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

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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

SITE DESCRIPTION

Cervignano del Friuli (UD)

North East Italy

- Latitude: 45° 51′ N
- Longitude: 13° 20′ E
- Altitude: 8 m above sea level
- Soil texture: fine silty-clayey soil

PRE-SOWING WORKS

- Plowing
- Harrowing
  - (Seedbed Preparation)

25/03/2004

06/05/2004

BESIDES:

- No Chemical Fertilisation
- No Chemical Herbicide
- No Irrigation

SEEDBED

19/05/2004

SOWING PARAMETERS

KENAF VARIETY	EVERGLADES 41
DATA	19/05/2004 (ten days before last year first sowing)
FIELD SIZE	1,50 ha
PLANT POPULATION	440.000 plants/ha (to obtain **400.000** plants/ha)
SPACE BETWEEN PLANTS	5 cm X 45 cm
SOWING DEPTH	3 – 4 cm
QUANTITY OF SEEDS USED	20 Kg
WORKING DURATION	35 minutes (one hour to change sowing disk: 72 hole Ø 2.5 mm)

May, 19th 2005

6 days after sowing

23 days after sowing

KENAF DEVELOPMENT

September, 13th 2004

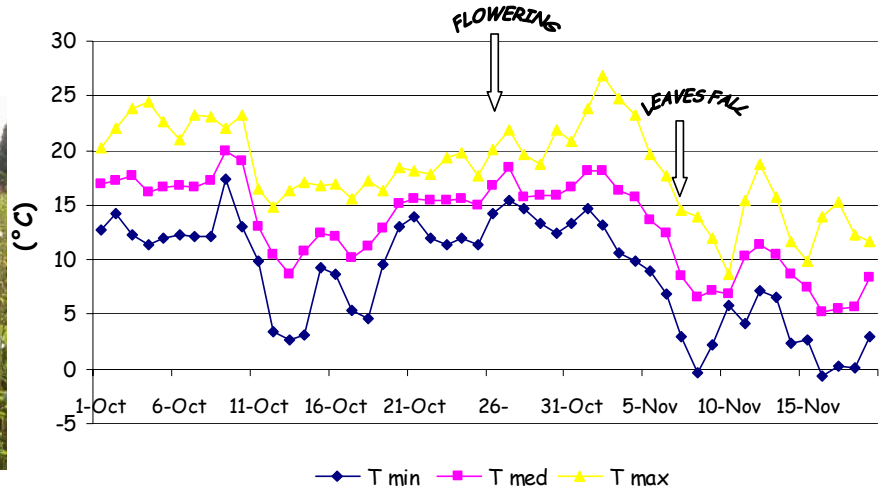
		notes
STEM HEIGHT (cm)	**119**	80 --- 170 (high variability)
BASAL STEM DIAMETER (mm)	**11,7**	8 --- 18 (high variability)
PLANT POPULATION (plants/ha)	**320.000**	400.000 (plant population attended)
KENAF YIELD (t/ha)	**29,8**	Fresh Weight (Stems plus Leaves)
KENAF MOISTURE (%)	**79%**	Stems and Leaves

KENAF FLOWERING

October 26th, 2004

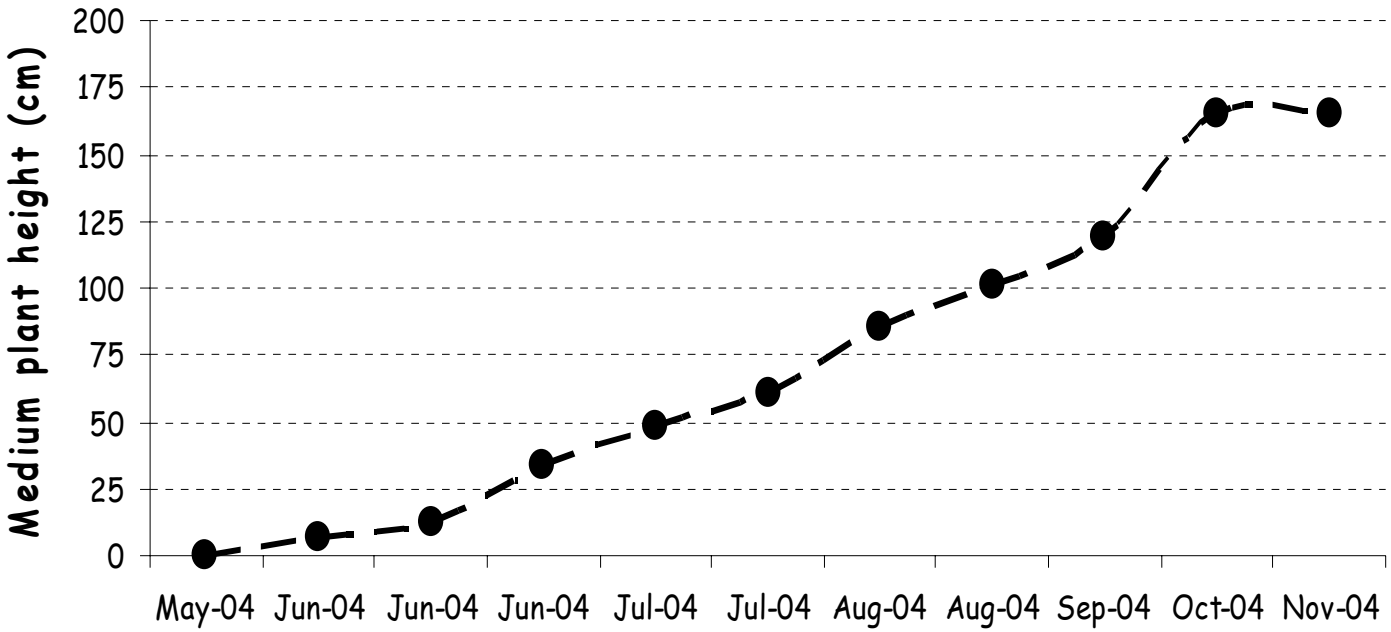
November 16th, 2004

November 4th, 2004



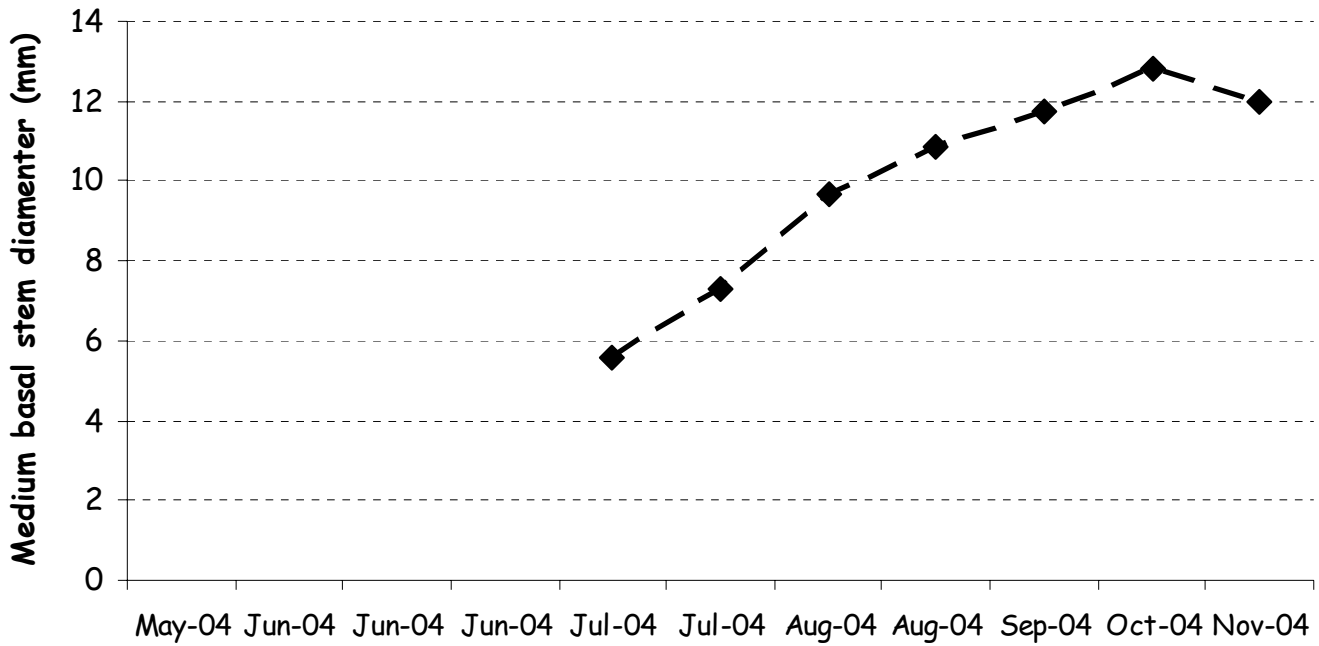
KENAF DEVELOPMENT

Medium kenaf plant height (cm) development

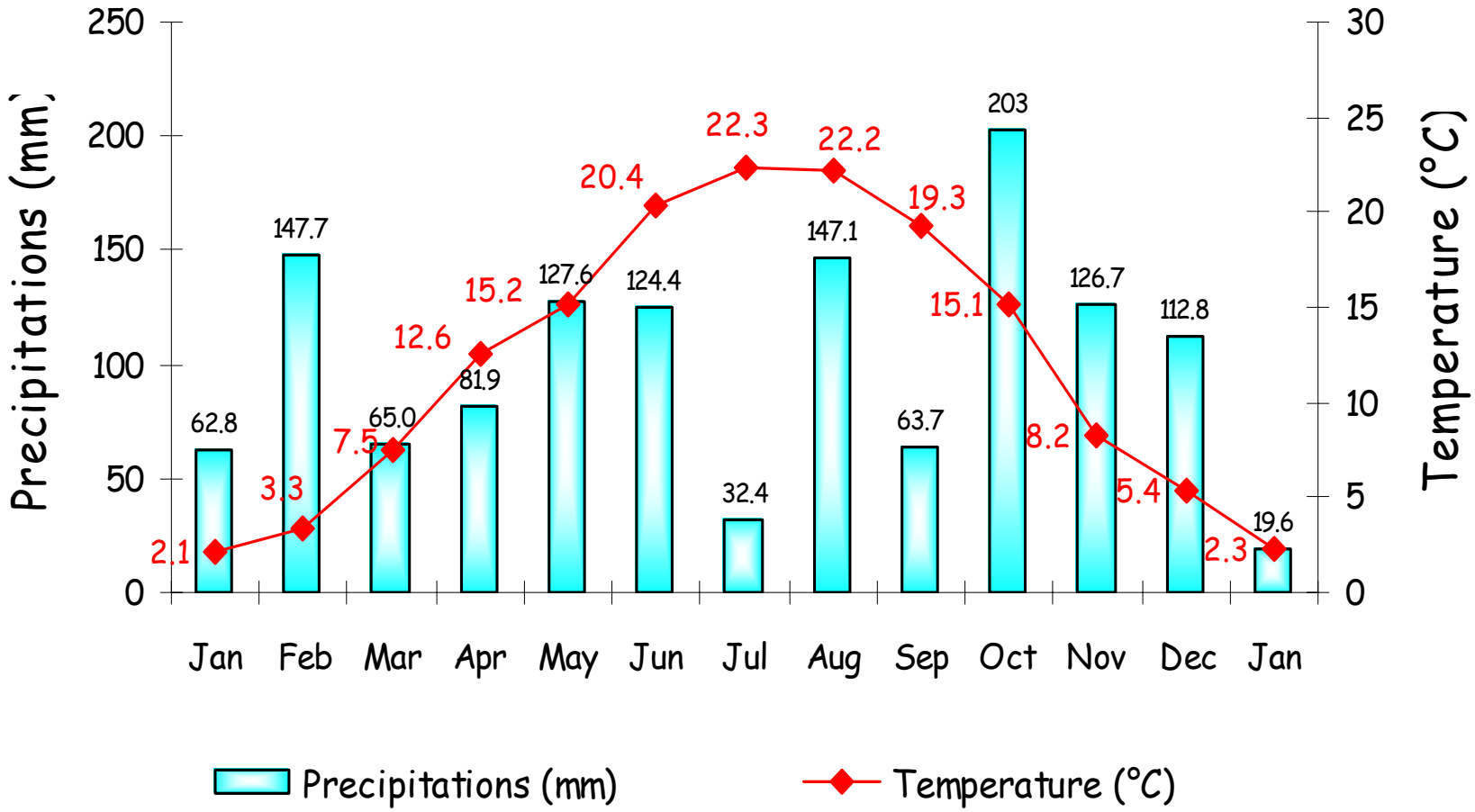


KENAF DEVELOPMENT

Medium kenaf basal stem diameter (mm) development



Temperature (°C) and Monthly Precipitation (mm) in Cervignano del Friuli



KENAF FIELD SITUATION IN JANUARY

		notes
STEM HEIGHT (cm)	**160**	110 --- 240 (high variability)
BASAL STEM DIAMETER (mm)	**12**	8 --- 20 (high variability)
PLANT POPULATION (plants/ha)	**335.000**	400.000 (plant population attended)
KENAF YIELD (t/ha)	**8,0**	Fresh Weight (Stems)
KENAF MOISTURE (%)	**40%**	Stems

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 FIELD SITUATION IN JANUARY

January, 12th 2005

KENAF DEVELOPMENT

- Low temperatures after sowing caused a contraction of the expected seed germination. Only the 76% of seeds germinated to obtain a final plant density of 335.000 plants/ha.
- The high plant population choice, theoretical density of 400,000 plants/ha, didn't allow ramified plants to develop.
- It was observed a clear plant development unhomogeneity. There were areas where average plant height was 110 cm and areas where average plant height was 240 cm.
- In other areas the plants showed a homogeneous development within the rows but a "wavy" plant development between the rows.
- The high average temperature at the end of October allowed the kenaf flowering. Immediately after a drop in temperature caused the leaves fall.
- Stems present high level of fungin disease before the harvest.
- No attack from the root-knot nematode *Meloidogyne incognita* was recorded.

OBSERVATIONS

WHAT ABOUT THE REGISTERED LACK OF HOMOGENEITY IN THE PLANT DEVELOPMENT?

- A first analysis shows that different areas, in which the plants had a limited development, were subject to water stagnation. Little subsidence, combined with the soil texture (silty-clayey soil), caused some field areas to have a difficult run-off; in these areas, usually circular, plants with both modest height and stem diameter were registered.

- In other areas the cause of the limited kenaf growth was the high weed development, in particular *Sorghum halepense*. The competition of these weeds strongly affected the final yield. The weeds infestation was not diffused homogeneously on the field, but it had a punctiform distribution.

KENAF SOIL ANALYSES

WHAT ABOUT THE "WAVY" PLANT DEVELOPMENT BETWEEN THE ROWS?

- **That could be due to the different chemical soil characteristics**

	High Kenaf Plants Soil (kenaf plants height: 220cm)	Low Kenaf Plants Soil (kenaf plants height: 120cm)
Organic Matter (g/Kg dry matter)	77.4	49.1
N-total (TKN) (g/Kg dry matter)	$9.68*10^{-3}$	$12.5*10^{-3}$
$N\text{-}NO_2$ + $N\text{-}NO_3$ (g/Kg dry matter)	4.06	3.82

- A possible explanation for this difference is to be found in the kenaf harvest typology used in the first year: only a part of the kenaf plants were harvested; the rest, after the cutting up, was immediately sown down.

- It is reasonable to expect a higher organic matter concentration in those areas in which the plants had been sown down. The cutting up and sowing down operations certainly produced a lack of homogeneity in the organic matter distribution and this was expressed in the kenaf "wavy" development in the second year.

OBSERVATIONS

DISCUSSION ABOUT THE COMPARISON BETWEEN THE TWO YEAR YIELD RESULTS

- **ABSENCE OF RAMIFIED STEMS** This is directly ascribable to the plant population choice: the thicker plants stopped the natural kenaf branch trend that was registered in the first year of project.
- **DIFFERENT YIELD** The comparison between yield values registered in this first two years is discouraging: if the clean difference between the average plant height, and above all the basal diameter, is directly related to the double plant population, the halved dry matter yield in the second year is due to a series of different factors.

	2003 *	2004
Medium Stem Height (cm)	200	160
Medium Basal Stem Diameter (mm)	17.0	12.0
Kenaf Stem Yield (t dry matter/ha)	11.0	4.8

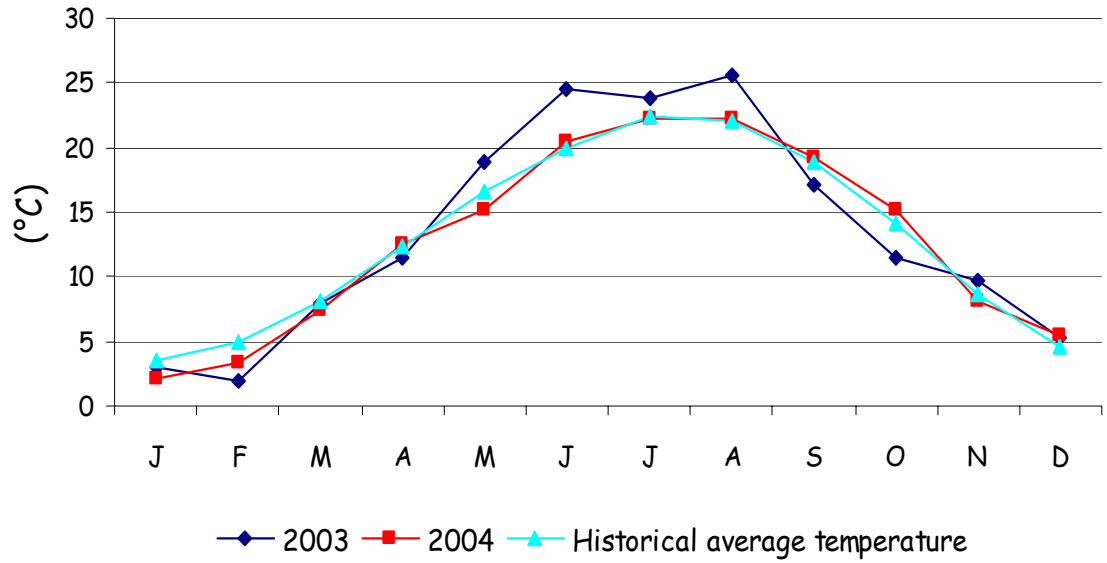
*** First sowing (28/05/2003)**

OBSERVATIONS

DISCUSSION ABOUT THE COMPARISON BETWEEN THE TWO YEAR YIELD RESULTS

- **SOWING DATE** In the first year was decisive to determine the final dry matter yield. In fact, the second sowing, twenty days postponed, caused a plant development clearly lower. For better yield results, as in 2003 first sowing, advancing a few days the sowing date should have been advisable. This really did not happen: even with the ten days advance of the sowing date, the final yield results didn't prove any good. Anyway, it is not possible to find a correlation between the advance in the sowing date and the lower dry matter yield.
- **ORGANIC MATTER CONTENT** It was already remarked that there was a correlation between the organic matter content in the soil and the small sized plants in some field strips. These strips directly affected the lower yield registered in the second project year.
- **CLIMATIC CONDITIONS**

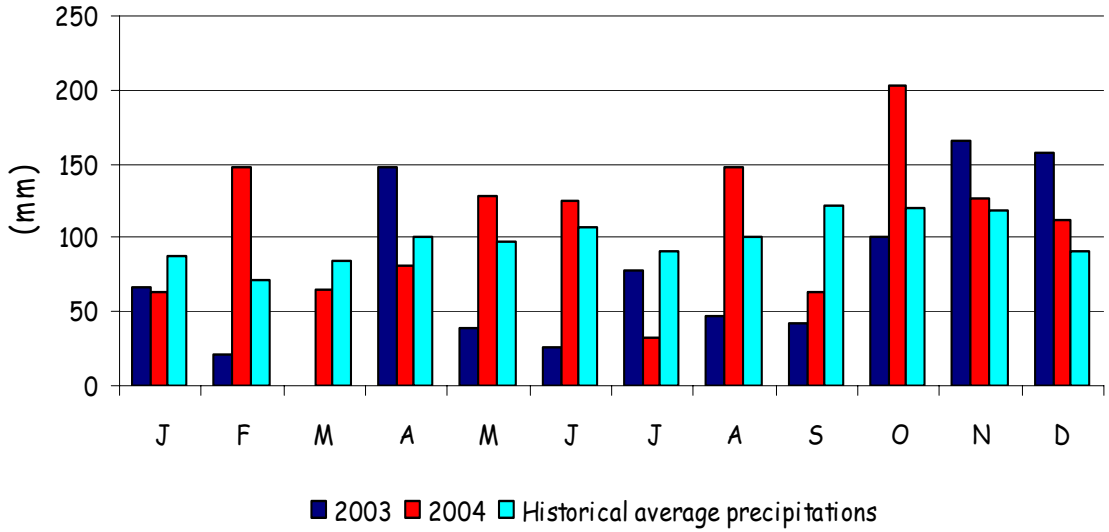
COMPARISON BETWEEN AVERAGE TEMPERATURE AND RELATIVE PRODUCTION



In the second year, average temperatures in the norm for this lands, matched the historical data, whereas in the first year clearly higher temperatures were registered during the summer.

It could be supposed that the temperature factor played a determinant influence on the final dry matter yield, in the light of the higher temperatures and yield in 2003.

COMPARISON BETWEEN AVERAGE PRECIPITATIONS



	2003	2004	Historical Average Precipitations
Year's Precipitations (mm)	892	1295	1193
Precipitations between May and October (Vegetative Period) (mm)	333	698	640

OBSERVATIONS

DISCUSSION ABOUT THE COMPARISON BETWEEN THE TWO YEAR YIELD RESULTS

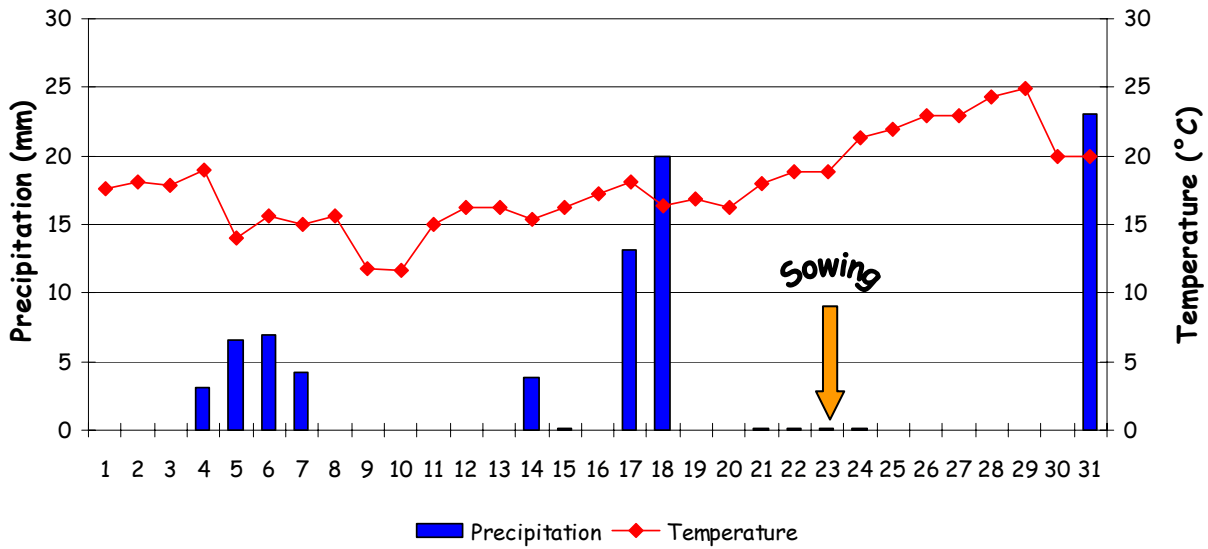
• We could think that, if the kenaf water demand is satisfied (kenaf water demand of about 450-600 mm), a possible subsequent water supply could not affect nor have a negative influence on the yield, above all in areas where problems with water stagnation are evidenced.

As for the kenaf climatic requirements, it appears more correct to think that **temperature is a more important factor than water supply**.

…WE WERE READY FOR THE HARVEST

THIRD YEAR OF PROJECT

SOWING PARAMETERS
Third year project



KENAF VARIETY	EVERGLADES 41
DATA	**23/05/2005** (ten days after last year sowing)
FIELD SIZE	1,10 ha
PLANT POPULATION	440.000 plants/ha (to obtain 400.000 plants/ha)
SPACE BETWEEN PLANTS	5 cm X 45 cm
SOWING DEPTH	3 – 4 cm

SOWING and KENAF DEVELOPMENT
Third year project

June, 4th 2005

Kenaf Situation on June, 10th 2005

Plant population: 350.000 plants/ha

Medium plant height: 4.4 cm

SOWING and KENAF DEVELOPMENT
Third year project

Kenaf Situation on June, 20th 2005

Problems with weeds (*Sorghum halepense*)

No problems with rabbits

SOWING and KENAF DEVELOPMENT
Third year project

Chemical Weed Control - Post Emergency

AGIL (Du Pont): 1.2 l/ha (a.s.: **Propaquizafop**)

Kenaf Situation on June, 28th 2005

Plant population: 350.000 plants/ha

Medium plant height:

- 26 cm (no weeds)
- 12 cm (weeds or germination postponed)

BIOKENAF

C.E.T.A.

Partner n. 5

Work Package 2

Task 2.4