THE FIRST CZECH DWARF HOPS

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Hop breeding aimed at new genotypes suitable for growing on low trellises in Czech Republic has been solved since 2008. Within Eureka program we studied dwarf hops in the cooperation with our English colleagues since 2011 to 2014. During this project we managed to carry out 24 crossings, which resulted in 75,502 seeds. Saazer was used as the standard of the best aroma quality as a female plant whereas English dwarf male hops were used as father plants. They have been the donors of genetic dwarfishness as well as tolerance to fungal diseases. Since 2011 we have evaluated 22,327 plants in breeding trials placed on 6 ha of low trellises. We have selected 91 perspective genotypes, which represent only 0.41% of the origin tested array.

In the period since 2014 till 2017 twelve best genotypes entered registration trials. Genotypes N33 and N5 were the most productive with the average yield of 3.16 resp. 2.86 kg of fresh hops/plant, which corresponds to 2.0 tons of dry hops/ha. Good yield of 2.0 kg of fresh hops/plant show genotypes N2, N3, N11 and PG1428. It corresponds to 1.5 tons of dry hops per hectare (Figure 1). Commercial assessments, carried out in all these genotypes, were aimed at aroma, overall appearance and damage caused by downy and powdery mildew. None of them showed damage caused by these fungal diseases. According to their aroma they can be divided into hoppy (N7, N12, N13 and PG1428), spicy (N3, N5, N8 and N35) and specific ones (N2, N10, N11 and N33). In samples harvested in 2016 alpha acid content does not exceed 9.0 % w/w. The highest content of alpha acids (Table 1) was found out in genotypes N11, N12, N3 (7.7 %; 7.5 %; resp. 7.0 % w/w). Genotypes N5, N7 and N10 have lower content of alpha acids (ca 3.0 % w/w). Content of beta acids is in all these hybrids lower than alpha acids. Their ration moves in the range since 1.5 till 2.3. Cohumulone ratio moves in relatively wide interval, since 15,0 % rel. (N10) till 32.4 % rel. (N13). In most of the genotypes cohumulone ratio is in the range of 20 %-25 % rel.

Genotype N2 is the riches on essential oils (1.0 – 1.5 g/100 g). Several other have the contents of essential oils till 0.6 g/100 g (N5, N7, N10, N12, N13 and N35). The composition of essential oils in the dwarf hops is very varied (Table 2). Typical for them is relatively low content of myrcene, mostly in the interval 15-30 % rel. Extremely high content of beta-sellinenes (till 30-35 % rel.) is specific to genotypes N2, N3, N5, M7, N10 and N33. Beta-farnesene, terpenic hydrocarbon typical for Saazer, was found in higher amount (> 5 % rel.) only in a few genotypes (N5, N10, N11, M12 and N13). The richest on it is genotype N11 (20-25 % rel.).

Genotypes with the highest variability in the content and composition of hop resins and essential oils (N5, N7, N8, N10, N33 and PG 1428) were chosen for brewing tests because of sensoric variability in beers. Genotype PG1428 was not distinctive in the beer but its bitterness was pleasant. Therefore, we can recommend it for the third hopping. Genotypes N5, N7 and N10 show higher sensoric bitterness with pleasant dying away. Therefore, they are suitable for the second and third hopping. Very interesting are genotypes N8 and N33, which are characteristic of their specific aroma. They bring spicy and fruity flavours into beer. The highest intensity was found out in N8 genotype. Therefore, these two genotypes can be used for the production of special beers.

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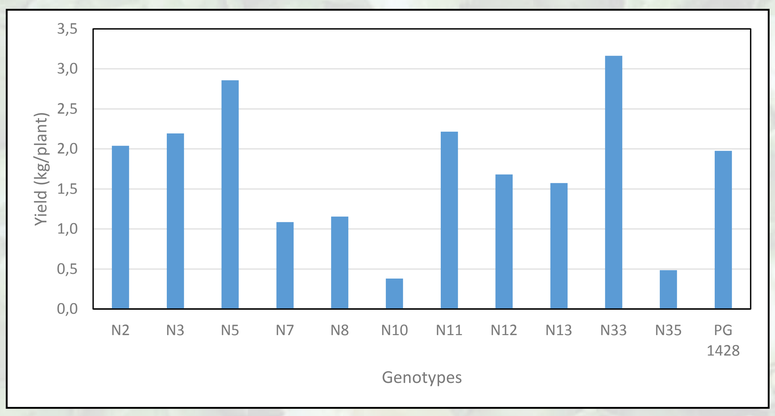

Table 1: Average contents of hop resins in perspective dwarf genotypes (2016)

Genotype	Alpha acids	Beta acids	Ratio	Cohumulone
	(% w/w)	(% w/w)	(alpha/beta)	(% rel.)
N2	7,3	4,9	1,5	22,2
N3	7,0	3,8	1,8	21,1
N5	3,2	1,7	1,9	24,8
N7	2,6	1,7	1,6	26,9
N8	5,2	4,8	1,1	15,9
N10	4,9	2,3	2,1	17,4
N11	7,7	4,4	1,8	32,4
N12	7,5	3,3	2,3	31,3
N13	6,1	4,6	1,3	31,5
N33	4,8	2,2	2,2	24,9
N35	2,6	2,4	1,1	22,7
PG 1428	4,2	2,8	1,5	18,5

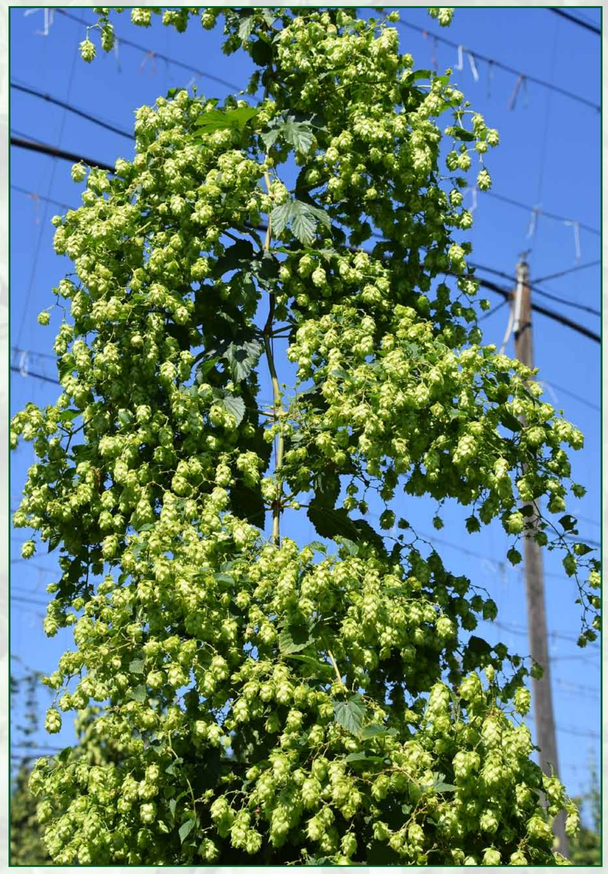

Table 2: Average yields and contents of hop essential oils in perspective dwarf genotypes (2016)

Genotype	Content	Myrcene	Caryophylene	Pharnesene	Humulene	Selinenes
	(% w/w)	(% rel.)	(% rel.)	(% rel.)	(% rel.)	(% rel.)
N2	1,2	26,3	4,9	1,9	1,8	30,8
N3	0,8	21,3	11,0	0,6	30,0	30,4
N5	0,3	18,9	4,4	7,1	3,0	34,9
N7	0,3	16,4	6,9	4,6	3,9	32,1
N8	1,5	32,0	15,9	0,2	16,7	3,3
N10	0,8	26,4	9,6	3,8	11,8	31,3
N11	1,0	30,1	5,5	16,5	13,3	5,8
N12	0,8	31,3	5,9	16,2	16,5	6,1
N13	0,8	30,5	5,6	13,8	11,8	6,4
N33	1,4	31,3	6,7	1,7	6,0	30,5
N35	0,5	15,9	21,4	4,7	26,7	5,3
PG 1428	0,4	22,8	9,7	4,8	28,3	12,6