BIOKENAF – QLK5-CT2002-01729

6th technical meeting
VOLOS, 22-23 November 2005

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INRA main involvement

- ***WP2: Adaptability and productivity field trials***
  - Task 2.2: Effect of different **sowing dates** and **plant populations** on biomass yields
  - Task 2.3: Effect of **irrigation** and **nitrogen fertilization** on biomass yields
- ***WP3: Development of the crop growth simulation model***
  - Task 3.1: Development, calibration and validation of the **crop production simulation model**
- ***WP6: Environmental impact assessment and life cycle analysis of kenaf production and use***

WP2:
Adaptability and productivity field trials

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1. Presentation of trial conditions

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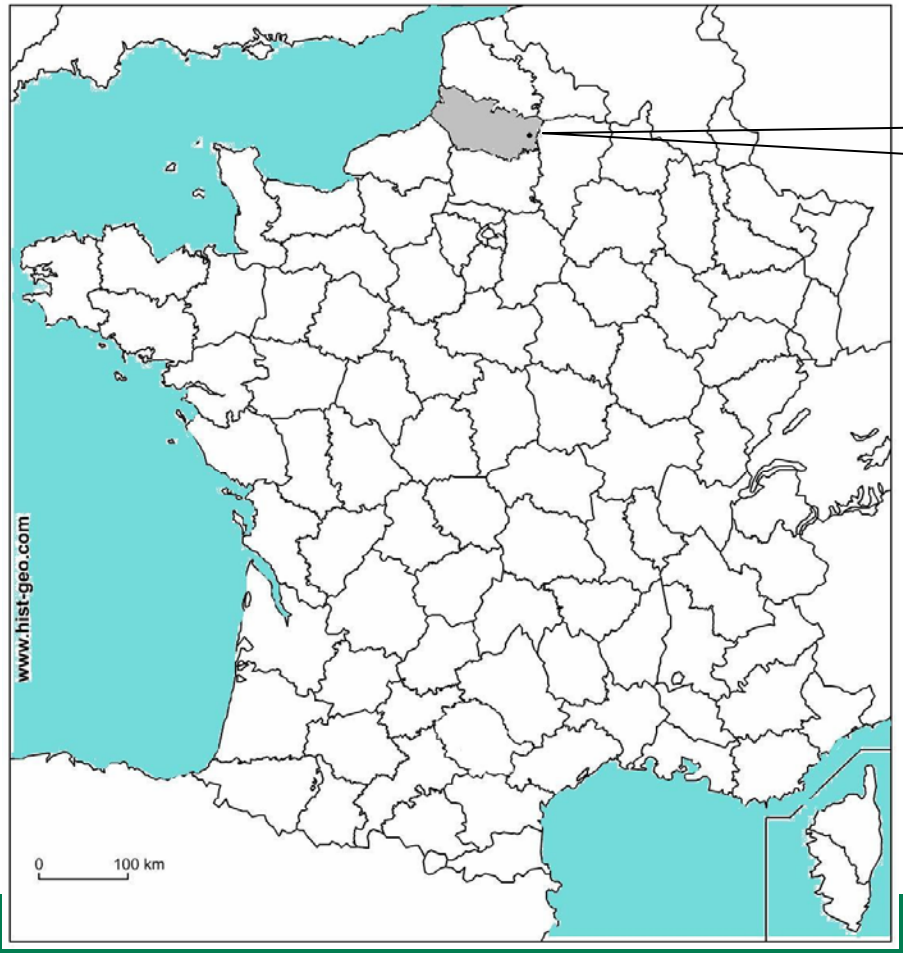
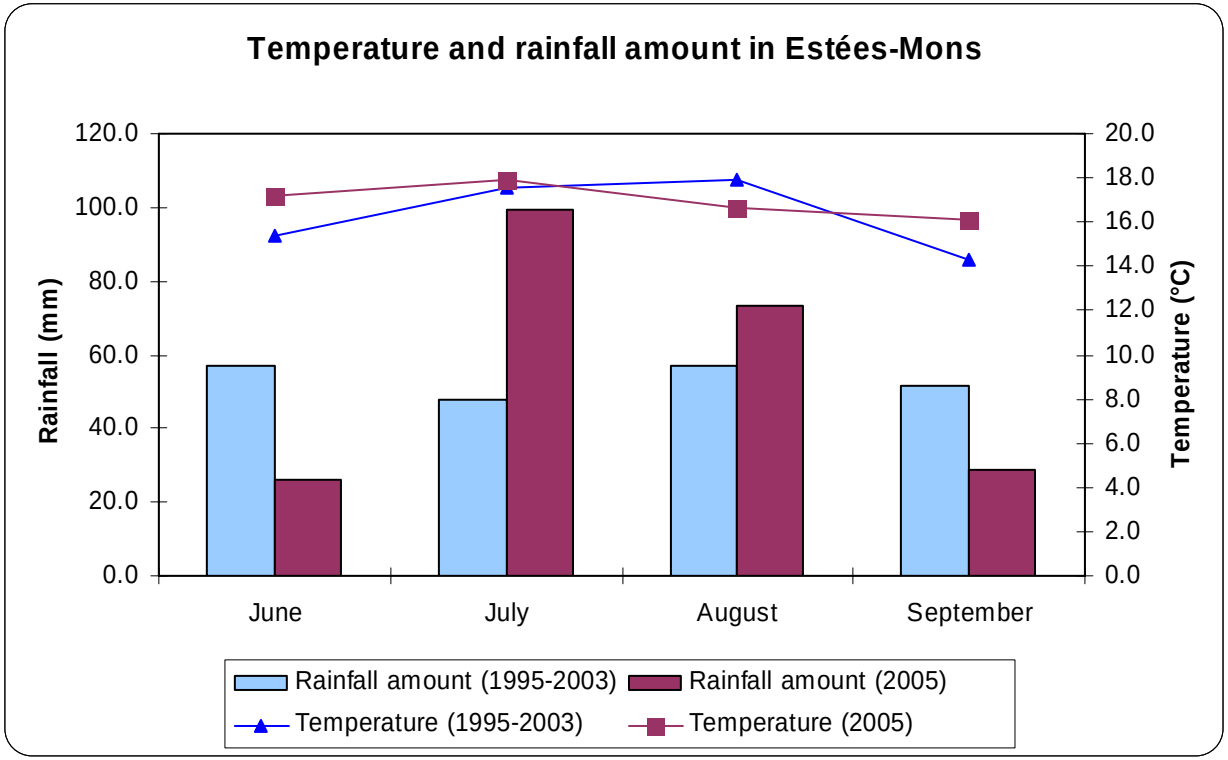
Trial location



Estrées-Mons
INRA centre

- **Climate:** Oceanic temperate
- **Soil type:** Deep loamy soil (Ortic luvisol, FAO classification)

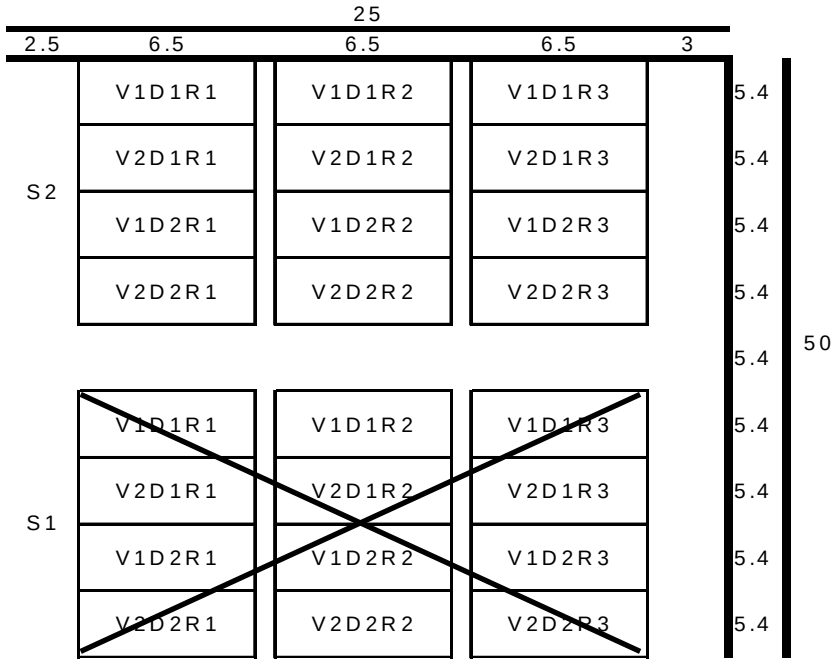
Meteorological data in 2005

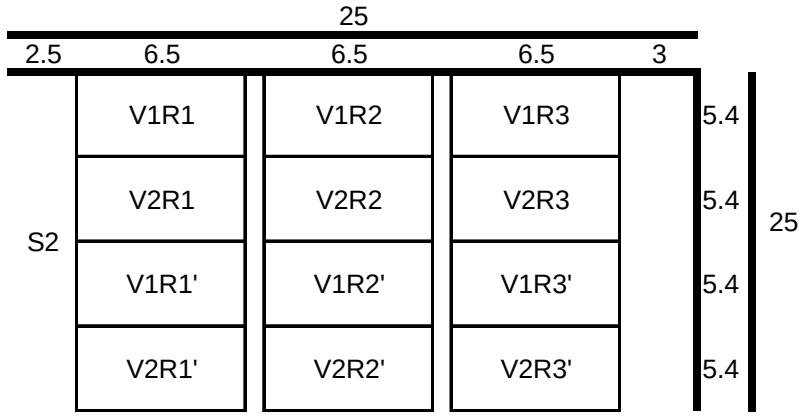


-Rainfall less important in June, more important in July

-Temperature more regular than usual

Experimental design in 2005



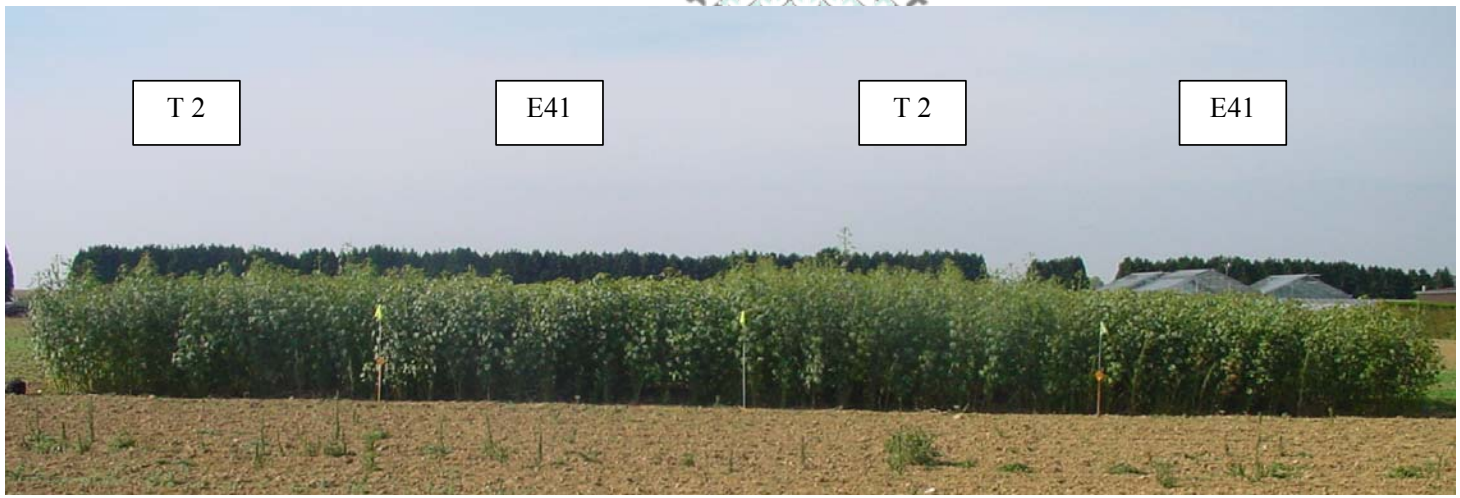


-V1: Tainung 2

-V2: Everglades 41

- 6 repetitions

Field observed the 14 October 2005:



Crop management sequence

Sowing

date 1: 26/04/2005
date 2: 23/05/2005
Sowing machine: pneumatic seed drill
Varieties: Everglade 41 and Tainung 2
Density: 80 plants/m²

Fertilisation

none

Weed control

date: 12/07/2005
type: manual weed control

Irrigation

none

Weed control is a problem:

Mechanical or chemical solution has to be performed

2. Results

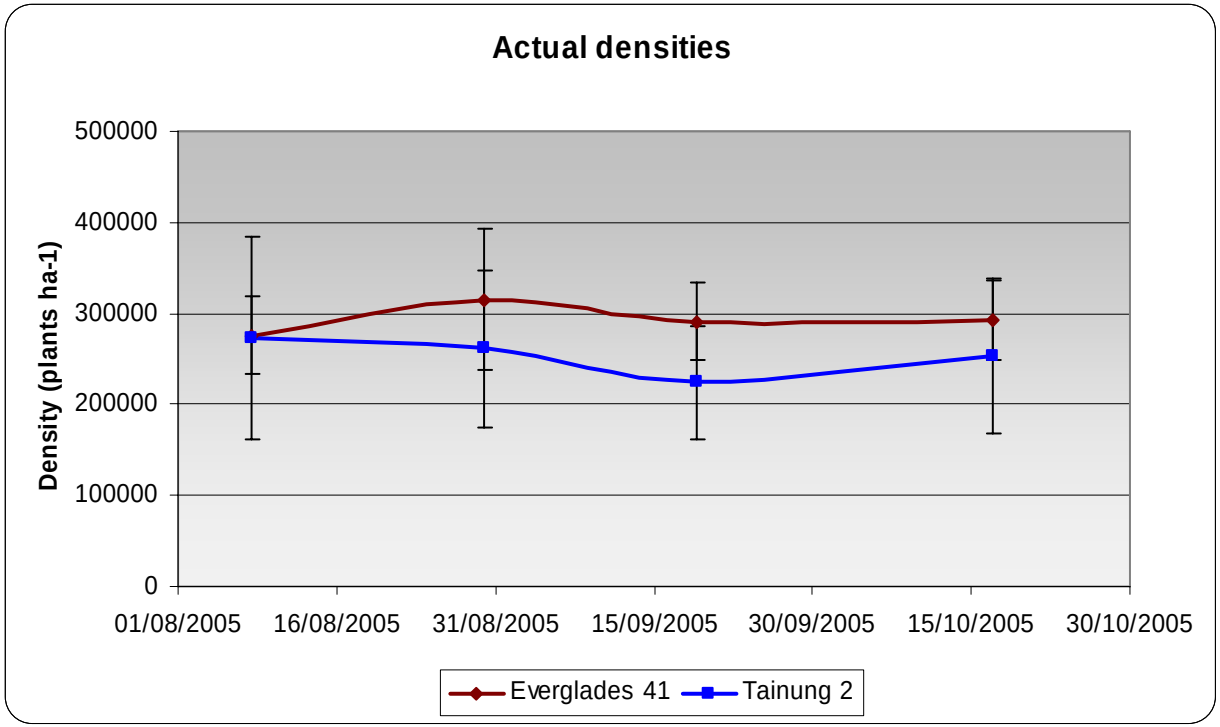
2.1. Losses at emergence

2.2. Biomass yield

2.3. A specific problem in 2005

2.4. Other data

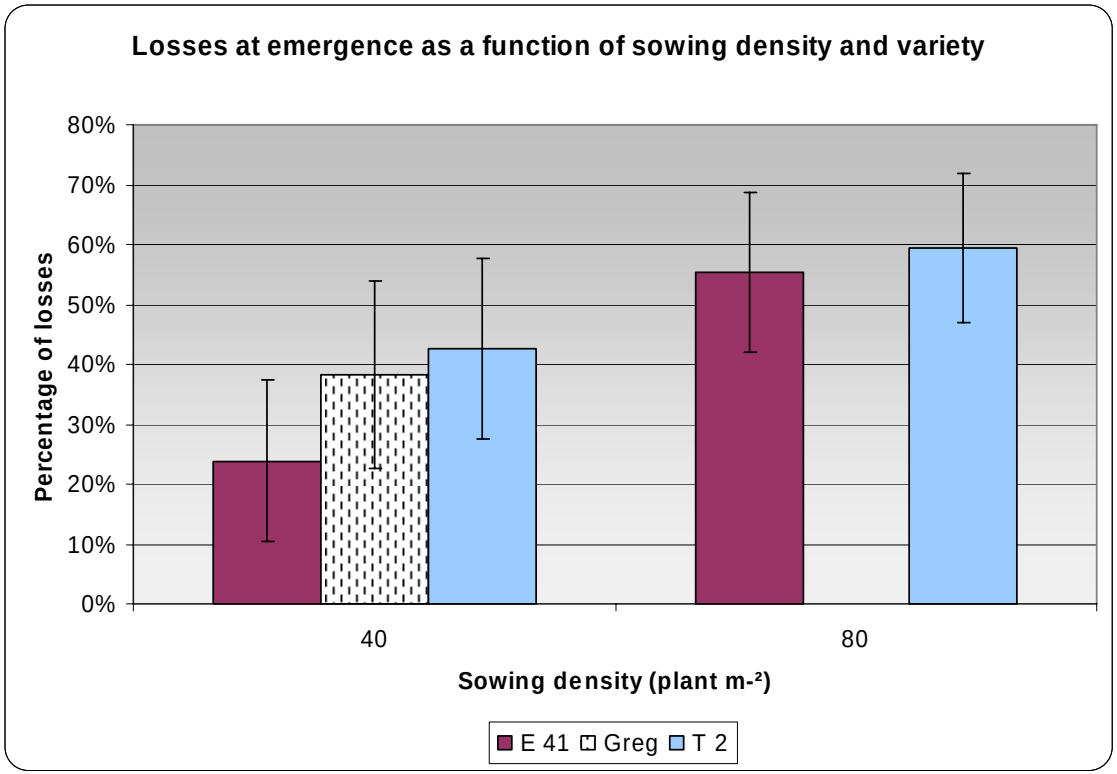
Densities and losses at emergence



- Very **important losses**

- Difference between varieties only in September due to the heterogeneity

Losses at emergence (2003-4-5)



- More losses for high densities
- No difference between varieties
- T2 more sensible ?

Losses at emergence are a very important problem (2 total losses of trials)

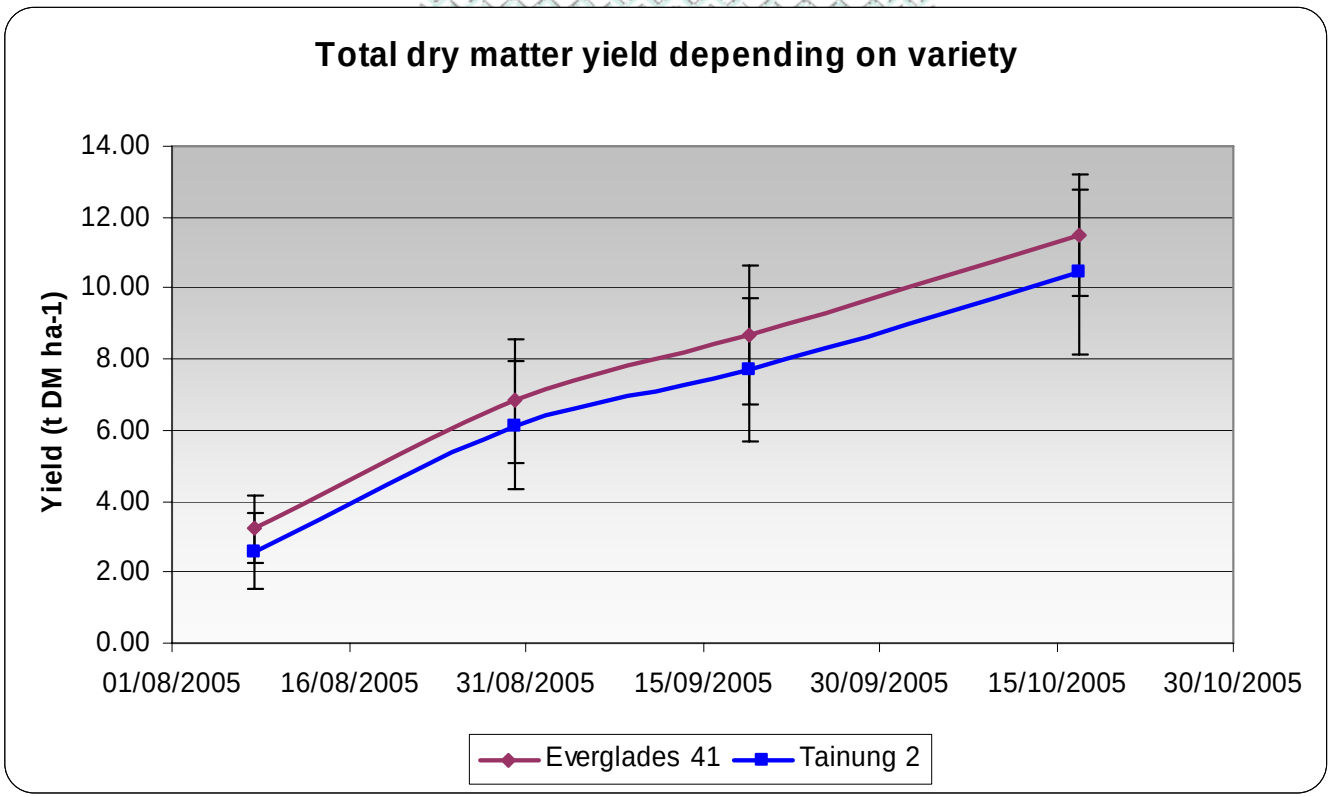
- Seed fungic protection (White et al. 1971)
- Starter fertiliser (?)
- Case of soils favourable to crusts: cropping management adapted
- Other problem?

2.1. Losses at emergence

2.2. Biomass yield

2.3. A specific problem in 2005

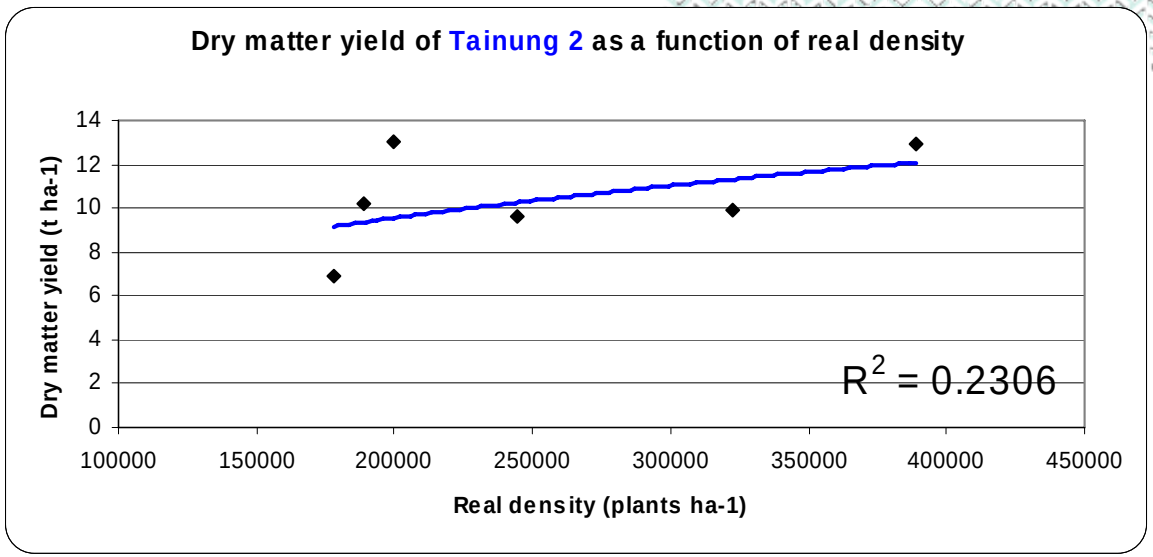
2.4. Other data

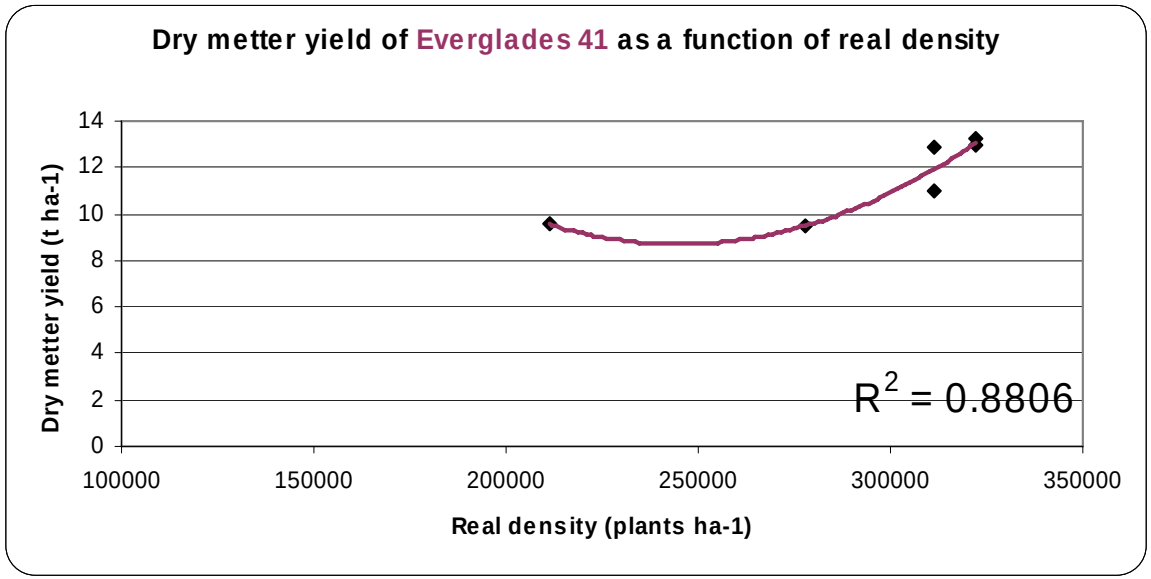


-Tainung 2 DM yield: **10.5 +/- 2.3 t/ha**

-Everglades 41 DM yield: **11.5 +/- 1.7 t/ha**

-No statistical differences (p=0.3 to 0.5)





-No correlation for T2

-Positive correlation for E41

30pl/m²: limiting density is not reached

Biomass yield in 2003-4-5

	trial objectif	yield min-medium-max (t MS/ha)
2003	V*S*D	8.9-**11.0**-12.3
	I*N	6.9-**8.6**-9.6
2004	V*S*D	10.0-**10.5**-11.5
	N	8.3-**9.9**-11.2
2005	V*S*D	6.9-**11.0**-13.1

- Medium DM yields varying from 8.6 to 11 t/ha
- No solutions for strong yield improvement

Other similar plant yields

PLANT	DM YIELD	SOURCE
Maize	+/- 17 t	INRA Mons, France
Hemp	6 to 12 t	ITC, France
Sugar sorghum	Until 25 t	INRA Paris, France

- Advantage of kenaf versus maize if we **take into account environmental assessment**

- **Sustainable yield** in the North of France near **10t** of Dry matter per hectare
- Other plants, better known in France can reach this yield with more security
- Advantage for kenaf due to low inputs (positive consequences in the cost and the environment)
- **One critical point: the establishment of the crop (losses at emergence, crusts…)**

2.1. Losses at emergence

2.2. Biomass yield

2.3. A specific problem in 2005

2.4. Other data

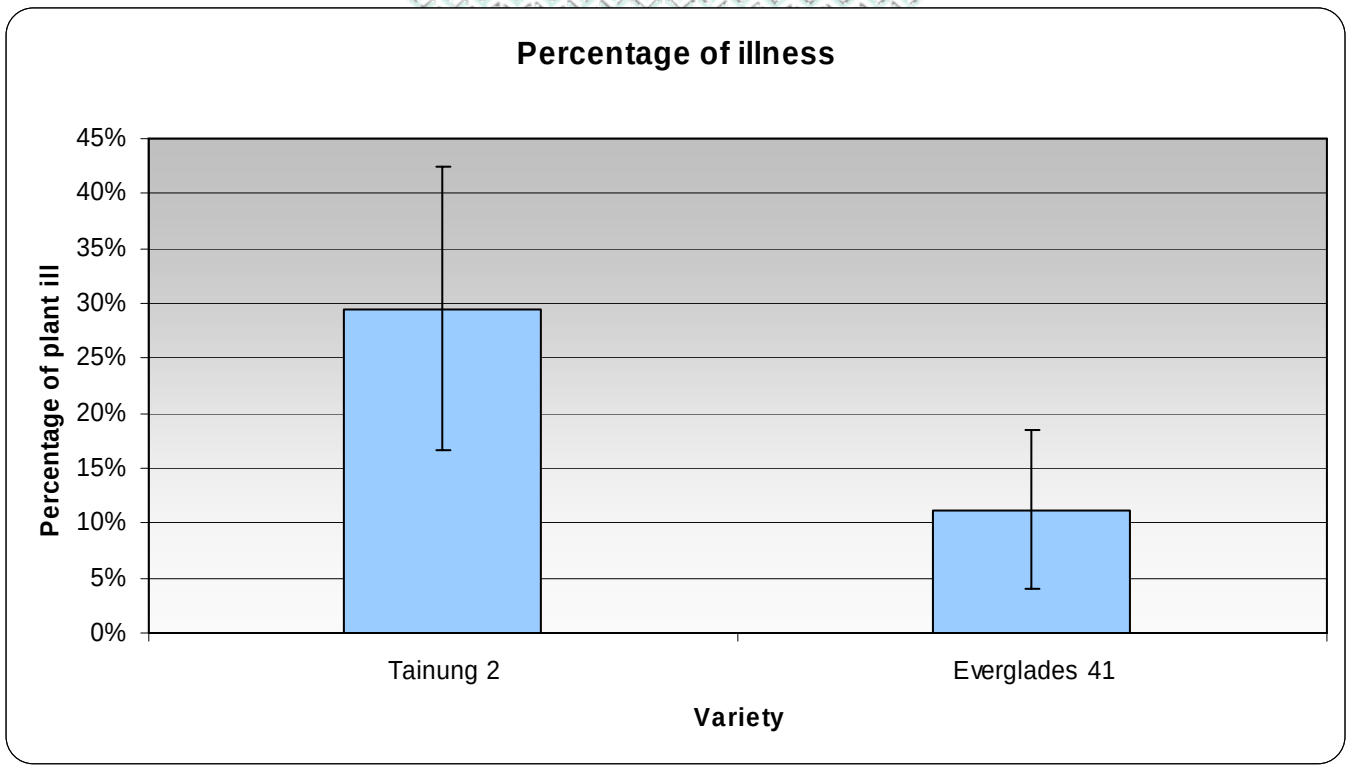
In September,

attack of an

unspecified disease

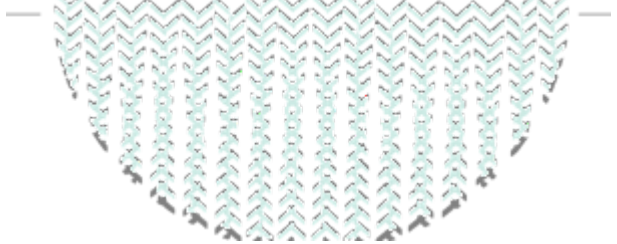
was observed

on few plants



- Very important attack and **T2** much **more sensible**

- Suspicion of **Gray mold** (Campbell and O'Brien 1981), exact determination in progress



2.1. Losses at emergence

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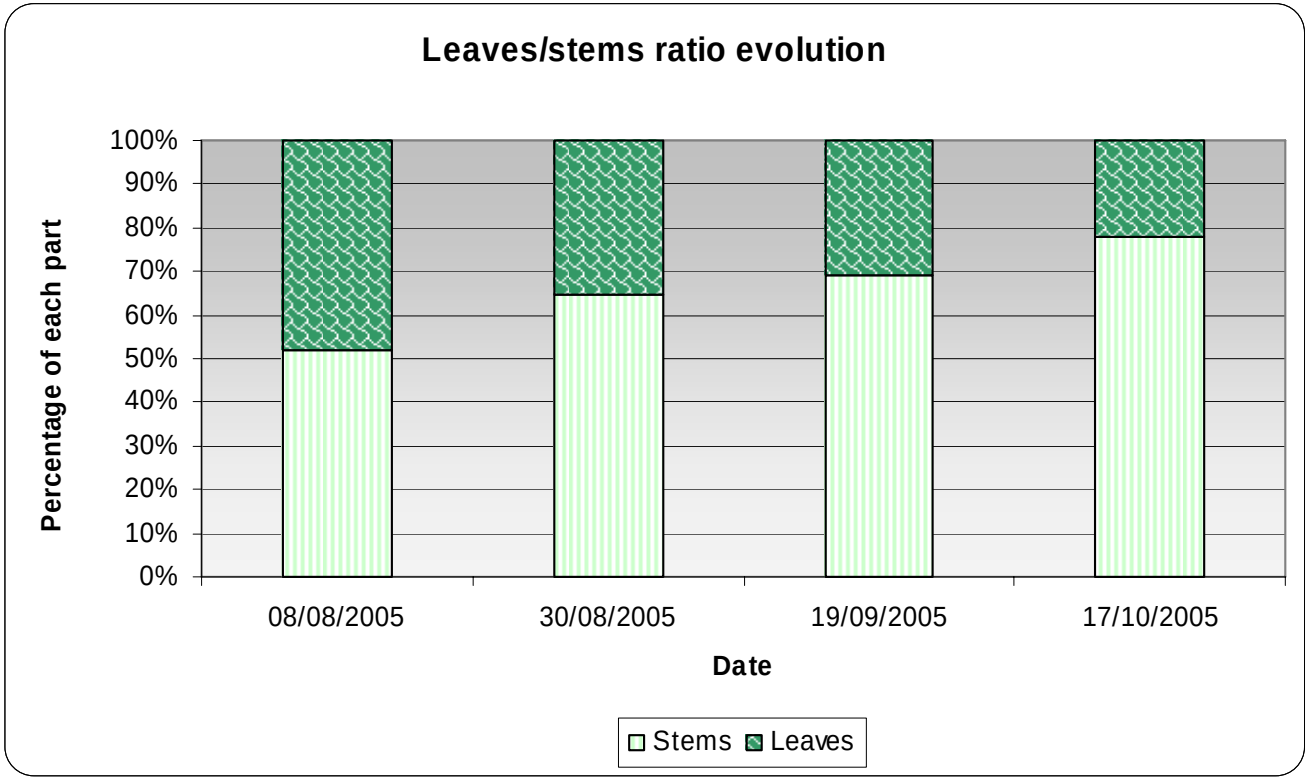
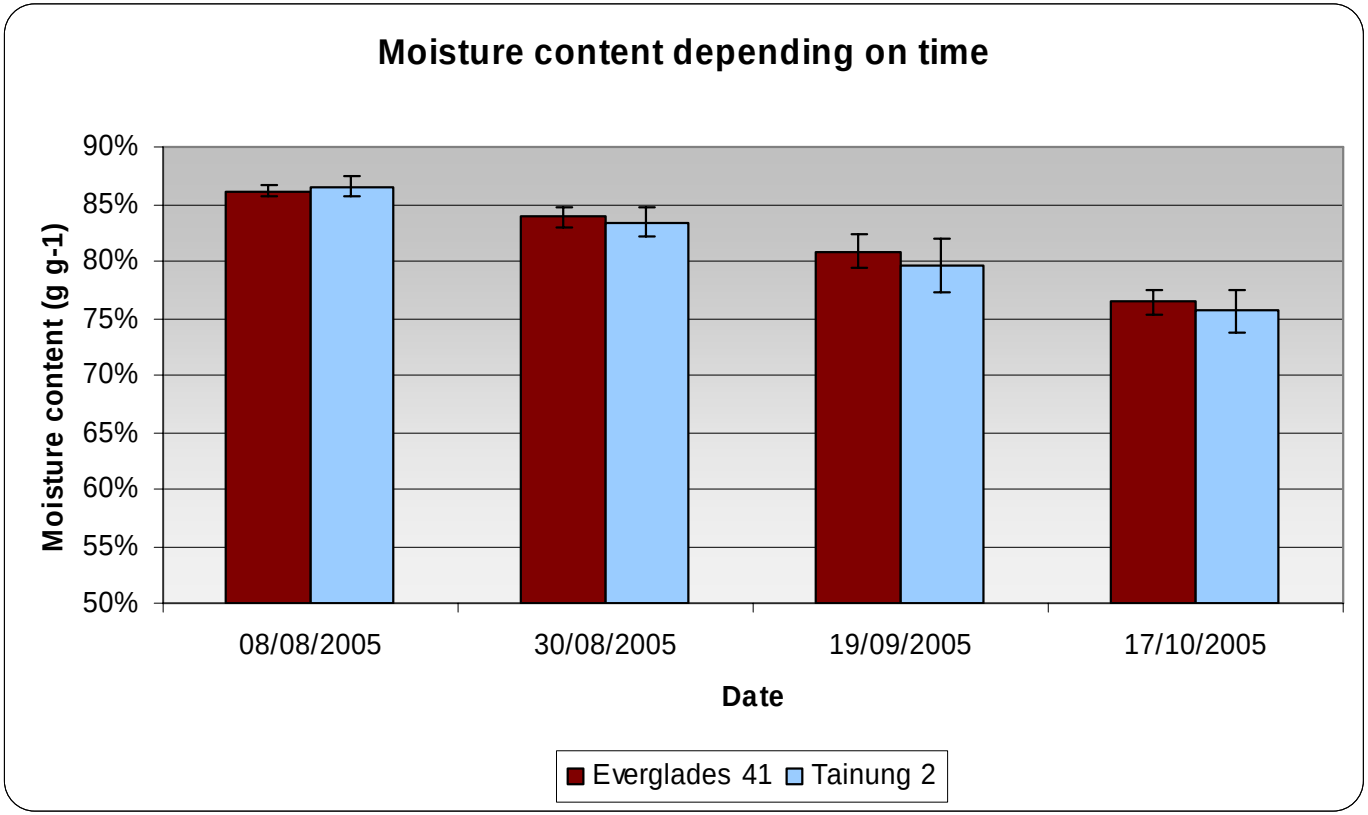
Leaves/stems ratio evolution



-Same trend for E41 and T2

-Total yield mainly explained by stems

Moisture content



-Same trend for E41 and T2

-regular diminution until **75% in October**

Synthesis

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Irrigation effect

- Positive effect in 2003 and 2004 … But …

  - Not for all the samples: interest not so obvious

  - French context: diminution of water use in agriculture ⟶ **no irrigation for energy crops**

Fertilisation

- **No differences** observed in 2003 and 2004 on the biomass yield
- Exact needs of the kenaf do not seem to be determined in the literature
- Work in progress: **analysis of the needs** (with soil analysis, plant N content and level of nitrogen supply)

Date of sowing

- No comparison in 2003 and 2005
- In 2004, confusion between sowing date and sowing density: no recommendations … But…
- One more time, for a sustainable yield, the **most important is to wait very favourable conditions (minimum risk of high rainfalls, high temperatures…)**

Sowing density

- In 2003, **no differences** were observed between densities
- In 2004, confusion between sowing date and sowing density
- In 2005, **30 pl/m², not a limit** but if more caution to the cost (more losses with highest density)

Variety

- Each year, differences between varieties are not significant
- In 2005 **Tainung 2 appeared more variable** in all the analysis and much more sensible to the disease observed

Conclusion

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- **Few differences** were generally observed between treatments in 2003, 2004 and 2005
- Very important problem for crop establishment

Thus, for a sustainable yield we have to **minimize risks of losses at emergence and/or during the growth period instead of maximizing the yield**

MODALITY	CONCLUSION
Irrigation	**0**
N-Fertilisation	Analysis of the needs in progress
Sowing date	waiting for **very favourable conditions**
Sowing density	Objective of **30-40 plants/m²**
Variety	**Everglades 41**

WP3:
Development of the crop growth simulation model

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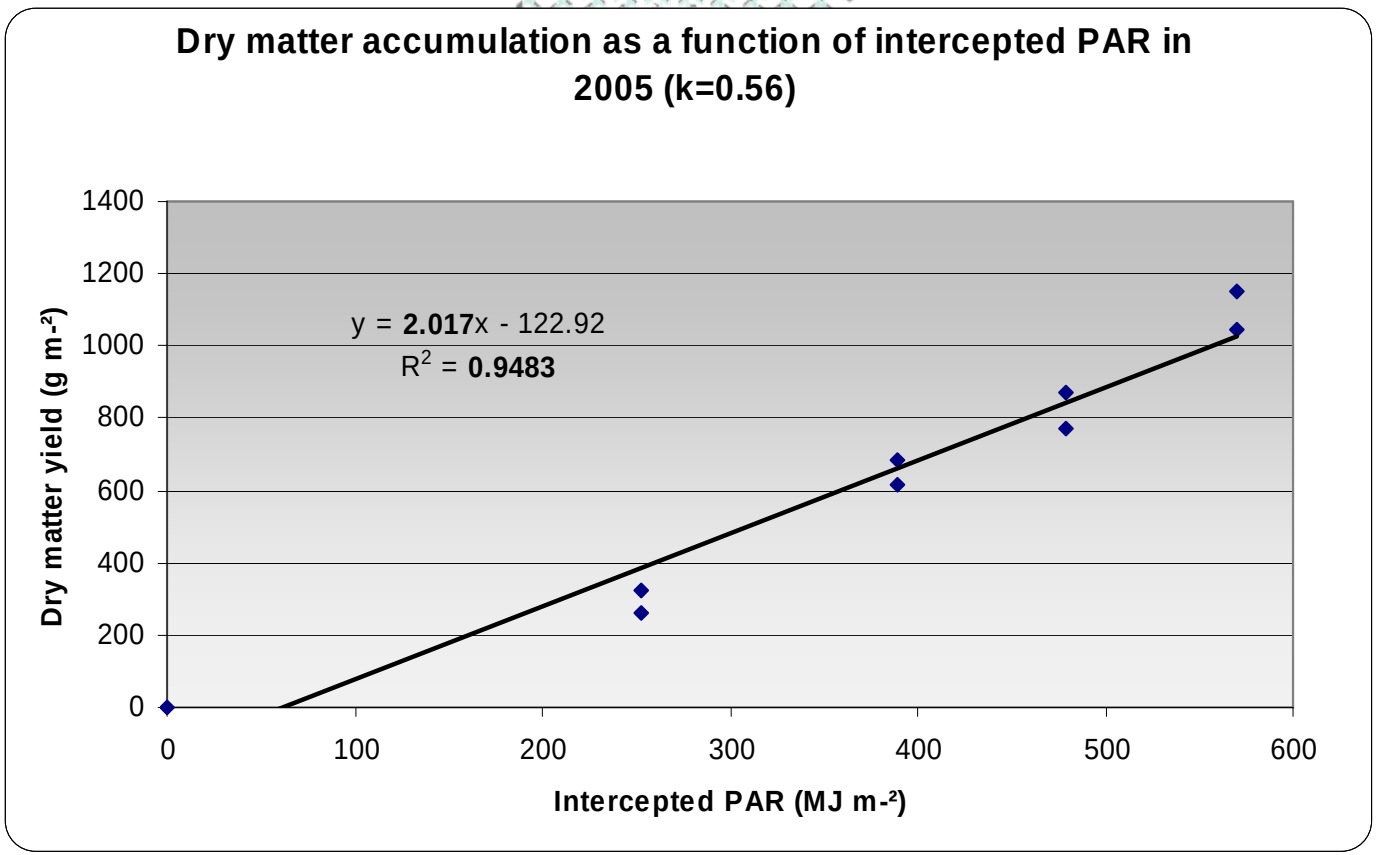
- **$DM = x * \Sigma PAR_{intercepted}$**
- $PAR_{intercepted} = PAR_{incident} * \varepsilon i$
- $PAR_{incident} = 0.5$ Global Radiation
- $\varepsilon i = 0.95*(1-exp(-k*LAI))$
- $k = 0.56$ [Muchow R.C. 1992]
- $LAI = y * \Sigma \theta$ (threshold 12°C)
- x and y determined by linear regressions

2005



RUE = 2.017 g.MJ-1 (Muchow RUE = **1.20** g.MJ-1)

Explanations

- Better RUE than Muchow
- In his trial Muchow reach a maximum of 2000 $MJ.m^{-2}$ (600 $MJ.m^{-2}$ for us)
- Thus **our limitation is the $PAR_{intercepted}$…**

  …and not cultivation techniques
- We could test a **kenaf variety with early maturity** if it is not sensitive to low temperatures

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