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EXPLOTATION OPPORTUNITY FOR WOODEN MASS BY MULTIFUNCTIONAL MACHINERY

Madălina COVRIG (PRESECAN)[1], Ilie COVRIG[2], Camelia OROIAN[2]

[1]University of Transilvanya of Brasov, 1 Sirul Beethoven Street, 500123, Brasov, Romania
[2]University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, 3-5 Manastur Street, 400372, Cluj-Napoca, Romania

Corresponding author email: ilie_covrig@yahoo.com

Abstract

The aim of this paper was to highlight the economic and productive efficiency of the use of modern woodworking machine systems, as well as the motivation for the extension of these systems, compared to classical systems. In order to achieve these desideratums, an object of study was chosen, an exploitation parquet within the activity was made the design of the works of exploitation of the wood mass, using the proposed system. The use of Harvester and Forwarder multifunctional machines, in addition to the opportunity to make definitive assortments in the exploitation floor and a clear record of the resulting quantity, considerably reduces the damages caused to the existing natural regenerations and avoids the destruction of the exploitation roads and the damage exploitation.

Key words*: economic efficiency, modern machines, harvester, forwarder, operating technology.*

INTRODUCTION

The exploitation of forests is defined as the set of activities through which the timber is extracted and valued, in order to ensure optimal conditions for development and regeneration of trees and to meet the requirements of society (Ciubotaru, 2007).

The notion of forest exploitation is defined, in fact, as the two sides of the activities specific to the enhancement of wood masses: the transformation of trees marked with parts with certain characteristics and their transfer to places accessible to users. This activity can be defined in two ways, namely: the productive side - by the structure and characteristics of the production process; the scientific side - the theoretical knowledge that regulates the development of this process.

As a production process, the exploitation of wood is an integral part of the forest production process and involves the transformation of the woody part of the trees into assortments of raw or semi-finished wood and their transport for delivery or further processing (Covrig, 2013).

When choosing the means of collecting wood, it must be taken into account that the forests in our country are located largely in the mountainous area with rugged, fragile and steep slopes, where environmental factors must be maintained within the normal limits. (Ionascu, 2012)

It is well known that cable installations, efficient and non-polluting, are the most suitable for wood collection, and yet it seems that the most appropriate operating solution is related to the use of multifunctional machines and equipment or processors. By using them, very good technical-economic results are obtained regarding: the capitalization and superior sorting of wood, labor productivity and production costs (Covrig et al., 2018).

The multifunctional wood harvesting machines involve a complex system consisting of two components: multifunctional vehicles for felling / cleaning and sectioning (harvesters), which have all the necessary functions for the application of the mechanized system of harvesting the wood mass, respectively the final assortments to "Cut - To - Length" (CTL) and specialized tractors for the approach of wood by carrying (forwarder), with which they work in tandem within the same method of exploitation. (Borz et al., 2012)

MATERIALS AND METHODS

This research was carried out within the exploitation prosecutor's office no. 958, Valea Cutii located within the basic unit I Ulmoasa,

administered by the Municipal Forest District Baia Mare, Maramureș County.
The basic unit I Ulmoasa, with an area of 1815 ha, is located in the northern part of the country, in the land of the Eastern Carpathians, in the foothills of the Northern Volcanic Mountains, Igniș Mountains district, within the Oaș-Gutîi-Țibleș mountain range, near the municipality Baia Mare and includes the hydrographic basin of the Băița valley.
The forest fund that makes up the basic unit consists of two large forest bodies, namely the Hotaru-Ulmoasa body, with an area of 1574.5 ha representing 86.7% and the Căpitanu Mare body, with an area of 240.5 ha representing 13.3%.
The area under study (Figure 1) is located within the Hotaru-Ulmoasa forest body, Hotaru basin, and from an administrative point of view within the I Ulmoasa district, Bagnău canton.

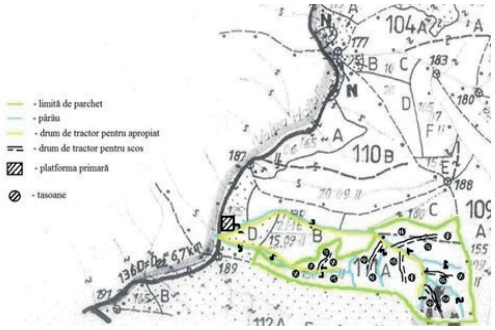

Figure 1. Sketch of the Valea Cutii parcel, item 958

Establishing the operating method
Following the analysis of the physical-geographical factors, the characteristics of the forestry technique applied in the studied prosecutor's office, respectively of the technical-economic factors that characterize the 958 Valea Cutii parquet, was chosen as the optimal exploitation method, the treatment of progressive cuttings is applied, and the volume of the average shaft is large, 1.64 m^3.
The system of cars, classics that were adopted for the operation of the 958 Valea Cutii parquet, consists of:
- for downing: Stihl type chainsaw, model MS 660;
- collected by: T.A.F. model 690 PE, produced by IRUM Reghin.

The system of modern machines used in the exploitation of the wood from the 958 Valea Cutii parquet were the John Deere harvester model 1270-D, with which the harvesting operation was performed and the John Deere forwarder model 1410D, with which the whole collection process is executed.
Harvester machines are from the latest generation. They perform without intermediate handling, the other operation, respectively the felling of the tree, the cleaning of the bar and the sectioning. Another major advantage of using this machine is the simpler organization of the work, the investment is less than the purchase of machines to carry out these operations separately, reducing the number of workers required to serve these machines.
Forward-type machines are used in the process of collecting wood, usually with harvester-type machines. These tractors are equipped with a semi-trailer and a hydraulic arm with a gripper, this feature allows the movement of the fully suspended wooden masses.
For the choice of the technological variant of exploitation, the most important is the volume of the average tree mentioned above and the volume per hectare which is 30.92 m3. In addition, the direct slope of the land, which in the studied situation is 33G and the collection distance, has a direct influence.

RESULTS AND DISCUSSIONS

Economic analysis of operating efficiency
As the design of the operating works was carried out in two variants, it is possible to evaluate the productivity, respectively the economic profitability for the classic machine systems and for the modern machine systems. The following tables (Tables 1-4) show in antithesis the total costs and fuel consumption that were calculated for the two variants.
The use of the classic car system results in a total cost of 18.38% higher than in the case of modern car systems. This difference is mainly due to the cost of fuel and lubricants, the cost of human resources and the cost of materials needed to carry out the work of operating the parquet. The analysis of the cost structure showed that in the case of operation using modern systems and machines, the value of fuel and lubricants is 22.34% lower than in the

case of the technological process using classic systems and machines, representing 24.16% of the total.

The value of labor in both classic and modern systems has the highest share of total costs, being 36.4% for classic car systems and 32.79% for modern car systems, mainly due to the reduction in the number of required working hours. Within the modern operating system, the total time required is 42.86% lower than the classic operating system. The time difference can be explained by the automation of operations related to the technological process of collection and the technological process of the primary platform. Expenditure on materials required for the operation of the flooring operations represents 2.21% of the total expenses and 2.67% of the total I for the modern car system, while the same category of expenses represents 2.44% of the total expenses and 2 , 93% of the total I for the classic car system. As it was found, the largest share in total expenditures I is represented by human resources expenditures, followed by those with fuels and lubricants. These types of expenses are higher in the case of the technological process that uses classic car systems, due to the higher fuel consumption, performance and lower automation.

The value of the categories of expenses mentioned above directly and totally influences II, these representing the share of total I, and implicitly also the sales expenses which are 21.42% lower in the case of the modern operating system compared to the classic operating system.

Table 1. Analysis of fuel requirements in the two operating variants

The need for fuels and lubricants in the technological process using modern machine systems			The need for fuels and lubricants in the technological process using traditional machine systems		
Combustible	Required quantity (l)	Value (ron)	Combustible	Required quantity (l)	Value (ron)
Gasoline	4.18	24.42	Gasoline	112.23	655.43
Diesel	1715	9689.54	Diesel	1888	10667.2
Lubrificants		613.28	Lubrificants		1976.50
Total fuel and lubrificants		10327.24	10327.24		13299.13

Table 2. Expenditure analysis in the two operating variants

No	Modern machine systems	Value (ron)	No	Traditional machine systems	Value (ron)
1	The value of labor in the technological process	14016.90	1	The value of labor in the technological process	19060.19
2	Required fuels and lubricants	10327.24	2	Required fuels and lubricants	13299.13
3	Expenditure required for other activities required for the preparation and conduct of operations	9745.7	3	Expenditure required for other activities required for the preparation and conduct of operations	9745.7
4	Expenses for arranging the primary platform	244.77	4	Expenses for arranging the primary platform	244.77
5	Expenditure on materials required for the operation of the parquet operation	945.12	5	Expenditure on materials required for the operation of the parquet operation	1279.32
TOTAL I		35279.73	TOTAL I		43629.11
6	Own equipment repair costs (7% of Total I)	2053.29	6	Own equipment repair costs (7% of Total I)	2613.5
7	Other expenditure (6% of Total I)	1759.96	7	Other expenditure (6% of Total I)	2240.13
TOTAL II		3813.25	TOTAL II		4853.63
8	Sales and sales expenses (3% of Total II)	114.4	8	Sales and sales expenses (3% of Total II)	145.60
9	Profit (10% of Totalul I)	2933.28	9	Profit (10% of Totalul I)	3733.56
OVERALL TOTAL (RON)		42735.28	OVERALL TOTAL (RON)		52361.90
Total (ron/m^3)		55.29	Total (ron/m^3)		67.74

Table 3. The structure of the technological process of exploitation of the wood mass from the Valea Cutii parquet using modern machine systems

The trial Technological	Operations - phases	Symbol of the norm	Group of species	U. M.	Volume mc	Average distance (m)	N.T. ore/mc	Time required
A. Processes technological harvesting	1. Felling, sectioning, shaping, sorting with harvester John Deere 1270 D	-	Hardwood	mc	773	-	0.17	129.37
	2. STIHL MS 660 chainsaw cleaner	D64B11	Hardwood	mc	41	-	0.27	11.07
B. The technological process of collection	1. Assembled, removed, approached with forwarder John Deere 1410 D	-	Hardwood	mc	757.4	1150	0.24	178.98
C. The primary platform technological process	1. Manually stacked timber	J.20	Hardwood	mst	96	10	0.40	38.4
	2. Expedition of wood ster	-	Hardwood	mst	96	-	0.020	1.92
D. The technological process of transport	1. Ready for loaded rot wood	J.22.b.I.	Hardwood	mc	727.5	-	0.21	150.52
	2. Loaded round wood with winches mounted on vehicles	-	Hardwood	mc	727.5	-	0.13	93.18
	3. Manually loaded wood of steri	-	Hardwood	mst	96	10	0.21	20.16
Cleaning the floor of non-recoverable waste		J.6.II.B.	Hardwood	ha	25	-	21.05	526.25
Total time background								1.149.85

Table 4. Structure of the technological process of exploitation of the wood mass from the Valea Cutii parquet using classic machine systems

The trial Technological	Phase operations	The symbol of the norm	Group of species	U. M.	Volume mc	Average distance (m)	N.T. hours/mc	Time required
A. Processes technological harvesting	1. Down with STIHL MS 660 chainsaw	D65A11	Hardwood	mc	773	-	0.24	185.52
	2. Cleaning the legs with the STIHL MS 660 chainsaw	D64B11	Hardwood	mc	41	-	0.27	11.07
	3. Sectioned with STIHL MS 660 chainsaw	D64C11	Hardwood	mc	732	-	0.15	109.8
B. The technological process of collection	Gathered wood with winch mounted on TAF 690 PE	-	Hardwood	mc	757.4	50	0.20	151.48
	1. Forming and tying the load for the loved one with TAF 690 PE	J.7	Hardwood	mc	757.4	-	0.06	45.44
	2. Unloading the load from TAF in the primary platform	J.7	Hardwood	mc	757.4	-	0.024	18.17
	3. Close by semi-grinding wood material with TAF 690 PE	J.8.XIV	Hardwood	mc	757.4	2050	0.31	234.79
	4. Hand-picked small pieces of wood	-	Hardwood	mst	96	100	1.77	169.92
C. The primary platform technological process	1. Receiving, sorting, shipping roundwood	J.11	Hardwood	mc	727.5	-	0.08	58.2
	2. Handled round wood with tractor	J.21.III.b	Hardwood	mc	727.5	20	0.21	152.77
	3. Mechanically shaped sterry wood	-	Hardwood	mst	96	-	0.43	41.28
	4. Manually stacked timber	J.20	Hardwood	mst	96	10	0.40	38.4
	5. Expedition timber shipment	-	Hardwood	mst	96	-	0.020	1.92
D. The technological process of transport	1. Ready for Loaded rot wood	J.22.b.I.	Hardwood	mc	727.5	-	0.21	152.77
	2. Loaded round wood with winches mounted on Vehicles	-	Hardwood	mc	727,5	-	0.13	94.57
	3. Manually loaded wood of steri	-	Hardwood	mst	96	10	0.21	20.16
Cleaning the floor of unusable waste		J.6.II.B.	Hardwood	ha	25	-	21.05	526.25
Total time background								2.012.51

CONCLUSIONS

After a comparative analysis of the efficiency and productivity of the timber exploitation from item 958 Valea Cutii, UBI Ulmoasa, using classic and modern machine systems, the following can be concluded: small in the case of using multifunctional machines, the difference between the two technologies adopted being 44%.

From the point of view of labor, the use of harvester and forwader requires lower costs, the difference being 37% smaller than in the case of operation with classic car systems.

There is an appreciably higher efficiency of fuel consumption by modern cars, the difference between the two variants being approx. 18%.
The labor force is also lower in the case of using modern machine systems by 34%, modern technology requiring the operation of equipment only by a single operator.
By using harvester and forwarder machines, some machines are removed from the structure of the technological process, because modern machines are designed to perform a multitude of operations, being able to take the place of other machines.
The reduction in the number of machines implicitly leads to a reduction in the amount of fuel needed to carry out the operation process, as well as to a reduction in the need for labor.
The arrangement of the tractor roads and the primary platform does not imply a difference in cost for the two studied variants, because the collection routes are unchanged and the dimensioning of the primary platform is done according to the volume of wood to be exploited.
The value of the materials necessary for the good development of the exploitation works is higher in the case of the solution that proposes the use of the classic machines, by approximately 30%.
The difference in costs per m3 between the two variants is 18% higher in the case of adopting the classic car system.
The total cost of the operating works, which includes the achievable profit, presents a difference between the two variants for which the design of the works was made, the use of classic machine systems being more expensive than the use of modern machine systems;

RECOMMENDATION

It is recommended to extend the use of multifunctional machines wherever possible, for the exploitation of wood, due to lower costs, increased productivity, the time required to operate a parquet being considerably reduced, so the effect on soil and stress caused to wildlife is limited to a short time.
By using the harvester and the forwarder, most operations are performed in the parquet, their quality being higher as in the case of classic car systems. Because forwarder collection involves transporting the roundwood on trailers and not semi-crawling as in the case of TAF collection, the pieces of wood remain clean without any traces of mud or even pebbles on the ridge, which can later influence the process. log processing.
For the expansion of modern machinery in the exploitation sector, it is necessary to make the forest fund as accessible as possible by building forest roads and permanent collection routes that can be used later for cultural or protection purposes.

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