

MACROSTRUCTURE OF SCOTS PINE (*Pinus sylvestris* L.) WOOD FROM STANDS GROWN IN CONDITIONS OF MIXED FRESH CONIFEROUS FOREST

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In this study characterised was macrostructure of Scots pine (*Pinus sylvestris* L.) wood derived from forest stands of younger age classes. Said trees have grown in conditions of forest stand type mixed fresh coniferous forest, which have share in the area of Polish forests about 21 %. This macrostructure was expressed with following features : average width of annual increment, width and share of late wood, and share of sapwood and heartwood in volume of stem.

Key words: mixed fresh coniferous forest, macrostructure of wood ,latewood, sapwood, heartwood, volume of tree stem

INTRODUCTION

The Scots pine occurs on the whole area of Poland with the exception of highest parts of mountains. Its share in creation of forest stands is very high. Such forests with pine as the main species are covering 70.8% of State Forests (Praca zbiorowa 1990, 1997a). The share in volume of standing stock is 68.% (Głaz 1996, Praca zbiorowa 1997 b,c). This species is characterised by exceptional wide ecological scale growing on rather pure soils and on very rich soils. The optimum of the growth this species obtains in conditions of good fresh forests especially mixed fresh coniferous forests. In those last forests, pines are characterised by the best technical quality and great growth of volume (Bernadzki 1993). Without doubt majority of the needs of

Polish population will be supplied by raw material from pine forests, and the knowledge on this topic is essential thing.

The scope of this study is an attempt to evaluate quality of Scots pines from unripe forests grown in conditions of mixed fresh forest. The quality of wood was expressed by its macrostructure and especially by the share of sapwood in volume of stem.

METHODS

Studies were made on trees cut down in course of thinnings, in forest stands grown in conditions of mixed fresh coniferous forest on the terrain of Experimental Forest District "Zielonka" in LZD Murowana Goślina. Experimental areas were located in forest stands about 30, 40, and 60 years old, taking into respect conditions of representation. After establishing area, measured were all breast diameters of trees and their heights. This last measurement was limited for not so great number of trees. On the base of characteristic of thickness-height parameters of trees on the test areas accordingly to the Ulrich II method, were selected experimental (sample) trees and cut in the number of three (Grochowski 1973). After marking on each cut tree North direction, were cut out from them the discs beginning from the butt, then in distance 0.5 m, and further down to the stem end. There was also cut disc from the height of 1.30 m, that is on the breast diameter. The above discs were used for determination of the thickness of the sapwood ring and roller of heartwood in the subsequent 1 m long sections of the whole stem. Measurements were made on the two perpendicular diameters in North-South, and East-West directions. The discs cut at the butt were used for the determination of the age of trees (despite to the notes contained in the Forest Taxation Plan), while the discs from the height 1.30 m were used for the measurements of the thickness of growth rings and the width and share of late wood in growth ring. Measurements were made with accuracy 0.01 mm.

RESULTS

The growth rate (Table 1) was differentiated in dependence upon the age of trees. At pines 30 and 40 years old average width of growth ring was 1.93 mm, while at pines 60 years old it was lower and on the level 1.78 mm. Variability of this feature diminished with the age. The highest was found at younger trees (29.8%), and the lowest (15.9%) at pines 60 years old. The share of tracheids of late wood has deciding effect upon the strength parameters, and density. The share of late wood in the studied growth rings was between 29-32% (Table 1). The lower values were at younger trees, while the higher values at older trees. The variability of this feature was between 13 to 34 %.

Table 1

Tabela 1

Average occurrence of growth rings and share of summer wood in wood of Scots pines from unripe forest stands growing in conditions of forest type - fresh mixed coniferous forest

Przeciętna słoistość i udział drewna późnego w drewnie sosen zwyczajnych z drzewostanów przedrębnych rosnących w warunkach siedliskowego typu lasu - boru mieszanego świeżego

Age of trees (years) Wiek drzew (lata)	Measures Miary	Macrostructure feature Cecha makrostruktury	
		Year increment in thickness Przyrost roczny	Share of late wood Udział drewna późnego
30	Minimum value (mm) Wartość minimalna (mm)	1.49	0.45
	Maximum value (mm) Wartość maksymalna (mm)	2.58	0.84
	Arithmetic mean (mm) Średnia arytmetyczna (mm)	1.93	0.61
	(%)	100	31.6
	Coefficient of variation (%) Współczynnik zmienności (%)	29.8	33.9
40	Minimum value (mm) Wartość minimalna (mm)	1.58	0.50
	Maximum value (mm) Wartość maksymalna (mm)	2.46	0.64
	Arithmetic mean (mm) Średnia arytmetyczna (mm)	1.93	0.56
	(%)	100	29.0
	Coefficient of variation (%) Współczynnik zmienności (%)	24.3	12.9
60	Minimum value (mm) Wartość minimalna (mm)	1.55	0.51
	Maximum value (mm) Wartość maksymalna (mm)	2.10	0.88
	Arithmetic mean (mm) Średnia arytmetyczna (mm)	1.78	0.68
	(%)	100	38.2
	Coefficient of variation (%) Współczynnik zmienności (%)	15.9	27.7

Table 2

Tabela 2

Average volume of the usable stems and percentage of sapwood and heartwood at Scots pines from unripe forest stands growing in conditions of forest type - fresh mixed coniferous forest

Przeciętna objętość drewna strzał użytkowych oraz udział bielu i twardzieli u sosen zwyczajnych z drzewostanów przedrębnych rosnących w warunkach

Age of trees (years) Wiek drzew (lata)	Measures Miary	Volume Objętość		
		Total Całkowita	Sapwood Biel	Heartwood Twardziel
30	Minimum value (m ³) Wartość minimalna (m ³)	0.01802	0.01702	0.00100
	Maximum value (m ³) Wartość maksymalna (mm)	0.10003	0.09683	0.00320
	Arithmetic mean (m ³) Średnia arytmetyczna (m ³)	0.05637	0.05464	0.00173
	(%)	100.0	96.9	3.1
40	Minimum value (m ³) Wartość minimalna (m ³)	0.05090	0.04930	0.00160
	Maximum value (m ³) Wartość maksymalna (m ³)	0.26855	0.25475	0.01380
	Arithmetic mean (m ³) Średnia arytmetyczna (m ³)	0.14294	0.13567	0.00727
	(%)	100.0	94.9	5.1
60	Minimum value (m ³) Wartość minimalna (m ³)	0.26252	0.17212	0.09040
	Maximum value (m ³) Wartość maksymalna (m ³)	0.55108	0.39648	0.15460
	Arithmetic mean (m ³) Średnia arytmetyczna (m ³)	0.40552	0.28232	0.12320
	(%)	100.0	69.6	30.4

The sapwood and heartwood reveals another technical properties what decides on the use of such wood (Krzysik1974, Mućk1984a,b). The share of this two kinds of woods is illustrated in the Table 2. It can be seen that the pines grown in the studied conditions have 3 % share of heartwood in the whole stem volume. In the age of 40 such share is a little above 5% while at trees in the age of 60 years such share of heartwood is above 30%. The obtained results allow to state , that share of sapwood and heartwood in the stems of pines grown in conditions of mixed fresh coniferous forest is

very strongly connected with development phase of forest stand that is with the age of trees. Increase of heartwood formation occurred after the age of 40 years. When comparing obtained results of given macrostructure of trees at pines from dry coniferous forest and fresh coniferous forest conditions in unripe forest stands (Pazdrowski and Sptawa-Neyman 1996, 1997), we could conclude that in respect to the growth rate and analysed growth rings, all three mentioned forest stands are alike. The analogical situation is in respect to percentage of sapwood and heartwood in younger 30-40 years of age Scots pine trees in dry forest, fresh forest, and mixed fresh forest. But in age of 60 years there is difference between dry, fresh forest, and mixed fresh forest. It seems that on the rich forest stand the process of formation of heartwood is more intense.

In reasumption it is to be stressed, that pine wood from unripe forest stands from mixed fresh coniferous forest is characterised with small growth rings width below 2 mm, and share of late wood in range from 29-38%. Also it can be stated, that raw material harvested in forest stands in age 30-40 years it is mainly sapwood. In older forest stands we can expect raw material with about 70% of sapwood, and 30% of heartwood. Those facts are to be taken into account in the industrial uses of raw material from unripe forest stands. The sawn timber from such trees has to be impregnated with chemicals, to protect it from biological attack (Krzysik 1974, Sptawa-Neyman and Wojcieszyn 1995).

CONCLUSIONS

1. The age of trees in strong way effects upon macrostructure of wood in pine trees grown in conditions of mixed fresh coniferous forest.
2. The share of sapwood and heartwood in the volume of stems is closely bound with the age of trees and the quality of habitat.
3. In actual situation of the harvesting in Poland of large amount of unripe raw material from pine forests in the course of thinnings, there is a need to protect obtained sawn timber with the use of chemicals against biological attack. Also the attitude of customers and their expectations are to be changed.

Received in May 1998

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MAKROSTRUKTURA DREWNA SOSNY ZWYCZAJNEJ Z DRZEWOSTANÓW PRZEDRĘBNYCH WYROSŁYCH W WARUNKACH SIEDLISKOWEGO TYPU LASU BORU ŚWIEŻEGO

Streszczenie

Przeprowadzono badania makrostruktury drewna sosny zwyczajnej (*Pinus sylvestris* L.) wyrosłej w warunkach boru mieszanego świeżego. Makrostrukturę wyrażono przeciętną szerokością słoja rocznego, szerokością i udziałem w przyroście rocznym drewna późnego, a także udziałem bielu i twardzieli w objętości strzał sosen. Stwierdzono, że wiek sosen wpływa na makrostrukturę drewna z drzew z drzewostanów przedrębnych to jest :na słoistość drewna, udział drewna późnego w słoju rocznym oraz na udział w strzałach drewna bielastego i twardzielowego. Wpływ ten wyrażał się w różny sposób i ze zróżnicowaną intensywnością. Dla racjonalnego wykorzystania drewna z użytków przedrębnych należy uwzględniać charakterystykę makrostruktury sosnowego surowca drzewnego z tych drzewostanów.

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