

Traditional and “new” agricultural crops for biofuel production.

Energy balance, economic and environmental aspects

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EU - Agriculture and biofuel demand

EU estimated arable land use in 2020 (million hectares)

	“no biofuel”	14 % “more imports”	14 % “more domestic”
Rape for biodiesel	0	2.7	2.6
Cereals for bioethanol	0	4.6	8.3
Sugar beet for bioethanol	0	0.3	0.5
Farmed wood for BTL	0	0	6.9
Total land for biofuel production	0	7.6	18.3
Non-biofuel arable production	87,6	84,8	80,8
Set-aside	10,8	7,7	3,4
Total arable land (EU-25)	98,4	100,1	102,5
BTL, Biomass To Liquid, second generation biofuels produced from farmed wood and straw			



Agriculture and biofuel demand at 2020

- ◆ For each additional 1 million hectares needed, land use will change as follows:
 - 220.000 ha re-oriented from other land agronomical uses
 - 400.000 ha taken out of set-aside
 - 370.000 ha re-oriented from exported crops to domestic biofuel production

Agriculture and biofuel demand at 2020

◆ Benefits:

– socio-economical:

- ◆ potential improvement of the profitability of farmer business
- ◆ potential employment in rural regions

– environmental:

- ◆ potential improvement of soil stability

Agriculture and biofuel demand at 2020

◆ Problems:

- use of uncultivated lands (permanent landgrass)
- competition between food and energy crops



Traditional crops for SVO and biodiesel production

◆ Rape:

- microthermic crop
- no irrigation
- seeds production:
 - ◆ 0.7-3.4 t/ha
- extractable oil: 35-40 % w/w
- SVO yields:
 - ◆ 0.2-1.4 t/ha
- biodiesel yields:
 - ◆ 0.2-1.2 t/ha



EU-27 surface allocated to rape (FAO data, average)

– Countries	Surface to rape (,000 ha)
– Italy	57
– Austria	58
– Czech. Rep.	278
– Denmark	116
– Finland	60
– France	1,108
– Germany	1,010
– Hungary	106
– Lithuania	42
– Poland	410
– Romania	37
– Spain	58
– Sweden	61
– UK	472



Traditional crops for SVO and biodiesel production

◆ Sunflower:

- germination temperature: 12-23 °C
- irrigation: 400-600 mm
- seeds yields:
 - ◆ 1.2-4.2 t/ha
- extractable oil: 40-48 % w/w
- SVO yields:
 - ◆ 0.5-2.0 t/ha
- biodiesel yields:
 - ◆ 0.4-1.8 t/ha



EU-27 surface allocated to sunflower (FAO data, average)

Countries	Surface to sunflower (,000 ha)
Italy	227
Bulgaria	519
France	820
Germany	34
Greece	28
Hungary	432
Portugal	66
Romania	916
Slovakia	66
Spain	968



Traditional crops for SVO and biodiesel production

◆ Soybean:

- photoperiod: short
- irrigation: 50-100 mm
- seeds yields:
 - ◆ 0.7-3.6 t/ha
- extractable oil: 18-20 % w/w
- SVO yields:
 - ◆ 0.1-0.7 t/ha
- biodiesel yields:
 - ◆ 0.1-0.6 t/ha



EU-27 surface allocated to soybean (FAO data, average)

Countries	Surface to soybean (,000 ha)
Italy	275
France	94
Hungary	21
Romania	92

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Traditional crops for SVO and biodiesel production

◆ Oil palm:

- optimal temperature: 24-27 °C
- fruits per tree:
 - ◆ 2,000-5,000
- extractable oil: 60-70 % w/w
- SVO yields:
 - ◆ 5.5-7.0 t/ha
- biodiesel yields:
 - ◆ 4.9-6.3 t/ha



Traditional crops for SVO and biodiesel production

◆ Benefits:

- technical know-out
- germplasm availability
- special mechanization

◆ Problems:

- too low yields (rape, sunflower, soybean)
- environmental impacts (oil palm):
 - ◆ deforestation, soil erosion, contamination
- socio-economical impacts (oil palm):
 - ◆ dependence of the native communities on the oil palm trade companies



ENERGETIC CONSIDERATIONS

Crop	Field phase energy input [MJ/kg]	Total energy input [MJ/kg]	SVO energy balance	
			(without co-products)	(with co-products)
Rape	16.5	20.4	1.8	3.4
Sunflower	9.1	13.0	2.8	4.3



“New” crops for SVO and biodiesel production

CROP	YIELD TONS/HA	AGRONOMICAL TOTAL COSTS EURO/ha
BRASSICA carinata	2,5	400
JATROPHA curcas	1,1 -12,50	445



Traditional crops for bioethanol production

Main crops

sugar cane in Brazil (12,8 million tons of bioethanol in 2005)

cereals in United States (12,9 million tons of bioethanol in 2005, produced from corn prevalently)

In EU the traditional crops are sugar beet and cereals (corn and wheat prevalently).



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