

## Hop Gardening

The hop (*Humulus Lupulus*) is a hardy, perennial plant which produces annual vines from a permanent root stock (crown). Vines may grow up to 25 feet in a single season but will die back to the crown each fall. In addition to the true roots and aerial vine, the crown also produces underground stems called rhizomes. Rhizomes resemble roots but possess numerous buds and are used for vegetative propagation. Thus propagated, all plants of a given variety are genetically identical.

Hops are dioecious, which means they have separate male and female plants. Only the female produces the flowers that are used for brewing or medicinal purposes. Male plants have no commercial value, but are used to pollinate females. Pollination stimulates higher yields by increasing cone size and seed set, but because brewers prefer seedless hops, males are only grown with otherwise poor yielding female varieties. Hop seed from a pollinated female is only planted when a cross between the male and female is desired to obtain a new variety.

Hops are native to the temperate zones of the northern hemisphere. They are found wild in western Europe, Asia and certain parts of North America. Commercial hops are generally grown between the 30th and 50th parallel north or south latitude and at various altitudes. Hops are very sensitive to short days and poor yields result at latitudes too close to the equator. Therefore the ability to grow hops is usually not limited by your location on earth. The health of the vine is more dependent on the grower's ability to provide proper growing conditions and care. Under good conditions, hops are a prolific vine, will produce from 1/2-2 pounds of dried flowers per plant, and will be a joy to grow and utilize.

### GROWTH CYCLE

In this discussion of hops, I will be referring to the female of the species. Being a perennial, the hop lays dormant during winter and is rather unaffected by freezing temperatures. The time of year when the annual vines break ground, when they flower and when they die back is very much determined by local temperature and day length. The vines will not break ground until soil temperatures have risen to the point where most spring flowers appear. A minimum of 120 frost free days are required for the hop to fully ripen a crop of flowers. Once out of the ground the vines need to be supported off of the ground. Vegetative growth continues until approximately mid-July when most hops are either past bloom or in full bloom depending upon location and variety. At this "burr" stage the flower is approximately 1/4 inch in diameter and is composed of many florets whose styles give it a spiny appearance. This is when the flower is receptive to pollen and if males are present, wind-borne pollen will fertilize the female flower and result in a seeded female hop cone. Regardless of pollination, the styles eventually fall off and miniature petals grow which eventually result in a cone-like structure. Most female flowers develop and ripen predominately between mid-August and mid-September depending on location and variety. Earlier flowers can and will occur but this occurrence is highly variable based upon location, weather, and cultural practices. Commercial growers actually delay flowering by removing the earliest vines in the Spring in order to enhance regrowth and encourage a higher yield of flowers. After the flowers ripen, the vine will continue to build reserves until it totally dies back with the first freezes of Fall.

### PRODUCTION

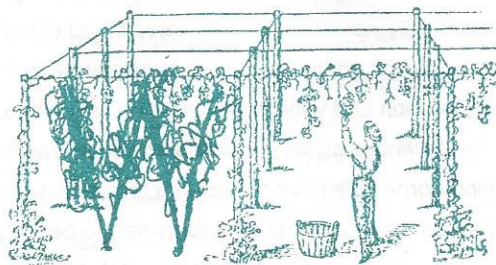
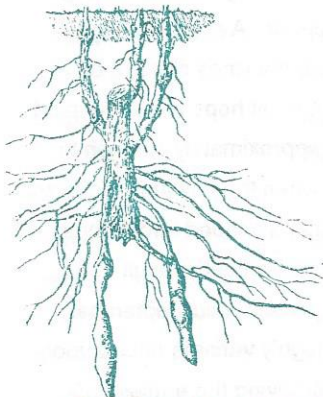
Because hops can produce such a large vine in a matter of months, they will use a large amount of solar energy, water and nutrients. It is not to say that the hop will not grow under less than optimum conditions, only that the vines will be smaller. Hops prefer full sun and rich soil, preferably light textured, well drained soil with a pH of 6.5-8.0. If drainage is a problem, small mounds can be built using surrounding top soil mixed with organic matter. Because the hop is a perennial, it's not a bad idea to dig holes about one foot deep so that some manure and other slow release organic fertilizers can be mixed with your soil and replaced into the hole. This puts the nutrients in the root zone.



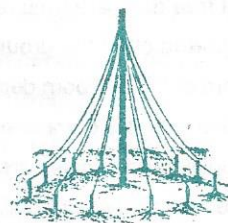
Upon obtaining the rhizomes, they should be stored in a plastic bag slightly moistened in a refrigerator. Rhizomes should be planted vertically with the bud pointing up or horizontally about 1" below the soil surface. First year "baby" hops have a minimal root system and require frequent short waterings much like any baby plant, but do not drown it with too much water. Mulching the soil surface with some organic matter works wonders in conserving moisture as well as helps control weeds. Once the hop is established after the first season, less frequent deep watering is best, preferably drip irrigation. Try not to soak the vine during watering, as that will sometimes encourage diseases. Each Spring apply a hearty dose of manure as a top dressing or fertilize with a balanced chemical fertilizer that is recommended for garden vegetables. Don't expect very much in growth or flowers the first year because the hop is basically establishing it's root system. Full growth and maximum crops of flowers will be achieved during the second year.

### SPACING AND SUPPORT

Space between plants varies from country to country and is mainly based on the need to have enough room to allow tractors to get between the rows. In the United States, hops are grown on 7' by 7' grid with an 18 foot tall trellis. In a home garden, the main concern is just to get the vines off the ground and possibly to keep different varieties from getting tangled up with each other. Plant mixed varieties at least 5 ft. apart. Identical varieties can be as close as 3 ft. if you don't have much room. Hops mainly grow up if they can, then lateral sidearms extend off of the main vine. Hops don't have to be grown on an 18' trellis. Some of the less vigorous varieties will yield more if they are limited to more like 12'-15'. Actually just about anything over 6 feet will work, the vine will just become bushier. The vines are easiest to grow and deal with if they are trained onto strong twine. This twine can be supported by a trellis wire, pole, tree branch or building. Small diameter poles, lattice and chain link fence also work but require more hand labor. Keep in mind that the vine does die back each Fall. In the first year vines can be established with a 6 foot stake.



HORIZONTAL HOP YARD, NEW YORK.



TENT TRAINING.

Commercial hop farmers do not train up the first shoots of spring but prune them off mechanically. Hardier shoots are trained onto the string about 4 weeks later (early to mid May in Oregon). Only 2-3 vines should be trained onto each string with 2 strings per plant. All subsequent vines, which can be extensive with older plants should be cut off. Vines are ready to be trained when they are about 12" long and must be gently wrapped clockwise onto the string without kinking. Once trained, the vine will take care of itself unless you want the vine to grow horizontally, this must be done manually.

### HARVEST

Because most hops are produced out of reach from the ground, it is safest to lower the vines in order to pick the hops. The harvest date varies with variety and location but will become evident as you gain experience as a hop grower. At maturity, the hop aroma is at its strongest and is measured by crushing a cone and smelling it. The yellow lupulin glands in the cone become much more evident and plump looking when magnified. The cone will develop a drier,



papery feel and in some varieties a lighter color as it matures. Some browning of the lower bracts is a good sign of ripeness. Squeeze the cones as they develop and you will notice they become more light and resilient rather than green and hard. The actual picking is self explanatory and this is where you want the flower cones, not the leaves. I don't know why raw hop cones are occasionally called leaf hops, when the idea is to not pick the leaves.

## DRYING

Drying can be done in a food dehydrator, custom made hop dryer, well vented oven, or they can be air dried. If you use heat, the temperature should not exceed 140 degrees F. Cooler temperatures take longer but a higher quality hop is obtained. Under dry weather conditions, I suggest taking a screen off of your house and setting it up in a wind protected area, elevated on each end. Spread the hops as shallow as possible and fluff daily so moist inner cones are brought to the outside of the pile. If weather is dry and the pile is not too thick they will dry in about three days. A high moisture content in the cones will adversely affect storability and recipe formulation. The hops are dry when the inner stem of the cone (strig) is brittle and breaks rather than bends. The strig takes much longer to dry than the bracts, so be patient. Pack the hops in an air tight container and store in a freezer until used.

## DISEASES AND PESTS

### DOWNY MILDEW: *Pseudoperonospora humuli*

The primary disease in hops is downy mildew. By being specific to hops, the disease may or may not be a problem everywhere. The disease first appears in the spring when some of the shoots develop into 'basal spikes'. The spikes are characterized by a stunted form, pale down curled leaves, silvery upper surface and the underside of the leaf turns black. Once the shoot develops into a spike it will not continue to grow and should be removed as it is now a source of infection for other parts of the plant as well as other plants. There must be moisture on the leaves in order for the windborne spores to germinate. This is why it is a good idea to not sprinkle irrigate. Lower leaves are also often removed as they create a damp area around the basal spikes ideal for spreading the disease. Downy mildew can be controlled by spraying a copper fungicide such as Kocide 101, but repeated applications may be necessary as rain will wash off the fungicide. Systemic fungicides such as Ridomil and Aliette provide longer protection but may not be available to home gardeners. Hopefully this disease is not a problem in your area, so don't worry about it unless the spikes appear.

### POWDERY MILDEW: *Sphaerotheca humuli*

Powdery mildew is the oldest of the fungal diseases affecting hops. It caused great damage in the USA when hops were grown on the east coast and was one of the problems that forced the hop industry west. It appeared in Washington in 1997 and Oregon and Idaho in 1998, where it is causing significant problems. The disease is characterized by white fuzzy mold growing on both sides of the leaves. If the disease proves to be persistent, it can be controlled with sulfur based fungicides, or by planting resistant varieties such as Nugget and Cascade.

### HOP APHID: *Phorodon humuli*

This pest is a problem in all hop growing districts of the Northern Hemisphere except some areas in China. If uncontrolled, this insect is capable of completely destroying a crop. The soft green aphids can completely cover the underside of the leaves, sucking the life out of the plant. They can also appear later during cone formation, particularly in cooler weather, and inhabit the inner part of the cone making control next to impossible at this late phase. Black sooty mold grows on the honeydew of the aphid in hop cones and is often the reason for not picking some vines. The aphid overwinters on various species of *Prunus*, mainly on sloe (*P. spinosa*), Damsons (*P. insititia*) and plums (*P. domestica*). The eggs are laid in the axils of the buds and hatch wingless females in the spring. They reproduce asexually, and soon produce winged females that migrate to the hop. Once on the hop the migrants produce several



generations of wingless, asexual aphids that build up in large numbers throughout the summer unless controlled. The actual aphid has a very soft body and is not hard to kill, but the tall vines and abundant leaves make it difficult to effectively spray the vine and hit all the aphids. Organic insecticides such as insecticidal soap, nicotine and diatomaceous earth work well if effectively applied. Some success can be derived via the introduction of ladybugs and lacewing predator insects as long as the predators decide to stay on the hops. The other option is to spray with a commercial insecticide such as diazinon or malathion.

**SPIDER MITE: *Tetranychus urticae***

Spider mites are mainly a problem in hot dry climates. Females overwinter mainly in the soil or under leaves. In the spring they emerge and climb up the vines to feed on the lower sides of the leaves. Very small and just visible to the naked eye, their arrival is more evident by the existence of their fine white webs on the bottom of leaves. Mites are often not as big a problem as aphids, so control may not be necessary. Many of the same insecticides used on aphids are also effective on spider mites. The introduction of predatory mites is also proving to be a somewhat effective control measure.

Please note that most of the above pests and diseases have *humuli* in the Latin name. This means that they are specific problems on hops and do not infect or inhabit other plants. Therefore if hops do not have a history of growing near your location, these problems will hopefully not exist in your area. Don't let the potential problems of growing hops stop you anymore than the potential of brewing a bad batch of beer. Mainly because of the higher heat used in drying commercial hops, the full aromatic potential may be somewhat diminished. Therefore by using lower drying temperatures and hopefully organic growing conditions, homegrown hops are the best.

**MAJOR US-GROWN VARIETIES**

<u>variety</u>	<u>yield</u>	<u>maturity</u>	<u>trait</u>	<u>cone structure</u>
Bullion	high	mid-late season	alpha	outward bracts
Cascade	high	mid-season	aroma	elongated
Centennial	high	mid-season	alpha/aroma	medium, dense
Chinook	high	mid to late	alpha/aroma	long with outward bracts
Crystal	moderate	mid to late	aroma	medium, oval
Fuggle	low	early	aroma	small, light
Galena	high	mid-season	alpha	medium-compact, plump
Hallertauer	low	early	aroma	loose, small, light
Liberty	moderate	mid-season	aroma	small, plump, dense
Mt. Hood	moderate	mid-season	aroma	medium, compact
Northern Brewer	moderate	mid-season	alpha	medium, loose
Nugget	high	mid-season	alpha	long, tight
Perle	moderate	early	alpha/aroma	loose, medium long
Saaz	very low	early	aroma	small, light
Santiam	high	mid-season	aroma	medium, compact
Willamette	moderate	mid-season	aroma	medium, round, light

[www.freshops.com](http://www.freshops.com) for color photos of hops, pests, diseases and current information on ordering rhizomes (March-May), and year round whole hops and hop oil. Also join the HopNation at the website for hop news via e-mail.