EFFECTIVENESS OF SCOTS PINE LONGWOOD TIMBER CUT-TO-LENGTH (CTL) LOGGING

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Abstract. In the last two decades the amount of timber harvested in Poland has almost doubled. On the other hand, in some regions of the country a decrease in the number of people willing to work in the forest can be observed. In such a situation, multioperational machines like harvesters and forwarders are being more frequently used in skidding and logging process. These machines operate mainly in the short-wood system, in which large- and medium-sized timber is bucked out of the butt part of the stem in form of logs, while in four of sections in the top part. Buyers are reluctant to buy cut-to-length (CTL) timber because of the widespread belief that timber produced as logs has a greater volume in comparison with longwood one. This paper presents preliminary results of research on CTL logging of large-sized pine longwood timber. Volume and value of timber provided in form of longwoods and logs were compared. The study was conducted in The "Lasy Mazurskie" Forest Promotional Complex (N Poland). The analysis showed that volume of CTL timber is usually smaller compared with the longwood one by a few percent, while the value is larger by several percent.

Key words: longwood, cut-to-length

INTRODUCTION

In the last two decades the amount of timber harvested in Poland has almost doubled (Table 1). On the other hand, in some regions of the country a decrease in the number of people willing to work in the forest can be noticed. In such situation, multioperational machines like harvesters and forwarders are being more frequently used in skidding and logging process. These machines operate mainly in the short-wood system, in which large- and medium-sized timber is bucked out of the butt part of the stem in form of logs, while in four of sections in the top part [Drewno... 2001]. It is noticeable that most buyers are reluctant to buy cut-to-length (CTL) timber because of the widespread belief that timber produced as logs has a greater volume in comparison with longwood one. Only the modern plants built in the recent years are interest in CTL timber, mostly in this of the first class of thickness.

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Table 1.   Timber harvested in the State Forests NFH according to cutting category, mln m^3
Tabela 1. Pozyskanie drewna w PGL LP według kategorii cięć, mln m^3

Timber harvested Pozyskanie drewna	1990	1995	2000	2005	2006	2007	2008	2009
Total – Ogółem	15.8	18.8	24.1	28.2	28.7	32.3	30.7	31.2
including dead wood and broken trees w tym posusz, złomy itp.	4.4	5.4	7.0	5.8	5.7	11.9	7.5	5.4
Final harvest Użytki rębne	7.7	7.0	8.9	12.2	12.6	13.4	14.1	15.3
including dead wood and broken trees w tym posusz, złomy itp.	1.2	1.0	1.2	1.5	1.5	3.3	2.6	2.1
Intermediate harvest Użytki przedrębne	8.1	11.8	15.2	15.9	16.0	18.9	16.6	15.9
including dead wood and broken trees w tym posusz, złomy itp.	3.2	4.4	5.8	4.3	4.3	8.5	5.0	3.2

Source: Leśnictwo [2000, 2010].
Źródło: Leśnictwo [2000, 2010].

OBJECTIVES, SCOPE OF RESEARCH AND METHODOLOGICAL ASSUMPTIONS

The aim of this research is to determine the volume and value of pine timber bucked in the traditional longwood system and to compare it with the volume and value of timber bucked in the form 6-meter-long logs. This length of the logs was adopted because of the fact that the CTL timber should be logged by overshot skidders, which get the highest performance while skidding logs bucked in maximum length.

The scope of the work included the quality assessment and measurement of length and diameter inside bark in the middle of the 150 logs bucked at the research plot. Then, boundaries of logs were determined for each selected longwood, and diameter inside bark both in the middle of the length as well as in the thinner end were measured. Length and diameter in the middle of the remaining top part of the longwood was also determined. Volume of longwood timber was noted by a forester's recorder. In turn, volume of the logs was calculated in two ways: a) based on log length and diameter in the thinner end – according to the draft of appendix #5 to the General Director of the State Forests NFH regulation on conifer logs volume determination [Zarządzenie... 2004] and b) based on the Huber's formula (length and diameter of the log in half of length). Volumes of the tops were determined on the basis of their length and diameter according to Huber's middle section formula. To determine the value of logged timber, the average price of timber in the Maskulińskie Forest District was obtained from Internet sales in the second half of 2011.

RESULTS

Volume of longwood timber equalled 258.83 m^3, including 73.51 m^3 in WA, 87.26 m^3 in WB and 98.06 m^3 in WC timber classes. 2nd thickness class was the most widely represented amounting to 159.38 m^3 (61.6%), while 1st class was the least abundant (9.64 m^3, 3.7%; Table 2).

Table 2.   Volume of longwood timber and after CTL logging
Tabela 2. Zestawienie miąższości drewna dłużycowego oraz po składowaniu

KJW	I	II	III	Total – Razem	
			m^3		%
1	2	3	4	5	6
Longwood timber (Dd) – Drewno dłużycowe (Dd)					
WA0	*	20.82	52.69	73.51	28.4
WB0	3.72	72.39	11.15	87.26	33.7
WC0	5.92	66.17	25.97	98.06	37.9
Total – Razem	9.64	159.38	89.81	258.83	100.0
%	3.7	61.6	34.7	100.0	*
CTL logged timber (volume according to diameter in thinner end) Drewno kłodowane (miąższość według D$_{ck}$)					
Ko	*	10.34	96.15	106.49	42.9
Ks	0.79	33.44	39.22	73.45	29.6
Kw	22.31	31.61	3.78	57.70	23.2
Total, K = 6 m Razem, K = 6 m	23.10	75.39	139.15	237.64	95.7
Kw > 6 m	7.95	1.12		9.07	3.7
S2	1.71			1.71	0.7
Total – Razem	32.76	76.51	139.15	248.42	100.0
%	13.2	30.8	56.0	100.0	*
Dd = 100%	339.8	48.0	154.9	96.0	*
CTL logged timber (volume according to diameter in half of the length) Drewno kłodowane (miąższość według D$_{L/2}$)					
Ko	*	8.56	103.96	112.52	42.1
Ks	0.73	29.43	48.29	78.45	29.4
Kw	19.97	39.30	6.26	65.53	24.5
Total, K = 6 m Razem, K = 6 m	20.70	77.29	158.51	256.50	96.0

Table 2 – cont. / Tabela 2 – cd.

1	2	3	4	5	6
Kw > 6	7.95	1.12	*	9.07	3.4
S2	1.71	*	*	1.71	0.6
Total – Razem	30.36	78.41	158.51	267.28	100.0
%	11.4	29.3	59.3	100.0	*
Dd = 100%	314.9	49.2	176.5	103.3	*
Dck = 100%	92.7	102.5	113.9	107.6	*

Source: own calculations.
Źródło: obliczenia własne.

Volume of CTL timber, determined in accordance with the draft of the General Director of the State Forests NFH regulations [Zarządzenie... 2004] amounted to 248.42 m^3 and was lower compared to the longwood timber volume by 4.0%. Volume of full-sized logs constituted 95.7% (237.64 m^3). Most of the logs were classified as butt ones (Ko; 106.49 m^3), then logs from the middle of the stem (Ks; 73.45 m^3). Top-part logs accounted for 23.4% (57.70 m^3), while undersized logs from the apical part of the stem – 3.7% (9.07 m^3). Volume of the medium-sized timber (1.71 m^3), originating in the top parts of stems accounted for only 0.7% of total volume. Analysing logs volume in diameter classes one can note that, compared to the share of longwood timber, share of 1st class has increased up to 13.2% (more than 23 m^3) while in case of the most valuable 3rd class the amount rose to 56.0% (an increase by almost 50 m^3). This increase took place at the cost of 2nd diameter class by more than 82 m^3.

Volume of CTL timber determined according to the traditional method was in comparison with the longwood timber volume higher by 3.3% and amounted to 267.28 m^3. Also the volume structure in diameter classes was more favourable comparing to the volume of logs determined basing on the diameter in the thinner end. Total volume of CTL timber was higher by 7.6%, while in case of the share of 3rd thickness class it was almost 14% (about 20 m^3). This difference results probably from the diameter measurements. The diameter of the thinner end was determined by single measurement of the smallest diameter that was rounded down, while the mid-length diameter was measured twice, averaged and then rounded.

Value of the analysed long-wood/bole timber equalled 60 615.31 zl in total. LCT logging, depending on the method of diameter measuring and volume determination, increased timber value by 6.5-14.9% (Table 3). The highest increase in value, as expected, was observed in the 3rd thickness class. Similar results were presented by Tarkowska [2011].

Table 3. Value of longwood timber and after CTL logging
Tabela 3. Zestawienie wartości drewna dłużycowego oraz po składowaniu

KJW	I	II	III	Total – Razem	
		zł			%
Longwood timber (Dd)					
Drewno dłużycowe (Dd)					
WA0	*	5 356.78	16 617.37	21 974.15	36.3
WB0	680.95	15 835.31	2 753.49	19 269.75	31.8
WC0	974.31	12 723.17	5 673.93	19 371.41	32.0
Total – Razem	1 655.26	33 915.26	25 044.79	60 615.31	100.0
%	2.7	56.0	41.3	100.0	
CTL logged timber (volume according to diameter in thinner end)					
Drewno kłodowane (miąższość według D_{ck})					
Ko	*	2 795.32	34 724.57	37 519.89	58.1
Ks	125.90	6 368.65	8 439.36	14 933.91	23.1
Kw	3 555.54	6 020.12	813.38	10 389.05	16.1
Total, K = 6 m Razem, K = 6 m	3 681.45	15 184.09	43 977.31	62 842.85	97.4
Kw > 6 m	1 266.99	213.30		1 480.30	2.3
S2	209.27			209.27	0.3
Total – Razem	5 157.71	15 397.39	43 977.31	64 532.41	100.0
%	8.0	23.9	68.1	100.0	
Dd = 100%	311.6	45.4	175.6	106.5	
CTL logged timber (volume according to diameter in half of the length)					
Drewno kłodowane (miąższość według $D_{L/2}$)					
Ko	*	2 314.11	37 545.15	39 859.26	57.2
Ks	116.34	5 604.94	10 391.04	16 112.33	23.1
Kw	3 182.62	7 484.69	1 347.03	12 014.33	17.2
Total, K = 6 m Razem, K = 6 m	3 298.96	15 403.74	49 283.22	67 985.92	97.6
Kw > 6	1 266.99	213.30		1 480.30	2.1
S2	209.27			209.27	0.3
Total – Razem	4 775.22	15 617.04	49 283.22	69 675.49	100.0
%	6.9	22.4	70.7	100.0	*
Dd = 100%	288.5	46.0	196.8	114.9	*
Dck = 100%	92.6	101.4	112.1	108.0	*

Source: own calculations
Źródło: obliczenia własne.

SUMMARY AND CONCLUSIONS

Performed studies did not confirm fears of the timber buyers that CTL logging causes a significant increase in the timber volume. Volume of the logs determined on the basis adopted in the State Forests proved to be even lower by 4.0%. Taking into account the fact that the value of CTL timber is higher than that of longwood timber, one should consider promoting it among potential buyers. In author's opinion CTL logging carries only advantages, both for forests and consumers, which should be commonly known. Technology of timber production in CTL logging is environmentally friendly. Timber is skidded by overshot tractors the most often, which according to many authors is not only more efficient, but also less harmful to the environment. If harvest works are performed with multioperational machines (harvesters), the positive impact is even higher. When machines harvest timber, it can also be manufactured according to the specific needs of the recipient.

The performed studies allow to draw the following conclusions:

– CTL logging of longwood timber reduced the total volume of manufactured timber.
– Value of CTL logged timber was higher compared to timber manufactured in the form of boles.
– Research should be conducted on how to measure and determine the volume of CTL timber.
– Obtained results cannot be applied to all stands, as the Mazurian forests have their own characteristics and transfer of this study outputs into the entire forests requires more extensive investigation.

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**EFEKTYWNOŚĆ KŁODOWANIA
SOSNOWEGO DREWNA DŁUŻYCOWEGO**

Streszczenie. W ostatnim dwudziestoleciu pozyskanie drewna w Polsce wzrosło prawie dwukrotnie, jednocześnie w niektórych regionach kraju daje się zauważyć zmniejszenie chętnych do pracy w lasach. W tej sytuacji w pracach pozyskaniowo-zrywkowych coraz częściej są wykorzystywane maszyny wielooperacyjne (harwestery i forwardery). Pracują one przede wszystkim w systemie drewna krótkiego (short wood system), w którym z odziomkowych części drzew wyrabia się drewno wielko- i średniowymiarowe w postaci kłód, a z części wierzchołkowej – w postaci wyrzynków. Nabywcy niezbyt chętnie kupują drewno kłodowane ze względu na powszechne przekonanie, że drewno wyrobione w postaci kłód ma większą miąższość w porównaniu z drewnem dłużycowym. W artykule przedstawiono wstępne wyniki badań nad kłodowaniem wielkowymiarowego sosnowego drewna dłużycowego. Porównano miąższość oraz wartość drewna wyrobionego w postaci dłużyc oraz po jego składowaniu. Badania prowadzono w Leśnym Kompleksie Promocyjnym Lasy Mazurskie. Analiza wykazała, że miąższość drewna po składowaniu jest zazwyczaj mniejsza w porównaniu z drewnem dłużycowym o kilka procent, natomiast wartość większa o kilkanaście procent.

Słowa kluczowe: kłodowanie, drewno dłużycowe