Hop Evaluation and Selection

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This poster was originally presented at the MBAA 112th Anniversary Convention, Keystone, Colorado, 1999.

ABSTRACT

This poster illustrates some of the methods used for hand evaluation of hop samples and how to identify common flaws in hops. Brewers have to react to ever-changing raw materials, thus hop selection gives them more control over the flavors of their beers. When evaluating hop samples for purchase, it is important to understand how to properly evaluate the samples. When rubbing hops, many of one’s senses have to be employed to assess the hops appearance and aroma. The best way to examine hops is in leaf form, soon after harvest, because that is when oxidation is at its lowest levels. Proper evaluation techniques will be outlined and photos will be presented to show many of the common flaws found in hop samples and how to identify them. Pellet evaluation will also be discussed.

Keywords: Hop Selection, Hop Evaluation Team, Hop Inspection

SINTESIS

Este cartel ilustra algunos de los métodos usados para la evaluación a mano de muestras de lúpulo y cómo identificar defectos comunes en los lúpulos. Los cerveceros deben reaccionar a las cambiadas materias primas, de tal manera la selección de lúpulo les da mayor control sobre los sabores de sus cervezas. Cuando se evalúan las muestras de lúpulo durante la compra, es importante entender como evaluar las muestras adecuadamente. Cuando se talla el lúpulo, muchos de nuestros sentidos deben ser usados para evaluar la apariencia y el aroma de los lúpulos. La mejor manera de examinar los lúpulos es cuando la oxidación está en sus niveles más bajos. Las técnicas de evaluación apropiadas serán delineadas y se presentarán fotografías para mostrar muchos de los defectos comunes que se encuentran en muestras de lúpulo y cómo identificárselas. También se discutirá la evaluación de las bolitas.

COMMON FLAWS IN HOPS

Following is a list of common, and in the case of the mildews, hopefully not that common flaws in hops. When you find a flaw, it is important that you look at it in relation to the whole sample. For example, finding 1 or 2 windburn cones in brewers’ cut is not that uncommon.

INSECT DAMAGE

There are two insects that can wreak havoc with the hop grower: Spider Mites and Hop Aphids. They both affect the hops’ appearance and yield.

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John has been a member of the Master Brewers Association since 1989, has served as district technical committee chairman and is the current Vice President of District Northwestern. He has been a member of the MBA National Technical Committee since 1995. He is also a technical editor for the New Brewer magazine and a member of the National Craft Brewers Conference technical committee. John has attended brewing classes at the University of California at Davis.

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SPIDER MITE

These small insects love hot weather and dust, which means they normally appear in late summer just as the cones are ripening. By feeding on the juice, they kill the cones. Dead cones have a reddish tinge. The grower is constantly on the lookout for spider mites to control them through spraying.

HOP APHID

Aphids like cool weather and so are more predominant in the spring. They burrow into the hop, suck the life out of the cone, leave their waste and die. What’s left is a black moldy mess that leaves the cone unusable. Hop growers call this honeydew. Aphids also can be controlled through spraying.

MILDEW

Two types of mildews affect hops: powdery and downy. They both can affect the hop at any stage of development, but are most damaging early on. Downy mildew is related to warm wet weather and is environmentally driven. Oregon has downy mildew while Yakima rarely does and Idaho has none at all. Powdery mildew is a systemic infection that is born out of the soil and lives with the hop year-round. It was found in Yakima starting in 1997. Both kinds keep the hop cones from developing properly by totally stunting their growth. Of the two mildews, powdery affects the grower the most. Hops that have been exposed to either mildew near harvest time may have some silver or brown spots but may still be useable. That is up to the brewer. You probably will never see any hop samples that have been severely damaged. Only in a bad year might you see the diseases in your samples.

WINDBURN AND SPRAY BURN

Evidence of windburn and spray burn shows on the cones as brown discoloration. When the spray is applied, the grower uses a large fan that blows the spray over the field at around 130-mph. This can cause stress to the hop cones and burn them, either by the chemical or wind force. High wind conditions may cause the cones to bump into each other causing bruising to the cones. This is more of a cosmetic flaw and should not hurt brewing performance. Evaluate the hops to determine if they meet your needs.
**HOP SELECTION TEAM**

When evaluating beer flavors, you rely on a set framework for tasting procedures, a lexicon to describe what you taste and an educated taste panel to help you make decisions. When selecting your hops, you should also have a trained and consistent team to make the decision for your company. (Figure 6) At Full Sail, we have had the same four people doing the hop selection for the last six years. The hops selection team have an understanding of what effect the selection will have on the finished beer. Just like at a taste panel, the team should refrain from wearing perfumes and should have clean but not soapy hands and the selection should take place in a properly lit, comfortable environment away from noise and any odors.

The team needs to evaluate the samples of a given variety and judge them against the same variety. Varieties differ in appearance, aroma, color and many other variables to the point where they cannot be judged against each other. They can only be judged based upon what they will contribute to your beer. Even within the same variety, there are big differences in aroma and appearance, depending on what country, state or field they are from. As brewers, our challenge is to make a consistent beer time and time again. Hop lots need to be selected in line with where you want the beer’s hop flavor to be year after year.

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**FIGURE 6a**
Selecting Hops

**FIGURE 6b**
Hands post rub

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**THE BREWER’S CUT**

Figure 7 shows a brewers’ cut. It is a sample of hops removed from every 50th bale in a lot to provide the broker with a picture of what this field of hops represents. These samples are analyzed for alpha, beta and hop storage index (HSI). The brewers cut is divided into two brewers samples. When evaluating, you are given a sample from each lot you are considering. Notice the hop tong used to remove the sample (Figure 7).

In addition to the analytical data, you are also given a leaf / stem (LS) and seed (S) count. The U.S. Department of Agriculture does these on every 10th bale in the lot. The percentage given is based on weight. Scores from 0-1%, are given 0 as a score, 1-2% is given a 1 and 2-3% are called a 2. This score is important because it indicates hop product quality. High LS/S numbers mean less brewing material and possibly dirtier hops (Figure 8). It is all a reflection of how the grower processed the hops. During the last few years, the average leaf stem was less than 1%. It is important to remember that some hop varieties are prone to have more seeds. Also, the growing conditions and locale may affect seed production.

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**FIGURE 7**
Brewers Cut and Hop Tong

**FIGURE 8**
High Leaf and Stem sample

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**HOT RUBBING DESCRIPTORS**

<table>
<thead>
<tr>
<th>Positive Descriptors</th>
<th>Defects and Off Aromas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest-Woody,</td>
<td>Earthy,</td>
</tr>
<tr>
<td>Mint,</td>
<td>Grassy (brown-dead),</td>
</tr>
<tr>
<td>Citrus,</td>
<td>Musty,</td>
</tr>
<tr>
<td>Piney,</td>
<td>Kerosene (from kiln),</td>
</tr>
<tr>
<td>Spicy,</td>
<td>Hay-like,</td>
</tr>
<tr>
<td>Grapefruit,</td>
<td>Straw-like,</td>
</tr>
<tr>
<td>Estery,</td>
<td>Tea,</td>
</tr>
<tr>
<td>Grassy (fresh),</td>
<td>Oxidized,</td>
</tr>
<tr>
<td>Resinous,</td>
<td>Cheesy</td>
</tr>
<tr>
<td>Floral,</td>
<td></td>
</tr>
<tr>
<td>Herbal</td>
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</table>
HAND EVALUATION OF HOPS

Figure 9 shows two samples of Willamette hops. The ones on the left are nice and green and show good lupulin color and cone stability. The ones on the right have a dull brown color, are very low in moisture and shatter easily. These samples illustrate the wide variation you may see in the selection process. Remember to evaluate by asking the question “is the look, aroma and feel right for this variety”. Your evaluation should start with lower alpha hop varieties and work up to super-alphas. It is also good to take short breaks between varieties to clear your head and nose. Get to know your hop brokers and ask them for general information on what you should be looking for in the samples. If you know ahead of time that a certain flaw is common in the hops this year, you may be able to move through your samples faster. Ask the brokers how they evaluate hops and what they consider important.

1. EXAMINE THE SIDES OF THE BREWERS’ CUT

A lot can be learned from looking at the sides. The sample has three cut sides and one uncut side. First, look at the uncut side, to see what the hops look like on the inside of the bale. As these cones have not been cut, you can check the cone stability and shatter, which is when the petals just fall off the strig due to low moisture. Look at the cut sides. How does the lupulin look? It should be a nice bright yellow or light orange. If it is a deep orange color, it may be a sign of oxidation - too much heat in the kiln. Rub the cut side to feel for any seeds. Do you see any leaf or stem?

2. FEEL FOR MOISTURE

Take your hand and press down on the hop sample. How does it feel? It should have a nice firmness with a slight spring when released. This indicates that the hops were properly dried and baled. The harder the sample feels, the more moisture it has. If the sample is too moist, it may go through a secondary sweat, causing raggy cones - like a wet rag. If the cones are wet and raggy, they will not fall apart when being rubbed. When the sample is hard, it is referred to as boardy, like pressing on a board. If the sample is too dry, it will shatter when pressed and the hops will seem lifeless (Figure 11). This is normally an indication of late harvesting. Lower alpha hops tend to break apart easier than high alpha hops due to less lupulin and essential oils.

3. INSPECT WHOLE CONES

Take the cardboard divider and cut off a 2-inch sample. Break the cones apart and inspect for flaws. Look for wind or spray burn, aphid or spider damage, mold, leaf and stem. Check the cones’ sizing, are they the right size for the variety? Also check the strig in the cone. Are the hop petals attached well? This is a sign of proper drying. You may find some broken cones but the whole cones should outnumber the broken by a great majority. The more broken cones you have, the greater chance of oxidized hops. Break open a cone and inspect the lupulin glands. How do they look? Is the color right for the variety?
5. WHOLE CONE AROMA EVALUATION

Take a sample of unbroken cones and evaluate their aroma. In unbroken form, you should be able to detect any off aromas, especially kiln related. Use the list of aroma defects mentioned earlier.

6. FIRST RUB - THE LIGHT ONE

Take a sample, lightly rub it in your hand and set aside. This helps rinse your hands to move properly between samples. Take another sample and lightly rub it in your hands making sure that you start to break apart the lupulin glands. Take a smell. How does it smell? The light rub is a good way to look for any grassy notes.

7. BIG RUB - RELEASE THE AROMA

Take your lightly rubbed sample and crush it in your hands. The hops should fall apart. This rub releases the hydrocarbons in the oils and lupulin glands. Feel the sample for moisture. How does it feel? Do you feel the hop oils? High alpha hops will be stickier than low alphas. Give the sample a big smell. Evaluate it using the known hop descriptors mentioned earlier and any other aromas you may be picking up. Do you like it? Is it true to type? How will this hop sample work in your brewery? Evaluate and discuss with your team.

8. BIG RUB - HOLD THAT SAMPLE

Keep the big rub sample in your hand for a minute to warm it. Give it another smell. Does it smell the same? Do you still like it or do you like it better?

9. DISCUSS THE RUB

I suggest that you look at all the samples of a given variety before selecting with the team. Rub the samples, take notes and then discuss. Are the hops true to type? How will they work in the brewery? Will they provide repeatability in brewing? Which one do you like best? Why?
10. CHOOSE YOUR LOTS

Check to make sure your choice of hops supplies the alpha, beta, hop storage index that you’re looking for.

It is good to have a rating scale to work with when you do your selection. Use the framework of the selection process to come up with an evaluation form. Each variety also has trademark characteristics that you may want to look for when selecting. Assess a score to each sample and rate per your criteria. Evaluate based upon what you consider most important.

<table>
<thead>
<tr>
<th>Sample #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Appearance</td>
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<td></td>
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</tr>
<tr>
<td>color and sheen</td>
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<tr>
<td>Hop flaws: Spider, mold, windburn, etc.</td>
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<td></td>
</tr>
<tr>
<td>Cone stability and lupulin</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Light Rub Aroma</td>
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</tr>
<tr>
<td>Big Rub Aroma</td>
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<tr>
<td>Overall Impression</td>
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<td></td>
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<tr>
<td>Total Score</td>
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</tbody>
</table>

**FIGURE 15**

Hop evaluation form

**FURTHER EVALUATION**

After selecting your hops, use your lab and brewery to evaluate their performance. The following can be done:

**HOP TEAS**

Hop teas can be used to check the hop aroma of either leaf or pellet samples. Many times, the initial aromas of teas will have grassy notes due to the chlorophyll, and strange aromas from the myrcene. I have found no written method for preparing hop tea. I make it by taking a liter of water, adding a handful of cones and bringing it to a boil. Allow the tea to simmer for awhile to drive off the myrcene and other volatile compounds, since you would never find these in your beer after proper boiling. Smell your tea at different times along the way to see how additional time in the kettle may affect the aromas in the beer. If you’re doing hop teas, it is important to develop a baseline to compare one lot to another. Sometimes the aromas you get out of hop teas are not that pleasant. It is good to get to know the process before passing too strong a judgement.

**EVALUATE IN PLANT**

Run brewing trails to see how well the hop performs in your beers. To truly evaluate the hop, it must be put into a malt base and fermented. Start with a lighter house beer or brew a pale malt only brew and hop it around 12-20 ibu so that you can really see the character of the hop variety. Evaluate with your taste panel. Once you find a hop you like, see how it works in your regular beers.

**EVALUATING PELLETS**

The best pellets start with high quality hops. Your pellets will be only as good as the hops used to produce them. During the processing, the hop powder must be kept from excessive temperatures to keep the acids and essential oils from oxidizing, which happens most commonly at the pellet die. A lot of technology is being developed to prevent this from occurring. Know your suppliers’ process. The following steps can be used to evaluate pellets.

1. Warm sample to room temperature
   This will allow the aroma to be released. If the sample is too cold, the aroma is locked in just like in a beer.

2. Examine Appearance
   The pellets should be green in color. Dark olive and brown pellets indicate the possibility of oxidation. Keep in mind that the incoming hop color will affect the color of the pellet. A glassy appearance is a sign of excess heat during the process.
3. Finger smash
Rub the pellet between your fingers: with a little effort the pellet should be able to be broken down with your fingers. This shows that the pellet has not been exposed to too much heat.

4. Evaluate the aroma
The pellet should have a fresh hop aroma. Check for cheesy aromas and other signs of oxidation. Evaluate with a hop tea if you like doing teas.

CONCLUSION

- Learn to identify the flaws in hops and how they can affect your beer.
- Get to know the aroma, feel and appearance of your favorite varieties.
- Develop your aroma vocabulary. Learn the common hop descriptors and how to identify them. Tune your sense of smell as well as your tasting palate.
- Establish a team to help with selection. This provides more input to make a better decision.
- Create process for evaluation. Establish guidelines and follow them for each sample. Create a personal evaluation form.
- Select for consistency. Pick the hops that will keep your beers’ quality at its best.
- Develop a strong relationship with your suppliers.

ACKNOWLEDGMENTS
I would like to thank the following people for their advice and input in preparing this poster:

The Full Sail Rub Team: Jim Keiter, Greg Knutson, and Matt Swihart
Ralph Olson and Ralph Woodall of Hop Union USA
Lori LaBree, John Gorman and David Hysert of J.J. Haas. Inc
Larry Sidor of S.S. Steiner. Inc
Frank Kirner of Anheuser Busch. Inc

FIGURE 17
Full Sail Rub Team