RESEARCH ON THE COEFFICIENT OF UTILIZATION OF QUERCUS PETRAEA L. LOGS FOR PRODUCING RADIAL PLANKS WITH A THICKNESS OF 33mm.

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Abstract: The number of entities that sawn radial grain (quarter sawn) boards is very small. Sawing of quarter sawn logs is very complicated and it has a low coefficient of utilization.
It was in the interest of entities to know utilization coefficient of logs during a quarter sawn.
Quarter sawn boards primarily used for barrel branches and some other special products.
In order to have reliable results are sawn 5 oak logs. Sawing of logs is done on the "Beha-n" entities in Rahovec, which exclusively used sawn quarter boards. Sawing of logs is done in special sawmill adapted for this purpose.
Obtained data of the study:
the average diameter was 34.40cm.;
Average log length 50.12%;
Thickness boards 33mm.
Coefficient of oak log utilization in quarter sawn, expressed as a percentage:
Radial boards 71.79%;
Outer part with bark 19.79%;
Sawdust 6.26%;
Others 2.25%.
Keywords: Coefficient of utilization, board, sawdust, logs.

STUDIM MBI KOEFICIENTIN E SHFRYTËZIMIT TË TRUPAVE TË LISIT (QUERCUS PETRAEA L.) PËR PRODHIMIN E DËRRASËS RREZORE ME TRASHËSI 33mm.

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Abstrakt: Numri i subjekteve që merren me prodhimin e dërrasave në prerje rrezore është i vogël. Sharrimi i trupave në dërrasa rrezore është mjaftë i ndërlikuar dhe me një koeficient të ulët të shfrytëzimit. Ishte në interes të subjekteve të dihet sa është koeficienti i shfrytëzimit të trupave gjatë sharrimit rrezor. Dërrasat me prerje rrezore kryesisht përdoret për degë fuçish dhe për disa prodhime tjera të veçanta.
Për të pasur rezultate të besueshme janë sharruar 5 trupa nga druri i lisit. Sharrimi i trupave është bërë në ndërmarrjen "Beha-n" në Rahovec e cila ekskluzivisht merret me prodhimin e dërrasave rrezore. Sharrimi është kryere në sharrë shirit të adaptuar për këtë qëllim.
Nga të dhënat e studimit ka rezultuar që diametri mesatar i trupave të matur është 34.40cm.
Gjatësitë e trupave të përdorur ishin nga 95 deri në 102cm.
Lagështia mesatare e trupave ishte 50.12%.
Trashësia e dërrasave të sharruara ishte 33mm.
Koeficienti i shfrytëzimit të trupave të lisit në dërrasa rrezore, shprehur në përqindje është si vijon:
Dërrasa rrezore gjysmë të skuadruara 71.70%,
Anjet dhe copat 19.79%,
Tallashi 6.26%,
Tjerat 2.25%.
Fjalë kyçe: koeficienti i shfrytëzimit, dërrasë, anje, tallash, trupa.

1. INTRODUCTION

In our country are a few enterprises that produce radial boards from the oak wood (quercus petraea L.). However, it is a very complicated work and with a small exploation, it is thought that is of interest to know to what extent it is used.

The study about the utilization of the oak logs, in this case is made in the factory "Beha- N" Rahovec, which deals with the production of the radial boards from the oak wood.

To obtain data on this subject we have sawn 5 logs, which have been sawn with band sawing machine, shown in figure 1.

Figure 1. Sawing of the oak logs with band sawing machine.

2. THE GOAL OF THE STUDY

Determining the use of oak logs, during the sawing on radial boards has been done through:

- Determining the amount [m^3] and percentage (%) of the boards resulting of sawing,
- Determining the amount [m^3] and percentage (%) of the outer parts with bark and pieces,
- Determining the amount [m^3] and percentage (%) of the sawdust.

3. MATERIALS AND METHODS

a) Used materials

- Oak logs,
- Band sawing machine,
- Meter,
- Scale,
- Micrometer, etc.

b) Used methodology

The determination of balance of the planks has been done through the measurements on turf.

The logs were measured by meter, while the measurement of boards, outer parts with bark, and sawdust has been done through of weighing.

For the calculation of these, are used the formulas:

Volume of the logs in [m3]

$$Q = \frac{D^2 \times \pi}{4} \times l .....(m^3) \quad ..... \quad (1)$$

Where:

Q-Volume of the measured log in [m^3],

D-The average diameter of the log, in m,

l -The length of the measured log, in m.

The volume of the sawn material, in [m^3]

$$V_l = \frac{P_{lsh}}{\gamma_u} ..... (m^3) \quad ..... \quad (2)$$

Where: V_l- The volume of boards in [m^3],

P_{lsh}-Weight of the boards in kg,

γ_u-The specific weight of wood in kg,

Productivity of the boards, in [%]

$$R_l = \frac{V_l}{Q} \times 100 = ...(\%) \quad ..... \quad (3)$$

Where: R_l- Productivity of the board, in (%)
Volume of the sawdust, in [m^3]

$$V_{tg} = \frac{P_t}{\gamma_u} ..... \ (m^3) \quad ..... \quad (4)$$

Where: V_{tg}- Volume of the sawdust, in m^3,
P_l- The weight of sawdust, in [m^3]
Productivity of the sawdust, in [%]

$$R_t = \frac{V_{tg}}{Q} \times 100....(\%) \quad ..... \quad (5)$$

Where: R_t-Productivity of the sawdust, in (%).
The volume of outer parts with bark, in [m^3]

$$V_a = \frac{P_a}{\gamma_u} \ .....(m^3) \quad ..... \quad (6)$$

Where: V_a-Volume of outer parts with bark, in [m^3],
Pa- The weight of outer parts with bark in wet condition in kg.
Productivity of outer parts with bark in [%]

$$R_a = \frac{V_a}{Q} \times 100.....(\%) \quad ..... \quad (7)$$

Where: R_a- Productivity of ***outer parts with bark*** in %.
To produce radial boards also is build the cutting model. The thickness of sawn material that produce in this subject is 33mm. In figure 2.vWe can see the cutting model of the logs.
As we can see above in the figure 3. The sawn material separates half and then in quarter. Then from the quarters drawn the boards one by one. In this case the sawn material is half clear.

Figure 3. Sawing of the logs.

Since the sawn material produced half e clear and has not a regular geometric form though that the volume to draw by weighing. In this case has been required the calculation of the specific weight which has been calculated by the formula:

$$\gamma_u = \frac{P_u}{V_u} \text{ ..... } gr/cm^3 \text{ .....(8)}$$

Where:
P_u- The weight of the moisture sample in gr.
V_u- The volume of the moisture sample in [cm^3].
For calculation of the specific weight were taken from sawn material the samples size of 2×2×2cm. And then were sent to the laboratory of the Faculty of Applied Technical Sciences in Ferizaj, There the samples has been weighed on scales accurately 0.1gr and accurately has been measured with micrometer 0.01mm. Shown in figure 4. Then the samples have been dried to the moisture 0%. Data of measurements are given in the table 1.

Figure 4. The appearance of the samples.

According to the table 1. The wood moisture resulted on the average 50.12%, the average volume of samples in a wet state 7.36cm3, the average weight of samples in a wet state 7.38gr, the average weight of samples in a dry state in 0 % moisture 4.92 gr. Based on these data emerges that 1cm3 weghs 1.00171gr/cm3, or 1m3 is equal to 1001,71kg. For simplification is 1002kg

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Table 1. Sample size, volume, weight and moisture.

Nr.	Dimensions of samples in mm.			Volume cm 3	Weight of samples gr.	Weight of dry samples in gr.	Moisture %
1	19,81	19,30	19,32	7,38	7,30	4,90	49%
2	19,85	19,12	19,28	7,31	7,00	4,70	49%
3	19,90	19,17	20,17	7,69	6,80	4,60	48%
4	19,92	19,23	19,29	7,38	7,40	4,90	51%
5	19,83	19,33	19,28	7,39	7,30	4,80	52%
6	19,76	19,29	19,31	7,36	7,30	4,80	52%
7	19,85	19,35	19,28	7,40	7,20	4,80	50%
8	19,72	19,29	19,27	7,33	7,10	4,70	51%
9	19,83	19,30	19,27	7,37	7,30	4,80	52%
10	19,84	19,24	19,23	7,34	7,00	4,70	49%
11	20,00	19,13	19,91	7,62	7,10	4,70	51%
12	19,84	19,26	19,31	7,38	7,20	4,80	50%
13	20,42	19,24	19,24	7,56	7,10	4,80	48%
14	19,84	19,26	19,33	7,38	7,20	4,70	53%
15	19,88	19,81	19,31	7,60	7,20	4,80	50%
16	19,78	19,27	19,25	7,34	7,30	4,80	52%
17	19,80	19,28	19,30	7,37	7,40	4,90	51%
18	19,80	19,28	19,26	7,35	7,10	4,70	51%
19	19,81	19,38	19,30	7,41	7,30	4,80	52%
20	19,81	19,25	19,28	7,35	7,20	4,80	50%
21	19,77	19,26	19,28	7,34	7,20	4,80	50%
22	19,77	19,17	19,28	7,31	6,70	4,70	43%
23	19,81	19,31	19,24	7,36	7,20	4,80	50%
24	19,82	19,30	19,39	7,42	7,30	4,90	49%
25	19,80	19,24	19,30	7,35	7,30	4,80	52%
			Average	7,40	7,18	4,78	50,20

Nr.	Dimensions of samples in mm.			Volume cm 3	Weight of samples gr.	Weight of dry samples in gr.	Moisture %
26	19,92	19,26	19,27	7,39	7,00	4,70	49%
27	19,90	19,17	19,11	7,29	7,30	4,80	52%
28	19,97	19,27	19,24	7,40	7,50	4,80	56%
29	19,96	19,30	19,22	7,40	7,50	4,90	53%
30	19,86	19,24	19,24	7,35	7,40	4,80	54%
31	19,69	19,34	19,20	7,31	7,20	4,70	53%
32	19,95	19,21	19,32	7,40	7,40	4,80	54%
33	20,06	19,22	19,29	7,44	7,60	4,90	55%
34	19,95	19,15	19,19	7,33	7,50	4,80	56%
35	19,96	19,25	19,28	7,40	7,40	4,80	54%
36	19,92	19,22	19,27	7,38	7,30	4,90	49%
37	20,07	19,29	19,28	7,46	7,50	4,90	53%
38	19,88	19,28	19,29	7,39	7,40	4,80	54%
39	19,92	19,22	19,23	7,36	7,30	4,80	52%
40	19,87	19,22	19,22	7,34	7,30	4,80	52%
41	19,93	19,18	19,15	7,32	7,40	4,80	54%
42	19,90	19,21	19,13	7,31	7,50	4,80	56%
43	20,01	19,23	19,31	7,43	7,30	4,80	52%
44	19,90	19,25	19,20	7,35	7,30	4,80	52%
45	19,70	19,20	19,25	7,28	7,20	4,80	50%
46	19,96	19,24	19,21	7,38	7,30	4,80	52%
47	19,93	19,81	19,23	7,59	7,30	4,80	52%
48	19,88	19,25	19,19	7,34	7,30	4,80	52%
49	20,01	19,29	19,26	7,43	7,40	4,80	54%
50	19,91	19,21	19,19	7,34	7,50	4,80	56%
			Average	7,38	7,36	4,81	53,16

Nr.	Dimensions of samples in mm.			Volume cm 3	Weight of samples gr.	Weight of dry samples in gr.	Moisture %
51	19,80	18,25	19,23	6,95	7,60	5,20	46%
52	19,84	19,31	19,25	7,37	7,60	5,20	46%
53	19,83	19,28	19,21	7,34	7,50	5,20	44%
54	19,84	19,27	19,20	7,34	7,60	5,20	46%
55	19,90	19,15	19,05	7,26	7,40	5,10	45%
56	19,90	19,22	19,16	7,32	7,50	5,20	44%
57	19,87	19,29	19,21	7,36	7,60	5,20	46%
58	19,85	19,21	19,21	7,32	7,40	5,10	45%
59	19,86	19,19	19,25	7,33	7,50	5,10	47%
60	19,84	19,18	19,05	7,25	7,50	5,10	47%
61	19,90	19,21	19,23	7,35	7,60	5,10	49%
62	19,85	19,21	19,22	7,33	7,60	5,20	46%
63	19,81	19,27	19,21	7,33	7,70	5,10	51%
64	19,81	19,13	19,18	7,26	7,60	5,10	49%
65	19,79	19,25	19,29	7,35	7,60	5,10	49%
66	19,96	19,18	19,03	7,28	7,50	5,10	47%
67	19,82	19,16	19,27	7,32	7,70	5,20	48%
68	19,95	19,26	19,25	7,39	7,70	5,20	48%
69	19,79	19,21	19,21	7,30	7,70	5,10	51%
70	19,87	19,25	19,16	7,32	7,60	5,20	46%
71	19,85	19,20	19,27	7,34	7,60	5,20	46%
72	19,83	19,26	19,22	7,34	7,70	5,10	51%
73	19,87	19,25	19,19	7,34	7,60	5,20	46%
74	19,85	19,25	19,15	7,32	7,60	5,30	43%
75	19,84	19,18	19,29	7,34	7,60	5,20	46%
			Average	7,31	7,58	5,16	46,99

Volume of logs- The logs which are sawn on this subject are elected logs in the forest, since the logs must be first quality and much smaller increase yearly as well as the largest tree of heartwood, since the sapwood is not appropriate.
The logs who will sawn was measured with precision 0.1 cm in diameter and length. The logs diameter has been measured on both sides. In every side are made by two measurements indirectly to each other. From these measurements is drawn the average diameter of the log in m, and volume in m3, table 2.

Table 2. Logs measurements

Nr.	First measurement, m	Second measurement, m	Third measurement, m	Fourth measurement, m	Average, m	Logs length, m	Logs volume m^3	**Volume of five logs in m^3**
1	0,340	0,320	0,290	0,340	0,323	0,970	0,079	
2	0,340	0,310	0,320	0,340	0,328	0,950	0,080	
3	0,350	0,360	0,350	0,350	0,353	1,020	0,099	**0,456**
4	0,340	0,340	0,340	0,320	0,335	1,005	0,089	
5	0,360	0,390	0,400	0,370	0,380	0,960	0,109	
Average					0,344	0,981	0,091	

Based on the length of the diameter the volume of logs was calculated in equation [1], represented in table 2. So from the 5 measured logs, the volume of the logs is 0.456m3.

The result for the sawn lumber, outer parts with bark and pieces, and sawdust.

The sawn lumber, outer parts with bark and pieces, and sawdust were weighted with weighed and the weights are represented in table 3.

Table 3. The weight of sawn lumber, outer parts with bark and pieces and sawdust.

	Boards volume in kg.	Weight of outer part with bark and pieces kg.	Sawdust weight in kg.
Log I	53,40	15,40	5,73
Log II	57,80	16,20	5,46
Log III	72,00	20,20	5,68
Log IV	65,20	18,40	5,53
Log V	80,00	20,00	5,80
Total	**328,40**	**90,20**	**28,20**

Determination of the coefficient of utilization

After finished work in terrain, is done final balance of productivity, percentage of utilization of oak logs in quarter sawn in primary wood processing, based on cutting model shown in figure 2. The results are shown in table 4.

Table 4. Productivity in volume and percentile.

	Logs	Boards			Outer part with bark and pieces			Sawdust			Others		
	volume m^3	Weight kg.	Volume m^3	%	Weight kg.	Volume m^3	%	Weight kg.	Volume m^3	%	Weight kg.	Volume m^3	%
Log I	0,079	53,40	0,053	67,46	15,40	0,015	19,45	5,73	0,006	7,24	4,63	0,00462	5,85
Log II	0,080	57,80	0,058	72,11	16,20	0,016	20,21	5,46	0,005	6,81	0,70	0,00070	0,87
Log III	0,099	72,00	0,072	72,58	20,20	0,020	20,36	5,68	0,006	5,73	1,32	0,00132	1,33
Log IV	0,089	65,20	0,065	73,11	18,40	0,018	20,63	5,53	0,006	6,20	0,05	0,00005	0,05
Log V	0,109	80,00	0,080	73,25	20,00	0,020	18,31	5,80	0,006	5,31	3,42	0,00341	3,13
Total	**0,456**	**328,40**	**0,328**	**71,70**	**90,20**	**0,090**	**19,79**	**28,20**	**0,028**	**6,26**	**10,11**	**0,010**	**2,25**

6. CONCLUSIONS

In the study were taken 5 logs.
The total volume of logs is 0.456m3.
From the data obtained in this study, resulted that the average diameter of measured logs is 34.40cm.
The length of logs taken for this study varies from 95 to 102cm.
The average moisture of logs is 50.12%.
The thickness of sawn lumber is 33mm.
From the results of this study we can conclude that:

- The swaging average of teeth is 0.6mm; in some cases swage of 1mm was ascertained.
- The percentage of sawn lumber half clear which results from sawing the logs is 71.70%
- The percentage of outer parts with bark is 19.79%
- The percentage of sawdusat is 6.26%
- Other elusive 2.25%
- To produce 1m3 of sawn lumber half clear in average 1.392m3 of raw material (logs) are necessary.

Irregular shape of oak logs, compared to coniferous kind, as well as numerous and different defects hamper sawing when it's required to achieve a higher quantitative and qualitative efficiency.
The improvement of the technical condition of the machinery and the improvement of technology of forming the swage, will improve the quantitative efficiency and quality of sawing.

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