

Laboratory and Industrial Scale Brewing Trials with Lubelski, Marynka, Oktawia and Other Polish Hop Varieties

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ABSTRACT

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Seven Polish hop varieties, two aroma and five bitter, from the Poznan region were analysed for bitter substances and hop oils by Woellmer, HPLC and GC methods. Brewing tests were performed on both the laboratory and industrial scale. All resulting beers underwent sensory testing with the results expressed in terms of points and by descriptive observations. The results show that Polish hop varieties vary widely in their ability to give a pleasant aroma and taste to the beer, which is correlated with the hop oil composition of each variety.

Key words: Beer, hop aroma, hops, Polish hop varieties.

INTRODUCTION

There is some documented evidence that wild hops were collected in Poland as early as the 13th century and handed over as part of a levy paid by peasants to the church. By the 17th century both cultivated and wild hops were in use in brewing. Between the two world wars only local hop varieties were grown in Poland. In this period beer consumption per capita was very low, only about 5% of the present level³.

The breeding of Polish hop varieties started in 1946, at the State Agricultural Institute in Pulawy, and the first two varieties, Lubelski and Nadwislanski, were registered and handed over for cultivation in 1964. The highly aromatic variety Lubelski still makes up more than 40% of the Polish hop harvest³.

The total area of hop culture in Poland dropped from above 2300 ha in 1966 to about 1900 ha in 2000. In the same period the number of plantations fell from 1725 to 1118. The main region of hop culture in Poland, about 85% of the total harvest, is in the Lublin district. Next, with some 10% of total production, is the Poznan area. The remaining 5% of the hop harvest comes from Silesia. Aroma hops constitute more than 60% of the total harvest³.

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There have been many recent reports on the impact of hops on beer quality^{2,4,5,9-12} but this report specifically concerns Polish hop varieties.

MATERIALS AND METHODS

Two aroma varieties, Lubelski and Limbus, as well as five bitter varieties, Marynka, Northern Brewer, Oktawia, Sybilla and Zbyszko, were chosen for our investigation. The experimental hops came from the Poznan region (Slupia Wielka), where the spring was quite cool and dry, and in June the weather conditions improved, it was warm, and there was enough rain. July and August were hot and dry, but some rain in August improved the condition of the hop plants before harvest.

Hops were analysed for total α -acid content by the Woellmer method⁸ and composition of individual acids by HPLC⁷. Hop oils were analysed by GC⁶, using a Hewlett-Packard gas chromatograph, type HP 6890 series; program ChemStation.

Laboratory-scale brewing tests, on 2-litre samples, were carried out in the Department of Brewing and Malting Technology of our Institute. The wort of 12.5% extract ($^{\circ}$ Plato) was boiled for 1.5 h. Hop addition was calculated to produce a wort containing 100 mg α -acid per litre, a normal dose for a Pilsener beer, the commonest type in Poland. Hops were added in two stages: the first portion, 80% of the total, 10 min after the beginning of boiling and the final 20%, 20 min before the end of boiling. After 7 days of fermentation at 8–9°C, the beers were stored for 3 weeks at 2°C and then bottled.

Brewing tests were also performed on an industrial scale, first in a small brewery in Gosciszewo and repeated in a medium-sized brewery in Jablonowo. The time of wort boiling and the dosing and the timing of hop additions were identical to those adopted in the laboratory tests. All beers underwent sensory testing, focussed on hop flavour and bitterness quality, by a panel of 20 experts. The panel came from our Department of Brewing and Malting Technology, the main Polish breweries, the Institute of Hop Breeding, Pulawy and COBORU-Slupia Wielka, Poznan district.

RESULTS AND DISCUSSION

Hops of all seven varieties tested were analysed twice for aroma and bitter substances before the brewing tests. These hops are at the present time in culture or breeding

trials in Poland. The mean results obtained are shown in Table 1. The results of the tasting of the laboratory-scale and industrial-scale beers are presented in points¹. Descriptive observations and remarks are summarised after the variety of hop used to prepare the beers.

For bitterness evaluation we adopted an 18-point scale awarded as follows:

Acceptable	12 points
Satisfactory	14 points
Good	16 points
Excellent	18 points

For aroma and taste quality the awardable points were as follows:

Acceptable	24 points
Satisfactory	28 points
Good	32 points
Perfect	36 points

The main results of the sensory assessment are presented in Table II. The two leading Polish hop varieties Lubelski (aroma) and Marynka (bitter) won an almost equal number of points for aroma and taste as well as bitterness quality. Descriptive observations and remarks on hop aroma and taste of the beers prepared from individual hop varieties are summarised as follows:

Lubelski: deep, noble, very pleasant, more floral and herbal than resinous.

Limbus: intense, fairly pleasant, more resinous than floral.

Marynka: intense, enjoyable, pleasant, combination of floral, resinous and herbal.

Oktawia: deep, quite pleasant, floral and resinous.

Sybilla: fairly intense, nice, floral/resinous, slightly less noble than the others.

Zbyszko: very intense, sharp, harsh, resinous.

Northern Brewer: sharp, intense, harsh, strongly resinous.

The corresponding observations on hop bitterness quality were:

Lubelski: pleasantly bitter, not persisting.

Limbus: fairly intense, quite pleasant, acceptable.

Marynka: intense, pleasant, but fast elapsing.

Oktawia: deep, enjoyable, but fast elapsing.

Sybilla: intense, fairly pleasant, not persisting.

Zbyszko: very intense, fairly good.

Northern Brewer: very intense, acceptable.

The above results show that Polish hop varieties vary widely in their ability to give a pleasant aroma and taste to the beer. The aroma and taste quality correlated with the hop oil composition of each variety, especially with myrcene, humulene and caryophyllene as well as humulene oxides. The hop varieties tested were quite similar in their ability to confer a pleasant bitterness to beer; the bitterness quality had no correlation with the amount of co-humulone in α -acids.

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Table I. Analyses of hop varieties.

	Aroma hops			Bitter hop varieties			
	Lubelski	Limbus	Marynka	N. Brewer	Sybilla	Zbyszko	Oktawia
α -Acids (%)	4.0	5.3	11.1	8.4	7.3	8.5	10.6
Cohumulone in α -acids (% w/w)	31.8	35.5	25.3	30.7	33.9	25.6	33.5
Oil content (% v/w)	1.2	1.7	2.3	1.9	1.7	1.9	1.6
Myrcene	38.8	40.8	37.6	42.9	39.6	53.3	39.7
Caryophyllene	7.6	12.0	8.0	10.2	9.5	9.7	7.6
Humulene	38.5	26.9	39.7	32.2	36.4	23.9	33.6
Linalool	0.58	0.32	0.36	0.41	0.27	0.74	0.37
α -Terpineol	0.27	1.05	0.50	0.18	0.36	0.20	0.68
Geraniol	0.19	0.08	0.12	0.10	0.08	0.02	0.06
Humulol + humulenol-2	0.70	1.08	0.66	0.46	0.86	0.61	0.88
Caryophyllene and humulene oxides	2.44	1.24	0.98	1.40	1.14	1.13	1.53
Humulene/myrcene ratio	0.99	0.66	1.06	0.75	0.92	0.46	0.85

Table II. Results of sensory evaluation of laboratory-scale and industrial-scale beers.

Hop variety	Bitterness quality, points			Aroma and taste quality, points		
	Lab. scale	Indust. scale	Mean result	Lab. scale	Indust. scale	Mean result
Lubelski	16.8	17.2	17.0	31.9	33.0	32.5
Limbus	16.2	15.7	16.0	29.6	30.0	29.8
Marynka	17.4	16.9	17.2	31.8	32.7	32.3
Oktawia	16.5	16.8	16.7	30.2	32.0	31.6
Sybilla	16.9	16.2	16.6	31.3	31.4	31.4
Zbyszko	15.8	14.5	15.2	28.4	27.5	28.0
N. Brewer	16.0	14.8	15.4	30.0	27.6	28.8

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