

## Fast growing tree species in Austria

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## Facts renewable energy in Austria

• Kyoto agreement 1998: until the period 2008 – 2012 reduction of discharge of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O around 13 % to 1990

• 1990 emission 77 Mio.t/year CO<sub>2</sub> 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

• Deficit in timber production and increasing demand

• Demand 1997 → 2002.....+ 23 % sawn timber

+ 8 % pulp and paper industry

+ 47 % wood board

prediction 2010

+ 27 %

+ 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.....Ø 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

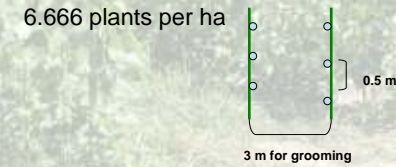
• **Energy balance – energy input:output**

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
<b>Fast growing trees.....</b>	<b>1:16 - 24</b>

**Production technology**

- On almost every arable land growing
- Annual rainfall > 600 mm
- pH 5.5 – 7
- Average temperature > 8.5 °C
- One year old Cuttings (20 cm) or rods (2 m), diameter 1.5 cm
- Plantation: end of April – middle of May
- Plant spacing:

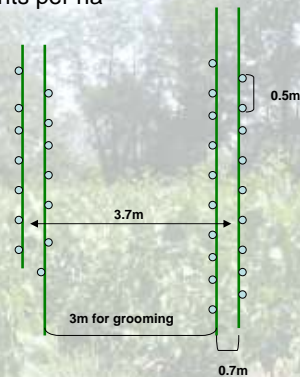
• **Poplar:** row spacing.....3m spacing in the row.....0.5m



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

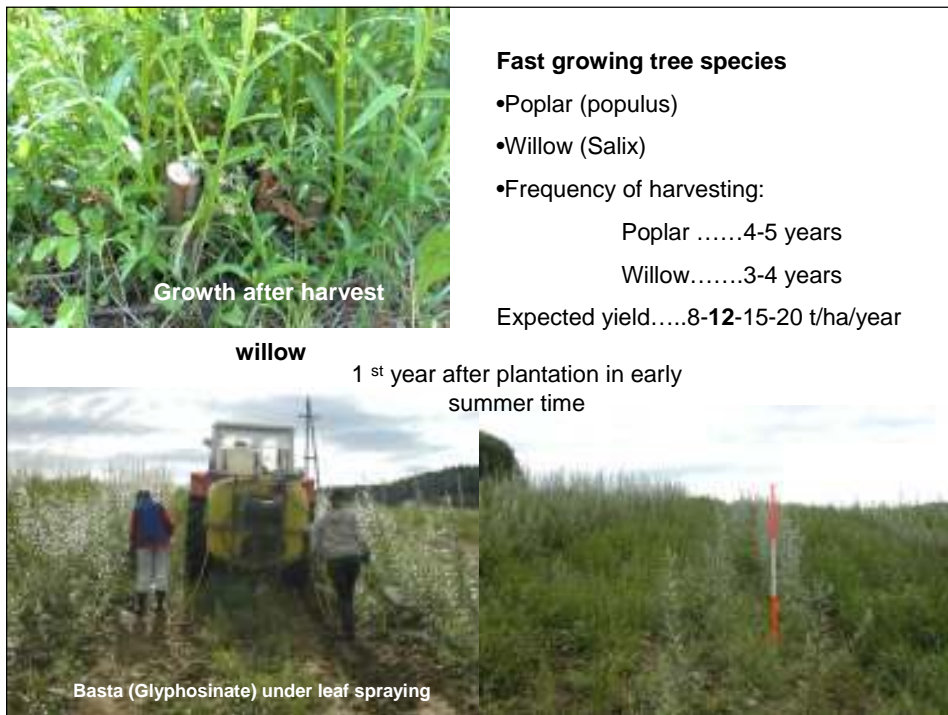
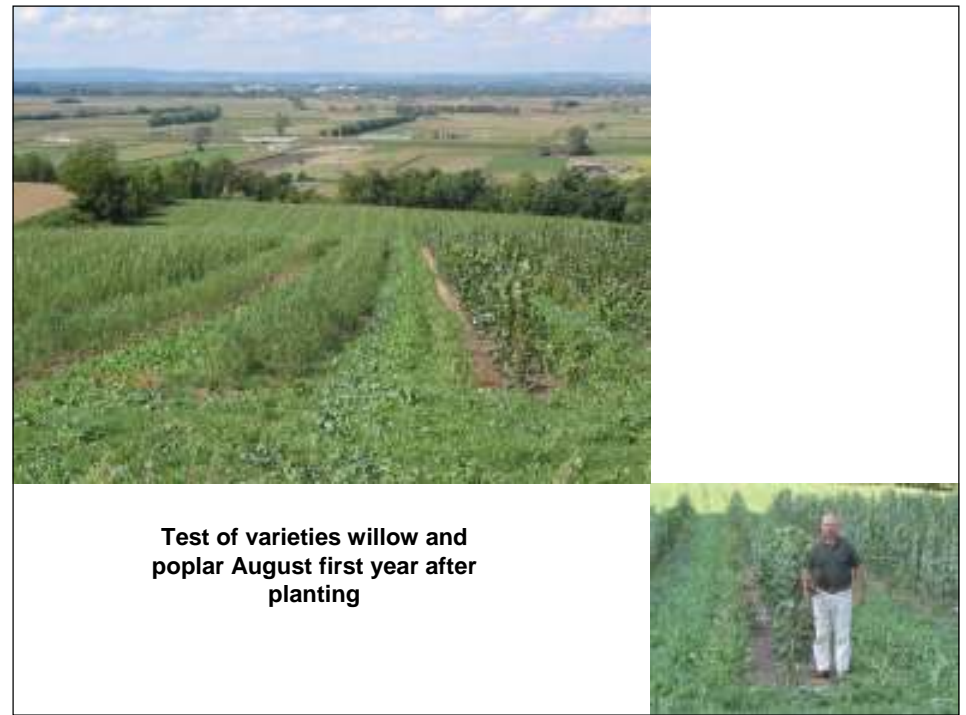
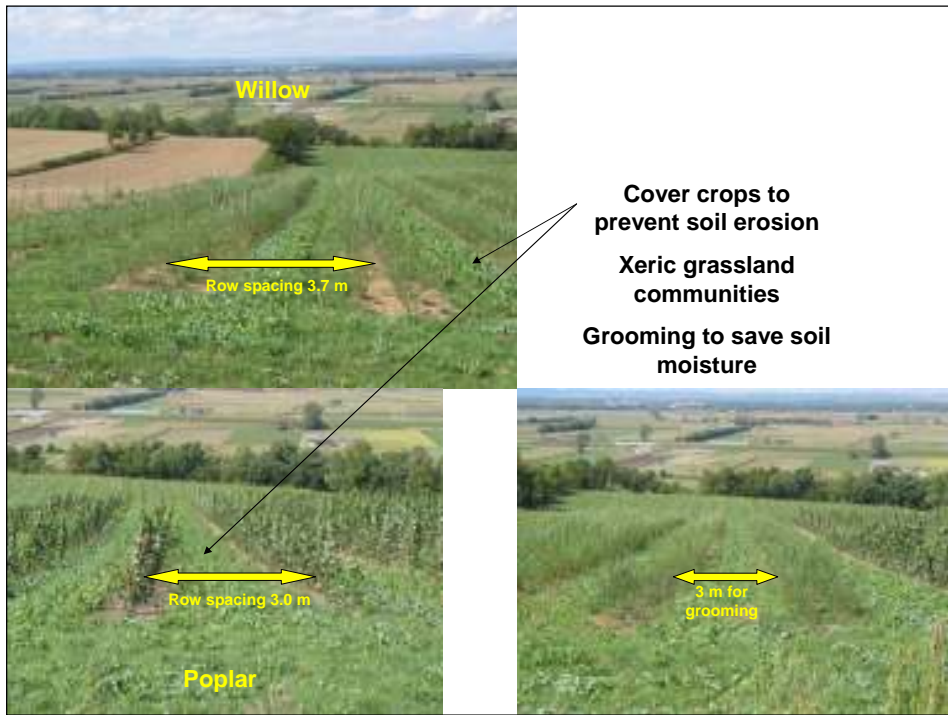
**Willow:** double row, row spacing 3.7m spacing in the row 0.5m

10.811 plants per ha



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







Willow 10 years old, 1<sup>st</sup> year after harvest



Willow 10 years old, 4<sup>th</sup> year after harvest  
⇒ harvest next winter



Poplar 10 years old, 4<sup>th</sup> year after harvest  
⇒ harvest next winter



Wood shavings



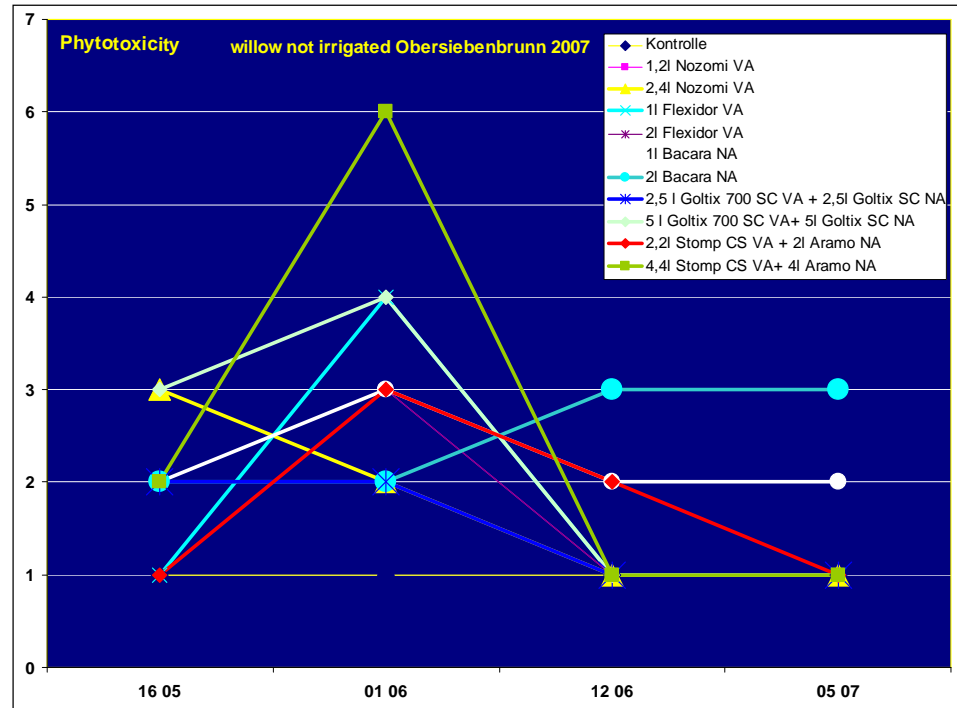
Herbicide tests

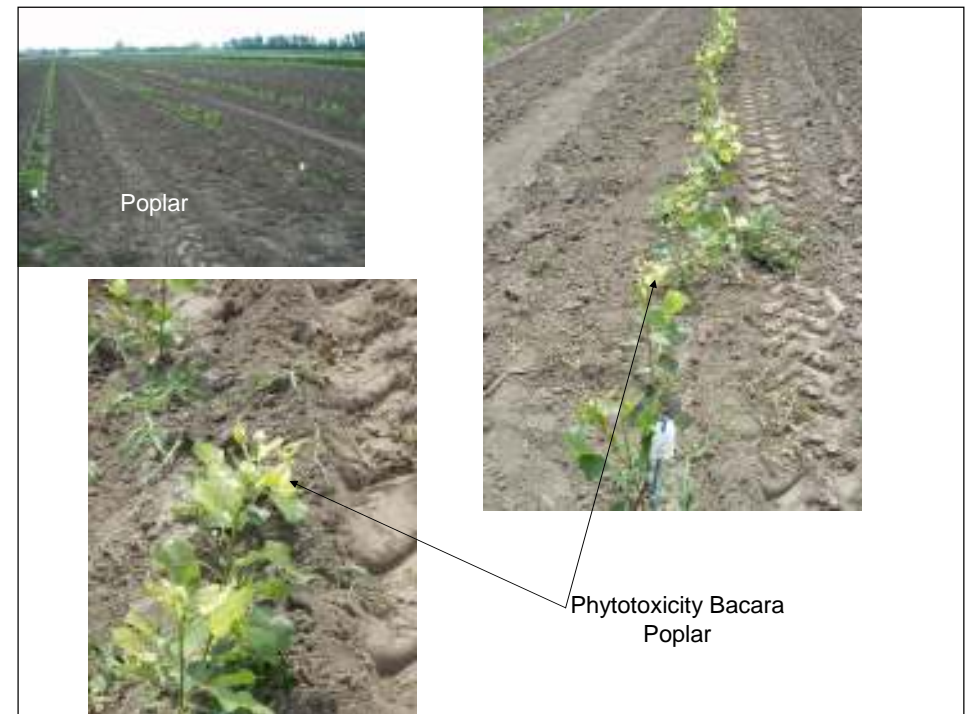
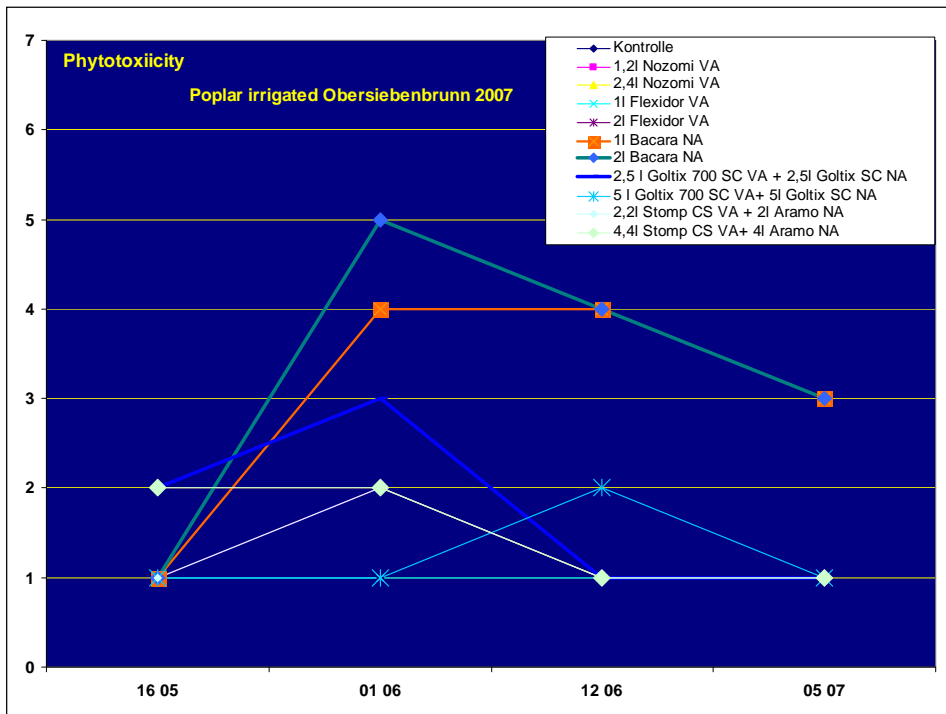
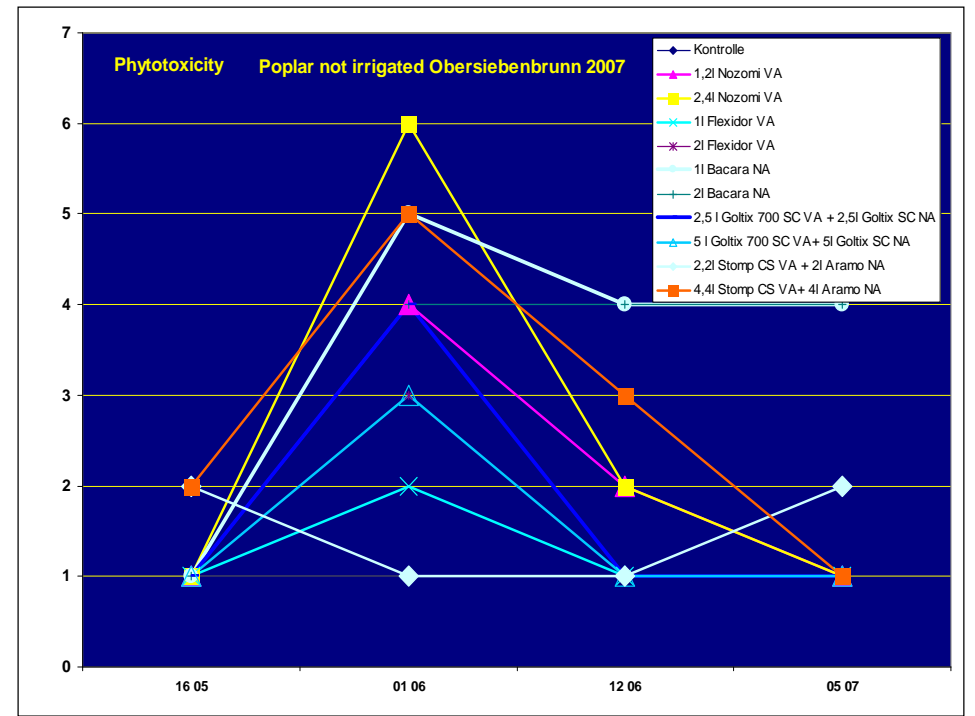
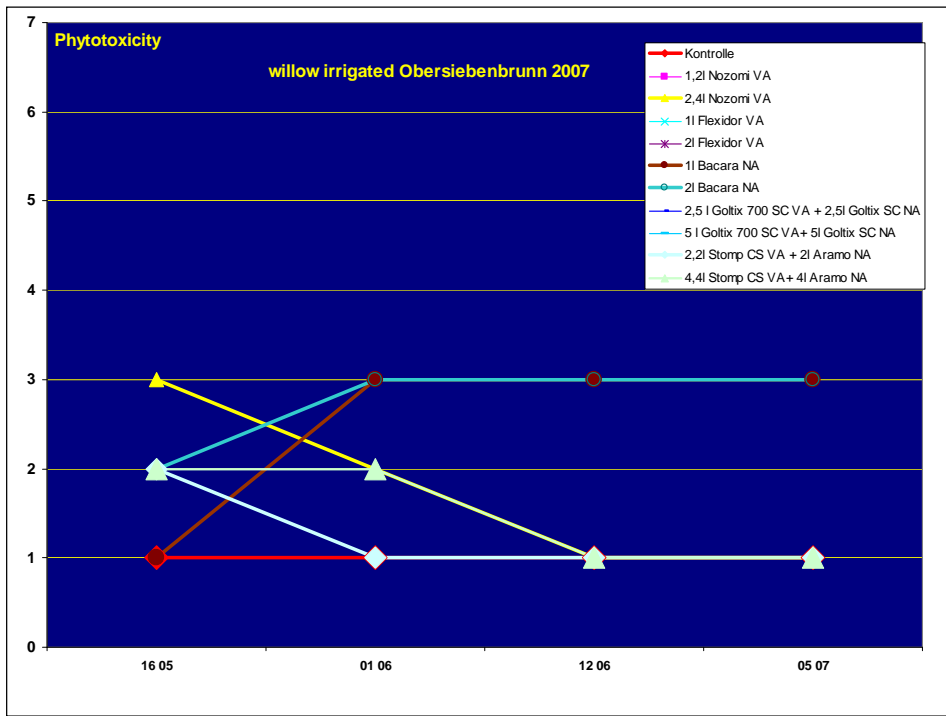


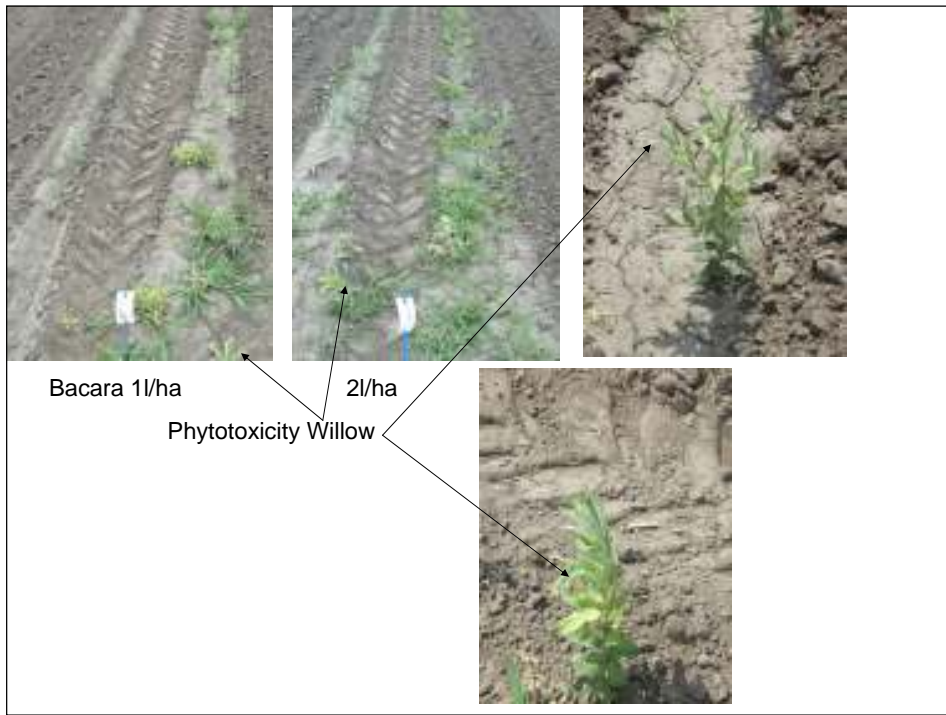
Plot sprayer with special spray booms and band spraying

### Herbicide test 2007

Herbicide	appointment	active substance	application rate	efficiency of herbicid % effect					Phyto toxicity 1 to 9	1 no Phytotox perishing
				Lamium amplexicaule	Amaranthus retroflexus	Echonochloa crus galli	Willow	Poplar		
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 + Flurtamone	1 l	100	68	50	3	4		
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		



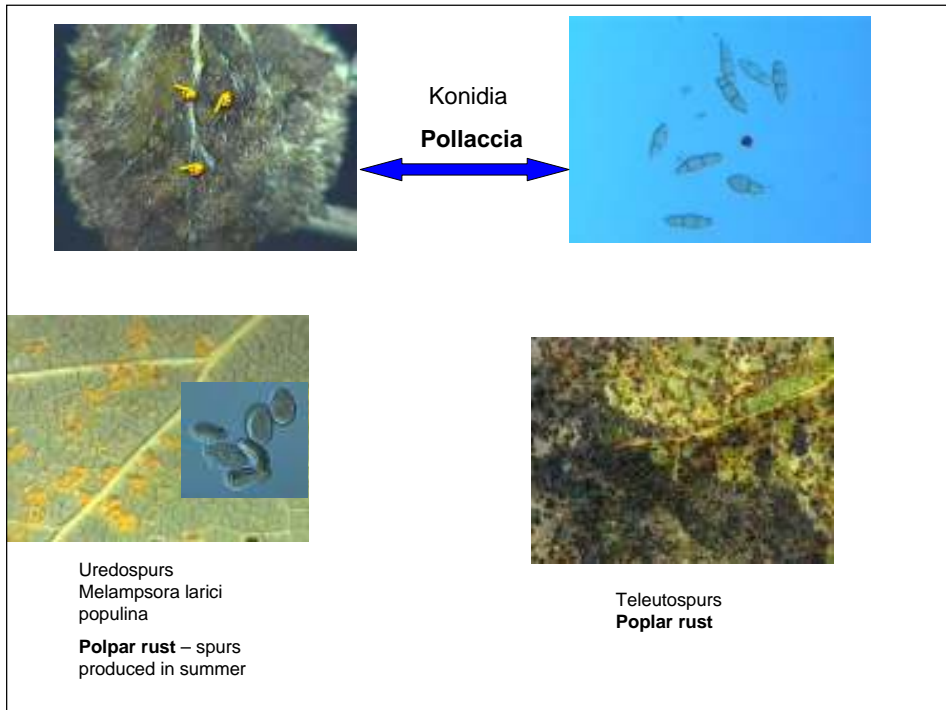




## Deseases and Pests

### Pollaccia saliciperda (variant Venturia Saliciperda)

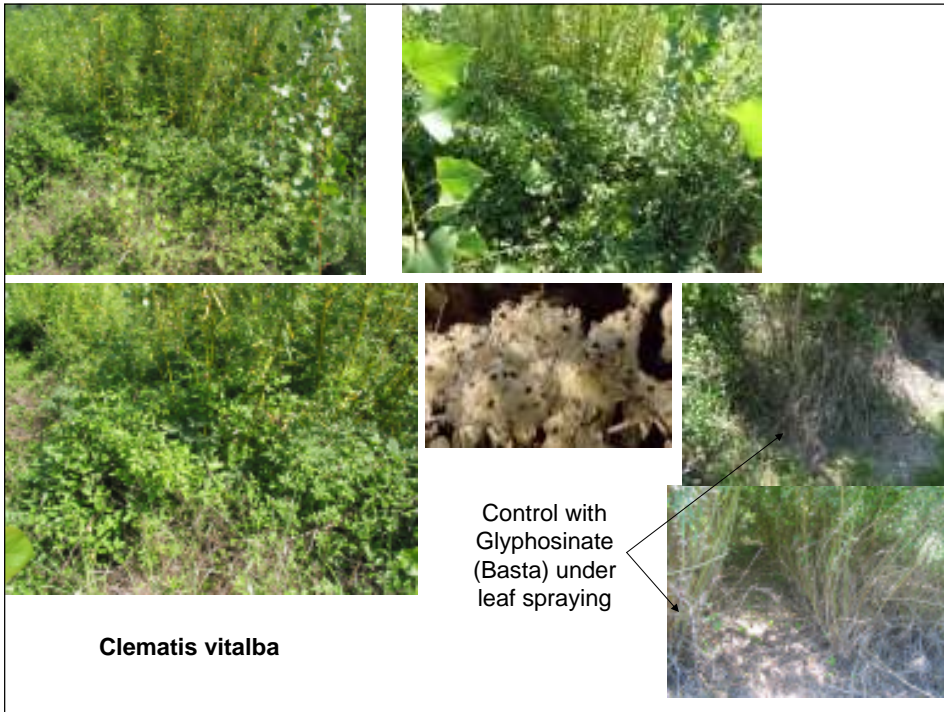
- Perishing of the tips of the sprout
- Infection in springtime 1. by Ascospores – from leafes on the soil or 2. infected tips from last year with Konidia, encouraged by wet conditions



### Willow weevil (Chrysomelidae) feeds on leafes



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



## conclusion

- Renewable bio energy has limits in available agricultural land
- Fast growing trees (polar, willow) have an enormous 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 superioir and has a low protein content ⇒ low NO<sub>x</sub> in the exhaust fumes
- Rivalry food – feed – renewable energy in the future