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Witold Zychowicz, Tomasz Nurek, Monika Aniszewska, Arkadiusz Gendek

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# THE EFFECTIVENESS OF THE PROCESS OF HARVESTING OF POPLAR WOOD FROM PLANTATION FOR PAPER AND CHIPBOARD



**Warsaw University of Life Sciences - SGGW**  
Faculty of Production Engineering  
Department of Agricultural and Forestry Machinery



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# INTRODUCTION



## GENERAL POPLAR PROJECT

Derivation of the genetically modified poplar line with improved parameters for dry matter growth and water yield and reproduction and cultivation of *Populus trichocarpa*

## STUDY SCOPE

Development of field production technology of poplar (*Populus trichocarpa*) containing fragmentation of wood material

# STUDY PURPOSE



The purpose of the study is to determine the parameters of the process of planting and harvesting of genetically modified poplar. The results will be used in economic, energy, cost, LCA and environmental risks analysis.

# FIELD RESEARCH



- Two days of research (January and February 2017), poplar plantations in the vicinity of Człuchów (in the centre of northern part of Poland)
- Record of activity of all machines from two working days
- Approximately 7 hours of video recording of machine work
- Development of measurement results by identifying and determining the duration of component of machine cycles and schedules

# FIELD RESEARCH



## HARVESTING SYSTEM

**Felling** – harvester (or/and chain saw)

**Debranching and cross cutting** – harvester (or/and chain saw)

**Field transport (hauling)** to temporary depots – forwarder (tractor with wood trailer)

Thicker assortments – **storage and loading** on trucks

Other assortments (including branches) – **chipping** (transportable chipper), directly to the container or truck

# STUDY OF POPLAR WOOD HARVESTING





# STUDY OF POPLAR WOOD HARVESTING



# Plantation parameters



- Planting year - 2011, the age of 6 years
- Tree spacing 2,5 m x 1,5 m
- Average volume of tree – 0,03 m<sup>3</sup>
- The area is slightly undulated, distinct differences in the size of trees growing at the lower areas or hills



# Parameters of trees



## Diameter of the trees at the cut height

Site	Cutting diameter [cm]	Confidence -95%	Confidence +95%	N	SD	Variance	min	max
Site 1	12,62	12,27	12,98	110	1,89	3,57	7,00	16,50
Site 2	11,86	11,51	12,21	99	1,76	3,09	8,00	16,00
Average	12,26	12,01	12,52	209	1,86	3,47	7,00	16,50

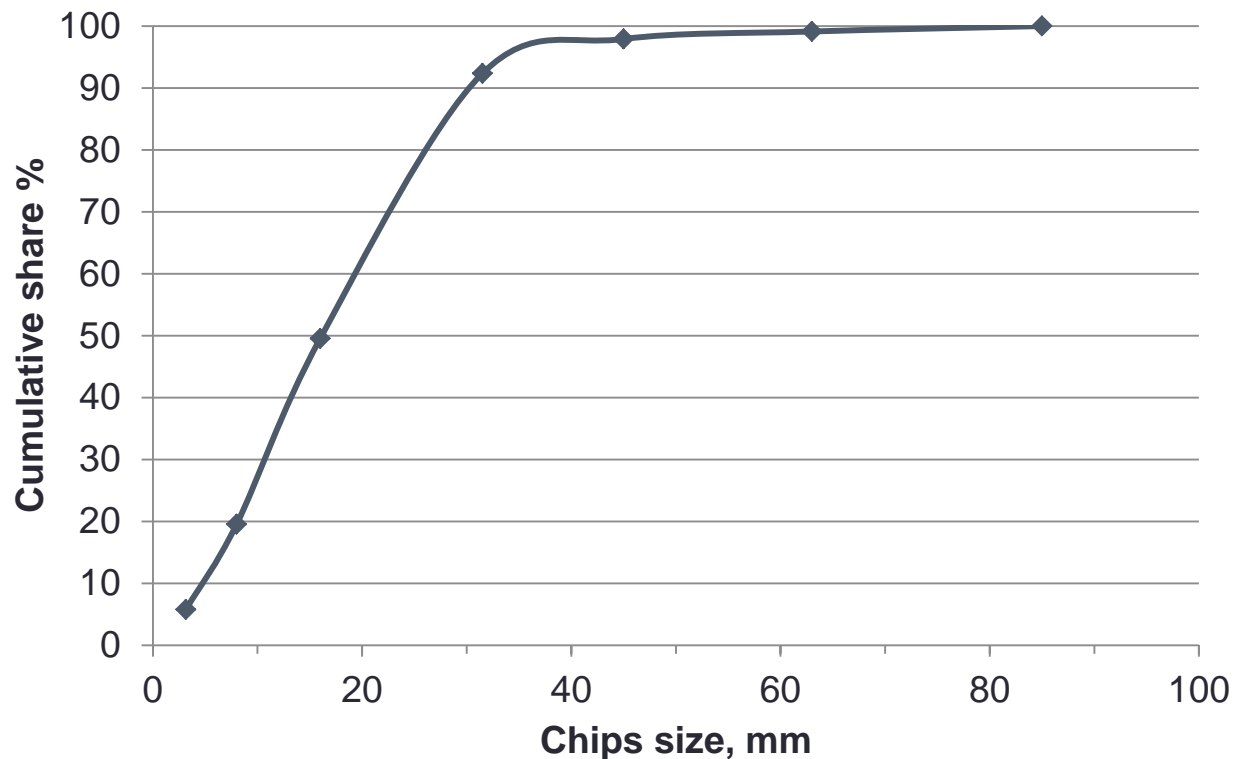
## Height of trees

Number	Average [m]	Confidence -95%	Confidence +95%	min	max	Variance	SD
102	9,37	9,24	9,50	7,10	11,20	0,44	0,66

# Chips parameters



## Cumulative distribution of chips of different sizes



Sieve size through which 50% of particles passed (d50) – 16.16 mm

# Chips parameters



The bulk density of chips

	Bulk density [kg/m <sup>3</sup> ]	Confidence -95%	Confidence +95%	N	SD	Variance	min	max
<b>BDar</b>	342,43	338,40	346,46	10	5,63	31,70	333,10	351,10
<b>BDd</b>	113,77	112,44	115,10	10	1,86	3,45	110,70	116,60

BDar – wet chips (moisture content – 66,8%)

BDd – dried chips

# Harvester operating cycle



# Productivity of machines



## Provisional results

### Harvester

- Average operating cycle time – 19,2 s (number of cycles – 1310)
- Average tree volume – 0,03 m<sup>3</sup>
- Operational productivity – 5,63 m<sup>3</sup>/h
- Overall productivity – 3,89 m<sup>3</sup>/h (10 hours working shift)

# Productivity of machines



## Provisional results

### Forwarder (full tree and/or tops transporting)

- Average operating cycle time – 33,5 min (2010 s)
- Average load volume – 7,3 m<sup>3</sup> of wood (equal to 17 m<sup>3</sup> of chips)
- Average hauling distance – 230 m
- Operational productivity – 13,1 m<sup>3</sup>/h
- Overall productivity – 9,1 m<sup>3</sup>/h (10 hours working shift)

# Study summary



- The first part of the database describing the process of obtaining poplar from plantations in Poland was created.
- The database needs further refinement and completion.
- The data collected should allow, by comparison of the parameters of trees and wood, to estimate the efficiency of the production process of genetically modified poplars.

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**Thank you for your attention**