

Economic and technical aspects in the application of kenaf fibres

Work Package 5: Utilisation of kenaf for
industrial products and energy.

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Competition

- With wood
- and other agricultural fibres like flax, hemp and jute
- price and quality

Agricultural production costs in Spain

- Wood chips € 70 /ton delivered to mill
- Yields between around 11 ton/ha

	<u>South Area</u>		<u>North Area</u>	
	<u>ECU/ha</u>	<u>%</u>	<u>ECU/ha</u>	<u>%</u>
Preparation labours	71.00	10.8	71.00	14.5
Sowing	150.90	23.0	150.90	30.9
Fertilization	82.40	12.5	56.10	11.5
Treatments	31.90	4.9	48.40	9.9
Irrigation	159.40	24.3	53.60	11.0
Harvesting	161.70	24.5	108.80	22.2
Total	657.30	100	488.80	100

Table 11.- Agricultural cost of kenaf productions in Spain

Agricultural costs in Southern Europe

- Wood chips € 70 /ton delivered to mill
- Yields between around 11 ton/ha

<u>Country</u>	<u>Cost (ECU/ha)</u>
Spain	488.80-613.91-657.30*
Italy	652.90-800.60
Greece	720.40-917.80
Portugal	460.70-620.30

**Table 12.- Estimations of agricultural costs of production of kenaf in the Southern countries of the European Union.
(*Aragón-León-Andalucía)**

Replacement of wood by whole stem kenaf

- So if yields are not improved, replacement of wood by whole kenaf stem is financially very critical.
- Kenaf must improve quality or give cost reduction in processing
- Mechanical pulping of whole stem kenaf for newsprint might be profitable because of the lower lignin content and the expected lower energy costs

Prices and amounts of flax fibres

	1998/1999	1999/2000	2000/20001
<i>Long fibre</i>			
Sold (tons)	72100	98100	87700
Price (€/ton)	1300	1810	2360
Stock (tons)	20000	6500	13300
<i>Cleaned short fibre</i>			
Sold (tons)	22900	35500	33500
Price (€/ton)	290	310	520
Stock (tons)	25300	18000	13700
<i>Uncleaned short fibre</i>			
Price (€/ton)	80	180	210

Pre-treatment of annual fibres

<u>Area</u>	<u>System</u>	<u>Cost (ECU/ton)</u>
Spain	Cotton grining	64.45
Europe	Kenaf separation: 4 ton/hour	26.70
Europe	Kenaf separation: 15 ton/hour	21.88
USA	Kenaf separation	18.70-28.40

Table 14.- Comparison of cost of Pre-treatment of annual fibers (cotton/kenaf).

Predicted costs separated fibres in Fair project

<u>Concept</u>	
Hour yield of separation.	15 ton/h
Annual volume of separation.	65760 ton
Average agricultural yield.	15 ton/ha
Surface necessities (in the area).	4384 ha
Agricultural cost.	613.91 ECU/ha
Unit agricultural cost.	40.92 ECU/ton
Maximun load (integral material).	12 ton
Cost of transport to the separation center.	80 ECU
Unit cost of transport.	6.66 ECU/ton
Separation cost.	21.88 ECU/ton
Final cost after separation processing per ton of kenaf	69.46 ECU/ton

11 ton/ha will result in total costs of € 85/ton

Separation

- Green decortication by hammer milling and sieving
- Strength of fibres decreases strongly
- applications where fibre strength is not important
- The strength of composites was only slightly reduced

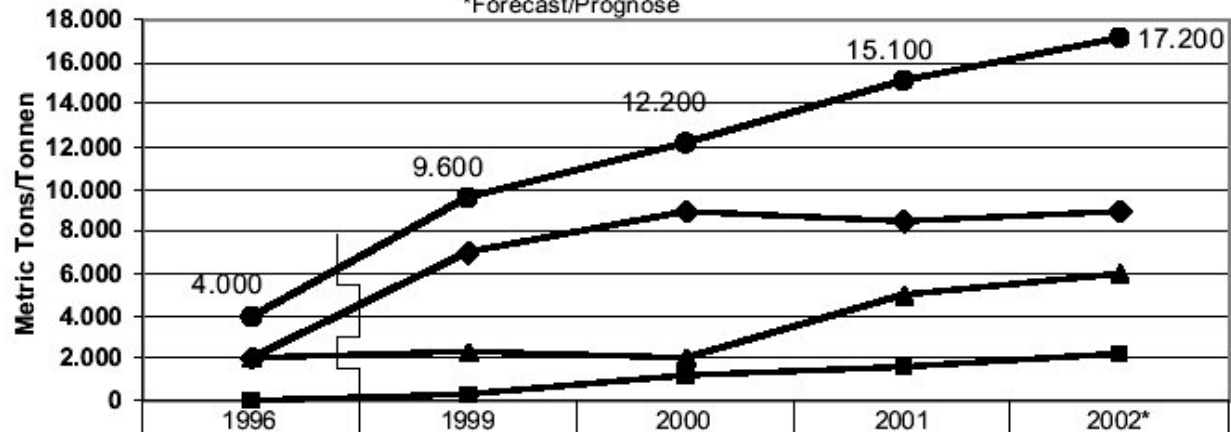
Natural fibres in automobiles (NOVA institute)

- Clean short fibres € 550 - € 650/ton in 2002
- 26000 tons are used in Western Europe
- In Western Europe 2/3 in Germany and Austria
- Strong growth market
- A market potential of 80.000 to 160.000 tons/year

Use of natural fibres in automobiles

Use of Natural Fibres for Automotive Composites in
Germany & Austria 1996-2002*
Naturfasereinsatz für Verbundwerkstoffe im Automobil in
D & A 1996-2002*

nova-Institut 2002
*Forecast/Prognose

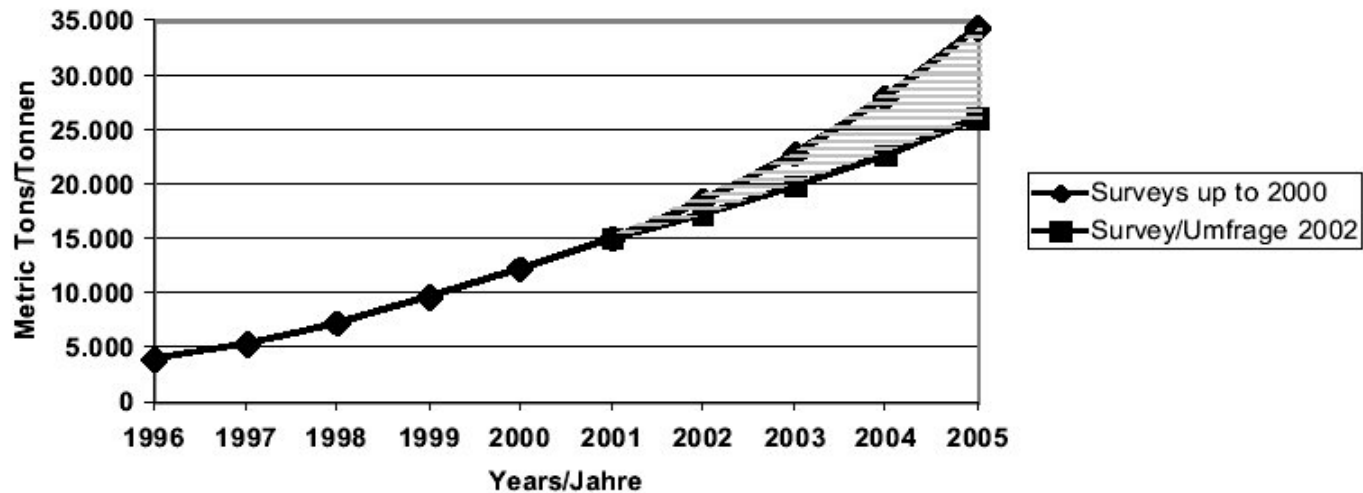


◆ Flax/Flachs	2.000	7.000	9.000	8.500	9.000
▲ Exotic (Jute etc.)	2.000	2.300	2.000	5.000	6.000
■ Hemp/Hanf	0	300	1.200	1.600	2.200
● Total/Gesamt	4.000	9.600	12.200	15.100	17.200

Forecast of use of natural fibres in automotives

Future Trends 2005: Estimated Increase in the Use of Natural Fibres for Composites in Germany & Austria* Zukunftstrends 2005: Geschätzte Zunahme des Naturfasereinsatzes für Verbundwerkstoffe in D & A*

nova-Institut 2002
*without wood & cotton fibres



Kenaf application in automotives

- Already done
- competes with flax and jute
- no extra research needed

Kenaf application in insulation?

- Short clean flax fibres are used by ISOVLAS, price is comparable with fibres for automotives
- Humidity regulation is an important property
- Stiffness of the felts is important
- ISOVLAS is willing to cooperate, but costs are still unsure

Economics of separated fibres

- Without income from the core fibres cleaned short fibres will cost at least € 250/ton.
- Transport will raise the costs
- Price fluctuates strongly and cost level was
- Separation only worthwhile if both fractions can be sold.

Fibre needs ATO

- Harvest 2003 - in contrary with the minutes only 50 kg of dry stems from one location, preferably from large scale experiment.
- Harvest 2004- depending on experimental possibilities at ISOVLAS minimal 300 kg of short bast fibres.

Thermal conversion

- Experiments on thermal conversion of bast fibres are not necessary.
- Separation of bast fibres to costly for thermal applications.
- Suggestion: Skip those experiments

Conclusion

- Application of separated kenaf bast fibre in automotives and insulation is promising
- Experiments at ISOVLAS are needed
- Suggestion: Skip the thermal experiments with bast fibres

Further work

- Continuation of study on applications of kenaf fractions
- Where can we separate large amounts of kenaf CETA or IPZS in Rome or Hempflax in the Netherlands?
- Costs of these large scale separation and experiments might exceed planned costs.