Annals of Warsaw University of Life Sciences - SGGW
Forestry and Wood Technology № 86, 2014:149-152
(Ann. WULS - SGGW, For. and Wood Technol. 86, 2014)

Oak bark share at different heights of stem

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Abstract: *Oak bark share at different heights of stem.*Oak is the most commonly found variety of non coniferous tree in Poland and has important commercial value. It is mostly found as a generative tree though it is also coppiced. Oak timber is obtained and transported in its bark. Its commercial price however doesn't include the bark. The conversion factor used for assessing and then subtracting the bark share from the final price of the timber in Poland (PN-D-95000:2002) doesn't take into consideration the origins of the tree (coppiced or generative). It was assumed that assortments from coppiced stands and those from generative stands would differ in bark thickness and that bark thickness is related to stem height. Two sample plots (coppice and generative) were compared from which 751 assortments from 240 trees were analysed. The results of this research suggests that there is no statistically significant difference between the thickness of bark with changes in stem height. It was however observed that the average thickness of bark in coppiced trees was smaller than that in generative trees.

Keywords: oak stands, bark participation, generative trees, coppice trees

INTRODUCTION

Oak is the most commonly found variety of non coniferous tree in Poland. It occupies 665 thousand hectares, accounting for 7.3% of woodland surface area [1]. It's importance to silviculture is still growing as it is used to transform unstable coniferous wood stands into more resistant mixed stands. Oak in Poland is mainly regenerated through planted forests, though regeneration does also occur in the form of coppicing. Coppiced oak wood stands used for commercial and industrial purposes are more commonly found in the south of Europe [2,3] and also in France and Germany [4,5,6]. The obtained assortments of oak are sold and transported in their bark, though the price of preparing the timber for contractors as well as its retail price doesn't include the bark. Price reductions for the bark are administered in: accordance to the technical guidelines governing timber sale in accordance with Polish norm PN-D-95000:2002 [7]. The conversion factor used in the aforementioned norm only takes into consideration the length of the assortment and not the section of the stem from which the log was cut nor whether the tree was generative or coppiced. The aim of this work was to compare bark thickness tą different heights of stem from oak trees from generative stands with those from coppiced stands.

MATERIALS AND METHODS

The research was carried out in northern Poland in Forest District Kwidzyn, Regional Directorate of State Forests in Gdansk, an area influenced by its maritime climate. The vegetation period starts approximately between 5th and 10th April and ends between 10th October and 25th November. Annual rainfall ranges between 600 and 700ml.

Two oak stands (consisting entirely of oak trees) of class III age (41-60 years) growing in soil typical for this type of habitat (sandy/clay) were chosen for the research. The selected trees were felled and 2.5 m long logs were cut with the use of a Valmet 901.3 harvester fitted with a 350 head allowing for the effective processing of hardwood. The following numbers of trees were analysed:

120 trees from the generative stand

120 trees from the coppiced stand

These trees were selected randomly from 480 trees cut down with the harvester. Every log had its top diameter with bark (D_{WK}) and without bark (D_{BK}) measured to the nearest 1mm with the use of a Haglof caliper. Bark share (G_K) was calculated using the formula (1):

$$G_K = D_{WK} - D_{BK} \text{ [mm]} \quad (1)$$

Each log was measured twice both with and without its bark. Diameter was measured in both east-west and north-south directions. All together 751 assortments were measured. Following that, the average thickness of bark was calculated at regular intervals along the stem (2.5m, 5.0m, 7.5m, 10m, 12.5m).

The collected set of data was tested for normality using the Shapiro-Wilk test whilst homogeneity of variances was checked using Bartlett's test. Following the confirmation of the lack of normal distribution as well as the lack homogeneity of variances, the Kruskala-Wallis test was used as a non-parametric version of a one-way analysis of variance in order to compare the influence of different factors on sample distribution. Calculations were carried out in programme R [8], and statistical accuracy was carried out at a significance level of 0.05.

RESULTS

The analysed data didn't concur with the expectations of the statistical analysis. The Shapiro-Wilk test indicated that the data samples didn't come from a normally distributed population (p-value = $1.111e^{-15}$). Furthermore, Bartlett's test indicated unequal variances for bark thickness in the analysed stands (p-value = $6.509e^{-09}$) and for the chosen stem heights (p-value = 0.001222).

Coppiced trees turned out to be shorter than generative trees and therefore their bark thickness could only be measured and analysed up to a maximum of 10m up the stem in comparison to 12.5m in generative trees (fig 1.).

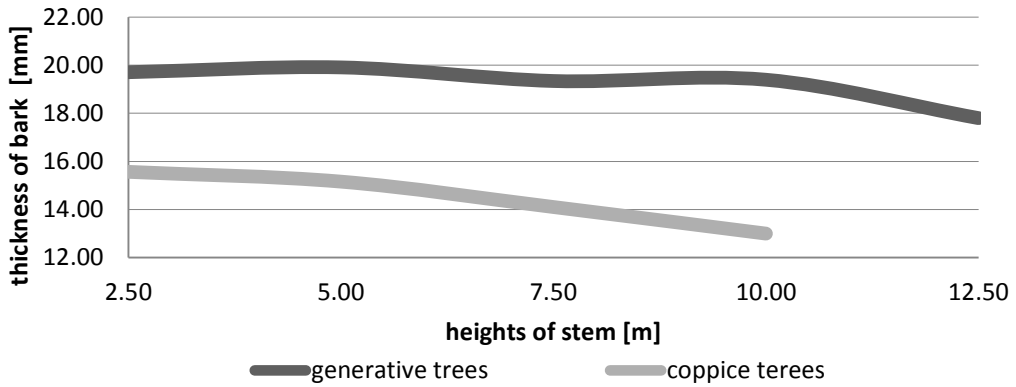

Fig 1. Bark thickness in relation to stem height.

Stem morphology as well as the inherent attributes of the Valmet 350 head allowed for the cutting of logs at both butt log level as well as from central parts of the stem. The top section of the tree was not processed by the harvester both in the case of the generative and the coppiced trees. The analysis of bark thickness in relation to stem height indicated that in the case of generative trees there was insignificant differences up to the 10m point- where average bark thickness was close to 20mm. Only at 12.5m does average bark thickness measure 18mm. The Kruskal- Wallis test however didn't indicate that these variables were statistically significantly dependent (p-value = 0.8344) (fig 2.).

Nevertheless, in the case of generative trees a decrease in bark thickness was observed at each height increment, with thickness falling from 16mm to 12mm. However, the implementation of the Kruskal-Wallis test indicated that this was not a statistically significant dependence neither for coppiced trees (p-value = 0.2002) nor for generative trees.

Research into bark share of the entire oak biomass revealed various trends. Suchomel et al. [9] carrying out research in Germany pointed towards a 6% higher bark content in coppiced oak stems in comparison to generative oak stems in the Czech Republic [10]. However, it must be pointed out that the trees in these two studies were growing in completely different soils and climatic conditions. The previously cited authors [9] noticed that in the case of coppiced oak with an increase in DBH there was an observed fall in bark content from 18% to 11% of the above ground biomass of the tree. These results are confirmed by research carried out by Burger [11] but are also contrary to the results of Grote et al [12].

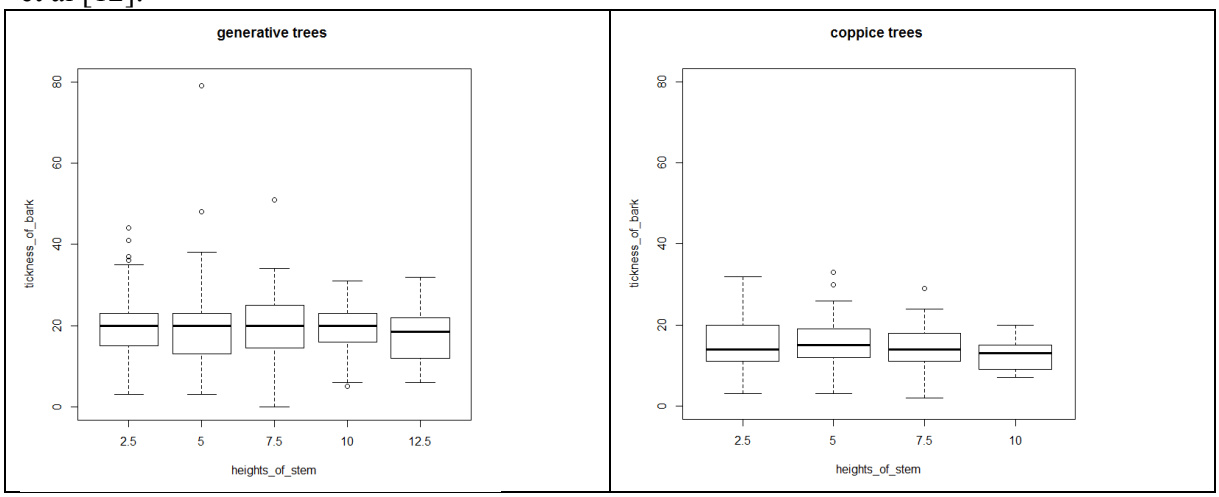

Fig 2. Analysis of variance significance in relation to stem height

CONCLUSIONS

Stem cross sections at a height of 12.5m of both coppiced and generative oak barks revealed insignificant differences in bark thickness. The same convertion factor can be applied irrespective of whether the wood being analysed came from the butt log or from the central part of the stem. The observed differences in bark thickness taking into account tree origin (coppiced or generative) encourages the continuation of research into bark thickness which should encompass different age classes and habitats with the aim of establishing the real bark share in coppiced and generative oak stems.

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Streszczenie: *Udział kory dębowej w zależności od wysokości występowania na pniu.*
Dąb jest najliczniejszym gatunkiem liściastym w Polsce i posiada duże znaczenie gospodarcze. Najczęściej występuje on w postaci generatywnej aczkolwiek również w postaci odroślowej. Surowiec dębowy jest pozyskiwany i transportowany wraz z korą, natomiast jego wartość określana jest dla samego drewna – bez kory. Stosowane w Polsce przeliczniki (PN-D-95000:2002) potrącające udział kory nie rozróżniają pochodzenia drzew (generatywne i odroślowe). Założono, że sortymenty pochodzące z drzewostanów generatywnych i odroślowych będą różniły się grubością kory oraz, że grubość kory zależy od wysokości na pniu. Porównano dwie powierzchnie próbne, na których przeanalizowano 751 sortymentów pochodzących z 240 drzew.
W wyniku przeprowadzonych badań nie zaobserwowano statystycznie istotnych różnic pomiędzy grubością kory a zmianą wysokości na pniu. Wykazano natomiast, że średnia grubość kory drzew odroślowych jest mniejsza niż drzew generatywnych.

ACKNOWLEDGEMENTS:
This research was supported by the General Directorate of State Forests in Warsaw as research project No. EO-5011-179/12 under the leadership dr hab. Piotr S. Mederski. The authors would like to thank Michał Wudarczyk form Forest District Kwidzyn for his help with the field research.

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