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# TUNUS Zeytin Sektörü

Ders Notu: 140

**Medoliva**

**Arezzo-Italie du 17-19 mai 2008**

**Tunisian olive oil sector**

**Biodiversity of Tunisian olive tree and olive  
oils patrimony**

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# INTRODUCTION

In Tunisia, agriculture civilization was based on rainfed cultivations among them olive growing, cereals and some fruit culture as figs and vine are the most important.

Olive growing is a millinery old culture which was introduced by the Phoenicians who were the first to introduce this crop in North Africa, about the eleventh century BC

The number of olive trees increased from 11 millions in the beginning of the 20th century to 27 millions at the independence (1956) and become double (55 millions) in 1976 through the important development program of olive growing

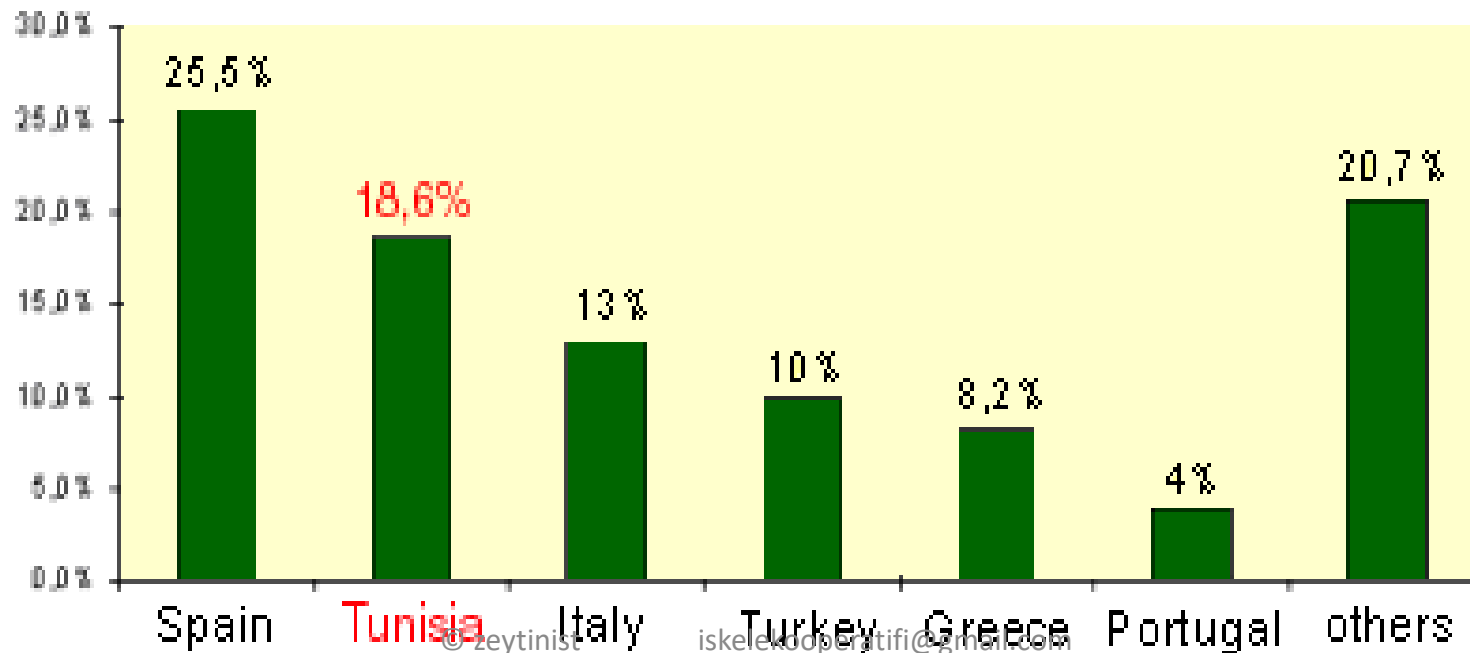
The regain of plantations in the beginning of the nineties until now imply that **the number of olive trees is nowadays about 66 million trees**

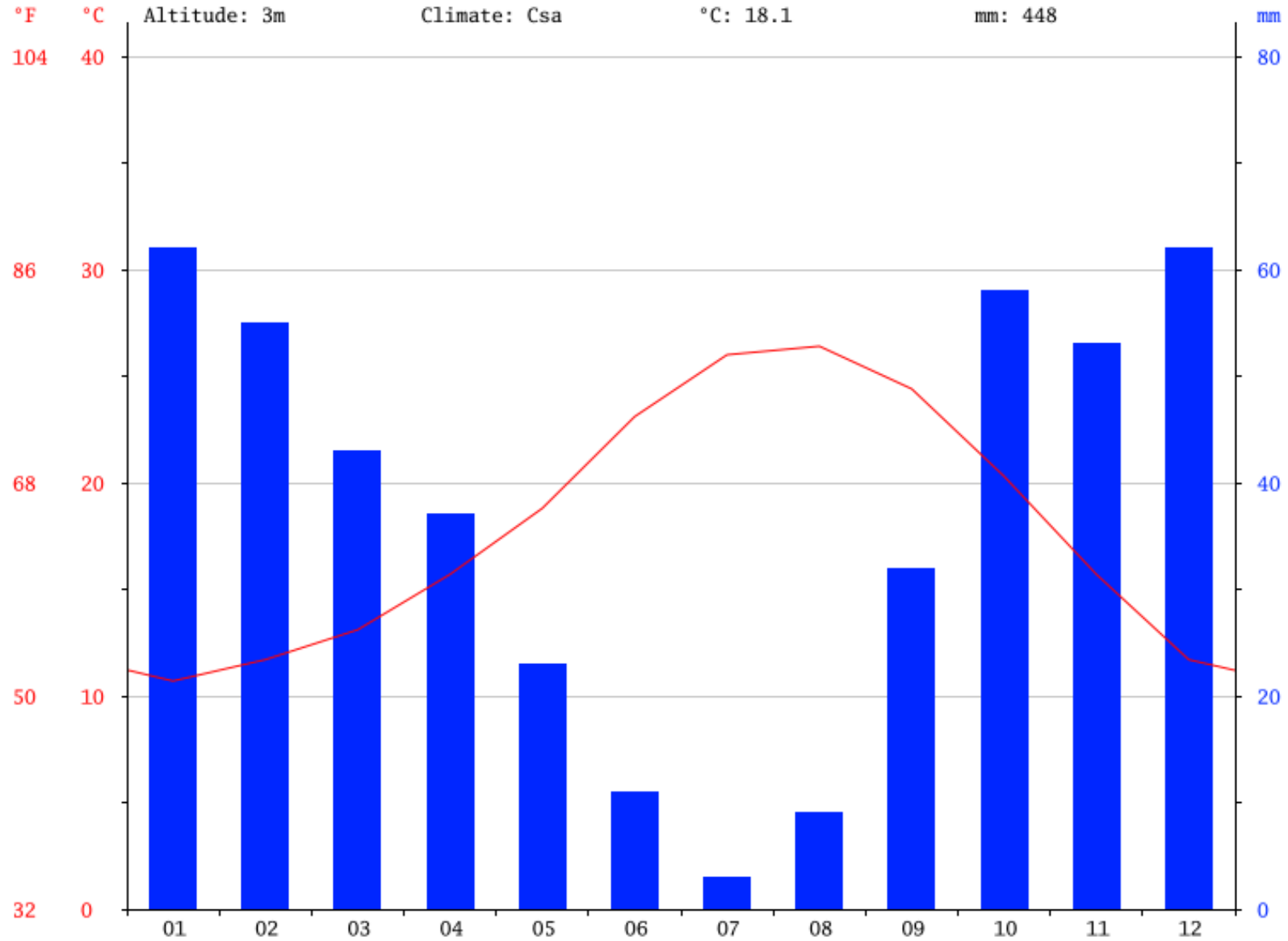
Tunus Zeytincilik sektörüne devlet olarak destekleyen ve bunu her alanda gösteren bir devlettir.



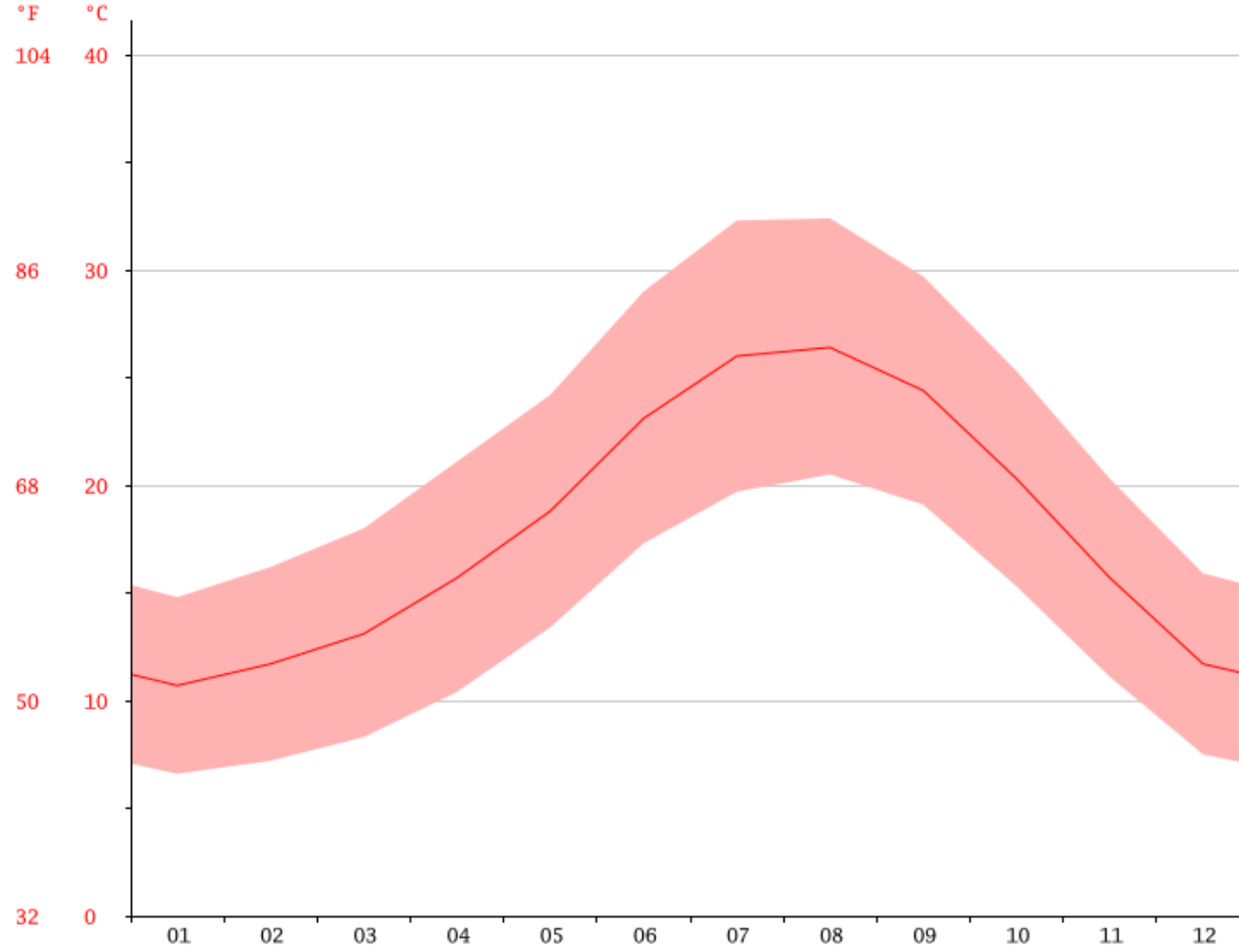
- covering 1.685 million hectares that represents a third of arable surfaces
- **7th position after Spain, Italy, Greece, Turkey, Morocco and Syria**
- Compared with a leading producing country, this area placed Tunisia in the second rank following Spain with nearly 19% of worldwide olive-growing area.

### Worldwide Olive-Growing Surface





3 mm yağışla Temmuz yılın en kurak ayıdır. Ortalama 62 yağış miktarıyla en fazla yağış Ocak ayında görülmektedir.



26.4 sıcaklıkla Ağustos yılın en sıcak ayıdır. Ocak ayında ortalama sıcaklık 10.7 olup yılın en düşük ortalamasıdır.



	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	10.7	11.7	13.1	15.7	18.8	23.1	26	26.4	24.4	20.3	15.7	11.7
Min. Temperature (°C)	6.6	7.2	8.3	10.4	13.4	17.3	19.7	20.5	19.1	15.3	11.1	7.5
Max. Temperature (°C)	14.8	16.2	18	21.1	24.2	29	32.3	32.4	29.7	25.3	20.3	15.9
Avg. Temperature (°F)	51.3	53.1	55.6	60.3	65.8	73.6	78.8	79.5	75.9	68.5	60.3	53.1
Min. Temperature (°F)	43.9	45.0	46.9	50.7	56.1	63.1	67.5	68.9	66.4	59.5	52.0	45.5
Max. Temperature (°F)	58.6	61.2	64.4	70.0	75.6	84.2	90.1	90.3	85.5	77.5	68.5	60.6
Precipitation / Rainfall (mm)	62	55	43	37	23	11	3	9	32	58	53	62

Yılın en kurak ve en yağışlı ayı arasındaki yağış miktarı: 59 mm Yıl boyunca ortalama sıcaklık 15.7 dolaylarında değişim göstermektedir.

- The olive growing in Tunisia is characterized by a wide distribution across the entire country, from the far north to the deepest south
- The major part of the olive orchards is conducted in rainfed conditions (more than 97%) and
- More than 80% of olive orchards are located in semi arid and arid regions (Center and south)

### Geographical distribution of olive orchards

Region	Rainfall	area		Number of olive tree	
North	400-600 500-1200	229 000ha	14%	22 668 000	34,4%
Center	200-350 200-300	1148 000ha	68%	34 745 000	52,7%
South	100-200	308 000ha	18%	8 487 000	12,9%
	<b>Total</b>	<b>1 685 000ha</b>	<b>100%</b>	<b>65 900 000</b>	<b>100%</b>

## **Age structure of the trees**

**The age structure of trees is composed by:**

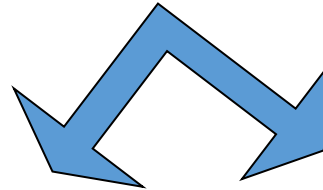
- 31 % of young trees (less than 20years)**
- 54% of trees in production (20 to 70 years old)**
- 15% of old trees (more than 70 years old)**



# Plant Material

**Until 90 years, There is not very studied and not valorized of the Tunisian olive oil**

**Facing the International conjuncture marked by a strong concurrence on olive oil not only by the oils of seeds but also by the oils carrying signs of quality: biological oil, IGP oil, DOP oil**

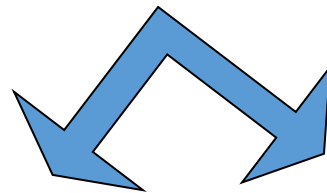


**Know the real potentialities of olive tree varieties cultivated in Tunisia and essentially the chemical characteristics of their oils (minors compounds)**

**Make more attention for the interesting varieties that are not very exploited sufficiently in oleicol Tunisian production**

🌍 Prospecting of the Tunisian olive groves :

- **South** : Sfax : Boughrara, Taous, Jbéniana, Chaâl ; Mednine : Zarzis, Benguerdane, Djerba, Benikhdèche ; Gabès : Matmata ; Tataouine : Douirat et Chneni,
- **Centre** : Sidi Bouzid ; Kairouan : El alaa, Oueslatia, Gafsa : Oasis et Sned
- **North** : L'Ariana : Borj Amri, Béja : Thibar ; CapBon : Nabeul, Grombalia, Siliana : Le Krib



demonstrated that the Tunisian olive grove lands although dominated by two major varieties: Chemlali and Chetoui is very rich in cultivars



## Tunus Zeytin Çeşitleri

We have demonstrated that although it's dominated by two major varieties: *Chemlali* in the South and the Center and *Chetoui* in the North, is very rich in cultivars).

- Chemléli Sfax
- Chetoui
- Chemléli Zarzis
- Chemléli Tataouine
- Chemléli Jerba
- Zalmati
- Chemchéli
- Oueslati
- Zarrazi
- Jerboui
- Marsaline
- Fouji
- Meski
- Tounsi
- Besbessi
- El horr
- Jemri Bouchouka
- Jemri Dhokkar
- Sahli Mguargueb
- Zarrazi Gafsa
- Fakkhari
- Toffehi



# CHARACTERIZATION

**Primary Description**

✓ **Pomological markers**

**Weight fruit**

**Olive oil content**

✓ The olive oil content was measured by quantitative NMR





## Second Description

## ✓ Chemical markers

✓ Each sample is made up of nearly 3 kg of olive coming exclusively of the tree The olives are collected at the same stage of maturity which corresponds to the end of fruit colour.

✓ Olive oil extraction



## Chemical markers

**Acid  
Composition**

**Antioxydants**



**Oxydative  
Stability**

**Sterols**

**Pigments**

# RESULTS

## Fruit Characterization

Variété	PMF	PN	P/N	Hum
	Moy	Moy	Moy	Moy
Ouesléti	1,4	0,21	5,8	49,0
Zalmati	1,3	0,17	5,4	50,0
Elhorr	1,2	0,23	4,2	48,7
Jemri BenGuerdane	1,2	0,26	3,7	46,8
Chemléli Ontha	1,0	0,25	3,0	45,1
Jemri dhokkar	0,9	0,24	2,9	43,6
Chetoui	2,4	0,27	7,6	52,9
Chemchéli	2,4	0,3	6,8	51,3
Zarrazi	2,7	0,36	6,5	49,3
Jarboui	2,4	0,43	4,7	42,3
Toffehi	2,0	0,35	5,1	42,9
Fakhari	2,0	0,31	5,5	44,7
Jemri bouchouka	2,1	0,27	8,1	48,3
Fouji	2,7	0,38	6,1	56,3
sahli mguargueb	3,0	0,35	7,5	53,9
Meski	6,3	0,62	8,4	61,1
Besbessi	10,8	1,21	7,5	58,5
Marsaline	6,6	0,62	9,7	51,1
Tounsi	8,1	0,85	7,6	62,0

**Olives Oil**  
Average weight (< 2 g)

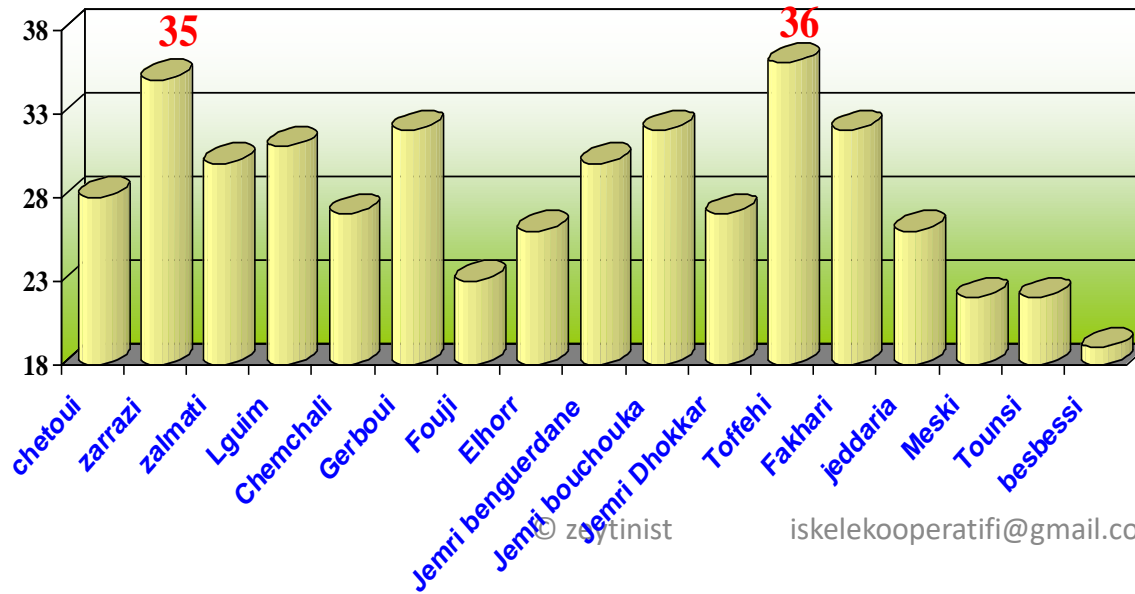
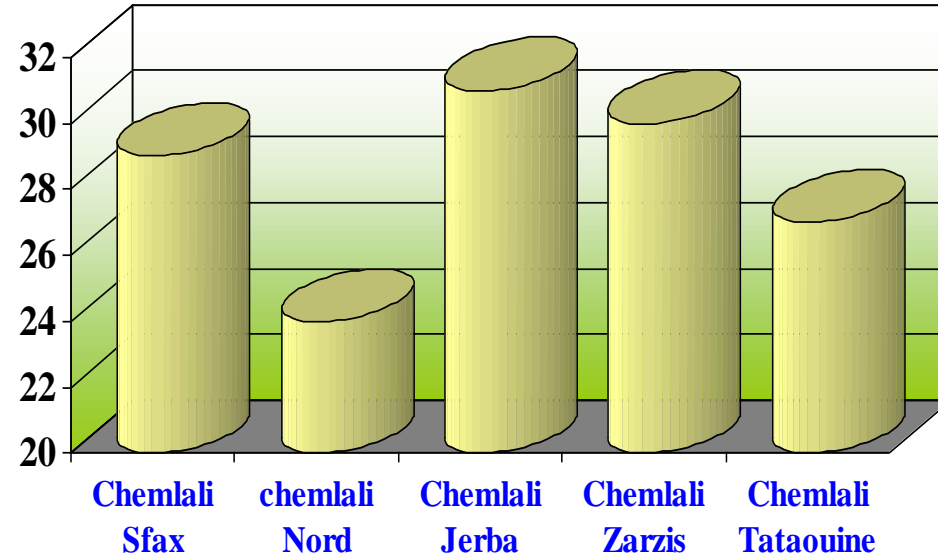
**Olives both used**  
Average weight (2 - 4 g)

**Table Olives**  
Average weight > 4 g

# RESULTS

## Pomological characteristics

**Olive oil percentage/Fresh weight**

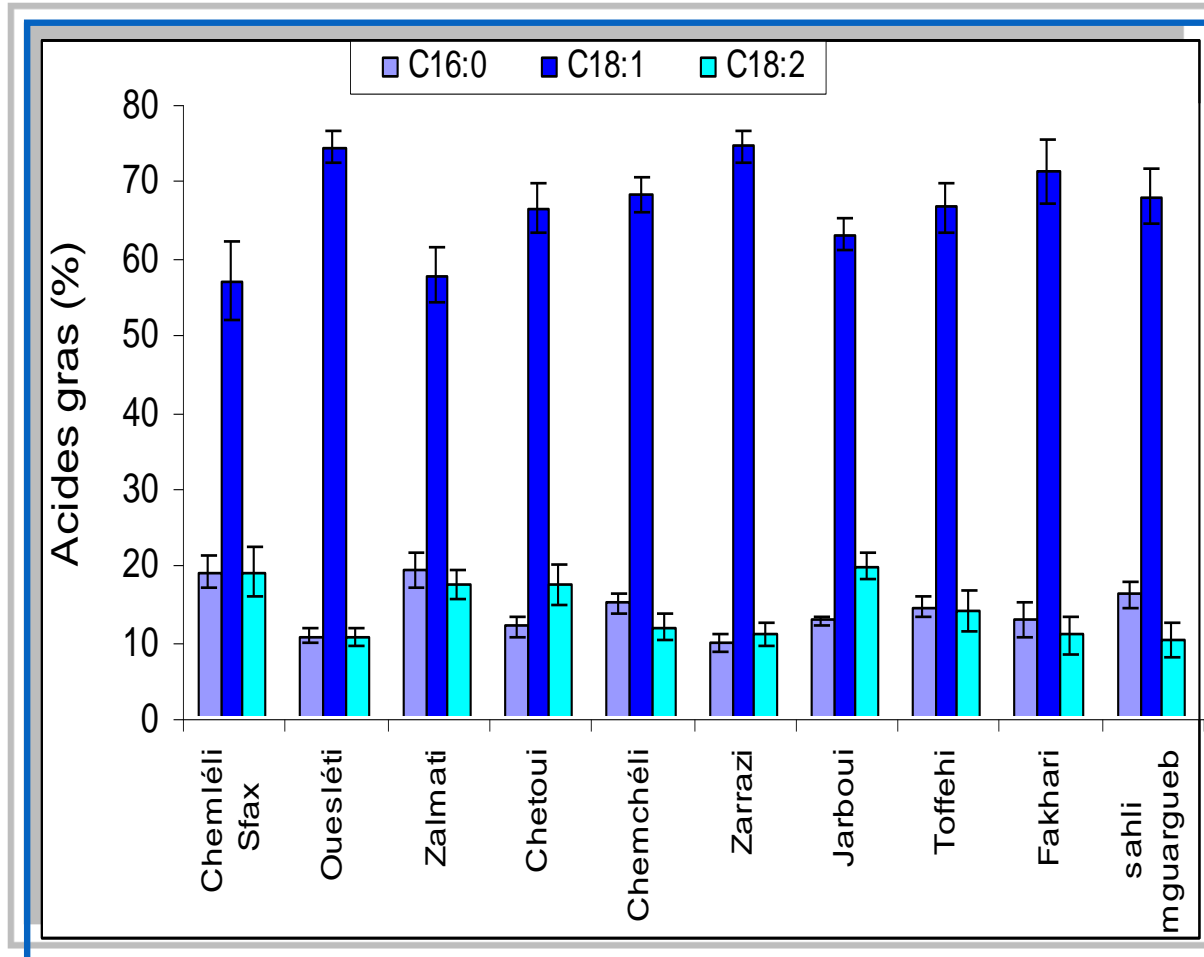


**Zarrazi and Toffehi varieties have the high percentage of olive oil: 35-36%**

# Chemical characteristics

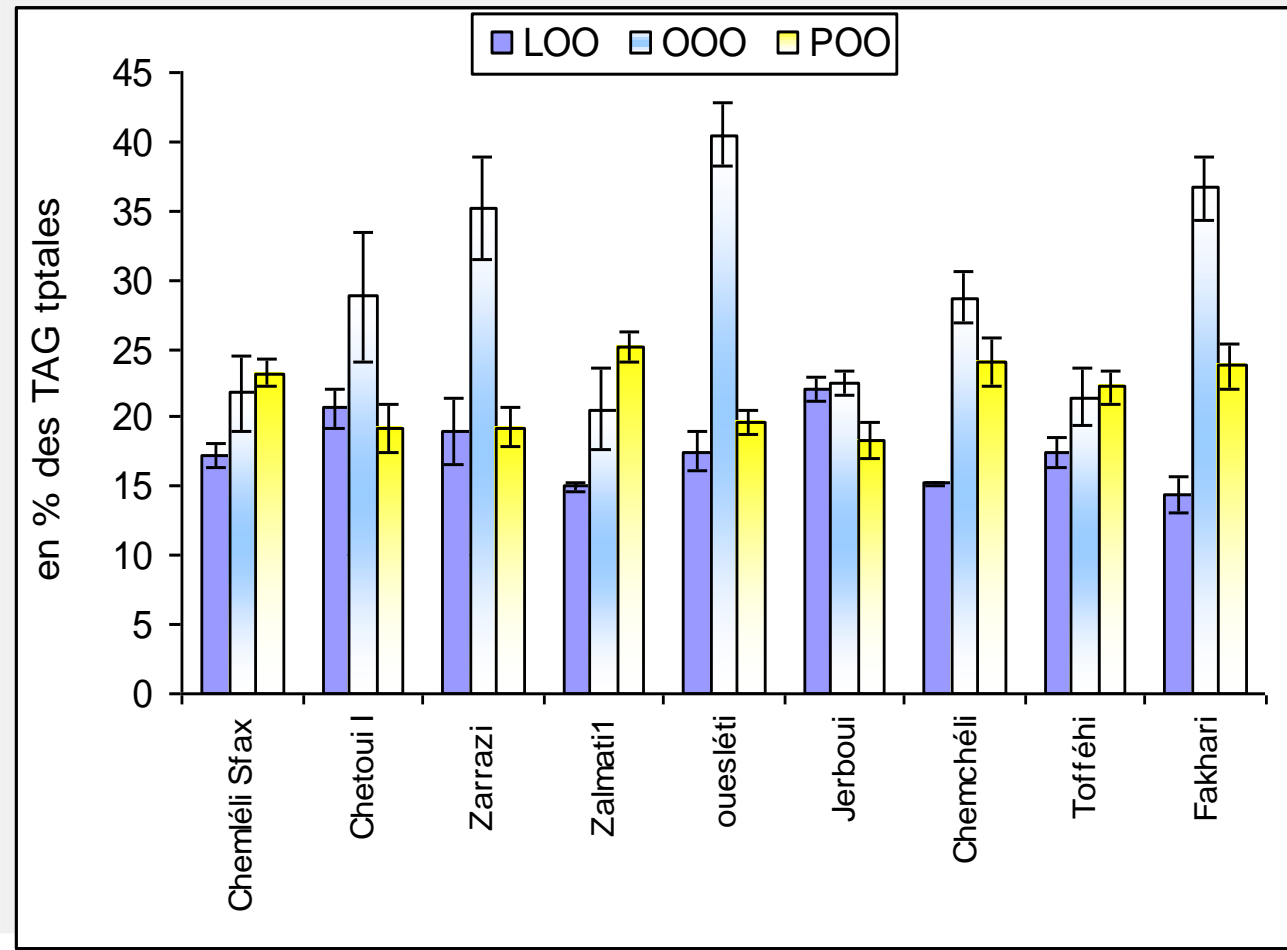
## Major compounds

### Acid composition



we notice intervarietal diversity regarding the percentage of oleic, palmitic and linoleic acid.

# Triacylglycerols

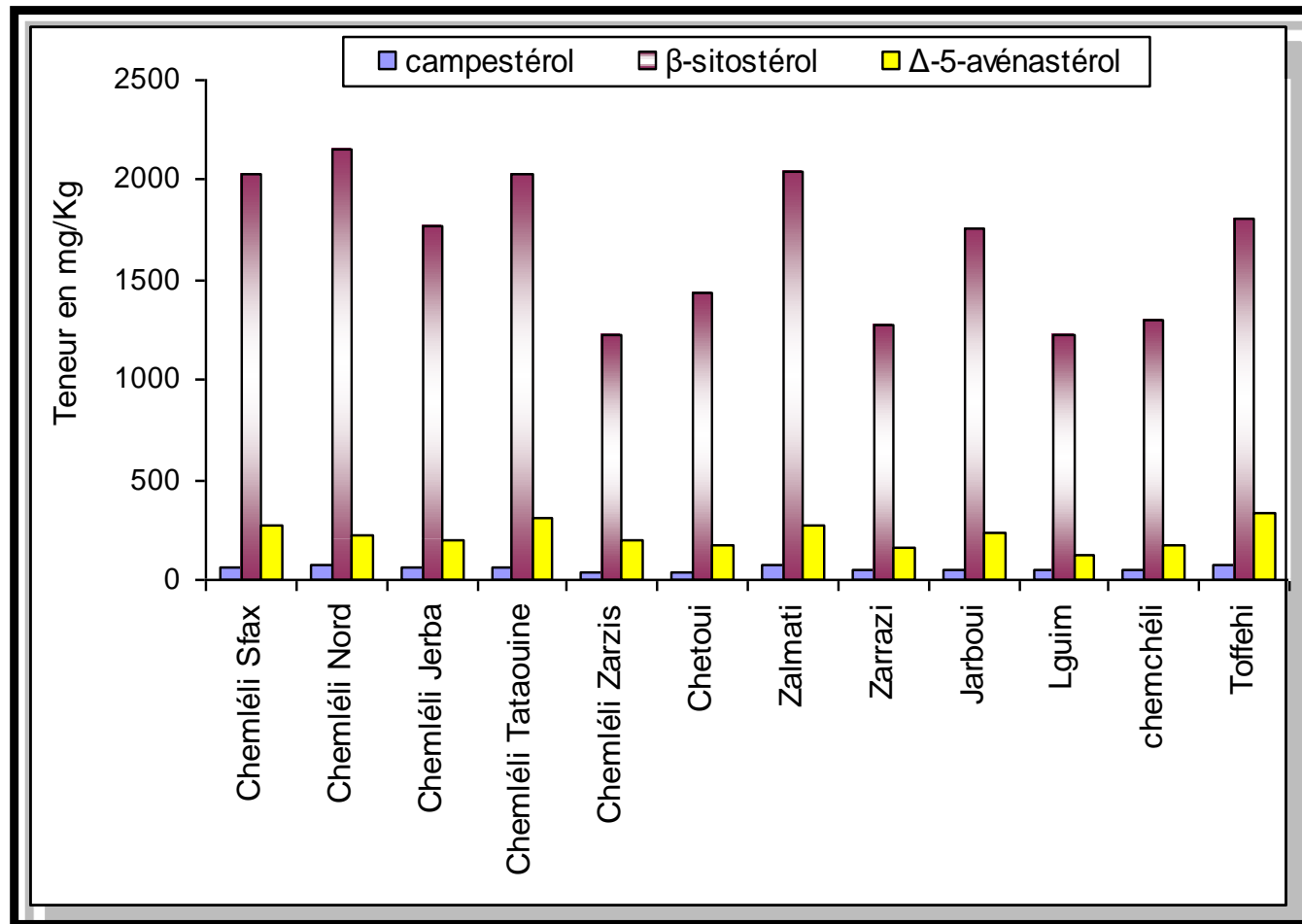




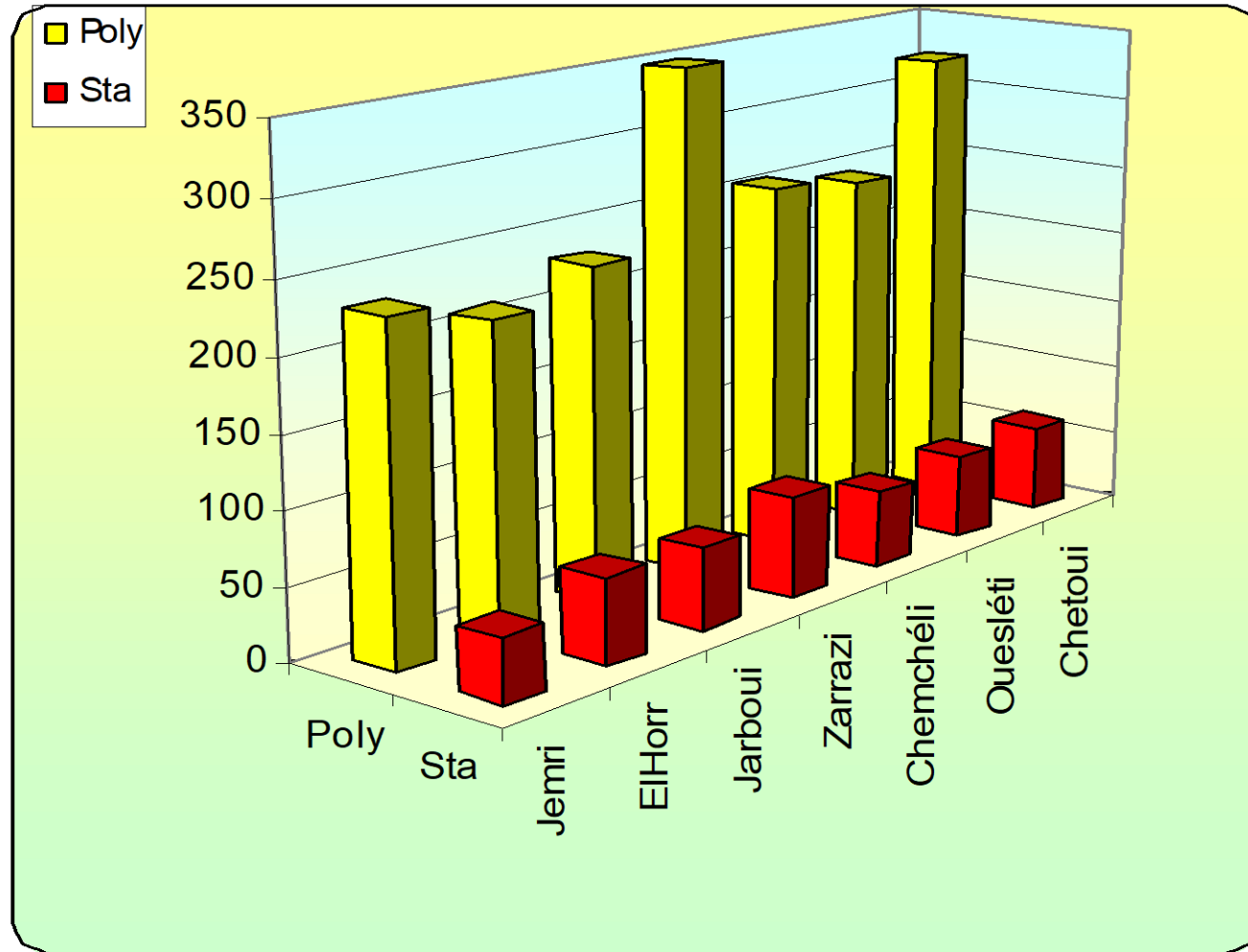
# Chemical characteristics

## Minor compounds

### Sterols



## Phenolic compounds and Oxidative stability



The antioxidant properties and the biological values of the olive oil may be largely attributed to the phenolic components which give oil its specific taste both bitter and fruity.

Phenolic compounds content and oxidative stability show the existence of a high variability between different varieties

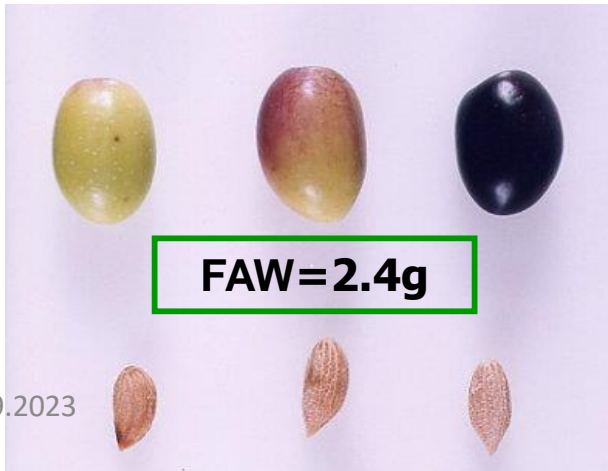


# CHEMLÉLI SFAX



The Chemlali is the main olive oil variety of the Tunisian olive grove, the tree is vigorous presenting a falling shape. The olives of Chemlali Sfax give much flavored, slight bitter and not very piquant oil. **The principal detected flavor is the green almond one. At full maturity, the oil of the Chemlali Sfax becomes sweet,** weak fruity flavors, however, green almond flavor is replaced by dry almond or almond paste ones.

<b>Acid Composition</b>	<b>Palmitic Acid</b>	<b>19%</b>
	<b>oleic Acid</b>	<b>57%</b>
	<b>linoleic Acid</b>	<b>18%</b>
<b>Content of Antioxidant (mg/Kg)</b>	<b>Polyphenols</b>	<b>224</b>
	<b>Tocopherols</b>	<b>286</b>
<b>Content of Sterols (mg/Kg)</b>	<b>β-sitostérol</b>	<b>2027</b>
	<b>Total Sterols</b>	<b>2478</b>
<b>Oxidative Stability (at 100° C)</b>	<b>39h</b>	

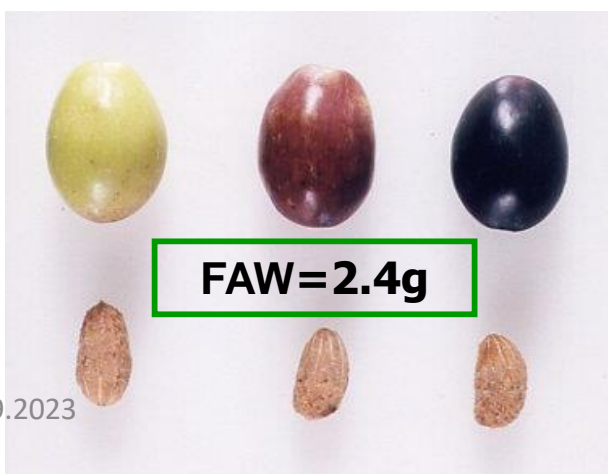


# CHETOUI

The Chetoui is the second principal variety oil olive in Tunisian olive grove, it predominant in the North of the country.

The Chetoui oil have a green intense almond flavors, in addition it is bitter and piquant perceived with an average to strong intensity. The intensity of the bitterness of this oil drops during fruit ripening but persist until full maturity.

<b>Acid Composition</b>	<b>Palmitic Acid</b>	<b>12</b>
	<b>oleic Acid</b>	<b>66</b>
	<b>linoleic Acid</b>	<b>17</b>
<b>Content of Antioxidant (mg/Kg)</b>	<b>Polyphenols</b>	<b>325</b>
	<b>Tocopherols</b>	<b>274</b>
<b>Content of Sterols (mg/Kg)</b>	<b>β-sitostérol</b>	<b>1437</b>
	<b>Total Sterols</b>	<b>1723</b>
<b>Oxidative Stability (at 100° C)</b>	<b>60h</b>	



# CHEMCHALI

Chemchali is the principal olive oil variety of Gafsa region (South-West); it is present in both of the old oasis and the new plantations. The fruits are used for oil extraction and table olive

The Chemcheli oil is moderately fruity with bitter and piquant taste. This flavored oil has in particular green grass and tomato flavors and sometimes apple and almond perfume.

<b>Acid Composition</b>	<b>Palmitic Acid</b>	<b>15</b>
	<b>oleic Acid</b>	<b>68</b>
	<b>linoleic Acid</b>	<b>12</b>
<b>Content of Antioxidant (mg/Kg)</b>	<b>Polyphenols</b>	<b>255</b>
	<b>Tocopherols</b>	<b>310</b>
<b>Content of Sterols (mg/Kg)</b>	<b>β-sitostérol</b>	<b>1303</b>
	<b>Total Sterols</b>	<b>1620</b>
<b>Oxidative Stability (at 100° C)</b>	<b>53h</b>	





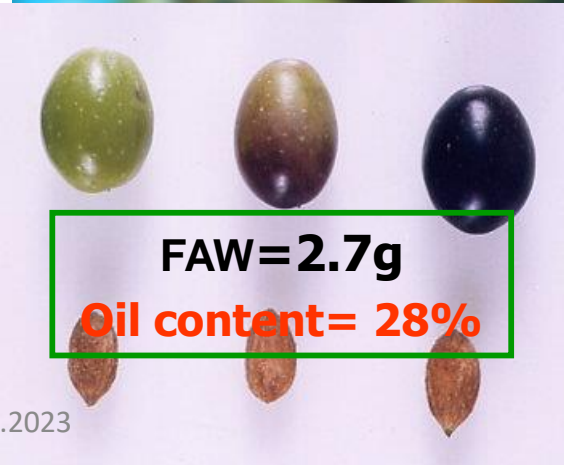
# OUESLATI

The Oueslati is olive oil variety; it's widespread in the areas of Oueslatia and El Alaa. It merits a better attention and should be diffused on a large scale in the Tunisian olive grove.

**The Ouesletti oil is bitter, piquant at the beginning of ripening having very intense green almond flavors. The bitterness and piquant taste decrease considerably during the maturation of the fruit.**

<b>Acid Composition</b>	<b>Palmitic Acid</b>	<b>11</b>
	<b>oleic Acid</b>	<b>74</b>
	<b>linoleic Acid</b>	<b>11</b>
<b>Content of Antioxidant (mg/Kg)</b>	<b>Polyphenols</b>	<b>246</b>
	<b>Tocopherols</b>	<b>230</b>
<b>Content of Sterols (mg/Kg)</b>	<b>β-sitostérol</b>	<b>1230</b>
	<b>Total Sterols</b>	<b>1465</b>
<b>Oxidative Stability (at 100° C)</b>	<b>59h</b>	

# ZARRAZI



Zarrazi is cultivated in the areas of Zarzis, Tataouine and Matmata. This fruits of this variety are used for both oil and table.

The Zarrazi olives give slightly bitter, vaguely piquant and soft oil. **This fruity oil has in particular fig flavors and sometimes grass and apple perfume.**

<b>Acid Composition</b>	<b>Palmitic Acid</b>	<b>9.8</b>
	<b>oleic Acid</b>	<b>75</b>
	<b>linoleic Acid</b>	<b>11</b>
<b>Content of Antioxidant (mg/Kg)</b>	<b>Polyphenols</b>	<b>350</b>
	<b>Tocopherols</b>	<b>258</b>
<b>Content of Sterols (mg/Kg)</b>	<b>β-sitostérol</b>	<b>1274</b>
	<b>Total Sterols</b>	<b>1547</b>
<b>Oxidative Stability (at 100° C)</b>	<b>70h</b>	



# CHEMLELI JERBA

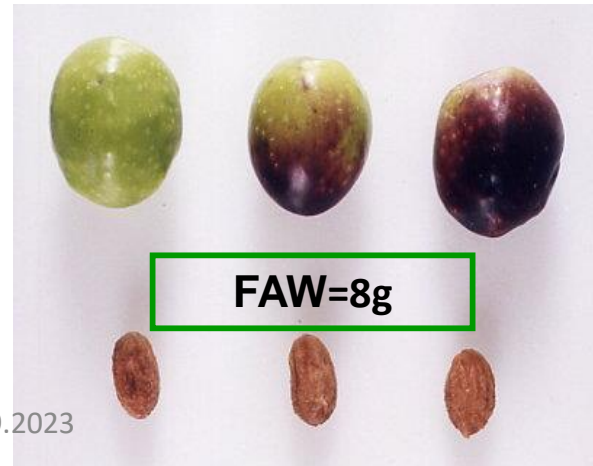
The Chemlali Jerba variety is cultivated for oil in Jerba island. It is clearly distinguished from other Chemlali. The acidic composition of its oil is excellent. It is very stable. On the sensorial level, the oil of Chemlali Jerba is **fruity with an average to strong intensity accompanied by a bitter taste, slightly piquant savor and having green grass, green almond and sometimes fig flavors.**

<b>Acid Composition</b>	<b>Palmitic Acid</b>	<b>16</b>
	<b>oleic Acid</b>	<b>70</b>
	<b>linoleic Acid</b>	<b>7</b>
<b>Content of Antioxidant (mg/Kg)</b>	<b>Polyphenols</b>	<b>352</b>
	<b>Tocopherols</b>	<b>437</b>
<b>Content of Sterols (mg/Kg)</b>	<b>β-sitostérol</b>	<b>1774</b>
	<b>Total Sterols</b>	<b>2111</b>
<b>Oxidative Stability (at 100° C)</b>	<b>77h</b>	



# TOUNSI

Tounsi is the principal table olive variety of Gafsa region (South-West);



Fruit Average Weight	8g
Oil Content/Fresh Weight	20%

<b>Acid Composition</b>	<b>Palmitic Acid</b>	13
	<b>oleic Acid</b>	75
	<b>linoleic Acid</b>	7
<b>Content of Antioxidant (mg/Kg)</b>	<b>Polyphenols</b>	75
	<b>Tocopherols</b>	165
<b>Content of Sterols (mg/Kg)</b>	<b>β-sitostérol</b>	1980
	<b>Total Sterols</b>	2142
<b>Oxidative Stability (at 100° C)</b>	28h	

# Processing sector

The processing sector recorded an important evolution by the modernization of equipments in comparison with situation ten years

In 2007, there are some 1674 olive mills with a capacity of about 32.000 tons per day.

Nowadays, the traditional system tend to disappear and centrifugation system is processing

Distribution of the units according to the processing system

	2000	2007
Olive mills	1440	1674
Capacity of triturating	22.000T/j	32.000T/j
Repartition/system	<p><b>Classic:</b> capacity: <b>42%</b></p> <p><b>Super press:</b> capacity: <b>27%</b></p> <p><b>centrifugation</b> : capacity: <b>31%</b></p>	<p><b>Classic:</b> capacity: <b>28%</b></p> <p><b>Super press:</b> capacity: <b>20%</b></p> <p><b>centrifugation</b> capacity: <b>52%</b></p>
Repartition/region	<p><b>North:</b> capacity: <b>18%</b></p> <p><b>Centre</b> capacity: <b>36%</b></p> <p><b>South</b> capacity: <b>46%</b></p>	<p><b>Nord:</b> capacity: <b>19%</b></p> <p><b>Centre</b> capacity: <b>33%</b></p> <p><b>Sud</b> capacity: <b>48%</b></p>



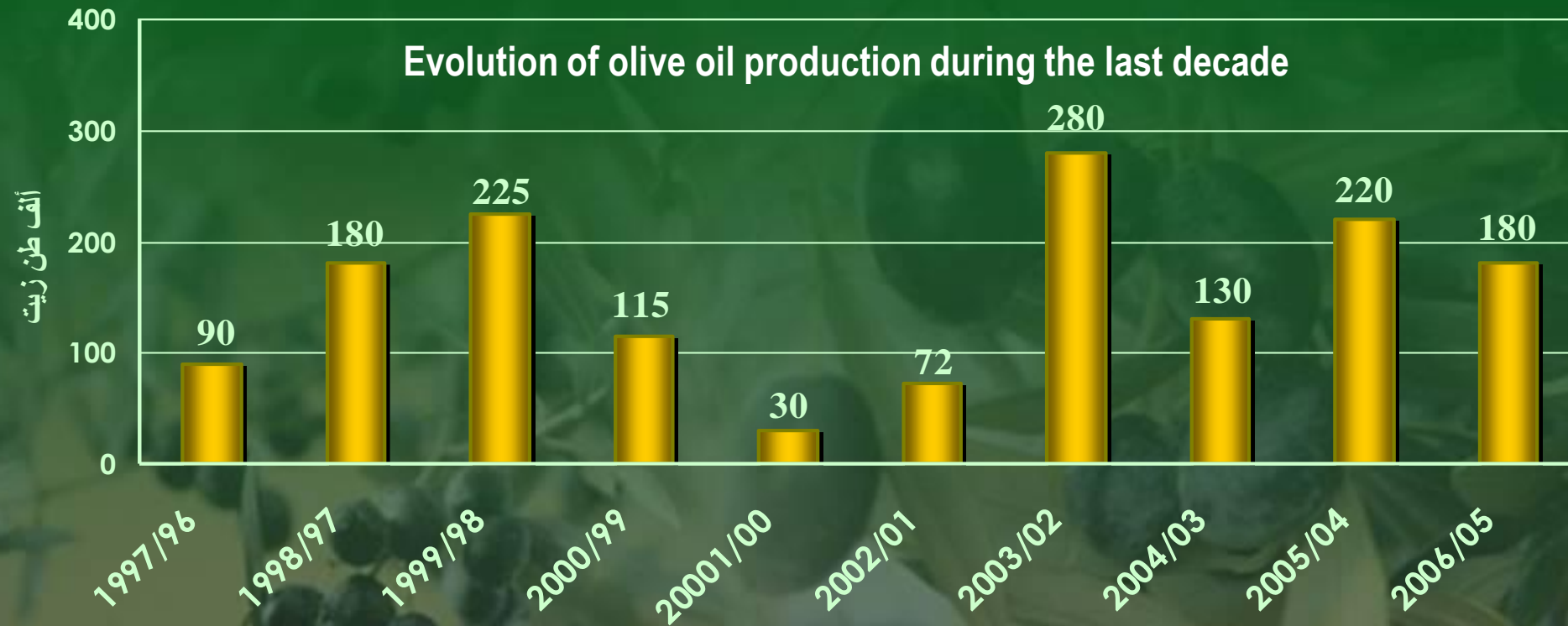
The modernization of the processing sector permitted a substantial improvement of the quality of oils which increases from

- 33% of extra virgin during 1996-2000
- to more than 60% during the last five years.

The processing chain also includes

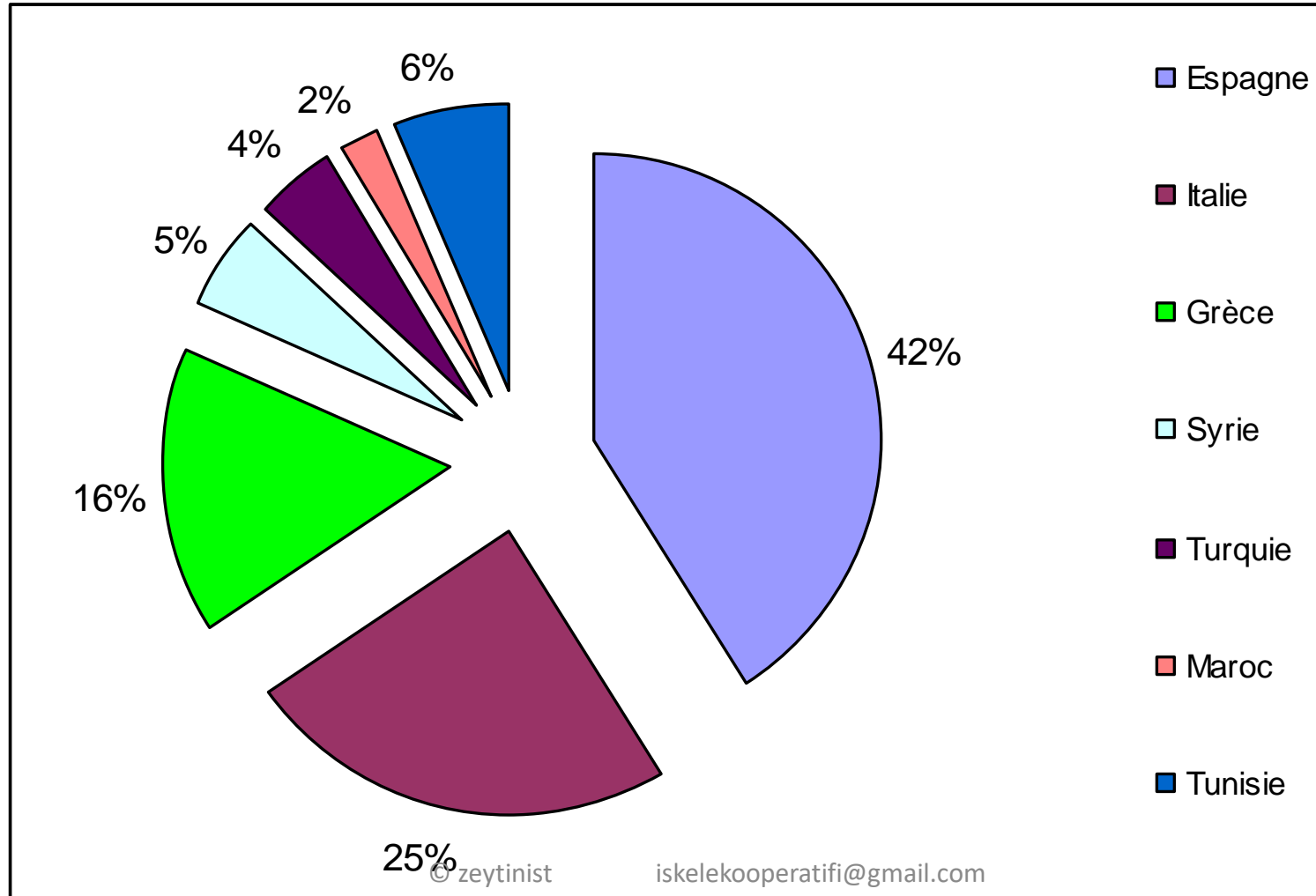
- 10 pomace factories for pomace oil extraction
- 10 olive oil refineries and soap factories and more than
- 35 plants for conditioning and packaging

# Production and Productivity



Important fluctuations can be seen from year to year due to the rainfed conditions (aridity and low precipitations), the presence of old trees in traditional regions and more or less to the specific behavior of the olive tree (example 30.000 tons in 2000/2001 and 310.000 tons in 1996/1997)

- The average of Olive oil production is 172.000 tons that places Tunisia at the 4th world producer (represent 6%) after Spain, Italy and Greece



As for productivity, the average yield/ha is about

- 800 kg/ha in the north in spite of the favorable conditions,
- 500 to 800 kg in the centre, and
- 200-300 kg /ha in the south
- With a national average of 400-500 kg/ha

This low productivity constitute a real constraint for the improvement of olive growing in Tunisia

The production of table olive did not record a notable evolution during the last five years (2001-2006) with an average of 17000 tons in comparison with the preceding period (1996-2000) where the average was about 15000 tons

# Marketing

## 1-Local market

Nowadays, according to the National Institute of Statistics (INS), the average of consumption of vegetable oils is about 23 Kg/year /capita of which 16-17 kg of seeds oil and 6-7 kg olive oil.

## 2-Export market

Olive oil exportation represent an important income of foreign currency

- 66% of the olive oil production are devoted to the export

**45% of food exports receipts**

**4,5% of the total exports**

**10% of the value of the total agricultural production**

During the last few years , the amount of olive oil exported reached an average

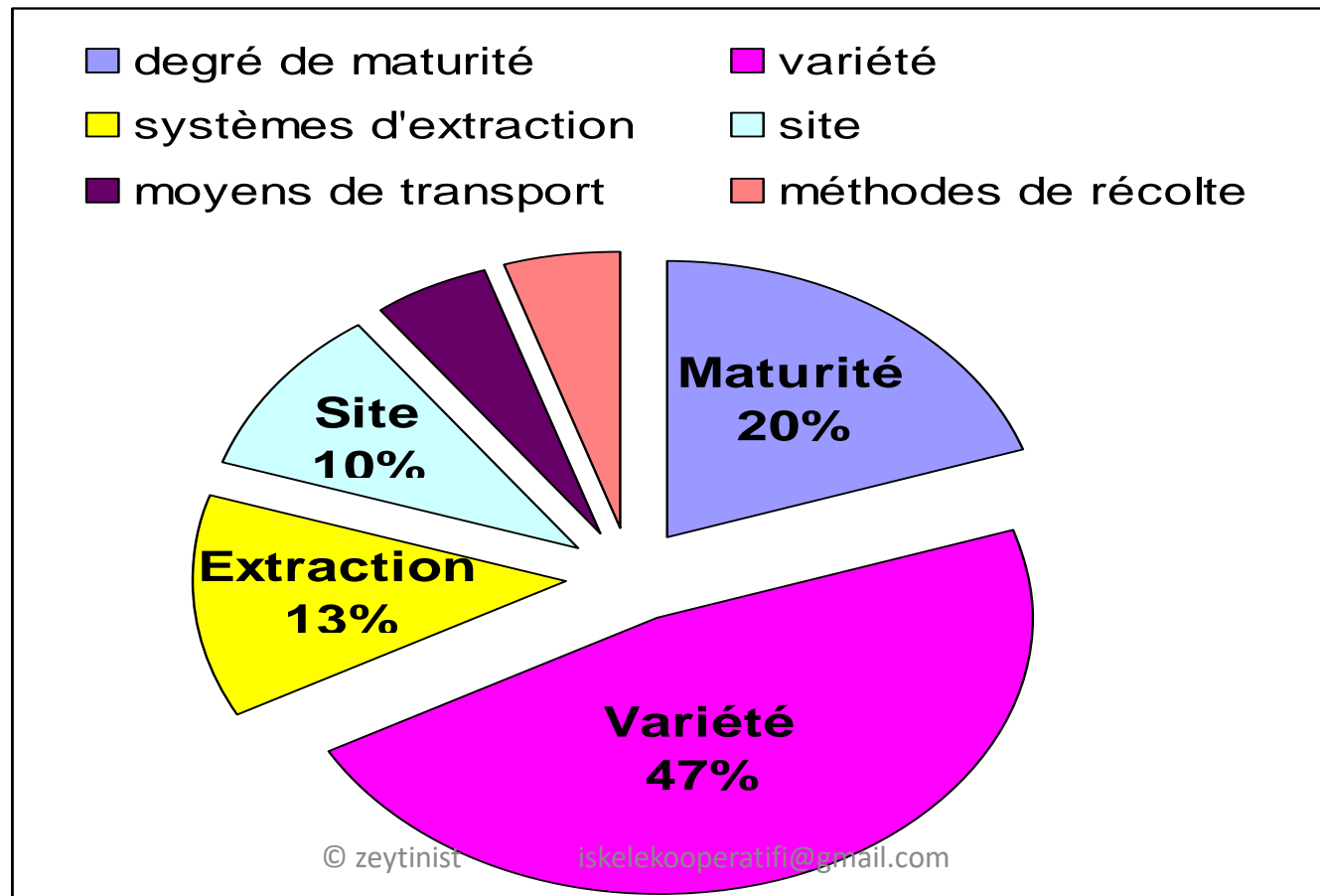
- Olive oil exportation : 110.000 tons/year: 3<sup>rd</sup> world exporter (8.2%) after Spain, Italy, Greece (ONH and 118 private exporters).
- Olive oil is mostly exported in bulk: 99%
- Packaging olive oil exporters = 1% of the total olive oil exportation so the government encourages private enterprises to promote conditioned olive oil and the creation of Tunisian label
- Principal destination: European market, 89% of the total exportation
- Share in the European Market: 10.9%
- Share in the USA market: 3.5%



# Necessity to produce the high quality of olive oil



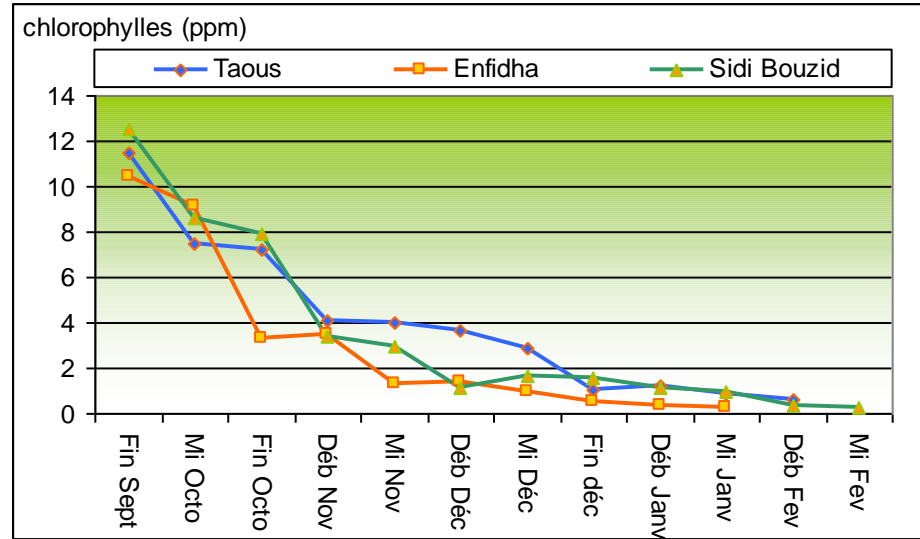
To promote quality, further progress must be pursued at the different factors that affected the olive oil quality especially at the level of harvesting conditions: the period, transport, storage of olives and the extraction conditions.



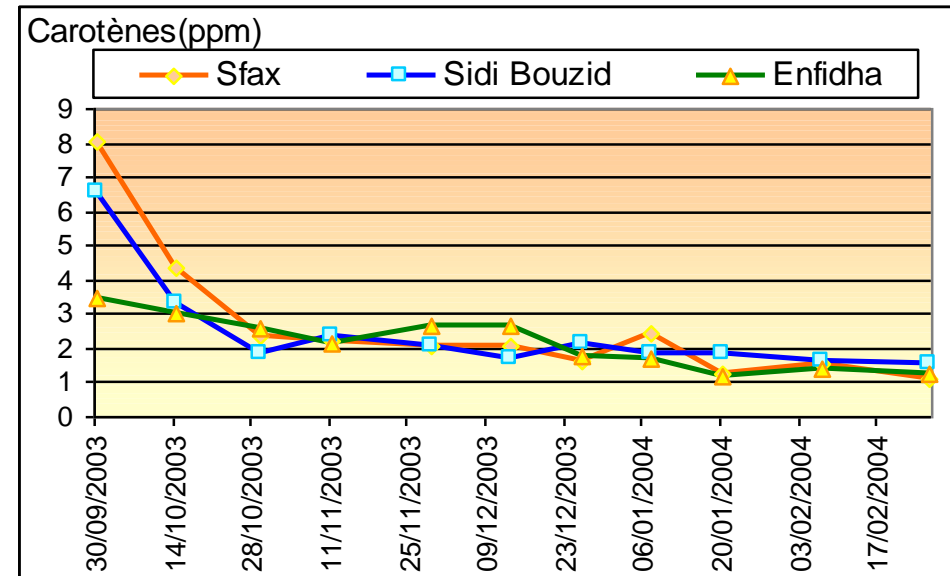


# Degree of ripening

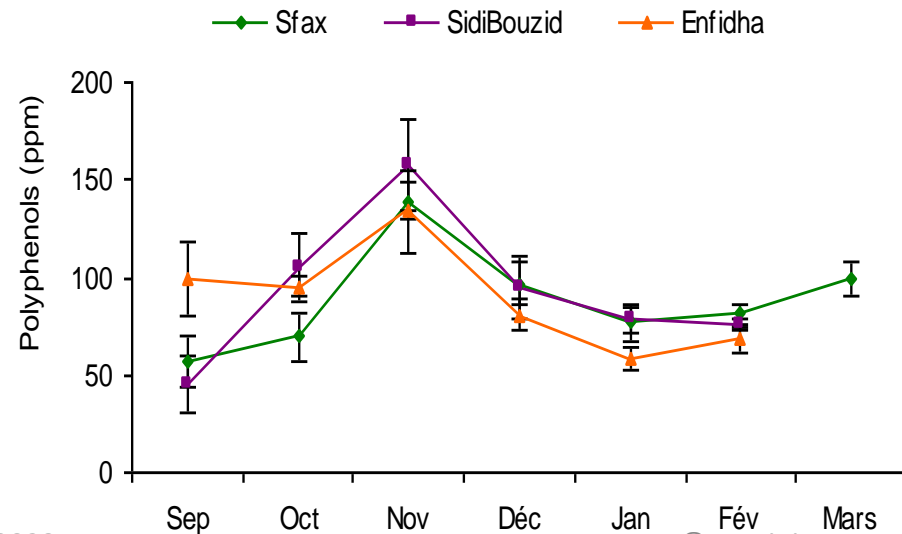
## Evolution of chlorophylls tenor



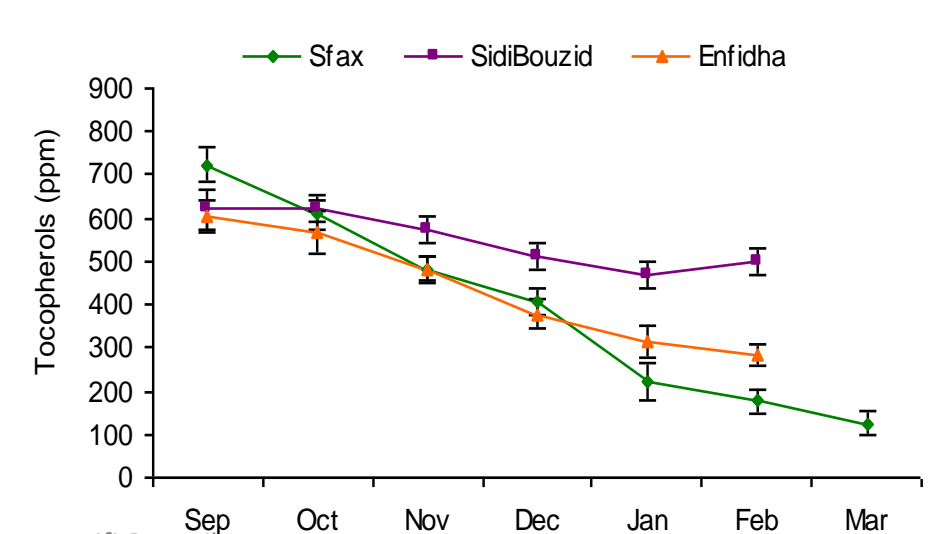
## Evolution of carotenes tenor



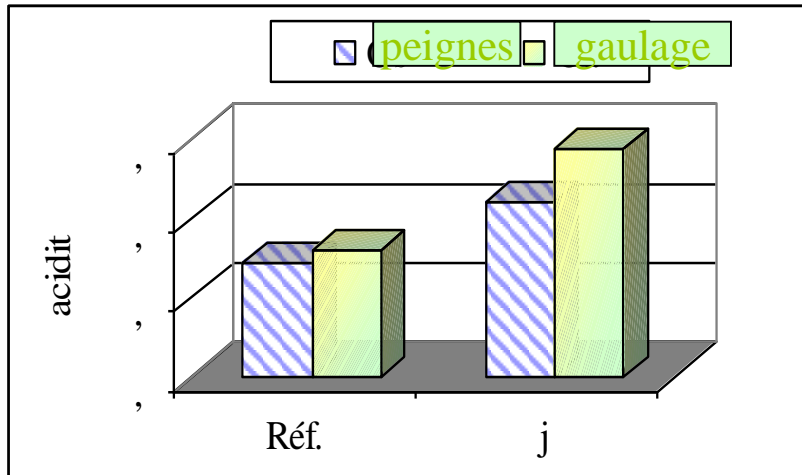
## Evolution of polyphenols tenor



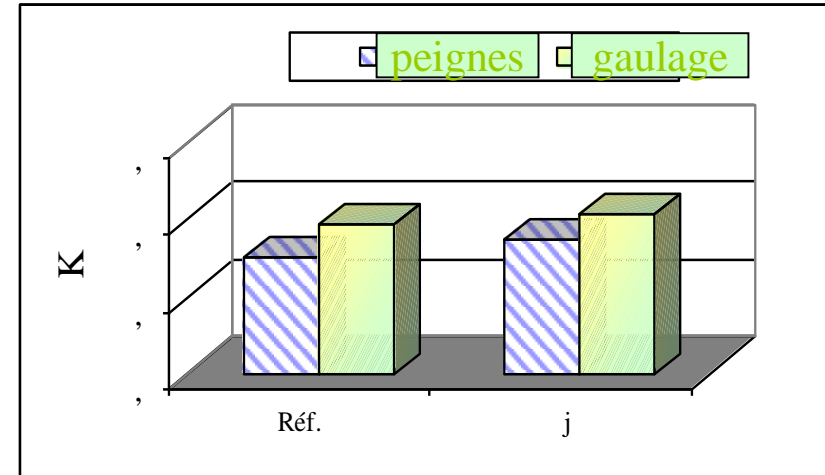
## Evolution of tocopherols tenor



# Harvesting

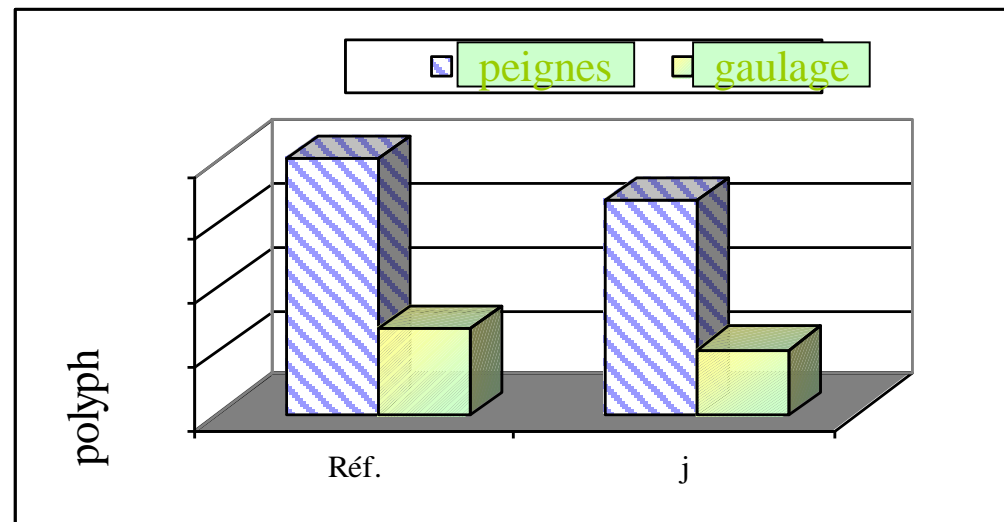


Évolution de l'acidité en fonction du mode de cueillette (peignes et gaulage)



Évolution du K 270 en fonction du mode de cueillette (peignes et gaulage)

Évolution de la teneur en polyphénols totaux en fonction du mode de cueillette



# Extraction Conditions

Étude de l'impact des paramètres de fonctionnement de la chaîne continue sur la qualité de l'huile











































Sorularınız varsa cevaplayayım.

Daha sonra aklınıza soru gelirse lütfen yüz yüze, e posta veya telefon yoluyla ulaşınız.





Bu ders notları zeytincilik programı öğrencileri, Kursiyerler, sektör temsilcileri, diğer üniversitelerde okuyan önlisans, lisans, yüksek lisans ve doktora öğrencileri ile araştırmacılara yönelik hazırlanmıştır. Daha detay bilgiye ulaşmak isterseniz lütfen iletişime geçiniz.

DERS NOTLARI SÜREKLİ YENİLENMEKTEDİR.  
LÜTFEN DAHA ÖNCE İNDİRDİĞİNİZ DERS NOTU VARSA  
YENİ TARİHLİ OLAN DERS NOTUNU TERCİH EDİNİZ.  
NOTLARDA HATALI ve  
EKSİK BİR YER GÖRDÜĞÜNÜZDE LÜTFEN BİLDİRİNİZ.



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