Agronomic performance of guayule as alternative source of rubber and latex in Europe: genetic variation and effects of irrigations and fertilization

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Guayule field testing in Europe

- Near Cartagena, Spain
- Montpellier, France
- Perpignan, France

- Trial with > 30 guayule lines
- Fertilizer/irrigation trial with AZ2 > 3 years
- Cultivar trial with 6 lines > 2 years
- Rubber & resin determination using NIRS (Sunisat et al. in press) on basis of ASE

Goal: test agronomic & economic feasibility
Montpellier trial
Montpellier trial

- Unexpected problems with snow cover and water logging
- Some guayule lines survived extended frost periods and snow (< -5 C)
- Yield potential with water logging severely compromised
- Irrigation had negative effect on yield
Cartagena trials

- Nursery first
- Technique like with lettuce
- Drip irrigation
- Plant density: 50,000/ha
Cultivar trial (6 lines)
A few months regrowth
Fertigation trial
Fertigation trial: Total biomass

Days after planting (June 6, 2009)
Fertigation trial: Leaf biomass

![Graph showing DW Leaf, t/ha over days after planting (June 6, 2009)]

- **100I/0F**
- **100I/50F**
- **100I/100F**
- **66I/100F**
- **33I/100F**

Days after planting (June 6, 2009):

- J09
- D09
- 366
- J10
- 549
- D10
- 732
- J11
- 915
- D11
- 1098
- J12

DW Leaf, t/ha:

- 0
- 2
- 4
- 6
- 8
- 10
- 12
Fertigation trial: Stem biomass

Days after planting (June 6, 2009)
Fertigation trial: Rubber % (NIRS-ASE)

NIRS-calibration: Sunisat SUCHAT et al. (in press)

% Rubber in stem

Days after planting (June 6, 2009)
Fertigation trial: Resin % (NIRS-ASE)

Days after planting (June 6, 2009)
Fertigation trial: Rubber yield

Days after planting (June 6, 2009)
Fertigation trial: Average annual yield

- Average annual yield per year:
  - 0 kg/ha
  - 500 kg/ha
  - 1000 kg/ha
  - 1500 kg/ha
  - 2000 kg/ha
  - 2500 kg/ha

- Annual resin production
- Annual rubber production

- Graph showing:
  - 100F/0F
  - 100F/50F
  - 100F/100F
  - 66F/100F
  - 33F/100F

kg/ha per year
Fertigation trial: Gross chain value

- Rubber @ € 2.50/kg
- Resin @ € 1.50/kg
- Lignocellulose @ € 40/ton

Total chain value, euro/ha

Days after planting (June 6, 2009)

- 100I/0F
- 100I/50F
- 100I/100F
- 66I/100F
- 33I/100F

Graph showing the total chain value in euros per hectare over days after planting.
Fertigation trial: Daily gross value/ha

rubber @ € 2.50/kg
resin @ € 1.50/kg
lignocellulose @ € 40/ton

Total chain value, euro/ha/day

Days after planting (June 6, 2009)
Cultivar trial, stem production

Days after planting (June 26, 2010)
Rubber % of 6 guayule lines

Rubber, %

Days after planting (June 26, 2010)
Rubber yield development of 6 lines

Rubber yield, kg/ha

Days after planting (June 26, 2010)
Average annual rubber yield, kg/ha

- Only data for year 1 and year 2
- In Fertigation trial AZ2: 1300 kg/ha in year 2 and 2500 kg/ha in year 3
Gross chain value – 6 lines

Economic yield, euro/ha

rubber @ € 2.50/kg
resin @ € 1.50/kg
lignocellulose @ € 40/ton

Days after planting (June 26, 2010)
Agronomic and economic feasibility in Europe

- Plenty of room for both farmers and industry to earn money and obtain good quality rubber, resin and energy!
- Large variation in rubber % between harvest dates, treatments and cultivars (4-13 %)
- Optimal water use can be analysed
- Resin % range = 7-11 %, mostly around 10 %
- Rubber and resin yields: 1500-2500 kg/ha per year (both!)
- Gross production chain value
  - after 2 years: 8000 €/ha
  - after 3 years: 15000 €/ha (annually: 5000 €/ha)
Rubber mats from dried US latex
Rubber tyre from the Spain guayule trial
Conclusions

- **Agronomic feasibility**
  - testing essential (guayule does not like all soils!)
  - at the right sites: excellent performance also in Europe

- **Optimal cultivar choice and agronomy**
  - depends on cost prices and market prices and goals
  - Didier Snoeck et al., this conference

- **Experimental data available to convince European farmers and industry of the feasibility of EU guayule**

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Molecular variation in CPT-genes

- DNA sequences from cDNA and genomic, from AZ2
- CPT1 and CPT2: single genes apparently (but still not very high coverage)
- CPT3 (with a 21 nucleotide deletion compared to CPT1 and CPT2): looks like at least four alleles/loci
- RNA-samples taken from six varieties from stem and leaf
  - testing whether the varieties show sequence variation
  - testing whether expression level differences between varieties coincide with rubber % differences: set up not yet decided