

AGRONOMIC AND GRAIN QUALITY CHARACTERISTICS OF NEW EUROPEAN MALTING BARLEY VARIETIES

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ABSTRACT. *The field experiments were carried out in 2003–2005 at the Jõgeva Plant Breeding Institute in Estonia to investigate the agronomic and quality characteristics of the European malting barley varieties. 14 malting barley varieties of Northern region of European Brewery Convention (EBC) were included in the trials. Grain yield, 1000 grain weight, grading rate, protein content and germination at the 3rd day were measured in the malting barley trial. Most of the varieties showed lower grain yield than standard. The average grain yield of German variety 'Cruiser' was significantly superior compared to standard variety 'Scarlett' and Danish variety 'Power' was on the same level as standard variety. Majority of the varieties indicate high level of 1000 grain weight. The average grading was sufficient. The protein content met the requirements of malting barley. The germination at 3rd day was very good in 2003–2005.*

Keywords: *malting barley varieties, grain yield, grain quality.*

Introduction

Barley is mainly used for animal feed. It is a component of fodder for swine, poultry and cow. Barley is also used for human food. The groats, perling barley and flour are made from barley. The important use of barley is for malt. Malt is used in beer, spirit and flavorings in a variety of foods. In addition to growing conditions, the quality of malting barley depends also on variety. European Brewery Convention (EBC) was founded in 1949 for international evaluation of malting barley varieties.

Results and discussion

The agronomic and quality traits of malting barley varieties were investigated in trials at the Jõgeva Plant Breeding Institute in 2003–2005. This research project included 14 varieties belonging to the Northern region of European Brewery Convention (EBC). 4 varieties from Great Britain, 4 Denmark, 3 Germany, 2 Sweden and 1 France were tested (Table 1). The standard was German variety 'Scarlett'.

Trials were arranged in 3 replications to the 5 m² plot. The seeding rate was 500 seeds per m². The precrop was potato. Fertilize background N₆₀ P₁₄ K₄₂ was used. Chemical weed control was carried out at 3–4 leaf growth stage with a sprayer Hege-Tecnoma. The plots were organised in randomised order according to the NNA method. The plots were sowed with the sowing machine Hege 80 and harvested with the harvester Hege 125. The data processing was carried out by Agrobase/4.

Table 1. Malting barley varieties, pedigree and origin

Variety	Pedigree	Origin
'Scarlett' (standard)	Amazone × (St. × Kym)	Germany
'Braemar'	NFC 5563 × NFC 94.20	Great Britain
'Auriga'	(Viskosa × Krona) × Annabell	Germany
'Process'	111203 × Optic	Denmark
'Sebastian'	Lux × Viscosa	Denmark
'Antto'	(Chalice × Optic)NFC 94-20	Sweden
'Power'	Chalice × Sj 933275	Denmark
'Beryllium'	NFC 94-20 × NFC 94-4	Denmark
'SW Immer'	Apex × Alexis	Sweden
'Cellar'	Hadm 86508-91 × Hadm 46544-88	Great Britain
'Rangoon'	Hdm. 79264-85 × Omega	France
'Cruiser'	NSL 90-1446 × Chariot	Germany
'Carafe'	Cork × Chariot	Great Britain
'Class'	Thistle × (Optic × Meltan)	Great Britain

Grain yield. The average grain yield in the trial during 2003–2005 was 4815 kg/ha, the grain yield of varieties ranged from 4090 to 5551 kg/ha (Figure 1). The average yield of variety 'Cruiser' (Germany) was significantly (264 kg/ha *i.e.* 5%) superior compared to standard variety 'Scarlett'. The yield of variety 'Power' was on the same level as standard. The rest of the varieties showed significantly lower grain yield than standard. The Danish variety Process (–1197 kg/ha *i.e.* 77%), French variety Rangoon (–1135 kg/ha *i.e.* 79%) and Great Britain variety 'Cellar' (–952 kg/ha *i.e.* 82%) showed the lowest grain yield.

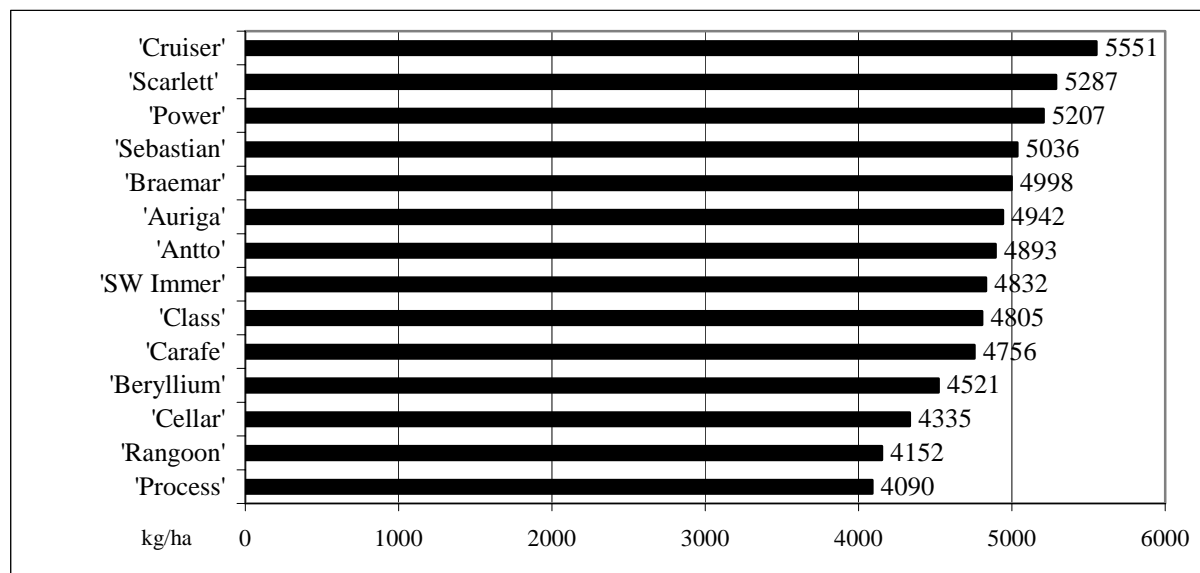


Figure 1. The average grain yield (kg/ha) of malting barley varieties at Jõgeva in 2003–2005

1000 grain weight. The malting barley varieties divided into groups on the bases of 1000 grain weight: >45 g – big grain, 41–44 g – medium grain, 37–40 g – small grain (Kunze, 1996). The barley with medium size of grains suits better for malting because they soak uniformly and rapidly. The 1000 grain weight was determined from the barley sieved with the 2.5 mm sieve according to the EBC methodology, because this fraction is used for malting (Analytica-EBC, 1998). The average 1000 grain weight of three years was 46 g in the trial, varied between varieties from 43 to 49 g (Table 2). There were no varieties with too low 1000 grain weight for malting. The majority of the varieties belonged to the group of big grains. The grains of standard variety Scarlett, Great Britain varieties Braemar and Cellar turned out to be of medium size (41–44 g). The 1000 grain weights of the rest of varieties were high (45–49 g).

Table 2. The grain quality characteristics of malting barley varieties at Jõgeva in 2003–2005

Variety	1000 grain weight g	Grading %	Protein %	Germination %
Scarlett	44	92.4	10.8	98
Braemar	44	91.7	10.3	98
Auriga	46	86.8	10.4	100
Process	45	74.6	10.0	80
Sebastian	45	76.3	9.6	97
Antto	47	94.1	11.4	93
Power	47	71.5	9.6	97
Beryllium	44	72.7	9.9	92
SW Immer	43	84.7	10.4	97
Cellar	44	74.3	10.3	99
Rangoon	49	83.4	10.5	88
Cruiser	45	91.7	10.0	97
Carafe	48	85.7	10.1	98
Class	47	85.5	10.0	97
Average	46	83.2	10.2	95
LSD 95%	1	3.0	0.4	2

Grading indicates proportionally this part of the grain yield which remains to the 2.5 and 2.8 mm sieve (Küüts, 1992; Kunze, 1996). This part is used for malting. The rest of the fraction is used for feed. The average grading of varieties turned out to be highest in 2005 (95%), but it was rather good in 2003 and 2004 too, respectively 77 and 78%. The average grading of three testing years was 83%. The grading of standard variety Scarlett, Swedish variety Antto, Great Britain variety Braemar and German varieties Cruiser and Auriga showed the average level over 90% in the tested years. The lowest level of grading turned out to be the Great Britain variety Cellar (74%), Danish varieties Beryllium (73%) and Power (72%).

The grading is an important characteristic from the economical point of view. The average grading of trial was 83.2 g in 2003–2005. The grading of varieties ranged from 71.5–94.1 g. The varieties Antto, Scarlett, Cruiser and Braemar showed a grading rate of over 90%.

Protein content. The quality of malt depends on the protein content of grain. It's not possible to brew quality beer from barley with too high protein content (>12%) (Home, 1991; Home, Elamo, 1993). The protein content of barley depends on the growing conditions (precipitations and temperature) (Lepajõe, 1986; Briggs, 1998).

The average protein content over 3 trial years turned out to be 10.2%, varied between 9.6–11.4%. The average protein content of varieties was the highest in 2003 (11.5%). The Swedish varieties SW Immer' (12.4%) and Antto (12.3%) exceeded the malting barley requirements. The protein content of all tested varieties remained within the limits in tested years. The Danish varieties Sebastian, Power and Beryllium showed lowest protein content (9.6%) in average 2003–2005.

Germination. The germination of malting barley at the third day should be at least 93% (Kunze, 1996; Briggs, 1998). An adequate test was carried out three weeks after barley harvesting according to the EBC methodology (Analytica-EBC, 1987). The aim of this test was to find out varieties with long-lasting dormancy or low germination rapidness.

The average germination of varieties in three tested years was 95%. The germination of Danish varieties Beryllium (92%) and Process (88%) and French variety Rangoon (88%) was below 93%. The germination of Swedish variety Antto was also low in 2005, only 87%. The germination of the rest of varieties was within limits.

Summary

The field trial of malting barley varieties was carried out in 2003–2005 at the Jõgeva Plant Breeding Institute in Estonia. The aim of the study was to investigate the agronomic and quality characteristics of the European malting barley varieties.

The climate conditions in 2003–2005 were favourable for forming a relatively good level of grain yield. The average grain yield of the German variety 'Cruiser' was significantly superior compared to standard variety 'Scarlett'. The yield of Danish variety 'Power' was on the same level as the standard variety. The rest of the varieties showed a lower grain yield than the standard variety. Most of the varieties indicate a high level of 1000 grain weight. The grains of standard variety Scarlett, Great Britain varieties Braemar, Cellar, Danish variety Beryllium and Swedish variety SW Immer turned out to be medium, the most suitable size for malting. The average grading was sufficient in 2003–2005. The grading of standard variety Scarlett, Swedish variety Antto, Great Britain variety Braemar, German varieties Cruiser and Auriga were over 90%. The protein content of all tested varieties met the requirements of malting barley (<12%). The germination at third day was excellent (>95%) for all varieties in average of 2003–2005.

References

- Analytica-EBC 1998. Analysis Committee of the European Brewery Convention. – Verlag Hans Carl, Getränke-Fachverlag, Nürnberg, Germany: 271.
- Briggs, D. E. 1998. Malts and malting. Blackie Academic & Professional, London, p. 796.
- Home, S. 1991. Evaluation of malting potential of barley in breeding. – *Ferment*, 4, p. 244–246.
- Home, S., Elamo, E., 1993. Evaluation of malting potential in barley breeding programmes. – *Monatsschrift für Brauwissenschaft*, 46, p. 216–220.
- Küüts, H. 1992. *Õlleoder*. – Tartu, lk 5–24.
- Kunze, W. 1996. *Technology brewing and malting*. VLB, Berlin, 726.
- Lepajõe, J. 1986. *Oder*. Tln: Valgus, 153 lk.