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THE INVESTIGATIONS OF RAW MATERIALS COSTS OF RADIAL SAWN TIMBERS MANUFACTURING

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The results of experimental researches of raw materials costs in the manufacture of radial sawn timber are given. With the help of developed and proposed simulation model, which takes into account the actual dimensional and qualitative characteristic of raw materials and specification of lumber, received voluminous output purely radial sawn timber from logs provided by segment and cleaving-segment cutting patterns.

Radial sawn timber, sawlog, sector log sawing schemes, live-and-segment log sawing schemes, edged sawn timber, general-purpose sawn timber, the volume of logs, taperingness of logs

Formulation of the research problem. At the present stage of development of the theory of cutting of wood, it was found that the resource of raw materials is possible under conditions of intensification of sawmill production through specialization of enterprises by destination [1]. In addition, today there are many computer programs for the calculation schemes of sawing logs into lumber without a clear delineation of their output depending on the type of sawing that is radial, tangential or mixed. So now the sawing processes have urgent task is the development of convenient for practical use of software for predicting useful life, volume, quality and value of lumber outputs the specified specification (size, type of cross-section, quality and quantity) and improvement of technological processes of milling, aimed at obtaining the maximum possible value out of such lumber [2, 3].

Known [4, 5] that timber sawing type radial and semi-radial give the best result for dimensional stability and balanced internal stresses that occur in structures, namely: bars for window and door production, joinery boards oversized, wooden beams and other. The materials used in the construction of wooden structures, estimated ratio of strength and weight. The ratio of strength (σ_w) to density (ρ_w) at appropriate moisture content is called the coefficient of wood

quality (k). Since the strength of wood in radial direction is higher than in tangential (in softwood by 10-15%, the hardwood of 20-70%), respectively, and the ratio of quality lumber radial cutting for woodwork construction area will be higher.

Research of the ways of obtaining the radial timber and billets and the magnitude of their surround output of logs at one time were many scientists [6, 7].

Most of them note the combined segment and sector cutting schemes as the most rational to radial sawn timber and billets [8, 9]. Other in their writings offer a technologically more complex and more expensive ways of getting sawn production radial type cutting [10].

The aim of the research is to determine the output of lumber from wood raw materials during the production of radial sawn timber.

Results. Application of the developed simulation model [11], which takes into account the actual sizes, form and quality characteristics of raw materials and specification of lumber to get the size of a useful output of a purely radial lumber from logs. In addition, all factors, which in reality is unmanageable, were included in this model as manageable. This gave the opportunity to conduct a series of active experiments with the use of experiment planning, which greatly increased the efficiency of research. Therefore, it was possible to simulate cutting some of the logs by different cutting plans with comparison techniques results.

Experiments were performed on two models: using sector log sawing schemes and using live-and-segment log sawing schemes. Each model were carried out on a series of 20 experiments. Thus, the number of duplicate observations on the model with the sector log sawing schemes was 1020 logs with diameters 14 cm - 46 cm, on the model of the live-and-segment log sawing schemes – 840 logs with diameters 20 cm - 46 cm. Variable factors were: the volume of logs that it was considered according by ГОСТ 2708-75 [12] and ranged between 0,073 $м^3$ to 0,77 $м^3$; coefficient of sorting, which take into account the quality of raw materials and ranged within 1,101 – 1,388; correction coefficient on volume of logs, which

changed within 0,9 – 1,3. As a response accepted the magnitude of costs logs raw materials reversed size dimensional output of lumber from logs.

The main experiment was a separate series of experiments, the results of which was tested the hypothesis of normality distribution of the initial value of the experiment and the required number of duplicate experiments. Verification of the homogeneity of variances and discarding blunders were make according by t-criterion Student's and G-criterion Kohren.

According to the results of the previous series of studies the magnitude of the costs of pines timber in the production of radial sawn timber according to the specification it was received:

- on condition of the sector log sawing schemes of the calculated value of G-criterion Kohren's ($G_{calcul.}$) was 0,1565, tabular ($G_{tab.}$) – 0,36;

- on condition of live-and-segment log sawing schemes $G_{calcul.}$ = 0,1622, $G_{tab.}$ = 0,24.

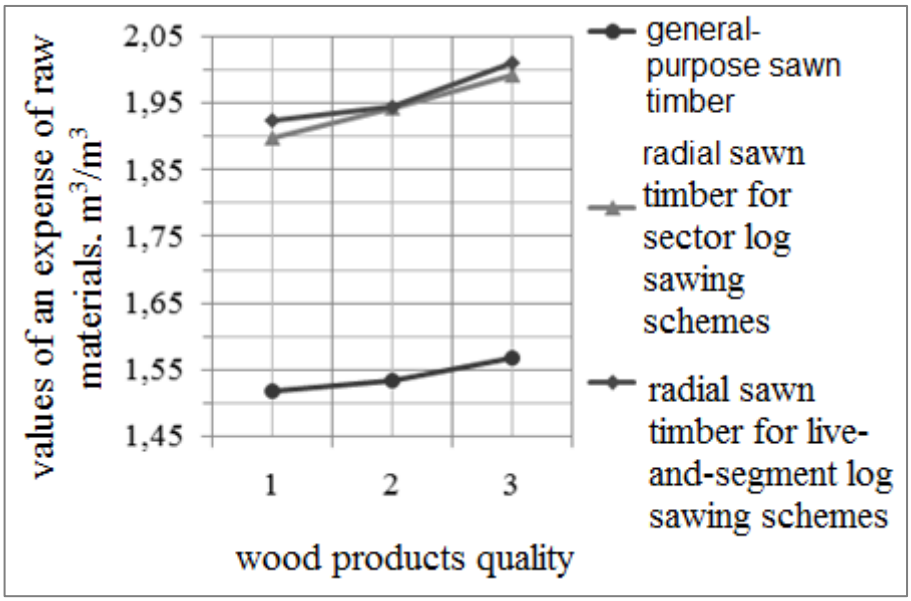
The results obtained comply with the parity of $G_{calcul.} < G_{tab.}$ that allows to accept a hypothesis of uniformity of dispersions of experiments.

Averaged values costs of wood for the manufacture of radial sawn timber for sector log sawing schemes and live-and-segment log sawing schemes compared with consumption of wood on the general-purpose sawn timbers are in Fig.1.

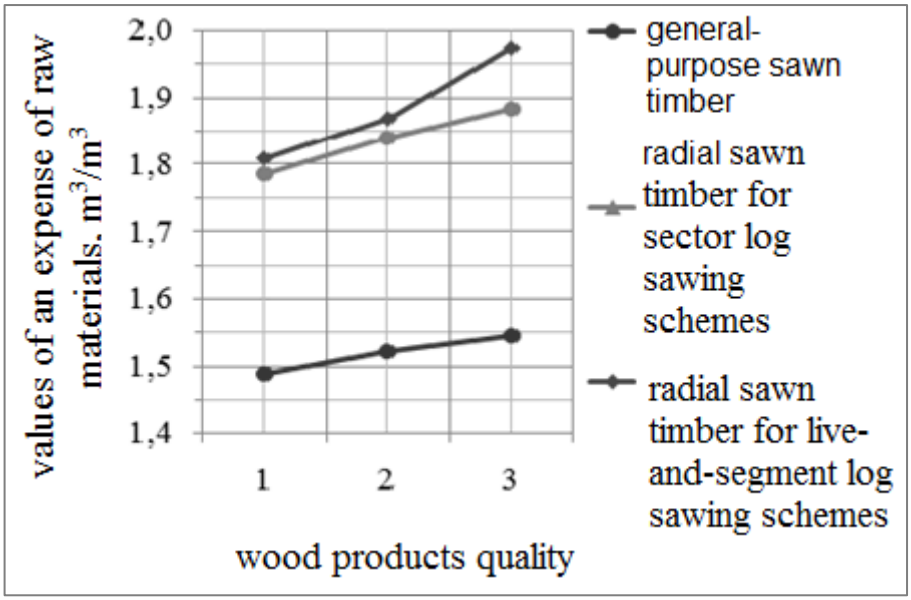
It is evident that greater consumption of wood in radial sawn timber observed conditions of application live-and-segment log sawing schemes compared with sector log sawing schemes. This can be explained by the differences in decision sawing programs, more quantity of kerfs for live-and-segment log sawing schemes and a significant influence of the coincidence of the logs on the volumetric output of lumber. However, there is also a significant increase (from 22% to 28%) values of the magnitude of the cost of the wood for all varieties on the production radial sawn timber compared with edged sawn timber of general-purpose sawn timber.

The balance of raw materials in production of the radial sawn timber, received in imitating model, presented in tables 1-2.

Obtained by experimental data on the imitating model balances sawlog raw materials can be seen that in the process of manufacturing radial sawn timber at special schemes of cutting obtained a large number of sawmill waste, which can be used for own needs of production.



a



b

Figure 1. Experimental values of the magnitude of the costs of the wood in the manufacture of lumber: a – from logs diameters of 14 cm – 24 cm; b – from logs diameters of 26 26 cm and more

Conclusions. During the research the cost of raw materials for the production of radial sawn timber, it was found that the conditions of application of the sector log sawing schemes for radial lumber, the magnitude of the costs of raw material increases with decreasing taperingness and deterioration quality.

Tables 1. Balance sawlog raw materials pine to manufacture radial sawn timber when sector log sawing schemes

Name of products	The volume of products, %	The volume of products, $м^3$
Sawn wood	54,3	203,876
including:		
Board length 1,0 m and more	54,3	203,876
Waste	45,7	171,58
including:		
lumpy	26,5	99,492
very small wood-waste	13,2	49,56
shrinkage and wood dust	6	22,53
Total raw materials:	100	375,442

Tables 2. Balance sawlog raw materials pine to manufacture radial sawn timber when live-and-segment log sawing schemes

Name of products	The volume of products, %	The volume of products, $м^3$
Sawn wood	50,8	179,897
including:		
Board length 1,0 m and more	50,8	179,897
Waste	49,2	174,23
including:		
lumpy	26,8	94,906
very small wood-waste	16,4	58,077
shrinkage and wood dust	6	21,248
Total raw materials:	100	354,127

In the case of live-and-segment log sawing schemes, the magnitude of the costs of raw material increases with deteriorating grade logs and increase correction coefficient on volume.

Therefore, the application of the derived quantities the cost of raw materials in the production would allow the operation of cutting wood forecast the volume output of lumber and milling wastes, thereby increasing the efficiency of the process of manufacturing radial lumber.

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Приведены результаты экспериментальных исследований величины расхода сырья в производстве радиальных пиломатериалов. С помощью разработанной и предложенной имитационной модели, в которой учтено фактическую размерно-качественную характеристику сырья и спецификацию пиломатериалов, получены объемный выход сугубо радиальных пиломатериалов из бревен при условии раскроя их по развально-секторной и секторной схемам.

Радиальные пиломатериалы, пиловочник, секторная схемы раскроя, развально-сегментная схема раскроя, пиломатериал обрезной, пиломатериал общего назначения, объем бревен, сбег бревен