Fast growing tree species in Austria

Rosner, J, E. Zwatz:

Office of the Lower Austrian Provincial Government, Department of Agricultural Education, Frauentorgasse 72, A-3430 Tulln, Austria

Liebhard, P.: University of Natural Resources and applied Life Science Vienna, Department of Applied Plant Science and Plant Biotechnology, Institute ofAgronomy and Plant Breeding, Gregor Mendel Strasse 33, A-1180 Vienna, Austria

Facts renewable energy in Austria

•Kyoto agreement 1998: until the period 2008 – 2012 reduction of discharge of CO_2, CH_4, N_2O around 13 % to 1990

•1990 emission 77 Mio.t/year CO_2 equivalent ⇨ 1998 80 Mio.t, ⇨ 2013 83 Mio.t; goal of the Kyoto agreement are 67 Mio.t/year……16 Mio.t reduction of gasemission requested

•Renewable bioenergy needed

•Defile in timber production and increasing demand

	prediction 2010
•Demand 1997 → 2002…….+ 23 % sawn timber	
+ 8 % pulp and paper industry	+ 27 %
+ 47 % wood board	+ 50 %

Increasing demand 2 – 2.5 Mio. cubic metre timber for bio energy

Biofuel:

•Oilseedrape……..1.500 – 2.000 l/ha

•Biodiesel……1.400 l/ha

•Bioethanol…….2.500 l/ha

•BTL…… 4.000 l/ha

•Costs for ethanol in Brasil……200-250 €/t

•Costs for Ethanol Europe……600-650 €/t

•➔ with cereals and maize we can produce 40 % of the energy need in Europe – 20 Mio. ha arable land

•Calculation:

Austria has ~ 2 Mio. Cars……∅ 15.000 km per year, fuel consumption 6l/100 km ⇨ 900 l fuel per year per car

Oilseedrape produces 1.500 l oil per year ⇨ 1.200.000 ha oilseedrape

Total arable land in Austria: 1,38 Mio ha……87% of arable land needed for fuel production (without fuel oil ….heating)

Fast growing tree species (poplar, willow)

➔Production of timber on arable land

•Austria 1.800 ha fast growing trees – poplar and willow – 900 ha in yield

•2 – 2.5 kg timber replaces 1 kg heating oil

•Harvest full mechanized

•Recultivation possible and aimed at

•Renewable energy with high potential of yield

•Energy production with hold open of the countryside

•Long term change to BTL (biomass to liquid) – produced from organic matter like timber

•**Energy balance – energy input:output**

Ethanol from wheat……..1:2.7

Etahnol from sugar beets……1:1.6

Rape-seed oil……1:3.4

Rape methylic ester……1:3.1

Cereal – total plant……..1:12 – 14

Fast growing trees…… 1:16 - 24

Production technology

•On almost every arable land growing

•Annual rainfall > 600 mm

•pH 5.5 – 7

•Average temperature > 8.5 ℃

•One year old Cuttings (20 cm) or rods (2 m), diameter 1.5 cm

•Plantation: end of April – middle of May

•Plant spacing:

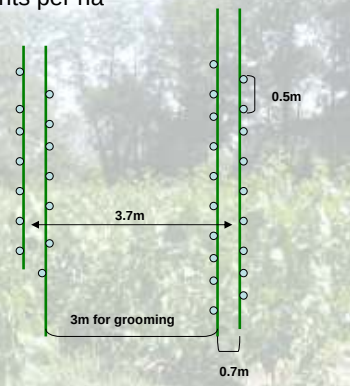
•**Poplar**: row spacing……..3m spacing in the row…..0.5m

6.666 plants per ha

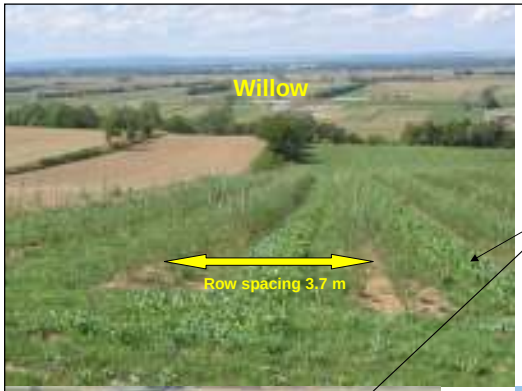
Tested varieties: AF2, Monviso, Pegaso, Sirio…….Italien hybrids

Willow: double row, row spacing 3.7m spacing in the row 0.5m

10.811 plants per ha



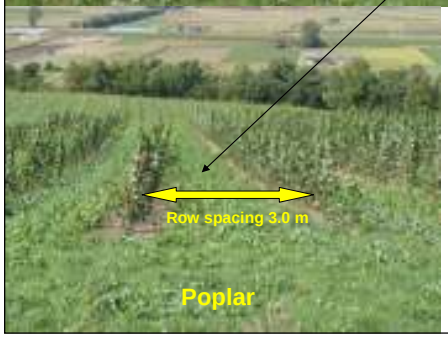
Tested varieties: Inger, Sven, Tora, Tordis….Swedish hybrids



Cover crops to prevent soil erosion

Xeric grassland communities

Grooming to save soil moisture



Test of varieties willow and poplar August first year after planting

Fast growing tree species

•Poplar (populus)

•Willow (Salix)

•Frequency of harvesting:

Poplar ……4-5 years

Willow…….3-4 years

Expected yield…..8-**12**-15-20 t/ha/year

willow

1 st year after plantation in early summer time

2nd year after plantation

Dry and hot period – damage on willow

Willow 10 years old, 1st year after harvest

Willow 10 years old, 4th year after harvest ⇨harvest next winter

Poplar 10 years old, 4th year after harvest ⇨harvest next winter

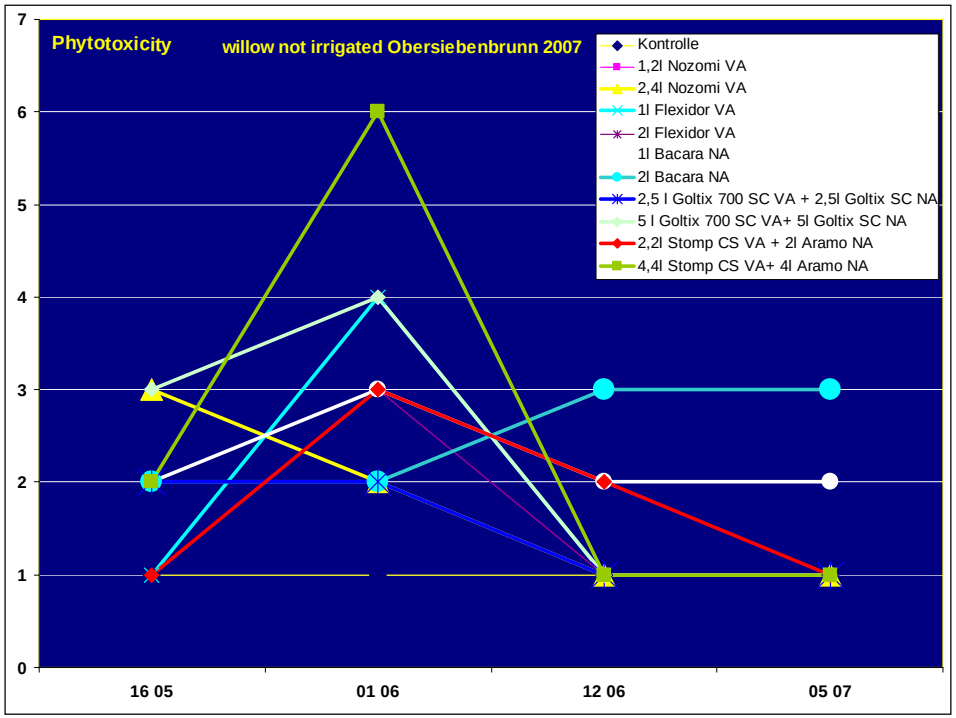
Wood shavings

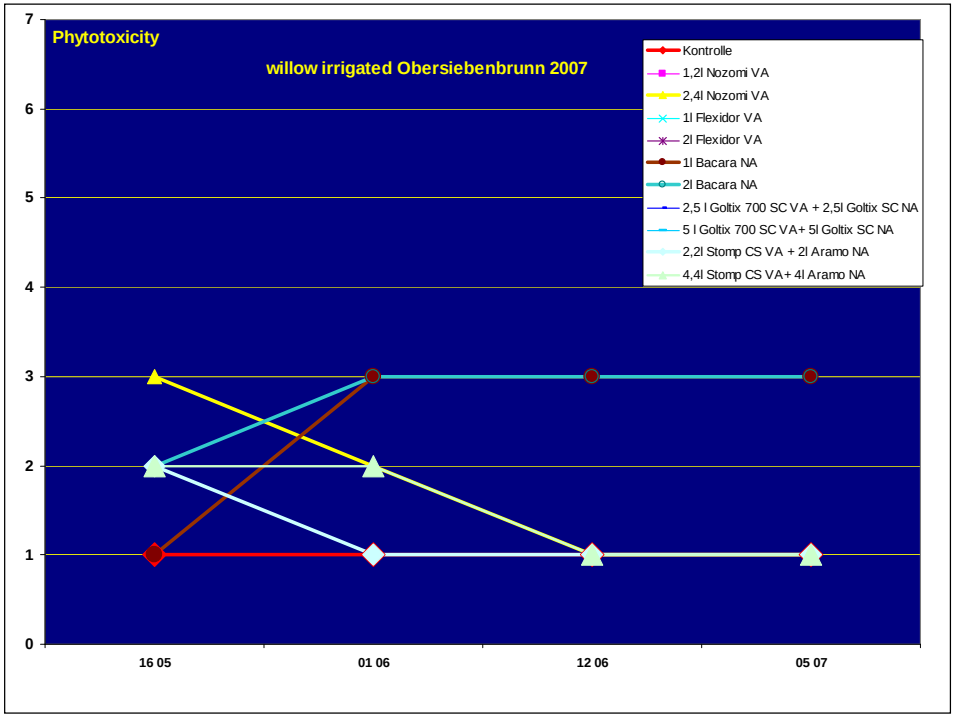
Herbicide tests

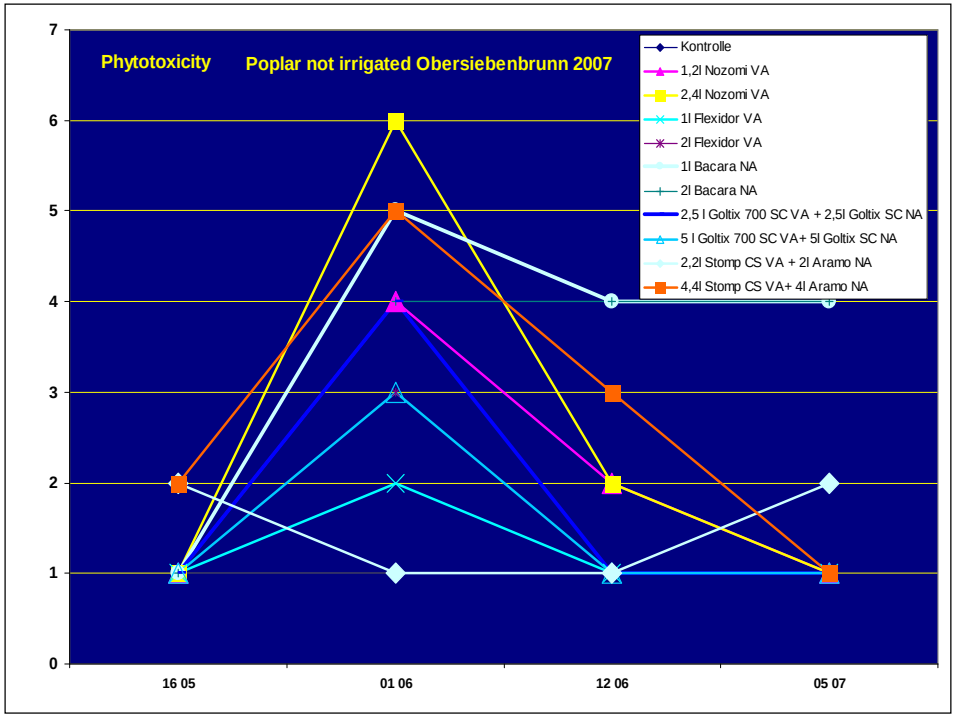
Plot sprayer with special spray booms and band spraying

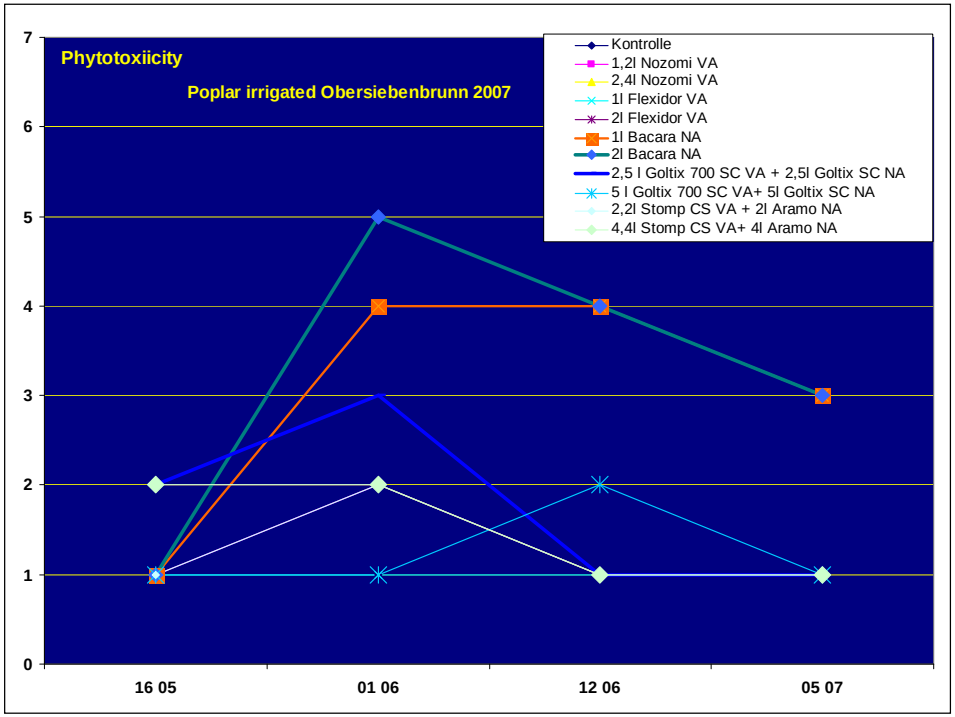
Herbicide test 2007

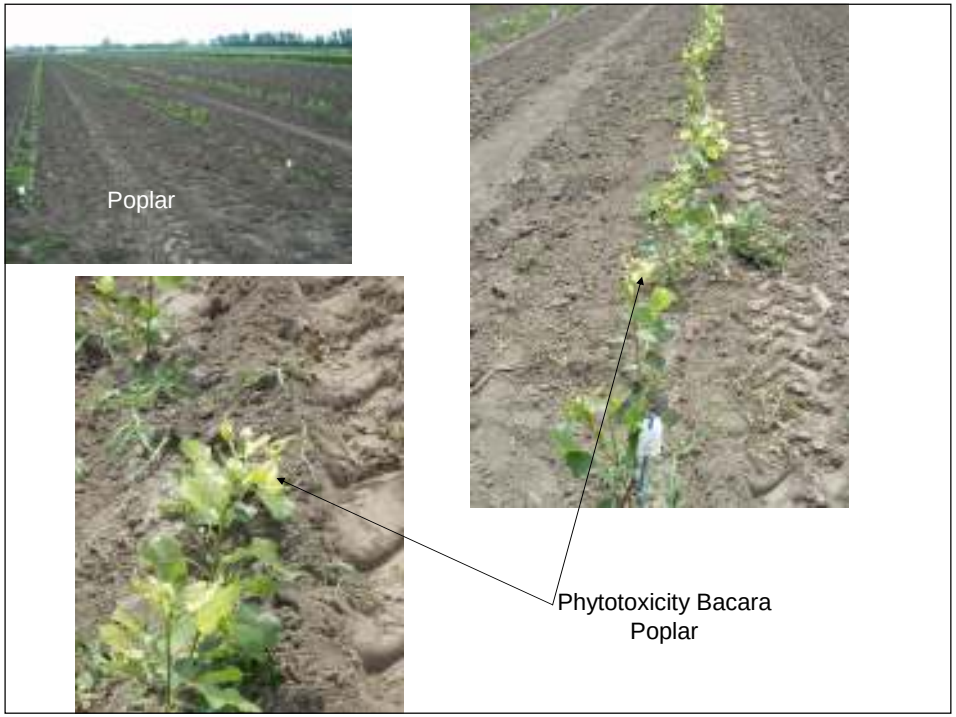
Herbicide	appointment	active substance	application rate	efficiency of herbicid % effect			Phyto toxicity		1 no Phytotox
				Lamium	Amaranthus	Echonochloa	1 to 9		9 total
				amplexicaule	retroflexus	crus galli	Willow	Poplar	perisihing
Nozomi	pre emergency	Flumioxazin	1.2 kg	98	100	62	1	1	
Flexidor	pre emergency	Isoxaben	1.0 kg	54	33	57	1	1	
Callisto	pre emergency	Mesotrione	1.5 kg	92	22	25	1	1	
Chikara +	pre emergency	Flazasulfuron	0.2 kg	88	75	88	1	1	
Break Thru		adjuvant	0.3 l						
Chikara +	pre emergency	Flazasulfuron	0.15 kg	80	72	83	1	1	
Break Thru		adjuvant	0.3 l						
Bacara	BBCH 14	Diflufenican +		100	68	50	3	4	
		Flurtamone	1 l						
Lontrel	BBCH 25	Clopyralid	1.2 l	33	22	28	1	1	
BAS 65903	pre emergency	nn	4 l	50	22	52	1	1	
Stomp CS	pre emergency	Pendimethalin	4.4 l	78	47	78	1	1	
Goltix SC +	pre emergency	Metamitron	2.5 l						
Goltix SC	BBCH 14	Metamitron	2.5 l	88	58	52	1	2	
Stomp CS +	pre emergency	Pendimethalin	3 l						
Aramo	BBCH 25	Tepralxydim	2 kg	77	63	100	1	1	




Phytotoxicity
willow irrigated Obersiebenbrunn 2007
Kontrolle
1,2l Nozomi VA
2,4l Nozomi VA
1l Flexidor VA
2l Flexidor VA
1l Bacara NA
2l Bacara NA
2,5 l Goltix 700 SC VA + 2,5l Goltix SC NA
5 l Goltix 700 SC VA+ 5l Goltix SC NA
2,2l Stomp CS VA + 2l Aramo NA
4,4l Stomp CS VA+ 4l Aramo NA
0
1
2
3
4
5
6
7
16 05
01 06
12 06
05 07


Phytotoxicity
Poplar not irrigated Obersiebenbrunn 2007
Kontrolle
1,2l Nozomi VA
2,4l Nozomi VA
1l Flexidor VA
2l Flexidor VA
1l Bacara NA
2l Bacara NA
2,5 l Goltix 700 SC VA + 2,5l Goltix SC NA
5 l Goltix 700 SC VA+ 5l Goltix SC NA
2,2l Stomp CS VA + 2l Aramo NA
4,4l Stomp CS VA+ 4l Aramo NA
0
1
2
3
4
5
6
7
16 05
01 06
12 06
05 07


Phytotoxiicity
Poplar irrigated Obersiebenbrunn 2007
Kontrolle
1,2l Nozomi VA
2,4l Nozomi VA
1l Flexidor VA
2l Flexidor VA
1l Bacara NA
2l Bacara NA
2,5 l Goltix 700 SC VA + 2,5l Goltix SC NA
5 l Goltix 700 SC VA+ 5l Goltix SC NA
2,2l Stomp CS VA + 2l Aramo NA
4,4l Stomp CS VA+ 4l Aramo NA
0
1
2
3
4
5
6
7
16 05
01 06
12 06
05 07


Poplar
Phytotoxicity Bacara
Poplar

Bacara 1l/ha 2l/ha

Phytotoxicity Willow

Deseases and Pests

Pollaccia saliciperda

(variant Venturia Saliciperda)

- Perishing of the tips of the sprout
- Infection in springtime 1. by Ascospores – from leafes on the soil or 2. infected tips from last year with Konidia, encouraged by wet conditions

Konidia

Pollaccia

Uredospurs
Melampsora larici populina

Polpar rust – spurs produced in summer

Teleutospurs
Poplar rust

Willow weevil

(Chrysomelidae)
feeds on leafes

Damage by game (deer) – **game bite** ⇨ fence

Control with Glyphosinate (Basta) under leaf spraying

Clematis vitalba

Harvest with double chop harvester

Recultivation with rotary cultivatior – rotary brushwood chopper

conclusion

- Renewable bio energy has limits in available agricultural land
- Fast growing trees (polar, willow) have an enermous positive energy balance
- 2.0 – 2.5 kg timber replaces 1 kg heating oil
- Hybrids have a higher potential than varieties from conventional natural selection
- Plant protection is necessary, especial weed control in early growth and against Clematis vitalba
- Harvest full mechanized
- Recultivation after 10 – 20 years with rotary cultivator practicable
- Energy grain for combustion is possible, a cereal yield of 6.000 kg/ha corresponds 2.500 kg heating oil
- Energy grain can be produced on poor arable land – winterrye is superoir and has a low protein content ⇨ low NO_x in the exhaust fumes
- Rivalry food – feed – renewable energy in the future