

**DESENVOLVIMENTO DE UMA MOTOSSERRARIA PORTÁTIL PARA A
PEQUENA PROPRIEDADE RURAL**

**DEVELOPMENT OF A PORTABLE SAWMILL FOR THE SMALL RURAL
PROPERTY**

R. BERTINATTO^{1*}

C. A. BREDA¹

R. BARICCATTI¹

T. C. M. VIDAL¹

I. WERNCKE¹

C. C. MAXIMO²

RESUMO

O rápido crescimento da produção florestal no Brasil revelou a dificuldade dos pequenos produtores em processar a reduzida quantidade de árvores plantadas em suas propriedades, devido ao elevado custo de retirada e transporte da madeira para a serraria, geralmente realizado por terceiros, ficando o lucro do produtor condicionado ao pagamento destes serviços. Este contexto incentivou o presente trabalho, que teve como objetivo a construção de uma motosserraria portátil, com baixo custo de construção e utilizando aquela motosserra que geralmente o produtor possui e utiliza para a derrubada das árvores. A construção foi realizada no município de Cascavel, estado do Paraná, no ano de 2009. Complementou-se a máquina instalando um silenciador, para diminuir o ruído e direcionar os gases de escape para longe do rosto do operador, além de um conjunto de tração com guincho trefor para redução do esforço. Na avaliação do funcionamento, a qualidade de corte foi satisfatória e os complementos contribuíram significativamente para melhorar rendimento do produto, como também um menor desgaste do operador. No entanto concluiu-se que este modelo de motosserraria é indicado para o processamento de pequenas quantidades de madeira devido a razoável ergonomia e necessidade intensa de trabalho próximo ao nível do solo.

Palavras-chave: motosserra, serraria portátil, reflorestamento, agricultura familiar

¹ Western Paraná State University/ College of Agriculture Engineering/ Post-Graduation Program of Energy in Agriculture/ 2069 Universitária St., Cascavel, PR, Brazil, 85819-110/ engrovian@gmail.com;

² Western Paraná State University/ College of Biological Sciences;

ABSTRACT

The fast forest production growth in Brazil has revealed the small producers' difficulty in processing the planted trees small quantities in their properties, due to high wood cutting and transportation costs when taking it to the sawmill, which is usually made by outsource, and, because of this, the producer profits are always depending on these services payment. This context has encouraged this research, which had as its objective the building of a portable chainsaw, with low production costs and that makes use of a chainsaw usually already owned by the producer who will work with it. It was made in Cascavel city, Paraná state, in 2009. The machine was complemented with the installation of a silencer, in order to decrease the noise and target the exhaust gas away from the operator's face, in addition to a traction set with a tirror hoist to decrease the effort made by him as well. In the operation evaluation, the cutting quality was satisfying and the complements have contributed in a meaningful way to improve the profits, as well as there was a smaller operator's exhaustion. However we concluded that this sawmill model is indicated to the processing of small wood quantities due to the reasonable ergonomics and the intense need to work near to the ground level.

Keywords: chainsaw; portable sawmill; reforestation, family agriculture

INTRODUCTION

The techniques that have been used in Brazil's woodcutting, mainly in the primary processing do not provide good profits neither good quality products. This happens due to the lack of cutting/sawing knowledge of the species being processed, as well as of planning (implementation and layout) a sawmill. This shows up, thou, that the logging industry needs new technological improvements (NÉRI, 2002).

Fortech (1994) writes that the primary cutting with portable sawmills in Australia is a highly informal industry and, therefore, its characteristics are hard to evaluate. The lack of statistical sources about this industry production, the lack of published papers regarding its efficiency, costs and production quality have, as well, been determined. Hunt (2002) found the same lack of information in Papua New Guinea, determining that the world sawmills importance is hard to evaluate, due to the lack of data on its production and sales. In Brazil we do not have a different situation, due to the recent arrival of some portable sawmill models, with high prices, lack of

assistance, as well lack of knowledge both coming from technicians and producers, makes portable sawmills not bought, neither studied, nor tested and nor evaluated.

Most part of the wood cutting work with chainsaws is made, nowadays, freely, or informally, which means that it is made without any kind of guides, frameworks or rails to help improving the product's quality and presenting smaller accident possibilities. Even much smaller is the usage of traction sets, which really help the operator, avoiding exhaustion, increasing the profits and the ergonomy. The few existent studies about portable sawmills emphasize the need for more information.

According to Smorfitt et al. (2001), the most simple way of existing portable sawmills is a chainsaw, usually associated with a lightweight metallic framework used as a guide to the wood cutting.

This paper has as its objective to develop a portable sawmill so it can be used by limited forest producers. It will be build with the following characteristics: a) Low

building costs; b) To use, preferably, materials which exist in the property; c) To make manual transportation possible; d) Easy and secure operation; e) To be efficient on wood

cutting; f) To have an alternative, or additional profit source to the producer; g) To decentralize the waste material and provide smaller soil compaction.

MATERIALS AND METHODS

The research was carried out in Cascavel, PR, in 2009, by starting the building of the metallic framework on the maintenance sector from the Western Paraná State University - Cascavel *campus*. The building ending and the necessary portable sawmill adaptations were carried out in Agrosoldas, located, as well, in Cascavel.

As an initial mechanism we used a Stihl chainsaw, model MS380, two-stroke, single cylinder engine, 72,2cm³ cubic capacity and from 3,6kW to 3,9kW power (ISO 7293). The sound pressure levels with the original silencer are: 102 dB (ISO 7182) and 113 dB (ISO 9207).

The cutting set is, as well, Stihl, the saber is a Rollomatic model, cutting length is 40,0 cm, and the chain is an Oilmatic 9,32mm (3/8") RapidSuper, the traction link is 1,6mm (0,063"), chain sharpening in 0 degree and depth regarding the cutting tools is 1,15mm.

For the metallic framework structure we purchased 7,0 Kg of used tubular steel, and as fixation elements we used steel nuts and bolts with thin screws on several sizes, washers, rivets and electric welding with coated electrode.

Looking for improving ergonomics and decrease the operator's efforts a Starfer manual turnstile hoist was installed, it was a Tirfor model with 2,0 tons traction capacity and 35,0 cm lever length. Also, to improve even more the process, a scooter silencer, purchased in a motorcycle pieces junkyard, was adapted to the chainsaw

looking for redirect the gas exhaust. The scooter silencer adaptation was outsourced and this process consisted of repositioning the silencer gas exhaust so that the gases could not disturb the operator, and, also a support was put on the chainsaw framework so that the set could be more resistant was outsourced.

The building process began by cutting and welding the tubular steel. After that, it continued by welding and drilling the fixation tools (nuts and screws), followed by the traction set fixation on the framework (with rivets), then, the fixation of framework on the saber, with the screws clamping as the last action.

The metallic framework was conceived as an adjustable length system that aimed to be used by most chainsaws that are sold nowadays, and it is possible its application in sabers that vary from 40,0 to 75,0 cm long. So that can be made, the support, which covers the guide/log was developed in three steps: the two side parts fit inside the central part and is clamped by screws. (Figure 1). Due to the space occupied by the metallic framework, the log's maximum diameter to be processed by this paper saber has to be 25,0 cm, because due to its length, if we use bigger logs they will end up not working properly, once the vertical trail and the support will be in the saber way. The minimum cut thickness with this configuration is 5,0 cm and the maximum is 30,0 cm, the cutting length is limited because it depends on the guide length that will be used.

FIGURE 1. METALLIC FRAMEWORK ADJUSTABLE SYSTEM TO SABERS FROM 40,0 TO 75,0 CM



The screws sizes used on the portable sawmill were chosen so that the original tool which comes along with the chainsaw works as a unique tool for building and dismantling the

whole metallic framework, which makes necessary that the operator carry only one tool while working. (Figure 2 and 3).

FIGURE 2 AND 3. ORIGINAL CHAINSAW TOOL CLAMPING THE SCREWS



The material costs chart (Chart 1) was developed on an electronic spreadsheet, where it is described the quantity of used material, unit of measurement, unit value and total values of each item. The portable chainsaw with full oil and gas tank approximate weight is 21,0 Kg. The

total building cost was stipulated in R\$197,50 (Table 1).

To help the project, we used basic ergonomy concepts, such as the Individual Equipment Protection Regulatory Norm – NR 6 (1992), Unhealthy Activities and Operations Regulatory Norm – NR 15 (1990) and Regulatory Norm on Safety and Health

on Agriculture, Cattle Breeding, Forestry, Wildlife Exploitation and

Aquaculture Work – NR 31 (2005).

TABLE 1. METALLIC FRAMEWORK AND COMPLEMENTS COSTS SPREADSHEET

| Material | Quant. | Unit. | Unit value | Total value |
|----------------------------------|--------|-------|------------|-------------------|
| Silencer adaptation labour force | 1,0 | un. | R\$ 40,00 | R\$ 40,00 |
| Welding framework labour force | 1,0 | un. | R\$ 60,00 | R\$ 60,00 |
| Framework metals | 7,0 | Kg | R\$ 1,50 | R\$ 10,50 |
| Screws, nuts, rivets and washers | 1.0 | un. | R\$ 14,00 | R\$ 14,00 |
| Scooter silencer | 1,0 | un. | R\$ 10,00 | R\$ 10,00 |
| Tirfor – 2 ton. turnstile hoist | 1,0 | un. | R\$ 63,00 | R\$ 63,00 |
| TOTAL | | | | R\$ 197,50 |

We carried out two tests with the portable sawmill. The first one occurred in Western Paraná State University, in Cascavel-PR, looking for the making of adjustments and improvements soon after the building and the second one in Cantagalo-PR, making possible to test the machine

under real field conditions, in similar situation to which nowadays sawmills face. During the making of the second test we verified the noise level using a Instrutherm noise dosimeter, DOS-450 model, with immediate readings next to the operator's ears.

RESULTS AND DISCUSSION

The sawmill building process was relatively simple, once its setup is considered to have low complexity, and, because of this, it is accessible to the producers who do not have mechanical building experience.

Intending to have low costs and easy transportation, in a way that the machine can be carried manually, it was essential to use the tubular steel, because it is a highly resistant material, has considerable low weight and a low purchasing price. With its usage the building process became more simple, consequently diminishing the labor force costs.

In order to do this research we felt no need of buying materials for the

making of the metallic framework, however, in the forester's land there might be potentially usable materials, which will reduce the costs even more and will create a usage to the waste material, it only depends on creativity to happen.

To obtain a bigger saber useful length the bumper spike and the hand guard lock chain lever were taken off the machine, making it easier to the metallic framework to access the powertrain. The absence of lock chain lever when the sawmill is working will not really affect the operator's safety, because the saber and the chain will be kept between two regulation vertical rods from the framework and it will be

kept inside the log. Even though, at the beginning and at the end of the process it will be necessary a lot of attention coming from the operator in order to avoid accidents, once the chain will not be inside the log anymore.

Intending to control the gas release right to the operator's lungs, as well as the framework and the saber heating, due to the chainsaw gas exhaust positioning right in front of the vertical framework saber support; also, to avoid excessive noise, we put, preventively, a gas exhaust stretcher and a silencer, sending the gas away from the operator's face and reducing considerably the noise levels and the set temperature.

However, even trying to reduce the noises it is necessary that the operator use an ear protection, according to a brief test we made with a dosimeter, because every reading with the working chainsaw exceeded the tolerated limit by the Regulatory Norm NR 15, which is 85,0 dB to an eight hours workday.

The traction set usage, by the utilization of the manual hoist reduced

substantially the efforts made by the operator to go through the log with the sawmill. However, the working position did not match the best ways of trying to assure working health and safety, due to the need of working near the ground. About this, it is recommended that regular pauses and stance changes are made, as well as a correct usage of EPIs to protect the operator, e.g.: boots with steel toe, helmet, protection glasses, ears protection and steel mesh overalls. If the log that is going through the cutting process has small diameter and weight, easels should be used in order to elevate the working position.

The total set weight with the full fuel and oil tank, metallic framework, silencer and hoist was nearly 21,0 Kg, showing that the chainsaw may be carried manually by the workday's end. During the work with the portable sawmill the operator's machine support is not necessary, once it will be supported by the guide which will be on the log. The built sawmill can be seen on the Fig. 4.

FIGURE 4. BUILT PORTABLE SAWMILL



The building cost was R\$197,50, showing that it is possible to adapt the

sawmill for a better, safer and with low costs work. The sawmill processing

usage adds up value to the logs, which will give the producer a greater benefit as well.

The forest processing also contributes with shells, sawdust and smaller soil compaction, as well as reduced transportation costs, due to fact that the cut wood only takes one third of the original logs volume. Furthermore, outside reforestation areas, low density trees are not viable to be cut, once it is hard to carry it to the sawmills and this factor contributes to the encouragement of portable sawmill usage.

However, the portable sawmill presented some inconveniences,

among them is a relatively low productivity, from high working intensity and big efforts made on ground level, which may be seen on the Figure 5. The high sawing precision with the portable device was not a high quality one as it is made in conventional sawmills. It is possible to see that portable sawmills are machines adequate in low production areas. They must be very light, able to cut efficiently low diameter logs, which are short, some times crooked and present low building costs to be profitable if only some cubic meters are sawn weekly.

FIGURE 5. PORTABLE SAWMILL TEST



Wyatt (1996) says that a portable sawmill from a chainsaw is generally not an adequate tool for a production of big, meaningful wood quantities, or as a unique income alternative. This must be the role of a bigger sawmill, with a stronger and more efficient

CONCLUSIONS

The built sawmill cutting quality was satisfactory and met the objectives we were looking for achieving. The tools usage, as a traction set, in order to reduce the efforts, and the silencer

sawing system. Operators who have been expanding the woodcutting have noticed that their portable sawmill was a valuable learning tool, from experiences that have really contributed for bigger business success.

to reduce the engine noises really helped the operator to be safer and healthier, as well as made the profits to be greater.

We noticed, as well, that this equipment model is recommended only to smaller wood quantities processing. To bigger quantities it is necessary that bigger sawmills are used, with a more efficient sawing system.

It is possible to produce low cost machines to small reforestation areas, easier to built and to transport, and more adequate to the producers purchasing power.

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