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For the Gardener Series

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Growing Hops (*Humulus lupulus*)

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for the Gardener

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

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. Below ground, 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-known 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.

Above ground 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 *rhizomā* = 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.

HOPE 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 be 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.

*coir: coconut fiber twine

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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.

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 varieties section, page 4), 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 yellowflowering 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 evolutionary 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. 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

SUGGESTED FERTILITY REGIMEN FOR HOPS

- ▶ In 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, 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.

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

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.”

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.

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,



Hop bine

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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 have grown at the UCSC Farm & Garden that do well in our climate.

- ▶ *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 Americanstyle 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: [youtube.com/watch?v=HRqj87JkaNI](https://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.

– Orin Martin, Manager, Alan Chadwick Garden at UCSC

This material was produced by the Center for Agroecology and Sustainable Food Systems (CASFS) at the University of California, Santa Cruz. For more information and additional publications, see casfs.ucsc.edu.