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THE ANALYSIS OF THE EFFECTIVENESS OF GRINDING OF CHIP RESIDUE BY MERI CRUSHER MJ 2.3 DT

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Abstract. The article shows the effectiveness of the process of grinding arbomass remaining on logging area. In the research undertaken Meri Crusher MJ 2.3 DT was subjected to scrutiny; the crusher was aggregated with a 1.4 Crystal tractor. In order to establish the actual effectiveness of grinding, the results were measured before and after the utilization of chip residue. The analysis showed that a decrease in dimension of chip residue was greater in its length than in its diameter. The achieved effect of grinding the arbomass appeared to be satisfying in terms of possibilities of a mechanical surface preparation before its regeneration.

Key words: chip residue, crusher, effectiveness of grinding

INTRODUCTION

Grinding is not the only method known which makes it possible to prepare a surface to future cultivation. As a result of the awareness of negative effects of using other means, it appears to be on the first place of all the methods being used nowadays. It has been proved during numerous investigations [Mayer 1977, Röhring and Gussone 1982, Gornowicz 1992] as well as a Directive 11A by a General Director of the Forestry Commission 11.05.1999 zn. spr. 26-7120-2/99 on improving the forest husbandry on ecological basis.

The characteristic of this method (grinding of slash remaining on logging area) and its results (it should enable a preparation of a surface which is to be later regenerated) raises a question: what is the actual effectiveness of grinding of branches remaining on a logging area and whether the achieved effect is satisfying.

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METHODOLOGY

The experimental areas were located in the Forest Division of Dąbrowa, a part of the Regional Management of National Forests in Toruń. There were eight areas established in four forest districts. The research was conducted in pine timber forest where, after achieving assortment, the logging residues were crushed.

The experimental areas were situated on flat grounds easily accessible for machinery working on timber forest, as well as for a crusher. The same forest habitat type appeared on all of the areas – fresh coniferous forest. The age of timber forest on the experimental areas ranged between 90 and 135 years.

In order to establish the effectiveness of grinding, the arbomass remaining on the logging area was measured. It took place before utilization of chip residue on the experimental areas mentioned above. To do it, on each area eight circular control areas of a 2-meter radius were randomly established. The size of the surface was established using a steel measure (measuring accuracy was of 1 cm), the borders were marked with a biodegradable paint. In order to establish the control areas, a net was created of squares of 20 meters in length of a side. Next, the squares were numbered and, randomly again, eight of them were chosen. The circular control areas of a 2-meter radius were established in the middle of the squares. Then all the branches localized in the control areas were measured before being grinded. The length and diameter were measured in the middle of the length. The measurement was done using a slide caliper and a steel measure. The measuring accuracy of the diameter was 1mm, whilst of the length 1 cm.

After grinding of chip residue, we proceeded with another stage of measurement. In order to establish the effectiveness of grinding of arbomass remaining on felling site, a net of squares was appointed and randomly chosen eight circular control areas of a 2--meter radius. The chip residue was taken and mixed with soil from each control area and put it into boxes which had been prepared. Total weight of the sample taken from each of the experimental area was about 50 kg. Using steel sieve (sieve mash of 0.5 cm in diameter), grinded branches were separated from other impurities and measured, by analogy, the same way we did it before grinding. After the measurement was conducted, the achieved material was subjected to statistical analysis. The statistic parameters were defined for each of the eight experimental areas (logging areas). A population of the results achieved for a particular experimental area became a sum of results from each circular area of a 2-meter radius on an established logging area.

RESULTS

Table 1 shows the characteristics of chip residue on the experimental areas before grinding. An average length of chip residue (mainly branches) oscillated between 43 and 95 cm. They showed a considerable variation at a level of 54-86%. Frequently the material was of significant length – maximum values were over 3 meters (maximum length 3.33 m).

An average diameter of branches remaining on the experimental logging areas oscillated between 2.3 and 2.8 cm, although there were also branches significantly thicker – diameters in the middle of length were reaching even 8 cm. An average variation of the thickness of branches in most of the cases run into the level of 40-50%.

Table 1. The characteristic of chip residue before grinding
Tabela 1. Charakterystyka pozostałości zrębowych przed rozdrabnianiem

Area Po-wierz-chnia		The number of repetition Liczba powtórzeń	Value – Wartość			Standard deviation Odchylenie standardowe cm	Variation Zmienność %
			average średnia cm	maximal maksymalna cm	minimal minimalna cm		
I	diameter średnica	150	2.46	6.7	1.0	1.13	45.7
	length długość	150	95.39	300	17	58.81	61.6
II	diameter średnica	169	2.32	6.4	0.9	0.99	43.0
	length długość	169	67.77	265	2.0	51.32	75.7
III	diameter średnica	200	2.32	6.2	0.7	1.05	45.2
	length długość	200	42.76	220	10	33.75	78.9
IV	diameter średnica	215	2.36	7.2	1.0	1.05	44.5
	length długość	215	57.16	333	10	49.22	86.1
V	diameter średnica	171	2.40	7.8	1.0	1.29	54.1
	length długość	171	68.63	250	4.0	45.28	66.0
VI	diameter średnica	151	2.77	4.8	1.1	0.81	29.4
	length długość	151	78.13	206	18	39.61	50.7
VII	diameter średnica	162	2.57	6.2	1.1	1.13	43.8
	length długość	162	62.47	225	10	42.89	68.7
VIII	diameter średnica	148	2.57	6.4	1.0	1.19	46.3
	length długość	148	57.16	245	10	41.51	72.6

After the process of grinding of chip residue was conducted, measurement followed similar to the one which had taken place before grinding. Table 2 shows the characteristics of dimension of chip residue after being grinded.

An average length of grinded chip residue oscillated between 9 and 25 cm, although there were also branches significantly longer, with the length of 2 m or even more (the maximum value – 2.35 m). Coefficient of variation of the length of material reached significant value in most of the cases and run into the level of 80-100%.

Chip residue was grinded very well, an average diameter after grinding reached 1.4 cm and the maximum value ran into a level of less than 10 cm. Only in one of the cases

Table 2. The characteristic of chip residue after grinding
Tabela 2. Charakterystyka pozostałości zrębowych po rozdrobnieniu

Area Po-wierz-chnia		The number of repetition Liczba powtórzeń	Value – Wartość			Standard deviation Odchylenie standardowe cm	Variation Zmienność %
			average średnia cm	maximal maksymalna cm	minimal minimalna cm		
I	diameter średnica	135	1.68	5.4	0.4	1.10	65.4
	length długość	135	19.52	119	1.0	19.58	100.3
II	diameter średnica	172	1.17	3.8	0.3	0.68	57.7
	length długość	172	19.92	235	3.0	20.15	101.1
III	diameter średnica	140	1.22	5.6	0.3	0.95	77.6
	length długość	140	20.04	123	3.0	19.62	97.3
IV	diameter średnica	147	1.42	6.5	0.3	1.13	79.6
	length długość	147	24.24	219	3.0	26.59	109.7
V	diameter średnica	116	1.58	41.3	0.3	3.83	242.2
	length długość	116	18.42	98	3.0	16.66	90.5
VI	diameter średnica	143	1.41	6.5	0.3	0.98	69.4
	length długość	143	23.04	123	3.0	20.52	89.0
VII	diameter średnica	141	1.14	3.7	0.3	0.58	51.0
	length długość	141	9.06	29	3.0	5.12	56.5
VIII	diameter średnica	114	1.76	5.6	0.4	1.05	59.6
	length długość	114	25.43	120	3.0	21.06	82.8

(the area V), maximum diameter of a piece of wood was 41 cm. Diameters of grinded chip residue were characterized by a significant variation in most of the cases at the level of 50-80%.

The fact that on the experimental areas there appeared branches of significant sizes, especially in terms of their length, was very often due to the way there were placed against a drum of a crusher. If a branch was perpendicular to the direction of drum run it was grinded partially or was not grinded at all. Similarly, if it was placed in a pit of a milling of a drum it did not grind the material completely.

Round billets-wood and blocks of significant diameter and length remaining on logging areas were not grinded sufficiently; it is technically impossible if a crusher is used. This kind of material should have been cleared away before grinding proceeded. Later mechanical surface preparation was considerably impeded by biomass in such a form.

After grinding was conducted on the analysed areas, the length of branches became considerably smaller (Fig. 1).

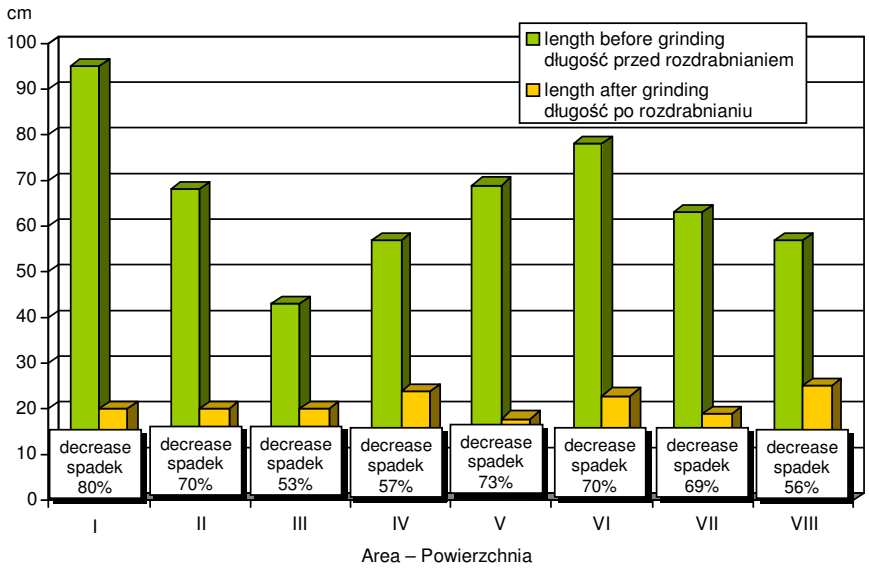

Fig. 1. Average lengths of chip residue before and after grinding on the experimental areas
Rys. 1. Przeciętne długości pozostałości zrębowych przed i po rozdrobnieniu na powierzchniach badawczych

An average length of branches after grinding decreased, on average, by 66% (from 53 to 80%). The largest decrease in length after grinding of chip residue was registered on the area I – 80%, whilst the smallest on the area III – 53%.

The diameter of grinded branches changed as well (Fig. 2). An average diameter of branches after grinding decreased, on average, by 43% (from 30 to 57%). The largest decrease of the diameter of material remaining after grinding was registered on the area VII – 57%, whilst the smallest one on the area VIII – 30%. As a result of grinding the decrease of dimension of chip residue was larger in its length than in its diameter.

CONCLUSIONS

1. The Achieved effectiveness of grinding was satisfying in terms of possibilities of a mechanical surface preparation and its later regeneration. The arboreal material was significantly grinded. The length of remaining material decreased nearly by 66%, and by 43% if its diameter considered. The length of grinded branches came, on average, to 21 cm, whilst its diameter to 1.4 cm.

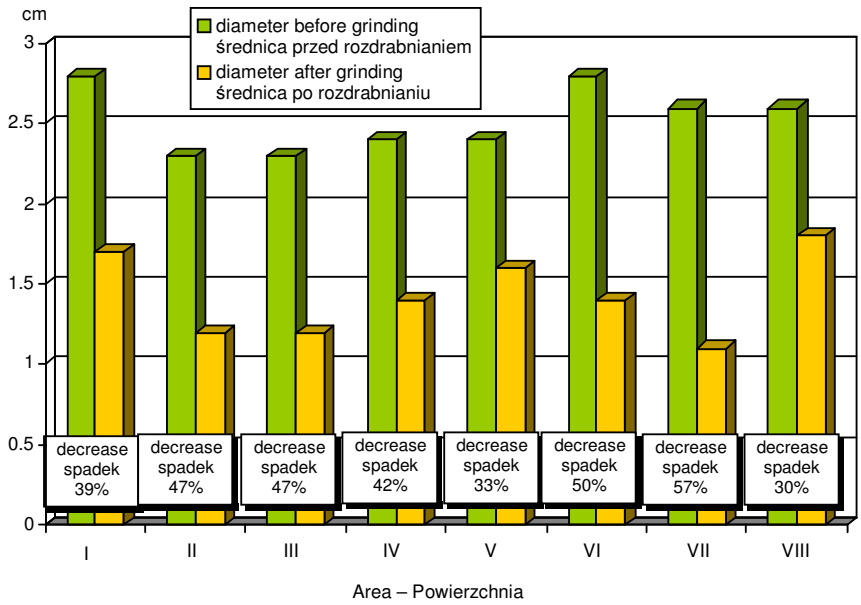

Fig. 2. Average diameters of chip residue before and after grinding on the experimental areas
Rys. 2. Przeciętne średnice pozostałości zrębowych przed i po rozdrobnieniu na powierzchniach badawczych

2. Meri Crusher MJ 2.3 DT does not only grind chip residue, but also mixes it with upper layers of soil at a depth of 20 cm. Ungrinded branches appeared scarcely on surfaces. We also observed that branches which were perpendicular to a drum became only partially grinded and maintained their significant lengths.

3. Round billets-wood and blocks remaining on a logging area must be cleared away before grinding is proceeded.

REFERENCES

Gornowicz R., 1992. Der Nährstoffeexport aus Kiefernbeständen in Abhängigkeit vom Holzernteverfahren – II. Teil. In: Międzynarodowe Sympozjum Mechanizacji Prac Leśnych. Thesalonik, Grecja, 1-6.

Mayer H., 1977. Waldbau auf soziologischökologischer Grundlage. GFV Stuttgart N.Y.

Röhring E., Gussone, 1982. Waldbau auf ökologischer Grundlage. Paul Parey Hamburg.

Zarządzenie nr 11A Dyrektora Generalnego Lasów Państwowych w sprawie doskonalenia gospodarki leśnej na podstawach ekologicznych. 1999. Warszawa.

ANALIZA SKUTECZNOŚCI ROZDRABNIANIA POZOSTAŁOŚCI ZRĘBOWYCH ROZDRABNIACZEM MERI CRUSHER MJ 2,3 DT

Streszczenie. Artykuł przedstawia skuteczność procesu rozdrabniania pozostającej na zrębie arbomasy. W przeprowadzonych badaniach poddano analizie rozdrabniacz Meri Crusher MJ 2,3 DT, który został zagregatowany z ciągnikiem klasy 1,4 marki Crystal. W celu ustalenia rzeczywistej skuteczności rozdrobnienia, pomiary wykonano przed i po utylizacji pozostałości zrębowych. Przeprowadzona analiza wykazała, iż spadek wymiarów pozostałości zrębowych był większy w zakresie ich długości niż średnicy. Uzyskany wynik rozdrabniania arbomasy okazał się zadowalający z punktu widzenia możliwości późniejszego mechanicznego przygotowania powierzchni do odnowień.

Słowa kluczowe: pozostałości zrębowe, rozdrabniacz, skuteczność rozdrabniania

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