

# RESEARCH REGARDING THE CUT SURFACE AT THE FELLING OF BEECH TREES

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**Abstract:** *In this paper the analysis of the correlation between the breast height diameter, stump height and the total cut surface at beech trees felling was carried out. Felled trees were analyzed in terms of base diameter, stump diameter and height. The cut surface was determined using photo images of the stump and notch. Simple correlation analysis showed a direct close relationship between the cut surface and breast height diameter, the correlation coefficient value being very significant. Analyzing the correlation between the stump height and breast height diameter it resulted a direct correlation same as the correlation between stump height and the cut surface, the correlation coefficients are significantly distinct.*

**Key words:** *beech, stump, technological consumptions, felling trees.*

## 1. Introduction

Knowing the total cut surface at felling trees is necessary for the determination of technological consumption in this operation.

Technological consumption are those quantities of wood that are lost in the production process because of the specific operations of trimming and wood movement, the obligation to insure working conditions imposed by work safety or as a result of environmental factors actions [1].

At tree felling the following categories of technological consumption are recorded: consumption in cuts, consumption in breaks [5].

Technological consumption includes the volume of lost wood in the form of notch, chips and sawdust, wood that is consumed in the execution of timber felling cuts [3].

For the present paper three beech cutting

areas located in Management Unit I Vulcana, the Forest District Pucioasa, in the County Forest Administration of Târgovişte were studied. In these three cutting areas the shelterwood system was applied.

The harvesting method used was the tree length system, using harness for skidding and logging, and tractor for hauling.

## 2. Research Method

For the beech specimens found in this cutting areas breast height diameter, stump diameter and height were recorded so as to analyze the correlation between them.

In determining the cut surface we used images of stump and notch. The photos were taken as it can be seen in Figure 1 and Figure 2, with the camera lens in a perpendicular position to the items we wanted to capture.

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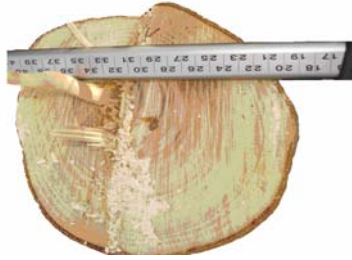


Fig. 1. *The caliper positioning on stump when shooting the picture*

In order to determine the scale, the caliper also appears in the photo, thus being able to use its units.

The coordinates of the picture corners were introduced in AutoCAD Map and then images were brought in the AutoCAD Map file and georeferenced, so that by digitizing them we can determine our areas of interest.



Fig. 2. *The caliper positioning on notch when shooting the picture*

Georeferenced image involves aligning it to a defined coordinate system. It involves the establishment of a connection between an image and a coordinate system [4].

### 3. Research Results

As can be seen in Figure 3, there were analyzed 261 trees with breast height diameters between 22 cm and 92 cm.

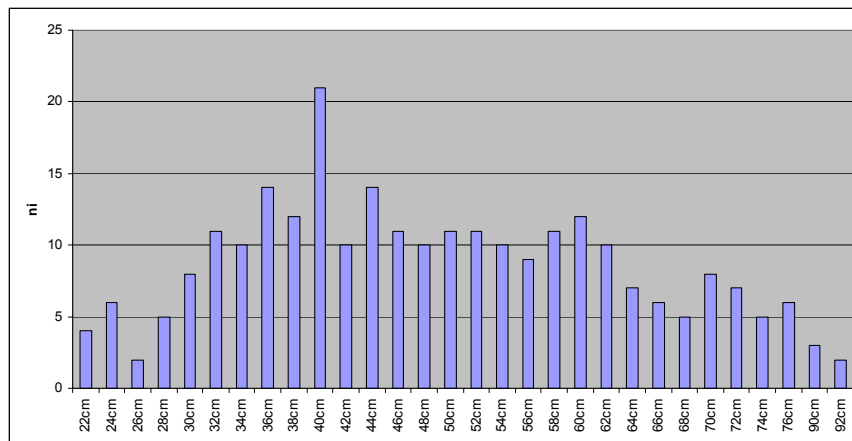


Fig. 3. *The distribution of analyzed trees on diameters categories*

Of all the 261 trees examined only 24.14% meet the condition for the stump height, meaning 30% of the diameter but not more than 10 cm measured upstream.

In Figure 4 we can see that, except for the diameter of 26 cm, stump height limit of 10 cm is exceeded in all cases.

Out of 261 cut trees, only in 5 cases a notch was not achieved, in the other cases

wedge-type notch was performed.

Figure 5 shows a comparison between average cut surface for wedge-type notch implementation and average cut surface for block-type notch implementation.

The distribution of the average cut surface for implementation of block-type notch is a theoretical distribution because no block-type notch was executed; this surface was

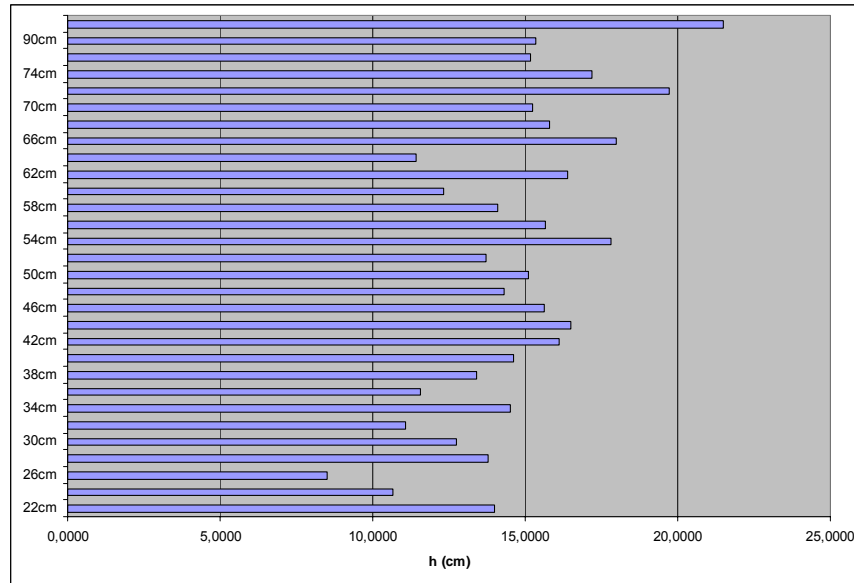


Fig. 4. *The distribution of average stump height on diameters categories*

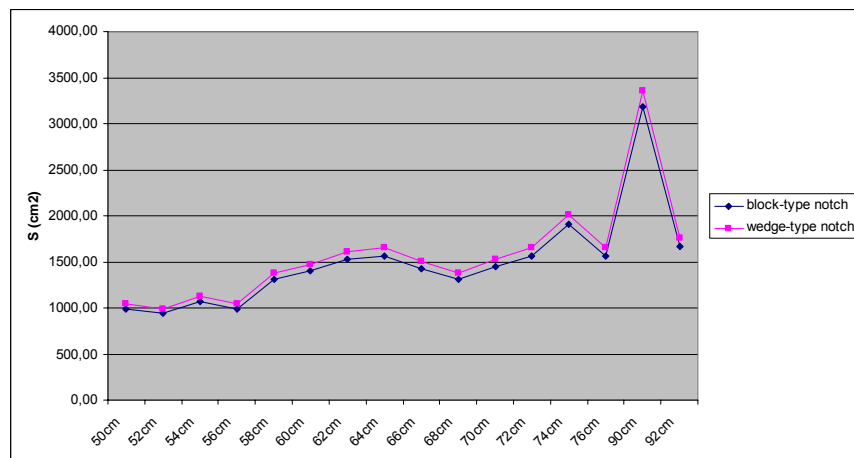


Fig. 5. *The distribution of cut surface on types of notch*

calculated using twice the lower surface of the wedge-type notch.

Analyzing Figure 5 it can be seen that the average cut surface for the implementation of block-type notch is always lower than for wedge-type notch.

Further, the cut surfaces were separated and their distribution was analyzed as follows: the distribution of the stump

surface (Figure 6), the distribution of the surface of the cut from the opposite side (Figure 7), the distribution of the surface of wedge-type notch (Figure 8), the distribution of total cut surface at felling trees (Figure 9).

As it can be seen in Figure 6 there is a close correlation between the stump surface and breast height diameter.

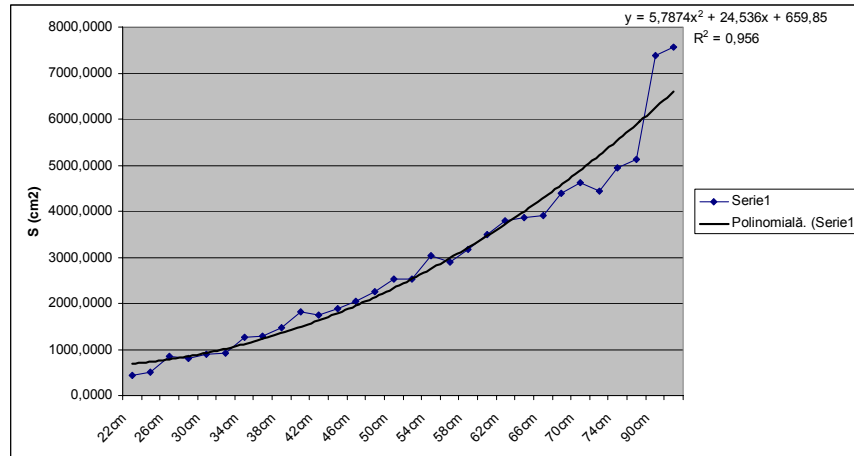


Fig. 6. *The distribution of stump surfaces*

Also, in terms of total cut surface at felling trees one can observe a strong correlation between the total cut surface and breast height diameter.

Doing the simple correlation analysis, which shows the linear relationship between two variables, the following values of correlation coefficients resulted:  $RSd = 0.9451$ ;  $RSh = 0.2164$ ;  $Rhd = 0.1748$ ; where  $RSd$  = the coefficient of correlation between the cut surface at tree felling and the breast height diameter;  $rSh$  = the coefficient of correlation between the cut

surface at tree felling and stump height;  $Rhd$  = the coefficient of correlation between stump height and breast height diameter.

The verification of the significance of the values obtained for the correlation coefficients was done using the standardized values shown in Table 1, values taken after [2].

It is noted that at the simple correlation level we have a direct close relationship between the cut surface and breast height diameter, the correlation coefficient value ( $RSd$ ) is very significant.

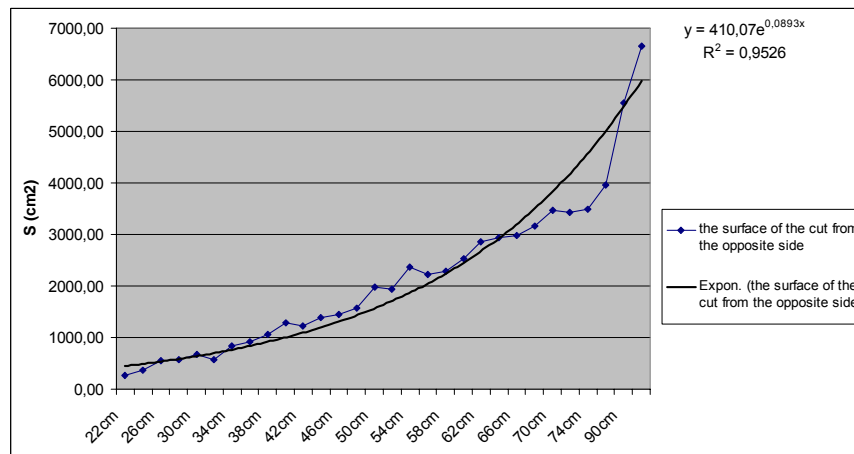


Fig. 7. *The distribution of the surface of the cut from the opposite side*

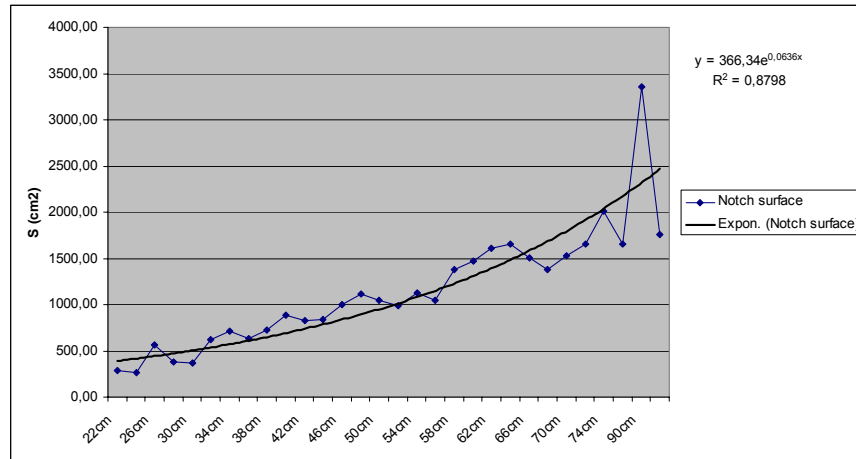


Fig. 8. The distribution of the wedge-type notch surface

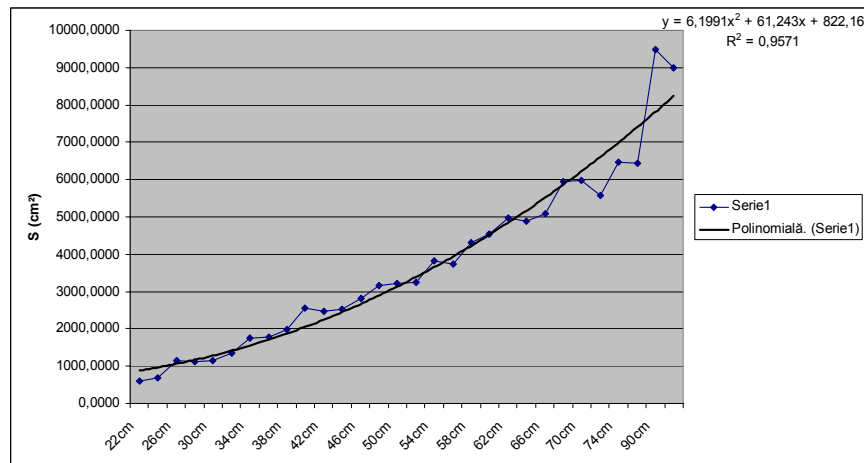


Fig. 9. The distribution of total cut surface at felling trees

Analyzing the correlation between stump height and breast height diameter, a direct correlation results, as for the link between stump height and cut surface, the correlation coefficients ( $rSh$ ,  $rhd$ ) are distinctly significant.

Then, the multiple correlation analysis was performed ( $RS - dh$ ), which shows the simultaneous influence of the factors that influence the measured feature ( $d =$  breast height diameter and  $h =$  stump height) on the characteristic measured ( $S =$  total cut surface).

Checking the significance of correlation coefficients using the test "t" Table 1

$f = N - 2 = 259$ degrees of freedom		
$\alpha = 0.05$	$\alpha = 0.01$	$\alpha = 0.001$
0.1233	0.1615	0.321
Significant	Distinctly significant	Very significant

The correlation coefficient value, resulting from the calculations is  $RS - dh = 0.9466$ . To analyze the significance of multiple

correlation coefficients, the value of  $F$  calculated  $F$  is compared with theoretical values for  $F$  set out in Table 2.

Checking the significance of correlation coefficients using the test "F" Table 2

$f_1 = K - 1 = 2$	$f_2 = N - K = 258$	$F$ calculated = 1111.2887
degrees of freedom		
The level of statistical significance		
$F = 5\%$		$F = 1\%$
3.02		4.66
Significant		Distinctly significant

#### 4. Conclusions

Analysis of data regarding the cut surface at trees felling leads to the following conclusions:

- At the simple correlation level we have a direct close relationship between breast height diameter and the cut surface.
- The multiple correlation coefficient between the breast height diameter, stump height and total cut surface is distinctly significant.

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