DAHLIAS

SEED TO BLOOM

The Dahlia Grower's Companion

Audiobook PDF

Kristine Albrecht
Brion Sprinsock

Read by Marnie Sher

ISBN: 9798391379737

My home garden.

Acknowledgments

This book is the collective effort of many people who must be thanked. My husband and co-author, Brion Sprinsock, has his fingerprints all over this book. He wore many hats including writer, editor, graphic designer, interviewer, photographer, researcher, and cheerleader.

When I first discovered dahlias two generous people took me under their wing and taught me many of the techniques in this book. Special thanks to Karen Zydner and Kevin Larkin for their kindness, generosity, and patience.

Nine friends generously read the first drafts and offered helpful edits. Thanks to Art Lewis, Sybil Albrecht Lewis, Patricia Santana, Lee Kavaljian, Eben Sprinsock, Janet Egger, Dr. Virginia Walbot, and Dr. Keith Hammett. Special thanks to Missy Foran who took on the responsibility of chief editor. Her red pen and her gracious nudging transformed this effort from a manuscript into a book.

My small farm is the laboratory for the techniques described in this book. I have the best farm crew that includes Jan Palia, Iris Wallace, Brittany Nielsen, and Narcizo Solorio Lopez.

Finally, I wish to thank and celebrate Erin Benzakein of Floret Farm for supporting and inspiring me throughout my dahlia journey. Erin has been the standard-bearer for flower farmers and farmer-florists, and the path I am on now owes much to her encouragement and generosity.

'KA's Mocha Katie (left) and 'KA's Mocha Maya' (center).

PDF Contents

Author Kristine Albrecht with 'Pam Howden' dahlias.

1. Soil

Unnamed 'KA's' seedlings.

Hand watering young dahlia plants.

Planting into no-till soil.

Cover crop seeds.

Agribon row cover protecting the seeds from birds.

Cover crop growing across an entire plot, both beds and paths.

Cover crop after termination with a weed-whacker.

A silage tarp covering the garden bed after cover crop termination.

No-till soil after six weeks under the silage tarp.

Early season dahlias growing under rice straw mulch in no-till beds.

Gabriela Salazar, Mexico

Gabriela's Website: lamusadelasflores.com
Gabriela's Instagram: @lamusadelasflores

Gabriela Salazar of la Musa de las Flores. Photo by Laura May Grogan.

2. Propagating Dahlias

A rooted dahlia cutting.

Dahlia tubers.

Germinating dahlia seeds.

"Lulu Island Mom' and 'Steve Meggos'.

Heather Henson, Alberta, Canada

Heather's Website: borealblooms.com
Heather's Instagram: @borealblooms

Heather Henson with a dried flower bouquet.
Photo by Megan Timm of Brighter by Megan photography.

3. Cuttings

Dahlia cuttings in rooting cubes.

CUTTINGS vs. TUBERS

Dr. Keith Hammett, a plant pathologist and leading dahlia expert with 60 years of experience growing and hybridizing dahlias, believes that cuttings produce better plants than tubers. He reasons that tubers are made up of old plant material. When a tuber is planted, it is one-year-old plant tissue. Older plant material has had more opportunities through cell division to accumulate mutations. Dr. Hammett explains that this is why the body of a 70-year-old does not look the same as it did when that person was 20 years old and why we are not as vigorous in old age as we were when we were young. In contrast, a cutting is 100% new plant material. When planted in the garden, it is only a few weeks old and is less likely to have damaging mutations that can occur with age.

Another reason Dr. Hammett cites the benefits of cuttings over tubers is that there is a more direct connection

'KA's Papa John' grown from a cutting. Photo by Iris Wallace.

1. Filling the cutting bed w/ potting soil (sand below).

2. Pulling out soil to make a trench.

3. Nestling tubers into the trench.

4. Tubers in potting soil with crowns left unburied.

Green shoots growing from a tuber clump in a cutting bed.

Taking a cutting.

Stripping off the lower leaves.

Taking a pull.

Pushing a cutting down into a rooting cube.

Adding a small amount of water to the bottom tray below cuttings.

Rolling the rooting cube in mycorrhizal inoculant.

Making a hole in the potting soil for the rooting cube.

Settling the cutting into potting soil.

Watering in the cutting.

Typical clamshell packaging for a cutting arriving by mail.

Hoop house frame (2x4s & 60d nails).

Five gallon pots as a base for plywood.

Plywood shelf with cut out for access.

10' PVC pipes slip over the 60d nails.

Agribon row cover installed over pipes.

Snap clips (from Johnny's Select Seeds) secures the Agribon to the pipes.

Checking on young plants in the hoop house with my sister-in-law Janet.

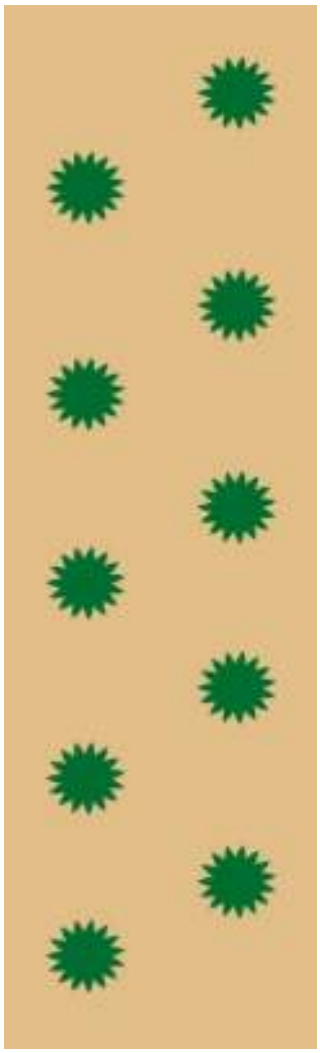
Lorelie Merton, Australia

Lorelie's Website: florelie.com.au
Instagram: @florelieseasonalflowers

Lorelie Merton in her dahlia patch. Photo by Hannah of Florelie Seasonal Flowers.

4. Planting Dahlias

'KA's Apricot Jam'.



My planting pattern.

Transplanting a cutting from a 4 inch pot into native soil.

Maximum number of plants in each row
PLANT SPACING in Inches (2 Rows-Zigzagged)

Row Length	4"	5"	6"	8"	9"	10"	12"	16"	18"	21"	22"	24"	inches apart
20 feet	120	96	80	60	53	48	40	30	27	23	22	20	
25 feet	150	120	100	75	67	60	50	38	33	29	27	25	
30 feet	180	144	120	90	80	72	60	45	40	34	33	30	
35 feet	210	168	140	105	93	84	70	53	47	40	38	35	
40 feet	240	192	160	120	107	96	80	60	53	46	44	40	
50 feet	300	240	200	150	133	120	100	75	67	57	55	50	
60 feet	360	288	240	180	160	144	120	90	80	69	65	60	
70 feet	420	336	280	210	187	168	140	105	93	80	76	70	
80 feet	480	384	320	240	213	192	160	120	107	91	87	80	
90 feet	540	432	360	270	240	216	180	135	120	103	98	90	
100 feet	600	480	400	300	267	240	200	150	133	114	109	100	

The plant spacing chart made by my friend Iris.

ROOT COMPETITION

My farm has a row of tall pines on the north side of my planting beds. Fortunately, trees on the north side do not block the sunlight. I like the trees because they provide a shady work area on hot days. However, it took me several years to realize that the plants closest to the trees were consistently smaller and less vigorous than the surrounding plants. Likewise, when I dug up my tubers, those nearest the trees were not as plump as the others and were entwined with roots. The nearby tree roots were attracted by the water I gave my dahlias.

The ideal solution would have been to move the beds away from the trees. However, I didn't have that option because my farm is small. Instead, I dug a 30-inch (76 cm) deep trench between my planting beds and the trees. Once the 60-foot (18m) long trench was dug and the tree roots were cut, I inserted a root barrier into the channel before putting the removed soil back. Root barriers are made of 60 mil polypropylene and are commonly used to keep bamboo shoots from running. They are suitable for over 50 years of service underground. The severed roots that remain under my dahlia beds slowly decomposed. The roots on the tree side of the barrier will stop or turn and grow in a different direction. It was a big job to dig such a deep trench and cut several dozen roots; however, I now have plants that grow beautifully right up to the edge of my beds.

Planting beds in early season.

Low metal hoops with Agribon row covers for early-season blooms. The metal hoops I buy from Johnny's Select Seeds. They are 54" Wire Support Hoops.

One year I added strings of lights inside my low hoops to raise the air temperature at night. The lights didn't add much warmth but my neighbors loved the nighttime garden art installation.

My daughter's wedding with late October dahlia blooms. Photo: Woodmancy Photography

Late-season dahlia blooms from my farm on my daughter's wedding arch.

Four inch sink pots planted with three lines of drip tape.

POTTING SOIL

Even though it is called potting soil, these mixes contain no soil. Instead, they are typically a blend of moss, fine bark, perlite, vermiculite, and compost. The organic matter (compost and moss) feeds your plants, while the other ingredients hold your plant roots and keep the mix from compacting.

KA's Apricot Jam' growing at the farm.

Galena Berkompas, Washington

Galena's Website: microflowerfarm.com
Galena's Instagram: @microflowerfarm

Galena Berkompas of Micro Flower Farm. Photo by Dani Winters.

5. Growing Dahlias From Tubers

Unnamed 'KA's' seedling.

Viscot surgical markers.

Artline garden markers.

Rooting the tip of a long tuber sprout.

Pre-sprouted tubers develop roots and leaves, making them more resilient for planting.

The items I gather when I am planting tubers. Sluggo Plus is needed if your tuber is pre-spouted and has leaves. Small bamboo sticks mark the location of your tubers if you plan to stake your plants as a group. A tall garden stake is used if you stake plants individually. A plant tag identifying your tuber variety is needed. Finally, if your tuber is pre-sprouted and has roots, I sprinkle a little Mykos mycorrhizal inoculum in the hole to extend the root system.

1. Making a 4 or 5 inch hole.

2. Setting a stake at the tuber crown.

3. Covering the tuber and securing the plant tag.

4. Water your sprout once it emerges from the soil.

David Hall, England

David's Website: hallsofheddon.com
David's Instagram: @hallsofheddon

David Hall of Halls of Heddon in his display garden.

6. Growing Dahlias From Seed

Three woman dahlia breeders at the Triple Wren Dahlia Festival. Me on the left, Noni Morrison in the middle, and Sandy Boley at right. Noni is the hybridizer of 'Salish Twilight Girl'. Sandy is a hybridizer with her husband Steve. Their varieties start with 'Sandia, "Irish', and 'SB's'.

The life cycle of a "KA's Mocha Katie' bloom from bud (on the left) to seed head (on the right).

A mature dahlia seed head.

A corn tassel bag over a bloom.

Me with a "bouquet" of dahlia seed heads.

Seedlings in four inch pots.

SEED BANKING

Seeds hold the promise of the survival of the species. Nature has optimized a seed's chance for survival with seed banking. If every seed in a seed head sprouted simultaneously, survival could be at risk under the wrong environmental conditions. For instance, what if all the seeds from a seed head sprout at the same time as a hatch of hungry grasshoppers? Or what if a spell of hot, dry weather sets in just after every seed has sprouted? In these circumstances, all the seeds in a seed head could be lost.

Nature protects against this risk with seed banking. In a seed head full of seeds, one inherited trait is the number of days it takes for a seed to germinate. My experience with dahlia seeds is that some will sprout in two days. Most will sprout in four to ten days. A few will sprout in 12 days. A tiny number will sprout in 20 to 22 days. In this way, the species' future has a better chance of survival. If the first set of seeds sprouts early and the grasshoppers eat all the young plants, the seeds that wait 20 days will rise from the soil after the grasshoppers are gone. Seed banking is critical to remember when you are sprouting your seeds. Not all seeds are viable; however, those that are will sprout in their own time, according to nature's way.

LABELING SEEDLINGS

I am sometimes asked why I make an X in front of the seed parent name on my plant labels. Why don't I just put the name of the seed parent, like, 'Jomanda'?

I use the X because it differentiates my plants grown from cuttings and tubers from those grown from seed. Plants from tubers and cuttings are clones of the mother plants. Seeds, on the other hand, are unique and don't produce blooms identical to the mother plant. By putting an X in front of the name, I know that while the plant was an offspring from 'Jomanda', it is not an exact clone of 'Jomanda'. Instead, it is a unique seedling with its own set of traits.

Seeds in moist paper towels covered in plastic wrap.

Seeds placed on to moist paper towel.

Germinated seeds.

Planting the root tip into seedling mix.

The first leaves (cotyledons).

Seedling with true leaves.

Seedling potted up in a four inch pot.

A seedling ready for planting.

Pulling seedlings out of a 72 cell tray with two butter knives.

Gently placing a seedling into a four inch pot filled with potting soil.

The six colorful seedlings above are seed-mates from the same seed head from the white pompon seed parent next to the snips.

SEEDLING TERMINOLOGY

A dahlia plant grown from a tuber or a rooted cutting is a clone. It will grow, produce blooms, and perform identically to the parent plant. A plant grown from a dahlia seed is the first generation of a new cultivar that is unique and unrepeatable. Plants grown from seed are called seedlings.

"First-year seedling" refers to a unique plant grown directly from seed. A first-year seedling is a unique plant with no identical siblings or offspring. If you grow a dahlia plant from a seed, you witness something no one else has ever seen. It is lost forever if a grower loses a first-year seedling through disease, pests, or drought. If a first-year seedling survives and produces viable tubers, there is a path to growing and multiplying it in future years.

A second-year seedling is a plant grown from a tuber or a rooted cutting from a first-year seedling. Hybridizers grow new varieties for several years to observe their traits, growing habits, productivity, disease, and pest resistance and ensure that their genes are stable. Because most breeders only name a new cultivar once it has been under observation for several years, second-year seedlings typically have a number, not a name. Every subsequent year a seedling is grown for observation, another year is added on. That is why we sometimes hear about third-year or fourth-year seedlings. Eventually, if a seedling is worthy of introduction, it will get a permanent name.

COTYLEDONS

Early on, a tiny seedling depends entirely on its internal food supply (the endosperm) to grow. As it develops, however, it switches to energy from light. Inside the seed are the cotyledons, often called seed leaves or cot leaves; these are the first temporary ready-made leaves that expand and break out of the seed casing. Their job is to turn light into sugar and fuel the new plant while it constructs its first real leaves. Notice that the cotyledons don't look like dahlia leaves. When the first set of real dahlia leaves appear, the cotyledons will wither and die.

Meanwhile, the tiny root is burrowing into the soil. Although roots are not glamorous, they have three essential jobs. First, they provide the plant with an underground structural foundation to keep it from blowing over in the wind. Second, they take in water, nutrients, and minerals. Finally, they store excess energy in tiny underground tubers.

The tiny embryonic root is what scientists call "positively geotropic." This means the root knows which way is down and will push down into the soil. On the other hand, the cot leaves and their embryonic shoots are "negatively geotropic," meaning they push up, against the forces of gravity, toward the sun.

You have probably heard the terms monocot and dicot. About one-third of all flowering plants are monocots, like wheat, corn, and grasses. Dahlias, and 200,000 other species, are dicots. Monocot and dicot refer to the number of cotyledons a germinated seed produces. Monocots burst forth with a single cot leaf. Dicots, like dahlias, germinate with two.

Melissa Smith, South Carolina

Melissa's Website: fraylickfarm.com
Melissa's Instagram: @flwrtherapy

Melissa Smith of Fraylick Farm. Photo by Emily Barbee.

7. Dahlia Field Care

'KA's Snow Jo' & KA's Mocha Jake'.

Two levels of twine installed over young plants that are protected from frost by row cover.

Polypropylene twine is reusable and rolls up after use for easy storage until the following season.

POUNDING IN STAKES

We have all struggled with pounding stakes into the ground in our gardens. If the stake is made of soft wood, like redwood or cedar, using a hammer will split and splinter the top end of the stake. Using a hammer can also cause hand injuries from the stake itself or the hammer.

When I was first learning how to grow dahlias, a member of my local dahlia society took me under his wing and taught me several garden tricks. His name was Dean, and he was 91 years old. One tool Dean showed me is still in use at my farm, the stake pounder. Dean took a 12-inch (30 cm) long piece of 2-inch (5 cm) wide galvanized pipe and screwed a galvanized cap on one end.

Slipping the pipe's open end over the stake, he could quickly pound it into the ground without splitting or injury. The rounded pipe cap does not split or splinter the ends of the stakes, which means they last for years and years. Unfortunately, Dean is no longer with us, but I think of him every time I pound in my stakes. You can see me using Dean's stake pounder on the Kristine Albrecht YouTube channel. Look for video 101.

Gabriela Salazar's natural twine plant supports. Photo by Laura May Grogan.

Crop support mesh at Halls of Heddon. Photo by David Hall.

Rice straw mulch in my dahlia patch.

‘KA’s Mocha Blush’.

1

Pinching out a young plant.

2

3

4

The black rings in this photo show where the plant will push new lateral branches.

Cut above a leaf axil for a hollow stem.

Cut across the leaf axil for a solid stem.

'KA's Snow Jo'.

Main bud with three side buds before disbudding.

Main bud after three side buds are disbudded.

The side buds outgrow the main bud when not disbudded.

Unnamed 'KA's' seedling. Photo: Jan Palia

Upper, middle, and lower leaves all from the same plant.

The lower leaves stripped from a mature plant.

Me with a 'Maki' bloom at the Monterey Bay Dahlia Society show.

DAHLIAS ARE AN INFLORESCENCE

Dahlias belong to the Asteraceae family. This is one of the largest flowering plant families and includes daisies, marigolds, sunflowers, cosmos, zinnias, lettuce, and chrysanthemums. This family used to be known as Compositae – a name that aptly describes the structure of a dahlia bloom. Technically speaking, a dahlia bloom is an inflorescence; a composite of individual flowers: ray florets and disc florets. The ray florets are the showy petals, while the disc florets are the reproductive parts found in the center. Typically, disc florets are yellow, but varieties have been selectively bred to be red or brown. Both disc and ray florets are easily seen in open-center dahlia varieties. In fully double varieties, the disc florets are hidden behind the mass of ray florets until the bloom matures fully and the bloom "pops its center." In the accompanying photo, a single dahlia bloom has been dissected into its individual florets, with the ray florets notably larger than the disc florets. The green structures at the base of the bloom are bracts, which protect the bud while it is still developing.

A dahlia bloom reduced to individual parts. The large parts are ray florets. The small tubular parts are disc florets. Each one of these 138 parts are individual flowers. The green parts are bracts that hold the immature bud.

Kaolin clay on Melissa's plants in the heat of summer. Photo by Melissa Smith.

PLANTS ARE MODULAR

Dahlia plants are built from repeatable modular sections. Unlike animals, young plants don't have a predetermined adult shape they will grow into. Instead, depending on environmental stimuli, they will grow more in one direction or less in another direction as needed. Each modular section holds a leaf, a node (where the leaf attaches), an axillary bud (wedged between the leaf and stem), and the internode (the length of stem between each leaf node). By reproducing these modular sections over and over, a plant can grow tall, wide, recover from an injury, or change its shape to capture more light. Look closely at a dahlia plant, and you will see these modular sections repeated from the tuber crown to the bloom.

Plants need this modularity to survive in an uncertain world while rooted in one place. For example, if a tall tree shades one side of a plant, it can grow bigger on the sunny side to capture more light.

Animals don't require this flexibility. Their mobility allows them to seek sun and shade as needed. Also, animals must grow into a predetermined symmetrical shape to move about. Imagine the difficulty of walking if one of our legs grew to be twice the size of the other. Yet, that is what plants do with their stems and branches.

WHY DO DAHLIAS SHUT DOWN IN THE HEAT?

The underside of dahlia leaves have tiny pores called stomata. These allow the passage of carbon dioxide and oxygen during photosynthesis. Water vapor also passes through the stomata, cooling the plant on a warm day. Stomata are flanked by two guard cells. The plant can open or close the stomata by increasing or decreasing the water pressure inside the guard cells. For instance, to retain moisture they close every night when photosynthesis stops.

When outside temperatures rise dramatically a plant will close its stomata to retain as much water as possible in order to survive. However, energy production stops because photosynthesis cannot occur with the stomata closed. This is why our plants shut down in very hot weather. Without the ability to make energy from the sun, they enter a dormant state until the weather cools down and the stomata can reopen.

Melissa Smith's dahlia plot is surrounded by trees that provide partial shade. Photo by Melissa Smith.

Gabriela Salazar's translucent canopies protecting her dahlia beds. Photo by Laura May Grogan.

Stripping the lower leaves off of mature plants. The organza bags are excluding bees as part of my breeding program.

Silky Teflon Floral Snips. My favorites.

Disbudding with finger-cut gloves.

'KA's Mocha Jake'.

Emily Avenson, Belgium

Emily's Website: fleuropean.com
Emily's Instagram: @fleuropean

Emily Avenson of Fleuropean. Photo by Anna Doshina.

8. Dahlia Diseases

A dahlia plant with powdery mildew in late season.

Crown gall.

A condition on dahlia tubers many growers refer to as leafy gall.

Three dahlia seed heads with varying degrees of Botrytis infection.

A tuber clump with Pythium.

VIRUSES CAN CHANGE DAHLIA BLOOM COLOR

Recent research has revealed that certain cultivars infected with Tobacco streak virus (TSV) undergo changes in bloom color. The virus has incorporated a portion of the plant's genome into its own, which can have effects on the plant beyond the typical symptoms of viral infection. Specifically, TSV can suppress a mechanism in the plant that regulates anthocyanin production, the pigment responsible for dahlia color. By inhibiting the plant's ability to limit anthocyanin production, the virus causes the plant to produce more pigment. This raises the question: why would a virus benefit from this adaptation? The answer lies in the fact that anthocyanin is more than just a pigment. It is also an antibiotic that helps plants defend against bacteria, fungi, nematodes, and herbivores. By increasing the level of anthocyanin in the plant, the virus is essentially boosting the plant's natural defenses against its competitors. Without bacterial and fungal competitors, the plant is a better host for the virus.

MERISTEM CELLS

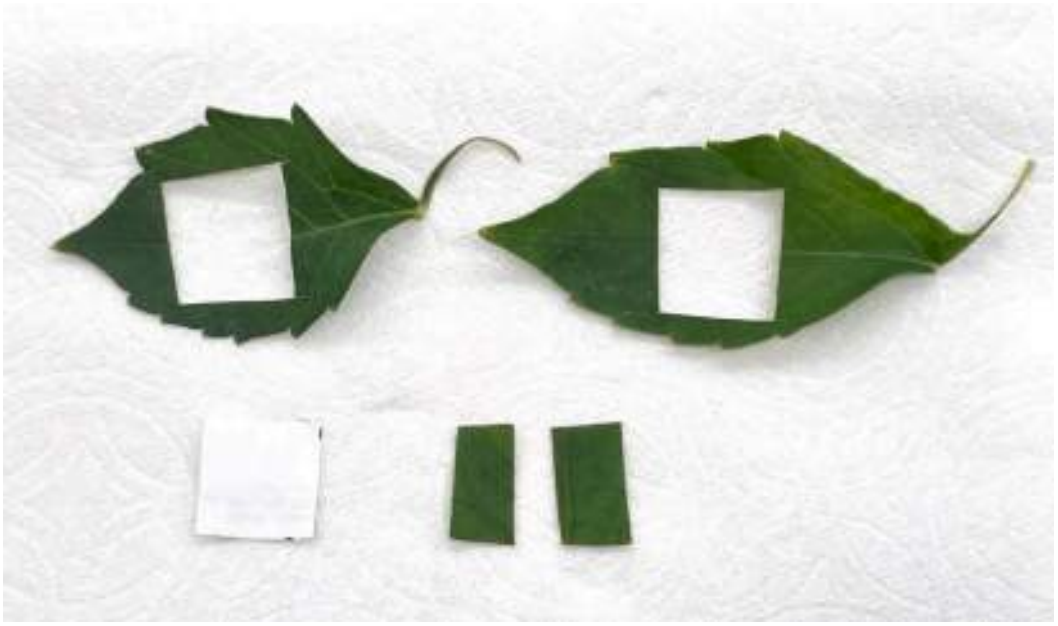
Most of the cells produced by plants and animals become differentiated. The cells that make up our hair, skin, or bones only function for the purpose for which they evolved. Plants can make undifferentiated cells that when grouped together are called meristems. These cells are produced in different parts of the plant and await instructions to fulfill a particular function. Once activated, they can grow into a leaf, a root cell, or other structures as the plant dictates.

Meristem cells are activated when we pinch out our young dahlia plants. At each leaf axil, undifferentiated cells are waiting to be set in motion. The meristem cells stay undifferentiated as long as the main growth tip is undisturbed. When we pinch out that tip, however, the undifferentiated cells start growing new stems, resulting in a bushier plant.

Meristem cells are also at the root tips underground. The cells at the very ends of the roots form a cap, like a protective helmet, over the tip of the root. This protects the tissue in the root tip from abrasion or infection as it pushes its way into the soil. Through abrasion, the outer cells of the root cap are lost. However, just behind the root tip are fast-growing undifferentiated cells. Some grow into root tip cells to replace those lost through abrasion. Others develop into root cells behind the root tip. The growth of these root cells pushes the root forward and lengthens the roots.

Properly equipped laboratories can isolate meristem cells in a plant's growth tip to produce virus-free plants. This process is often referred to as tissue culture propagation. First, dahlia plants are grown at high temperatures. This forces the growth tip to multiply and "outrun" the viruses. Next, the meristem cells are harvested and reproduced in various growing mediums. Eventually, these tiny bits of plant tissue differentiate and grow into little plants with leaves and roots. Finally, these tiny plants are tested for viruses. Propagation through tissue culture is one way a variety infected with a virus can be "cleaned" or "cleared" of the virus. Unfortunately, using meristem cells to grow dahlia plants is not an option for the home gardener or the farmer-florist. This expensive technique can only be done in a lab with specialized equipment in a sterile clean room.

Dahlia leaves exhibiting virus symptoms.



Using two half-size leaf samples to test different sides of the plant.

A negative Agdia comb test. Positive tests display two red lines instead of one.

Philippa Stewart, England

Philippa's Website: justdahlias.co.uk
Philippa's Instagram: @justdahlias

Philippa Stewart of Justdahlias.

9. Dahlia Pests

Sluggo Plus sprinkled on young plants.

Green Lacewing eggs for control of Whiteflies.

Cucumber beetle.

Ladybug larvae.

The leaf on the left was chewed by an earwig.
The leaf on the right was eaten by a snail.

Releasing mature Ladybugs for control of Aphids.

YELLOW AND BLUE STICKY TRAPS

Many insects are attracted to the colors blue and yellow. A simple and non-toxic method to reduce insects in your dahlia patch is to hang sticky traps in and around the plant canopy of your dahlias. They can be attached to plant stakes, hung from low hoops, or even placed on the ground for crawling insects. These 5x7 inch (12x17 cm) double-sided cards are inexpensive and available from Arbico Organics. Melissa from Fraylick Farm hangs her sticky traps at the top of her low hoops. She pinches a hole in the trap and hangs it on the hoop with a plastic zip tie. This allows the trap to swing, keeping baby lizards from getting snared (when the traps were hung tight to a surface, they crawled on and became trapped). She prefers traps that are 3x5 inches (7x12 cm). The Arbico Organic traps are marked with a grid to make cutting the traps down to different sizes easy.

HORTICULTURAL OIL

Horticultural oils are made either from vegetable oil or mineral oil. Most of the standard big brands are mineral oil-based. The labeling of horticultural oil can be confusing. There are often references to "Dormant Oil" or "Superior Oil." Dormant oil is used in the winter when plants have dropped their leaves. Superior oils can be sprayed on a plant in winter or when plants have leaves. Check the label on the product you are using to ensure it can be applied when you plan to use it. Horticultural oil smothers and kills insects and their eggs.

Many of these oils are OMRI approved for organic gardening but can be harmful if inhaled. Use a mask and protective clothing when spraying horticultural oils. Follow the mixing direction on the product you use and apply oils in the morning or late afternoon when the temperatures are below 80 degrees (26°C). Never apply oils to a plant that is dry and under watered. It is a good idea to give your plants an extra water boost the day before you plan to spray.

NEEM OIL

Neem oil is an extract from the neem tree grown in India. It has different effects on different chewing or piercing insects. When some insects ingest neem oil, it prevents them from molting, so they cannot mature. In others, neem oil prevents the laying of eggs. Still, others exposed to neem oil stop eating and starve. None of these effects are instantaneous. Reducing insect pressure with neem oil takes time and multiple applications.

Although neem oil biodegrades quickly, the seeds of the neem tree are poisonous, and one should wear a mask and protective clothing when using it as a spray, however, it is OMRI approved for organic gardening and is said to be safe for honey bees and mammals. Pure neem oil will not mix with water, so some suppliers add a surfactant to promote blending. If you buy pure neem oil, add a small amount of dish soap to encourage mixing. Follow the instructions on the product label.

A tuber clump almost completely eaten by a gopher.

Four GopherHawk traps set in a dahlia bed.
Notice the undisturbed soil.

'KA's Coral Sea'.

My home garden.

A vase supporter made from a cardboard box.

Me and Jan with tubs of blooms with Rigi Pot inserts for florists and designers.

Philippa's dried dahlia blooms. Photo by Philippa Stewart.

Dahlias drying in Philippa's bathroom. Photo by Philippa Stewart.

A dried dahlia bloom.

Philippa's dahlia patch. Photo: Philippa Stewart.

'KA's Mocha Katie".

Heather Henson's daughter Isla Rose with a dried bouquet.
Photo by Megan Timm of Brighter by Megan Photography.

Using a "stem crutch" to hold a thin stem.

Ceramic containers with pin frogs glued to the bottom.

'KA's Cloud'.

11. Digging, Dividing, & Storing Tubers

A giant tuber clump I left in the ground for four years.

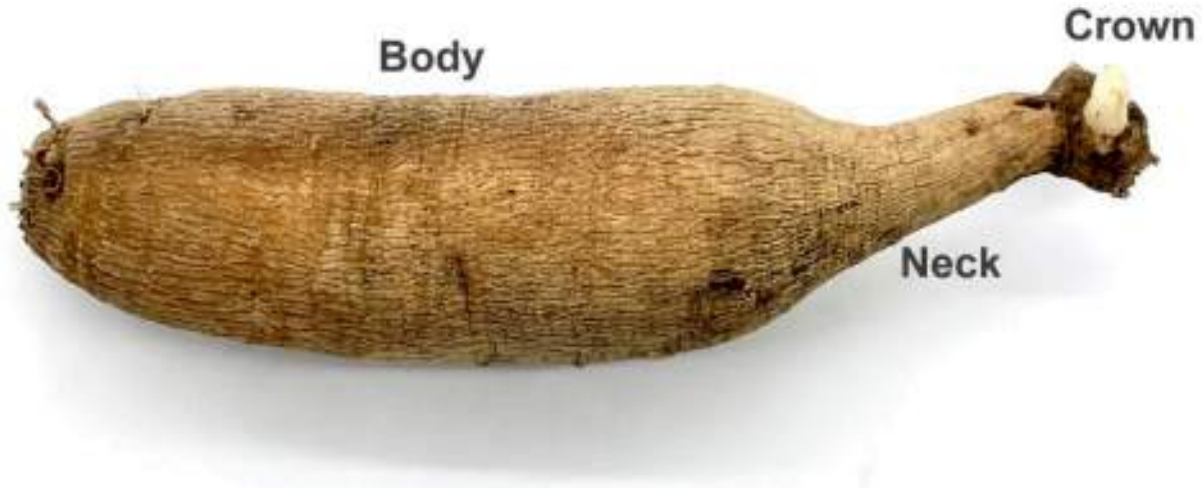
A tuber clump with three prominent eyes in the center of the image.

Using a cordless multi tool to cut down dahlia stalks.

Digging underneath a tuber clump.

Lifting tubers out of the ground with the plant tag.

Washing tubers on an elevated metal mesh.



A viable tuber must have a body, an intact neck, a crown and an eye.
This tuber also has a young sprout at the crown.

Making a horizontal cut with the multi tool to remove the green stalks.

The tip of the snips point to an eye on this tuber crown.

Making a pie-shaped cut to release a single tuber.

The mother tuber is easily identified and should be discarded. Notice that three tubers on this partial tuber clump were chewed by gophers.

I dry my tubers on a table with the tuber crowns hanging off the table edge. This helps the crowns dry completely.

Arrangement and photo by Emily Avenson.

THE DAHLIA HOTEL

A friend who grew up in Sweden told me that the most Swedish city dwellers live in apartments and do not have access to a basement or a garage. Even though Sweden is far to the north with cold winters, most people have access only to heated spaces in their homes, making storing dahlia tubers over the winter difficult. That's where the "Dahlia Hotel" comes in. Someone in Sweden has started a business renting out space in a climate-controlled environment for dahlia growers. For a fee, growers check their tubers into the Dahlia Hotel for a nice cool winter rest.

PEAT ALTERNATIVES

I store my tubers over the winter in peat moss. I purchased it years ago and reuse it each year. It has been the best storage medium I have found for my climate. However, more growers are choosing to avoid peat. In parts of the world, peat is banned or being phased out of commerce.

One peat alternative I have experience with is vermiculite. Agricultural vermiculite is a mineral mined from the earth and baked at high temperatures. The baking process makes the mineral expand like an accordion. This is what gives vermiculite its ability to absorb and hold moisture.

Vermiculite was the storage medium I used for the first several years I grew dahlias. It worked well in my climate but was dusty and sometimes irritated my skin. Vermiculite is not acidic like peat, so it does not have the same anti-fungal properties.

The first layer of tubers nestled into peat moss.

The first layer of tubers being covered with more peat moss.

Tuber varieties are kept in separate boxes. Each box is labeled.

Boxes full of tubers going into refrigerated storage.

Unnamed 'KA's' seedling.

'KA's Rosie Jo'.

A robust tuber clump from a plant that was disbudded, cut from, and deadheaded.

Tuber size and color can vary.

A dahlia tuber with lenticels. Photo by Paula Fisher.

Me with an 'Aggie White' bloom.

12. Common Dahlia Questions

Deformed blooms caused by toxin injection from thrips.

‘KA’s Mocha Maya’.

'Bloomquist Alan'.

13. Common Dahlia Myths

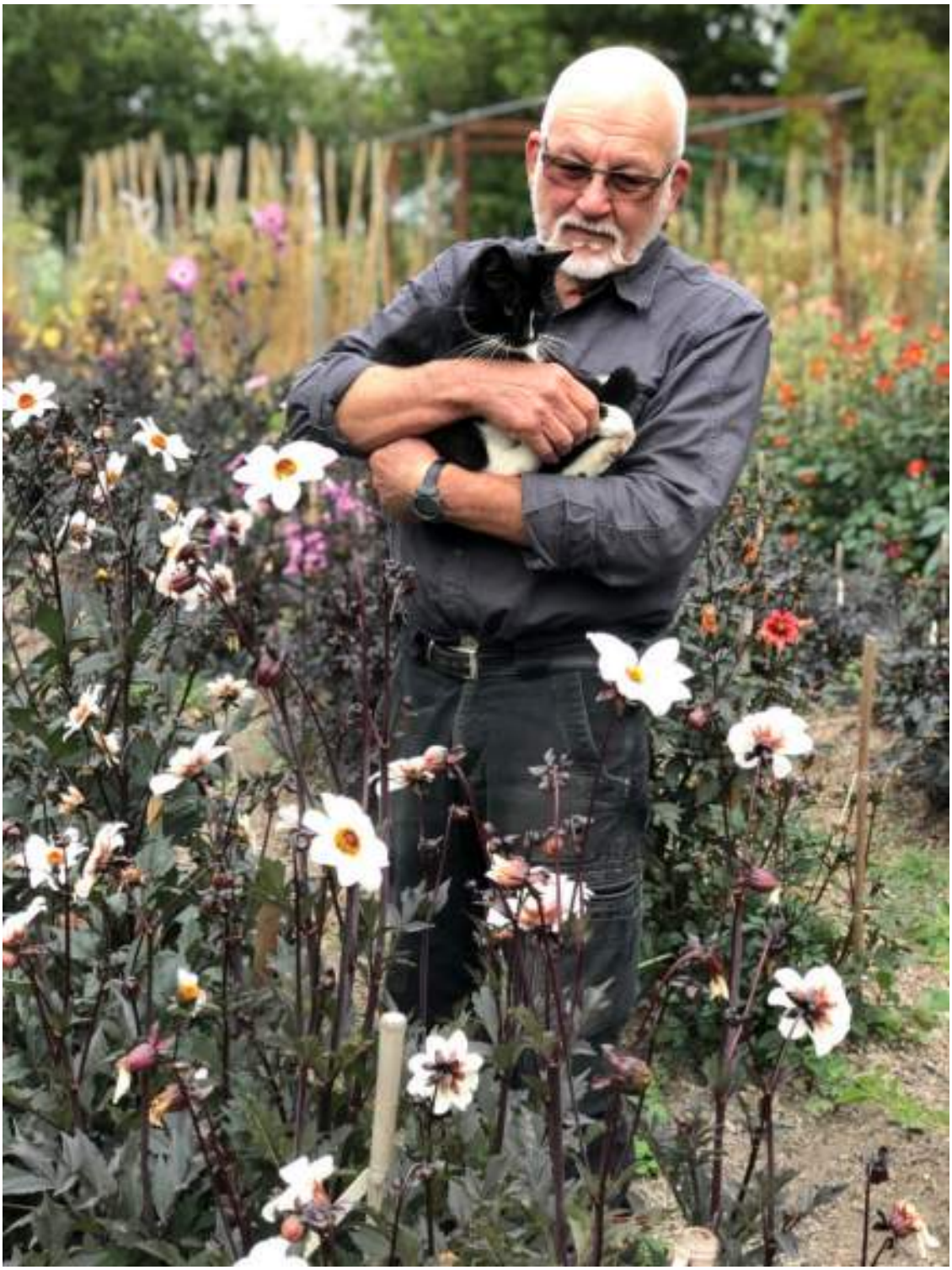
'KA's Mocha Jo'.

Unnamed 'KA's' seedling.

Making friends at the farm.

Keith Hammett, New Zealand

Keith is on Instagram: @drkeithhammett
He also has a website at: www.drkeithhammett.co.nz



Dr. Keith Hammett in his dahlia patch with his cat "Skitty." Photo by Trina Woolmore.

14. Dahlia Culture

A foggy morning in the dahlia patch.

VARIETY & CULTIVAR

Dahlia growers typically call the various plants they grow varieties. Technically speaking, "variety" refers to naturally occurring plants in the wild. These wild types, also called species dahlias, have a botanical name with a genus (like *Dahlia*) and a species name (like *coccinea*). Botanists always use upper case for genus and lower case for the species name (*D. coccinea*). These variety names are in Latin and are always italicized. There are currently 42 recognized wild dahlia species.

In contrast, a cultivar is a term used to describe a plant that is bred or found in a cultivated area like a farm, garden, nursery, or park. The word cultivar comes from combining the first few letters of the word CULTIvated with the first few letters of the word VARiety. To ensure that cultivars are not confused with varieties, their names are not in Latin. They are capitalized, and they are not italicized. They also have single quotes around them. 'KA's Cloud' is a proper cultivar name.

Unless we grow the native species dahlia from Mexico, we all grow cultivars, not varieties. So, technically, we should be referring to our cultivars, not our varieties, however, because of widespread popular usage, I use these two words interchangeably in this book.

THE LANGUAGE OF FLOWERS

In the mid-1800s, an unspoken language flourished that was based on flowers to communicate emotion. In England and America, flowers were a secret way to express feelings that proper etiquette did not allow in polite company. Each flower species had a symbolic meaning inspired by literature, legends, and cues from the flowers themselves. For example, Baby's Breath symbolized purity and innocence. Camellias symbolized longing. Chrysanthemums expressed condolences. The Daffodil symbolized unrequited love. Hyacinth symbolized forgiveness. Lavender symbolized distrust. Nettles symbolized cruelty, and Oaks symbolized bravery.

Young women in high society would deliver flowers to friends, lovers, or relatives to express feelings they could not express in words. Sometimes women would wear or carry a particular flower to send a coded message of affection, sorrow, or desire to those who shared the language of flowers.

By WWI, this practice faded, but today, flowers still carry messages of love or sorrow. Visiting a cemetery reveals that flowers are common on headstones and monuments. Flowers lift our spirits, and we want to see them during times of grief. One of the most common headstone carvings is of ivy. In the language of flowers, ivy symbolizes fidelity and attachment. Ivy vines wrap themselves around trees. Even if the tree dies, the vine can remain entwined. It is a fitting symbol of the attachment the living have to those who have departed. There is another reason ivy is common on headstones. It is easy to carve. Asking a stone carver to make ivy leaves is an affordable request.

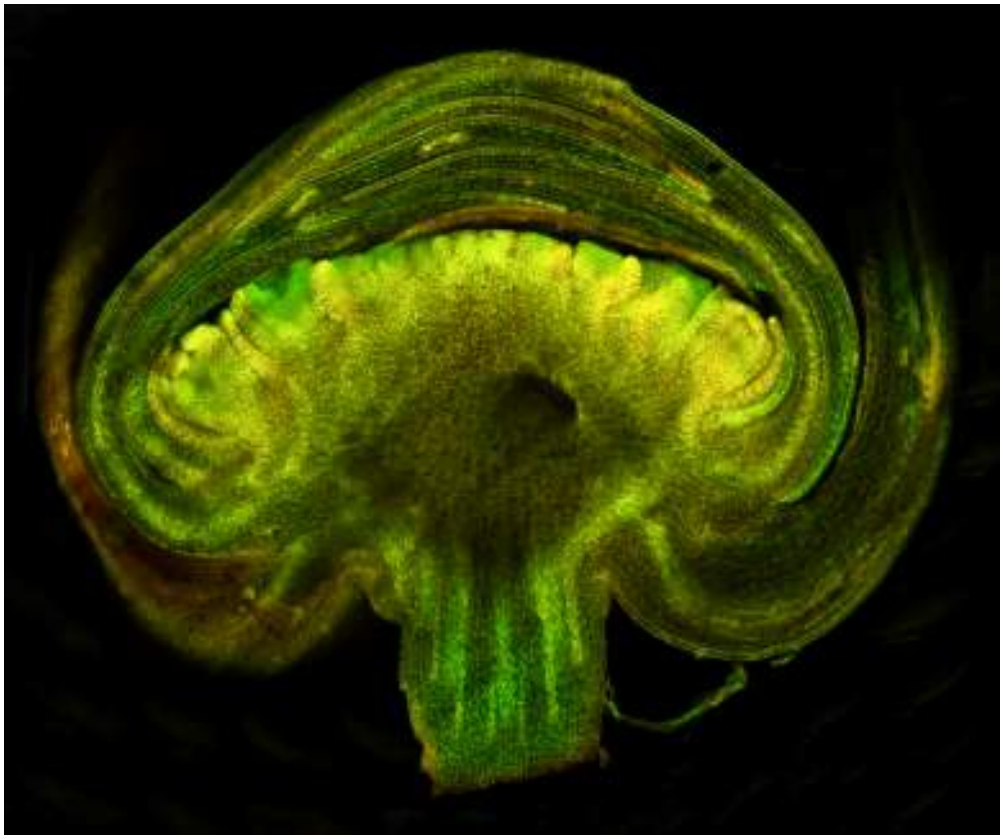
The dahlia is also perfect for a headstone. It symbolizes eternal love and commitment. As perfect as those sentiments are, dahlias are rare on headstones. They have too many petals, making them expensive to carve. Only the wealthy could afford to pay for a craftsman to reproduce a bouquet of dahlias. Therefore, most people chose ivy, daisies, or iris on headstones because of their simplicity. As a result, finding dahlias on a monument is rare indeed.

Unnamed 'KA's' seedling.

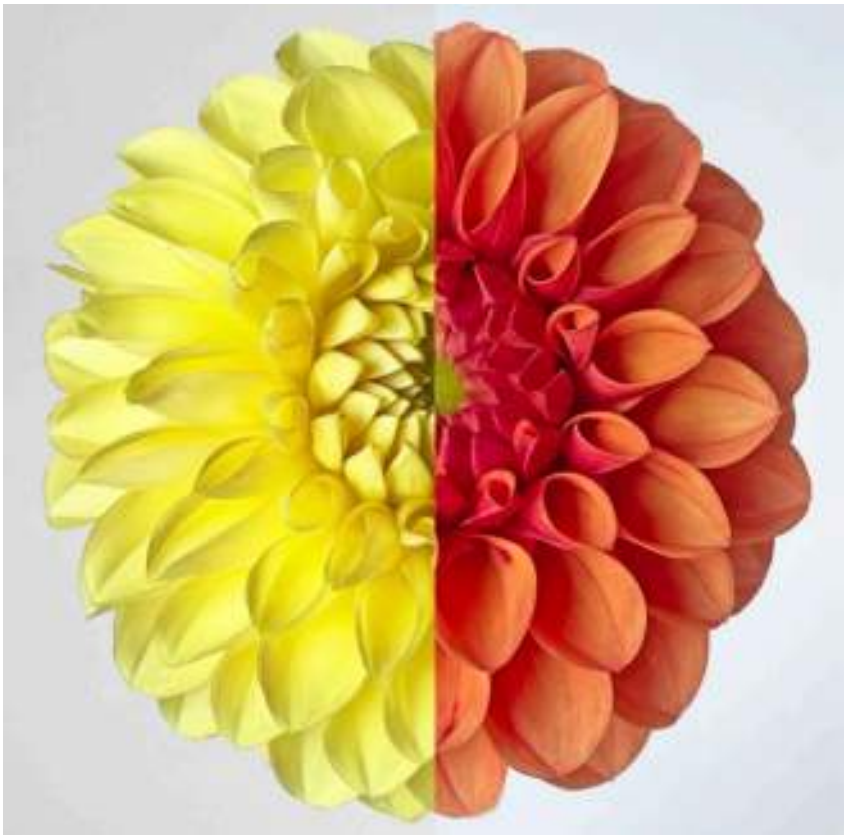
Kristine, Dr. Walbot, and one of her students at Stanford University in 2017.

Dr. Walbot collecting leaf samples at my farm.

PhD student Zach Meharg and colleagues in the lab at HudsonAlpha. Photo by Dr. Sarah Carey.



A dahlia bud seen through a confocal microscope. Photo by Zach Meharg.



A split image of two 'KA's Blood Orange' blooms.
The bloom on the left was covered with foil and developed in darkness.

A split image of two blooms (an unnamed 'KA's' seedling with picotee petal edges). The bloom on the left was covered with foil and developed in darkness.

The stems of varieties with purple stems are often green in the areas where they are shaded.

Covering a purple-stem often changes the stem color.

'Unnamed 'KA's' seedling'.

'KA's Apricot Jam' & 'Bloomquist Alan'.

Mini Sweet Dahlia Muffins.

TUBERS AS FOOD: A RECIPE

At a dahlia society meeting years ago a member made deep-fried dahlia chips (like potato chips). Like most things deep-fried, they were pretty tasty. Over the years, however, I have tried preparing dahlia tubers in different ways but was never satisfied with the results—until I used them as a substitute in a recipe for sweet potato muffins. Now, one of my favorite things to do at a dahlia society gathering is to bring a plate of dahlia tuber muffins. They always capture the imagination of those assembled, and since they are so tasty, there are never any leftovers. What a great way to use tubers that I am culling anyway! A bonus of this recipe: it is vegan.

SWEET DAHLIA MUFFINS

Makes 12 muffins
20 minutes of prep time
30-minute cook time

Ingredients:

1 cup (220 g) packed brown sugar
3/4 cup (180 ml) vegetable oil. Additional oil is needed to grease the muffin tins, or use paper muffin cups
1/2 cup (125 ml) applesauce
2 cups (300 g) washed, peeled, grated, and drained fresh dahlia tubers (not old or shriveled)
1/2 cup (125 ml) soy, oat, or almond milk
1 teaspoon lemon juice
2 cups (250 g) all-purpose flour
1/2 cup (71 g) chopped walnuts
1 teaspoon baking powder
1 teaspoon baking soda
1 teaspoon salt
1/2 teaspoon ground cinnamon

Preparation:

1. Preheat the oven to 375° (190° C).
2. Fill a 12-cup muffin pan with paper muffin cups or grease the metal cups liberally.
3. Skin and grate the washed dahlia tubers (as fresh as possible) with the finest grater you have. Squeeze out any excess water.
4. Using a hand mixer, combine the brown sugar, oil, and applesauce in a large bowl for two minutes.
5. Add the grated dahlia tubers, plant-based milk, and lemon juice and stir until combined.
6. Whisk together flour, walnuts, baking powder, baking soda, salt, and cinnamon in another bowl. Add the wet ingredients and hand mix until fully mixed. Don't over-mix.
7. Spoon the batter into the muffin cups.
8. Bake for 30 minutes or until an inserted toothpick in the center of the muffin comes out clean.
9. Remove from the pan and cool on a rack.

Triple Wren Farm in Ferndale, Washington.

Me and my friend Iris, who is an amazing dahlia grower, at Santa Cruz Dahlias.

GLOSSARY

ADS: The American Dahlia Society.

Baling twine: A bright-colored synthetic twine used to bind bales of straw, hay, or alfalfa.

Bench score: The score given to a new cultivar at an ADS-sanctioned show by three senior judges.

CHD: Classification Handbook of Dahlias published by the American Dahlia Society.

Coolbot: An electronic control that allows a standard air conditioner to cool an insulated space below the device's pre-set temperature limit.

Chicken leg: A slang term for a single tuber divided from a large tuber clump.

Crown: The part of a single tuber closest to the plant's main stem.

Cultivar: A plant humans have developed through controlled or selective breeding, then reproduced through vegetative propagation (cuttings, tissue culture, or tubers).
Cutting: A shoot taken from a tuber that will develop roots and grow into a full-size plant. Like tubers, cuttings are clones of the parent plant.

Diploid: A species that has two sets of chromosomes, one set from each parent. Humans are diploids.

Disc center: A dahlia bloom's yellow open central portion, the part the bees visit and where seeds develop.

Disc floret: The individual parts that make up the yellow disc center of the bloom.

Deadhead: To cut off a bloom that has passed its prime.

Double or Fully double bloom: A bloom that has petals in rows stacked on top of each other, creating a bloom that has depth from front to back. The terms are interchangeable.

First-year seedling: A new plant in its first year grown from seed rather than a tuber or cutting.

Germination: The process of sprouting a seed, usually after a period of dormancy.

Herbarium: A collection and repository of dried and preserved plant specimens and descriptions.

Hybrid: A cross between two different varieties or species of plants.

Hybridizing: Cross-breeding seed and pollen parents to develop new cultivars.

Involute: When margins of the ray florets curve upward, toward the face of the bloom, along its length. When fully involute, the margins touch or overlap, appearing quill-like.

Leggy: A plant that has not received enough light. Instead of bushing up and out, a leggy plant will grow abnormally tall and thin as it reaches for more light.

Meristem: The swiftly-growing tip of a plant where undifferentiated cells divide rapidly to build new plant tissue.

Neck: The thinnest part of an individual tuber between the crown and the tuber body.

Octoploid: An organism with eight sets of chromosomes, four sets from each parent. Modern dahlias are octoploids.

Organza bag: A tight weave mesh bag used to protect blooms from pests or exclude pollinators from a bloom for breeding purposes.

Pollen parent: The dahlia bloom that contributes the pollen for sexual reproduction.

Pot root: A miniature tuber clump from a plant grown in a small pot.

Propagation: Growing a new plant from part of a parent plant. Dahlias can be propagated through tubers, cuttings, seeds, and meristem culture.

Pull: A pull is identical to a cutting (see above), except the shoot is pulled from the tuber crown rather than cut from the tuber crown.

Ray floret: Ray florets are what are commonly called petals. These surround the disc center.

Rooted cuttings: See cuttings.

Sausages: A slang term for single tubers divided from a large tuber clump.

Second-year seedling: A plant propagated in its second year from a cutting or a tuber from the original plant that was propagated from seed the previous year.

Seed parent: The dahlia bloom that receives pollen from another bloom and will gestate the seeds in a seed head.

Seedling bench: An evaluation at a select ADS-sanctioned dahlia shows. Three senior judges give scores to new cultivars that have not yet been included in the Classification Handbook of Dahlias.

Single: Single blooms have an open disc center and a single row of (typically eight) petals around that center.

Termination: Cutting down a cover crop to stop it from re-growing while leaving the roots in the soil.

Tetraploid: A species that has four sets of chromosomes, two sets from each parent.

Tissue culture: A laboratory-based process of harvesting meristem cells from fast-growing plant tissue. This process is done to develop virus-free plant stock.

Trial garden: A garden operated by a dahlia society for growing and evaluating new dahlia seedlings.

Variety: A plant that reproduces and grows without human intervention. A breeder produces a new seedling through selective breeding called a cultivar. When a new seedling is generated in the wild without human intervention, it is called a variety. Wild dahlias are also referred to as species dahlias. Note that many dahlia growers interchange the terms cultivar and variety.

Bibliography

George N. Agrios, *Plant Pathology (Fifth Edition)*, 2005.

Kristine Albrecht & Brion Sprinsock. *Dahlia Breeding for the Farmer-Florist and the Home Gardener.* KDP Publishing. 2020

Benzakein, Erin. *Discovering Dahlias.* Chronicle Books L.L.C. San Francisco, California. 2021.

Buchmann, Stephen. *The Reason For Flowers.* Simon and Schuster, Inc. New York, New York. 2015.

Cook, Ward H. *Guide to Judging Dahlias*. American Dahlia Society. 2002.

Frost, Jessie. *The Living Soil Handbook*. Chelsea Green Publishing. White River Junction, Vermont. 2021.

Gips, Kathleen. *Flora's Dictionary.* T.M. Publishing. Chagrin Falls, Ohio. 1995.

Hammett, Keith. *The World of Dahlias.* Kaye & Ward Ltd. London, England. 1980.

Hodge, Geoff. *Practical Botany for Gardeners*. University of Chicago Press. 2013.

Jahren, Hope. Lab Girl. Alfred A. Knopf. New York, New York. 2016.

Lowenfels, Jeff & Wayne Lewis. *Teaming With Microbes.* Timber Press Inc. Portland, Oregon. 2010.

McClaren, Bill. *Encyclopedia of Dahlias*. Timber Press Inc. Portland, Oregon. 2004.

Mefferd, Andrew. *The Organic No-Till Farming Revolution.* New Society Publishers. Gabriela Island, B.C. Canada. 2019.

Menzel, John. *Dahlias in Australia "The Winkie Way."* Bounty Printing. 2016.

Cristian Olaya, Badri Adhikari, Gaurav Raikhy, Jianlin Cheng & Hanu R. Pappu, *Virology Journal, volume 16, Article number: 7* (2019) Identification and localization of Tospovirus genus-wide conserved residues in 3D models of the nucleocapsid and the silencing suppressor proteins.

Peters, Richard W. M.D. *Raising Beautiful Dahlias the Easy Way.* American Dahlia Society. 2006.

Pollan, Michael. *The Botany of Desire: A Plant's-Eye View of the World.* Random House Publishers. 2001.

Puget Sound Dahlia Society. *Dahlias: A Monthly Guide.* Puget Sound Dahlia Society. 2018.

Rowlands, Gareth. *The Gardener's Guide to Growing Dahlias.* Timber Press Inc. Portland, Oregon. 1999.

Stout, Mrs. Charles H. *The Amateur's Book of the Dahlia.* Doubleday, Page & Company. Garden City, New York. 1922.

M. Tsompana, J.W. Moyer, in *Encyclopedia of Virology (Third Edition)*, 2008.

Waite, W. H. *Modern Dahlia Culture.* A. T. DeLa Mare Company, Inc. New York, New York. 1931.

Weaver, Tara Austen & Poole, Emily, *Dahlias: A Little Book of Flowers*, Sasquatch Books, 2022.

Resources

Agdia Inc. At-home virus test kits. agdia.com.

AgroThrive liquid fertilizer. Agrothrive.com

The Amercican Dahlia Society. dahlia.org

Arbico Organics. Organic & biological pest control products. arbico-organics.com

Coolbot controller for building or buying a cool shed. storeitcold.com

EZ Pots. Makers of pin frogs. ezpots.com

Floral Genius pin frogs and pin cups. hhfshop.com/collections/arranging-tools

GopherHawk. Makers of the GopherHawk Trap. gopherhawk.com

Hida Tool Company. Teflon floral scissors. hidatool.com

Hydrodynamics International. Makers of Root Riot plugs. hydrodynamicsintl.com

Johnny's Select Seeds. johnnyseeds.com

Liquid Fence animal repellant. Liquidfence.com

Midco. Makers of corn tassel bags. midcoglobal.com

Monterey Lawn & Garden Products. Makers of Sluggo & Sluggo Plus. montereylawngarden.com

Stanford University Dahlia Project. web.stanford.edu/group/dahlia_genetics

Stuewe & Sons. Suppliers of Rigi Pots. stuewe.com

Trimax. Makers of the BugZooka. trimaxlocks.com/shop/bugzooka/bugzooka

Xtreme Gardening. Makers of Mykos mycorrhizal inoculum. xtreme-gardening.com

Podcasts

The Joe Gardener Podcast. Joe Lamp'l. US. Organic gardening & cut flowers.

The Flower Podcast. Scott Shepherd. US. Cut flowers.

Flower Power Garden Hour Podcast. Marlene Simon. US. Cut flowers & gardening.

Let's Grow Girls Podcast. Sarah & Nicole. UK. Cut flowers.

The No-Till Flowers Podcast. Jennie Love. US. Cut flowers & regenerative farming.

Quince Flowers Podcast. Caitlyn & Peter Mason. Australia. Exclusively dahlias.

Slow Flowers Podcast. Debra Prinzing. US. Cut flowers.

The Sustainable Flowers Podcast. Heather & Clara. Canada. Cut flowers.

Recording the "Let's Grow Girls" podcast with Sarah & Nicole.

Authors Brion and Kristine near Kanab, Utah. Photo by Iris Wallace.