Fuel consumption and productivity for two tractor-mounted chippers in relation to knife wear and raw material

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Supply chain costs

- Comminuting is the major part of the supply, depending if it is the main product or only a by-product of timber production
- Presently in Sweden (and even elsewhere) chipping is mostly performed at the landing or in the forest
- It's crucial to investigate fuel consumptions in order to reduce chips supply costs and energetic balance besides environmental impact
- Wood chips quality is also important

Case study within the Cost Action FP0902

- Aim of the study
- Location
- Machine
- Material/methods
- Results
- Conclusions



Aim of the study

Influence of knives sharpeness and raw material on:

- Productivity
- Fuel consumption
- Particle size distribution

Blades sharpeness
Raw material



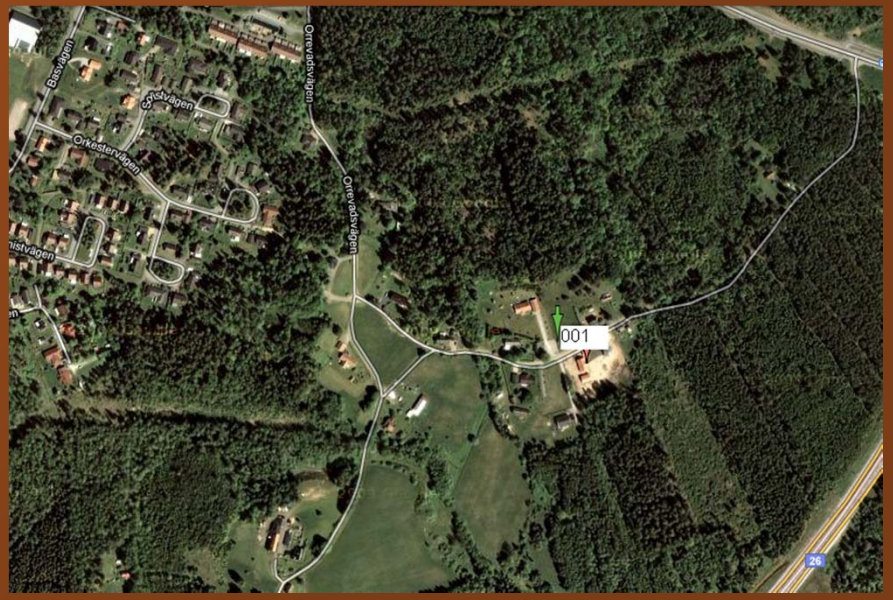
Location in four different chipping spots in the South-West of Sweden:

DRUM CHIPPER

- logging residues at Skultorp (N 58 20.268 E 13 51.267),
- tree sections from a thinning near Tibro (N 58 25.216 E 14 04.980).

DISC CHIPPER

- logging residues from a final felling near Mariestad (N 58 35.873 E 13 42.658)
- pulpwood at the biomass terminal in Götene (N 58 31.351 E 13 29.071).





Material and methods

- Jenz 561 powered by a 246 kW Claas Xerion 3300 tractor
- TS 1200 disc-chipper mounted on a John Deere 810D forwarder
- Time study/Weights/Samples
- Fuel measurements

Results drum chipper (1/2)

Passing from a “good” blades status to a “dull” one, there is a 15.7% decrease in productivity for the same kind of raw material.
By replacing knives and comminuting thinning there was an increase of 9.5% if compared to the blades in good conditions that were used at the beginning

ANOVA table for productivity

	Effect	DF	SS	MS	F-value	P-value	Power
odt h^{-1}	Raw Material	1	29.339	29.339	15.584	0.0019	0.962
	Residual	11	11.986	1.090			
odt h^{-1}	Blades Status	2	39.945	19.973	18.330	0.0003	0.999
	Residual	11	11.986	1.090			

Results drum chipper (2/2)

Concerning fuel consumption, chipping of forest residues required 2.4 l odt^{-1} when blades were in good conditions and 3.1 l odt^{-1} with dull blades. By replacing a new set of blades the fuel consumption was on average 2.3 l odt^{-1} by comminuting thinning material.

ANOVA table for fuel consumption

	Effect	DF	SS	MS	F-value	P-value	Power
l odt^{-1}	Raw Material	1	0.720	0.720	7.562	0.0189	0.711
	Residual	11	1.047	0.095			
l odt^{-1}	Blades Status	2	1.536	0.788	33.220	<0.0001	1.000
	Residual	10	0.231	0.23			

Results disc chipper

The only significant impact on productivity was raw material

Particle size distribution: a statistical significant effect, limited to the accepts particles, was detected between forest residues and pulpwood.

Conclusions

- Fuel costs account for a large share of the overall costs for chipper contractors
- Knife wear increases costs and decreases productivity
- It is also one of the few factors that the contractor can control by himself

THANK YOU