USING THE MORPHOMETRIC CHARACTERISTICS OF WOOD RAW MATERIALS IN THE SAWMILL TECHNOLOGY

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ABSTRACT

The opportunities of use of uneven distribution of knots in wood raw material are considered at cutting lumber on sawn blanks.

Key words: morphometric characteristics, wood raw materials, sawmill technology

INTRODUCTION

Size-qualitative features of stem, and therefore the round timber, form during the growth of the tree as a living organism. It is accompanied by structural and morphological changes, which in turn can be expressed with the use of bionics laws and laws of the dimensionless ratios.

Analysis of structural and morphological characteristics and their synthesis with the internal structure of the tree suggests a helical spiral distribution of knots in the body of a tree [1]. On the other side from the numerous studies of botanists it is well known about the whorled arrangement of branches of coniferous trees. And if the most popular Russian species (larch, spruce, fir) it is species with a not strict whorled arrangement of branches, but pine belongs to the breed with the strictly whorled arrangement of branches [6 – 7]. SP Isaev [1] has been determined the average number of knots in a whorl: for larch – 3,08, for spruce – 5,02; for fir – 4.97. In this case, the average number of knots in a whorl expresses an odd number and explicit odd number of knots in a whorl influences their uneven distribution along the axis of the logs along its circumference.

From the papers of Gorbacheva LN [2–4], Shalaev VS [8–12] and [5, 13] school by PP Aksenov aware It is well known about of the uneven distribution of the knots around the circumference of the logs, the so-called concentration of knots in logs. This phenomenon has been predetermined by biological characteristics of the tree growing, growing conditions, strong development of the branches in the direction of maximum light output.

The study of this phenomenon and aspects of its use in the sawing technology focused on the above papers and especially in the sawing of logs. In fact it was studied with this trend of improvement of the quality of lumber produced and increases their value output when knots in the greatest number and large size would fall on the faces of the boards. This direction was investigated and foreign scientists.

However, most of the lumber produced in sawmilling is processed, cut on sawn blanks and details. Finally, except for the production of export lumber, It is important the final product and its quality output. This part of the production chain consists: the stem – the tree-length – saw log - boards - sawn blanks - sawn details was studied from the above point of view a much less. Although it visually can be estimated quite tangible difference in the saturation knots symmetrical about the longitudinal axis of the parts of the board faces.

In this case, the considered biological phenomenon, really, the uneven distribution of knots around the circumference of the logs, the so-called concentration of knots in the logs should be used to improve the sawmill technology first of all in the considering the part of the production chain: saw log - boards - sawn blanks.

It should be point at first, the classification by type of saw logs concentration of knots on the surface, which incidentally was proposed in the 70's in the papers Gorbacheva L. N, Shalaev V. S. They are:

1. Logs with a maximum concentration of the knots on the surface of one quart;
2. Logs with a maximum concentration of the knots on the surfaces of two opposite quarters;
3. Logs with a maximum concentration of the knots on the surfaces of two adjacent quarters;
4. Logs with knots on the surface concentration of the three quarters;
5. Logs with a uniform distribution of the knots on the surfaces of all quarter, the log.

The second, it has not been almost revised before it is possible to offer some certain classification of groups of lumbers by location of the knots on their face side, which arises in the analysis of this trend. They are:

1. Boards with a few numbers of knots and their location is rather uniform;
2. Boards with a many number of knots and their location is uniform;
3. Boards with knots are uneven distributed about the longitudinal axis of the board;
4. Boards with knots are not uneven distributed along the length of the board.

In the production of merchantable lumber we compare their grade for position orientation sawing logs and without orientation. The magnitude of the value output can be to assess the effectiveness of the orientation of logs before sawing.

For the production of saw blanks the output capacity depends not only on the quality of lumber, but also on the specification of sawn blank.

In any case, you must consider and take into account the possibility of changing the output of sawn blanks when considering the uneven distribution of knots with respect to the longitudinal axis of each group-classification boards, moreover, each board.

MATERIALS AND METHODS

In order to have a preliminary quantification of the uneven distribution of knots in width face board and its impact on the output of sawn blanks the following experiment has been carried out.

The sample was taken form 32 pine boards relative to the longitudinal axis of their conventionally divided into two parts. The knots area was determined on face of each half of the board. As a result, the two groups formed a half board: with smaller and larger sets of the aggregate area of defects on the board face. On average, in the group with a smaller defect area was f1 = 1,11 %, in the group with larger defect area was f2 = 2,02 % of the total board face. Homogeneity of variances by Fisher has been verified. The received heterogeneity was dispersion. In addition, for the entire sample and both groups half boards a defect area was f3 = 1,56 %.

For a produce group of boards the volumetric output P sawn blanks with length of 1000 mm of two quality groups was determined:

- the size of up to 0,2 knots allowed width of board face, with a width of 75 mm sawn blanks;

- the size of up to 0,5 knots allowed width of board face, with a width of 50 mm sawn blanks.

For sawn blanks with width b = 75 mm Output capacity is calculated by P obtained earlier settlement-experimental by [14] Eq. 1:

$$P = 84{,}934\text{-}38{,}519\ f \qquad \textbf{(1)}$$

where: f – defects area on board faces.

For sawn blanks with width b = 50 mm Output capacity is calculated by P also obtained earlier settlement-experimental by [14] Eq. 2:

$$P = 90{,}337\text{-}27{,}980\ f \qquad \textbf{(2)}$$

RESULTS AND DISCUSSION

The results of calculation of volume output sawn blanks are summarized in Table. The produce of sawn blanks can be from sorted according to the quality of lumber and not sorted. In this case the criterion of quality timber for sorting is the area of defects in their faces. From these data, the volume output of 75 mm wide sawn blanks of sorted lumber was 42,2 %, and from unsorted – 24,8 %; the volume output of 50 mm wide sawn blanks of sorted lumber was 33,8 %, from unsorted – 46,7 %. As a result, consumption of lumber when cutting when considered uneven distribution of the knots in width faces, decreased from 100 % to 82,5 %. Naturally, it should also take into account some characteristics of edge knots when cutting lumber.

Table 1: Volume output of sawn blanks with length of 1000 mm

Width of sawn blanks, [mm]	Dimensions of knots permitted in parts of width of board face	Area of defects on boards faces, [%]	Volumetric output of sawn blanks, [%]
75	0,2	1,11	42,2
50	0,5	2,02	33,8
75	0,2	1,56	24,8
50	0,5	1,56	46,7

CONCLUSION

Even from the preliminary examination and the variety of options, assumptions we can see the necessity and feasibility of carrying out the studies with the implementation of a significant amount of experiments and optimization solutions.

Obviously, for the considered groups of lumber may be differences on the optimal solutions. Despite the abundance of research on the optimization of cutting lumber, this aspect has not been studied for quite a detailed level.

Focused on the knots sawing logs will naturally give different for the five proposed types of logs results in classification of groups of lumbers. In this case, as in the previous (not oriented to the knots sawing logs) case, appropriate optimization solutions for each group of lumber are required.

The choice of technological decisions can be considered not only in terms of output, but also on labor costs. In this case, considering both these two groups of classifications angle sawing efficiency technologies is possible to formulate a very interesting optimization task.

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