

Dry hopping and barrel aging synergistic harmony?

CONES AND CASKS | Inspired by a lecture they attended at the Bierkulturhaus in Obertrum, Austria, the authors of this article decided to delve deeper into the subject of combining maturation on oak with dry hopping. The particular challenge, in this case, was to discern what influence the oak has on the beer and to find a hop variety or a hop product that would complement the aromas and flavors imparted by the wood. Once this was established, a second set of trials was carried out to determine how the quantity of the hop addition and the time spent on the wood influenced the beer.

TO SIMULATE aging on wood, a product was obtained from Wilhelm Eder GmbH of Bad Dürkheim from their XT Series 4: wood chips cut from French oak. These oak chips are used to convey aromas and flavors described as brown sugar, coffee and a roasty note mingled with sweet smoke and fine chocolate.

The quantity recommended for wine is 60 to 200 g/hl over a period of two to six months of maturation. However, to simulate the standard contact time for dry hopping, which is seven days, the quantity of wood chips was increased to 400 g/hl, in

order to partially compensate for the greatly reduced time on the wood.

■ The first set of trials

The beer used in the trials was a pale ale with an original gravity of 12.1 % and 5.2% alcohol by volume. It was not dry hopped. With the addition of the wood chips, this beer served as the control for the trials. The pale ale was then divided into multiple samples, and the hops or hop products were added according to the list in table 1. The selection of hop varieties and hop products was based on numerous preliminary tests.

The beers were analyzed after a contact time of seven days. The results are presented in table 2. The addition of oak chips and hop oil, of course, does not alter the composition of the bitter substances. Slight differences in the results are due to variations in performing the analysis. A significant increase in the alpha acid content occurred with the varieties Zeus and Chinook, while the addition of Saphir exhibited no significant effect, due to its low alpha acid content. Beers with higher additions of alpha acids exhibit a correspondingly higher number of bittering units.

A balance was sought between the hops and the oak in the nose and on the palate. The aromas and flavors were judged according to their overall impression, the descriptors used to define them and their sensorial bitterness. The aroma variety Saphir complemented the wood best in the nose but was less apparent on the palate. Though it was not very pronounced, the overall impression of the various beers revealed a trend in the results: hop oil proved to be poorly suited as an addition to the pale ale matured on oak.

In assessing the sensorial bitterness, the panelists were asked to estimate the number of bittering units the beer possessed. It was

DESCRIPTION OF THE SAMPLED BEER

Original beer	pale ale – no dry hopping, no oak chips	
Control beer	addition of oak chips, no dry hopping	
Dry hopped with:	hop oil – type “Nobel Plus”	12 mg/hl
	Saphir Type 90 pellets	300 g/hl
	Zeus Type 90 pellets	300 g/hl
	Chinook Type 90 pellets	300 g/hl

Table 1

Authors: Willi Mitter, Alexander Feiner and Sandro Cocuzza, Simon H. Steiner, Hopfen, GmbH, Mainburg, Germany

g – a collision of aromas or

of less consequence that the estimates agree with the analysis results, but rather that the differences in the intensity of the bitterness of the various beers be distinguished. Interestingly, the perceived bitterness of the various beers did not vary significantly in the sensory analysis.

A remarkable result was also obtained in the descriptions of the flavor impressions of the individual beers in the trial. The control beer possessed a pronounced sweet, vanilla-like note, which was strongly masked by dry hopping (see fig. 1). Conversely, the typical flavor characteristics of each hop variety were less distinctive in combination with maturation on wood chips and, aside from a few exceptions, were defined using similar descriptors.

The second set of trials

The variables were defined for a second set of trials based on these findings. In these trials, the amount of wood chips was reduced to 250 g/hl, while the other two factors, the quantity of hops and the time spent on the wood, remained the same. A pale ale that had not been dry hopped, the same as the beer described above, was once again chosen for the trials. Two different quantities of two hop varieties were used to dry hop the beer: Hallertauer Saphir and Hopsteiner cultivar 05256. The two varieties were added in quantities of 200 and 300 g/hl once primary fermentation was complete. The company's internal tasting panel, which in this case consisted of nine people, evaluated the beers both one and three months later. The primary focus was on how the aromas of the beers were described.

The sensory evaluation of the beers aged one month on wood revealed that the control beer possessed a strong vanilla-like character, despite the lower quantity of oak chips. As in the first set of trials, the

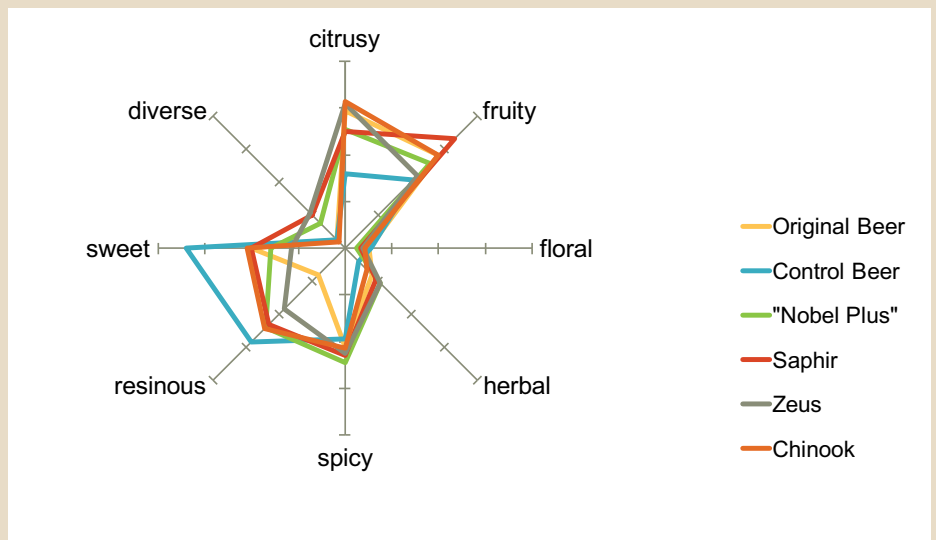


Fig. 1 Aroma impressions – intensity (first set of trials)

BEER ANALYSIS				
	IBU EBC 9.8	Iso- α -acids mg/l*	α -acids mg/l*	Linalool μ g/l**
Original beer	30.8	27.1	5.1	46.2
Control beer	31.2	26.6	4.3	45.0
"Nobel Plus"	31.0	26.2	4.3	189.3
Saphir	31.3	26.6	4.8	125.6
Zeus	39.0	26.2	7.8	125.4
Chinook	36.1	26.3	7.2	107.7

* HHV 29 (Hopsteiner method, HPLC) ** HHV 05 (Hopsteiner method, GC)
Table 2

dry hopped beers once again exhibited much less of the vanilla-like character (see fig. 2). The flavors and aromas of the hops are very dominant in these beers, which is most likely attributable to the reduction in the quantity of oak chips in this set of trials.

As for dry hopping, of course, no direct comparisons are possible in these trials, but certain changes were observed (see figs. 2,

3). The results indicated that with both Saphir and the new cultivar, prolonged maturation increased the spicy notes of the hops. With 05256, a significant increase in the fruity notes was discovered over time. Since fruity notes are also often associated with the descriptor "sweet", this was most likely the reason that the sweet vanilla-like aroma was more prominent in the beer dry hopped with the new cultivar than with

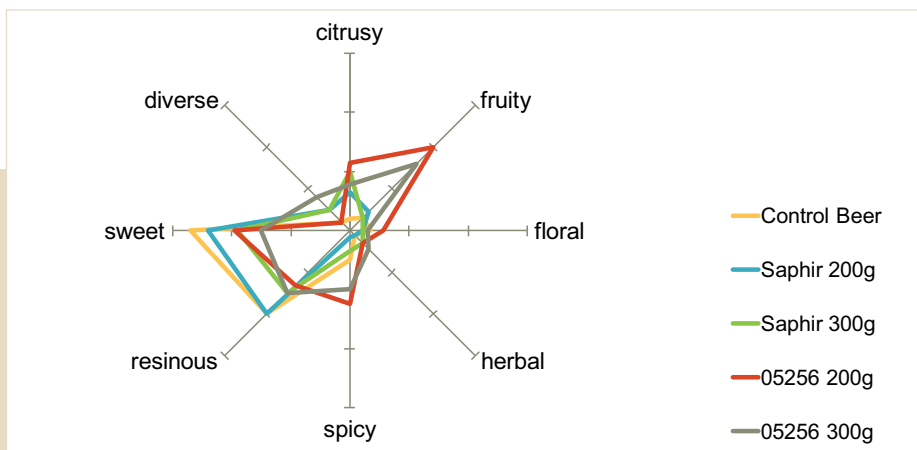


Fig. 2 Aroma impressions – intensity after one month (second set of trials – Hopsteiner tasting panel)

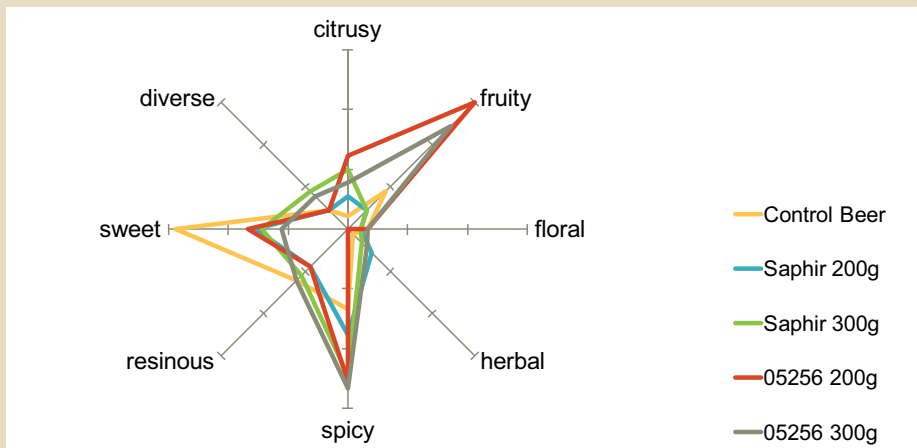


Fig. 3 Aroma impressions – intensity after three months (second set of trials – Hopsteiner tasting panel)

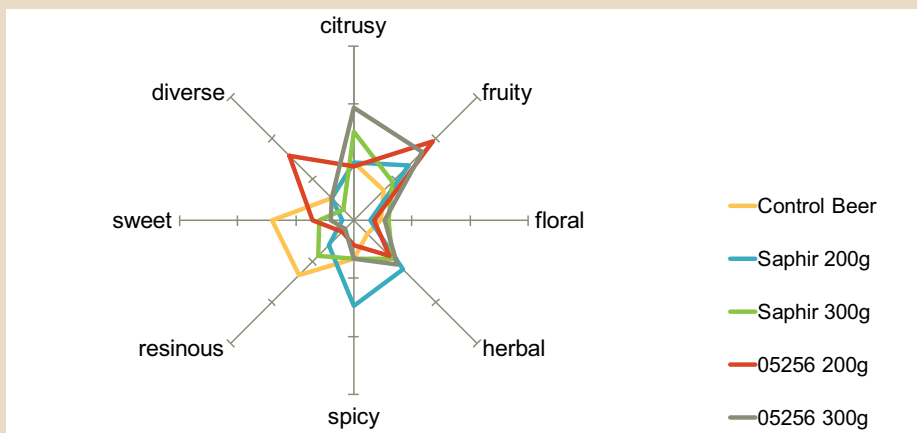


Fig. 4 Aroma impressions – intensity after three months (second set of trials – tasting by seminar participants)

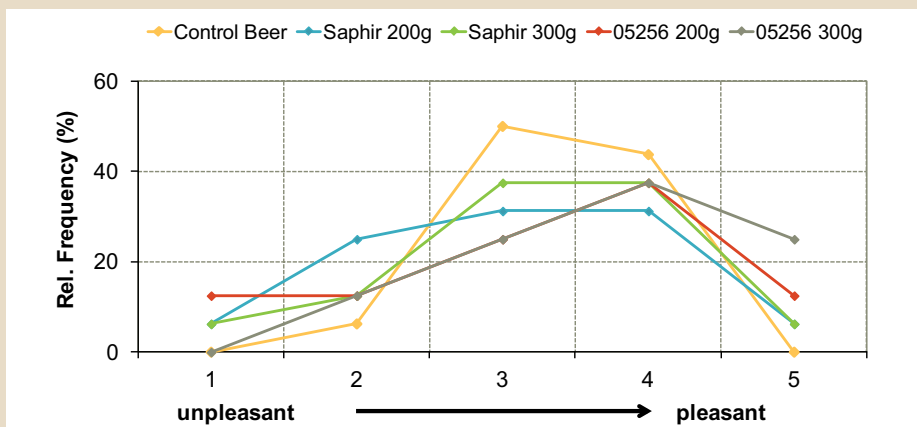


Fig. 5 Aroma quality after three months (second set of trials – tasting by seminar participants)

Saphir. This is largely true for the beers dry hopped with both 200 g and 300 g of hops.

The influence of the quantity added during dry hopping was clearly evident. This was typically perceived as a more intense aroma. Adding a lower quantity of Saphir tended to impart a sweet character to the beer, which was evident both at one and three months of maturation (see figs. 2, 3).

Tasting at the Bierkulturhaus

The beers matured for three months were made available for a tasting at a seminar in Obertrum at the Bierkulturhaus. This allowed all of the flavor and aroma characteristics to be assessed once again in greater detail. When comparing descriptions of the aromas (see fig. 4) with those of our panel, it became apparent the degree to which results in such sensory assessments can vary. This is undoubtedly due to the individual perception of each taster and is probably related to the amount and kind of training they have received.

The latter is evident in the characterization of the typical “hoppy” note as “spicy” by the Hopsteiner tasters while most of the seminar participants described the same note as “herbal”.

Furthermore, the distinction between “fruity” and “citrusy” is merely a question of definition. There are, of course, citrus fruits that possess what one would call a “fruity” aroma, and other kinds of fruit, which may convey an impression best classified as “citrusy”.

Despite the differences in the tasting results from the two panels, as stated above, the characteristics of each variety came to the fore in this series of experiments, which reflected the individual hop profiles. For each individual hop variety, the characteristics exhibited an array of different manifestations, which changed with the quantity of hops added. The same was true for the Hopsteiner cultivar. However, compared to the results from our tasting panel, the sweet character was found to be largely absent in the beers.

In assessing the quality of the aroma (see fig. 5), the pale ale dry hopped with cultivar 05256 at 300 g/hl was judged to be best. Around 60 percent of the tasters rated this beer with scores of 4 or 5, and none found the aroma unpleasant. The control beer was considered to be relatively neutral and received neither the worst nor the best score.

This could indicate that even with maturation on wood, hops are still capable of contributing certain accents to the aroma and flavor of the beer.

The intensity of the bitterness expressed in the estimate of the bittering units proved to be very consistent. The largest discrepancy was only 2 IBU, which shows that the quantity of alpha acids introduced by dry hopping still does not have a significant effect on the sensorial bitterness. The overall impression (see fig. 6) indicated that dry hopping with cultivar 05256 best complemented the simulated oak aging of the beer. Though, equal numbers of tasters gave the beers dry hopped with the lower quantity of cultivar 05256 both the best and the worst rating. Nevertheless, it was given a score of 4 by more than 40 percent of the panel.

Conclusions

The perfect balance between dry hopping and maturation on oak was not found in these sets of trials. On one hand, the “wood note” should not dominate in the nose and

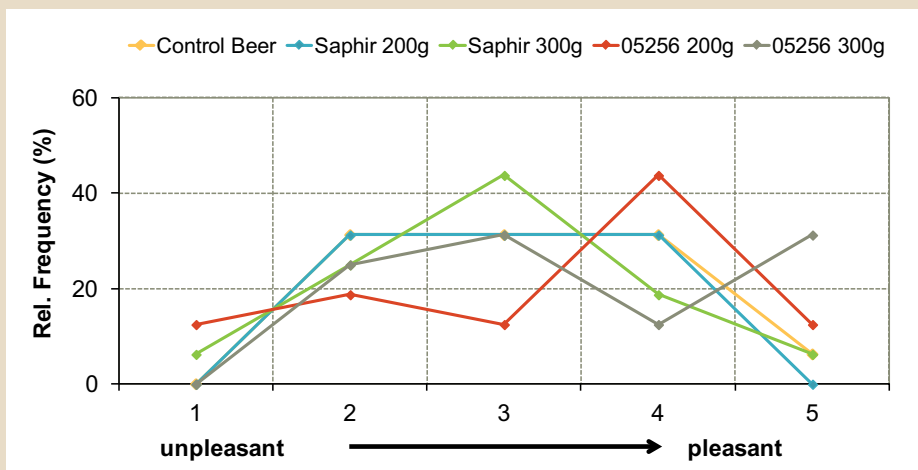


Fig. 6 Overall impression after three months (second set of trials – tasting by seminar participants)

on the palate, in order to allow the hops to reach their full expression. On the other hand, the aromas derived from the wood can easily be masked by dry hopping. It could be that pale ale may not be the most appropriate beer style for conducting these kinds of experiments. There are also a number of other variables that could be modi-

fied in trials of this nature. Variations in the perception of flavors and aromas by individual panel members only serve to deepen the challenge. Therefore, the authors look forward to continuing their study of the interplay of the aromas and flavors in beer derived from dry hopping and maturation on wood.