The Italian (Apulian) Oliveculture between present and future and face the opportunity of high density plantations

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Olive oil world production and consumption between 1991-92 and 2005-06 (Source I.O.O.C.)

~same rate of increasing trend

Olive oil: average 2001/02-2006/07 production (Source I.O.O.C.)

2,213,7 (1,000t)

563,0 (1,000t)
Italy: olive acreage and olive oil production (avg. 2001/06)

- 2,889,150 acres
- 682,400 tons

The Italian Oliveculture and the altimetry

- Mountain: 11%
- Hill: 62%
- Plain: 27%

Distribution of olive acreage

- Northern Italy: 2%
- Central Italy: 19%
- Southern Italy: 79%

The profile of the Italian oliveculture

- Centuries-old: (70%)
- Non irrigated: (90%)
- Avg farm size: 2.5 acres
In three regions (74.3% of total acreage)

In three regions (79.0% of total olive oil production)

The main weak point of Italian olive culture...
First of all: where is Apulia?

The representativeness of Apulian Oliveculture

- The average Apulian production of olive oil is about 220,000 tons
- Such production is:
  - 40% of the national
  - 8% of the world
- The regional production of extra virgin olive oil is about 50% of the total
Apulia (%)

- Oil 99.4%
- Table 0.6%

Crop destination

- Small trees
  - Annual pruning
  - Light alternate bearing
  - Harvesting from the tree
  - 90% extra virgin oil
  - Small fruits
  - Tall trees
  - Pruning shift 4 to 6 years
  - Pick up harvesting
  - 90% lamp oil

How many olivicultural models exist in Apulia?

- The common denominator
- The differences

nobody mourns (I believe)......
tall and narrow isodametric
small and broad
25 to 40 lbs/hour/worker

40 to 80 lbs/hour/worker

2 to 3 trees/hour

Cv. Coratina

~150,000 acres
This is the place where our growers should come and learn how to prune olive trees (P. Spiegel Roy, October 1977, personal communication).

- 45 to 60 lbs/hour/worker (98-100%)
- 12 to 15 trees/hour (90 to 100%)
- 25 to 30 trees/h (50 to 75%)
Cv. Cima di Bitonto and its variant (syn. Ogliarola del Gargano, Ogliarola barese)
“Laocoonte”
Rome,
Musei Vaticani

45 to 60 lbs/hour/worker

...suffering forms calling to mind...
on the Gargano headland

Cv. Ogliarola di Lecce (syn. Cima di Mola, Cima di Monopoli, Fasanese, Pizzuta ecc.)

~250,000 acres
Thousand olive trees are visible, regularly spaced, and it is wonderful to think that so many trees have been planted by men.

431 years later.....
The town of Fasano surrounded by thousands of monumental cylinders.
six days labour for pruning: 1.5 tons in “on” year

Cv. Cellina di Nardò

~175,000 acres

before…
...during and...

...after pruning

The progress
Before processing: 3 to 21 days of piling up
The above harvesting system leads to the production of lamp oil

The future
(We will avoid talking about olive culture leading to lamp oil)

The traditional olive growing for extra virgin oil production is burden by high and unrestrainable production costs

1. Pruning
2. Harvesting

<table>
<thead>
<tr>
<th>Labour needed for the management of a rainfed oliveyard in the province of Bari (No. hour/acre/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>harvesting</td>
</tr>
<tr>
<td>No.</td>
</tr>
<tr>
<td>fertilization</td>
</tr>
<tr>
<td>pruning</td>
</tr>
<tr>
<td>tillage</td>
</tr>
<tr>
<td>protection</td>
</tr>
<tr>
<td>harvesting</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>
Italian traditional oliveculture: production costs of extra virgin olive oil according to the region and harvesting methods
(Source: Pampanini, R. and Pignataro, R. - 2006)

<table>
<thead>
<tr>
<th>Central Italy</th>
<th>Southern Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Harvesting</strong></td>
<td></td>
</tr>
<tr>
<td>manual</td>
<td>mechanical</td>
</tr>
<tr>
<td>7.6 €/liter</td>
<td>5.5 €/liter</td>
</tr>
<tr>
<td>manual</td>
<td>mechanical</td>
</tr>
<tr>
<td>6.4 €/liter</td>
<td>4.0 €/liter</td>
</tr>
</tbody>
</table>

It has been considered that the “élite” (remunerative) olive oil production is about…

- 6 to 8% of total Apulian production
- between 13,000 and 17,000 tons

The question is:

- will the quotations of mass extravirgin olive oil produced in Apulia continue to be satisfactory?
If the selling price is equal to the production cost, it is evident that till now the subsidies by EU covered the losses.

In the near future....

2010.....

Free trade area consolidation between European Union and Countries of the southern side of the Mediterranean Sea.
The rules of trade balance
• European industry needs to expand the export to North African Countries
• North African countries must pay what do they import
• How to pay?
• Algeria and Lybian Arab Republic with natural gas and crude oil, respectively
• The other countries…..?

...with the same low cost
• Vegetables
• Fruits
• Olive oil
• produced in Southern Europe

Why low cost?
7.00 to 8.00 €/h
~0.60 to 0.80 €/h

2014…..
The end of the European Community Agricultural Policy
Farmers, please get a second job from 2013 on, when European subsidies will be reduced and/or cut.


<table>
<thead>
<tr>
<th>Country</th>
<th>€ billion</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>1.00</td>
<td>43.04</td>
</tr>
<tr>
<td>Italy</td>
<td>0.75</td>
<td>31.65</td>
</tr>
<tr>
<td>Greece</td>
<td>0.55</td>
<td>23.20</td>
</tr>
<tr>
<td>Portugal</td>
<td>0.04</td>
<td>1.69</td>
</tr>
<tr>
<td>Others</td>
<td>0.01</td>
<td>0.42</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2.37</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

The 2004 “cake” of the EU Agricultural Policy was shared out among 15 partners.

from 2014 on
In addition

1. It is not sure that a new “cake” will be arranged

2. If so, the “cake” will be anyhow notably smaller

3. This time the “cake” will be cut into 27 slices

4. As a consequence, each slice will be.

Talking about subsidies to Apulian olive culture we do mean.....

EU- Annual Olive Oil subsidies in Italy (Avg. 2000/2004) (Source: AGEA)

<table>
<thead>
<tr>
<th>Region</th>
<th>€ billion</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apulia</td>
<td>0.28</td>
<td>37.50</td>
</tr>
<tr>
<td>Others</td>
<td>0.47</td>
<td>62.50</td>
</tr>
<tr>
<td>Total</td>
<td>0.75</td>
<td>100.00</td>
</tr>
</tbody>
</table>
There is a reasonable fear that a debit balance will sign Apulian (only Apulian?) traditional olive farms in a few years after 2014.

We are doubtful that the National/Regional government will be able to support an Apulian olive museum spread over 370,000 ha.

In addition in Italy are in force....

GAZZETTA UFFICIALE DEL 30/08/1945, N. 104
DECRETO LEGISLATIVO LUOGOTENENZIALE 27 LUGLIO 1945, N. 475.
DIVIETO DI ABBATTIMENTO DI ALBERI DI OLIVO.


After-war and peasant economy.

Since nobody will be so foolish asserting that the traditional models should be erased because no more profitable.
The imperative is... to hand down to our descendants what we inherited from our ancestors.

The question is: all what we inherited?

The only remaining possibility: establishment of oasis of the most representative and impressive traditional olive training forms...

... new solutions urge also because....
### Olive nursery activity in 2006 in some Mediterranean Countries (Olivebioteq, 2006)

<table>
<thead>
<tr>
<th>Country</th>
<th>Acres</th>
<th>Rooted Cutting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>6,000,000</td>
<td>10,000,000</td>
</tr>
<tr>
<td>Tunisia</td>
<td>4,212,500</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Turkey</td>
<td>1,650,000</td>
<td>30,000,000</td>
</tr>
</tbody>
</table>

- **Spain (6,000,000 acres)**
  - 10,000,000 rooted cutting (L. Rallo, 2006)

- **Tunisia (4,212,500 acres)**
  - 1,000,000 rooted cutting (T. Jardak, 2006)

- **Turkey (1,650,000 acres)**
  - 30,000,000 rooted cutting (H. Zafer Can and M. Isfendariologu, 2006)

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**the “monocono”?**

**the “bushy vase”?**

- spacing m 5.00 x 4.00
- 500 trees/ha

**framework < 1.00m**

**drip irrigation**

**Working with a shaker…**
One team of 5 workmen plus one shaker machine will harvest no more than 1.5 acres/day...

So, the above examples of modern olive growing are to be considered only temporary makeshift and not resolutive...

...Do not forget that it remains to solve the pruning problems.
What to do?

• Restructure the traditional oliveculture
  or
• Introduce new models?

In 2000, probably we met a real and innovative possibility

Why innovative?

Because it seems the only model allowing a remarkable reduction of both harvesting and pruning costs
harvesting efficiency: 1.2 acres/hour

harvesting: 92-99%.

Pellenc self-moving and towed

New Holland self-moving

Wake Up to a New World in Olive Harvesting

Grape Harvester
Is it reasonable that a machine factory invested a many thousands of Euro only to pursue a dream?

The only real specialist for olive

Material: self-rooted cuttings aged 6-8 months

Spacing:
ft 13.0 x 4.8 = 670 tree/acre

Placing:
Strictly North-South

Resources: irrigation
### Hypotesis of irrigation schedule of one acre of high density olive orchard. Annual avg. rainfall ~ 18,000 inch

<table>
<thead>
<tr>
<th>Season</th>
<th>April-August</th>
<th># day</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shift</td>
<td></td>
<td># day</td>
<td>3</td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td>No.</td>
<td>50</td>
</tr>
<tr>
<td>spacing</td>
<td>inches</td>
<td>157.5 x 59</td>
<td></td>
</tr>
<tr>
<td>Tree/acre</td>
<td>No.</td>
<td>670</td>
<td></td>
</tr>
<tr>
<td>Dripper flow</td>
<td>GPH</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Dripper/tree</td>
<td>No.</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Dripper/acre</td>
<td>No.</td>
<td>1,000</td>
<td></td>
</tr>
<tr>
<td>Water/tree/hour</td>
<td>GPH</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Single intervention duration</td>
<td>hour</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Water/tree/intervention</td>
<td>gallon</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>Water/acre/intervention (5.6 gal x 675)</td>
<td>acre-inc</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Water/acre/season (3,780 gal x 50)</td>
<td>acre-inc</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>gallon/acre</td>
<td>190,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>m³/ha</td>
<td>1,900</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Fertilization schedule (supported by 18,000 inches rainfall +19,000 gallon/acre)

- N₂ 80 to 120 lbs./acre (100 to 150 kgs./ha)
- P₂ O₅ 20 to 30 lbs./acre (50 to 75 kgs./ha)
- K₂ O 16 to 24 lbs./acre (40 to 60 kgs./ha)

### About the harvesting costs
**Machine rent daily cost:** 1,000.00 €/day

*Oil: 20%*

**Harvesting speed:** 1.2 acres/hour

1. **1st example:** 2 t/acre (~6 lbs/fruit/tree) = 400 liters oil/acre
2. 8 hour/harvesting/day = 9.6 acres/day = 3,840 liters/oil/day
3. **harvesting cost:** 1,000.00 / 3,840 = **0.26 €/liter of oil**

*****

1. **2nd example:** 4 t/acre (~12 lbs/fruit/tree) = 800 liters oil/acre
2. 8 hour/harvesting/day = 9.6 acres/day = 7,680 liters/oil/day
3. **harvesting cost:** 1,000.00 / 7,680 = **0.13 €/liter of oil**

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**To be underlined:**

Harvesting cost between:

0,13 €/liter of oil

and

0,26 €/liter of oil

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**Considering a selling price between 3.5 and 5.0 €/liter**

the incidence of harvesting cost is only **5.2% to 7.4% of the selling price**

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- Since the achievement of extra virgin olive oil is strictly dependent on:
  1. Olive fruit healthy
  2. Processing timelineless

- It becomes necessary the adjustment of the working capacity of the oil mill to the amount of olive harvested daily
Suitable features of olive oil varieties for high density plantation

- Semi-dwarf habit (h<2.5m: w<1.2m)
- Early bearing (3° year)
- Consistent initial crop (2.5-7.5 lbs/tree)
- Crop stabilization between 6 and 7 years (7.5-15.0 lbs/tree)
- Fruit impact-resistant
- Good quality of oil

Suitable features of olive harvesting machine

- Harvesting efficiency till 765 inches height
- Harvesting efficiency till 381 inches width
- Number of beater adjusted to the fruit bearing strip
- Minimum harvesting height above ground: ~10 inches
- Flexible and soft beater to reduce damages
- Efficient fan to give a clean crop
- Harvesting speed: 1.2 to 1.5 acres/hour
The first experimental orchard established in the province of Bari in 2002

1. Arbequina
2. Arbosana
3. Cipressino
4. Coratina
5. Frantoio
6. Fs-17®
7. Leccino
8. Urano®

### 3rd - 6th year cumulative yield (2004-2007) at Cassano delle Murge (tons/acre)

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>lbs/ tree</th>
<th>trees/ acre</th>
<th>lbs/ acre</th>
<th>Tons/ acre</th>
<th>Kg/planta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fs-17®</td>
<td>13.6</td>
<td>675</td>
<td>9.2</td>
<td>4.59</td>
<td>6.15</td>
</tr>
<tr>
<td>Urano®</td>
<td>10.9</td>
<td>675</td>
<td>7.4</td>
<td>3.68</td>
<td>4.93</td>
</tr>
<tr>
<td>Arbosana</td>
<td>10.2</td>
<td>675</td>
<td>6.9</td>
<td>3.44</td>
<td>4.66</td>
</tr>
<tr>
<td>Arbequina</td>
<td>5.1</td>
<td>675</td>
<td>3.4</td>
<td>1.72</td>
<td>2.31</td>
</tr>
<tr>
<td>Leccino</td>
<td>3.7</td>
<td>675</td>
<td>2.5</td>
<td>1.25</td>
<td>1.66</td>
</tr>
<tr>
<td>Coratina</td>
<td>3.2</td>
<td>675</td>
<td>2.1</td>
<td>1.08</td>
<td>1.45</td>
</tr>
<tr>
<td>Frantoio</td>
<td>1.8</td>
<td>675</td>
<td>1.2</td>
<td>0.60</td>
<td>0.82</td>
</tr>
<tr>
<td>Cipressino</td>
<td>0.9</td>
<td>675</td>
<td>0.6</td>
<td>0.30</td>
<td>0.40</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>6.1</strong></td>
<td><strong>-</strong></td>
<td><strong>4.0</strong></td>
<td><strong>2.06</strong></td>
<td><strong>2.78</strong></td>
</tr>
</tbody>
</table>

Source: Dipart. di Scienze delle Produzioni Vegetali, Univ. di Bari (Italy)
Canopy growth

1. Suitable: Arbequina, Arbosana, Urano®

3. Fair: Fs-1®

4. Unsuitable: Cipressino, Coratina, Frantoio, Leccino

Additional news

harvesting efficiency

Min.: Urano® 92.2%
Max.: Fs-17® 99.9%
Avg.: 97.8%

damages (No. of shoot/tree wounded/broken)

Min.: n 0.5 Urano®
Max.: n 3.4 Fs-17®
Avg.: n 1.4

About quality of ‘Arbequina’, ‘Arbosana’ and Urano® oil

Sensorial characteristics of ‘Arbequina’ and ‘Arbosana’ oil (Source: Camposeo et al., Olive&Olio, 2006)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Variety</th>
<th>CEE reference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arbequina</td>
<td>Arbosana</td>
</tr>
<tr>
<td>Fault</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fruity</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Overall evaluation</td>
<td>7.3</td>
<td>7.5</td>
</tr>
</tbody>
</table>

Low polyphenol content
main chemical parameters (crop 2006)

<table>
<thead>
<tr>
<th>Variety and provenance</th>
<th>Oleic acid (%)</th>
<th>Polyphenol mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urano® - Tuscany</td>
<td>0.16</td>
<td>199</td>
</tr>
</tbody>
</table>

(Source: A. Mersi, OlivoeOlio, 2008, revised)

The new orchard established in June-July 2006 at Valenzano, near Bari (by hard wood cuttings plus….)

The Olive varieties

1. Arbequina (by cutting and micro)
2. Arbosana
3. Carolea
4. Cima di Bitonto
5. Coratina (by cutting and micro)
6. Don Carlo®
7. Frantoio
8. Fs-17®
9. I-77®
10. Koroneiki
11. Leccino
12. Maurino
13. Urano® (by cutting and micro)
14. Canino (by micro)
15. Gentile di Larino (by micro)

Bearing earliness of olive varieties at Valenzano in April 2008, 23-24 months after plantation (% of tree with inflorescences)

<table>
<thead>
<tr>
<th>Variety</th>
<th>%</th>
<th>Variety</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbequina</td>
<td>93</td>
<td>Frantoio</td>
<td>-</td>
</tr>
<tr>
<td>Arbequina (micropr.)</td>
<td>-</td>
<td>Fs 17®</td>
<td>89</td>
</tr>
<tr>
<td>Arbosana</td>
<td>95</td>
<td>G. Di Larino (micropr.)</td>
<td>-</td>
</tr>
<tr>
<td>Carolea</td>
<td>84</td>
<td>I-77®</td>
<td>92</td>
</tr>
<tr>
<td>Cima di Bitonto</td>
<td>-</td>
<td>Koroneiki</td>
<td>91</td>
</tr>
<tr>
<td>Coratina</td>
<td>95</td>
<td>Leccino</td>
<td>-</td>
</tr>
<tr>
<td>Coratina (micropr.)</td>
<td>-</td>
<td>Maurino</td>
<td>-</td>
</tr>
<tr>
<td>Don Carlo®</td>
<td>30</td>
<td>Urano®</td>
<td>100</td>
</tr>
<tr>
<td>Urano® (micropr.)</td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>
About 10-12 years ago, near S. Casciano (Florence)...

Is it possible to compare this harvesting system...
Additional possibilities of mechanizing other cultural practices

From the plantation....

...to the training....

...and annual pruning
finally….

The purpose of the high density olive planting is knocking down labour below 32 hours/acre/year, safeguarding the oil quality

Problems waiting for solution

• Find the critical point between the crop load and yield constancy
• Verify the most suitable spacing on the row for varieties with spreading habit (Coratina)
• Good compromise between mechanical pruning and alternate bearing
• About the longevity….

So far, nobody knows the longevity of high density olive plantings, and nevertheless….
...butchering age

Broiler: ~35/38 days
(...the death of old age of the chicken mother...)

Chianina young beef: ~12/24 months
(... the death of old age of the cow mother...)

Ham & dressed pork: ~9/10 months
(...the death of old age of the sow mother...)

Recalling UE and WTO resolutions...

Since oliveculture is still a matter concerning the Economy, the final question is:
“Is it more important to know that an olive grove can be immortal or how long its career (or management) will be remunerative?"

I do not know if high density plantings will be the future of the olive culture...

... I fear that the traditional Italian (Apulian) olive culture will have a dark future

With the cooperation
Prof. Francesco BELLOMO
Dr. Salvatore CAMPOSEO
Dr. Giuseppe FERRARA
Dr. Alessandra GALLOTTA
Prof. Vito GIORGIO
Dr. Marino PALASCIANO
University of Bari (Italy)
I thank you very much for the patience.