Logistic chains for wood chips from short rotation forestry

Franz Handler und Emil Blumauer

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Contact: Ifz FRANCISCO JOSEPHINUM WIESELBURG
BLT - BIOMASS | LOGISTICS | TECHNOLOGY
Rottenhauser Str. 1 Tel.: +43/7416/52175-15
AT 3250 Wieselburg Fax: +43/7416/52175-45
E-Mail: franz.handler@josephinum.at
Harvesting

- Forage harvester (Claas Jaguar 890 - 370 kW) equipped with a special header (Biomasse Europa)
  - Theoretical cutting length: 34 mm
  - Maximum diameter of trunks: 13 cm
  - Working width: 120 cm
Results - Working time requirement - Harvester

Mass flow related to effective chopping time

MPh ... man power hours
t ... tons
DM ... dry matter
h ... hours
ha ... hectares
Transport

Chain 1:

- Tractor-pulled trailers directly transport the wood chips from the field to the storage.
- Types of trailers:
  - 2- or 3-side tippers
  - Body tippers
  - Push-off trailers
  - Silage trailers
- Loading space: 19 – 40 m³
Transport

Chain 2:

- Tractor-pulled trailers transport the wood chips from the field to an interim storage near the field.
- The transport from the interim storage to the storage is carried out by articulated lorries or road trains.
- A wheel loader or telehandler loads the lorries.
Transport

Chain 3:

- Tractor-pulled adapted field transfer trailers transport the wood chips from the field to the articulated lorries or roadtrains.
- By means of an auger the field transfer trailers directly load the wood chips on the lorries.
- The lorries transport the wood chips to the storage.
Transport

Chain 4:

- Tractor-pulled hook lift trailers transport the wood chips from the field to an interim storage for the containers near the field.

- At the interim storage two loaded containers are picked up by a hook lift lorry and are transported to the storage.
Working time requirement for transport from field to storage

Plot size 3 ha, bulk density 130 kg DM/m³, dry matter content 45 %, loading space of the trailers 35 m³, driving speed of the tractors 32.5 km/h
Transport: Field – interim storage

Requirement: Forage harvester need not wait.

Haul distance 1 km, bulk density 130 kg DM/m³, dry matter content 45 %, driving speed of the tractors 32.5 km/h

Diagram showing different transport units and their working time requirements in [MPh/10 t DM].
Transport: Field – storage
Transport: Field – storage

- Chain 1: Tractor pulled trailer 40 m³
- Chain 2: Tipper 19 m³, articulated lorry 90 m³
- Chain 3: Field transfer trailer 35 m³, articulated lorry 90 m³
- Chain 4: Hook lift trailer with container 35 m³, lorry with trailer (2 containers) 70 m³

Graph showing total costs [€/t DM] vs. distance field - storage [km] for different transport options.
Conclusions

- A lower working time requirement for chopping causes a lower working time requirement for transport of wood chips.
- The working time requirement for transport corresponds to the loading space of the trailers and to the transport distance.
- Because of the high costs idle time of the harvester should be avoided. This requirement causes idle time of the transport vehicles.
- The degree of utilization of the transport chain determines the idle time of the transport vehicles.
Conclusions

- The degree of utilization of the transport chains is mainly determined by:
  - mass flow through the harvester
  - transport distance
  - speed and loading space of transport vehicles

- The direct transport from field to storage by a tractor with trailer is the most time and cost effective way to transport wood chips up to a distance of 10 to 15 km.

- For larger distances the use of containers is the most time and cost effective way. (containers act as buffer → enough containers must be available)
Are there any questions?
Related publications


Authors

Ifz FRANCISCO JOSEPHINUM WIESELBURG
BLT - BIOMASS | LOGISTICS | TECHNOLOGY

BLT is the research department of the HBLFA Francisco Josephinum. The main activities are:
- Testing and development of agricultural machinery
- Analyzing and development of agricultural processes
- Research in area of the energetic use of solid and liquid biofuels

Franz Handler
Head of the department process engineering

Main tasks:
- Working time requirement and logistics in agriculture
- Mechanization in hillside farming
- Processes for producing biomass