WP2
Adaptability and Productivity Field Trials

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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

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Task 2.2 – Effect of different sowing dates and plant populations on biomass yields

2 sowing dates x 2 varieties x 2 plant densities

- S_1: 12/7/2004
  S_2: 02/8/2004
  Later than in 2003
- V_1: Tainung 2
  V_2: Everglades 41
- D_1: 20 plants/m^2
  D_2: 40 plants/m^2

Each field: 8 x 4 m^2

75 kg N/ha

120 kg K_2O/ha

60 kg P_2O_5/ha

Harvest dates

H_1: 03/11/2004
H_2: 07/12/2004

Task 2.3 – Effect of irrigation and nitrogen fertilization on biomass yields

4 irrigation levels x 3 nitrogen fertilization

- I_1: 0% PET= 251 mm H2O
  I_2: 25% PET = 300 mm H2O
  I_3: 50% PET = 350 mm H2O
  I_4: 100% PET = 448 mm H2O
  more than in 2003, due to late sowing
- N_1: 0 kg N/ha
  N_2: 75 kg N/ha
  N_3: 150 kg N/ha

Variety: Tainung 2
Sowing: 19/7/2004
20 plants/m^2
→ Later than in 2003

Each field: 8 x 5 m^2

120 kg K_2O/ha

60 kg P_2O_5/ha

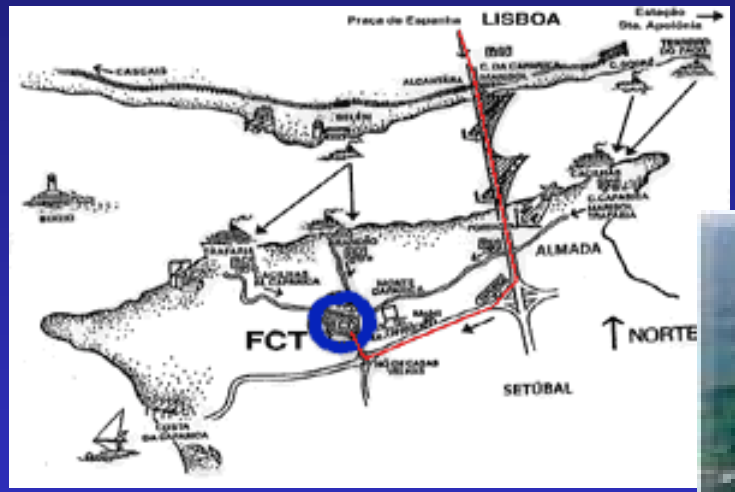
Harvest dates

H_1: 09/11/2004
H_2: 13/12/2004

At early stages of growth, all the fields were fully irrigated - to compensate the water deficit of the soil
40 days after sowing, irrigation was differentiated

Experimental fields

Located in Monte de Caparica, in the Peninsula of Setúbal, near the University - near Lisbon, in the south border of river Tejo



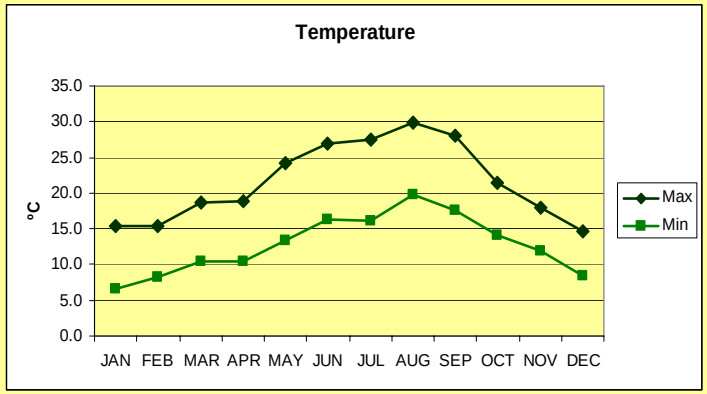
Fields

Latitude: 38º 40´ N
Longitude: 9º W
Altitude: 50 m

Urban area near the Atlantic coast and the estuarine zone

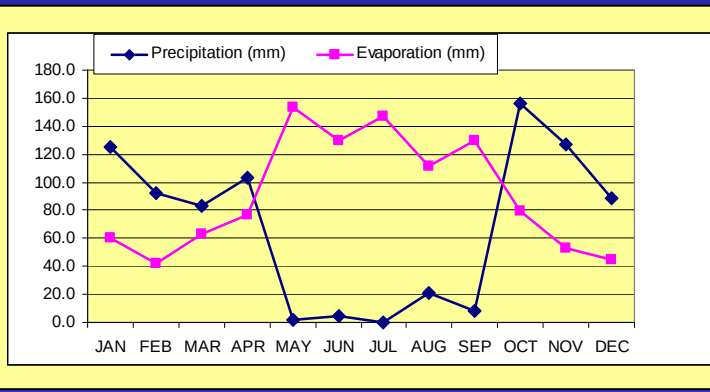
Climatic conditions at Monte de Caparica

2003



average minimum temperature - 12.4ºC

average maximum temperature – 21.5ºC

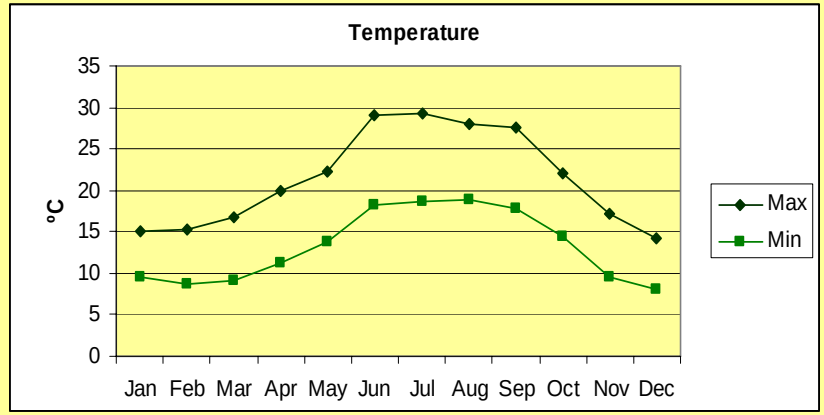


812 mm rainfall, 1090 mm total evaporation

Irrigation was necessary

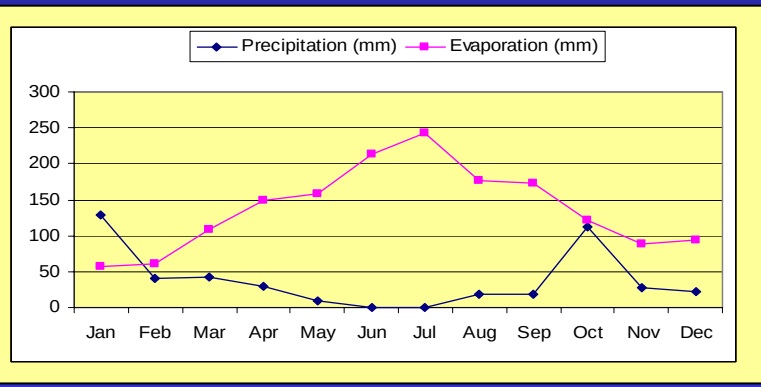
between May and September

2004



average minimum temperature – 13.2ºC → higher than in 2003

average maximum temperature – 21.4ºC



451 mm rainfall, 1645 mm total evaporation, 2004 was a very dry year.

Significant difficulties experienced during this reporting period:

S_1: 18/5/2004
S_2: 15/6/2004

Task 2.2

Variety: Tainung 2
Sowing: 02/6/2004
20 plants/m^2

Task 2.3

First sowing dates,

due to an invasion by the rabbits during the month of June we had to sow again, this time only one block, as for task 2.2 as for task 2.3

Rabbits eat the plants after emergence, namely S_2 plants and plants from task 2.3 fields, and for S_1 plants, they eat the leaves and the upper part of the stem.

Last week of June and first week of July were the worst period. But, even until the end of August (time when hunters start their activity) rabbits gave a lot of work.

Also, in 2004, the activity of the rabbits were of major concern because, probably, in 2003 we permited with the first crop, their multiplication.

Due to a technical problem, leaf areas were only measured at the end of the vegetative cycle.

Task 2.2

– Effect of different sowing dates and plant populations on biomass yields

Growth stages

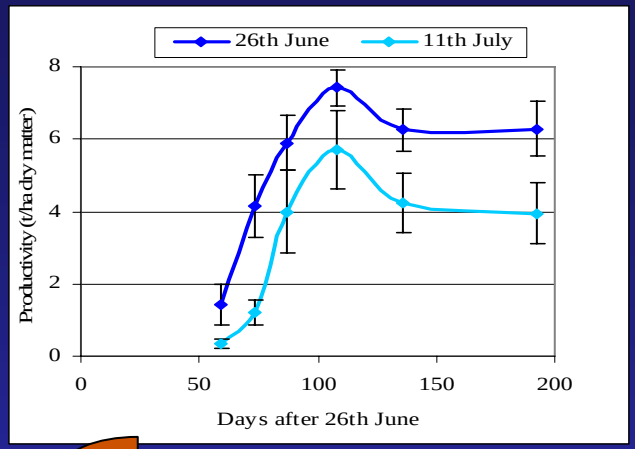
	Tainung 2				Everglades 41			
	D_1		D_2		D_1		D_2	
	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
Emergence 50%	4 days after sowing (as for 2003)							
Total emergence of seeds	90 ± 10 % (as for 2003)				90 ± 5 %			
Half-bloom > 50%	S_1 – 20/10/2004, 100 ± 4 days after S_1 S_2 – 3/11/2004, 114 ± 5 days after S_1							
Physiological maturity > 50%	It was not achieved (as for 2003)							

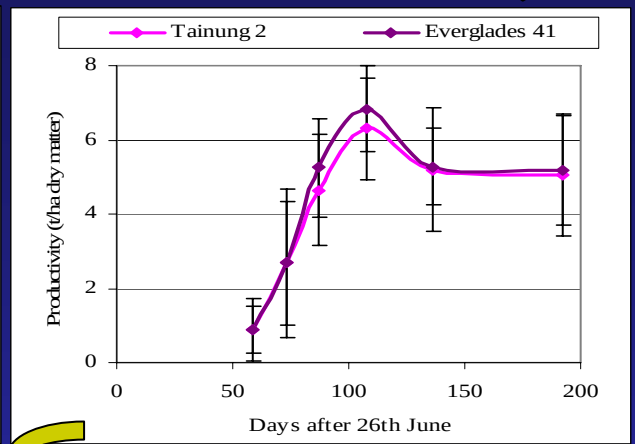
Better than in 2003

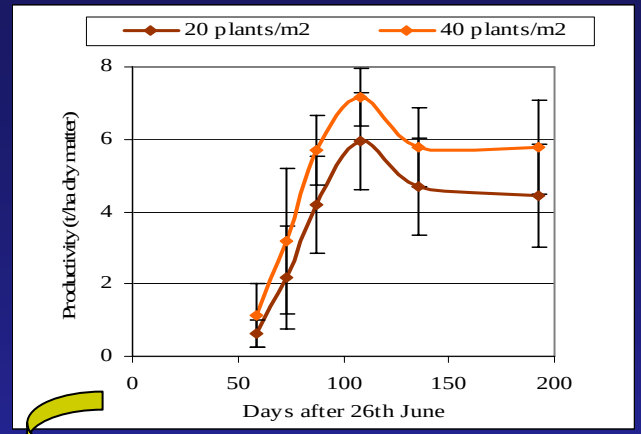
Approximately as in 2003 Days after S_1, sooner

Biomass Productivity

2003



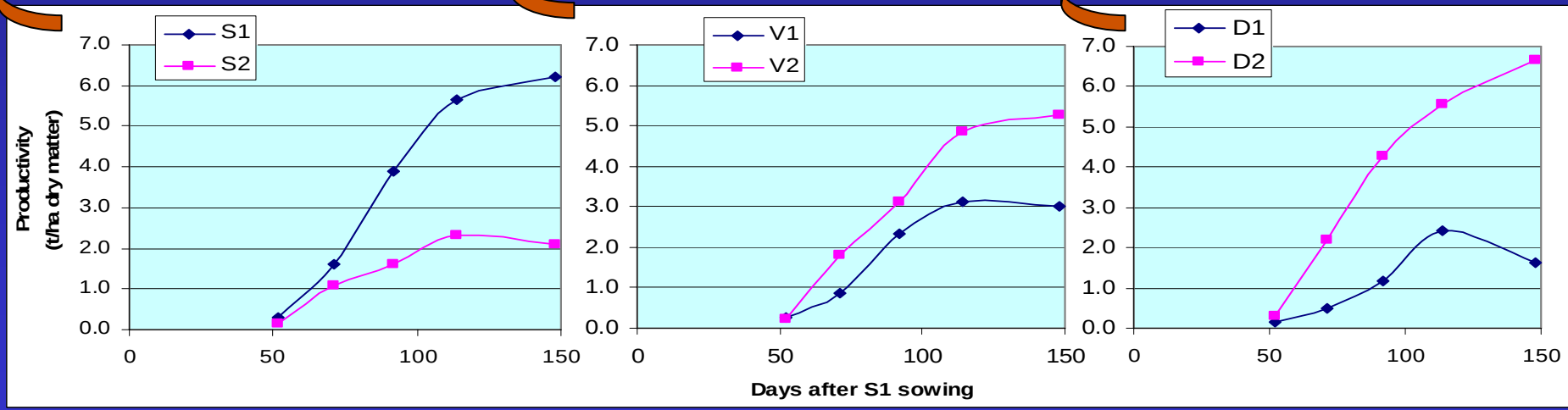




S1 > S2

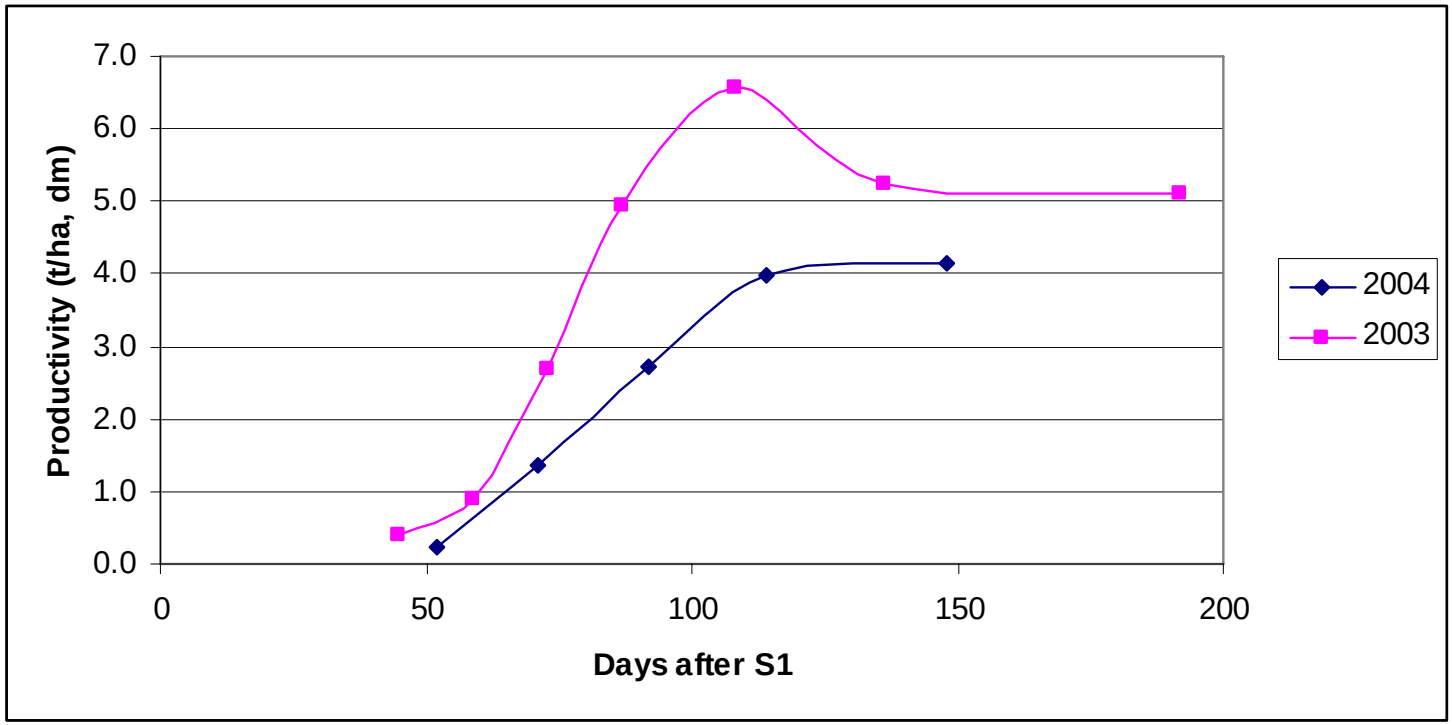
Everglades 41 > Tainung 2

40 plants/m² > 20 plants/m²



2004

Comparison between 2003 and 2004



Higher productivities in 2003 than in 2004, mostly because of the sowing that was performed in 2004 later than in 2003.

Differences were significantly higher for S2 fields and not for S1 fields

Slower growth in 2004 than in 2003, also due to the S2 fields that presented very low productivities

Highest productivities, obtained 108-114 days after sowing (middle October- begginning of November), as for 2003 as for 2004

Biomass Productivity

2003

Bark 34-40% **Core 60-66%**

At the end of the vegetative cycle

2004

Bark 30% **Core 70%**

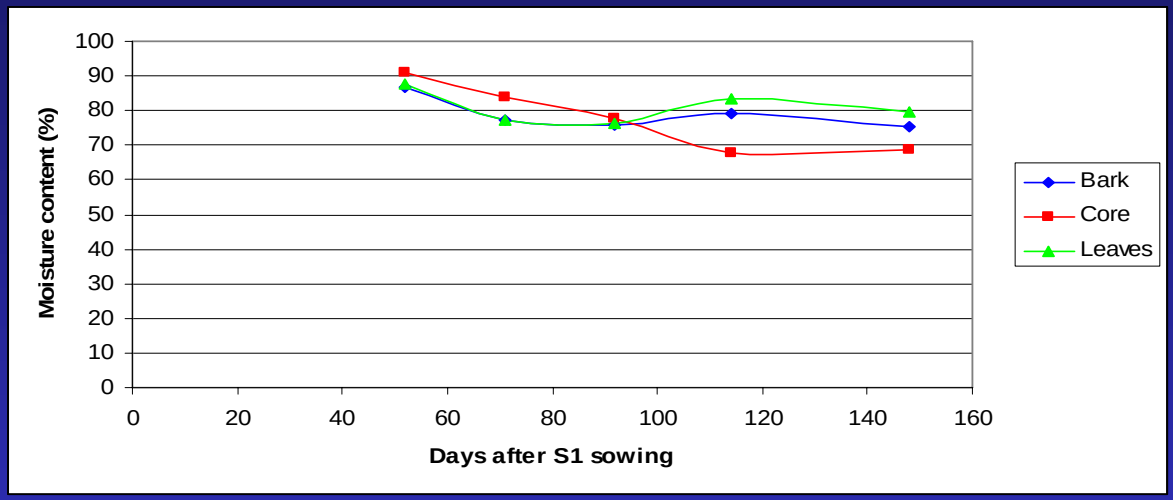
Bark + Leaves – 37%, Core – 63%

Productivities obtained
lower than those obtained by other
mediterranean partners of the Biokenaf project

Mainly due to the difficulties experienced
namely,
the late sowing date

Biomass Quality

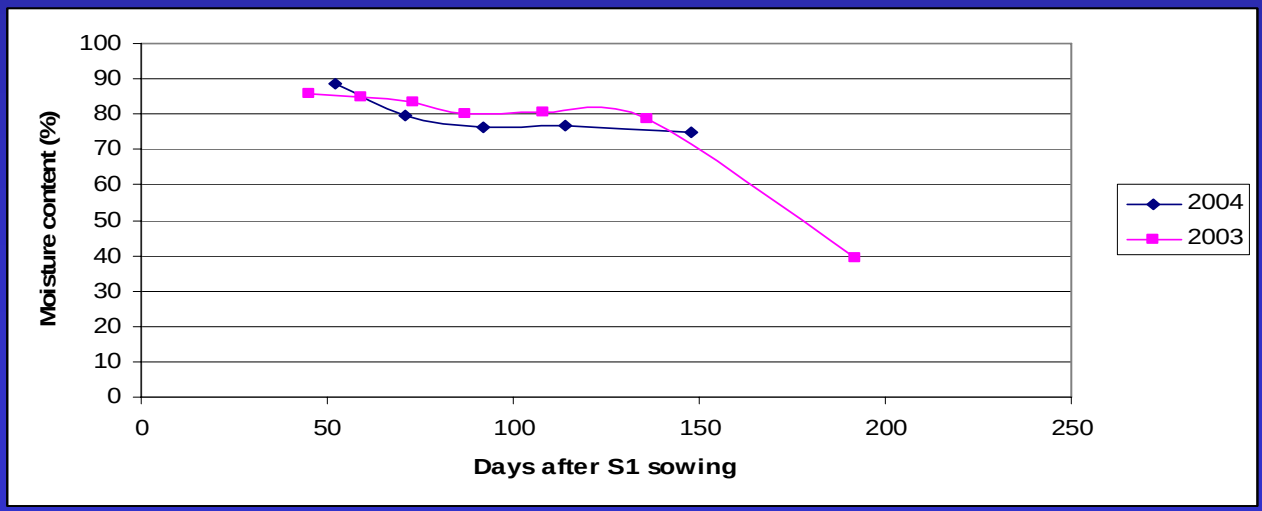
Moisture content



No significative differences among all the fields

No significative differences between leaves, bark and core

Moisture content decreased along the growing season

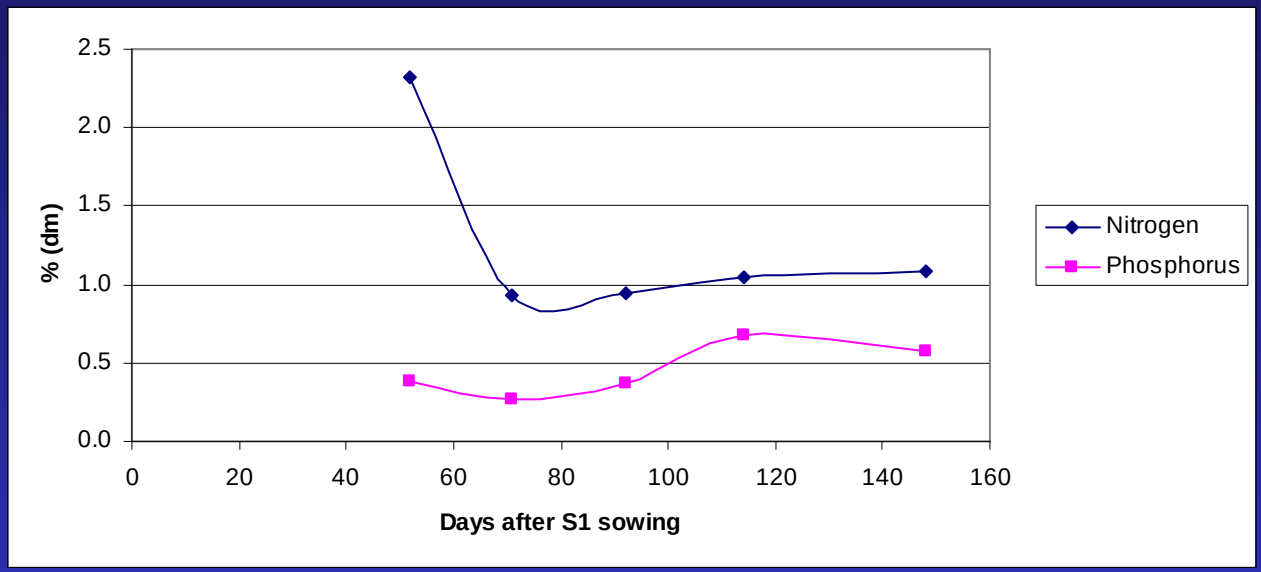


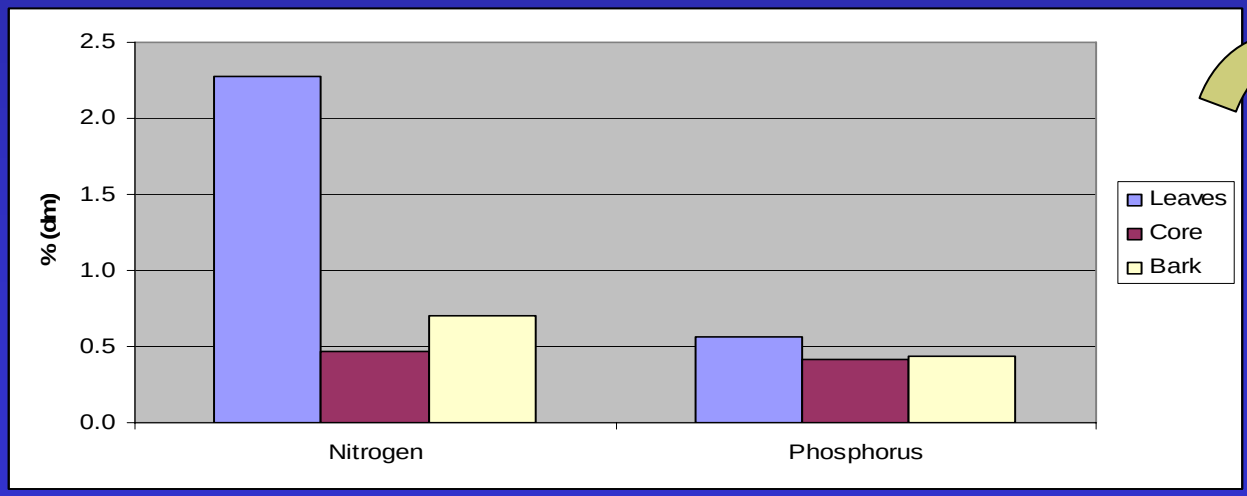
No significative differences between 2003 and 2004

But,
the January harvest in 2003 presented a much lower moisture

Biomass Quality

N and P content





Nitrogen content decreased along the growing season

At the beginning of the cycle, P decreased due to the dilution effect of the growing crop. At the end of the cycle, P increased

No significative differences among fields

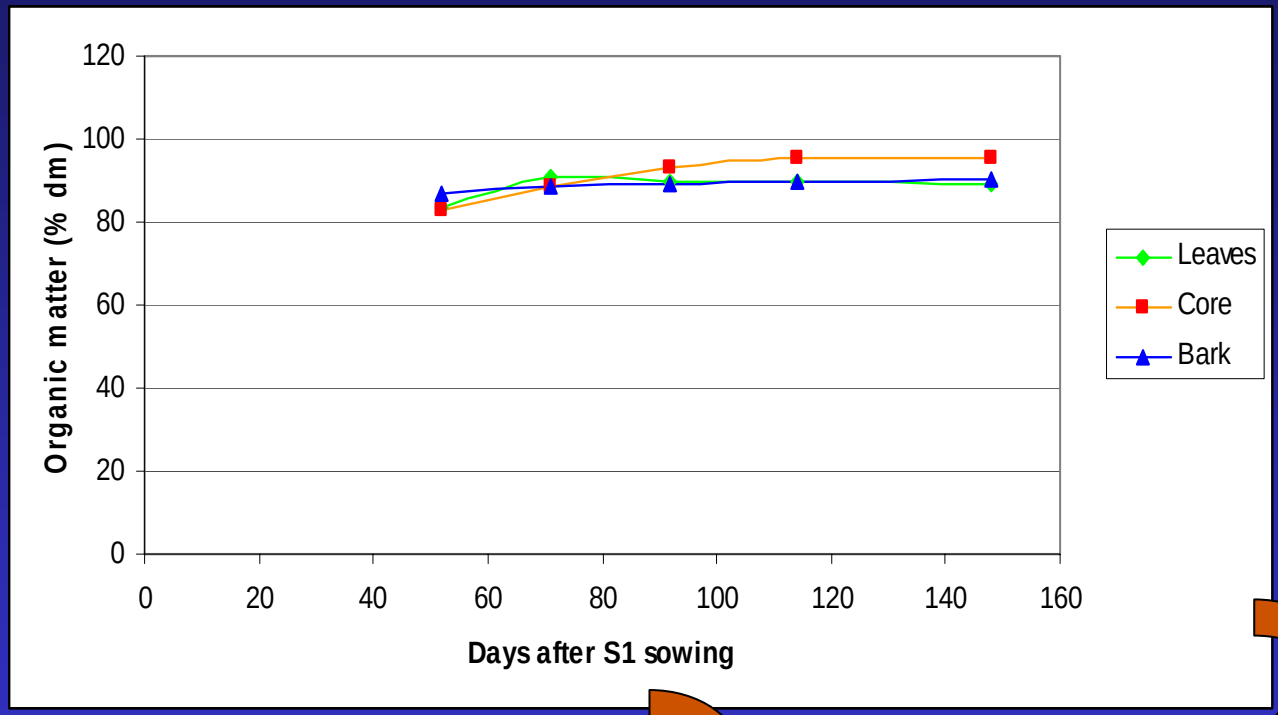
N and P

Higher in leaves than in stems

Higher in bark than in core

Biomass Fuel Quality

Organic matter content



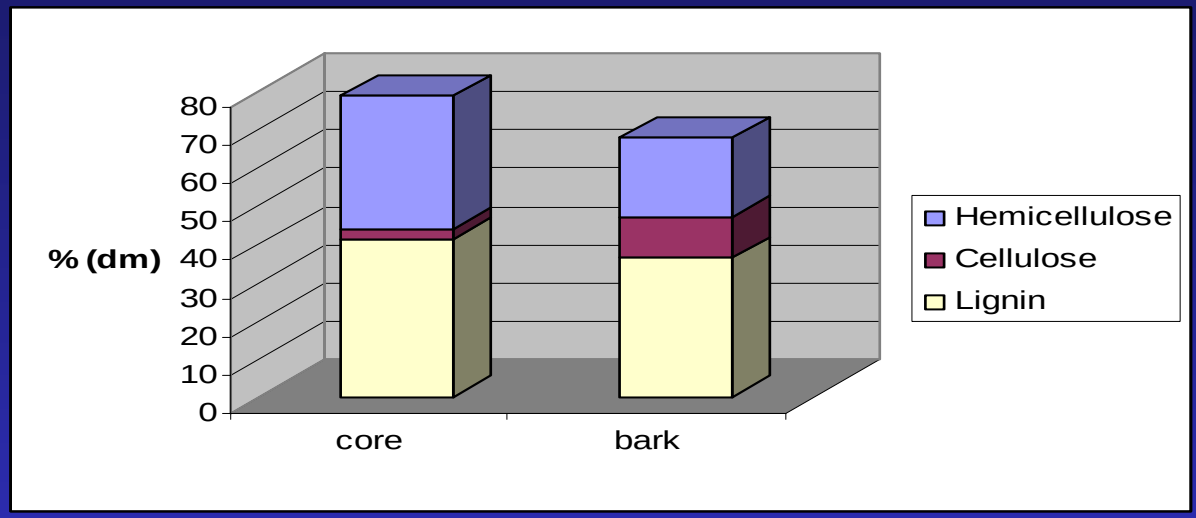
No differences between fields

Better quality for energy purposes at the end of the growing season when the ash content was lower

Bark and leaves presented an inferior quality for energy purposes than core

Biomass for Pulp production

Fiber content



No differences between
sowing dates
plant populations
varieties

Fiber content of core higher than of bark

Bark contains less lignin, less hemicellulose and more cellulose than core

Harvest Date

Strong effects on the biomass productivity and biomass quality

the crop should only be harvested 108-114 days after sowing – middle October onwards, when highest productivities are obtained

In terms of the kenaf biomass quality,

the composition of the biomass changed over the course of the growth period as nitrogen, phosphorus and water content decreased and organic matter increased

Between the November harvest and the December harvest there were no significant differences in terms of Productivity and Biomass Quality.

Task 2.3

– Effect of irrigation and nitrogen fertilization on biomass yields

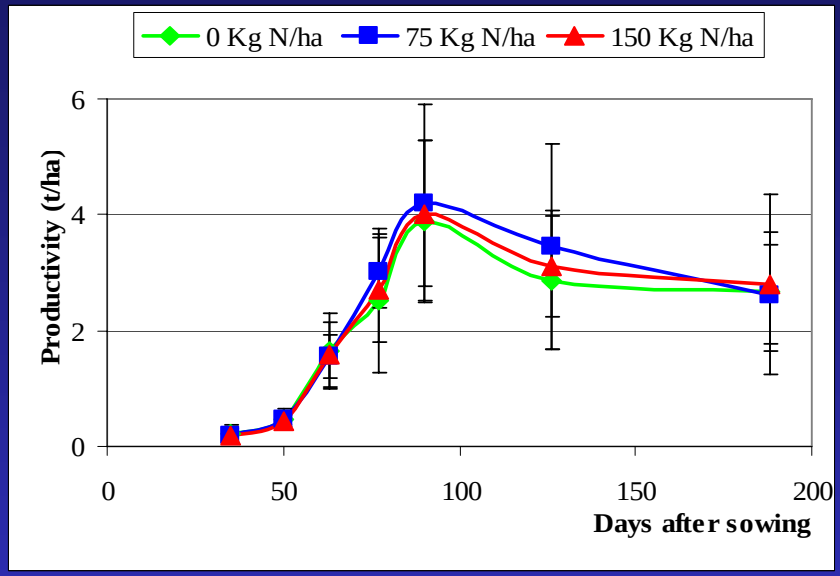
Growth stages

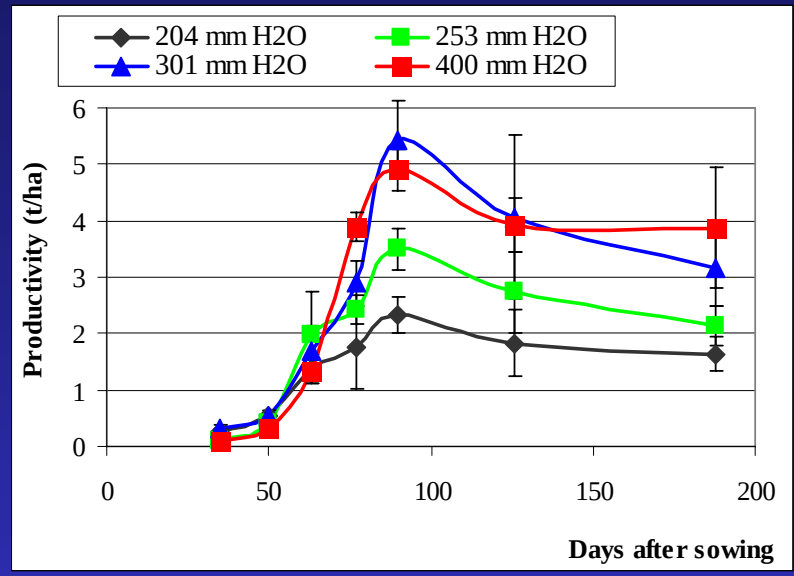
Emergence 50%	**5 days after sowing (as for 2003)**
Total emergence of seeds	**90 ± 10 % (as for 2003)**
Half-bloom > 50%	**27/10/2004, 100 ± 5 days after sowing**
Physiological maturity > 50%	**It was not achieved (as for 2003)**

Approximately as in 2003 Days after sowing, sooner

Biomass Productivity

2003





No significant differences among different levels of nitrogen

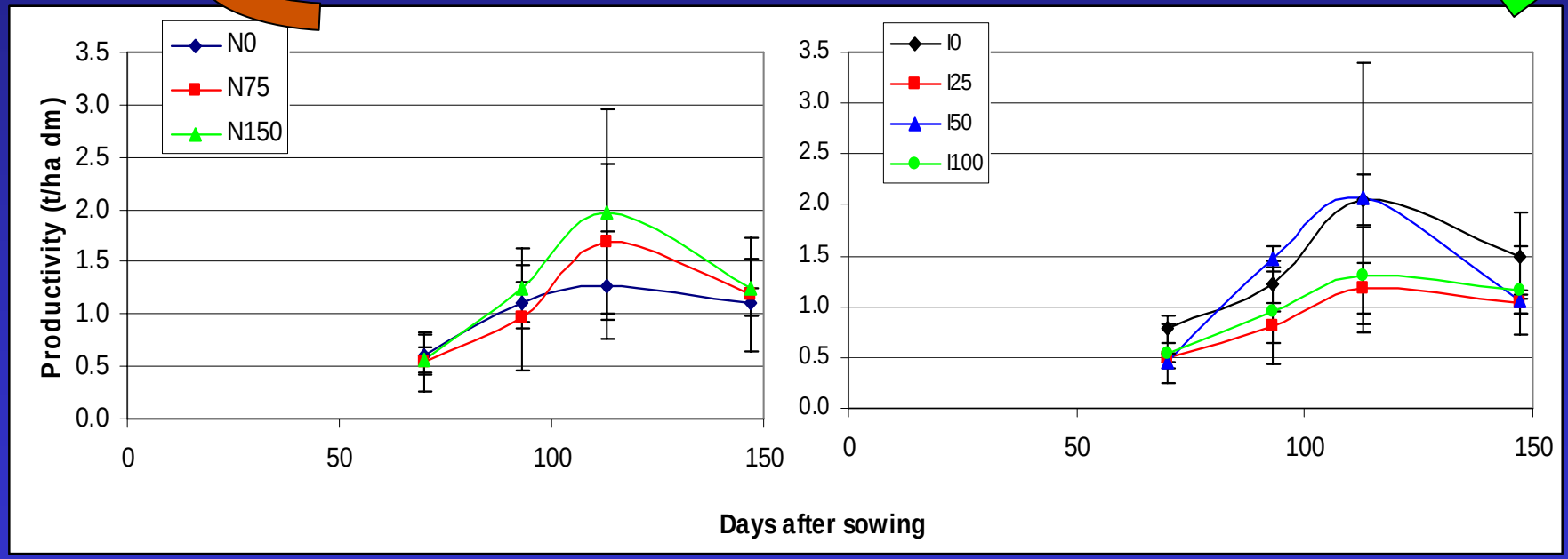
Significative differences among different levels of irrigation

Higher productivities in the fields with higher N-fertilizer, although not significative

Higher productivities in the I0 and I50 fields, although differences to I25 and I100 fields were not significant

Differences were expected in these fields: but maybe due to the late sowing, the hottest weather coincided with the start of the growing period, when the crop was fully irrigated

No significant differences among different levels of nitrogen and among different levels of irrigation



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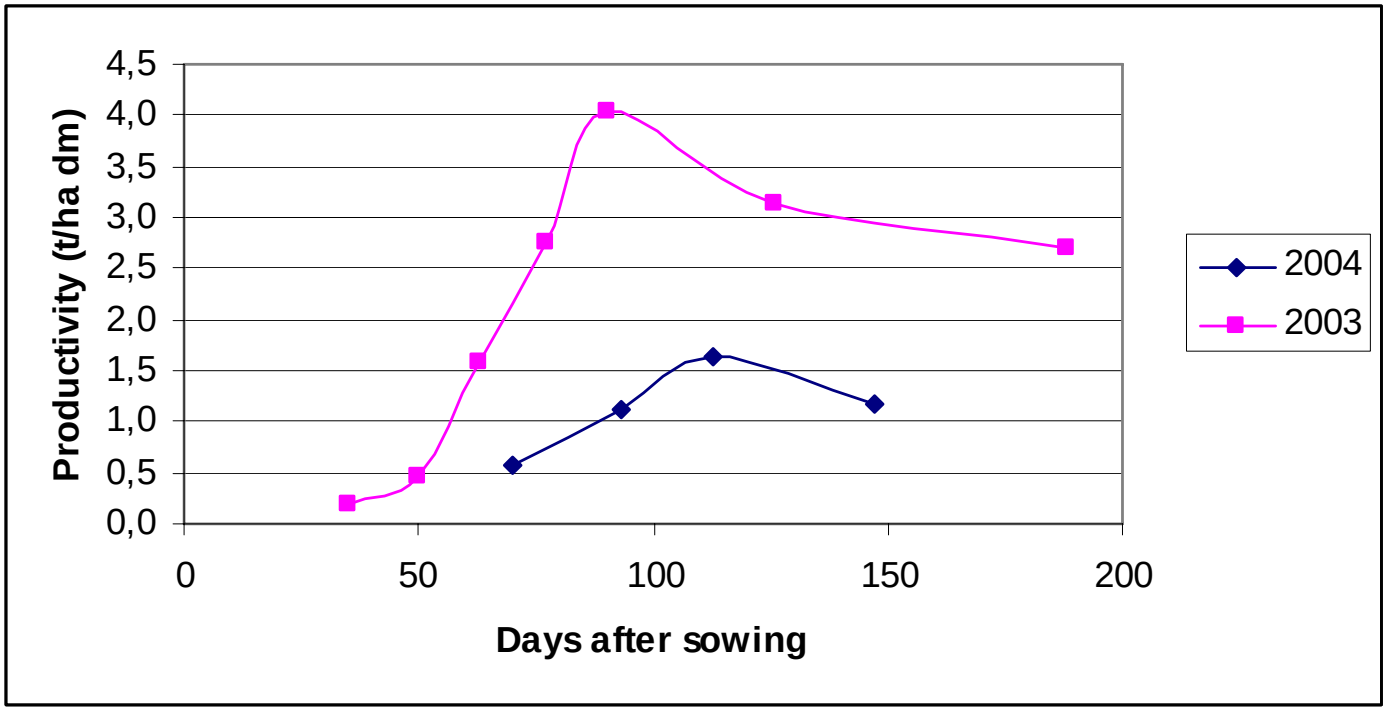
Comparison between 2003 and 2004



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Slower growth in 2004 than in 2003, also due to the late sowing

Highest productivities, obtained middle October- begginning of November, as for 2003 as for 2004 (90-110 days after sowing)

Biomass Productivity

2003 — **Bark 38-40%** — **Core 60-62%**

2004 — **Bark 32%** — **Core 68%**

At the end of the vegetative cycle

Bark + Leaves – 35%, Core – 65%

Productivities obtained
lower than those obtained by other
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Mainly due to the difficulties experienced
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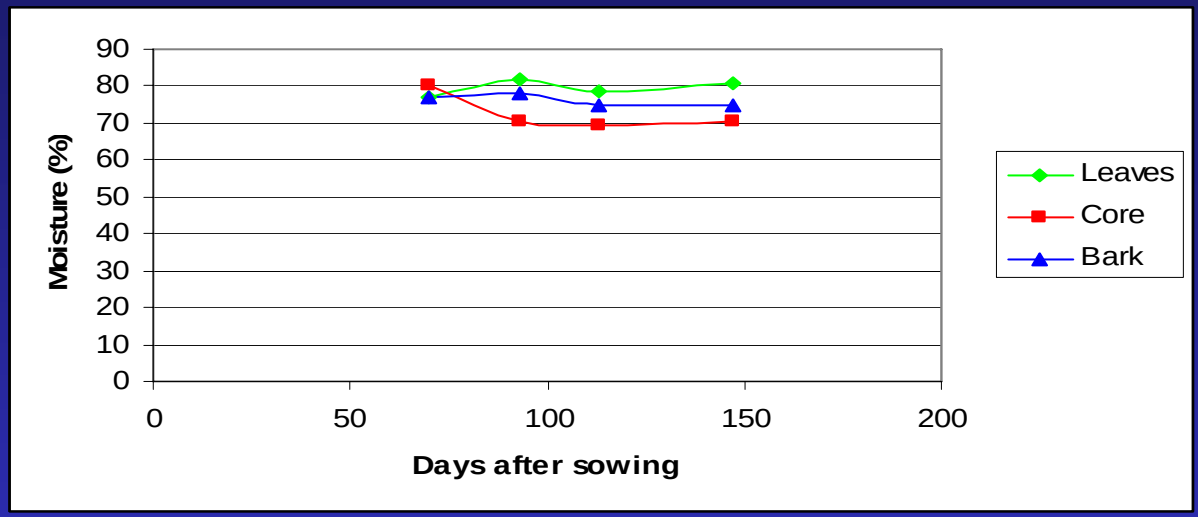
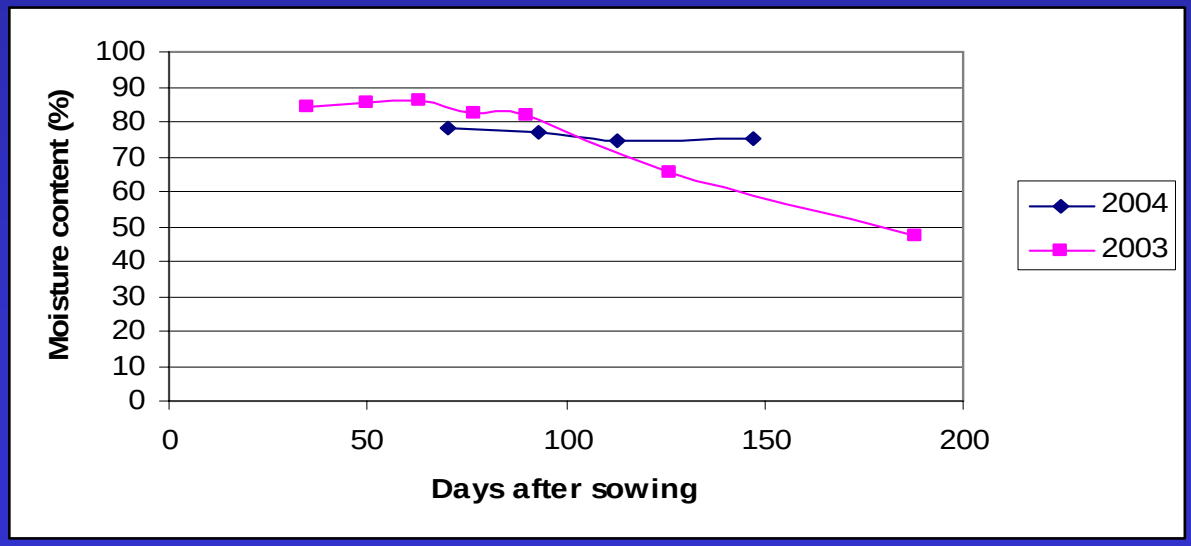
Biomass Quality

Moisture content





No significative differences among all the fields

No significative differences between leaves, bark and core

Moisture content decreased along the growing season

No significative differences between 2003 and 2004

But,
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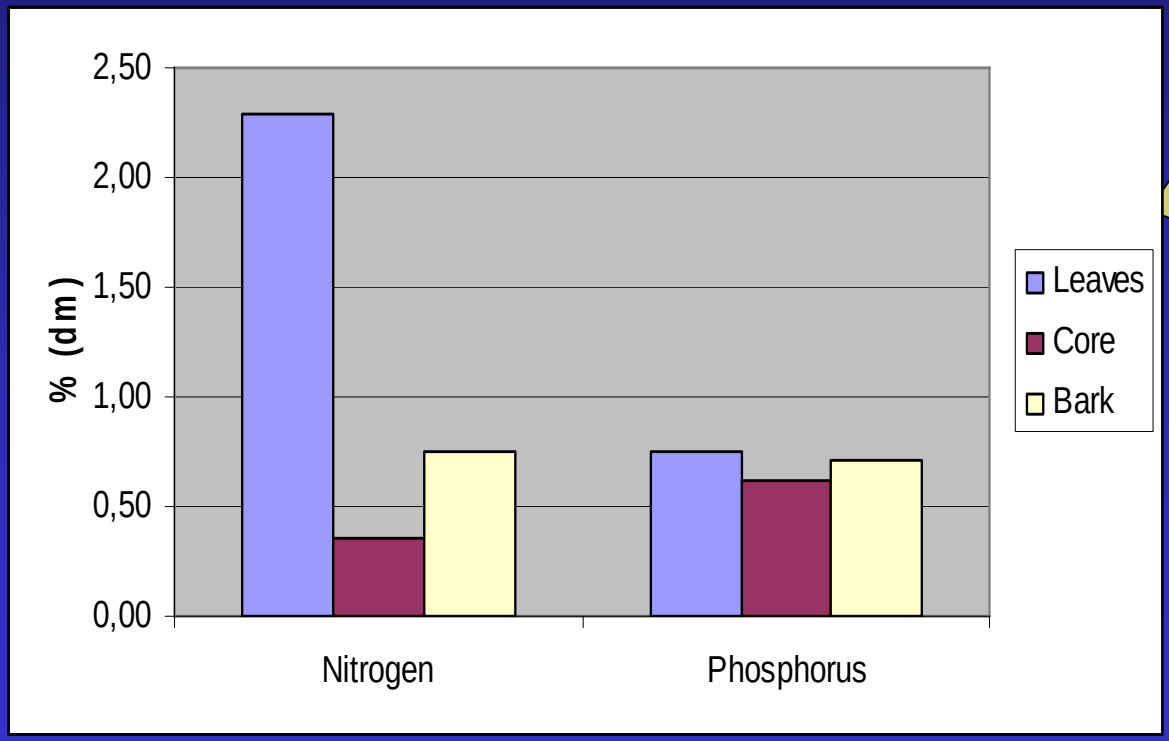
Biomass Quality

N and P content



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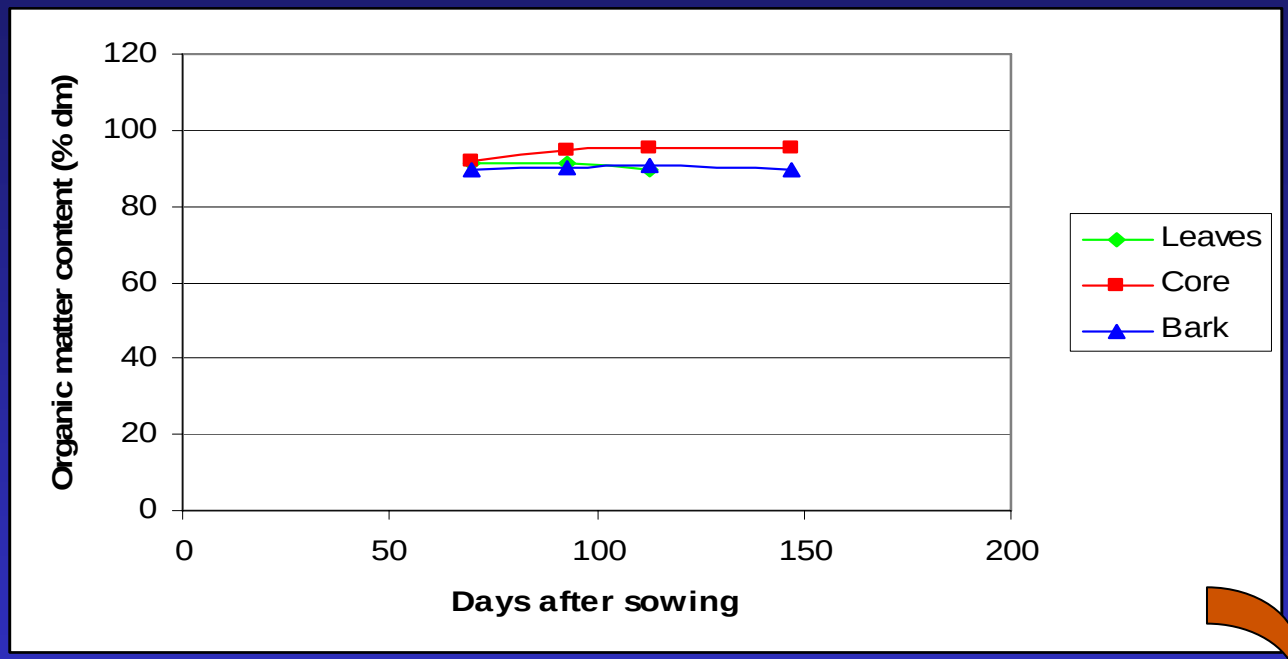
Biomass Fuel Quality

Organic matter content



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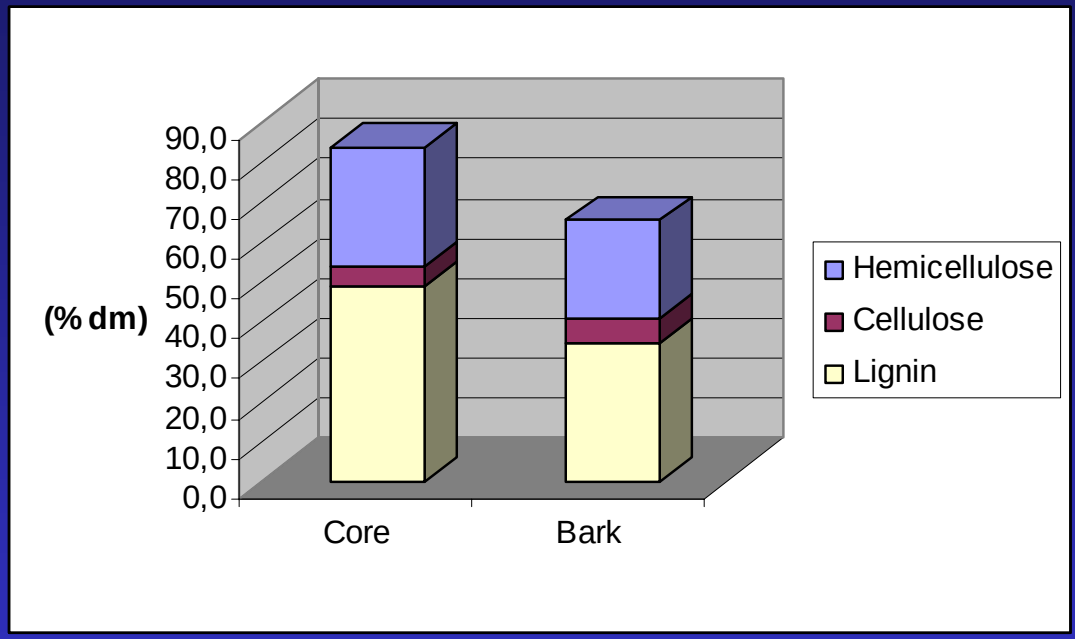

No differences among irrigations rates and N-fertiliser rates

Fiber content of core higher than of bark

Bark contains less lignin, less hemicellulose and more cellulose than core

Harvest Date

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