provide limited frost protection, a warmer growing environment and some hail protection.



6. Dahlia Support Techniques (continued)

A Guy Wire Support System

The illustrations used to explain a "guy wire support system for dahlias" were taken of dahlia beds with two 50 foot long side-by-side rows of dahlias.

Steel posts are driven into the ground at each end of each row of dahlias. The guy wires are then tied to the posts at the desired height and stretched tight.

In some cases, 2" by 2" stringers are tied across the two posts. By drilling holes in the stringers, guy wires can be placed at several different locations according to the need to support the dahlias.

The bottom set of guy wires is located 12" to 15" from the ground and are centered over the row. When the dahlias are tall enough, their stems are secured to the wire loosely (I call it the "stem wire".)

Bamboo posts are inserted in the row at 10 foot intervals next to the guy wire.



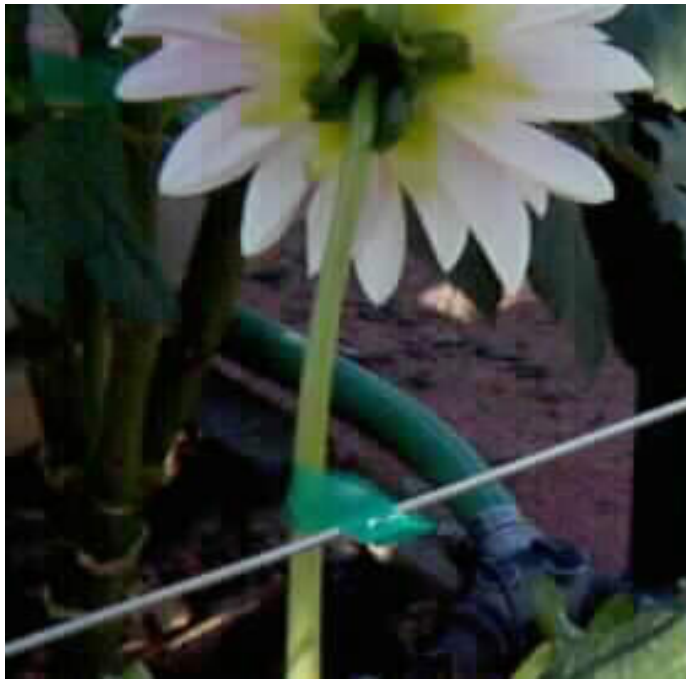
6. Dahlia Support Techniques (continued)

To stabilize the guy wire it is secured to each bamboo stake with a small wire. A butterfly wrap and twist holds the guy wire firmly to the post.

The picture on the right shows that the guy wires are hardly visible once the plants exceed the height of the top wires.

As the plants grow, additional wires are added as needed to adequately support the plants.





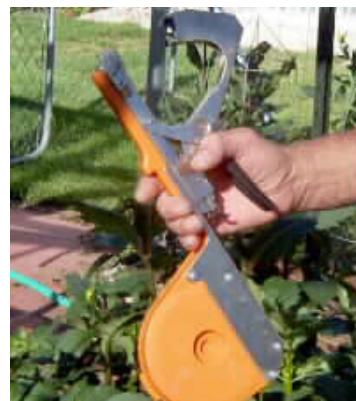
6. Dahlia Support Techniques (continued)

I use electric fence wire size 14. Size 16 will also work on 50 foot rows, but it is more tedious to handle.

I use a "tapener" to secure the dahlia stems to the wires and other support mechanisms we use in various parts of our landscaping. As shown in the photos at the right and below, it wraps a 1/2" green plastic tape (ribbon) around a stem and the guy wire and staples it together in one simple motion. It is very fast and the tape is quite strong. The green ribbon-like tape stretches with plant growth.

The tapener is shown in the photograph on the far right. The roll of tape is in the orange part of the tool. The tapener, rolls of tape, staples and the very sharp blade that cuts the tape as it is stapled together are readily available at A.M. Leonard—garden tools mail order.

On the negative side, the plastic tape is very tough. Consequently, it is somewhat annoying when it comes time to cut the plants and make compost. It can be broken, but scissors are the best way to free it from dahlia stalks. Some scraps inevitably wind up in the compost pile.



7. *Pot Tuber Notes*

by Walter & Kit Jack¹

One may plant roots (clumps) directly, take cuttings, or cut up the pot roots the way one would any other field grown clump. The Jacks recommend repotting pot tubers and starting them growing before deciding how to handle them. Once the new growth is 2 to 3 inches high, one can divide the clump or start taking cuttings.

Suppose you plant an intact pot root, a divided pot root, and a rooted cutting, all at an equal stage, on the same day. Which would bloom first? In their experience, intact pot roots tend to flower 1 to 2 weeks earlier than those that have been divided. Green plants from cuttings tend to flower 2 to 3 weeks later than the divided clumps, because it takes a bit longer for the root structure to get underway. However, from the time you start a pot root, you would need a few extra weeks for plants from cuttings, because you need to add the time required for the cutting to root. If you plant a pot root and it has more than 1 shoot, remove the surplus with the point of a sharp knife.

Which produces superior blooms, an intact pot root, a divided pot root, or a rooted cutting? In general, the Jacks find no difference in bloom quality among plants from undivided pot roots, divided pot roots, tubers, or cuttings. This comparison probably varies by cultivar. For example, Camano Cloud has a reputation for producing better blooms from cuttings than from tubers (if they keep) or pot roots. (Susan Ambrose once wrote that Camano Cloud frequently does not put out feeder roots when planted from tubers.) While one might compile a list of varieties that do best from each method of propagation, we do not have such a list. If a cultivar produces huge tubers and you plant the entire tuber, there is a danger that the plant may rely too much for nourishment on the mother root and not put out enough feeder roots to have maximum vigor. Rooted cuttings, in contrast, must put out feeder roots since they start without any mother root. This difference may explain why rooted plants sometimes produce superior blooms compared to plants from tubers it may also explain why the smaller pot roots often produce superior plants and blooms to unrestricted field tubers. One guess is that some cultivars tend to produce better results from cuttings and others tend to do so from tubers. However, in general, pot roots and tubers produce clumps that are easier to handle and divide compared to clumps from rooted cuttings.

The Jacks start their pot tubers in tunnel houses and then shift them outside under shade cloth to harden them off. They start their roots in 4 inch planter bags and keep them until they average 4 to 5 inches of growth above the planter bags.² Around mid November (which corresponds to mid May in the Northern Hemisphere), they break away the potting mix, spread the new roots, and plant the started pot tubers about 4 inches deep.

The Jacks start the pot roots before planting them out for several reasons. By determining that they are healthy, they have no crop failures and thus avoid gaps in their display beds. They delay planting in beds until all threat of frost is past. Because they live in extreme Southern New Zealand, their growing season is short. They can have frost as late as mid November and as early as the first part of March. By starting pot roots, they can also determine any growth problems (such as virus) before they plant in the field. When they plant out, their pot roots usually have 6 to 10 inches of plant growth.

Growing Your Own Pot Roots

During the flowering season, Walter and Kit carefully mark 2 to 3 especially vigorous and healthy field

7. Pot Tuber Notes (continued)

tubers to propagate. They take the tubers from those plants, place them in polystyrene trays with a mixture of 60% potting mix and 40% coarse sawdust, place them on heat pads, and start them growing on August 1 (corresponding to February 1) with at first only a light watering. As growth gets underway, they step up the watering. They take two crops of cuttings from each set of tubers, although they can take more if the shoots remain vigorous. They find they do not obtain worthwhile results from weak growth. As they finish with tubers, they remove the used tubers and replace with new tubers to start for cuttings.

They cover new trays of cuttings for a day with newspaper to protect them from too much shock, especially if the weather is hot and sunny. Cuttings should receive bottom heat for up to 2 weeks.

The Jacks pot the cuttings starting 3 to 4 weeks after they take them. They recommend leaving the trays of rooted cuttings up to a week without water (depending on growing conditions) before potting them. Let the mix almost dry out but keep an eye on the cuttings and mist them lightly periodically to keep the leaves healthy. The harsh treatment forces the rooted cuttings to put out lots of new growth as the plant looks for moisture. By drying out the rooting medium, you keep root damage to a minimum, because dry potting mix breaks away from the young, tender roots more readily than does heavy, wet potting mix.

The potting mix they use contains peat, river sand, bark, 6 month time release Osmacote, plus a fungicide. The fungicide is most important because it prevents dampening off of the new cuttings. If your potting mix does not contain a fungicide, spray with Benlate or a similar fungicide immediately after repotting. If your potting mix does not contain time release fertilizer, use a balanced Osmacote or Once brand 3 to 4 month time release fertilizer at the rate the manufacturer recommends.

Once their potted cuttings have started growing in their greenhouse, they place them on sawdust pads about 4 to 5 inches apart. The close placement prevents the plants from growing too vigorously. One wants root growth, not top growth. Some varieties (such as Cheyenne) make long, robust tubers that like to escape the planter bag. For these varieties, they lift the tuber half way through the growing season and clip the roots.

Cover the pots with 1 to 2 inches of sawdust to keep the moisture in and prevent the potting mixture from going hard on the top and shrinking from the sides of the bag. If you plant the bags any deeper, the roots will form outside the bags and make them useless.³ A monthly spray with a combination fungicide/insecticide and an occasional clipping to prevent the plants from flowering (except one or two blooms to verify the variety) constitutes the extent of the care they receive.

The Jacks recommend growing the pot tubers hard — no foliar feed and not too much water. If the climate permits, grow them a little on the dry side — the tubers will be firmer and will keep better during the winter. Over fed and watered plants can form small, soft, poor keeping tubers.

The Jacks apparently grow most of their pot roots under shade cloth. They generally grow the more difficult to tuber varieties (such as Fern Irene and Margaret Ann) indoors, in their “tunnel houses.”⁴

Clay pots would be preferable to the planter bags the Jacks use, but the cost of clay pots for the high number of pot roots they grow would be prohibitive. For home use, a dahlia enthusiast can use small containers such as for margarine or dairy products. Keep the drainage holes small to prevent the roots from escaping. To winter the pots tubers, cut off the tops, leave the tubers in their containers in the growing medium, and then replot them to start when you are ready to use them for the following season. (Bill McClaren recommends

7. Pot Tuber Notes (continued)

letting the lifted pot roots dry out for a couple days and then wrapping them in newspaper to store for the winter.)

If you find your pot roots tending to be soft or rotting, one problem may be that the soft or poor keeping ones could be immature. Some varieties mature late. Some varieties always make good pot tubers while others are very “shy.” Most healthy, vigorous dahlias make good pot tubers. Any dahlia that has health concerns or is not a vigorous grower, normally makes small or difficult to keep pot tubers. When an old favorite starts letting them down, the Jacks retire it to the “paddock block” (Kiwi term for a field) for 2 to 3 years without any fertilizer, restrict it to one set of blooms, and then cut it back. This treatment revives many varieties and makes them bounce back better than ever. Those that improve they try again. Those that fail to respond they discard.

¹ Editor’s Note: Walter & Kit Jack of Belle Fleur Gardens, No. 4 R.D., Invercargill, Southland, in extreme southern New Zealand, are among the most successful dahlia exhibitors in New Zealand. Belle Fleur Gardens is also one of the premier international commercial dahlia suppliers. The Jacks, originators of the Oreti line of dahlias (including the beautiful Oreti Kirsty, BB C DB, and highly successful Oreti Duke, Porn Pr), plant and sell only pot grown tubers. In response to a request from the ADS Bulletin, they sent some hints from their extensive experience. Alan Fisher helped turn their letters into an article and added some editorial comments.

² The Jacks use 4x4 inch black polythene bags that are approximately 4 inches deep. I am unaware of similar bags being sold in the U.S. The closest one could probably find would be 4 inch square plastic pots. The bags are presumably much less expensive than pots for growers who plant thousands of rooted cuttings each year.

³ When the stem has roots between it and the formed tuber, it is difficult to get the pot root to keep. This condition arises sometimes when the pot is too large or the roots grow through the drainage holes and form outside the pot.

⁴ The Jacks write,

A tunnel house is very common here, similar to a glass house but in the place of glass. It has a pull-over polythene cover, probably referred to in the U.S. under another name. One we use is 100 x 26 feet; another is 50 x 26 feet. For propagating, we use a 50 x 30 ft. hothouse constructed from Duralite (a fiberglass).

8. Naked Pot Tubers

The picture on the right shows a pot tuber at about 2 times actual size. It was grown in a 3" square pot.



The picture on the right shows a pot tuber at about 1 1/2 times actual. It was grown in a 3 inch square pot.



In this case the cutting was started in a foam cube. We did not get a good supply of sprouts from pot tubers grown in this manner. The eyes were mostly covered and did not readily break through the foam.



In many cases, the pot tubers are shriveled and a tangled mess. Nevertheless, they produce good plants the next year.



9. *Dahlia Diseases*

Dahlia Diseases Table of Contents

This table of contents provides a preliminary list of diseases with abstract that may afflict dahlias.

1. Bacterial Wilt

Causes stem drooping and wilting. Infected stems have a wet soft rot near the soil. Destroy infected plants and rotate plantings.

2. Bacteriosis

Causes browning and softening of the stem. The pith is moist and blackened with the rot extending into the bark. A foul odor is associated with the disease. The roots may be infected.

3. Botrytis Blight

A popular name is gray mold. A common fungus. Spores germinate and penetrate tender, weakened, injured, aging and dead tissues during periods of high humidity in temperatures ranging from 32 to 85 degrees fahrenheit. They initially cause brown spots which continue to enlarge in humid atmosphere and eventually turn to a tan to gray fuzzy mold. Remove affected parts and treat with fungicide.

4. Canker and dieback diseases

Cankers are dead portions of plant stem tissue. Caused by bacteria or fungi that enter the stem through wounds, stomates, or nectarhodes in flowers. The most common bacterial canker is fire blight caused by *Erwinia amylovora*.

5. Crown Gall

Caused by a soil bacterium — *Agrobacterium tumefaciens*. Causes large abnormal growths at the base and or on tubers of the infected plant. The plants are stunted and the shoots spindly. Infected plants, including tubers, should be destroyed.

6. Powdery Mildew

Causes white or grayish powdery mold. Worse late in the season. Badly infected leaves distort, droop, and drop. While unsightly, powdery mildew is seldom fatal.

7. Stem Rot

Dahlias growing in heavy wet soil, and infected with stem rot, typically wilt and die. A white mold encircles the stem at the soil line. Treat by improving drainage and not crowding plants. Rotate plantings.

8. Verticillium Wilt

Causes brown or black streaking in the conductive tissue of the stem. Plants wilt and die. Stored tubers rot if infected. Destroy infected plants and rotate plantings.

9. Viruses

Causes a variety of leaf mottling patterns, necrotic and ring spots on and bubbling or distorted leaves, stem streaking, stunting, and wilting. Diagnosis often is misleading, if based on symptoms alone. Infected plants can also be carriers showing no symptoms whatsoever. Viruses cannot be controlled with pesticides. Thrips is the most common vector. Controlling thrips will help prevent spread of viruses.

References

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<http://www.msu.edu/msue/imp/modop/00000480.html>

Diseases of Annuals and Perennials A.R. Chase; Margery Daughtrey; Gary W. Simone. Ball Publishing 1995, Batavia Illinois. USA.

Greenhouse Plant Viruses (TSWV/INSV) No. 2.947. L.P.Pottorff, S.E. Newman, Gardening Series, Colorado State University Cooperative Extension.

Watch Out for Botrytis, by Margery Daughtrey, Greenhouse Grower, May 1985

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Botrytis

Symptoms

Botrytis (also known as gray mold) is most often, but not always, associated with greenhouses. It occurs on outdoor plantings following cool, damp, cloudy weather. Dahlias started from cuttings are particularly susceptible to botrytis.

The picture on the right shows botrytis in its initial stage—most often attacking the leaf edges of tender shoots.

The picture on the lower right shows botrytis in the "gray mold" stage. Botrytis often appears on fruit such as strawberries in supermarket produce departments.

Control

Avoid splashing water on the foliage. Free moisture is needed for spore germination and infection.

Remove and destroy affected parts and other plant debris. The fungus readily attacks aging or dead tissue and then produces tremendous quantities of airborne spores.

Provide good air circulation around the plants.

Apply fungicide when symptoms first appear. Use several chemicals on a rotational basis to avoid building resistance of one chemical by the botrytis spores.

Benomyl (Benlate), chlorothalonil (Daconil 2787, Exotherm Termil), iprodione (Chipco 26019) and vinclozolin (Ornalin) are fungicides widely recommended for botrytis control.





Crown Gall

Crown Gall causes large abnormal growths at the base of the infected plant or the top of one or more tubers as shown in the adjacent picture. Notice the stretch marks on the skin. The plants are stunted and the shoots spindly. Since there is no effective treatment, infected plants and tubers should be destroyed.

The picture on the right shows the same tuber as above but from a different view.



Crown galls can appear on the body of a tuber as well as on the neck close to the stem of the plant.



Dahlia Viruses

Photographs by Ben Lawrence

Observable Symptoms

Leaf symptoms include mottling, necrotic and ring spots, bubbly surface, and distortion. Stem symptoms include streaking and soft dark tissue. Plant symptoms include stunting and generalized wilting. These symptoms are also symptoms for a variety of other fungal and bacterial diseases, environmental stresses, and cultural practices.

It is very important to recognize that diagnosis based on symptoms alone is often misleading and dahlia plants can be carriers of a virus and show no symptoms whatsoever.

Many of these symptoms are illustrated by the following photographs.

The pictures that appear on these pages are partial shots of several plants that were tested by Mary Jane Sosler, Plant Clinic Manager, Colorado State University Cooperative Extension Plant Clinic, Jefferson County. Mary Jane has had more than 10 years experience as a plant diagnostician and holds a Masters Degree in Horticulture. She performed serological tests on the plants shown.

The plants tested positive for Tomato Spotted Wilt Virus and Impatiens Necrotic Spot Virus. They were negative with regard to Dahlia Mosaic Virus even though it is very common. Plants that are infected with any virus, should be destroyed!!

The pattern on the leaf in the picture at upper right and on the right is typically referred to as "Oak Leaf". The center vein appears almost normal.

Here on the right the central and major lateral veins are affected.





This is another typical pattern. The central vein remains a narrow dark green stripe with a broader yellow stripe on each side of the central vein. This picture is an enlarged view of one leaf of the next picture down.

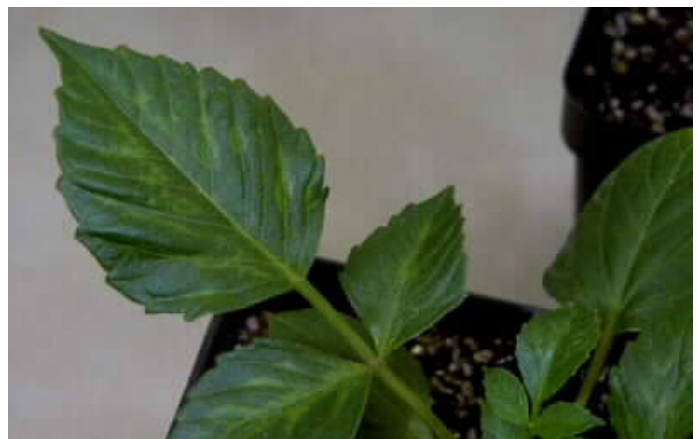
Note that the same plant may have different patterns on different leaves.

Dahlias Viruses (continued)

On an otherwise very healthy plant, the maple leaf pattern suggests virus. The word “suggests” is used because horticulturists and plant diagnosticians are quick to point out that virus is not absolutely indicated by such patterns and the pattern does not indicate which virus the plant is infected with. Only tests can confirm that a virus is present and what type of virus it is. However, if you see one or more of these patterns, the plant should be destroyed unless you can have it tested.



Faint differing patterns are visible on at least three of the leaves in this picture.

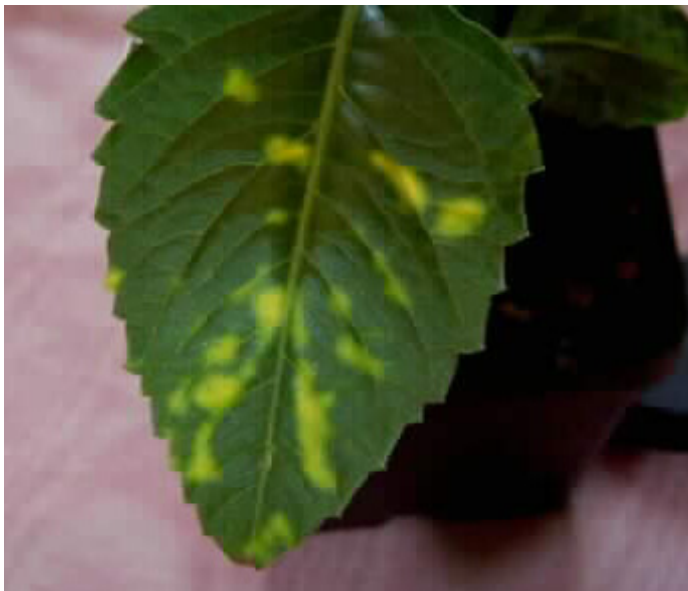




Dahlias Viruses (continued)

The dahlia stem and leaf stalks pictured on the left is also symptomatic of virus. It tested positive for Tomato Spotted Wilt Virus. The leaves on this plant looked normal. Brown streaks on stems or stem lesions are fairly common symptoms of Tomato Spotted Wilt (virus), but fungal organisms can also cause the same symptom.

This leaf of CR Miller was mailed to the laboratories of Agdia. <http://www.agdia.com>. Initially, Agdia reported that these symptoms were not indicative of any known disease. They subsequently corrected their report to indicate that the plant tested positive for "Tobacco Streak Virus."



Managing Viruses in Dahlia Gardens

Background Information

Some background information is important to understanding the strategies that will be recommended for managing — not controlling or eliminating — viruses in dahlia gardens. All viruses are obligate parasites. (Greenhouse plant viruses) This means they cannot survive outside of their host (the plant or certain insects [vectors]). They cannot survive in soil, compost, or other garden related materials and substances even though fungal and bacterial organisms can.

Viruses can be carried from one plant to another by insect feeding, vegetative propagation, and human mechanical inoculations. Insect feeding is, by far, the most common means of transmission. Some viruses, impatiens necrotic spot virus for example, can only be transmitted by one vector, the western flower thrips. Other viruses can be transmitted by up to 50 different insects. According to *Westcott's Plant Disease Hand*

Managing Viruses (continued)

-*book*; dahlias are known to be host to four viruses: Dahlia Mosaic (vector—aphids); Tomato Spotted Wilt (vector—onion, flower, and three other thrips); Cucumber Mosaic (vector—aphids and seeds); Tobacco Ring Spot (vector—nematodes).

In the case of vegetative propagation, viruses can be transmitted in two ways. Cuttings may be taken from a contaminated plant in which case the cutting is already infected. Secondly, the blades used to take the cuttings from a contaminated plant may be immediately used to take cuttings from a plant that is not contaminated, transferring juices containing viruses from the infected plant to the non-contaminated plant. This later is actually a case of mechanical inoculation.

Human mechanical inoculation occurs when juices from a contaminated plant are transferred by mechanical means to a non-contaminated plant (i.e. during activities such as dividing tubers, taking cuttings, disbudding, topping, trimming, etc.). The probabilities of transmitting virus by mechanical inoculation are thought to be much lower than by the other two means. Nevertheless, the possibility of such transmission is there and must be considered in developing strategies for managing viruses. A crude analogy might be "are you going to practice safe sex or not"?

Managing viruses in dahlias by observing virus symptoms and destroying plants with such symptoms is not possible. First, symptoms that correlate with virus also correlate with fungal and bacterial diseases, environmental stresses, and cultural practices. Thus, without a serological test, the diagnosis may be wrong and plants not having virus may be destroyed needlessly.

More seriously, however, is the fact that dahlias can be infected with virus and show no symptoms whatsoever (Greenhouse plant viruses). Thus one may destroy all dahlias showing symptoms of virus and still unknowingly and with high probability keep plants and tubers infected with virus.

The only sure way to keep viruses out of ones dahlias would be to start with all new stock, have all new stock tested prior to usage, and prevent any of the vectors (aphids, or other piercing, sucking insects, such as thrips, planthoppers, and leafhoppers) from reaching your dahlias. While this may sound easy, it is financially impractical and almost certainly infeasible.

Testing tubers or plants for viruses costs in the neighborhood of \$45.00 per plant per virus to be tested. [Link to Agdia](#) to obtain information with regard testing.

Complete control of all vectors is not feasible. Since a large number of different types of plants and many common weeds can carry viruses, completely preventing vectors from obtaining viruses is also infeasible.

Strategies for Managing Viruses in Dahlia Gardens

These strategies are designed to restrict the transmission of virus from one plant to another — maintaining an acceptable level of plant loss due to virus. They will not eliminate virus disease from the dahlia garden.

1. Remove infected plants— Restrict vectors ability to obtain viruses from nearby sources.
2. Chemical control of vectors (certain insects) — Restrict vectors ability to reach dahlia plants in your garden.
3. Sanitation — While the probabilities of transmission by mechanical inoculation are low, wash or sterilize instruments used in taking cuttings, dividing tubers, etc. between treatment of plants.

Remove infected plants.

Remove from the proximity of the garden and destroy (compost* or trash can), all plants (not just dahlias) bearing symptoms of virus even though they may not have virus. Since stunting is the most common symptom of virus disease, give special attention to removing stunted dahlias and other stunted plants

(including peony, columbine, delphinium, iris, impatiens, aster, gaillardia, tomato, cucumber) (Diseases of Annuals and Perennials Page 29).

* If you choose to compost, make sure you do it right.
Managing Viruses (continued)

While viruses cannot survive when the plant is finally dead, fungal and bacterial pathogens can. The composting temperature must reach 160 degrees fahrenheit to kill most pathogens.

Chemical Control of Vectors

Vectors (insects) include: aphids, thrips, planthoppers, and leafhoppers. While some viruses are transmitted by only one type of vector (i.e. Tomato Spotted Wilt Virus and Impatiens Necrotic Spot Virus are transmitted only by Thrips), dahlias can be infected with several types of viruses some of which are transmitted by other vectors. Thus, when applying chemical controls, it is necessary to control for all of those vectors. Use chemicals wisely. Follow the instructions on the label for the particular insects. In most cases, the chemicals will need to be applied at 5 or 7 day intervals. Rotate insecticide chemicals every two life cycles to prevent the insects from developing immunity to the chemical.

Sanitation

While the probabilities are low, viruses can be transmitted from one plant to another by means of cellular juices. A virus can survive in those juices (until they are dried up) for a short period. Blades or other instruments used in dividing tubers, taking cuttings, disbudding etc., can carry those juices from one plant to the next. Dipping such instruments in alcohol may help. While alcohol will not kill virus, it may wash away and/or dilute the infected juices, reducing the probability of transmission considerably.

10. Insect Problems

By Ben Lawrence

Insects are listed with descriptive indications of the pest on the plants. Additional information and methods of control are described on later pages. Click on the insect name for which you want more information.

1. Aphids

Indications: Aphids visible on foliage; Curled Leaves; Wet sticky glistening film on foliage.

2. Spider Mites

Indications: Individual mites are barely visible on a contrasting surface—1/50th of an inch in size; Fine stippling on upper surface of leaves leading to overall bronzing of the leaves; Fine webbing on foliage; Plant loses vigor.

3. Thrips

Indications: Individual thrips are typically barely visible on the blossoms. They can fly and run rapidly—very difficult to catch.

10. Insect Problems (continued)

1. Aphids

Aphids usually prefer the newer growth on plants. They often blend in with the color of the plant although they can be found in almost any color from reds to greens.

Natural predators, such as the parasitic wasp shown on the right with the aphid, help keep aphid numbers under control.

Aphid and Parasitic Wasp

Aphids, though small, are large enough to be seen with the naked eye. In the early stages of infestation, seeing a few aphids is about the only indicator available. A few aphids can be seen on the dogwood leaves at the right.

As the infestation increases, the new growth leaves of the plant begin to curl, as shown on the right.

Aphids feed on plant fluids and then excrete a liquid waste. This leads to a third indication for the presence of aphids. The waste is known as "honey dew" and forms a wet, sticky, glistening film on foliage.

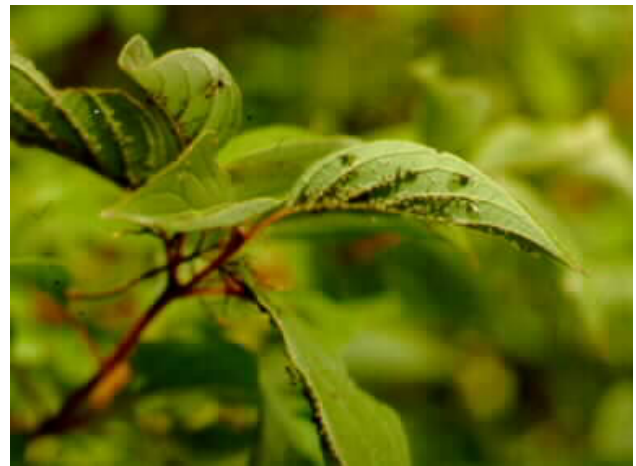
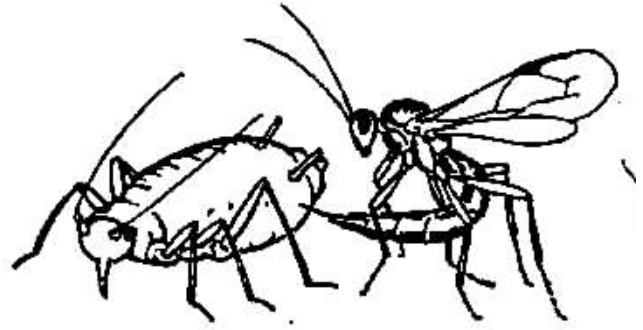
Picture of Honey Dew on Leaf.

A strong stream of water from a hose will dislodge aphids. If the stream of water is too strong the plant will be damaged. In the case of large plants, aphids tend to be removed from one location to another location on the same plant.

Picture of hose being used to wash aphids off dahlia plant.

Insecticidal soap and many chemical insecticides provide very good control of aphids.

Picture of a variety of chemical insecticides that effectively control aphids on dahlias. In all cases, the instructions on the label should be followed.



10. Insect Problems (continued)

2. Spider Mites

Spider Mites affecting dahlias are typically the "two spotted mite" or the "red spider mite." One indication of the presence of spider mites is seeing them. 1/50th of an inch in length, these pests are barely visible as a dot on a contrasting background. Hold a piece of white paper under the leaf and shake or scrape the underside of the leaf to cause the mites to fall on to the paper. If they are present they will appear as very small dots on the paper. If you do not get those small dots, it is likely that your plant does not have spider mites. The drawing of a red spider mite on the right is several hundred times the actual size.

Another indicator of the presence of spider mites on dahlia plants is the stippling and bronzing of the top side of the leaves. Using their needle like structures called stylets, these pests rupture leaf cells, pushes their mouth into the torn tissue, and draws up cell sap. As patches of cells are damaged, a stippling of the upper surface of leaves appears. In the picture on the right, a brownish haze shows on the leaf in the near foreground. That is the stippling effect and as the infestation grows, the leaf will become even more brown—sometimes described as a "bronzing" effect.

A third indication of spider mites on dahlias is the presence of fine webbings—spider webs made by very small spiders. These webs collect dust and dirt making the webbing more visible. Infested plants progressively lose their color, drop their leaves and may even die if the infestations are not removed.

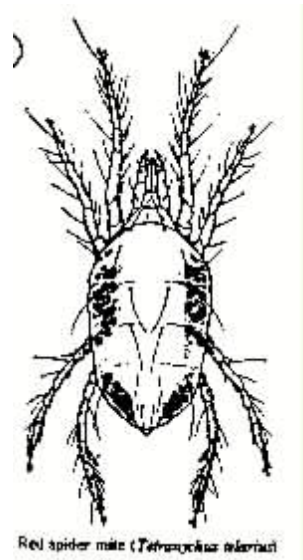
Control

Spider mites are more vigorous during hot and dry periods of the year and they

don't like moisture on the foliage. A strong stream of water will dislodge spider mites. However, care must be taken not to damage the plants. I have not found this control approach very practical except to remove one infestation from one plant.

Most insecticides are not effective on mites and some result in increased mite damage by killing their natural enemies.

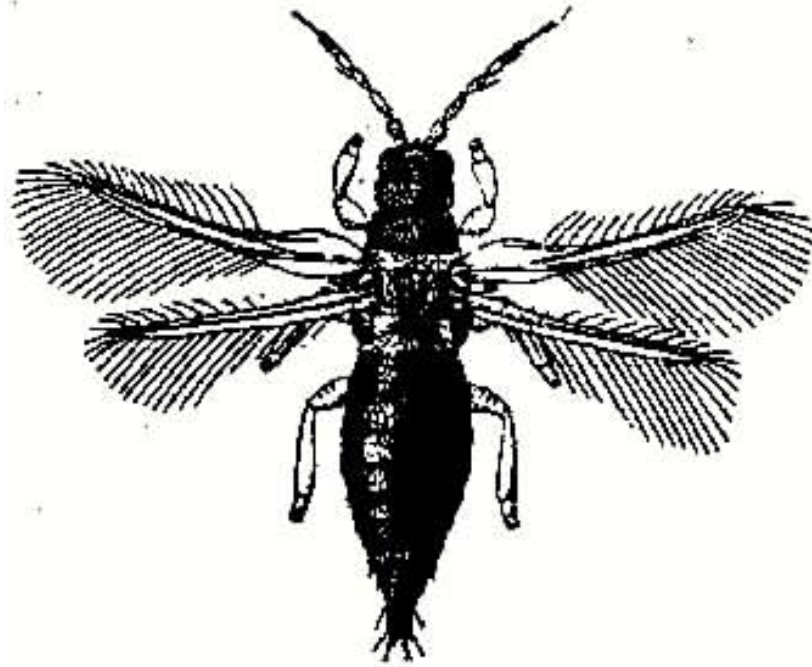
Three insecticides known to be effective against spider mites are Kelthane, Avid, and Talstar—displayed in the picture on the right. Be sure to follow the instructions on the label.



10. Insect Problems (continued)

3. Thrips

The picture below is magnified many times. Thrips are very small—less than a 32nd of an inch long and when landed they are very thin as their wings are folded.-



Thrips (Heliothrips haemorrhoidalis)

11. Topping Dahlias

By Carroll McAllister and Deannie Anderson

Topping a dahlia is of utmost importance in growing a plant with blooms of the largest diameter and depth possible for the variety. It also keeps your plant shorter and bushier, and thus easier to maintain.

Suggested Number of Leaf Pairs to be Kept on the Plant

Bloom Size Inches

Size Designation

Leaf Pairs

8 to 12 inches

A and AA

2 - 3

6 to 8 inches

B

3 - 4

4 to 6 inches

BB

4 - 5

Under 4 inches

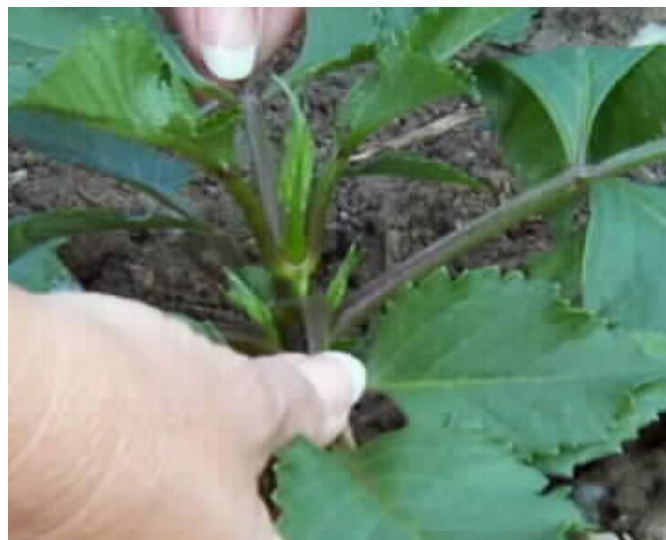
M

4 to 6

over 3.5 inches

Ball

5



11. Topping Dahlias (continued)

Specific recommendations are not made with respect to all other classifications. However, consider keeping leaf pairs in accordance with expected bloom size.

OPTION I

Under Option I the plant is topped while it is very small, just as it is developing the number of leaf pairs desired for its ultimate bloom size.

This option gives an early start to the development of the laterals to be nurtured and truncates the development of laterals that would later be discarded and, in theory, conserves the energy of the plant. Under this option, the point at which laterals emerge from the primary trunk is quite close to the ground.

The plant pictured on the right (Zorro an AA) has a pair of cotyledons (leaves that are not true leaves) and three pairs of true leaves. In this example, it will be topped leaving three leaf pairs (See table above).

To top this plant...

1. Count the number of true leaf pairs from the bottom up to be sure you are at the correct position for topping.

In this case, the top, or tip, of the plant is between the third pair of leaves. The top to be removed can be seen in the center of the picture between the top pair of leaves.

2. Then simply pinch out the center. Be extremely careful not to disturb the new growth on either side of what you are pinching.

Note how close to the ground the pairs of leaves are. This is the result of topping the plant when it is very small having developed only three true leaf pairs.



3. As the plant grows, you will observe new growth on the pairs of leaves you have left on the plant becoming robust and growing rapidly. These are referred to as laterals. The fewer left on, according to the above chart, the closer you come to the maximum bloom size.

4. When the dahlia has reached about 12-14 inches tall, remove any extra pairs of leaves at the bottom of the stem that are not true leaves (cotyledons). They do not match in shape and size the pairs you counted for topping.

11, Topping Dahlias (continued)

Since this plant is so low to the ground we cannot provide a picture showing the cotyledons to be removed. However, the picture at the right shows where the top was removed and the emerging three pairs of laterals

between the main stem and their respective leaf stems. The grower is pointing to five of the six emerging laterals. The sixth lateral is behind the main stem and cannot be seen.

The picture on the right also shows the two laterals on either side of the place where the top was removed. At the time when the top is removed those laterals are very small—sometimes barely visible. It is important that they not be damaged in the process of topping the plant.



OPTION II

Under Option II, the plant is allowed to grow until five to seven true leaf pairs have developed — ranging from 8 to 15 inches in height. Then the top, or tip, of the plant is removed and the leaf pairs to be kept are arrived at by counting down from the top most pair.

This option lets most of the potential leaf pairs and their respective laterals for the plant begin to develop. Since the bottom leaf pairs are the most mature and the leaf pairs to be removed are from the bottom upward, the most mature leaf pairs will be removed. In theory, the plant expended a lot of energy developing those leaf pairs only to have them removed.

Since the leaf pairs to be removed are several in number and at the bottom of the stem the remaining leaf pairs and their respective laterals will be some distance from the soil. Achieving this distance from the soil and being able to place a plant initially grown in a pot deeper in the soil, are the primary reasons for selecting Option II.

The plant pictured at the upper right is "Phoenix" a "B" size. In this example it will be topped to leave four leaf pairs (see table on "Topping Dahlias Page 1").



1. The first step is to allow the plant to grow until it has five to seven true leaf pairs. The plant pictured on the right has six pairs of true leaves. Looking carefully, the six nodes from which the leaf pairs sprout can be identified.

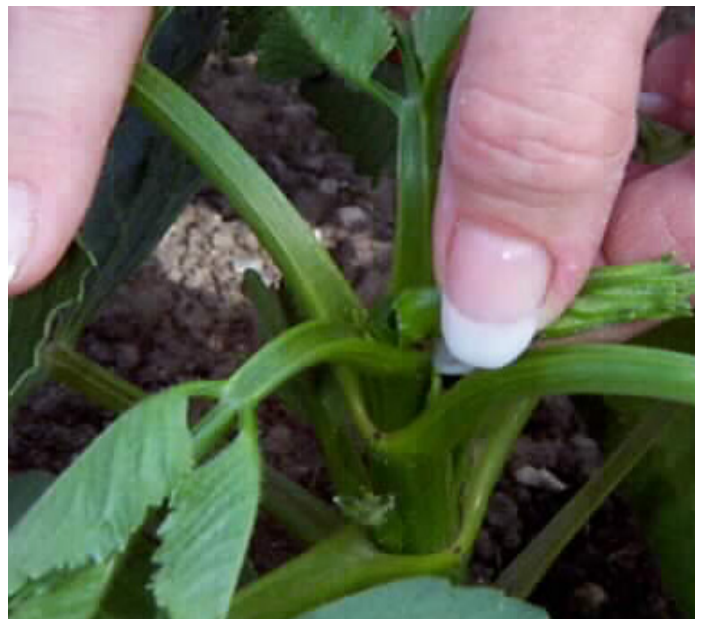
11, Topping Dahlias (continued)

2. Count the leaf pairs to be kept from the top down. The top is emphasized because as the plant grows, the stem becomes cane like or hollow. Counting from the bottom up and then topping may leave an "open" stem (as shown on the right) which can rot the whole plant if rain or water gets in.

3. Pinch out the growing center while not disturbing the tiny new sprouts on either side of it.

4. Starting at the bottom, remove all leaf pairs and new growth up to the lowest leaf pair you selected to leave on the plant. This will leave only the desired number of laterals (In this example, 4).

Now your plant is off and running. It is topped and excess foliage removed all in one process. It may resemble a small tree, but never fear, it will fill out and become a lush plant. Also with it's height and the stripped lower stem there are no leaves on the ground to provide a convenient walkway for spider mites.





Option I

Laterals emerge close to the soil.



Option II

Laterals emerge high up from the soil.

11, Topping Dahlias (continued)

Comments on this presentation by Alan A. Fisher

Ben — some comments on the nice new section on topping dahlias. The section says that in theory plants use up energy growing extra laterals. An alternative theory is that the extra growth makes the plant stronger and contributes to larger blooms. That is the theory I have heard more often. I am unaware of evidence to select between theories.

I often top late to delay the development of laterals to get my first blooms later. However, when I do, I always leave lower laterals whenever possible. The lower laterals bloom later than the higher ones. Because they have longer to develop, they should give larger blooms than higher laterals. I have never before seen recommendations to strip lower laterals and let higher laterals bloom. The plant has better stability if one lets the lower laterals develop.

Moreover, one can try to estimate blooming time. If one has a terminal bud, one can estimate when that bud would open. (See article in the June Bulletin in 2 of the past 3 or 4 years.) Count down leaf nodes. One can estimate 6 to 7 days for each set of leaves. If one selects a lateral 6 sets of leaf nodes down from the terminal bud, then one can expect the lateral from that leaf node to bloom 36 to 42 days later than the terminal bud. This procedure is useful in determining which leaf nodes to use when topping for a show. I would estimate more like 7 days per leaf node for AA and A and more like 6 days for B or BB. The exact timing varies with latitude (further north days are longer and thus development may be quicker). However, plants often develop faster in warm than in cold weather.

Thus temperature can also affect timing. When topping late, top as little as possible. It is not necessary to remove everything in the center. Indeed, when topping, I try to eliminate as little as possible to avoid getting a hole in the center. I then remove all side shoots from top leaf nodes as soon as I can. I check each plant at least twice a week and remove extra laterals as soon as possible — unless I want to leave some for double topping or timing purposes.

12. *Trimming Dahlias*

by Ben Lawrence

Dahlias produce lots of leaves and branches (laterals). At the bottom of the plant, these leaves and laterals provide hiding places for insects and moisture for bacterial and fungus organisms to multiply. Removing some of these leaves and laterals helps control those insects and organisms.

At the same time, the leaves provide shade — protecting the soil and roots of the plant from the heat of the sun. They help hold in available moisture increasing the humidity. Dahlias prefer high humidity. Removing the leaves takes away some of those benefits.

The degree to which leaves and branches should be removed from the bottom of dahlia plants depends on the particular environmental conditions in which the plant is grown and the personal inclinations of the grower.

The picture on the right shows a plant stripped of leaves and small laterals from the soil up to about eight inches. The open space allows good air circulation.

When removing leaves, be sure to rub off the very small beginnings of laterals or they will grow rapidly to fill in. The small laterals grew to the size shown in just 10 days.



13. Disbudding

by Louise and Ben Lawrence

We are unaware of any generally accepted terminology pertaining to dahlia culture, particularly when it comes to topping, disbudding, delateralizing, deleafing and other things that need to be done in the process of growing fine dahlias. In our conversations with other dahlia enthusiasts, we have found that considerable confusion can result unless we explain to those involved in the conversation, what we mean by certain words and phrases. Hoping to enable the viewer of these pages to understand what we are trying to say, we provide a few definitions of words and phrases that will be used.

Topping

Topping is the act of removing the growing tip of the main stem of a young dahlia plant. Some people refer to it as “stopping” because it is the process by which we stop the growth of the main stem and cause emerging laterals to begin vigorous growth.

The picture on the right shows the tip of the main stem of a young dahlia plant. In these pages removing that growing tip is called “Topping.”



Removing Laterals

The small growth that emerges in the angle made by the main stem or a lateral stem and a leaf stem is referred to as a “lateral.” Yes, a lateral is similar to a main stem in all respects except that it stems from the main stem. A “lateral” is often referred to as a meristem or an axil when it is small and a lateral when it is larger, having leaves and laterals of its own.

In these pages, the two words “removing lateral(s)” will mean just that. Hopefully, we will avoid the terms “delateralize” and “disbranching.”

A “node” is a place on the stem from which leaves and laterals emerge.



13. Disbudding (continued)

Removing Leaves or a Leaf

The picture on the right shows several leaf stems attached to the main stem of a dahlia plant. In these pages “remove a leaf” means remove a leaf at the point where its stem (or petiole) joins the main stem (node) or a lateral stem.

We will avoid using “disleaf” or “deleafing”.



Disbudding

Disbudding is the act of removing the two or three small side buds from the top of a lateral.

The picture on the right shows three buds. In some cases, the tip of a lateral may hold four buds. The two pointers show the small buds on both sides of the large bud.



13. Disbudding (continued)

Why Disbud?

Disbudding is not essential to grow dahlias with fine blooms. In fact, if a dahlia plant is not disbudded it will produce many more blossoms than a plant that is disbudded. Disbudding, in addition to topping, is done in order to produce larger and fuller blossoms. Disbudding directs most of the energy saved, by removing some buds, to the remaining bud causing it to grow larger in diameter and in depth. Disbudding does not affect the form or color of the blooms.

Disbudding

The last picture on the previous page showed three buds at the tip of a lateral.

The picture on the right shows one of the smaller buds being pinched very lightly and pulled off the stem.

The picture on the right shows the second small bud being removed.

A leaf has been removed on the plant pictured here to reveal the two small buds tucked beneath and to both sides of the central and larger bud. Attempts to disbud when the buds are at this very small stage, often lead to the accidental removal of the central larger bud. The stems of these buds are very small and brittle at this stage and only slight pressure on the central bud can cause it to break off. We find it better to wait a day or two until the small buds are a little larger making it easier to pinch and pull them off.

Disbud Carefully

Disbudding should be carefully done so as to leave a clean break level with the surface of the angle between the lateral stem and the leaf stem. For most dahlia competitions the two leaves being touched by the pointers must be kept on the stem in good condition and the spots left where the buds were removed should be as inconspicuous as possible. In competition, points are taken off for unsightly scars where buds have been removed.



13. Disbudding (continued)

In some cases, there will be three small buds and one large bud at the tip of a lateral. When this occurs, the third bud will be attached to the stem of the central bud together with a small leaf. The 1st and 2nd side buds will be in their usual place on their respective stems. When the buds are first visible, all four are firmly packed together and hard to differentiate. All three of the smaller buds should be removed.

If a plant is not disbudded, all the buds will develop. The picture on the right shows a central bud and two side buds whose stems are lengthening. Eventually, the stems will be 6 to 10 inches long and all three buds will bloom. The three blooms will be approximately the same size but smaller than the central bloom would be if the two side buds were removed.

Ideally, when the blossom is mature, the length of the stem of the central bud should be 1 and 1/2 times the diameter of the bloom.

Technically, the removal of the side buds and the third small bud, if it exists, constitutes disbudding. However, in practice the activity of disbudding also includes removing some laterals.

When the small side buds have been removed, two



questions need to be asked and acted upon when answered.

Will the stem for this bloom be long enough for the purpose it is to be used?

Blooms are generally cut just above a node. In the picture on the right, two side buds were removed from the first node below the central bud. The next node down has two laterals (*sometimes two buds instead of two laterals) and two leaves. In the picture, the distance from the bud to just above the second node is about three inches. By the time the bud matures into a full bloom, that distance may be estimated at 9



13. Disbudding (continued)

to 12 inches—not really long enough to ensure good placement in a competition type vase. Therefore, the two laterals at the second node would be carefully removed—do not remove or injure the leaves. Later the bloom would be cut just above the third node and the stem would be 18 to 20 inches long.

Alternatively, if the distance from the bloom to just above the second node was estimated to be 15 to 20 inches, the two laterals at the second node would be retained and the bloom stem would be cut just above the second node.

The picture on the right is a similar view of another plant. It is presented in the hopes that one of the two pictures will be helpful in understanding disbudding and removing laterals.

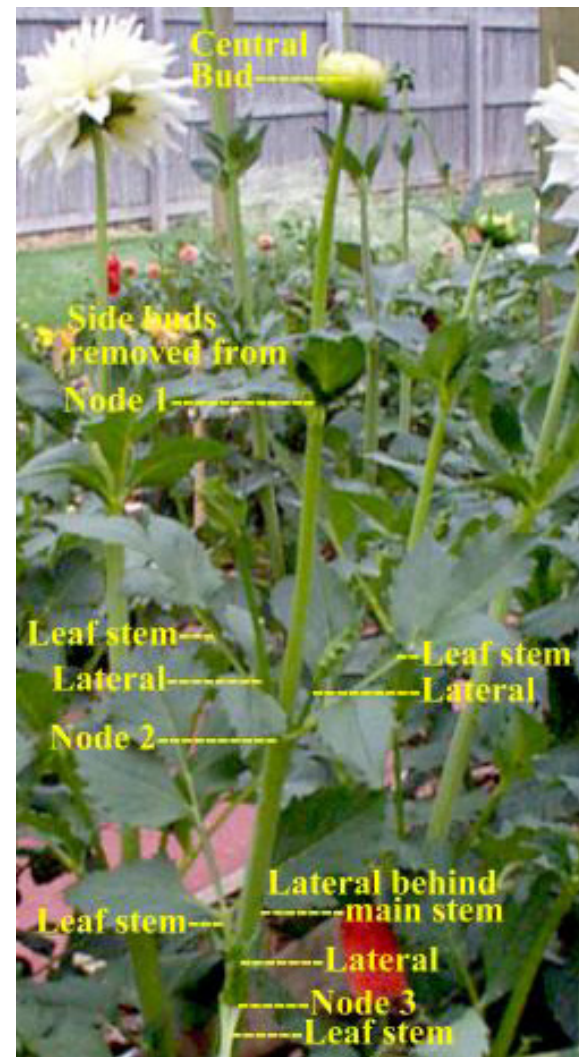
The second question is:

Do we want this plant to be on the tall side, the short side, or medium height for its type?

If it is desired that the plant be taller than the average, do not remove any more laterals than is required to get the desired stem length. If a shorter plant is desired, remove the laterals at the next node down. Some people remove laterals two and three nodes below the node where the side buds were removed. In the picture, the laterals at the second node are currently about waist high. They will grow considerably. A little imagination suggests that leaving the laterals at the second node would eventually result in a very tall plant.

Removing laterals is an art not a science. The beginner is advised to disbud and remove the laterals at the next node down if they are laterals. If the growth at that node appears to be additional buds, they should be removed. Beginners will not be beginners for long. They will very quickly develop their own disbudding and lateral removing strategies once they see the results.

Happy Disbudding!!!



14. Digging, Dividing, and Storing Dahlia Tubers

By Ben Lawrence

At one time, dahlia tubers were quite expensive. Today, however, the price for tubers at local Society tuber sales is such that many people choose to buy new tubers each year rather than digging and storing their tubers. At the same time, others write or call requesting information about digging and storing tubers. This page is prepared for the first time dahlia grower who intends to dig and store the tubers produced.

When should dahlia tubers be dug?

One consideration pertains to the tubers attaining maturity. In some parts of the country, tubers can be left in the ground for a very long time and reach maturity with little difficulty. In others, very hard freezes that can destroy the tubers require that the tubers be removed before any such hard freeze and the question of maturity becomes a secondary matter. You must dig the tubers prior to a hard freeze or lose them with one exception. Some very industrious persons have been known to mulch their dahlia beds with six inches of straw to protect against freezing and then dig the during a later warm spell. If you raise a lot of dahlias, that can be a substantial chore.

Some people advise that the plants should be cut down right after the first killing frost (the majority of the plant is blackened by the frost). But in some parts of the country a killing frost may be accompanied by a hard freeze. Obviously, deciding when to start the process of digging your tubers is very dependent on local conditions and you should consult with dahlia enthusiasts in your area in making those decisions.

Another consideration pertains to the visibility of "eyes" on the tubers. Once the majority of the dahlia plant is blackened by a frost or when a plant is physically cut down leaving a four to six inch stem, its tubers are stimulated to produce sprouts and develop a new plant. An "eye" is a precursor to a sprout. Eyes begin to swell quickly, typically within 4 to 8 days after the plant is destroyed by frost or being cut down. If you wish to divide the tubers when eyes are optimally visible, you should dig and divide the tubers in that 4 to 8 day window. Earlier, the eyes will be less pronounced—later, the eyes will turn to sprouts. And of course, these timing guidelines are average, not precise. In some cases, for example, I have seen plants still blooming that commence producing sprouts as though they have their own internal clock or respond to stimuli that we do not understand.

Cut down the plants.



At the end of the season, marked by a killing frost or determined by your fall plans, and when you plan to dig the tubers, cut the dahlia plants down, leaving a four to six inch stem stub.

14. Digging (continued)

Remove Dahlia plant paraphernalia

Support cages, stakes, and irrigation equipment should be removed. They will interfere with the digging process.



Remove mulch

If the surface mulch is to be mixed into the soil, it should be left. Otherwise it should be removed to avoid mixing it into the soil during the digging process or later tilling.





14. Digging (continued)

Dig with a fork spade

Place the fork approximately one foot from the stem stub and insert it deep into the soil—at least eight inches. Then gently pry back on the fork to loosen the soil. Repeat this action to totally encircle the stem stub and loose the soil. At the last insertion, prying back on the fork should lift the stem stub and the clump of dirt. Taking hold of the stem stub, gently lift while prying back on the fork until the clump comes free. Lift gently on the clump with one hand, letting it partially rest on the soil. Using the other hand, carefully remove the soil from the tuber clump. This must be done gently. Many tubers have rather small necks and can be broken or cracked while loosening the soil or carrying the clump to another location. A tuber with a cracked or broken neck will not grow.

Digging with a shovel or spade.

If a shovel or regular spade is used instead of a fork spade, it should be placed about four inches further from the stem stub than the fork spade. Otherwise, proceed using the same guidelines as for the fork spade.

If a shovel is inserted too close to the stem stub, it is likely to cut through a large tuber. One advantage of a shovel over a fork spade, is that the shovel will cut the strong roots that emerge from the end of each tuber. The fork spade leaves these roots intact and when the fork is bent backwards to pry up on the clump those roots put strain on the tuber and in some instances break it away from the clump, rendering it useless.



Wash the Tuber Clumps.

Washing the tuber clumps can be a wet affair. If only a few clumps are to be washed, spray them with a hose in some location where the water and wet soil will not be problematic.

If you have a large number of clumps to wash, you may wish to make a rack similar to the one shown on the right. In this case, the green plastic coated fencing material allows the water and soil to fall through easily. Almost all the soil can be removed using a hose with a shower type spray. Do not hose the clumps with a solid high pressure stream! The tubers can be damaged as the high pressure stream strips the skin off the tubers.

14. Digging (continued)

Tuber Clump Dividing Tools.

Some of the tools we use to divide tuber clumps are shown on the right. They include: Ratchet type PVC pipe cutters (they work well to cut off large stems and split the clump); several different types of pruning shears, utility knives, carpet knives, florist scissors (on the right near the fungicide bottle.) Not shown are a hammer, butcher knife, hatchet and a troybilt 8 horsepower chipper shredder (when I get exasperated at the tedium of dividing tubers, I just throw a bunch of stems in the shredder—makes me feel better).



Look for the “eyes.”



A tuber will not sprout unless it has at least one “eye.” The eyes are typically found at the top of a tuber on the ridge where the tuber joins the stem. A number of “eyes” are visible in this picture—pink or white small round dots in the center and center right of the picture. An eye is the beginning of a sprout. A sprout can be seen in the upper right hand corner of the picture. When a tuber is removed from the clump, the ridge containing the eyes must be attached to the tuber. In some cases, this will require taking a piece of the stem as well.



14. Digging (continued)

Tuber Clumps

There are five tubers visible in this picture. Note the following:

Not all tubers have “eyes.” The third tuber from the left has no visible eye. It might produce an eye next spring when it is moistened and warmed—then again it may not. Try to save the tubers with visible eyes first. Save the doubtful ones later or discard them. Tubers without eyes may grow roots, as tubers with eyes do, but they will not sprout.

The tuber from which the dahlia plant grows (sometimes referred to as the “mother” tuber) sometimes rots and dies and sometimes it lives on. The dark colored tuber second from the left is the old (mother) tuber from last year. Sometimes it may have an eye, but it has been my experience that it does not produce the second year.

The fourth tuber from the left has three eyes and should be saved.

The tubers on the extreme left and on the extreme right have eyes (not visible in the picture). Nevertheless, they are iffy. The necks are easily broken and if that happens they will not sprout. Additionally, tubers with very long and thin necks, tend to rot while in storage. If you decide to keep them, handle them with care and check them periodically for rot or shriveling.



PVC Pipe Cutter

The picture above shows the PVC pipe cutter being used to cut off part of the stem from this clump along with a tuber with a broken neck.

14. Digging (continued)

Florist's Scissors

In the picture on the right, a pair of florist scissors is being used to cut into the stem around the head of a smaller tuber to remove the tuber from the stem.



Separate the Tuber from the Stem

The previous picture showed the scissors cutting the small tuber from the stem. The picture on the right shows the tuber separate from the clump. The "eye" is visible on the head of the tuber.



14. Digging (continued)

Trim the Tuber

Remove carefully with a sharp knife, any excess material around the portion of the tuber on which the eye is located. The two photographs on the right provide a "before" and "after" illustration. The excess material hinders the drying process which may result in rot. Removing it with a very sharp knife provides clean surfaces that are less likely to become infected.



While the two "eyes" are visible in both pictures, they have been outlined with an indelible pencil in the lower picture for emphasis.

In addition to trimming the head, trim all the small roots clinging to the tuber including the root that is an extension of the tuber itself. If the tuber is extremely long, you may cut off a significant portion of the tuber—perhaps as much as one-third.

Treat the Tuber with Fungicide

While some believe it is not necessary, I treat the tubers to be stored with a fungicide. I use Consan 20. Some use powdered sulfur or fungicides prepared for use in storing bulbs in general. There are



14. Digging (continued)

several good fungicides to choose from and most are available at you local retail nursery.

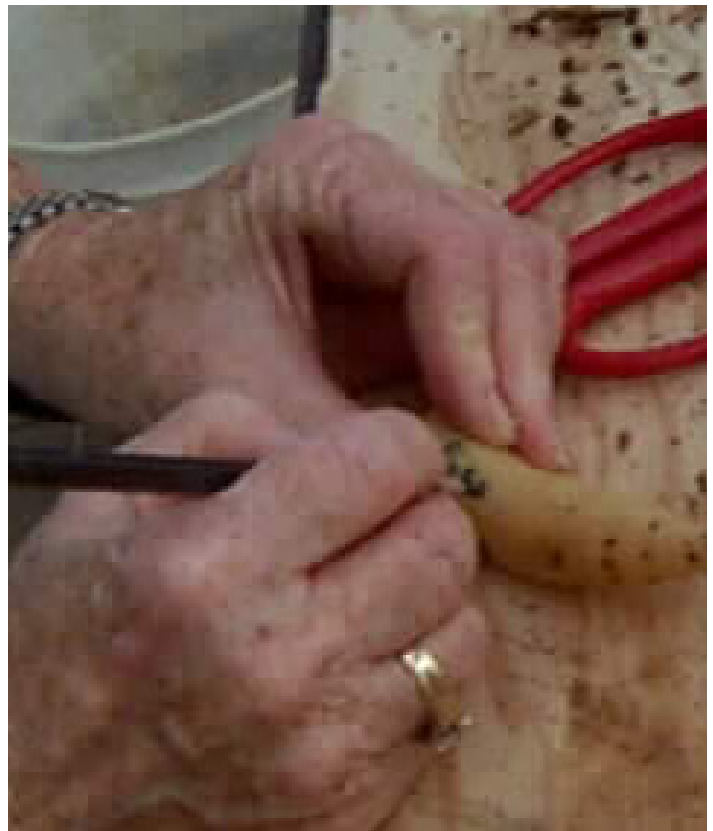
Let the Tubers Dry

The appropriate degree of dryness or moistness for storing dahlia tubers is very much dependent on local conditions. In Eastern Colorado, for example, letting them dry for 20 or 30 minutes is typically long enough. If you leave them for a couple of hours, the tubers will begin to shrivel—in a couple of days they will be hard and dry to the touch. This is not the case in locations where the humidity is high. It is best to ask dahlia growers in your local area about the amount of time required to dry for storage.



Tuber Identification

You must decide how you are going to identify your tubers next spring. Some people mark each tuber (using an indelible pencil—available at most good office supply stores) with the name of the variety. Others put all the tubers from one clump in a plastic bag and mark the bag or put an identification tag in the bag as well. Marking each tuber is time consuming if you have many to do but it is the most reliable, because you can identify each tuber even if they get put into the wrong bag, box, or bin. Make sure you can positively attest to the name of your tuber, particularly if you intend to put them in your societies tuber sale.





14. Digging (continued)

Bag the Tubers

Bagging the tubers is a convenient way to keep your dahlias in variety groups. It also provides a convenient way of putting your tubers in one of several different mediums that keeps the moisture and temperature of the dahlias fairly constant during the storage period. I put about four cups of coarse vermiculite in a one gallon plastic produce bag (a bag with fine holes at about 1/2 inch intervals available in the plastic bag section of your supermarket.) This bag can breathe, but at the same time keeps the fine material from the vermiculite contained in the bag.

Other materials also work well: sphagnum peat moss, wood shavings, and sawdust for example.

Box the Tubers

Even though you may bag your tubers, you must put them in some container that will prevent light from getting to the tubers. A box made of plastic, cardboard, wood, or whatever will do as long as the lid can be closed to prevent light from getting to the tubers. Of course, if the room where you store them is always dark—a crawl space for example—the box would not be absolutely necessary. It might be convenient, however.

To help ameliorate the swings of temperature in the room in which the tubers are stored, I fill all the spaces between the bags with vermiculite.

Temperature of Storage Room

The place where your tubers are to be stored ideally would be around 45 degrees fahrenheit. From experience, I have learned that a temperature range of 35 to 50 degrees fahrenheit is O.K. To dampen the swings in temperature of the room that I store them in, I fill the spaces between the bags as I pack them in the boxes with more vermiculite. Using a high low thermometer I have ascertained that the temperature inside each box stays within a range of 41 to 47 degrees fahrenheit as compared to the room temperature range of 35 to 50 degrees fahrenheit.

I randomly check bags of tubers once a month, and check all bags twice each storage season—December and March. Rotting tubers are removed and the bag involved is aired for a couple of hours. A bag in which the tubers are drying out is given a squirt of water from a spray bottle and returned to storage.

I lose about 10 percent of the tubers originally stored each year.