MECHANIZATION POSSIBILITIES OF THINNING WORKS IN STANDS OF RESINOUSES

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Abstract
Realization of improvement cutting represents an important instrument to obtain valuable stands with high ecosystem stability. Optimization of the application of the silvotechnics interventions it is an desideratum for the forest management, which considers the current and the future possibilities of modern technology. Therefore, the use of logistics performance, the moto - tools and motorized chain saws represents the practical modality of problem solving. A particular problem in the mechanization of improvement cutting in the resinous stands is to establish and respectively choosing of the available technologies in correlation with fitoclimatic storey and vegetation conditions, aspect which considerable influences the obtaining of higher efficiency. Establishing the technical condition due to mechanization of thinning in pure stands of spruce requires the realization of the experimental studies with applicative character to establish with precision the fuel and lubricant consumption and actual working time related process technology proposed.

Key words: improvement cutting, resinous stands, technology, moto - tools, motorized chain saw, fuel consumption, lubricant consumption, work time.

INTRODUCTION

Thinning are repeatedly executed works of pole forest, young timber stage and mature timber stage and which is preoccupied by the individual tending of trees, in order to more actively contribute to raising the productive and protective value of cultivated forest. (Florescu I., Norocel V.,1998). They represents an intervention system that is executable beginning from the time of the forest transition in pole forest and until the appropriation term exploitation (in our silviculture, through the recommendations of the technical norms in force, such interventions must be stopped, usually after running two thirds of exploitability stand age), (xxx, l986).

Thinning are considered generally positive individual selection works, the basic concern is focused on valuable trees that remain in stand until the exploitation term and not on those extracted through intervention. In this way, valuable copies are times ensure optimal condition growth and development, detrimental and repeated the extraction of less value, which it would interfere in any way, and which are extracted (Florescu I., Norocel V., 1998).

MATERIAL AND METHODS

The case study was realize in the base unit (U.B.) V Mărgău u.a. 13 C, from the Forest District Mărgău RA - Fig. 1 , a stand of Norway spruce (Picea abies) in the age of 40 years, an average slope of 200 on an area of 2.2 ha - Fig.2.

The work thinning was realize with the motorized chain saw STIHL MS-180, using the full method for determining the fuel and lubricant consumption.

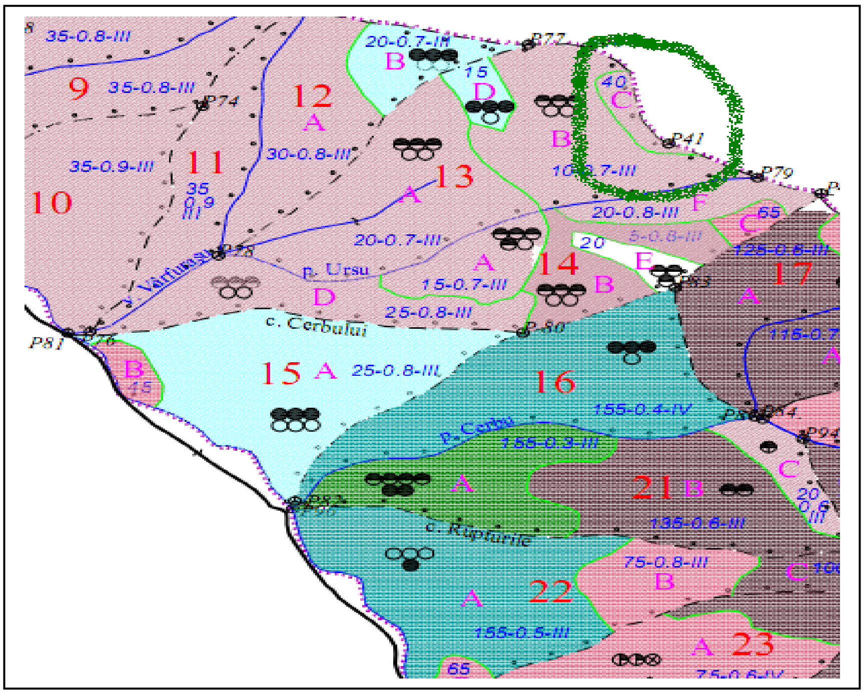

Fig. 1. Location sketch of the stand in u.a. 13C which will be runned with improvement cutting (thinning) in the case study

Table 1

Data concerning the stand from the u.a. 13C where was realised the case study

Forest District Măgura R.A. – U.B. V Mărgău						
u.a.	**S(ha)**	**T(years)**	**CLP**	**K**	**Composition**	**Slope**
0	***1***	***2***	***3***	***4***	***5***	***6***
0	1	2	3	4	5	6
13C	2.2	40	II	1.0	10Mo	20^g

Diameter copies which were extracted was measured at the collar level with a graduated millimeter tape.

Fig. 2. Stand from the u.a. 13 C were is realized case study

Fig. 3. Value trees from the spruce specie of the studied stand

The analysis of land data and respectively the images of Fig. 2 and 3 it is observed that stand in the u.a. 13C present a high density, being timely applying a moderate intensity thinning.

The images in Fig. 4 are presented the manner of determining the stump elements related extracted copies.

Extracted trees were inventoried and marked with the marking hammer round by the technical staff of land, which has the attribute of service this activity.

a) Measuring the diameter of stump b)Measuring the height of stump

Fig. 4. Verifying the stump elements for the extracted trees for the thinning application

RESULTS AND DISCUSSION

After applying the thinning in the stand u.a. 13C was extracted a total of 311 trees from the spruce specie – Tab.2.number distribution of trees in diameter categories is presented in the histogram in Fig. 5.

Table 2

Number of extracted trees by the motorized chain saw STIHL MS 180

No.	Specie extracted	Diameter extracted trees (cm)	Number extracted trees
0	***1***	***2***	***3***
1	Spruce	8	2
2	Spruce	10	91
3	Spruce	12	134
4	Spruce	14	68
5	Spruce	16	13
6	Spruce	18	3
Total			**311**

The analysis of data from Tab. 2 and the histogram in Fig. 5 observed that the percentages of extracted trees are from the category of 12 cm in diameter.

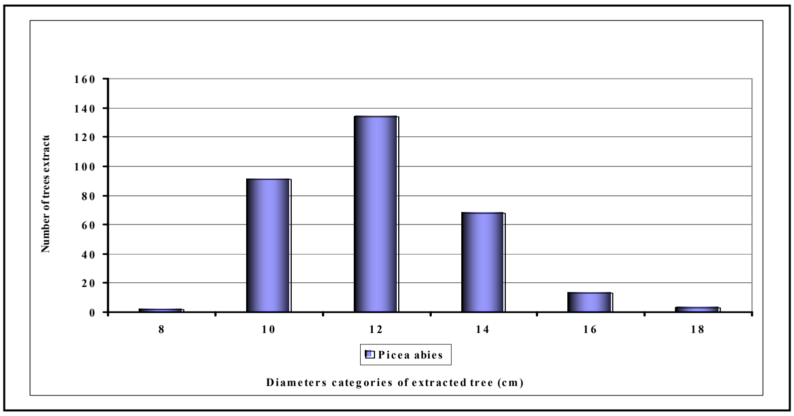

Fig. 5. Distribution of tree number on diameter category of spruce specie in the operation of thinning realized in the stand of u.a. 13C.

In Tab. 3 are presented data on the diameter correlation respectively the area cut section of extracted trees with a trim out time (felling).

Table 3

Inventory data regarding to the correlation of diameter and respectively the area cut section of trees extracted with a trim out time (felling) in the stand from u.a. 13C

No.	Specie	Category diameter of cut sections (cm)	Cut section area (mp)	Trim out time / category section diameter (hour)	Number of extracted trees (pieces)	Trim out time /number of extracted trees (hour)
0	***1***	***2***	***3***	***4***	***5***	***7***
1	Mo	8	0.005	00.0014	1	00.0014
2	Mo	9	0.006	00.0016	2	00.0032
3	Mo	10	0.008	00.0017	38	00.0646
4	Mo	11	0.010	00.0019	57	00.1083
5	Mo	12	0.011	00.0021	90	00.1890
6	Mo	13	0.013	00.0022	42	00.0924
7	Mo	14	0.015	00.0024	56	00.1344
8	Mo	15	0.018	00.0026	11	00.0286
9	Mo	16	0.020	00.0028	9	00.0252
10	Mo	17	0.023	00.0029	2	00.0058
11	Mo	18	0.025	00.0031	3	00.0133
Total					**311**	**01.4958**

The analysis diagram of Fig. 6 it is observed the existence of a direct correlation between the diameters of the cutting copy and respectively trim out time, aspect which is underscored by the regression equation and the determination coefficient related.

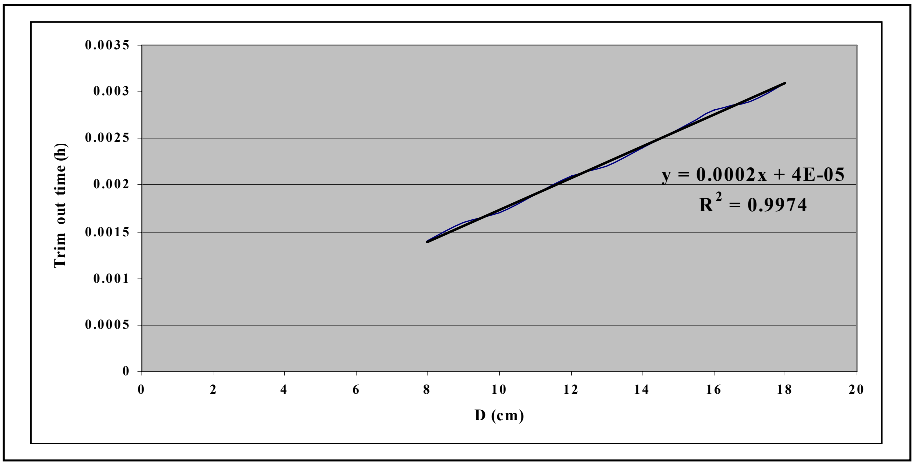

Fig. 6. Correlation trim out time (h) with sections cut diameter (cm) and the regression equation related to thinning work performed in the stand of u.a. 13C

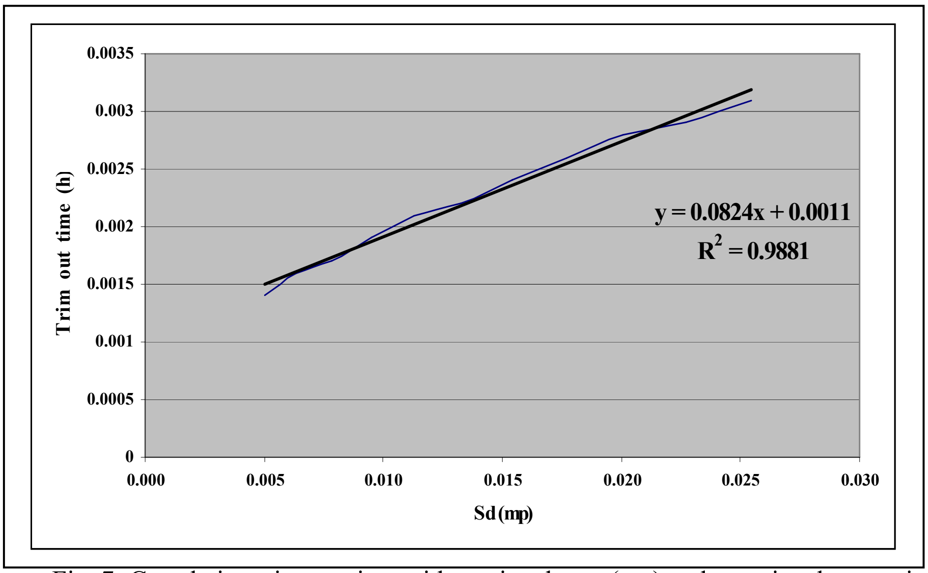

Fig. 7. Correlation trim out time with sectional area (mp) and associated regression equation for thinning work realized in the stand of u.a. 13 C

The analysis diagram of Fig. 7 observed a close correlation between the cut section area and respectively the trim out time aspect which is evident by the regression equation and by the determination coefficient related.

Fuel consumption for the section process of the extracted trees by the categories of diameter and respectively in order to the cut section area is presented in the Tab. 3.

Table 4

Fuel consumption for the categories of diameter and cut sectional area for the extracted trees in the stand from u.a. 13C

No.	Diameter of extracted trees (cm)	Sectional cutting area (mp)	Fuel consumption/ Cut section diametres (litres/cm)	Number of extracted (pieces)	Total consumption/ diameter cut section (litres/cm)
0	***1***	***2***	***3***	***4***	***5***
1	8.0	0.011	0.011	1	0.011
2	9.0	0.012	0.012	1	0.012
3	9.4	0.013	0.013	1	0.013
4	9.6	0.013	0.013	1	0.013
5	9.8	0.013	0.013	1	0.013
6	10.0	0.014	0.014	1	0.014
7	10.1	0.014	0.014	30	0.411
8	10.2	0.014	0.014	4	0.055
9	10.4	0.014	0.014	1	0.014
10	10.5	0.014	0.014	1	0.014
11	10.6	0.014	0.014	12	0.173
12	10.7	0.015	0.015	4	0.058
13	10.8	0.015	0.015	3	0.044
14	10.9	0.015	0.015	1	0.015
15	11.0	0.015	0.015	2	0.030
16	11.1	0.015	0.015	30	0.452
17	11.3	0.015	0.015	1	0.015
18	11.4	0.015	0.015	2	0.031
19	11.5	0.016	0.016	2	0.031
20	11.6	0.016	0.016	8	0.126
21	11.7	0.016	0.016	4	0.064
22	11.8	0.016	0.016	2	0.032
23	12.0	0.016	0.016	1	0.016
24	12.1	0.016	0.016	59	0.969
25	12.2	0.017	0.017	6	0.099
26	12.3	0.017	0.017	4	0.067
27	12.4	0.017	0.017	2	0.034
28	12.5	0.017	0.017	4	0.068
29	12.6	0.017	0.017	15	0.256
30	12.7	0.017	0.017	5	0.086
31	12.8	0.017	0.017	6	0.104
32	13.0	0.018	0.018	2	0.035
33	13.1	0.018	0.018	11	0.196
34	13.3	0.018	0.018	2	0.036
35	13.5	0.018	0.018	1	0.018
36	13.8	0.019	0.019	3	0.056
37	14.0	0.019	0.019	1	0.019
38	14.1	0.019	0.019	44	0.842
39	14.2	0.019	0.019	5	0.096
40	14.3	0.019	0.019	1	0.019
41	14.5	0.020	0.020	2	0.039
42	14.6	0.020	0.020	2	0.040
43	14.7	0.020	0.020	4	0.080
44	14.8	0.020	0.020	1	0.020
45	15.3	0.021	0.021	2	0.042
46	15.4	0.021	0.021	1	0.021
47	16.0	0.022	0.022	1	0.022
48	16.1	0.022	0.022	5	0.109
49	16.2	0.022	0.022	1	0.022
50	16.3	0.022	0.022	2	0.044
51	16.5	0.022	0.022	1	0.022
52	16.7	0.023	0.023	1	0.023
53	18.0	0.024	0.024	1	0.024
54	18.1	0.025	0.025	2	0.049
Total				**311**	**5.21566**

In the process of sectioning of the 311 trees which were extracted when the thinning application in the stand from the u.a. 13C has been noted a fuel consumption of approx. 5.2157 l.

Analyzing data from the Tab. 4 and 4.1. and respectively diagrams in Fig. 8 and 9 is observed that there is a close correlation between fuel consumption and diameter category and / or cut sectional area for extracted trees.

This aspect is supported by the constructed regression equations and respectively by related coefficients of determination.

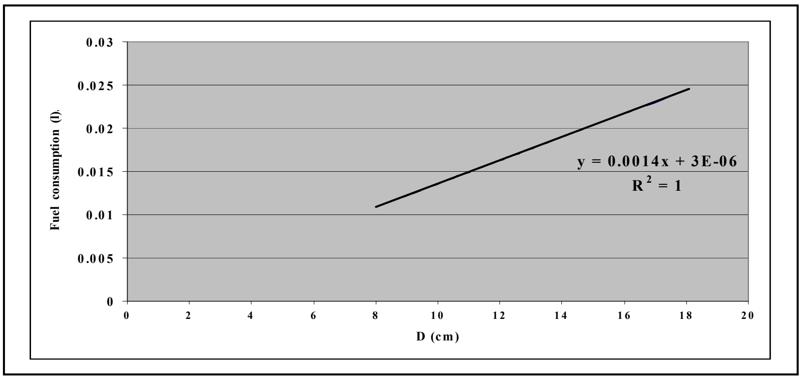

Fig. 8. The correlation between oil consumption (l) and cut section diameter (cm) of extracted trees in thinning work carried out in the spruce stand from u.a. 13C

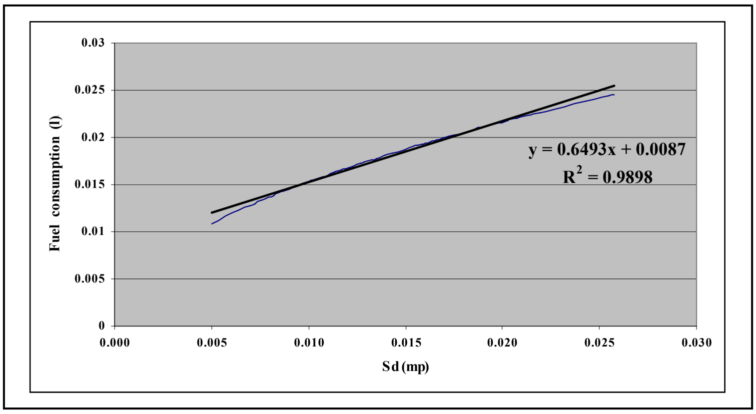

Fig. 9. The correlation between oil consumption (l) and cut section diameter (cm) of extracted trees in thinning work carried out in the spruce stand from u.a. 13C

By analyzing the data in Tab. 5 and 5.1 is observed that in the process of sectioning the extracted trees has been recording a mix oil consumption of approx. 0.0722 l and respectively 1.5359L lubricant oil.

Table 5

Evidence data on oil consumption and that the diameter and respectively trees cut sectional area extracted in the stand from u.a.13C

No.	Diameter of extracted trees (cm)	Cut section area (mp)	Oil consumption/cut section diameter (litres/cm)		Number of extracted trees (pieces)	Total consumption/cut section diameter (litres/cm)	
			mix	lubricant		mix	lubricant
0	*1*	*2*	*3*	*4*	*5*	*6*	*7*
1	8.0	0.011	0.0002	0.0032	1	0.0002	0.0032
2	9.0	0.012	0.0002	0.0036	1	0.0002	0.0036
3	9.4	0.013	0.0002	0.0038	1	0.0002	0.0038
4	9.6	0.013	0.0002	0.0038	1	0.0002	0.0038
5	9.8	0.013	0.0002	0.0039	1	0.0002	0.0039
6	10.0	0.014	0.0002	0.0040	1	0.0002	0.0040
7	10.1	0.014	0.0002	0.0040	30	0.0057	0.1211
8	10.2	0.014	0.0002	0.0041	4	0.0008	0.0163
9	10.4	0.014	0.0002	0.0042	1	0.0002	0.0042
10	10.5	0.014	0.0002	0.0042	1	0.0002	0.0042
11	10.6	0.014	0.0002	0.0042	12	0.0024	0.0508
12	10.7	0.015	0.0002	0.0043	4	0.0008	0.0171
13	10.8	0.015	0.0002	0.0043	3	0.0006	0.0129
13	10.9	0.015	0.0002	0.0044	1	0.0002	0.0044
14	11.0	0.015	0.0002	0.0044	2	0.0004	0.0088
15	11.1	0.015	0.0002	0.0044	30	0.0063	0.1331
16	11.3	0.015	0.0002	0.0045	1	0.0002	0.0045
17	11.4	0.015	0.0002	0.0046	2	0.0004	0.0091
18	11.5	0.016	0.0002	0.0046	2	0.0004	0.0092
19	11.6	0.016	0.0002	0.0046	8	0.0017	0.0371
20	11.7	0.016	0.0002	0.0047	4	0.0009	0.0187
21	11.8	0.016	0.0002	0.0047	2	0.0004	0.0094
22	12.0	0.016	0.0002	0.0048	1	0.0002	0.0048
23	12.1	0.016	0.0002	0.0048	59	0.0134	0.2853
24	12.2	0.017	0.0002	0.0049	6	0.0014	0.0293
25	12.3	0.017	0.0002	0.0049	4	0.0009	0.0197
26	12.4	0.017	0.0002	0.0050	2	0.0005	0.0099
27	12.5	0.017	0.0002	0.0050	4	0.0009	0.0200
28	12.6	0.017	0.0002	0.0050	15	0.0035	0.0755
29	12.7	0.017	0.0002	0.0051	5	0.0012	0.0254
30	12.8	0.017	0.0002	0.0051	6	0.0014	0.0307
31	13.0	0.018	0.0002	0.0052	2	0.0005	0.0104
32	13.1	0.018	0.0002	0.0052	11	0.0027	0.0576
33	13.3	0.018	0.0002	0.0053	2	0.0005	0.0106
34	13.5	0.018	0.0003	0.0054	1	0.0003	0.0054
35	13.8	0.019	0.0003	0.0055	3	0.0008	0.0165
36	14.0	0.019	0.0003	0.0056	1	0.0003	0.0056
37	14.1	0.019	0.0003	0.0056	44	0.0116	0.2479
38	14.2	0.019	0.0003	0.0057	5	0.0013	0.0284
39	14.3	0.019	0.0003	0.0057	1	0.0003	0.0057
40	14.5	0.020	0.0003	0.0058	2	0.0005	0.0116
41	14.6	0.020	0.0003	0.0058	2	0.0005	0.0117
42	14.7	0.020	0.0003	0.0059	4	0.0011	0.0235
43	14.8	0.020	0.0003	0.0059	1	0.0003	0.0059
44	15.3	0.021	0.0003	0.0061	2	0.0006	0.0122
45	15.4	0.021	0.0003	0.0062	1	0.0003	0.0062
46	16.0	0.022	0.0003	0.0064	1	0.0003	0.0064
47	16.1	0.022	0.0003	0.0064	5	0.0015	0.0322
48	16.2	0.022	0.0003	0.0065	1	0.0003	0.0065
49	16.3	0.022	0.0003	0.0065	2	0.0006	0.0130
50	16.5	0.022	0.0003	0.0066	1	0.0003	0.0066
51	16.7	0.023	0.0003	0.0067	1	0.0003	0.0067
52	18.0	0.024	0.0003	0.0072	1	0.0003	0.0072
53	18.1	0.025	0.0003	0.0072	2	0.0007	0.0145
Total					**311**	**0.0722**	**1.5359**

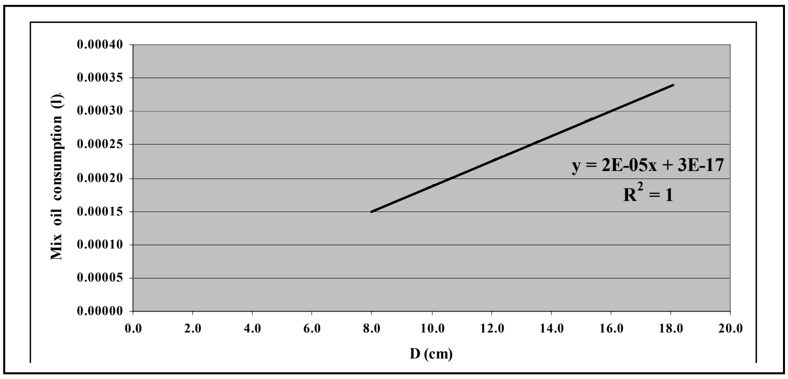

Fig. 10. The correlation between oil consumption STIHL 1:50 (l) and cut section diameter (cm) of extracted trees during the thinning application in the spruce stand of u.a. 13C

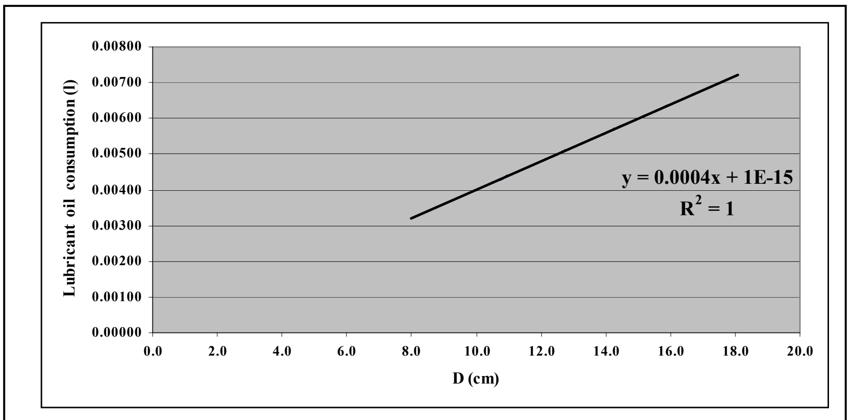

Fig. 11. The correlation between lubricant oil consumption (l) and cut section diameter (cm) of extracted trees during the thinning application in the spruce stand of u.a. 13C

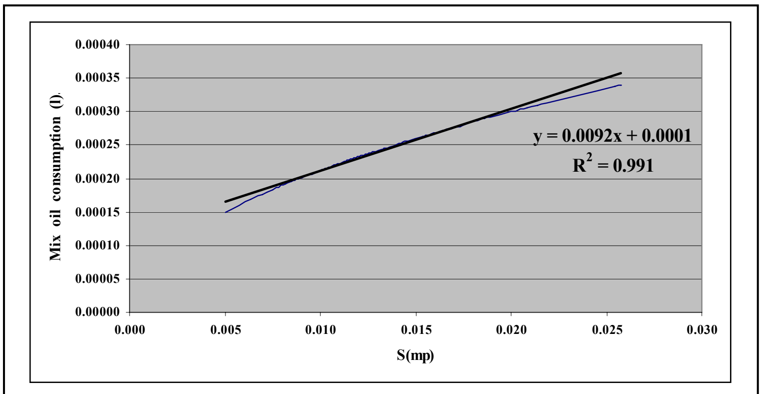

Fig. 12. The correlation between oil consumption STIHL 1:50 (l) and cut section diameter (cm) of extracted trees during the thinning application in the spruce stand of u.a. 13C

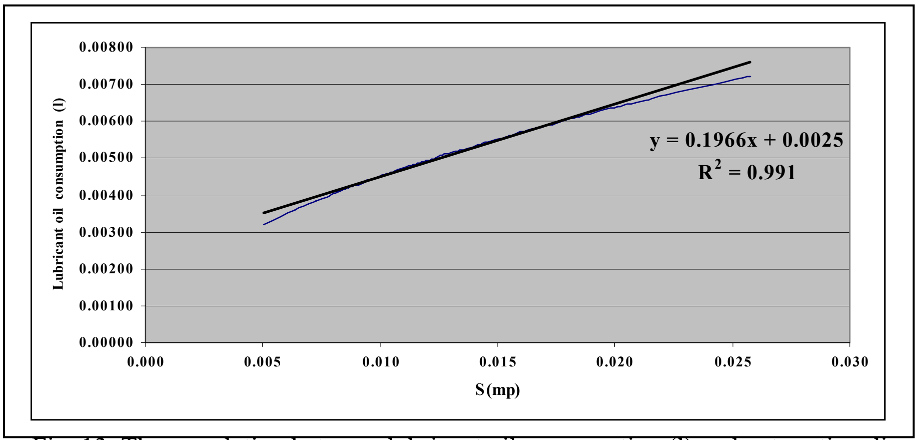

Fig. 13. The correlation between lubricant oil consumption (l) and cut section diameter (cm) of extracted trees during the thinning application in the spruce stand of u.a. 13C

The correlation between the consumption of lubricants and respectively cut sectional area corresponding to the extracted trees of the stand of u.a. 13 C are close, fact that is evident by the values of determination coefficients of regression equations related establish.

CONCLUSIONS

Upon realization the case study concerning at mechanization of thinning operations in pure stands of spruce where were obtained some interesting results that may constitute a serious basis for the development of consumption norms for fuel and lubricant that used for motorized chain saws.

It appears that time is directly correlated to the diameter of trees cut, but bear in mind that stand density running of the operations influence realization ensemble operations.

Following a stand with a high density of moving at the extracted trees is less easy but is at the same time a moderate intensity intervention.

To elaborate some technical norms of time for production of fuel and lubricant consumption relevant for proper motorized chain saws related to execution thinning operations in stands of resinous is necessary an sufficient volume information and especially the results for all work conditions. It is necessary to analyses the possibility of mechanizing the operations of thinning in the stands at different stages of development, respectively studying differential thinning involving mass selection (low thinning) and respectively thinning of a recommended individual selection (high thinning or thinning combined).

Correlations established between a number of parameters corresponding to the proposed work technology (type of cutting, fuel consumption, lubricant consumption, etc..) and respectively the biometric elements of trees extracted provide accurate information regarding to optimize the proposed operations aspects which needs to be carefully analyzed and interpreted properly.

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