

RESEARCHES UPON SOME DEDROLOGICAL MACHINES (I)

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Abstract. *The public domain and forestry nursery require a great volume of manual labour. One of the technology work that is demanding the most important work volume is the extraction of the dendrology material. According to this fact the developing of a machine able to solve this manual work represents an important target. In the present study are presented the testing results of the EXPLANT-500 machine destined for the dendrology material extraction, carried out in the working conditions from the Cluj-Napoca nursery.*

Keywords: extraction, dendrology, machine

INTRODUCTION

Actually, producing of dendrological material is becoming more and more important from the economical point of view, in close relation with habitats development and life quality increasing. Establishing the optimum mechanization system for the ornamental nursery enterprises is an important target of the researchers and designers. The present study is dedicated to the “EXPLANT-500” machine that executes the operation of dendrology material extraction in forestry and public domain nursery. The extraction is done with soil ballot (with a truncated cone form) around the roots. The “EXPLANT-500” machine can be used for digging the pit for replanting, also. In the same time, the machine can be used in the orchards for planting and replanting.

MATERIAL AND METHOD

The researches (field laboratory tests) were carried out in the nursery farm of the company RADP Cluj-Napoca. The testing plot characteristics were:

- slope: between 0 and 6°;
- surface: uniform;
- soil humidity: 18 – 22 %.

The EXPLANT-500 machine was used for extract medium and big size dendrological material, as:

- medium size ornamental trees (2,5 – 3,5 m): lime, maple, common chestnut etc.;
- medium size ornamental coniferous trees (1,5–3,0 m): fir, spruce, arbor vitae etc.;
- ornamental bushes (1,5 – 2,5 m): *spirea*, *forsitis viburaum*, *caraguna* etc.

The EXPLANT-500 dendrology material extraction machine (Fig. 1) is a tractor mounted one, working in unit with the 45 HP tractors. The machine has hydraulic command of the bits movement, coupled to the tractor hydraulic system (Fig. 2).

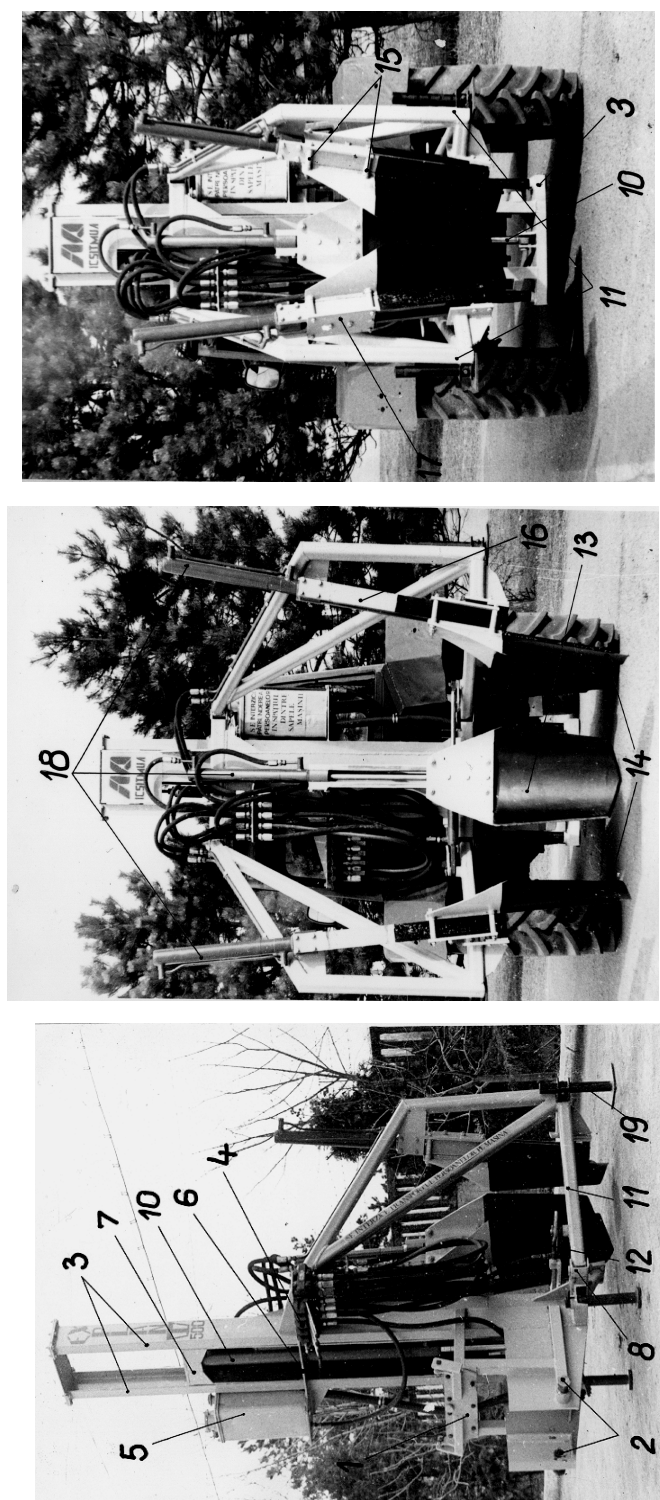


Fig. 1. The EXPLANT machine construction

1 – coupling device; 2 – bolt; 3 – guide; 4 – distributor; 5 – tank; 6 – holders; 7 – slip body; 8 – bolt; 9 – rollers; 10 – articulate arms; 11 – hydraulic cylinder; 12 – bit fixed on the slip body; 13 – bit fixed on the mobile arms; 14 – bits fixed on the mobile arms; 15 – holder; 16 – bar link; 17 – cramp device; 18 – hydraulic cylinders

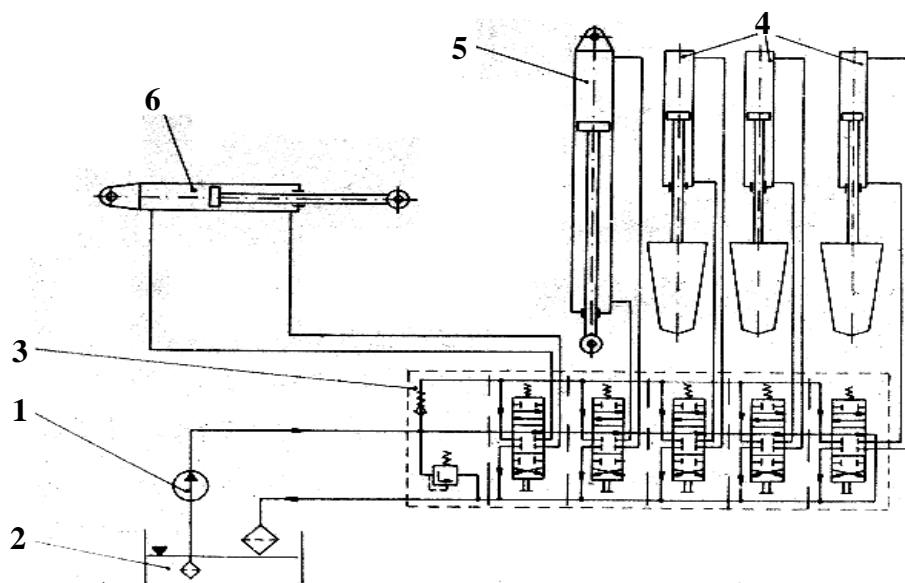


Fig. 2. The hydraulic system of EXPLANT-500 machine

1 – hydraulic pump; 2 – oil tank; 3 – distributor; 4, 5, 6 – hydraulic cylinders

The maximum ballot lifting is 200 mm above the ground level. The EXPLANT-500 machine was tested according the ASAE and DLG norms, as well as the data processing. The machine dimensions are: length: 1675 mm; breadth: 1350 mm with the arms closed and 2050 with the arms open; height: 2050 mm minimum and 2650 mm maximum.

RESULTS AND DISCUSSION

The experimental results regarding the qualitative indexes are presented in the table 1. Their values show that the machine EXPLANT-500 has fulfilled the expectations, as:

- the tolerances of ballot dimensions were situated between the imposed limit of $\pm 5\%$;
- the degree of cutting of lateral roots was $> 95\%$;
- the of the degree of corona wounding was $< 2\%$;
- the degree of ballot form preservation was 96% .

During the tests, the necessary power for the dendrology material extraction was situated between 11.7 HP (8.54 kW) and 14.1 HP (10.29 kW) at a 26.0-31.4 % engine loading degree. The corresponding fuel consumption was 4.9 – 5.3 l/h.

The working capacity of the EXPLANT-500 machine in the nursery conditions was quite high: 12 – 14 pieces extracted / h (~ 80 pieces/day work) at a 0.83 index of work time use (439 min – total daily operative time and 429 min net daily operative time). These characteristics are offering a high working efficiency to the extracting machine. The mean specific fuel consumption at extraction was of 0.44 l/piece extracted.

Table 1

Mean values of the EXPLANT-500 machine qualitative indexes during the field-laboratory tests

Indexes	Value, [mm]		Maximum tolerance upon the mean values of ballot, [%]		Standard tolerance, [mm]	Coefficient of ballot dimensions variation
	fixed	achieved	+	-		
<i>Dendrology material extraction</i>						
Ballot superior diameter	500	492	1,6	2,4	9,27	0,0188
Ballot inferior diameter	320	324	4,3	4,3	15,08	0,0463
Ballot height	500	481	3,9	3,1	17,07	0,0354
Degree of roots sectioning	-	96	-	-	-	-
Degree of ballot form preservation	-	96	-	-	-	-
Degree of corona wounding	-	1,6	-	-	-	-
<i>Replanting pit digging</i>						
Ballot superior diameter	500	490	2,0	2,4	11,0	0,0225
Ballot inferior diameter	320	325	3,9	3,0	15,0	0,0461
Ballot height	500	480	3,9	3,1	17,0	0,0357
Degree of ballot form preservation	-	97	-	-	-	-



Fig. 3. Aspects during the field tests of the *EXPLANT-500* machine

During the tests the machine versatile was proofed, pointing out its utility in the dendrological nursery. The maintenance index was 0.994 and the technical disponibility one of 0.995. In the same time, the technical security index was of 0.99. The values of these indexes are showing that the *EXPLANT-500* extract machine has a very good technical behaviour.

CONCLUSIONS

The study carried out on the development of optimum machine for the dendrology material extraction pointed out some outputs, such as:

1. The *EXPLANT-500* extraction machine is extremely useful in the nursery replacing a great volume of hand labour.
2. The machine has high-level qualitative working indexes (superior of the hand work ones).
3. The machine *EXPLANT-500* has a very good technical and ergonomic behaviour.
4. The machine has a high working capacity (>80 pieces/day) of the machine and a low specific fuel consumption (0,4 l/piece).

Acknowledgments: The author expresses her acknowledgements to the *National Institute for Mechanization in Agriculture Bucharest*, to the company *Mecanica MARIUS Cluj-Napoca* and to the *RADP Cluj-Napoca* for their kind help during the research work.

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