Advantage
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Contents

Using the Bull Hog mulcher for the rehabilitation of nonproductive forestry sites

Abstract

FERIC monitored two Bull Hog mulchers (the BH 150 and the BH 250) to evaluate their potential for rehabilitating backlog sites invaded by brush. Both mulchers provided good treatment quality, but their high operating costs limit their use to the creation of fast-growing stands on sites with moderate brush volumes near mills.

Keywords:

Bull Hog mulcher, Mulching, Site rehabilitation, Site preparation.

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Introduction

Among the possible treatments for rehabilitating poorly regenerated forestry sites, mulching of the vegetation, its incorporation into the surface soil horizons, and loosening of the soil itself can be advantageous, particularly on clayey sites where mineral-soil exposure should be avoided to decrease frost-heaving of seedlings. In an attempt to rehabilitate highly productive sites that had been invaded by brush and intolerant hardwoods, Matériaux Blanchet Inc. and Domtar Inc. carried out trials of two Bull Hog mulchers at Amos and East Angus (Quebec).

FERIC's previous trials of another mulcher (the Meri MJS-2.5) and of the Crabe forestry harrow demonstrated that mulching provides a high-quality treatment, but at a relatively high operating cost (Cormier and Provencher 1997). Our goal in the current trial was to determine whether using the Bull Hog mulchers would provide comparable treatment quality while decreasing operating costs.

Equipment and work techniques

Two models of Bull Hog mulcher were used during the study. In contrast with most horizontal-shaft brushcutting machines, the fixed-tooth design of this mulcher lets the machine work within the upper soil horizons. The Amos trials used a Bull Hog BH 150 mulcher mounted on a four-wheel-drive, 130-kW Valmet 8750 bidirectional tractor (Figure 1). The East Angus study used a Bull Hog BH 250 mounted on a 261-kW AHWI RT350 tracked vehicle with hydrostatic drive (Figure 2). The two mulchers were powered by the carrier's PTO, were equipped

Figure 1. *(Left)* The Bull Hog BH 150 mulcher mounted on the three-point hitch of a Valmet 8750 tractor.

Figure 2. *(Right)* The Bull Hog BH 250 mulcher mounted on an AHWI RT350 tracked vehicle.

with 48 teeth, and had an overall width of around 2.7 m (with an effective width of 2.2 m). The two models of mulcher differed primarily in terms of their construction: the model 250 is more robust, but also weighs 600 kg more (3200 vs. 2600 kg).

The mulching was carried out in two consecutive passes; the machine first mulched the vegetation, then backed up along the same path to further incorporate the mulched material into the upper soil horizons. The mulching treatment was designed to cover the entire site, but small patches of softwood regeneration and some sparse, large residual trees were left untreated at Amos.

Description of the sites

FERIC's trials of the Bull Hog BH 150 mulcher took place north of Amos during the summers of 1999 and 2000 on sites that had been harvested in 1979 and 1987, respectively. The two sites were level, had clayey soil, and differed primarily in the structure of the established vegetation (Table 1). The site treated in 1999 had been invaded by moderately dense brush (17 400 stems/ha) with an average height of 3.1 m and composed primarily (79%) of alder and willow. Residual trees (365 stems/ha), primarily birch and poplar with diameters of 10 to 14 cm, were also scattered about the site. The terrain treated in 2000 had denser brush (44 700 stems/ha) composed primarily (82%) of alder and willow with an average height of 3.0 m, but had few residual trees (30 stems/ha).

The trials of the Bull Hog BH 250 mulcher occurred in two blocks on a backlog site that had been harvested in 1989. The site was level, with a clayey soil and moderate stoniness. The two blocks differed in terms of the quality of drainage, which was reflected in the vegetation growing in each block. Brush and stumps were more abundant in the block with moderate drainage (East Angus 2000a), but were larger on the block with fresh drainage (East Angus 2000b). In contrast with the Amos sites, the vegetation was composed primarily (more than 60%) of intolerant hardwoods.

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Results

Table 2 presents the results of FERIC's time studies. Since the pass width was similar on both Amos sites treated with the Bull Hog BH 150 mulcher, the machine's travel speed accounted for the observed productivity difference (11.4 vs. 8.1 PMH/ha). The presence of numerous residual trees on the site treated in 1999

Table 1. Description of pre-treatment site conditions (n.a. = not applicable)

	Bull Hog BH 150		Bull Hog BH 250	
	Amos 1999	Amos 2000	East Angus 2000a	East Angus 2000b
Terrain				
Soil	Clayey	Clayey	Clayey	Clayey
Drainage	Fresh	Moderate	Moderate	Fresh
Slope (%)	0	4	0	0
Humus (cm)	8	9	10	6
Stoniness (%)	0	1	20	30
Brush				
Density (stems/ha)	17 400	44 700	19 300	12 400
Height (m)	3.1	3.0	2.4	4.2
Residual trees				
Density (stems/ha)	365	30	0	0
Diameter (DBH, cm)	11	27	n.a.	n.a.
Stumps				
Density (number/ha)	n.a.	166	1840	600
Diameter (cm)	n.a.	35	18	39
Height (cm)	n.a.	24	23	31

Table 2. Time studies

	Bull Hog BH 150		Bull Hog BH 250	
	Amos 1999	Amos 2000	East Angus 2000a	East Angus 2000b
Effective time (h)	24.6	14.2	4.6	1.4
Productive time (PMH)	26.2	15.3	4.8	1.6
Area treated (ha)	2.36	1.87	0.87	0.24
Productivity (ha/PMH)	0.090	0.123	0.181	0.143
Pass length (m)	38	40	58	73
Pass width (m)	2.0	1.9	2.4	2.3
Speed (m/min)[a]	8.1	11.4	13.3	12.1

[a] Mean travel speed for the machine performing a double pass.

slowed the machine's travel. At an hourly direct operating cost of around $100/PMH, the estimated treatment cost exceeded $1100/ha in the first year and $800/ha in the second year.

For the Bull Hog BH 250 mulcher, the productivity difference between the two blocks (5.5 vs. 7.0 PMH/ha) was directly related to the size of the brush; the taller vegetation created higher wood volumes in the second block. The greater productivity of this machine compared with that of the Bull Hog BH 150 mulcher reflects its higher travel speed and wider passes. The machine's power let the operator avoid overlapping the treatment between passes (the pass width was slightly greater than the effective width of the mulcher) while providing uniform treatment quality. At an hourly direct operating cost of around $200/PMH, complete treatment of the site was estimated to cost between $1100 and $1400 per hectare. However, a greater abundance of rocks in the soil can significantly increase costs; on the East Angus trial sites, the more frequent breakage of teeth (around 1 per hour) increased the cost to around $300/PMH.

At both Amos and East Angus, the dominant types of disturbance (Table 3) were incorporation of vegetation and humus into the surface mineral-soil horizons ("mixing") or production of a layer of finely mulched debris ("fine debris") covering the soil. The large volume of wood in the second block treated with the Bull Hog BH 250 mulcher at East Angus resulted in a greater proportion of fine debris on the soil surface, often overlying a deeper treatment of the soil. This same dominance of fine debris and the amount of litter left intact with the Bull Hog BH 150 mulcher at Amos in 2000 can be explained by the more superficial treatment, since the machine only penetrated the soil in 25% of the area (Figure 3). On the other sites, the mulching was concentrated in the first 8 cm of the soil.

The plantability of the site was evaluated primarily based on the quality of the plantable microsites, but ease of planting was also a criterion (Figure 4). The plantability of a microsite was considered good if a seedling could be planted easily; it was considered marginal if the microsite required additional effort on the part of the

Table 3. Types of surface disturbance created by the Bull Hog mulchers

	Bull Hog BH 150		Bull Hog BH 250	
	Amos 1999	Amos 2000	East Angus 2000a	East Angus 2000b
Coverage of site (%)				
Mixing	51	22	64	35
Fine debris	38	51	22	53
Coarse debris	7	3	0	2
Exposed humus	0	4	2	0
Mineral-soil exposure	2	1	7	10
Intact litter	0	18	4	0
Not treated	2	1	1	0

planter to prepare the microsite, and inadequate if a major effort would have been required. The mulching produced greater than 98% good or marginal plantability. The Bull Hog BH 150 mulcher's more superficial treatment produced more marginal plantability at the Amos site in 2000. An overly thick humus layer or layer of fine debris were the main reasons for the marginal quality of certain microsites.

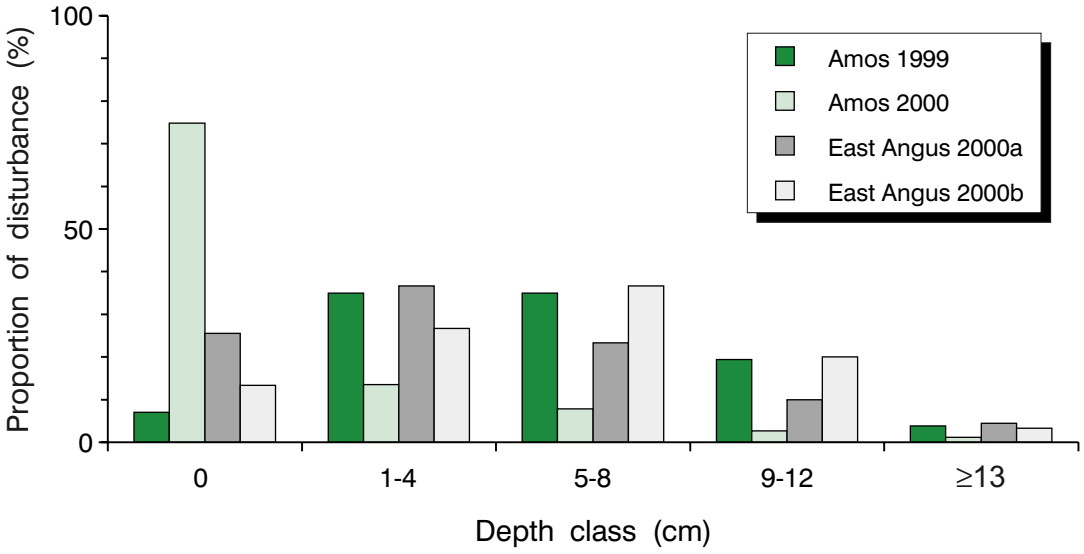

Figure 3. Distribution of depths of penetration of the treatment into the soil with the Bull Hog mulchers.

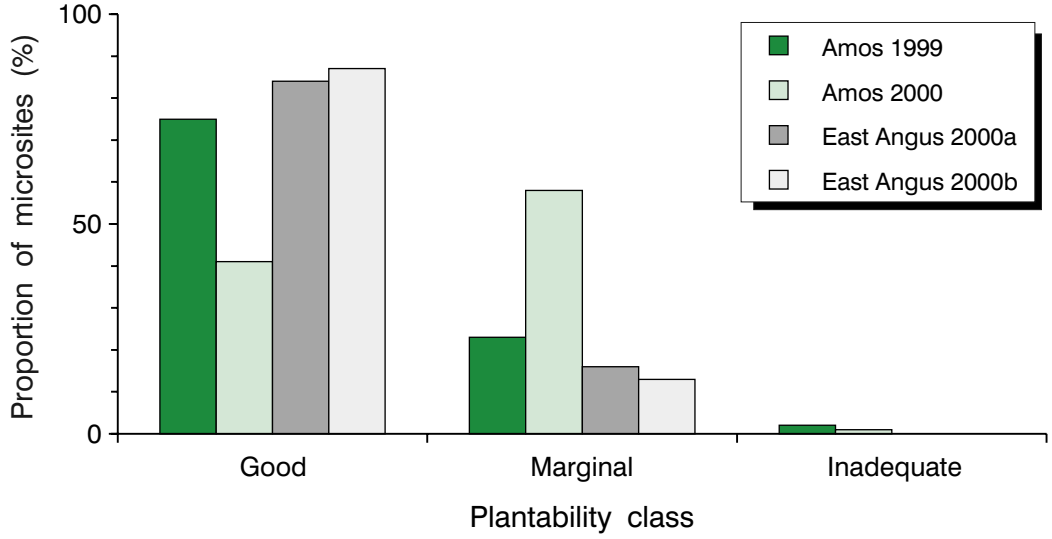

Figure 4. Plantability levels obtained with the Bull Hog mulchers.

Implementation

Because of the time and maneuvering (double passes) required to mulch the vegetation and effectively incorporate it within the soil, the low productivity of the Bull Hog mulchers made the treatment expensive. The Bull Hog BH 150 mulcher's productivity was improved at the Amos site in 2000 by using the machine under easier stand conditions, but mainly by performing a more superficial treatment of the soil. The use of a more powerful machine such as the Bull Hog BH 250 mulcher mounted on an AHWI RT350 carrier increased the operation's productivity, but the machine's hourly operating cost was too high for the improved productivity to lower the overall treatment costs. Thus, the Bull Hog BH 150–Valmet 8750 combination had the least expensive treatment cost under the study conditions.

No long-term study has been conducted to determine the impact of soil stoniness on wear or breakage of the mulcher's teeth. However, our observations suggest that as a result of downtime and the price of replacement teeth (around $100 each), this factor is not negligible. It would be preferable to avoid rocky sites to prevent undesirable cost increases when using the mulchers.

The treatment quality observed during this study was comparable to that observed during trials of the Meri crusher in the Abitibi region (Cormier and Provencher 1997), where uniform mixing and fine mulching were observed on 58 and 30%, respectively, of a site with moderate drainage. However, plantability was slightly greater in the Meri study. Primarily because of the larger stems being treated, the Bull Hog mulcher was unable to surpass the Meri crusher's productivity. The estimated operating cost of a mulching operation thus remains very high, exceeding $1000/ha on most of the sites FERIC observed. Treatment costs of this magnitude are generally not justifiable other than for highly productive sites near mills.

Based on our trials, it's obvious that even though the Bull Hog mulchers can produce a high-quality treatment of sites invaded by large trees and brush, use of the mulchers should concentrate on early post-harvest treatments to improve productivity and significantly decrease the treatment costs. The study also showed that productivity can be improved by accepting a more superficial treatment of the soil. Gains could also be achieved through partial treatment of sites or by restricting deep treatment of the soil to strips or small patches. Biological follow-ups will be required to test the pertinence of these options and their consequences for competing vegetation.

Reference

Cormier, D.; Provencher, D. 1997. Comparative trials of site rehabilitation with the Crabe forestry harrow and the Meri crusher. For. Eng. Res. Inst. Can. (FERIC), Pointe-Claire, Que. Field Note Silviculture-95. 2 p.