

# BIOMASS PRODUCTION CHAIN AND GROWTH SIMULATION MODEL FOR KENAF

---

**BIOKENAF**  
QLK5 CT2002 01729

**CETA**

*Centro di Ecologia Teorica ed Applicata*

*Centre for Theoretical and Applied Ecology*

## **Scientific Team**

- Dott. Massimo Vecchiet
- Dott. Denis Picco
- Dott. Roberto Jodice



# BIOKENAF

## QLK5 CT2002 01729

---

### CETA, Italy (5)

- **WP 2:** Adaptability and Productivity Field Trials
  - Task 2.4: Kenaf Field Trials with Size 2 ha
- **WP 4:** Harvesting and Storage Trials
  - Task 4.1: Harvesting Trial
  - Task 4.2: Storage Trial



# KENAF MOISTURE TREND

*Kenaf moisture content at the end of its cycle  
(stems cut at the height of 20 cm)*

	20/01/2005	28/01/2005	04/02/2005	02/03/2005
Kenaf Moisture (%)	31.4%	17.2%	15.5%	12.2%*

\* chopped kenaf



# KENAF HARVEST STUDY

---

- The kenaf harvest mechanization setting up and the choice of the optimal harvest time is one of the outstanding problems to solve in order to insert kenaf in the yield systems in a delimited area.
- It should be remembered that the development of a correct mechanization is strongly bound to the requirements of the manufacturing industries; in fact, the appropriate harvest date and typology should be chosen on the basis of the final industrial production.



# KENAF HARVEST STUDY

---

THE IDEA WAS TO HARVEST THE KENAF STEMS ACCORDING WITH THE QUALITY PARAMETERS REQUIRED BY A NATURAL FIBRE TRANSFORMATION FACTORY.

## 1<sup>st</sup> STEP

- SEARCH OF NATURAL FIBRE TRANSFORMATION FACTORY



# SEARCH OF NATURAL FIBRE TRASFORMATION FACTORY

---

IT WAS FOUND THREE FACTORIES WHICH WORK WITH  
NATURAL FIBRES:

- **HEMPFLAX** - Holland
- **K.E.F.I.** - North Italy
- **AGRIKENAF VOLTURNO** - South Italy



# HEMPFLAX

---



## Visiting address:

**HempFlax BV**

Hendrik Westerstraat 20-22  
9665 AL Oude Pekela  
Holland

## Postal address:

HempFlax BV

PO BOX 142

9665 ZJ Oude Pekela  
Holland



Web Site: [www.hempflax.com](http://www.hempflax.com)

E-mail: [info@hempflax.com](mailto:info@hempflax.com)



**LARGE BASKET OF FINAL PRODUCT**



# K.E.F.I.

---



**K.E.F.I. - Kenaf Eco Fibers Italia S.p.A.**

**Registered office:** via Pieve, 85 - 42016 Guastalla (RE), Italy

**Operational plant:** via Arginello, 48 - 46030 Dosolo (MN), Italy

E-mail: [info@kenaf-fiber.com](mailto:info@kenaf-fiber.com)

Web site: [www.kenaf-fiber.com](http://www.kenaf-fiber.com)

Natural-fibers products for automotive components, soundproofing systems, thermal insulation, and green building, but above all natural fibers materials to safeguard the environment in which we live and that we want to be increasingly safer for our health and for a sustainable future.





# AGRIKENAF VOLTURNO

---



ZONA INDUSTRIALE ALIFE  
LOCALITA' PISCIARIELLO  
CASERTA



ADMINISTRATION OFFICE: [adm@agrikenaf.it](mailto:adm@agrikenaf.it)

MARKETING OFFICE: [mkt@agrikenaf.it](mailto:mkt@agrikenaf.it)

CLIENT OFFICE: [servizio.clienti@agrikenaf.it](mailto:servizio.clienti@agrikenaf.it)

WEB SITE: [agrikenaf.com](http://agrikenaf.com)



**LARGE BASKET OF FINAL PRODUCT**



# KENAF HARVEST STUDY

---

## 2<sup>nd</sup> STEP

### CONTACT THE TRASFORMATION FACTORY WITH THE AIM TO KNOW THEIR NEED

According to ATO the necessary arrangements were made in the harvesting yard with a view to conveying the material to the Dutch firm.

The aim was to produce some panels or boards from the kenaf fibre harvested in Cervignano del Friuli and afterwards to evaluate the quality of the transformed product.

The Hempflax transformation line needs a material with specific characteristics. The stems must be cut at a height from **30** to **60** cm and baled in big rectangular bales.

To achieve this standard, Hempflax built a special fleet of machines, and had them patented to be used for the harvest of its hemp and flax fields.



# KENAF HARVEST STUDY

## Problems:

- impossibility to find a machine which could cut the stems at the desired length.
- difficulty to find a conventional baler for big rectangular bales. In these areas the fleet of baling machines is usually made up of round balers.



A solution for both problems was found in the **old conventional balers** for small rectangular bales.

Using the dimensions of the bale chamber (about 35 cm X 45 cm), at the plungerhead width, it was possible to cut the kenaf stems at about a maximum length of 45 cm.



# FIRST HARVEST TRIAL



Gaspardo FBR 175  
reciprocating a knife  
and teeth mower

Harvesting trial operations were carried out on 14<sup>th</sup> February, 2005.

The planned activities for this test included mowing the stems, with a mowing bar, and baling some bales

STEMS CHARACTERISTICS	
Average basal stem diameter (mm)	12
Average height (cm)	160
Average moisture content	15%



AMA model 153  
conventional baler





# FIRST HARVEST TRIAL



## THE TRIAL FAILED

The main problems usually pointed out in other experiences were associated to the material picking up and the machine flooding, owing to the fibrous kenaf structure.

In this case problems rose for the excessive stem length. In other words, owing to the kenaf mass picked up, a little plungerhead deviation was caused, so the following strokes caused the breaking of the baler. No bales were made.

The cut material analyses showed that most stems were cut at the desired length, which means that the principle was right but, probably, a more powerful machine was needed.



# FIRST HARVEST TRIAL



A surface of about 1000 m<sup>2</sup> of field was cut with the mower, and the whole stems were collected.

Finally about 400 Kg of whole stems were harvested by hand, and are available for possible further analyses.





# KENAF HARVEST STUDY

---

## 2<sup>nd</sup> STEP

CONTACT THE TRASFORMATION FACTORY WITH THE AIM TO KNOW THEIR NEED

Due to the impossibility to deliver the kenaf stems with the requested characteristics to Hempflax, a contact was made with an Italian factory processing natural fibres, the **K.E.F.I.**, in the Po Valley.

The aim was to produce some panels or boards from the kenaf fibre harvested in Cervignano del Friuli and afterwards to evaluate the quality of the transformed product.

The K.E.F.I. transformation line needs a material with specific characteristics. The stems must be chopped (size between **25** and **50** mm), moisture content about 15%, unbaled.



# KENAF HARVEST STUDY

---

3<sup>rd</sup> STEP

HARVEST THE KENAF STEMS WITH THE RIGHT SIZE



22<sup>th</sup> February, 2005





# KENAF HARVEST



Jaguar 870 (Claas)

2<sup>nd</sup> March, 2005

Harvesting operations



The stems were cut in a single size (34 mm), according to K.E.F.I. demands.

The bulk density was about 32 kg/m<sup>3</sup>, while the chopped kenaf moisture content was 12.2%.



# KENAF HARVEST STUDY

## 4<sup>th</sup> STEP

### CHOPPED KENAF STORAGE



The chopped kenaf was piled up near the field border.

Chopped kenaf is a really soft material therefore, in order to reduce the pile volume, the pile was compacted by power shovel.

Afterwards the pile was covered with a plastic sheet, normally used to cover the ensiled maize, with the purpose to prevent the chopped kenaf from becoming damp from rainfall or snow.



# KENAF HARVEST STUDY

## 5<sup>th</sup> STEP - KENAF TRANSPORT TO K.E.F.I.



8<sup>th</sup> March, 2005



For the chopped kenaf transports to K.E.F.I. firm (about 300 Km), a trailer model "walking floor" was used.

These trailers are characterized by the high volumetric capacity, about 88 m<sup>3</sup>, and by the particular floor that, thanks to its mobility, made the unloading easier.

The load operation was carried out with a machine normally used, in the past, to load the sugar beet in the field.





# K.E.F.I. VISIT and KENAF PROCESSING

---

## 6<sup>th</sup> STEP

### KENAF FIBER PROCESSING



12<sup>th</sup> April, 2005

Partners: CRES, UNIBO, ATO, C.E.T.A.

### K.E.F.I. PLANT

- SEPARATION PLANT, in which the fiber is separated from the core
- FIBRE PROCESSING PLANT, in which the fiber is added to with polyester fiber and processing to obtain panels



# K.E.F.I. VISIT and KENAF PROCESSING

---

- Separation Plant

- Serious of sieves which separate the fiber from the core. The fiber is pressed in big bales and transport to the fiber processing plant, while the core is separated in different sizes (fine, medium and large) and used to produce energy (burn).

- Fiber Processing Plant

- There is a work sequence: the bales are opened and mixed with other fibers (polyester fibers); after that, a machinery is used to bound the fibers by heat; another machine is used to form the panel and finally there is one which cut and packing the panels.



# K.E.F.I. PRODUCT: ISOLKENAF



Morphological and physical-mechanical characteristics		
Parameter	Unit	Isolkenaf
Structure	-	Heat-bound panels with no added adhesives
Raw material	-	Natural hemp fibers, polyester backing fibers
Sheet thickness	mm	30, 40, 50, 60, 80, 100, 120, 150
Density	Kg/m <sup>3</sup>	Panels 40; rolls 25;
Panel dimensions	m	0,6x1,2 - x1,4

Isolkenaf is available in handy felt rolls of different thickness, of 25 kg/m<sup>3</sup>, and in panels of higher density, 40 kg/m<sup>3</sup>. Isolkenaf contains no polluting additives. It is a product that can easily be reused and as a result it is fully recyclable even after removal.

Isolkenaf resolves all soundproofing and thermal insulation problems, whether on walls, floors or for roof insulation.

Isolkenaf is composed of fibers of kenaf straight from the cultivation, to which is added a certain amount of polyester fibers for strengthening and a natural fireproof product.

Kenaf fibers contain no protein substances and as a result it is not necessary to carry out any treatment against insects, such as moths or beetles.

Kenaf products used as soundproofing or thermal insulation materials soon convinced a high number of experts. In countries that are extremely sensitive to the criteria of bio-architecture and green building, it has obtained the certification of "Material recommended for green building".



# K.E.F.I.

## Panels of 140x60 cm

thickness cm	theoretical calculation on h 80 cm	panels per pack 1 row	panels per pack 2 rows	length m	width m	m <sup>2</sup> x plate	m <sup>2</sup> 1 row	2 rows x level	m <sup>2</sup> x pack
<b>1</b>	80	80	<b>160</b>	1,4	0,6	0,84	<b>67,20</b>	2	<b>134,4</b>
<b>2</b>	40	40	<b>80</b>	1,4	0,6	0,84	<b>33,60</b>	2	<b>67,2</b>
<b>3</b>	27	25	<b>50</b>	1,4	0,6	0,84	<b>21,00</b>	2	<b>42,0</b>
<b>4</b>	20	20	<b>40</b>	1,4	0,6	0,84	<b>16,80</b>	2	<b>33,6</b>
<b>5</b>	16	15	<b>30</b>	1,4	0,6	0,84	<b>12,60</b>	2	<b>25,2</b>
<b>6</b>	13	15	<b>30</b>	1,4	0,6	0,84	<b>12,60</b>	2	<b>25,2</b>
<b>8</b>	10	10	<b>20</b>	1,4	0,6	0,84	<b>8,40</b>	2	<b>16,8</b>
<b>10</b>	8	8	<b>16</b>	1,4	0,6	0,84	<b>6,72</b>	2	<b>13,4</b>
<b>12</b>	7	7	<b>14</b>	1,4	0,6	0,84	<b>5,88</b>	2	<b>11,8</b>
<b>15</b>	5	5	<b>10</b>	1,4	0,6	0,84	<b>4,20</b>	2	<b>8,4</b>

Packs are packed 3 at a time, height 250 cm



# BIOKENAF PROJECT PRODUCTION



Pack  
25 panels



Single panels



Impurities  
(*Sorghum halepense*)

Polyester backing fibers





# BIOKENAF PROJECT PRODUCTION

---

...I'll become a panel...



# BIOKENAF

---

C.E.T.A.

Partner n. 5  
Work Package 4  
Task 4.1 and 4.2

