Dynamics of biomass production in poplar clones grown under short rotation coppice management in the Czech Republic

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Introduction

- Short rotation woody crops (SRWC) are good alternative source of bioenergy
- Cultivated on fallow and former arable land, such as land use
- Rotation cycle 2-8 years
- Poplar clones-
  - 107 (black poplar clones)
  - 210 (black poplar clones)
  - 301(black poplar clones)
  - NE-42 (*Populus maximowiczii* × *Populus trichocarpa*)
  - J-105 (*Populus nigra* × *Populus maximowiczii*)
  - Cl97+98 (black poplar clones)
  - Cl00+02 (black poplar clones)
  - S x N (black poplar clones)
  - Vzcl98 (black poplar clones)

Aims of the study

- To study the dynamics of biomass yield of poplar clones at five different sites over 3 to 13 years
- To estimate the effects of clone, sites and number of rotations as well as their mutual interactions on stool survival and aboveground woody dry biomass

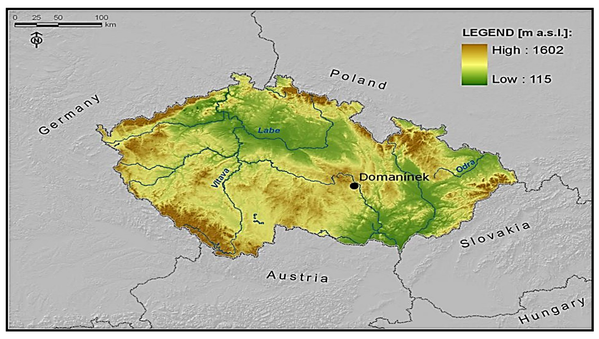
Materials and Methods

Table 1: Description of experimental sites in Czech Republic

Charactristics	Year	Bystřice	Smilkov	Rosice	Průhonice	Domaninek
Latitude (N)		49°21'	49°36'	50°03'	49°59'30	49° 31´
Longitude (E)		12°48'	14°36'	15°42'	14°34'34	16° 14´
Altitude (m a.s.l.)		551	515	219	332	530
Mean annual air temperature [°C]		5.7	6.8	8.5	9.4	7.2
Soil type		Histosol	Cambisol	Alluvial	Brown earth	Cambisol Luvic
pH/CaCl2		4.95	6.75	6.68		4.5
Plot status before the experiment		Lay fallow	Arable	Lay fallow	Arable	Arable
Influenced by neighboring river		Yes	No	Yes	No	No
Total rainfall [Apr-Sep (mm)]	1999	-	352	-	-	-
	2000	-	393	-	-	-
	2001	-	501	-	-	-
	2002	-	548	-	-	407
	2003	-	265	-	-	265
	2004	-	369	-	-	271
	2005	-	415	-	314	370
	2006	-	635	-	293	383
	2007	-	355	-	320	430
	2008	-	284	-	-	302
	2009	-	401	-	399	488
	2010	-	506	-	492	484
	2011	-	346	-	466	376
	2012	-	-	-	355	276
	2013	-	-	-	452	350
	2014	-	-	-	389	389
	2015	-	-	-	249	-

Table 2: Plantation and monitoring of poplar clones at different sites

Locality	Establishment year	Poplar clone	Spacing	Plant density per ha	Number of repetion	Number of harvest	Rotation length (year)
Bystřice	1998	107	3.0×1.5	2222	4	5	3-4
	1998	210	3.0×1.6	2222	4	5	3-4
	1998	301	3.0×1.7	2222	4	5	3-4
	1998	NE-42	3.0×1.8	2222	4	5	3-4
Smilkov	1998	107	3.0×1.5	2222	4	5	3-4
	1998	210	3.0×1.5	2222	4	5	3-4
	1998	301	3.0×1.6	2222	4	5	3-4
	1998	NE-42	3.0×1.7	2222	4	5	3-4
Rosice	2002	107	2.0×0.67	7463	4	4	3-4
	2002	210	2.0×0.68	7463	4	4	6-8
	2002	301	2.0×0.69	7463	4	4	3-4
	2002	NE-42	2.0×0.70	7463	4	4	3-4
Domaninek	2002	J-105	2.6×0.70	9216	2	2	3-4
Průhonice	2005	SxN	2.2×0.45	10101	3	2	3-4
	2005	J-105	2.2×0.46	10101	3	2	3-4
	2005	VZ cl 98	2.2×0.45	10101	4	2	3-4
	2005	J-105	2.2×0.46	10101	4	2	3-4
	2005	SxN	2.2×0.45	10101	4	3	3-4
	2005	J-105	2.2×0.46	10101	4	3	3-4
	2009	cl 97+98	3.0×0.55	6061	4	2	3-4
	2009	J-105	3.0×0.56	6061	4	2	3-4
	2009	cl 00+02	3.0×0.55	6061	4	2	3-4
	2009	J-105	3.0×0.56	6061	4	2	

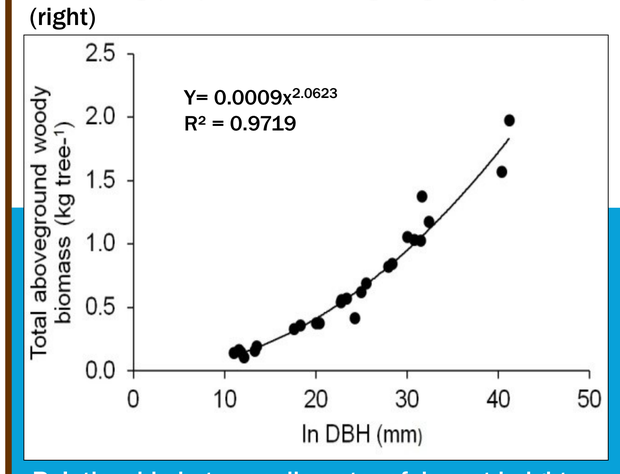


Map of Czech Republic

Measuring DBH using automatic-dendrometer DRL26

Measuring DBH using digital caliper (Mitutoyo, CD-15DC, UK, 0.01 mm precision)

Harvesting (left) and measuring length of poplar trees (right)



Relationship between diameter of breast height (dbh) and total aboveground woody dry biomass of trees (kg tree^{-1})

Results

Figure 1: Dynamics of survival rate(%)of poplar clones in two harvests at five different sites in Czech Republic

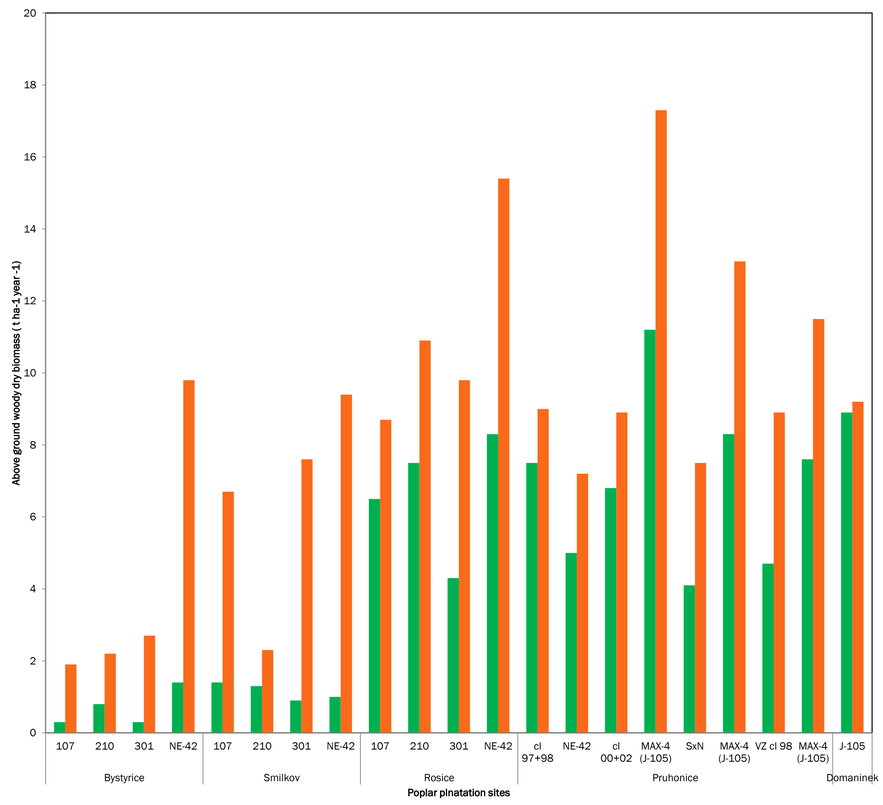


Figure 2: Dynamics of average annual above ground woody dry biomass (t ha^{-1} year^{-1}) of poplar clones in two harvests at five different sites in Czech Republic

Conclusions

- Second rotation produce more biomass as compared to first rotation
- Clone J-105 produced more biomass as compared to other clones in the current study
- In second rotation survival rate decreased while aboveground woody biomass increased
- Maximum biomass can be produced on arable lands (former agricultural lands) as compared to fallow lands
- For better and accurate results there is a need to continue with many rotations, clones and different sites

Acknowledgement:
This work was supported by the "Ministry of Education, Youth and Sports of CR within the National Sustainability Program I (NPU I), grant No. LO1415

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