Biomass production of *Populus nigra* L. clones grown in short rotation coppice systems

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Introduction

Populus nigra is an autochthonous European woody species that is one of the parental components in about 60% of new cultivated poplar hybrids. Black poplar is irreplaceable in regions where the planting of allochthonous species is usually not allowed (e.g. national parks). In these situations it is anticipated that only pure clones of black poplar will be grown.

The aim of the trial was to test the performance of black poplar clones as a possible replacement for commercial hybrid poplars, and to measure their potential yield in short rotation coppice systems.

Materials

- 3 clones of *P.nigra* (designated 107, 210, 301)
- clone'NE-42', an interspecific hybrid of *P. maximowiczii* × *P. trichocarpa*, used as a control

Tab. 1 Description of the study localities

Locality	Plant density plants.ha^{-1}	Established yr	Conditions for growing black poplar	Altitude m a.s.l.	Climatic region	pH/$CaCl_2$	Influenced by neighbouring river
BY	2,222	1998	unfavourable	551	moderately cold and moist	4.95	yes
SM			marginal	515	moderately warm and moist	6.75	no
RO	7,407	2002	favourable	219	warm and moderately dry	6.68	yes

Methods

- Three localities (Fig. 1), each with different soil and climatic conditions (Tab. 1) (Benetka et al. 2007)
- Four harvests mainly at three-year intervals
- Evaluated characteristics: plant mortality, number of shoots, thickness of shoots, the dry matter weight of individual plants (DMIP) and the dry matter yields per hectare
- Statistical analysis (Statistica 8.0)

Tab. 2 The percentage of surviving plants in the particular localities before harvests

Locality	BY				SM				RO			
Harvest	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.
Clone	%				%				%			
107	100	58	50	50	95	95	95	95	93	80	80	60
210	100	100	88	81	100	100	100	100	97	93	60	23
301	83	83	75	67	95	95	95	95	97	93	77	10
NE-42	100	100	94	94	100	100	100	100	97	90	87	63

Results and conclusion

- The number of shoots and plants per unit area fell during the course of the four rotations (Tab.2, Fig.2).
- The number of shoots per plant was always higher in the black poplar clones compared to 'NE-42' (Tab.3).
- Leading shoot diameter in 'NE-42' was the same as the black poplar clones only in favourable conditions (Tab.3, Fig.2). The proportion of stronger shoots in any given locality was always lower in black poplar compared to 'NE-42'.
- 'NE-42' gave the highest biomass yields in each of the three localities (Tab. 4, Fig.2), but biomass yields of black poplar clones were satisfactory.
- The differences observed between 'NE-42' and the best black poplar clone decreased as conditions became more favourable.
- Black poplar can be successfully grown in marginal conditions on land which otherwise would not be especially suitable for agricultural production, and also in areas where the genetic purity of native populations of black poplar is threatened by the spread of commercially grown hybrid poplars.

Tab. 3 Two yield traits and differences among clones before the fourth harvest

Number of shoots	BY				SM				RO			
Clone	N	mean	± SE		N	mean	± SE		N	mean	± SE	
107	5	13.4	± 2.6	b	18	28.4	± 1.6	b	18	6.6	± 0.8	a
210	13	12.5	± 2.1	b	20	36.5	± 2.0	a	7	8.6	± 0.8	a
301	8	22.4	± 2.3	a	19	40.5	± 1.6	a	3	6.7	± 3.8	a
NE-42	15	10.2	± 1.2	b	20	21.9	± 1.1	c	19	6.0	± 1.4	a
Diameter of the main shoot	BY				SM				RO			
Clone	N	mean	± SE [mm]		N	mean	± SE [mm]		N	mean	± SE [mm]	
107	5	49.2	± 3.4	b	18	57.8	± 1.6	b	18	61.2	± 4.7	a
210	13	39.0	± 2.8	c	20	44.1	± 1.6	c	7	53.3	± 3.9	a
301	8	37.0	± 2.7	c	19	47.1	± 1.6	c	3	52.7	± 11.7	a
NE-42	15	74.3	± 3.1	a	20	65.0	± 1.9	a	19	53.7	± 4.3	a

N = number of observations

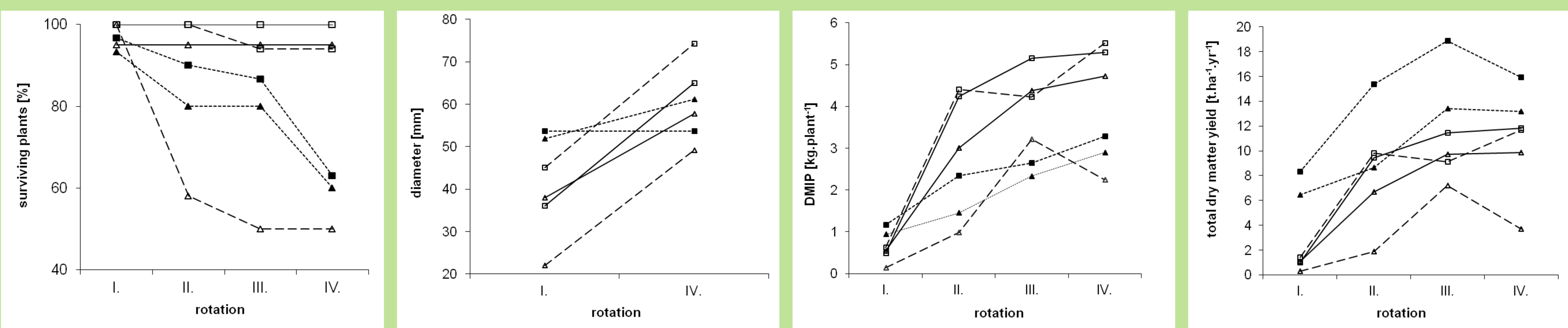
Tab. 4 Total dry matter yield per unit area [t.ha^{-1}.yr^{-1}] in black poplar clones and in hybrid clone 'NE-42'; expressed with respect to the percentage of surviving plants

I. rotation	BY				SM				RO			
Clone	N	mean	± SE		N	mean	± SE		N	mean	± SE	
107	2	0.3	± 0.0	a	4	1.1	± 0.1	a	5	6.5	± 0.8	ab
210	4	0.8	± 0.2	a	4	1.3	± 0.2	a	5	7.5	± 0.7	ab
301	3	0.3	± 0.1	a	4	0.9	± 0.1	a	1	4.3		b
NE-42	4	1.4	± 0.5	a	4	1.0	± 0.2	a	5	8.3	± 0.7	a
II. rotation	BY				SM				RO			
Clone	N	mean	± SE		N	mean	± SE		N	mean	± SE	
107	2	1.9	± 1.4	b	4	6.7	± 0.8	a	5	8.7	± 1.0	a
210	4	2.2	± 0.5	b	4	7.3	± 0.3	a	5	10.9	± 0.4	a
301	3	2.7	± 0.5	b	4	7.6	± 1.6	a	5	9.8	± 1.5	a
NE-42	4	9.8	± 0.9	a	4	9.4	± 1.0	a	5	15.4	± 1.8	a
III. rotation	BY				SM				RO			
Clone	N	mean	± SE		N	mean	± SE		N	mean	± SE	
107	1	7.2		a	4	9.7	± 0.7	ab	5	13.4	± 1.0	a
210	4	3.8	± 0.5	a	4	8.0	± 0.5	b	4	9.6	± 1.1	a
301	3	4.1	± 0.2	a	4	9.5	± 1.0	ab	5	10.5	± 1.7	a
NE-42	4	9.1	± 2.4	a	4	11.4	± 0.4	a	5	18.9	± 3.7	a
IV. rotation	BY				SM				RO			
Clone	N	mean	± SE		N	mean	± SE		N	mean	± SE	
107	2	3.7	± 2.8	b	4	9.9	± 0.5	b	5	13.2	± 3.0	ab
210	4	2.5	± 0.5	b	4	8.0	± 0.7	c	4	5.4	± 1.2	ab
301	3	3.3	± 0.5	b	4	9.1	± 0.6	bc	2	3.2	± 1.2	b
NE-42	4	11.7	± 2.6	a	4	11.8	± 0.1	a	5	15.9	± 4.1	a

N = number of observations

Fig. 1 Localities during the fourth harvest

Fig. 2 Time course of stool survival rate (a), diameter of the strongest shoot (b), dry matter weight of individual plants (c) and total dry matter yield per unit area (d) over the four rotations of the coppiced clones 107 and 'NE-42'



Key: BY locality (dashed line); SM locality (continuous line); RO locality (dotted line); clone 107 (triangle); clone 'NE-42' (square).

References

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