Shouldn't every beer be sampled in a hop field? Like a beer lovers wet dream.

BEER BASICS
HOPS

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BEER MAGAZINE is getting back to fundamentals. We've been bringing you information on specific styles, beer reviews, breweries, homebrewing, and everything in between, but we thought we should take a step back. We are going to profile the four main ingredients in beer: barley, hops, yeast, and water. In this issue we will start with the ingredient on everyone's mind these days—hops.

FRUIT OF THE BINE

The hops used in beer are the flower cone produced by the female hop plant. You knew there was a reason you loved beer, right? Hop farmers keep male plants out of sight lest the cones develop seeds. The plant is a vine, part of the humulus genus in the Cannabaceae family. Another leafy green genus in this family is cannabis. That makes hops and cannabis cousins, if you will.

Hop plants are perennial and once planted will sprout each spring. The vines are correctly called "bines" and they can grow up to 25 feet. A commercial hop farm with

rows of giant plants heavy with cones is an impressive sight. Even a couple plants growing in a backyard are a fitting backdrop to drink a beer (see Beer Magazine May/June 2008 for more on growing your own.)

BRIEF TIMELINE

Mankind had beer before he had hops, so when people say you can't have beer without hops they aren't exactly correct. Beer goes back thousands of years BC, but the earliest mention of hop cultivation is not until the 8th or 9th century. There is some evidence that hops were being grown at this early point, but it was not until the 11th century when Hildegarde, a Benedictine nun near Mainz, Germany, wrote about using hops in beer. It was at this time that we can say hops were taking a foothold as the preferred flavoring spice and preservative in beer.

After hops were first used in beer and began to replace things like sasafrass root and spruce bark, they didn't immediately become an everyday ingredient. In England, for example, it took a hundred years for the palettes of the people to acclimate to the taste of beer with hops, and this didn't occur until the early 1500s. Since this time hops have become by far the most commonly used choice for bittering and flavoring beer. The Colonies first had hops in the early 1600s, and soon they began growing their own supply. By the 1870s hops were being grown in the Pacific Northwest part of the U.S.

WHERE HOPS GROW

The vast majority of the world's hops are grown along the 49th parallel, plus or minus five degrees, in the Northern hemisphere. In North America this latitude includes Oregon, Washington, and Idaho (main U.S. producing states), and extends into lower Canada. On a global scale this latitude also includes hop producing countries like Germany, Czech Republic, Poland, and China.

You might have heard about Sierra Nevada's Southern Hemisphere Harvest Fresh Hop Ale. For that beer they use freshly harvested New Zealand hops, which are harvested opposite to those in the Northern Hemisphere. Hops grown in the Southern Hemisphere account for about 5% of world's production. The top three Southern-Hemisphere producers in order from most to least are Australia, South Africa, and New Zealand.

The majority of the world's hops are grown in Germany and the USA with those two countries growing 60% of the worlds hops. Just which country produces the most tends to switch back and forth, but they are fairly even at about 30% each.

England's historical hops such as East Kent Goldings and Fuggles, while debatably not technically "noble," are vital to many fine styles of beer such as Porter, Bitter, Stout, English Pale Ale, etc. The volume grown of these hop varieties is comparatively small, but the importance is significant in the way they enrich the world's beer styles.

A brief, non-comprehensive list of hop producing countries in ranking from most to least: Germany, USA, China, Czech Republic, Poland, Slovenia, United Kingdom, Spain, Ukraine, and France.

WHERE HAVE ALL THE HOPS GONE?

Hop availability is down, and prices are up. We are currently in a hop shortage, but how did this happen? For years hop farmers grew more hops than the world needed. Not only was the price of hops low, but hop supplies stockpiled excessively, frozen in warehouses. Many of those farmers slowly got out the hop-growing business, yet the stockpiles remained. Hops were plentiful, cheap, and abundant, but fewer were being grown.

The next unfortunate turn was unusual weather in Europe in 2007, resulting in a poor crop. And while farmers were giving up on hops and bad weather took hold, the remaining stockpile in warehouses was being used up.

Why not just plant more? Some farmers have, but it takes two to three years to get a good yield. A note of concern to brewers of some styles is that if farmers are getting into hop growing, they will most likely grow higher alpha acid hops because they can grow more alpha acid per acre. This means milder hops that are used in many wonderful beers will not be as prevalent until someone decides to plant additional acreage of those lower alpha-acid hop styles.

Delicious looking, we wonder if you can eat them?

HARVESTING AND PROCESSING

North American hops are typically harvested in late August or early September when the cones begin to dry out slightly and develop a paper feel when crushed between fingers. The cones can develop a slight browning on the edge. What is more important, though, is the growth of the fragrant yellow lupulin glands along the cones' stems. When you crack open a flower cone and sniff the yellow powder of the glands, you know where hop aroma in beer comes from.

The harvest and processing of hops is a mechanized procedure with machines and bines and cones being cut and sorted with impressive precision (search YouTube for "hop school 2007" or "hop harvest").

After they are harvested and dried, hops need to be converted into a storable format. Some of them are left whole, and these are known as whole hops or whole flower hops (the term whole leaf hops is sometimes incorrectly used). These are pretty much what you would imagine—whole flower cones slightly compressed into bales or smaller vacuum sealed packages. Some people prefer this more "pure" form of hops and believe the results are better. However, they can be slightly harder to work with, and might degrade faster than other forms. Another common form is hop pellets. Whole flower hops are milled into a near powder form, and then compressed into pellets (think rabbit food). These degrade more slowly than whole flower hops because there is less surface volume. They are also easier to measure and in some ways easier to work with. Due to the processing procedure they may have a higher alpha acid content than the same hops in whole form. One downside of pellets is that they disintegrate into green goo once in the brew kettle and bring about the challenge of separating the wort from fine particles.

A third way to store hops is sort of a cross between the whole flower and the pellet known as the plug. The plug is basically a more compressed version of whole hop without going as far as being a pellet. Plugs are said to be easy to measure since they often come in half ounce size, but they tend to be somewhat rare.

Sometimes an extract from the oils and resins is used to preserve hops. This results in a liquid that can be utilized for brewing. An advantage of hop extract is the lower volume of wort lost due to no hop trub in the brew kettle. Another advantage is improved storage and consistency. A disadvantage, though, is the higher cost to get the same amount of hop bitterness.

Would you eat a "hopsicle?"

PARTIAL HOP CHART WITH COUNTRY OF ORIGIN & ALPHA ACID %

Amarillo	USA	8-11%
Cascade	USA	4.5-6%
Centennial	USA	9.5-11%
Chinook	USA	12-14%
Columbus	USA	12-16%
Fuggle	UK	4-5%
Galena	USA	12-14%
Goldings	UK	3.5-4.5%
Hersbrucker	Germany	3.5-5.5%
Liberty	USA	3.5-4.5%
Mount Hood	USA	4-6%
Northern Brewer	UK	8-10%
Perle	Germany	7-9.5%
Saaz	Czech Republic	3%
Simcoe	USA	12-14%
Spalt	Germany	3.5-5.5%
Tettnang	Germany	4-5%
Tomahawk	USA	14-18%
Warrior	USA	15-17%
Willamette	USA	4-6%

NEW HOPS ON THE BLOCK

New hops are bred all the time. Some taste good and catch the fancy of brewers and beer drinkers. When this happens the hop might justify additional acres of planting, and one day become a regular in many beers (such as Simcoe and Amarillo in recent years).

GLACIER – moderate hop, around 5.5% AA. Kind of an English noble hop aroma and flavor.

SANTIAM – 5-7% AA substituted for German grown Tettnanger. Lightly spicy hop that would work well for many lager styles (Vienna lager, marzen, Oktoberfest).

STERLING – Saaz substitute with 6-9% AA. Said to be similar to Santiam.

VANGUARD – Mild hop 5.5-6 %AA. Regarded as Hallertau substitute with a refined aroma.

TEAMAKER - Extremely low AA% of .6 -1.8%. Due to the exceptionally low bittering acids, the hop is sometimes used for non-brewing purposes such as brewing tea.

MILLENIUM – Similar to Nugget but higher in alpha acids, around 15%. Said to have better storage stability.

VARIETY IS THE SPICE OF BEER

Hop varieties vary nearly as much as the world's beer styles. Indeed, often beer styles are brewed with particular hop varieties, like a crisp Czech Pilsner with Saaz hops or a stately English Porter with East Kent Goldings, or an American pale ale made with citrusy Cascades.

Different strains of hops have different contributions of flavor, aroma, and bitterness. That is, a Chinook hop might have a high alpha acid content (a major factor as to how bitter a beer will be) and yield a fiercely bitter beer. A Chinook-like hop might be well placed in a strong IPA. A hop like Fuggles, however, might be chosen more for its mildly spicy aromatic contributions, and might be nice in an English Bitter or Pale Ale.

For centuries brewers have experimented with these varieties and have found that certain hops work well when used certain ways. Brewing traditions often draw upon this wealth of experience. That is not to say that you can't break the rules, as seems to be the case more each year. Usually though, charts and books explain which hops work well in certain brews and what flavors they contribute. If you're curious, an Internet search will easily turn up such charts.

The way that hop varieties differ has a lot to do with the nature of their lupulin glands, the yellow resin at the base of the petals near the stem of the hop flower. This yellow dust is the treasure chest of the cone.

Hop aroma, flavor, and bitterness essentially come down to the acids in the hop resin, both alpha and beta. Alpha acids are where we get most of the bittering potential. Beta acids are not bitter, but are said to develop the potential to bitter over time, eventually providing more bitterness to the beer as they age. Predominantly, though, it is the alpha acid that works towards bittering the beer and you will often see a hop's "Alpha Acid %" listed as an indication of its bittering potential. An example might be a low Alpha Acid (AA) hop like Saaz at maybe 3% AA, with a hop like Warrior coming in with a staggering 15-17 % AA count (*cough* Three Floyds *cough*). Complex chemical reactions make use of these hop oils and resins in the brew kettle, but we will leave that to the scientists and Siebel students for now.

Hop soup coming soon!

LET'S MAKE SOME BEER ALREADY

You know all about hops now so let's make some friggin' beer! Hops provide an essential counterpart to the malt—bitterness to sweetness. Remember, brewers used to use other roots and spices to provide this balance. Historically hops have also provided antibacterial properties that helped distinguish beer as a safe alternative to often unsafe water. Now such a preservative quality is more a side effect than a necessity. On a somewhat but not entirely trivial note, hop resins also add to head stabilization.

Hops can be added at pretty much all phases of the brewing process. Most commonly, though, they are added to the boil kettle. Usually hops are dried in any of the forms mentioned, but some brewers have taken to brewing "wet hop" or "fresh hop" beers right when hops are harvested, before they are dried.

Whether fresh or dried, hops need to be boiled for an hour to extract the bitterness. Hops boiled this long are called bittering hops. A brewer might add additional hops and boil them for 45 or 30 minutes. These hops provide some bitterness, but also add flavor. Hops added at the end of the boil, right before the kettle is turned off, provide hop aroma to the beer. Because they are not boiled for very long at all, their aroma is not boiled off and will remain in the finished beer. Hops can be added at any time during the boil. Indeed, Dogfish Head produces a few beers that are continually, gradually hopped throughout their 60, 90, or 120 minute boils, and the beers are named as such (i.e. 60 Min IPA).

Additionally, some brewers add hops after the beer is finished fermenting. If this is done in conditioning tanks or kegs, it is called dry hopping. This will give the beer a fresh hoppy aroma.

Recently, brewers, especially home brewers, are getting even crazier with hops. I have heard of people adding hops to the mash water before the grain is added, adding hops to the mash after the grain is mixed with water, as well as an interesting technique called "first wort hopping." First wort hopping means adding hops to the wort as it is collected from the mash or lauter tun before the boil is started.

Is that all you can do with hops? Nope. Again the pioneers at Dogfish head created a way to give the beer an even greater hop aroma. The device is called Randall the Enamel Animal and it is essentially a three foot water filter packed with whole hops, through which beer is passed before being served. I've tasted beer served through a similar device and the effect is a potent, leafy hop aroma that can not be accomplished otherwise.

Lately a lot of talk about the hops shortage has been filling magazine and Internet space. You can see that there is a lot to love about our little green friends, including the inextricable smell and taste they provide to beer. The next time you savor a hoppy IPA it might mean just a little bit more. You can thank the hops.