THE RESEARCH ON NATIVE SPECIES OF FAST-GROWING TREES

(POPLARS AND WILLOWS)

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Vojtech Benetka, Jan Weger

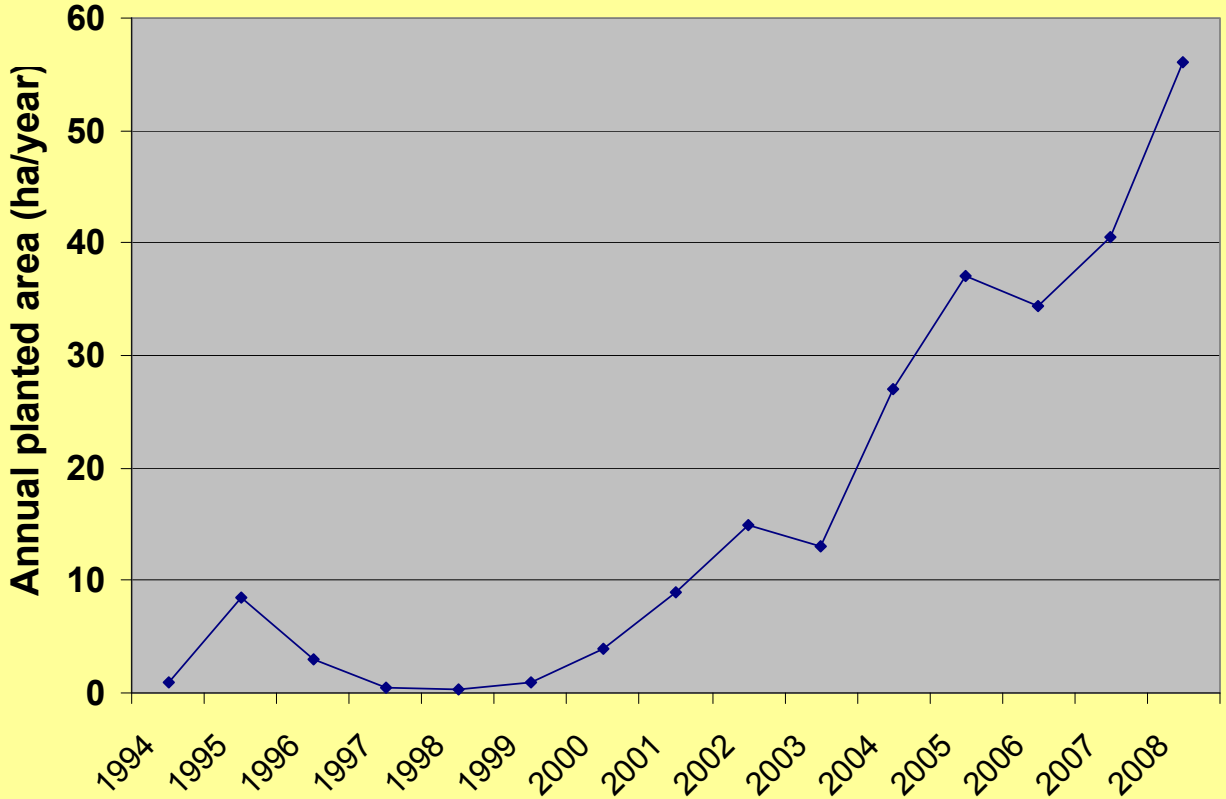
VUKOZ, Publ. Res. Inst.
Silva Tarouca Research Institute
for Landscape and Ornamental Gardening
Průhonice, Czech Republic

Research of poplar and willow for SRC

- Research started in 1994: clone selection, agronomy, biodiversity, hydrology
- Poplar and willow clones from national clone collections including pre-selections from natural populations in Czech Republic
- Nearly 30 testing plots and plantations were used for research
- *Populus nigra,*
  Salix alba, S. x rubens,
  S. viminalis, S. x smithiana

Practice of SRC in Czech Republic

- Not very impressive 225 ha of SRC were planted since 1994 (+25 ha of stool beds)



Practice of SRC in Czech Republic

- Mainly poplar clone MAX-4 is planted (70%), but also other clones from our selection, “Swedish” willows and “Italian” poplars
- Maximum growing area of SRC has been assessed about 60 000 ha (State Energy Policy, 2003)
- Mainly forestry companies are planting SRC as strategic development
- M of Environment: is stressing sustainable SRC: domestic species, hedges, mixed plantations and forbiding use of invasive species

Why research of native species for SRC? (**Pros**)

- Act on Nature Protection (no.114/1992 Coll.) limits use of non-native (allochtonous) species and their hybrids in landscape and in specially protected areas

- Relatively well accessible genetic source with interesting characteristics for breeding: horizontal resistance (*P. nigra* and rust), wide ecological amplitude of natural hybrids (*S.* x *smithiana*) and good adaptation to local ecological conditions

- Preservation of ecologically important species endangered by antropogenic activities – destruction of their natural habitats and breeding with introduced non-native species (*Salix daphnoides, Populus nigra*)

Why research of native species? (**Cons**)

- Limited gene-pool
- We can expect lower gains in productivity (yield) from intra-specific breeding in comparison with inter-specific hybridization where heterosis may occur
- Therefore it may not look promising to study native species = smaller chance for funding?!

Research of black poplar
(*Populus nigra* L. ssp. *nigra* Bugala)

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Research of black poplar

Assortment: selections from natural populations (plus trees) of black poplar and progenies of their controlled crossing (e.g. 250 plus trees and 300 selected progenies)

Tasks: In the beginning preservation of endangered specie and later testing for SRC

Methods: Collecting of genetic resources, field testing on more sites, specie verification (ELFO-Izoezymes), controlled pollination,

Results of black poplar I

Yields of dry biomass (t/ha/year) of selected clones of black poplar (BP) on locality Smilkov (1997-2007), density 2222 trees/ha

Clone	Harvest 1	Harvest 2	Harvest 3	Average
NE-42	0,8	9,4	11,4	6,8
BP-301	0,7	7,9	10	5,9
BP-311	-	7,2	9,7	-
BP-206	-	7,6	8,7	-
BP-210	1,25	7,3	8,0	5,3
Rotation	4 years	4 years	3 years	Σ 11 years

BP – black poplar clones, NE-42 (*P. maximowiczii* × *P.trichocarpa*)

Results of black poplar II

Sprouting ability (number of stems) **after harvest** of selected clones (BP) on locality Smilkov

Clone	**Harvest 1**	**Harvest 2**	**Harvest 3**
BP-206	25	39	69
BP-202	20	20	52
Blanc du Poitou	15	13	29
NE-42	14	11	26
Rotation	4 years	4 years	3 years

BP – black poplar clones,
NE-42 (*P. maximowiczii* × *P.trichocarpa*)
Blanc du Poitou (*P.* × *canadensis*)

Results of black poplar III

Yield of dry biomass (kg/plant) in fungicide sprayed field experiment against *Melampsora larici-populina*

Clone	Yield [kg]		Duncan's test between (s) x (u)	Change of yield in (u) treatment [%]
	(S)	(K)		
BP-007	1,12	1,25	ns	+ 12
BP-107	1,55	1,58	ns	+ 2
BP-152	1,50	1,41	ns	- 6
BP-049	1,40	1,28	ns	-9
BP-110	1,25	0,95	ns	-24
BP-009	1,28	0,92	ns	- 28
MAX-4	2,82	2,15	x	- 24

BP – black poplar clones

ns – non significant

Resistance of black poplar clones to *Melampsora larici-populina*

Susceptible semi-resistant highly resistant

clones (to rust *Melampsora larici-populina*)

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Research of willows

(with focus on natural hybrids)

Salix alba × *S. fragilis* = *S.* × *rubens*

Salix caprea × *S. viminalis* = *S.* × *smithiana*

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Method: clone test (9 years, 1999-2007)

- 4 sites (locations),
- 8 replications
- Plating density 12500 pc/ha
- 3-year rotation (3x)
- Assortment 38 clones

6 clones of balsam poplar hybrids
6 black × balsam poplar hybrids
1 black poplar
1 *P. × canadensis*
9 *Salix alba* and hybrids
5 *Salix caprea* hybrids
2 *Salix daphnoides*
4 *Salix viminalis*
1 *Salix* 'Tora'
3 other willows .
Tora and Max-4 only on one site

Location	ø °t (°C)	Σ P (mm)	Altitude (m).
Dalovice	7,1	560	405
Doubravice	7,7	691	330
Libedice	8,8	508	255
Nova Olesna	7,2	730	550

Results willows I

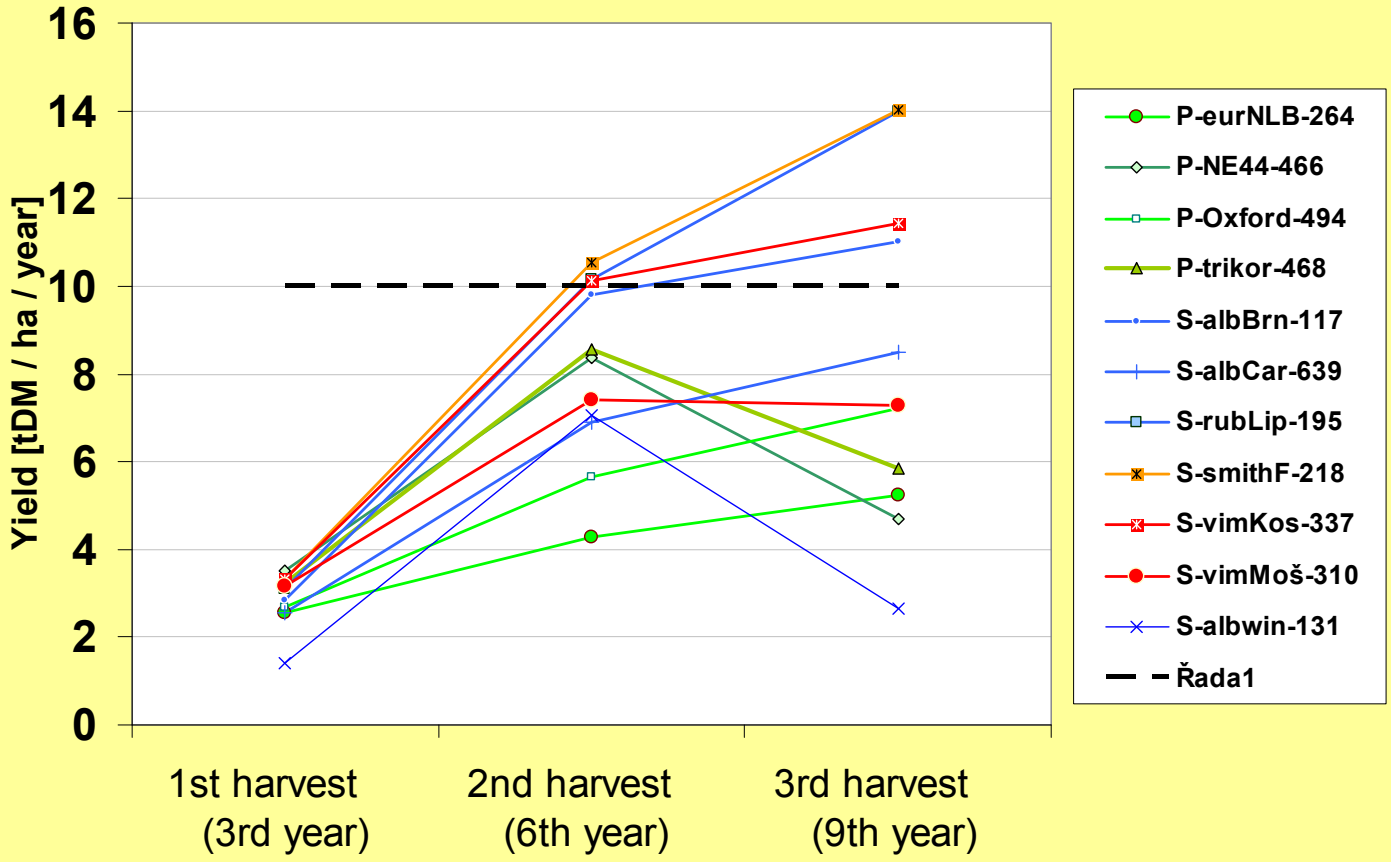
Average yields on four localities of the experiment in 3rd harvests (same selected poplar and willow clones)

Clones	No.	Yield	Survival
	ks	tDM/ha/year	%
Libedice	38	4,21 ^{b}	52% ^{b}
Dalovice	39	5,04 ^{b}	86% ^{Bb}
N.Olesna	36	11,85 ^{B}	91% ^{B}
Doubravice	20	15,22 ^{B}	76% ^{b}

A × a – significant difference (Kruskal Wallis)

Results willows II

Average yields (tDM/ha/year) of selected clones in 3 harvests (3rd, 6th, 9th year) of the experiment



Results willows II

Average yields of selected clones in experiment in 9th year (3rd harvest)

clone	No.	Yield tDM/ha/year	Survival (%)
NL-B-132 (*P. × canadensis*)	7	5,24 a	62a
Oxford (*P. maximoviczii × berolinensis*)	7	7,21 a	70a
SA-117 (*S.alba*)	7	11,01 Aa	83
SV-337 (*S.viminalis*)	7	11,44 Aa	85
x SA-195 (*S. × rubens*)	7	13,98 A	88A
x SC-218 (*S. × smithiana*)	7	14,01 A	83

A × a – significant difference (Kruskal Wallis)

Results willows III

Average yields of clones on „suitable“ and “unsuitable“ sites of the experiment

Clones	Suitable sites t(DM)/ha/year	Unsuitable sites t(DM)/ha/year
Best clones SC-218, SA-195 SA-117, SV-337	**13,7 – 14,9 (max. 22,2)**	**2,9 – 5,3**
Above average Oxford , SA-639, SC-383,SC-704, SV-310, SV-519…	**6,9 – 9,2**	**2,5 – 4,4**
Average and below average clones (24)	**5,5 – 8,1**	**0,7 – 3,6**

Information for creation of land suitability types for selected willow (and poplar) clones

Conclusions / Discussion

- Native species of poplar and willow (of Central Europe) and especially their natural hybrids may have under certain conditions good potential for selection and breeding of high yielding clones suitable for SRC
- Proper site selection for establishment of their SRC is one of these conditions → therefore land suitability types have been created for tested clones in Czech Republic
- Native black poplar may be interesting source of (horizontal) resistance against poplar leaf rust (*M. larici-populina*) and sprouting ability after harvest for breeding for SRC
- Spontaneous hybrids of domestic willows (*S.* × *smithiana*, *S.* × *rubens*) showed very good potential for use in SRC and can also be used for further improvement.

Thank you for your attention!

weger@vukoz.cz

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