OPPORTUNITY TO USE SMALL FOREST TRACTORS AT SKIDDING IN THINNED STANDS IN ROMANIA

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INTRODUCTION

- *From thinned stands could results important quantities of wood which can remain un – harvested because of difficult skidding conditions and of lower return. Till present days, in Romania, the yarding operation in thinned stands was realized mostly using un – mechanized equipments, respectively animals. The usage of animals at wood yarding make a fragmentation of technological lines, fact that reduce the productivity and increase the time in which are made the tending operations (thinnings). In the paper is analyzed the opportunity to use the small forest tractor FORESTER TD, which is now in prototype stage, in yarding operations.*

- FORESTER TD small tractor (Fig.1) is an adapted Romanian model based on technical features taken from models FORCAT 2000 and FORCAT 36D. In the present conditions it is in prototype stage and has been tested in logging works in different variety of the skidding process, in stands where the predominant species group is represented by deciduous, coniferous or mixtures of these. After cuttings, secondary products (thinnings), main products or incidental products could result. To work as forwarder, FORESTER TD can be equipped with different types of trailers, with different overall characteristics (Fig.2)

Fig.1. FORESTER TD small tractor

Fig.2 BERFOR Trailers for using the tractor as forwarder

Table 1. Factors of influences - quantification

Studied factors	Measurement unit	Observation – determination method	Comments
Group of Species	-	Observation	Beech
Movement Distance	m	Determining the length of the winch cable. Determining the real movement distance during "first skidding – forwarding"	The winch cable was marked in meter. Distances for "first skidding" – forwarding were determined by positioning technique
Volume	m^3	Volume determination	Using records cards with dimensional characteristics of logs
Time	Hours	Timing	Timing with electronic timer with possibility to interrupt the countdown
Volume of the average tree	m^3/tree	Forest management register	For thinning, the volume was established during forest inventory

Table 2. Average recorded times for yarding operation in relation with distances, declivity and volume of average tree

Operation	Declivity [%]	Yarding distance [m]	Volume of average tree		
			<0.1 m^3/tree	0.1...0,3 m^3	0.3...0.5 m^3
Yarding	< 10%	< 20	0.15	0.08	0.07
		20 - 40	0.19	0.10	0.09
	10 – 20%	< 20	0.16	0.09	0.08
		20 - 40	0.20	0.11	0.10
	20 -40%	< 20	0.17	0.10	0.09
		20 - 40	0.21	0.12	0.11
	Average	**< 20**	**0.16**	**0.09**	**0.08**
		20 - 40	**0.20**	**0.11**	**0.10**

Figure 3. Distribution of average of recorded times for yarding in relation with the influence factors

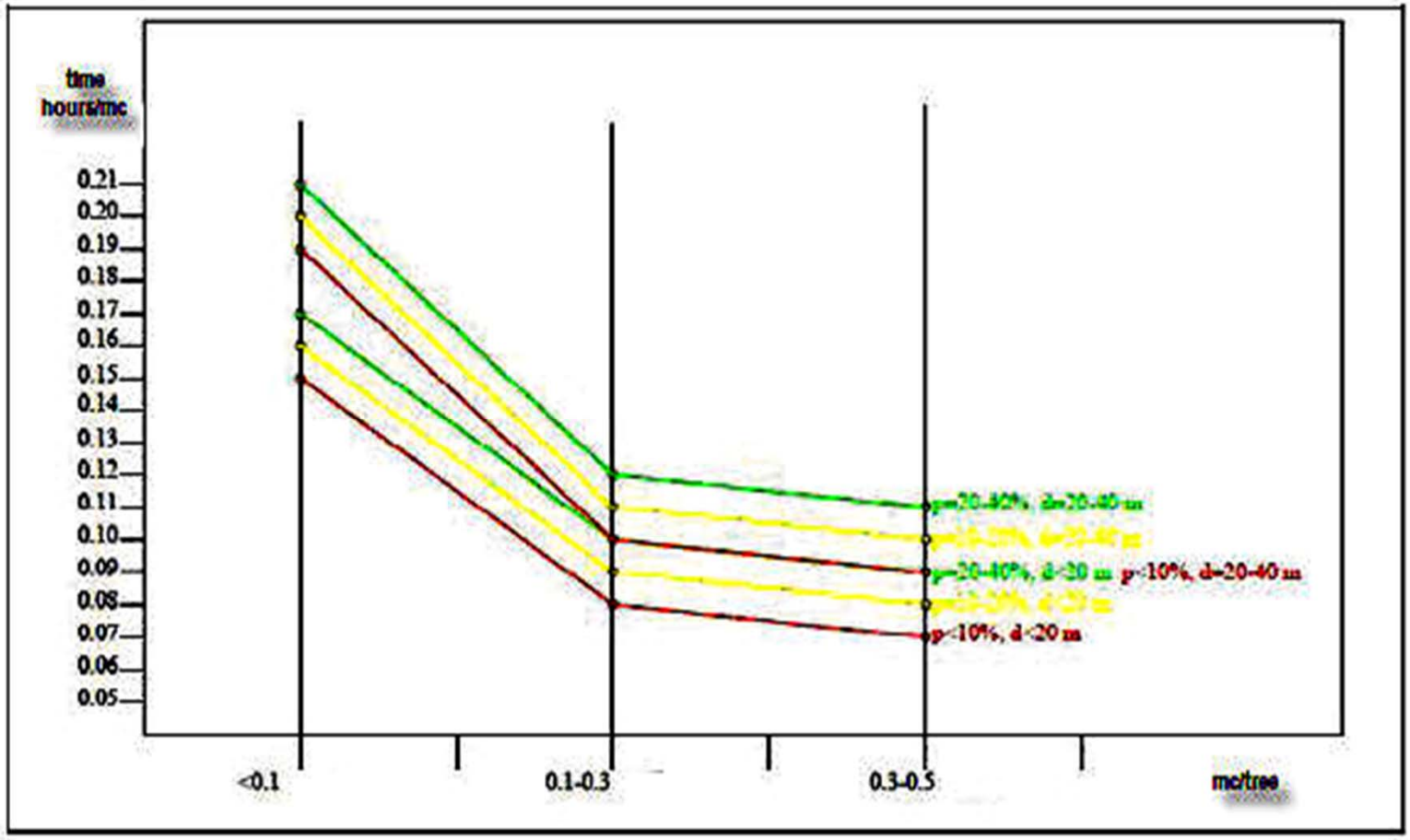

Figure 4. Average times for yarding distances (blue – experimental curve; black – theoretical curve)

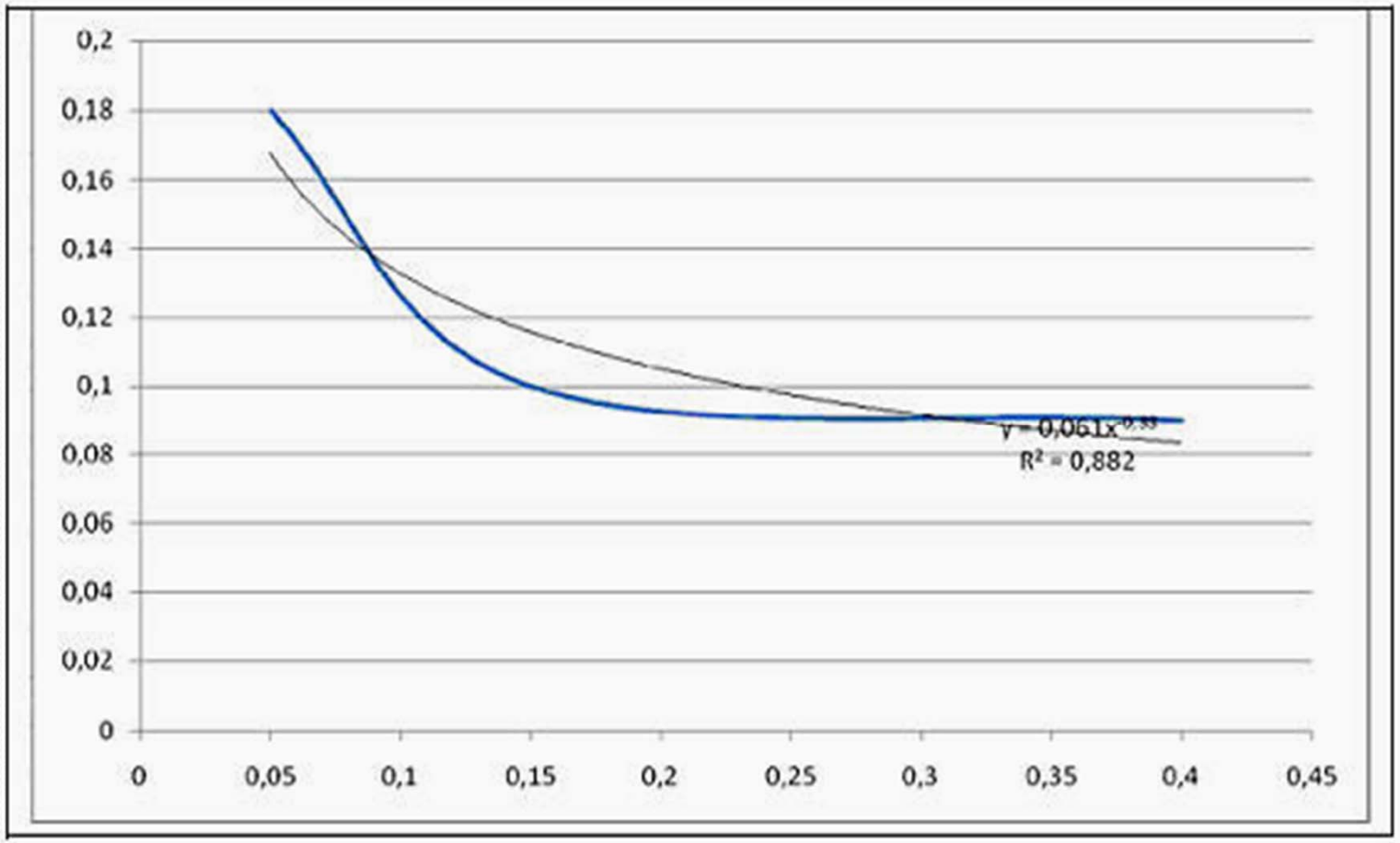

Table 2. Productivities at yarding for FORESTER TD

Productivities and times for average conditions										
Volume of average tree [m^3/tree]	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
Times [hours/m^3]	0.16	0.13	0.11	0.10	0.10	0.09	0.09	0.08	0.08	0.08
Efficiency [m^3/hour]	6.10	7.67	8.77	9.64	10.38	11.02	11.59	12.12	12.60	13.04
Productivity [m^3/8 hours – mean]	48.80	61.34	70.12	77.11	83.00	88.15	92.75	96.63	100.77	104.33
Productivity per workers [m^3/8 hours – worker]	16.27	20.45	23.37	25.70	27.67	29.38	30.92	32.31	33.59	34.78

Conclusions

- Due to its small size, FORESTER TD can penetrate easily through corridors that exist between trees and does not require specially designed tracks (made by earthmoving works). Only in special cases, when the declivities are very high are required some summary embankment works to achieve a relative horizontal platforms to keep the tractor stability.
- Fuel consumption in a thinning stand for 100 – 120m for forwarding, in 5.5 effective working hour, 26 m3 harvested, was 17 liter, approximately 3.1 l/hour and 0.65 l/m3.
- The number of collected trees is different in rapport with their position on stand and with the volume of each piece. During the research, sometimes till 10 pieces compose a load (0,05 – 0,07 m3/tree).
- The tractor has good results for distances for "first skidding" and forwarding till 500m. Productivity decrease as the forwarding distance increase.
- The slope declivity for FORESTER TD should be as small as possible. Even if this tractor could rich more than 350, the declivities should be as small is possible.
- For the roadside lending, FORESTER TD is very useful because it can do very easy the wood handling and loading.