WP2. Adaptability and Productivity Field Trials

Comparison of the results recorded from the years 2003-2006

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WP2: Field trials

 For a period of four subsequent years three different field trials (Task 2.1, Task 2.2 and Task 2.3) had been carried out in central Greece.

In all years the trials were established in exactly the same places that it was selected in the very beginning of the BIOKENAF project.

 In collaboration with NAGREF a field trial with size 2 ha was established in Komotini (Task 2.4)



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* The six tested varieties were:

Everglades 41

late variety that produce reasonable fiber production and a cotton-like leaf shape

Tainung 2

late variety, with superior raw fiber production and palmate leaf shape

Ġregg

is a new variety with slightly longer growing period that may contributes to greater fiber production and palmate leaf shape

Dowling

new variety, that may prove to be a very high fiber producer with non-palmate leaf shape

SF 459

new variety that is favored for soils with nematode problem and palmate leaf shape

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it is considered as a photoperiod-insensitive variety that combines a short maturity cycle (100-130 days between emergence and flowering) and high productivity when grown in the Mediterranean region)

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Comparison of plant height (cm) among the years



- Apart from the variety SF 459 (that gave the highest plants in 2005), all the other varieties developed their highest plants in the first trial (2003).
- It was found that the highest plants, averaged overall varieties were developed in 2003 with a height of 370 cm, followed by the ones in 2004 (334 cm) in 2005 (325 cm), while the shortest plants (276 cm) where the ones of 2006. The plant height reduction was 10% in 2004, 3% in 2005 and 15% in 2006.



Basal stem diameter (mm)

- In 2006 the largest stems were measured for the variety Gregg (21.4 mm) and the thinnest for the variety T-2 (18.2 mm).
- At the same time the core diameter varied from 15.7 to 18.2, while of the bark varied from 2.3 to 3.5 mm.
- Averaged overall varieties and years, the larger stems were developed in 2004 with a mean stem diameter of 21.1 mm, while in 2005 was 20.9, in 2003 was 20.1 and in 2006 was 19.5 mm.



Accumulation of fresh and dry stem yields (t/ha) in 2006

• At the end of December 2006 the fresh stem yields varied from 12 t/ha (G4) to 28 t/ha (SF 459), while at the same time the dry stem yields fluctuated from 7.6 (G4) to 13.2 t/ha (SF 459).

At the harvesting time (December 2006) the moisture content of the stems varied from 53 % (SF 459) to 36 % (G4).

 It should be noted that both fresh and dry stem yields maximized in the beginning of October 2006 (120 DAE)

Comparison of dry stem yields in December (2003-6)



From 2003 - 2006 the dry stem yields were gradually declined. In 2003 the reduction was 11%, in 2005 was 15% (compared to 2004) and in 2006 was 16% (compared to 2005). A comparison among the years showed that the achieved yields in 2006 was 37% lower compared to the recorded ones in 2003 (10 t/ha versus 16 t/ha).

⇒In all years the lowest yields were recorded from the early variety G4, while as a mean of all years the best yields were recorded from the variety SF 459 (14.5 t/ha).

⇒It is very important to point out that the three new realized varieties (Gregg, Dowling and SF 459) had at least equal or higher yields compared to the traditional ones (Tainung 2 and Everglades 41).

Comparison of dry stem yields (bark and core) in December 2006



⇒It is quite obvious that the highest dry stem yields in December 2006 was recorded for both stem fractions by the new realized late maturity variety SF 459 that gave 8,8 t/ha dry core yields and 4.4 t/ha dry bark yields. It can be said that three new realized varieties as a mean achieved higher dry stem yields.

On the other hand the early variety G4 gave the lowest values and were 4.9 t/ha for the core fraction and 2.8 t/ha for the bark fraction.

The bark fraction varied from 31.8 % (Gregg) to 37% (Dowling).

Experimental layout of Task 2.2 Sowing times and plant populations



Early sowing, Late sowing

V1: Tainung 2, V2: Everglades 41

D1: 200,000 pl/ha, D2: 400,000 pl/ha





- The size of each plot will be 6×8m (48m²)
- The distance between the rows will be 50 cm and within the rows 5 cm for the density of 400,000 plants/ha and 10 cm for the density of 200,000 plants/ha.
- A total number of 16 rows will be sown in each plot.

The plant height was measured on five marked plant per plot every two weeks, while on the same plants the basal stem diameter was measured every four weeks.

Harvest dates: 15/7/06 7/8/06 28/8/06 13/9/06 3/10/06 26/10/06 18/11/06 20/12/06

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Comparison of plant height (cm) among the years



- As a mean of all years it can be said higher plants were developed in the plots that were sown earlier compared to the ones that the sowing postponed. The density did not affect the plant height, while between the two varieties highest plants were recorded in the plots of Tainung 2.
- From 2003 to 2006 the mean plant height was gradually declined. This decline was 21% in 2004, 4% in 2005 (compared to 2004), 11% in 2006 (compared to 2005). After four years of experimentation it can be said the plant declined 32%.

Effect of sowing dates, plant density and variety on stem diameter



At the end of the growing period of 2006 the stem diameter was found to be quite higher in the plots that were established in the beginning of May 2006 compared to the ones that were established one month later (20 mm versus 16.6 mm).

>On the hand the difference for stem diameter between the two plant densities and the two varieties is guite small

Comparison of basal stem diameter (mm) from 2003-2006



- Averaged overall years, it was found that the largest stem were developed in 2003 (19.1 mm) and the smallest ones in 2005 (17.2 mm).
- Averaged the years, the early sowing resulted in stems with larger diameter compared to the ones from the late sowing (18.4 versus 18.1 mm).
- It was found that the low density resulted in stems with larger diameter compared to high density (18.8 versus 17.6, mean values)
- Sor the two varieties (Tainung 2 and Everglades 41) almost the same mean density was recorded (18.1 versus 18.3 mm).



Effect of sowing time on fresh and dry matter yields (t/ha)

- Statistical significant differences were recorded between the two sowing dates until the beginning of October 2006.
- It should be pointed out that the dry stems yields at the final harvest for both sowing dates was quite close (9,7 t/ha for the early sowing and 10 t/ha for the late one).
- It should be pointed out that among the years, only in 2006 the plots with the late sowing resulted in higher yields compared to the plots with the early sowing.

Effect of plant density on dry matter yields (t/ha)



The achieved dry matter yields were almost the same in the fourth growing period with a slight superiority of the high density over the low one (no statistical significant differences).

Effect of variety on dry matter yields (t/ha)



The achieved dry matter yields were almost the same in the fourth growing period with a slight superiority of the high density over the low one (no statistical significant differences).

Effect of sowing dates on dry matter yields



In all sites the early sowing resulted in significant higher dry matter yields. The peak dry matter yields (end of October - early November) varied from 12.9 t/ha (Lisbon) to 20.4 (Palamas), while for the late sowing varied from 10.8 t/ha (Bologna) to 15.4 t/ha (Catania).

At the final harvest of the crop (both yields and moisture reduced) the yields from early sowing varied from 9 t/ha (Bologna) to 17.3 t/ha (Palamas, Catania) and for the late sowing ranged from 6 (Bologna) to 14.3 t/ha (Catania).



Effect of plant density on dry stem yields

There is no clear picture regarding the effect of plant population on yields. In cases like Aliartos, Catania and Madrid a clear superiority of the low density (200,000 plants/ha) over the high one (400,000 plants/ha) was recorded, while in Bologna and Lisbon the opposite was happened. In Palamas and Paris both densities gave almost the same yields. The mean yields of low density, averaged overall sites, was 12.5 t/ha, while for the high density was 12.2 t/ha.

28 26 24 22 ⁻inal dry stem yields (t/ha) 20 18 16 14 12 10 8 6 4 2 Palamas (GR) -V1 alamas (GR) -V2 5 ologna (IT) -V2 ⋝ Catania (IT)-V1 Catania (IT)-V2 30 3 3 3 3 3 3 3 3 3 3 3 3 4 1 3 4 1 3 4 1 3 4 1 3 3 4 1 3 1 Aadrid (ES) -V1 Aadrid (ES) -V2 .isbon (PT) -V1 isbon (PT) -V2 Paris (FR) -V1 Paris (FR) -V1 Tainung Aliartos (GR) liartos (GR) -Everglades

Effect of variety on dry stem yields

In three sites (Aliartos, Catania and Madrid) Tainung 2 was more productive compared to Everglades 41. The opposite findings were recorded in the cases of Bologna and Lisbon. In the case of Paris almost the same productivity was recorded for both varieties. Averaged overall trials, Tainung 2 gave 12.5 t/ha, while Everglades 41 gave 12.2 t/ha.

Experimental layout of Task 2.3 Irrigation and nitrogen fertilization rates



Experimental plot of Task 2.3 Irrigation and nitrogen fertilization rates



The plant height was measured on five marked plant per plot every two weeks, while on the same plants the basal stem diameter was measured every four weeks.

> Harvest dates: 15/7/06 7/8/06 28/8/06 13/9/06 3/10/06 26/10/06 18/11/06 20/11/06



- The size of each plot will be 6×8m (48m²)
- The distance between the rows will be 50 cm and within the rows 10 cm (200,000 plants/ha).
- One variety will be sown (Tainung 2 or Everglades 41).
- A total number of 16 rows will be sown in each plot.

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Plant height in 2006

At the end of the growing period of 2006 the plant height in the no irrigated plots was 212 cm, in the low irrigated plots was 236 cm, in the medium irrigated ones was 252 cm, while in the highly irrigated plots was 261 cm.

• At the same time the effect of the nitrogen on the plant height was quite small and thus the plant height in the no-fertilized plots was 226 cm, in the medium fertilized plots was 243 cm, while in the highly irrigated plots was 252 cm.





Comparison of plant height among the years (2003-6)

- The plant height found to be significant affected by the irrigation. It should be noted that the highest plants grew up in 2003. Averaged overall years, the plant height was 221 cm (no water), 260 cm (25%), 273 cm (50%) and 282 (100% of PET).
- On the contrary no effects of nitrogen rates were recorded on plant height. Averaged overall years, the mean plant height was 256 cm (no nitrogen), 258 cm (75 kg N/ha) and 263 cm (150 kg N/ha).

Effect of irrigation and nitrogen rates on basal stem diameter (2003, 2004, 2005, 2006)



⇒The basal stem diameter averaged all years for the irrigation rates was 16.3 mm (no irrigation), 18.5 mm (25%), 19.4 mm(50%) and 20.3 mm (100% of PET).

At the same time the mean stem diameter for the nitrogen rates was 18.2 mm (no fertilization), 18.7 mm (75 kg N/ha) and 19.1 mm (150 kg N/ha)



Accumulation of dry matter yields (t/ha) in 2006

- In December 2006 the achieved dry yields were 7.3 t/ha (no irrigation), 8.9 t/ha (low irrigation), 9.1 t/ha (medium irrigation) and 9.3 t/ha (high irrigation).
- In December 2006 the dry yields were 8.1 t/ha (no fertilization), 8.9 t/ha (75 kg N/ha) and 9 t/ha (150 kg N/ha).
- Statistical significant differences were recorded only among the irrigation rates.

Effect of irrigation on kenaf dry yields



- The mean peak yields were 5.7 t/ha (no irrigation), 11 t/ha (25% of PET), 12.8 (50% of PET) and 18 t/ha (100% of PET). The corresponding values for the final dry yields were 4.7, 9, 11 and 13.
- The achieved dry yields (peak and final) were increasing when the applied irrigation rate was increasing.
- It should be pointed out that the most clear effect of irrigation on yields was recorded in the case of Madrid.





Effect of nitrogen on kenaf yields

- In most sites it was found that when the nitrogen application was increasing the dry yields were also slightly increased.
- It should be pointed out that only in very few cases the differences among the nitrogen rates were differ statistically significant.
- Averaged all trials, it was found that the peak dry yields were 10.2 t/ha (0 kg N/ha), 10.6 t/ha (75 kg N/ha) and 11.2 t/ha (150 kg N/ha). The corresponding values for the final dry yields were 7.6, 8.1 and 8.8 t/ha.

Effect of nitrogen on kenaf final dry yields



The increasing of the applied nitrogen fertilization (from 0-150 kg N/ha) did not result in increasing of dry yields in the cases of Palamas and Bologna. The mean dry yields were 13.6 t/ha (0 kg N/ha), 15.5 t/ha (50 kg N/ha), 13.6 t/ha (100 kg N/ha) and 15 t/ha (150 kg N/ha).

Conclusions

- The late maturity varieties more productive compared to the early.
- The new variety SF 459 is very productive with yields higher than the yields of the two traditional varieties Tainung 2 and Everglades 41.
- The yields were increased when the sowing time was between the early to the middle of May. When the sowing time was delayed until the middle of the end of June a serious decline of the yields were recorded.
- A mixture picture was recorded regarding the effect of plant density on the yields. Both densities (200,000 and 400,000 pl/ha), averaged overall trials, gave almost the same mean yields.
- Similar findings with plant densities were also recorded for the two varieties. It was found that their yielding capacity was almost the same with a slight superiority of Tainung 2 over Everglades 41, when grown in South Europe.

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Conclusions

- It was found that by increasing the applied water in the kenaf fields their productivity was increased and in most cases the yields that were recorded for the applied irrigation rates were differ statistically (P<0.05). This trend was quite strong and clear in all years in the case of Madrid
- On the contrary the dry yields did not or slight increased by the increase of the applied nitrogen.



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