
GREEN POWER
Feeds Your Engine
7530
Advanced vegetable oil fuels in advanced engines
The 2nd VegOil project
UN Framework Convention on Climate Change
Durban, South Africa
EU Pavilion – Dec 7th 2011
Prof. Dr. Peter Pickel
John Deere European Technology and Innovation Center, Germany
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2nd VegOil EU
A JIG SAW PUZZLE STORY
We must not look for the one solution!
If we want to strive for real sustainable energy supply
we have to look for multiple, multi-scale,
and thus also for decentralised solutions
– A piece of the puzzle –
2 | Pickel, John Deere
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LET‘S START WITH A QUESTION

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WHAT HAS BEEN THE GREATEST INNOVATION OF MANKIND?

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Innovation No. 1

Arable crop farming

- After more than 1 Mio years …
  - … mankind changed nutrition style completely from protein based to carbohydrate (energy) based …
  - … enabling unbelievable welfare and population growth up to 7,000,000,000 recently….
  - … creating the need for world climate summits
  - … and mankind started to settle down

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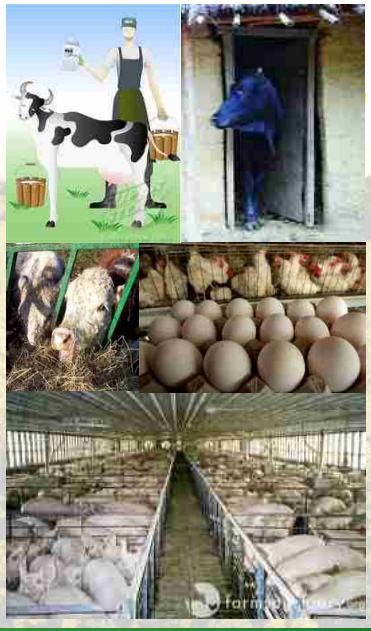
Innovation No. 2



Live stock farming

- Animal proteins as the first luxury „mass product“ …
- … bringing back protein based nutrition and …
- … the 7,000,000,000 popolation will grow and with this people will develop a growing demand for better life conditions and thus for proteins

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Innovation No. 2

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Innovation No. 3

Agricultural machinery

Agricultural production technology

- Improved welfare
- Partially a combination with live stock farming
- **Needs drive train energy (fuel)**

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Invention No. 4?

2nd VegOil EU

You already know
No. 5 ...

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Basic assumptions

John Deere - comitted to those who are linked to the land

- Diesel engines will stay basic drive technology for mobile agricultural machines at least for a mid term prospective
- As a fuel vegetable oil can support global sustainability (but usage is strongly limited)
- The highest energy density produced by photosynthesis is found in natural vegetable oil
- We find optimal agricultural conditions for production of rapeseed oil in Central Europe
- JOHN DEERE‘s colours are colours of the rapeseed flower

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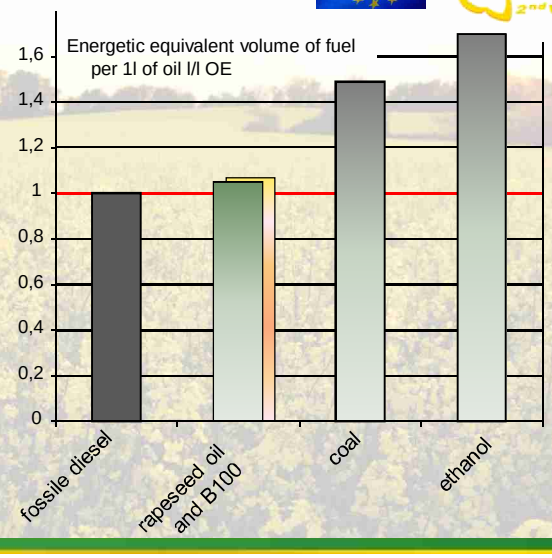
Energetic equivalent volume of fuels



Source:
TFZ Straubing (Bavaria, Germany)
Modified

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Central European biofuel alternatives
Energy balance different renewable fuels

	Agricultural	Conversion	Sum input	Sum output	Balance	Ratio
	MJ/ha	MJ/ha	MJ/ha	MJ/ha	MJ/ha	Output / Input
Rapeseed oil	14812	529	15342	36450	21108	2,38
RME	14812	4474	19287	36360	17073	1,89
Ethanol from wheat	12025	41689	53714	62726	9012	1,17
Ethanol from sugarbeet	14680	63315	77995	127020	49025	1,63
Methane from corn	15158	72395	87553	192456	104903	2,20

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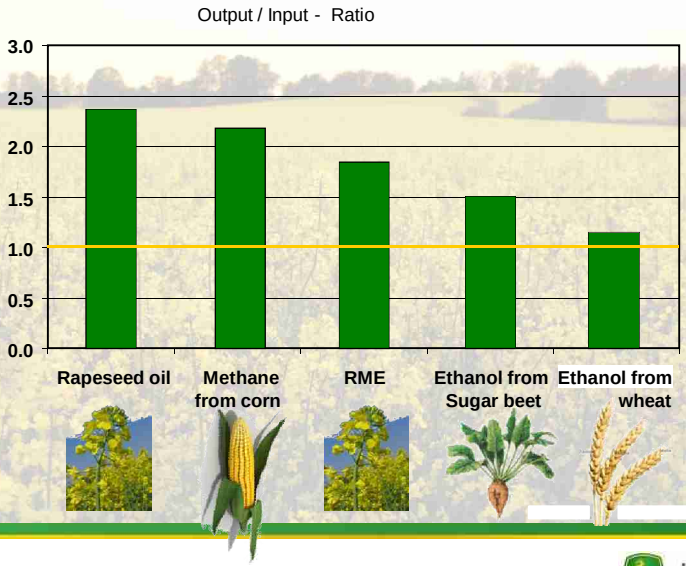
Energy Balance Results



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Basic Assumptions

Potential (Self-)Supply

Diesel consumption of German agricultural sector

1.55 Mio t = $6.65 \cdot 10^{10}$ MJ

= 2,2 % of total transport
= 5% of total diesel consumption

→ 1.82 Mio. ha

Maximum possible area for rapeseed:

1.8 Mio ha per year.

(UFOP)

≈ 10% of cultivated area, but subsitutes arable land for feed or imports

Charles Deere demonstrating a walking plow

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Pure Vegetable Oil (PVO)
powered tractors

Mandatory side conditions

Currently about 100 ha but decreasing with time and with increasing diesel price

No doubt!

Connection to live stock farming needed!

Calculatory income is needed

1. **Minimum farm size**
2. **or farming societies**
3. **or increasing diesel price**
4. **Tax regulations must fit**
5. **Rapeseed cake usage**
6. **Decentralized/self supply**
7. **Manufacturer supply**

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Pure Biofuels
General prepositions

Today's alternative two ways of thinking*) have to merge to meet future demands

*) Either change the fuel (biodiesel; BtL) or the engine (pure plant oil)
Both sides have to move

1. DIN 51605	Fuels for vegetable oil compatible combustion engines – Fuel from rapeseed oil
2. DIN SPEC 51623	Fuels for vegetable oil compatible combustion engines – Fuel from vegetable oil
3. CEN/TC WS 56	Fuels and biofuels – Pure plant oil fuel for diesel engine concepts

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EUROPEAN COMMISSION
Community Research

Plant oil (PO) powered tractor
The challenges

Demonstration of 2nd Generation Vegetable Oil Fuels in Advanced Engines

2nd VegOIL

1. **Emissions (NOx)**
2. **Emission after treatment**
3. **Engine lubrification**
4. **Fuel viscosity**
5. **Thermal characteristics**
6. **Cold start behaviour**
7. **Transient behaviour**
8. **Motor power/characteristic**
9. **Storage of fuel**
10. **Quality of fuel and blends**

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EU Project Proposal 2ndVegOil:

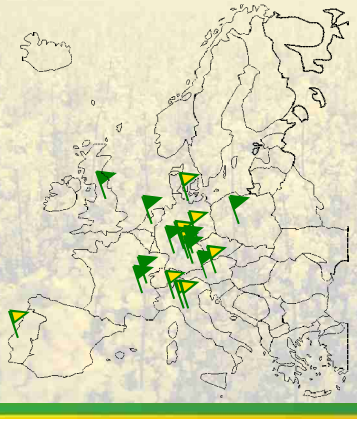
Multifuel-Tractor

Preceedingprojects:

a) 100-Traktorenprogramm (BMELV), 2001 to 2005

b) Motorentwicklung PÖ f. EU-3A (BMELV and FNR), 2006 to 2008

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz



The 2ndVegOil Partners

1. John Deere (D)
2. Vereinigte Werkstaetten für Pflanzenöltechnologie (D)
3. Technical University Munich, Internal Combustion Engines (D)
4. Lubrizol Ltd. (UK)
5. Waldland Vermarktungsges. m.b.H. (AU)
6. Rhônalpénergie-Environnement (F)
7. Fédération Régionale des CUMA Rhône-Alpes (F)
8. Institute of Technology and Life Sciences ITP (PL)
9. Nederlands Normalisatie-instituut NEN (NL)
10. regineering (D)

Other scientific partners

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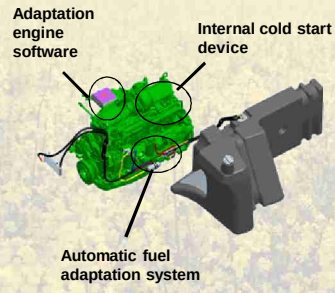
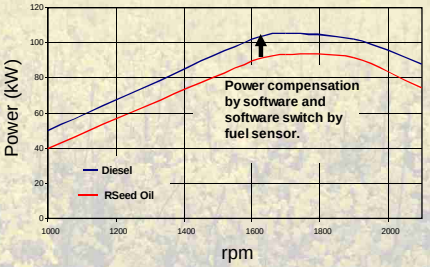
Multi-Fuel prepositions



Power decrease with biofuels due to lower heating value



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Field test fleet

Model	Lubricant	Basic fuel	Fuel additive
6830 Premium		Rapeseed	
6930 Premium	ACEA E7	Sun flower	JD Biodiesel Protect 100
7430 Premium	ACEA E9	Camelina Sativa	Lubrizol
7530 Premium		Jatropha	

EU Stufe 3A / TIER 3

EU stage 3B
/ int. TIER 4
and pre-investigations
for EU stage 4 / TIER 4

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2nd VegOil seen in the French TV

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Innovation No. 4?
Summary

Pure cold pressed vegetable oil as an agricultural fuel is an integrated technological approach

… combing the three grand innovations and …

contributing to …

… sustainability and …
… agricultural economy and …
… to our future business

Let‘s go for it!

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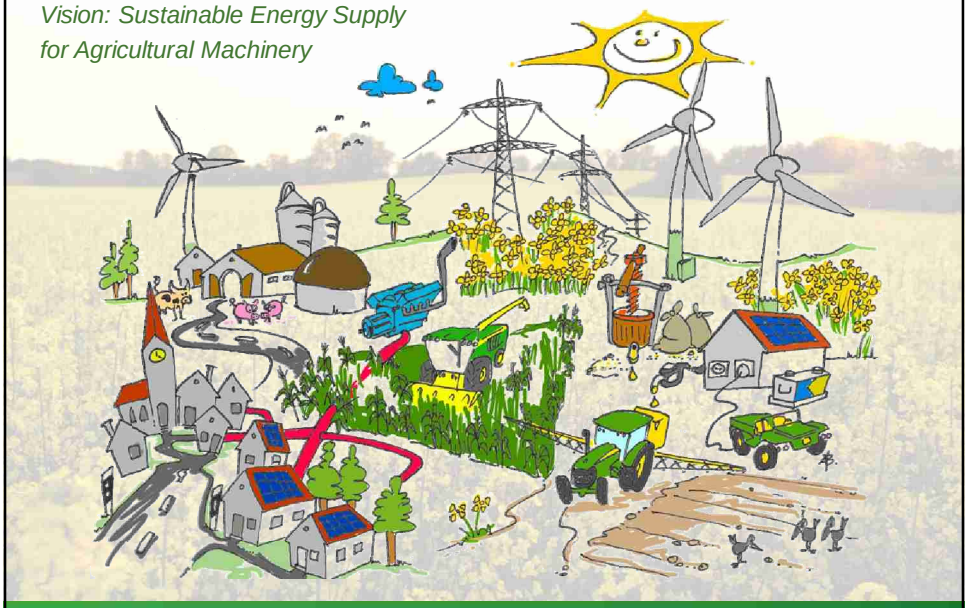
Vision: Sustainable Energy Supply for Agricultural Machinery



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