

# 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 autumn. 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. Although pollination stimulates higher yields by increasing cone size and seed set, males are generally only grown with otherwise poor yielding female varieties - mainly because brewers prefer seedless hops. 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 Europe, Asia and certain parts of North America. Commercial hops are generally grown between 30 and 50 degrees north or south of the equator and at various altitudes. Under good conditions, hops are a prolific vine, and will produce from 1lb to 2lbs (200g – 1kg) of dried flowers per plant.

## Growth Cycle

Being a perennial, the hop lays dormant during winter and is unaffected by freezing temperatures. Local climate and day length will determine when the vines break ground, when they flower and when they die back. 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 plant to fully ripen and once out of the ground the vines must be supported on canes, trellis or some other similar structure. Vegetative growth continues until approximately mid-July when most hops are either past bloom or in full bloom depending upon location and variety. The female plant produces flowers (burrs) on side shoots that develop along the stem into what eventually become hop cones. At this "burr" stage the flower is approximately ¼" 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 result in a cone-like structure. Most female flowers develop and ripen predominantly between mid-August and mid-September depending on location, weather, and cultural practices. Commercial growers actually delay flowering by removing the earliest vines in the spring in order to enhance re-growth and encourage a higher yield of flowers. After the flowers ripen, the vine will continue to build reserves until it dies back with the first frosts.

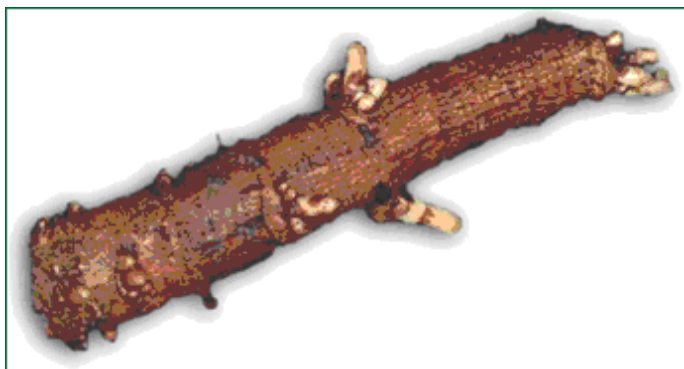
## Growing Hops

The ideal hop garden should have direct sunlight and plenty of room for vertical growth. Space along fences, garages, or property lines hold potential as hop gardens. Hop vines also need a strong support system to grow successfully; tall poles and strong twine are commonly used to support the growing vines. Growers should avoid sites with electrical wires nearby because of potential problems caused by sprawling vines. Soil should ideally be a well-drained loam and with a pH of 6.5 - 8.0 and because hops use large quantities of water and nutrients, the soil needs fertilizers rich in potassium, phosphates, and nitrogen. Home growers can use manure compost and commercial fertilizer for this purpose.

Once the site has been established and the soil fertilized, planting can begin. Rhizomes can be supplied as unrooted or rooted. Rooted rhizomes are generally referred to as setts and are dug up once the plant is dormant, typically in November. Willingham Nurseries supplies mainly rooted setts which should be planted upon receipt or as soon as the weather permits. Plants can be stored for short periods in a refrigerator or cool shed and if preferred potted up for later spring planting. Unrooted rhizomes are usually available in March and April and will, if available, be USA imports. In Northern latitudes, unrooted rhizomes can be affected by freezing temperatures so to avoid the loss of rhizomes to rot, plant after the threat of frost has passed. If your planting preparations are delayed, the rhizomes must be refrigerated in a plastic bag to prevent them from drying out. Ideally, you should plant unrooted rhizomes in early spring. Plants are also available in pots and you can safely

plant these out at any time of year. If you are planting unrooted rhizomes then plant the rhizomes vertically with the buds pointing upward or horizontally about 2 in. below the soil surface.

Spacing between rhizomes or plants varies. You can plant mixed varieties, but plant them at least 5 ft apart; identical varieties can be planted as close as 3 ft apart. 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 45cm deep so that some manure can be mixed with your soil and replaced into the hole.



*Unrooted rhizomes, typically US imports available from March or April. These have been largely replaced with pot plants – more expensive shipping but greater success rate!*



*Rooted rhizomes or setts usually available from November until April. These should be planted out upon receipt or potted up and stored until spring.*

Like any young plant, too much water may cause more harm than good. During their first year, young hops have a minimal root system and require frequent short watering. Mulching the soil surface with organic matter is a good method for conserving moisture and it also helps control weeds. After the first season the plant is established, and less-frequent deep watering such as drip irrigation works well.

### **Plant Support**

Don't expect much growth or many flowers during the first year because the plant is establishing its root system. Instead, look forward to the second year when hops are full grown and produce healthy crops of flowers. When the hop vines are about 1 ft (30 cm) long, select two or three strong vines and wrap them clockwise around a support system. The support system can be a trellis, tall pole, or strong twine. Hops mainly grow vertically, but lateral side-arms extend off the main vine. The main concern is to support the vines and prevent the side-arms from tangling. Tangled vines become an especially great concern when mixed varieties are planted in the same yard. In newly planted hop gardens, the growth that appears is a cause for celebration.

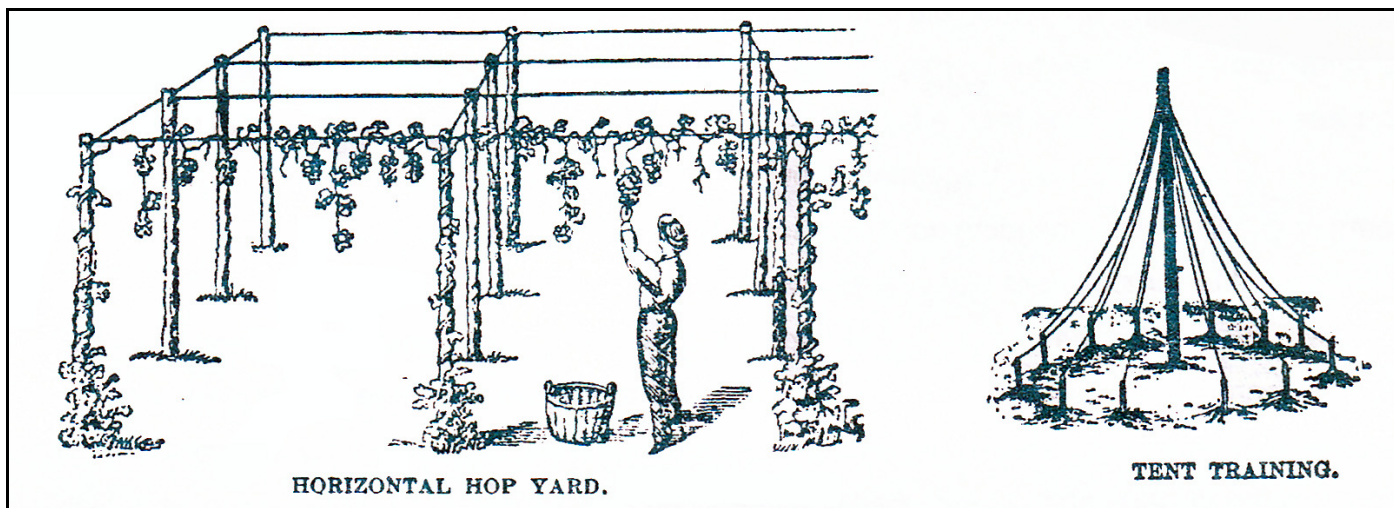
Growers have a tendency of letting every shoot grow and climb. Although this is understandable, leave only selected shoots and trim the weaker ones at ground level. This may be painful for the first-time gardener, but it forces the strength of the root into the hardier shoots. The selected shoots will take care of themselves once they've been trained, or wrapped. The early growth of a hop garden is amazing to watch; if you are not attentive, however, a jungle of vines is certain to develop. Severe trimming, like two to three shoots per vine, is an essential task that must be done every few weeks. Neglected trimming sessions can cause you to have a difficult harvest if you are struggling with tangled vines. In July, the lowest 4 feet of foliage and lateral branches can be removed to aid air circulation and reduce disease development. The removal of lower leaves (stripping) must be done carefully to avoid breaking or kinking the main stem. In August allow additional bottom growth to remain to promote hardiness of the crown and plant vigour for next year.

### **Pests and Disease**

Growing hops at home is a rewarding project; however, a few hazards merit concern. Hops have unseen enemies that can cause much frustration. With a close eye, however, you can spot these diseases and pests before your hop vines wither or become unmanageable.

Downy mildew (*Pseudoperonospora humuli*) is the main culprit of unhealthy hops. The mildew appears in the spring when the new shoots begin to grow. While some shoots are healthy, others will look brittle or spiky. Once the shoot develops into a spike, it will no longer grow. Other characteristics to look for are curled leaves with a silvery upper surface and black underside. Infected leaves must be removed because they are a source of infection for the rest of the vine. Downy mildew needs moisture to germinate, making sprinkle irrigation a bad idea when your vines show mildew infection. Drip irrigation is a better source of watering because the foliage remains dry and the water goes right to the roots where it is needed. The chances of downy mildew infecting your plants will be less if you strip the bottom 3 - 4 ft of the vines; these bottom leaves produce no cones, so

your harvest will be unaffected. Keeping the vines clear of weeds and leaves will prevent moisture from becoming trapped against the plants. Some hop varieties such as Willamette and Cascade are more susceptible to mildew than others; Nugget and Perle are quite hardy. Downy mildew can be controlled by spraying a fungicide containing copper hydroxide or by using a systemic fungicide.



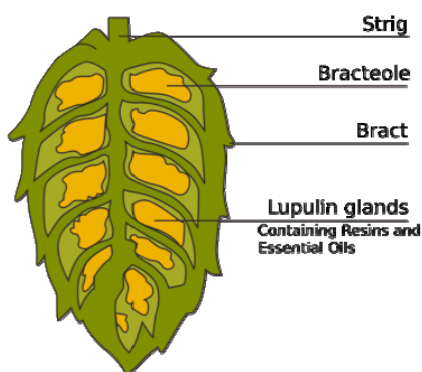
Wilt (*Verticillium* wilt) is another disease that damages hops. Characteristics to watch for are leaves with a dull green tissue alternating with yellow bands. Again, you remove the infected leaves to prevent wilt from spreading. The fungicides used against downy mildew can also be used to fight wilt.

Hop aphid (*Phorodon humuli*) is the most common and dangerous pest because it can destroy a whole hop yard. Fortunately, aphids are easily seen on the underside of leaves and they reproduce so quickly they are hard to miss. They appear in cool weather and, once hatched, will spread to all parts of the vine. Although aphids are easy to kill, tall vines and abundant leaves are difficult to spray effectively. Organic insecticides such as insecticidal soap work well against aphids. Also, commercial sprays like Diazinon and Malathion are available.

Although hops love the sun, the warm weather can also bring spider mites (*Tetranychus urticae*). Spider mites are barely visible to the naked eye, but their arrival is easily detected. Fine white webs under leaves and small freckle-like spots on the upper leaf surface are sure signs of spider mites, as are defoliation and red, rust-coloured cones. Because the mites like the sunlight, they tend to infect the top of a vine and work their way down. If you suspect mites to be the problem, inspect the parts of the vine closest to the sun. Many of the sprays used on aphids are effective against spider mites, too.

## Harvesting and Drying

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 colour 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. Drying can be done in a good dehydrator, custom made hop dryer, well vented oven, or they can be air dried. If you use heat, the temperature should not exceed 60° C (140° F). Cooler temperatures take longer but a higher quality hop is obtained. Under dry weather conditions, I suggest using a large screen 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 the weather is dry and the pile is not too thick then they will dry in about three days. A high moisture content in the cones will adversely affect storage 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.



Variety	Description	Alpha (%)
BRAMLING CROSS	Aroma variety with marked similarities to the German Hallertauer.. Originally bred as a replacement for the Goldings, good all around English hop.	5 - 7
CASCADE	Distinct flavour, most widely used hop by USA Craft Breweries	4 – 7
CHALLENGER	One of the few recognized dual-purpose with a good kettle hop aroma.	6 – 8
COBB	Cobb is a Kentish hop variety that is well-known for its aromatic qualities. Once widely planted it is now increasingly rare. Typical Goldings aroma.	4 – 7
EARLY BIRD	Early Bird is a Golding variety that is sought after for its typical English aromatic qualities.	4 – 7
FUGGLE	The dominant hop variety in England for 70 years until high alpha varieties were introduced. Grown in Slovenia as Styrian Golding.	4 – 5
HALLERTAUER	“Hallertauer Mittelfrüher” is the traditional German aroma variety.	3 – 5
KENT GOLDINGS	Golding hops consist of a group of traditional English aroma varieties that have been cultivated since 1790.	4 – 6
MATHON	Typical English Goldings variety.	4 – 7
MOUNT HOOD	Hallertauer hybrid that was released in 1989 from the USDA breeding program in Oregon. More vigorous and disease resistant than its German counterparts.	4 – 6
NORTHDOWN	An excellent dual-purpose hop with moderate bittering potential and excellent flavour & aroma characteristics.	7 – 10
NORTHERN BREWER	A strong fragrant hop with a rich rough-hewn flavor and aroma, ideal for steam-style beers and ales	7 – 10
NUGGET	A high-yielding, high alpha, vigorous, disease resistant variety that has become Oregon’s second most widely-grown hop since its release by the USDA in 1983.	12 – 15
PERLE	A very versatile hop combining good bittering potential with a highly acceptable aroma that is pleasant and slightly spicy.	7 – 10
PHOENIX	A seedling of Yeoman with good Wilt resistance with well balanced bittering and flavour components.	12 – 15
PRIMA DONNA	Dwarf, dual purpose, versatile hop with a rich citrus character and a well balanced bitterness. Also known as First Gold.	6 - 9
PROGRESS	Assertive fruity aroma. Similar to Fuggle, but slightly sweeter, and usually providing a softer bitterness in beers of all types.	4 - 7
SAAZ	Noble variety renowned for its high quality aroma.	3 - 5
SANTIAM	A recently developed American aroma hop released with high yield potential and Noble hop characteristics.	5 - 7
SPALTER SELECT	Grown in Germany in the Hallertau and Spalt regions and in the US in Washington State. Tolerant to Verticillium Wilt & Downy Mildew.	4 - 6
TARGET	A second generation selection from Northern Brewer by a male seedling of English Goldings.	9 - 13
TETTNANGER	An aroma variety grown mainly in the Tett nang region of southern Germany with good resistance to Verticillium Wilt. Comparable to the English Fuggle.	3 - 6
WGV	Produces a sweet, fruity flavour with a mild, clean bitterness. A more robust flavour than Kent Goldings. A good general purpose aroma variety.	6 - 8
WILLAMETTE	A triploid hybrid of the English Fuggle this is the most popular American aroma hop. Moderate yield, matures early to mid-season, tolerant to Downy Mildew.	4 - 6

All rhizomes and plants sold by Willingham Nurseries are female.

**Willingham Nurseries, Grange Lane, Willingham by Stow, Gainsborough, Lincolnshire DN21 5LB**

[www.willingham-nurseries.co.uk](http://www.willingham-nurseries.co.uk)

[sales@willingham-nurseries.co.uk](mailto:sales@willingham-nurseries.co.uk)