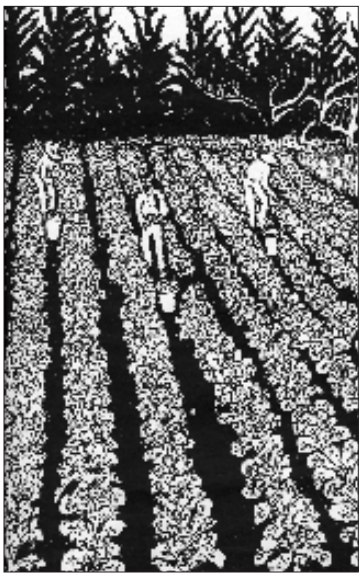

Forrest Cook

News & Notes of the UCSC Farm & Garden

Issue 159, Winter 2019

Hops *(Humulus lupulus)* – Grow Hops, Grow Beer!

– Orin Martin

"With heavy bines towering high above you, being in a mature hopyard in late summer is somewhat like being in a very orderly forest. The bines wrapping around their coir* are thick as cables. The mass of broad, deep green leaves soak up the sunlight, pumping its energy into the formation of flowers. Belowground, the plant's system of roots and rhizomes is as large as what grows above, drawing nutrients and water from the soil to nourish the massive amount of vegetation overhead."

– Laura Ten Eyck and Dietrich Gehring
The Hops Grower's Handbook, Chelsea Green Publishing, 2015

The hops plant is a vigorous, deciduous, dioecious, herbaceous perennial bine (that's right, bine – not vine) that grows from an underground rhizome that produces flowers (cones) containing precious essential oils and acids that are the object of every beer brewer's desires.

Okay, that sentence is a major mouthful. Let's deconstruct it a bit and define terms.

Let's stipulate that *vigorous* is a well-knows descriptor. But to put it in perspective, hops will grow a good 15–20 feet high a year. Some reports have it at 40 feet a year, and up to 1 foot a day. But that brings to mind a line from the late, great Marvin Gaye's song, *I Heard it through the Grapevine*: "Believe none of what you hear and only half of what you see."

Deciduous, of course, means that the above-ground parts of the hops plant (bines, leaves, and cones) senesce and die back in winter. This phenomenon is linked to the hops plant being native to the temperate zones of the northern hemisphere with its associated frigid winters.

Dioecious derives from the Latin words *di* (two) and *oika* (house/dwelling), or two houses, that is, there are separate pollen-bearing male plants and flower-bearing female plants. Female plants are pollinated by the wind, but with hops you only and emphatically want unpollinated female plants, and in fact, that is all that is sold in commerce. Should your hops get pollinated, the aroma and flavor from beer brewed with those cones will have an "off" taste, much like rancid butter or oil. Not exactly what the trendy craft or home brewer is searching for.

Hops are *herbaceous perennial* plants in that they are actually annuals above the ground, and long-lived perennials (25–50 years) below ground.

Aboveground they grow vigorous, rambunctious, even riotous and joyful (not to be too anthropomorphic) vegetative shoots (*bines*). The below-ground, truly perennial aspect of hops is a structure called a *rhizome* (from the Greek *rhizoma* = a mass of roots). Rhizomes are a plant adaptation, a modified underground stem with nodes and a horizontal growth axis. The rhizome features a mass of stored carbohydrates in the form of starches and buds that give rise to annual shoot growth (the bines), and of course, roots. At summer's end, after the production of flowering cones, the plant shuttles carbohydrates that are produced in the leaves as a byproduct of photosynthesis down to the rhizome for winter storage, and then conversion to soluble sugars that provide the energy for new spring growth. A double dividend of the carbohydrate storage is that starches and sugars lower the freezing point and serve as a built-in antifreeze/life insurance policy to protect against the vicissitudes of winter.

After the bines have raced to the top of your 15–20-foot trellis, the plant is triggered by day length (hormonally) to stop growing and to produce side shoots ("side arms") that bear the pendant, cone-shaped flowers, harvested in early fall for brewing. These flowers appear as little soft green pinecones. We presently have 4–5 hops trained teepee style around the base of an 80-foot-tall Douglas fir in the Alan Chadwick Garden. One day in early fall, I looked up and noticed that the hop cones are dead ringers for the actual Douglas fir cones.

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*coir: coconut fiber twine

Hops at the Chadwick Garden
A Variety Trial & Workshop

A couple of years ago we put in a few hop plants at the Alan Chadwick Garden at UC Santa Cruz. This year we took the first sizeable harvest of our Cascade hops down to the craft brewers at Shanty Shack on Fern Street (nice folks). They used our hops with some organic barley malt and brewed a wet-hopped, righteous 6.2% alcohol content, hazy IPA—"Cali-Pure"—with grapefruit notes. I said, if we grew a bunch more, would they buy it from us. They said "bring it on!" Thus the "hops project" begins.

Our intentions: to grow hops and perhaps a little barley too! And to have a demonstration-based workshop revealing both the how's and why's, the techniques, and a little of the science behind the how – in bite-sized morsels.

We'll be putting about 75 plants in this spring. It will be a "variety trial" of 6–8 varieties, heavy on the 'Cascade' as they seem to produce well here on the coast.

So come join hops grower and 2013 Apprenticeship alum Jon Sattler, and Chadwick Garden staff Evan Domsic and Orin Martin, for a workshop on Saturday, April 13. We will regale you regarding –

- Sourcing and selecting hops rhizomes to plant
- Soil assessment and improvement, including a cover crop scheme and soil fertility regime
- Double digging the bed
- Cultural techniques and growing tips from spring to fall
- Designing and building various hops trellises (we will erect one à la a Quaker barn raising)

Space is limited! Find out the details and register online at hops2019.bpt.me

The hops cone consists of overlapping bracts* on the outside that protect the more precious bracteoles (yep, you guessed it, small, modified bracts). These bracteoles contain the valued alpha and beta acids, natural resins, and essential oils that impart both degree of bitterness, flavor, and aroma to beers. Different hop varieties contribute differing, but distinctive identifying qualities to various beers (see varietals section, page 7), be it grassy, floral, citrusy, bright, spicy, tropical, piney, or bitter.

Another dividend of hops is that they are anti-microbial. Conveniently, with the exception of yeasts, no bacterial or fungal organisms will survive in beer. In fact, IPAs came about as the British attempted to prevent spoilage of beers shipped in wooden barrels on sailing frigates around the Cape of Good Hope to troops in India (hence, India Pale Ale, or IPA). The beer was foul-smelling on arrival. So even in the days before San Diego's over-the-top Stone Brewery's ultra hoppy IPAs, the Brits kept adding more and more hops in hopes that upping the ante would do the trick. The eventual success led to the creation of our IPA beers. But all things considered, and in light of the devastating effects colonialism wreaked across the globe, I wish the British had stayed home, brewed better English beers, and bred the elusive yellow-flowering sweet pea (it's not in the sweet pea gene pool—there are no yellow sweet peas).

Seasons, Cycles, and Care of Hops

Your mission, should you choose to accept it, is to get 2–3 bines per plant to scramble skyward in a madcap dash to the top of your trellis as early in the season as possible. Because it takes time and energy (what doesn't) to develop mature flower cones, laced with lupulin (oils/resins/acids) before the end of the growing season, floral initiation needs to start early.

And remember, flowering is a hugely caloric activity for plants, which they do at great expense. For instance, annual flowers that produce so prodigiously literally bloom themselves to death. But then that is their evolu-

Hop Bines

Bines are similar to vines, but differ in that their stems are much woodier and feature many small barbs (trichomes) that enable the bine to latch on to a support system and climb. When these bines issue forth in the spring, there can be as many as 10–15, which need to thinned to 2–3 per plant. They are at first leafless and they crawl and intertwine in a matted mess across the landscape looking not unlike Medusa's hairdo. The hop bine grows in a helix-like circular pattern, moving clockwise—an important tidbit to remember when coaxing/training your bines up the support trellis strings.

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*Bracts are modified leaves arising from or below a flower. The bright, showy portions of statice, bougainvillea, and poinsettia are bracts.

Winter/early Spring 2019 Calendar

Free Fruit Tree Q&A Sessions

Saturday, January 12, 10:00 am – 12:00 pm
San Lorenzo Garden Center, 235 River Street
Saturday, January 19, 10:00 am – 12:00 pm
The Garden Co., 2218 Mission Street

Join Matthew Sutton, owner of Orchard Keepers for these free Q&A sessions on fruit trees. Bring your questions about fruit tree selections, soil preparation, and more!

Basic Winter Tree Care – Pruning & More!

Saturday, January 26, 9:30 am – 12:00 pm
Louise Cain Gatehouse, UCSC Farm

Join Matthew Sutton of Orchard Keepers for a lecture and demonstration workshop on pruning fruit trees. Includes information on varietal selection, tools, timing, techniques, and more. Rainout date is February 2.
Register online or by check—details at: pruning2019.bpt.me

Ecological Farming Conference

January 23–26, Asilomar Conference Center
Pacific Grove, California

EcoFarm is an annual gathering of organic farmers, gardeners, and policy makers that offers a wide range of workshops, plenary sessions, vendors, exhibits, a seed exchange, and much more. See the registration details at eco-farm.org/conference

Sowing Seeds: Starting a Successful Spring Garden

Sunday, February 3, 9:30 am – 12 pm
Cowell Ranch Hay Barn, UC Santa Cruz

Workshop leader Laura Sasso will discuss best practices for sowing, cultivating seedlings, and transplanting. The workshop will also explore strategies for planning and timing a successful warm season garden in this region. During the hands-on portion of the workshop participants will sow seeds and work with seedlings, which you can take home and cultivate in your garden.
Register online or by check—details at: seedstarting.bpt.me

If you'd like more information about these and other upcoming events, need directions, or have questions about access, please call 831.459-3240, email casfs@ucsc.edu, or see our web site, casfs.ucsc.edu.
For more 2019 events, see Upcoming Events at casfs.ucsc.edu

Growing Blueberries in the Home Garden and Small Farm

Saturday, February 16, 9:30 am - 1:30 pm
Cowell Ranch Hay Barn/UCSC Farm, UC Santa Cruz

Join CASFS/UCSC Farm & Garden manager Christof Bernau to learn about varietal selection, site selection, planting, pruning, and general care of blueberries in the home garden and on the small farm. This is a lecture and demonstration workshop.
Register online or by check—details at: blueberry2019.bpt.me

Chix in the City, Hens in the Hood

Saturday, March 9, 9:30 – 11:30 am
Cowell Ranch Hay Barn, UC Santa Cruz

Come learn about the joys of keeping chickens without annoying your neighbors in a class taught by UC Master Gardener Candice McLaren. Find out what the best breed is for you and your family, the beautiful options there are for your birds and eggs, and if raising chicks or rescuing from Animal Services is right for you. You'll also get great ideas about how to design and place a chicken coop and how to transition baby chicks to the coop.
Register online or by check—details at: chickens.bpt.me

Growing Organic Hops: Production Techniques & Trellis Design

Saturday, April 13, 9:30 – 1:30 pm
Alan Chadwick Garden, UC Santa Cruz

Learn to grow hops! In this workshop led by hops grower Jon Sattler, with Evan Domsic and Orin Martin, of the Chadwick Garden, we'll discuss initial soil preparation, variety selection, planting rhizomes and annual fertility needs. You will also learn how to maximize your harvest using various trellis designs, and get hands on experience building a trellis system in the Chadwick Garden. Whether you are a home brewer interested in growing backyard hops, or you are considering farming hops for your local craft brewery, this workshop is for you!
Register online or by check—details at: hops2019.bpt.me

Also coming up —

- February 27, Giving Day to support the UCSC Farm's efforts to grow food for UCSC students in need
- April 7, first monthly guided tour of the UCSC Farm
- April 27, Alumni Weekend Farm Tour
- April 27–28, UCSC Farm & Garden Spring Plant Sale

Friends of the Farm & Garden Board Updates

This year's slate of Friends of the Farm & Garden Board officers was unanimously accepted at the Annual Meeting in November. They include president Amy Bolton, vice president Robin Somers, secretary Delise Weir, and treasurer Dan Dion. Many thanks to Kim Hatfield for her work on the Board as she moves on to new responsibilities.

Several new members joined the Board this fall. Sandra Morishige brings a wealth of marketing acumen, systems management, and other skills to the Board. Sarah Thorne is a long-time supporter of the Friends and of CASFS, with many years of campus experience and a passion for sustainable agriculture. Johno Turner is a 2018 Apprenticeship in Ecological Horticulture graduate and Patagonia employee, who looks forward to supporting the next groups of apprentices during their learning journeys at the Farm & Garden. A warm welcome to you all!

EcoFarm Features Farm & Garden Staff and Graduates

Apprenticeship alumni, Center for Agroecology & Sustainable Food Systems (CASFS) staff, and UCSC researchers are well represented at the upcoming Ecological Farming Conference, taking place January 23–26 at the Asilomar Conference Center (see page 3). Come hear about the many projects they're involved in, including a pre-conference session, Advancing Equity in Ecological Farming. Registration information is available at eco-farm.org/conference.

Friends Membership Renewals

Need to renew your Friends of the Farm & Garden membership? You can find renewal information and a secure donation link online at –

connect.ucsc.edu/joinffg

Contact us at casfs@ucsc.edu or 831.459-3240 with any questions. Thank you for your support!

#RegrowPuertoRico Report

Many Friends of the Farm & Garden members and Apprenticeship alumni generously supported the #RegrowPuertoRico campaign, which was initiated by four of the 2017 Apprenticeship in Ecological Horticulture class members in response to the devastation of Hurricane Maria. The four apprenticeship graduates – Arielle Zurzola, Crystal Cruz, Fernando Maldonado, and Gabriella Collazo Caceros – are all back in Puerto Rico, fworking at the University of Puerto Rico's student garden and at a family farm.

Here are some excerpts from the campaign's final report –

#RegrowPuertoRico was a humble campaign started by four Center for Agroecology and Sustainable Food Systems (CASFS) apprentices. We are all connected to Puerto Rico and were devastated by the hurricanes' destruction last September. We set out to raise donations and the response from the Santa Cruz community and donors all over the world has been incredible. ¡Gracias, gracias, gracias!

We are writing this to share our final donation numbers and how they were distributed. We surpassed our desired goal and raised a total of $21,158 from more than 200 donors! Donations went directly to organizations supporting small farmers, the farmers themselves, and to ship donated materials.

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Members of the 2017 CASFS Farm & Garden Apprenticeship class promoting the #RegrowPuertoRico campaign.

Support Funds Ongoing Education, Exciting Initiatives

Many Ways to Give to the UCSC Farm & Garden

Kaj Enderlein, a 1996 Apprenticeship graduate, lives and works on his 10-acre organic farm on Orcas Island in Washington State. When the 59-year-old decided to get serious about estate planning, he thought of the UCSC Farm & Garden. "Everyday I treasure my learning and inspiration all those years ago," he said. "A legacy gift to the Farm & Garden was the most natural thing in the world to me." While Kaj continues to run a community farm project and a sawmill and timberframing business on his farm, he connected with UCSC's estate planning specialist Tyler Hinz with the intent that someday his farm will benefit the UCSC Farm & Garden.

Jen Colby, a past apprentice at the Farm & Garden, gave a generous gift of stock last year to the Apprenticeship, saying "My late stepfather helped pay my apprenticeship fees when I enrolled in 1999. I am honored to pay his generosity forward as a beneficiary of his will, since many people do not have the same family resources." Her 2017 gift of stock was followed by a new gift of stock from Jen and her husband in 2018 that will support the Apprenticeship.

We have been fortunate to have other gifts of stock and mutual funds from Friends of the UCSC Farm & Garden. Two anonymous donors, who have set up stock transfers in recent years, are inspired by the programming and research conducted at the Farm & Garden. They have made it part of their annual giving to give gifts of stock, an easy way for them to support our work.

Local businesses have been great supporters of our work as event sponsors and program funders. We also have donations come in through employee-match programs through businesses, a way for a donor to double their contribution to the Farm & Garden.

Occasionally we have been pleasantly surprised by a check being handed off in person. That's how Sharon Naraghi-Eckard gave $20,000 to the Apprenticeship Program this fall, a gift that will support apprentice scholarships in 2019. Sharon and her husband Bill Eckard have been committed supporters of the Apprenticeship over the years.

Jim Nelson, the former Farm Manager at the UCSC Farm, recently donated his horticultural library to the Farm & Garden where it will benefit generations of apprentices to come.

For more information about giving in any form, please contact Ann Lindsey at alindsey@ucsc.edu or (831) 566-3779.

Grants and Gifts Fund Long-Awaited Initiatives

UC Cooperative Extension Specialist in Organic Farming to be based at CASFS UCSC

The first organic farming specialist ever hired by UC Cooperative Extension will be placed at UC Santa Cruz, based at the CASFS Farm. CASFS has raised two years of matching funds to establish the position with UC Division of Agriculture and Natural Resources (ANR), and ANR is committed to funding half of the position going forward. Gaia Fund granted $100,000 for the two-year period, an anonymous Friends member $10,000 per year, and CCOF has granted $5,000. The new organic farming agent will soon be doing research and extension in the Central Coast region, serving local organic growers and deepening the connection between CASFS and UC Cooperative Extension. The job posting can be found at https://ucanr.edu/jobs/, with applications due February 1, 2019.

Undergraduate Sustainable Agriculture Major Being Developed for Approval at UCSC

A new $75,000 grant from the Clarence E. Heller Charitable Foundation will help with the two-year development and approval process for a new undergraduate major in Agroecology & Sustainable Food Systems at UCSC.

The demand from undergraduates for classes and internships at the CASFS Farm & Garden has been growing steadily over the past decade. CASFS has helped develop new courses, increased the number of undergraduates served at the Farm and Garden sites in classes and labs to over 300 annually, increased 5-unit and 2-unit internships to a new high of 125 students, with past grant funding from the Heller Foundation and other funders.

This spring the UC Santa Cruz Environmental Studies Department and CASFS staff and faculty were given a green light to develop a proposal for the new undergraduate major. We have embarked on a two-year process of designing the new degree program and shepherding it through UCSC's approval process.

UCSC undergraduates take part in an Agroecology Practicum class at UC Santa Cruz's Alan Chadwick Garden.

Growing Hops, from page 2

tionary strategy—put out as many flowers as possible, attract pollinators, get pollinated, set seed, scatter it on the ground, and sprout a new generation of genetically diverse individuals, much in the vein of the Golden State Warriors — "strength in numbers."

So to fuel flowering you need to fuel first the rhizome growth, following by rampant bine growth with big, fat leaves.

Soil: Hops need a deep, fertile, well-drained soil, so double dig your beds prior to planting. If you need a refresher, check out the CASFS YouTube channel, www.youtube.com/user/casfsvideo/videos, for a double digging tutorial.

While 5 feet of fertile topsoil is recommended, 2–3 feet of a reasonable loam should suffice. Hops are heavy feeders and need as much as 20 gallons/week of water.

Feeding: In terms of nutrients, the big one is the big one—that is, nitrogen. It contributes to leaf growth, which is much needed by hops.

Phosphorous has "domain" over early root establishment, flowering, and fruiting. Again, much in demand by hops.

Potassium enhances photosynthesis and is responsible for strong structures: with hops, it is critical to capture as much sunlight as quickly as possible, to photosynthesize and grow the plant. Thick, plump rhizomes, long, sturdy and strong bines, and fat, flat, thick leaves comprise the trifecta of hops "winnings."

Here is a suggested fertility regime for hops –

• In the spring, double dig and add compost at a rate of 5 cubic feet (a contractor's wheelbarrow) per 200 square feet (5'x40' bed).

• Fertilize with 7–10 pounds of Sustane per 200 square feet. Sustane is a good organic fertilizer for hops, with an NPK ratio of 8-2-4.

• Think about a split application of nitrogen, one in March and one in May.

• After planting (see below), cover the bed with 4–6" of wood chips (ideally, fresh chips from living trees). Do this again in the fall and in subsequent springs and falls.

• In fall, plant a cover crop* as a green manure between the rows (see casfs.ucsc.edu/about/publications/for_the_gardener.html for an article on cover crops in the home garden).

Because hops have such persistent, spreading rhizomes and roots, and because early season bine growth blankets the ground, it is easier to sow the cover crops in the aisles, or alleys, between plants in the fall, then chop it onto the soil surface and mulch it over with compost and wood chips in early spring. Eventually, the hop roots will grow into the alleys and make use of the decomposed green manure.

Trellising, Planting, Spacing

A simple trellis system uses a 4"x4", 15–20' tall redwood post, buried 2–3 feet deep. Tie coir to the top and secure it in the ground 10' from the post. Position the coir strings every 4–5' around the circle, forming a teepee shape, and secure them to 18" pieces of rebar driven 12–15" deep. You can also purchase W-shaped metal "hops clips" and an applicator tool to secure the strings in the ground (see Sources).

Or erect 2 posts 10–15' apart and secure a cable between them at the top. Tie coir from the line every 3–5' with a half hitch and anchor the twine in the ground with a W clip or 18" piece of rebar driven 12–15" deep.

Plant 1 hop rhizome 2–4" deep at the base of each string with the rhizome positioned horizontally. Top dress with a handful of Sustane and spadeful of compost, then top dress with wood chips as described above.

Rows or circles of hops should be placed 8–12' apart.

Irrigation

Install inline drip or t-tape in the spring, prior to spring emergence of the bines. Water deeply once a week. Microsprinklers will also work if you trim up the lower 2' of foliage from the bines to avoid wetting the foliage.

Care of Hops

In spring, thin emerging hop bines down to the 2–3 strongest. This will take several passes spread over 2–3 weeks, as they keep producing more early-season shoots. The rationale here is analogous to simple plumbing or hydrology: more flow through a lesser number of outlets leads to fewer, bigger, more vigorous bines.

When the "keeper" bines reach 2–3 feet long, begin to train them (gently) up the strings of the trellis, wrapping them clockwise around the strings. And as hops can grow a number of inches a day, you will probably need to do this on two to three consecutive days, until they get the hang of it. And then it's shades of Jack in the Beanstalk meets James the Giant Peach – stand back!!!

When the bines are overhead, trim the leaves off the lower 2–3 feet. This prevents the splashing of fungal surface soil organisms onto the foliage. Hops are subject to both powdery and downy mildews; these fungal diseases can be prevented or allayed by sprays of the organically certified bacterial sprays Serenade and Sonata. These are merely bacteria species that both aggressively occupy leaf surface space and prevent disease organisms from proliferating and actually predate on pathogenic organisms. Spray a solution of 1 ounce per 1 gallon of water at 5–10 day intervals if weather is foggy or there is evidence of disease.

With the exception of watering, mid summer care is minimal. So drink a few beers, swim in the ocean, read good poetry, and listen to a ballgame while the hops grow taller.

"Bringing in the sheaves" – Gathering the Harvest

As gardeners we spend so much of our time with backs bent and to the sun, casting our shadows on the ground, being servants of the seasons and the morning's early light, trying to coax exotic flavors as well as nutrition out of sometimes-recalcitrant soil and plants, that it is a crying shame not to harvest our vegetables, flowers, fruit — and hops—at the peak of perfection.

In the case of hops, it is a multi-year process: Fall planning and ordering, spring planting, summer tending in year one, and plucking the cones off as they form to allow all the plants' resources to be partitioned into bine and rhizome establishment (much as you would remove the fruit buds from a young fruit tree to encourage its growth).

Year two: rinse and repeat, but with a harvest. It only gets better as time moves forward for 25–50 years, but with one caveat: You must "spring" in to harvest at the right moment. You probably have a 5–7-day window for optimum ripeness. Picked too young and green, and the lupulin—that yellow substance obtained from glands at the base of the hop cone containing the resins, essential oils, and appropriate acids that give beer its flavor, aroma, and bittering element—is undeveloped. Pick too late (brown, dry, and flaky) and the essences have volatilized. So don't be too anxious, but don't delay either.

A quick guide to assessing when to pick your hops for drying:

Look at it: A ripe cone is green, not brown, but it has a lighter hue than the soft but vibrant green of an immature cone. It has a bit of puffed up appearance, and the inside of the cone should be deep yellow (this is the pollen- like lupulin).

Feel it: squeeze it (gently)—it should have good "bounce back," and should feel sticky and resinous, so much so that you can't get it off your fingers; it won't even wash off.

Smell it: the aroma should go from vegetative and grassy to highly oily, aromatic, fragrant, and well, hoppy.

Taste it!: Touch a bit of the yellow lupulin to your tongue. It will be both highly aromatic and bitter, a hoppy bitterness that takes a few seconds to detect.

Drying the Cones

For a small home grower you can dry cones in a food dehydrator (Excalibur is an excellent brand) on low setting (120–140°) overnight. If you have more than a few hop plants, you can put an old screen or screen door on saw horses, spread the hops in a single layer, surround it with three or four house fans, and turn the cones occasionally. It should take 1–3 days for the cones to dry.

When dried the options are:

- Brew beer: note that wet hopping, or brewing with fresh-picked hops, is seriously trending with both small craft brewers and the beer-coifing public
- Store in a dark, cool place
- Freeze for future use

Varieties

Here are some of the varieties we will be growing as well as propagating for sale at future plant sales and workshops

Cascade: Along with Centennial and Chinook, this seems to be a craft brewer favorite. It is disease resistant, has a flowery, citrusy aroma, and is used for American-style ales, IPAs, and porters. Sierra Nevada Pale Ale and Anchor Steam Liberty Ale are heavy on this hop.

Centennial: Aka Super Cascade. Aroma is clean and spicy, floral and citrusy. For all American ales and American wheat beers.

Chinook: Aroma of medium intensity — spicy, piney, with a strong grapefruit note.

Willamette: Aroma is grassy, floral, slightly spicy. Used for American pale and brown ales.

Mt. Hood: Aroma is mild and clean. Used for lagers, pilsners, and bocks (don't sleep on a good pilsner or lager, and I don't mean Bud).

Nugget: Aroma is very herbal, spicy, and bitter. Used for American pale ales, IPAs, stouts, porters, and lagers.

CTZ: There is some dispute as to whether Columbus, Tomahawk, and Zeus are separate varieties—sisters, or one variety, and labeled variously. Describing the dispute, one beer scribe said "lawsuit dispute."

Any way you cut it these three sisters are exquisite and hard to source. They are floral, aromatic, and bitter. Good for American IPAs, pale ales, stouts, and lagers.

You may be "pining" for the aromatic qualities of Citra, Simcoe, and Mozaic. Good luck, as they are proprietary hybrids with plants sold only to big-time professional brewers. But you can source dried or pelleted hops of these amazing varieties.

Sources

Hops rhizomes are usually available by mail order in late winter and early spring (timing varies from vendor to vendor). Order early as demand is high and availability is short lived.

- Freshops: Purveyor of Fine Hops, freshops.com
- Great Lakes Hops, greatlakeshops.com
- Stark Brothers Nurseries & Orchards, starkbros.com
- The Thyme Garden Herb Co., thymegarden.com
- The Windsor Gardener, thewindsorgardener.com
- Yakima Valley Hops, yakimavalleyhops.com
- W clips, applicator tool: orchardvalleysupply.com
- Applicator tool and W clip video: www.youtube.com/watch?v=HRqj87JkaNI

Generally a rhizome will cost $4–7; by buying bundles of 50 the price comes down to $2-3/rhizome. If you can't use that many, find a friend who wants to share in an order. Also, most local retail nurseries will offer 1-gallon pots of 18–24" tall plants in late spring – early summer for $10–12.

Good luck and we hope to see you at the workshop on April 13!

#119
University of California Santa Cruz
Center for Agroecology & Sustainable Food Systems
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Santa Cruz, CA 95064

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#RegrowPuertoRico, from page 4

The projects that were supported include –

Fondo de Resiliencia, a grassroots effort powering local regional-food systems, sustainable farming practices, farmers markets, food communities, and the decolonization of agriculture. They are supporting 200 farms with rainwater collection, seed donations, reforestation, planting, and more. We raised $5,000 + The Cheesecake Factory Inc. donated $5,500!

Huerto Semilla UPRRP, an educational, urban agroecological community garden. It was founded and is sustained by students at the University of Puerto Rico Río Piedras Campus. They are using the funds for tools and outreach for the garden. We raised $2,658.

Desde Mi Huerto, the largest organic seed bank in Puerto Rico. We raised $5,500 and Santa Cruz Heirloom Seeds donated $2,000!

Nadja Zoe Vale from ***Proyecto Uvas de Puerto Rico*** has developed a rooftop table grape model. The project is 8 years old and the model was developed by Nadja and her father, Jorge Vale. They lost all of their $500 models yet saved plant materials to restart the project. We were able to gift her $500 + $500 from Escribanas to support 2 models!

Other donations included –

• 10 Solar Panels and an Invertor from The Nell Newman Foundation, with shipping costs covered by the Center for Agroecology & Sustainable Food Systems (CASFS).

• 120 pounds of seeds from CASFS, Renee's Garden Seeds, Mountain Feed and Farm Supply, and individual donors

• $3,000 donated to Finca Conciencia- La Colmena for bees from Empress Green Inc. farm

Fernando recently sent an update on the work that he and Arielle are doing on their family farm:

• We are incorporating our family farm as an LLC. The placeholder name is PanaCarite. We just finished and sent our business plan to our financial investor. We hope that we can officially start in January 2019.

• We are part of an advanced agroecology course from a local organization called "El Josco Bravo." It is great to learn more and to meet more local farmers and leaders of the agroecological movement on the island.

• In June we had our first fellow CASFS apprentice volunteer, Collin Withers. In January we are going to be hosting our second CASFS apprentice, Grace Rahn. We are so happy and thankful for the CASFS community.

• Our Agroforestry system is thriving. The Breadfruit trees are growing branches and are now taller than us after almost 2 years planted. We hosted a planting community day and 27 volunteers showed up. We organized them in "CASFS Style" and now have 100 cacao trees growing in the system. In the next month we are going to be adding 200 papayas, 200 bananas and 100 plantains. Lots of exciting work!

• Our fist "casita" for agrotourism is currently being built.

• We constantly go back to review notes and articles from CASFS to inform our decision making here. Most recently, we used the "starting a farm" Powerpoint from Darryl Wong and the LLC and Lease notes from Poppy Davis.

If you'd like to reach Fernando and Arielle about renting their casita or volunteering on their farm, send email to aquanando@gmail.com. You can follow their work on their Facebook page, facebook.com/PanaCarite/