

Comparative study of qualitative structure the beech logs sorted by the old and the new European standard EN 1316-1

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Abstract: *Comparative study of qualitative structure the beech logs sorted by the old and the new European standard EN 1316-1.* The study analyze the qualitative structure of beech logs sorted according to old and new European standards EN 1316-1 from the viewpoint of dimensional log characteristics, frequency, type and size of red heartwood. The results showed that the tightening up of sorting criteria, especially the mid-diameter of logs, has a negative impact on the qualitative structure of beech logs and further yield from the sale of wood assortments. The analysis also showed that by limiting of frequency and size of the red heartwood in beech logs can be achieved favorable qualitative structure and consequently significantly increase yield from sale of produced assortments.

Keywords: European standard EN 1316-1, red heartwood, logs, quality classes, hypothetical quality

INTRODUCTION

Standard EN 1316-1 classifies beech logs according to dimensional characteristics, as well according to the occurrence and size of wood defects (knots, cracks, sweep, taper, rot, T-disease, red heartwood, etc.). Apart from dimensional characteristics of logs, red heartwood (RHW) appears to be the main phenomena which it has a significant influence on the quality of raw wood and so it significantly decreases to its financial value (Becker et al. 2005). The colour inhomogeneity of “sound” beech RHW, its stability during production and use of the wood products reduces their physical and aesthetic properties. The calculated annual losses caused by the occurrence of RHW were 5.1 million euro in Germany, northern Rhine-Westphalia (Richter 2001).

European standard (EN 1316-1 2000) classifies the sizes and types of RHWs as one of the major characteristics, limiting their quality. The auxiliary standard (EN 844-10 1998) distinguishes two types of RHW: “red heart” - red or brown stain affecting the central portion of beech wood, sharply defined and “doty red heart“ resp. „star red heart“ (SHW) - unsound red heart of beech which appears at the ends of roundwood in a star-like form. In October 2012, there was revised and published European standard (EN 1316-1 2012), which tightened up the grading criteria for permissible dimensional characteristics of logs and RHWs.

The aim of the article was compare the quantitative qualitative structure of logs sorted by old and new standard EN 1316-1 in terms of dimensional characteristics of logs and frequency and size of RHWs and SHWs.

MATERIAL AND METHODS

Sample material came from standard beech forests of the University Forest Enterprise, Technical University in Zvolen in average age of 112 years. The 57 sampled trees were felled, cut on 12-14 m lengths and transported to timber yard. The cutting of the stem on the logs were made in according to the principles of qualitative evaluation of the standards EN 1316-1 2000 a EN 1316-1 2012.

Typology and dimensional measurements of heartwoods were evaluated on both ends of the logs. About log classification adjudicated size or less favorable type of heartwood. Mid-log diameters, log length were measured and calculated the volume of each logs. Simultaneously, the maximum width of RHWs and SHWs were measured and calculated the

proportion of RHW or SHW (in %). Finally, the logs were graded into the fourth quality classes according to the following criteria old and new standards (Table 1).

Tab. 1 Parameters evaluating of the log quality according to (En1310 2000) a (En1316-1 2012), and the average price of logs according to (Anonymous 2013)

Features	Class							
	F-A		F-B		F-C		F-D	
	Old	New	Old	New	Old	New	Old	New
Minimum log length (m)	3	3	3	3	2	2	unlimited	2
Minimum mid-log diameter (cm)	35	40	30	35	25	25	unlimited	20
Red heartwood of the diameter (%)	≤20	≤15	≤30	≤30	permitted	permitted	permitted	permitted
Star red heartwood (% of the diameter)	not permitted	not permitted	≤10	≤10	≤40	≤40	permitted	permitted
Average prices - excl. VAT (€/m ³)	150		100		50		41	

Descriptive statistics of the sampled variables were calculated. Further, there were compared the percentage of logs with and without RHW or SHW in the individual quality classes. The hypothetical reclassification of logs between qualitative classes was made as a result of the presence or absence of RHW and SHW. Finally, the average yield in €/m³ and yield proportions (in %) from each class were calculated. The average yield and yield proportions were compared in terms of old and new European standards. Also, the comparison was made from the viewpoint of a hypothetical classification (if the logs had the RHW or SHW).

RESULTS AND DISCUSSION

Increasing the permissible limit the mid-log diameter up to 5 cm (by the exception of class F-C) (Table 1), and also decreasing the permissible limit of RHW size (at 15%) in the class of F-A caused the shift of logs from best quality classes F-A and F-B into class F-C (Fig. 1a). By sorting of logs according to the new standards decreased the proportion of logs in the class F-A opposite to old standard 3-times (from 15% to 5%), in F-B 2-times (from 18% to 9%). On the other hand, in the class F-C was increased 1.44-times (from 45% to 65%). In the class of F-D was found non-significant movement. Decline of logs opposite to old standard was only 1.1-times (from 22% to 20%).

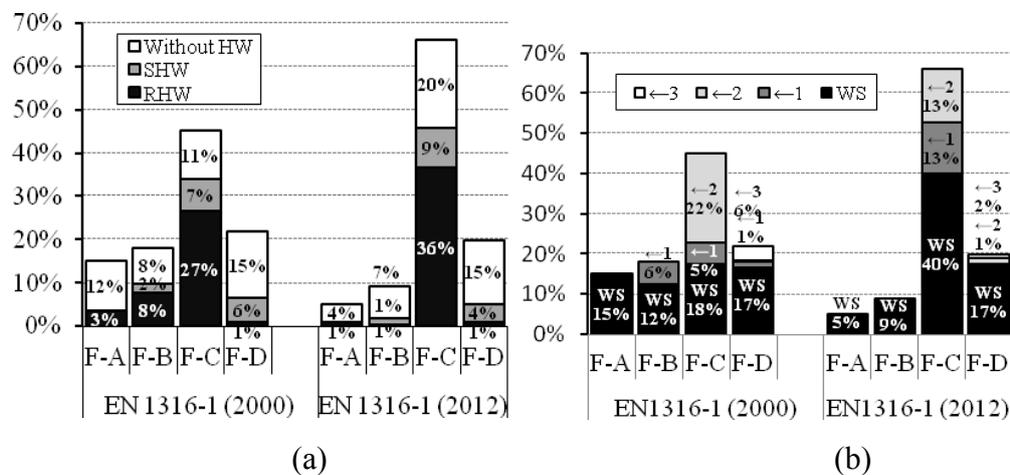


Fig. 1 (a) - Proportions of logs in the different quality classes, (b) - hypothetical quality of logs and potential of shifts in the quality

Tightening up the sorting criteria also reflected in the total yield (Fig. 2a, b). Using the criteria according to new standard the total yield decreased by 15.1 €/m³. As we expected, the greatest financial losses (in actual prices of wood raw materials) were found in classes F-A and F-B (in classes with the highest price per m³). While, in the old standards, from the total yield 77.4 €/m³ had a proportion of 61%, in the new standard, from the lower total yield of 62.3 €/m³ had only 36%. On the other hand, a significant increase was observed in favor of class F-C. From 33% in the old standards to 57% in the new standard which represents approximately increase of 2-times.

It must be said that the greatest impact on change of qualitative structure had a change of criteria the mid-diameter. But, from this study it is not possible to quantify what proportion plays the change of dimensional criteria and what size of RHW and SHW. But, we can exactly estimate the hypothetical quality if logs do not contain RHW and SHW (or contain RHW by size under 15%).

Fig. 1b shows that the greatest shift potential of logs into higher quality classes (F-A and F-B) is from class F-C. It could be shifted up to 22% logs into the class F-A, but only the 6% of logs into the class F-B by using sorting criteria according to old standard. On the other hand, logs sorted according to new standard could be proportionally divided between class F-A and F-B (every class 13%)

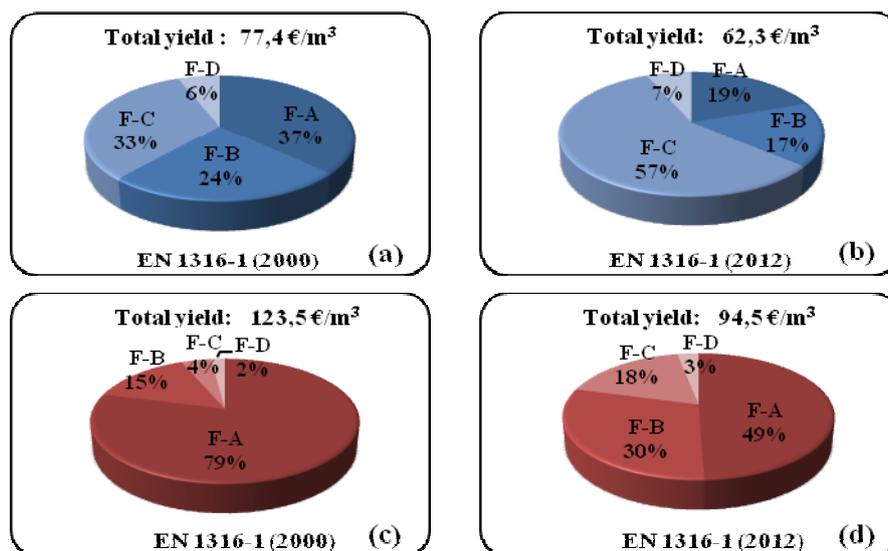


Fig. 2 Average yield and its proportion in the individual quality classes sorted old and new standard EN 1316-1 – (a,b) real quality, (c,d) hypothetical quality

Also, if the logs did not contain the RHW or SHW, the total yield from logs would be significantly higher too (fig. 2). The total yield for the old standards would be 123,5 €/m³ which represents an increase of yield, compared to the real quality by 46.1 €/m³(fig. 2a,c). In comparison to real and hypothetical quality in new standards could increase only to 94,5 €/m³ (fig. 2 b,d), which would represent the difference only 32.2 €/m³.

Due to the fact that SHW and RHW is a facultative colored heartwood (Bosshard 1965), originating from the effects of wounding, it can be reduced by various silvicultural technologies (Račko et al. 2011). Also, a reduction of tree age and maintain a large annual increment can limit the formation and size of RHW and SHW and to achieve the great financial yield (Knoke 2003, Knoke and Moog 2005, Saniga 1996, Seeling and Becker 2002, Zell et al. 2004).

CONCLUSION

Based on the obtained results, we can say that tightening up the sorting criteria in the new edition of the standard (En1316 1-2012), the proportion of logs in quality classes F-A and F-B decreased 3-times and 2.25-times, in favor of class F-C. This reduces the total financial yield (at current log prices) up to 15.1 €/m³. On the other hand, we can achieve a significant increase in the total yield by the restriction of RHW and SHW in sorted logs. Up to 32.2 €/m³ in the new standard, up to 46.1 €/m³ in old standard.

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Streszczenie: *Studium porównawcze jakości kłód bukowych sortowanych wg nowej i starej normy Europejskiej EN 1316-1. Praca dotyczy analizy jakościowej kłód bukowych sortowanych wg nowej i starej normy EN 1316-1 pod względem wymiarów, częstości występowania i rozmiarów fałszywej twardzieli. Badania wykazały że zaostrzenie kryteriów, w szczególności średnicy w połowie kłody, ma negatywny wpływ na rozkład jakościowy kłód oraz późniejszą wydajność materiałową wyrobów. Wykazano także że zmniejszenie częstości występowania oraz rozmiaru fałszywej twardzieli ma największy wpływ na rozkład jakościowy kłód i w konsekwencji na uzysk ilościowy materiałów tartych.*

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