Evaluation and comparison of a harvester-baler system and a chain mulcher in post-fire naturally regenerated pine stands in Northwest of Spain

This study analyzed the productivity and cost of a systematic brushcutting work on young and dense pine stands in Northwest of Spain carried out with Biobaler WB55 and a conventional chain mulcher, followed by selective clearing with clearing saws.

AIM OF THE STUDY

The aim of this study was to assess and compare the brushcutting and clearing work on post-fire naturally regenerated pine stands applying two different techniques and working methods: Biobaler WB55 and conventional chain mulcher leaving on the terrain wide and narrow untreated strips (around 2.8 and 1.6 m width, respectively).
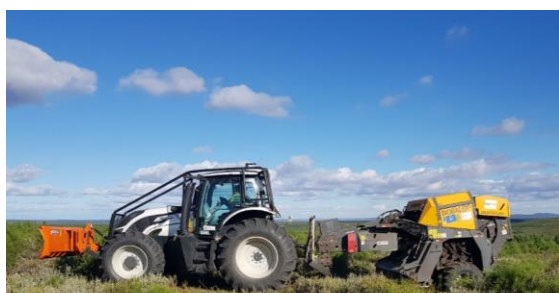

Figure 1. The Biobaler is a harvester-baler system able to collect the biomass and produce bales of 1.2 m diameter.

MATERIALS AND METHODS

Two sites in Leon, Northwest of Spain, were selected for the trials, representing a total area of 11.4 ha. Each site was divided in four strata to be systematically cleared leaving on the terrain untreated strips of different widths: Biobaler and narrow untreated strips, Biobaler and wide untreated strips, chain mulcher and narrow untreated strips, and chain mulcher and wide untreated strips.

A time study was performed per each of the stratum. The bales produced by the Biobaler were georeferenced, marked, extracted and weighted individually. The biomass left on the ground by the Biobaler was also weighted. The canopy cover percentage and the average of pine and shrub heights were measured on the untreated strips to calculate the biovolume.

Afterwards, a selective clearing on the untreated strips was carried out by a crew of four forest workers equipped with clearing saws. This work was also timed in the four strata of each site.

Figure 2. Forest workers clearing the untreated strips.

RESULTS

The average Biobaler weight productivity was 1.41 oven dry tonne (ODt) per productive machine hour (PMh). The average surface productivity was 0.75 ha/PMh and 0.45 cleared ha/PMh. This productivity was 0.80 ha/PMh and 0.71 ha/PMh in the strata with wide and narrow untreated strips respectively (Table 1).
The average biomass collection efficiency was 31%.

The average surface productivity of the chain mulcher was 0.71 ha/PMh and 0.39 cleared ha/PMh.

Table 1. Biobabler surface productivity

Site	Stratum	ODt/PMh	ha/PMh	Cleared ha/PMh
1	Narrow untreated strips	1.04	0.62	0.48
	Wide untreated strips	2.49	0.71	0.37
2	Narrow untreated strips	1.25	0.78	0.50
	Wide untreated strips	0.91	0.88	0.43

The clearing productivity carried out after brushcutting was higher on the strata treated by the chain mulcher than on the Biobaler strips (Figure 3).
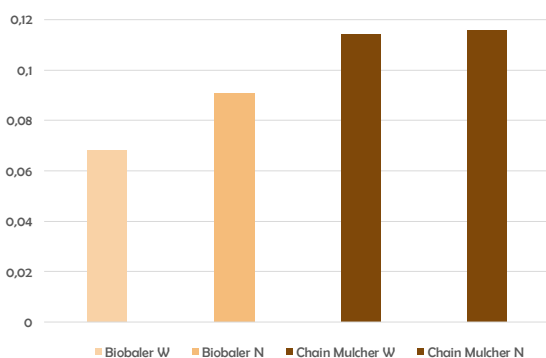

Figure 3. Motormanual clearing productivity of a team of four workers equipped with clearing saws (ha/PMh)

The total cost of the operations was higher when using Biobaler compared to the chain mulcher (Figure 4).
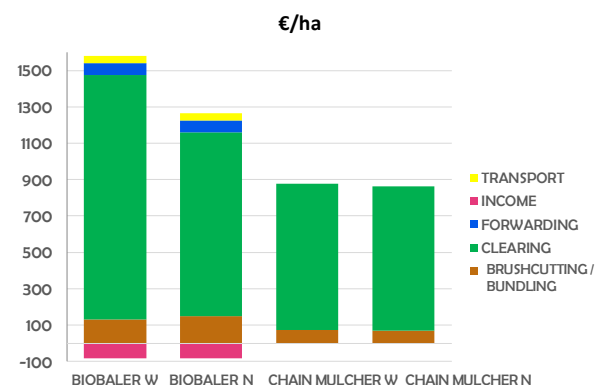

Figure 4. Total cost per ha of the four assessed alternatives.

CONCLUSIONS

The Biobaler productivity (ha/PMh) was 13% higher when leaving on the terrain wide untreated strips than when leaving narrow strips. The chain mulcher productivity was similar to the Biobaler productivity when leaving on the terrain untreated narrow strips.

The motormanual clearing productivity on the untreated strips was 49% higher on the strata treated with chain mulcher. This was probably due to the higher stump height on the treated strips with Biobaler, which might slow down the crew progress.

The selective clearing cost per ha was lower when working on narrow strips, this was especially evident in the case of Biobaler.

The total cost per ha was lower when using chain mulcher compared to Biobaler. The income coming from the sale of the bales at current woody biomass price cannot compensate the difference.

There is a need for improvement of the Biobaler biomass collection efficiency, which would increase the weight productivity and reduce cost.

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