Pistachios: A Sustainable Alternative Tree-Crop in Southwest New Mexico?

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Are pistachios a sustainable crop for Southwest NM?

**ANSWER:** Yes! Pistachios *can* be grown sustainably in Southwest New Mexico.

But, there’s more!
The genus *Pistacia*

- In the Cashew Family (Anacardiaceae):
  - Cashew (*Anacardium occidentale*)
  - Mango (*Mangifera indica*)
  - Marula (*Sclerocarya birrea*)
  - Marking tree, tar tree, Australian cashew (*Semecarpus* spp.)
  - Ambarella, yellow and red mombin (*Spondias* spp.)
  - Sumac (*Rhus* spp.)
  - Smoke tree (*Cotinus* spp.)
  - Poison ivy/oak (*Toxicodendron* spp.)
The genus *Pistacia*

- There are ~11 species in the genus

- Most are adapted to arid or semi-arid conditions.
  - Native to various parts of southern Asia, north Africa, and the Mediterranean region.
  - *P. mexicana* is native to Mexico and Texas.

- Some *Pistacia* species produce resins for turpentine and mastic.

- *P. chinensis* is a popular ornamental tree in the US.
Pistacia vera

Native to Southwestern Asia
P. vera

Native to Southwestern Asia

Pistachio forests in Afghanistan

Photos courtesy of Dr. Owen Burney
History of the US Pistachio Industry

• The USDA Plant Introduction Station at Chico, CA.
  – Dr. William E. Whitehouse collected seed from Asia in 1929.
  – Lloyd E. Joley began evaluation of varieties in 1940s.

Photos courtesy of Pioneer Nursery
History of the Pistachio Industry

Figure 8
Pistachio total production and value of production, 1980-2010

- Million pounds
- Million dollars

Pistachio’s Climate Requirements

Kerman, Iran ➔ 30°15’ N latitude, 5,800 feet elevation.
Kerman, CA ➔ 36°43’ N latitude, 220 feet elevation.
Deming, NM ➔ 32°15’ N latitude, 4,300 feet elevation.
Pistachio’s Climate Requirements

Kerman, Iran
Latitude: 30°15'N  Longitude: 056°58'E  Elevation: 1754m  Station: IF40641

State University, NM, USA
Latitude: 32°17'N  Longitude: 106°45'W  Elevation: 1163m  Station: US72000002985351

Temperature: Daily High Daily Low
Precipitation: High Low
Humidity: High Low

© 2007 Climate-Charts.com
Regulated Deficit Irrigation

- **Stage 1**: water stress increases % split but reduces nut size.

- **Stage 2**: Split and yield insensitive to water stress.

- **Stage 3**: water stress reduces % splits and kernel growth.

Avoid water stress during Stage 3!!!
Salinity

Pistachios are exceptionally salt tolerant for fruit trees.

• Soil
  – ECe of 9.4 dS/m → significant yield reduction (UCB-1 rootstock).

• Water
  – Pistachios can be irrigated with water as saline as 8 dS/m without yield loss.

Sources:
Sanden et al 2004
## Mineral Nutrition

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Recommended Leaf Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (N)</td>
<td>2.2-2.5%</td>
</tr>
<tr>
<td>Phosphorus (P)</td>
<td>0.14-0.17%</td>
</tr>
<tr>
<td>Potassium (K)</td>
<td>1.8-2.0%</td>
</tr>
<tr>
<td>Calcium (Ca)</td>
<td>1.3-4.0%</td>
</tr>
<tr>
<td>Magnesium (Mg)</td>
<td>0.6-1.2%</td>
</tr>
<tr>
<td>Manganese (Mn)</td>
<td>30-80 ppm</td>
</tr>
<tr>
<td>Boron (B)</td>
<td>150-250 ppm</td>
</tr>
<tr>
<td>Zinc (Zn)</td>
<td>10-15 ppm</td>
</tr>
<tr>
<td>Copper (Cu)</td>
<td>6-10 ppm</td>
</tr>
<tr>
<td>Chlorine (Cl)</td>
<td>0.1-0.3%</td>
</tr>
</tbody>
</table>

Source: UC Pistachio Production Manual
Cultivars

Pistachios are “dioecious”.

- Male and female flowers are borne on separate plants.
- It is necessary to plant male trees for pollination.
Female Cultivars

Fewer than 20 named female cultivars were ever imported to the US. Examples:

- ‘Red Aleppo’ (Syria)
- ‘Bronte’ (Italy)
- ‘Trabonella’ (Italy)
- ‘Sfax’ (Tunisia)
- ‘Kastel’ (Israel)
- ‘Rashti’ (Israel)
- ‘Kalehgouchi’ (Iran)
- ‘Aria’ (Iran)

A few commercial cultivars were developed in the US:

- ‘Kerman’ (USDA, 1957)
- ‘Lassen’ (USDA, 1962)
- ‘Joley’ (UC Davis, 1980)
- ‘Lost Hills’ (UC Davis, 2005)
- ‘Golden Hills’ (UC Davis, 2005)
Female Cultivars

TABLE 1. Relative growth and production characteristics of tested varieties compared to ‘Kerman’ in northwestern Kern County

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Golden Hills</th>
<th>Lost Hills</th>
<th>Kalehghouchi</th>
<th>Aria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloom date</td>
<td>Earlier</td>
<td>Earlier</td>
<td>Earlier</td>
<td>Earlier</td>
</tr>
<tr>
<td>Harvest date</td>
<td>Earlier</td>
<td>Earlier</td>
<td>Similar</td>
<td>Earlier</td>
</tr>
<tr>
<td>Alternate bearing</td>
<td>Later onset</td>
<td>Much less</td>
<td>Less</td>
<td>Much less</td>
</tr>
<tr>
<td>Annual yield</td>
<td>Greater</td>
<td>Similar</td>
<td>Similar</td>
<td>Less</td>
</tr>
<tr>
<td>Lanky growth</td>
<td>Similar</td>
<td>Similar</td>
<td>Greater</td>
<td>Similar</td>
</tr>
<tr>
<td>Split-nut percentage</td>
<td>Greater</td>
<td>Greater</td>
<td>Greater</td>
<td>Similar</td>
</tr>
<tr>
<td>Closed shell percentage</td>
<td>Less</td>
<td>Less</td>
<td>Less</td>
<td>Less</td>
</tr>
<tr>
<td>Nut size</td>
<td>Similar</td>
<td>Larger</td>
<td>Larger</td>
<td>Larger</td>
</tr>
<tr>
<td>Shell-hinge strength</td>
<td>Similar</td>
<td>Weaker</td>
<td>Slightly weaker</td>
<td>Much weaker</td>
</tr>
<tr>
<td>Insect damage</td>
<td>Less</td>
<td>Less</td>
<td>Similar</td>
<td>Similar</td>
</tr>
</tbody>
</table>

Source: Kallsen et al., 2009
Male Cultivars

• ‘Peters’
  – Selection by A.B. Peters.
  – California, early 1900’s.
  – The industry standard for ‘Kerman’

• ‘02-16’
  – Earlier blooming.
  – From Russia.

• ‘02-18’
  – Later blooming
  – From Russia.

• ‘Chico’
  – Originally collected from Syria.
  – USDA, 1962

• ‘Ask’ (Israel)

• ‘Nazareth’

• ‘Gazvin’ (Israel)

• ‘Randy’
  – UC Davis, 2005
  – Earlier blooming

‘Randy’ inflorescence

Kalsen et al., 2009
Rootstocks

• Pistachio cultivars are typically t-budded onto seedling or clonal rootstocks.

• Commercial rootstocks can be:
  – *P. terebinthus*
    • Cold tolerant, but Verticillium susceptible.
  
  – *P. atlantica*
    • Reasonably cold tolerant, but Verticillium susceptible.

  – *P. integerrima*
    • Verticillium tolerant, but susceptible to cold injury.

  – *P. atlantica x P. integerrima*
    • e.g., ‘PGII’ and ‘UCB I’
Navel Orangeworm 
(*Amyelois transitella*)

- The most serious insect pest in pistachios.
- Causes reduced nut yields and quality.
- *Dramatically* Increases aflatoxin contamination in nuts.

- Controlled by:
  - Sanitation
  - Prevention of early splits
  - Early harvest
  - Well-timed pesticide applications.

http://www.ars.usda.gov/Main/docs.htm?docid=18741
Stinkbugs & Leaffooted Plantbugs

- Causes nut drop and kernel necrosis.

- Management:
  - Orchard sanitation
  - Trap crops
  - Pesticide applications (organic/“sustainable” options are very limited).
Stinkbugs & Leaffooted Plantbugs
Cotton Root Rot

- Caused by soil-borne fungus *Phymatotrichopsis omnivorum*.

- Fungus is known to occur in scattered locations around Southwest NM.

- Kills pistachio trees very quickly— with leaves remaining attached.

- No effective control methods. Avoid infested fields for pistachio plantings.
Alternaria Late Blight & Septoria Leaf Spot

• Fungal diseases first confirmed in southern NM pistachios in 2008.

• Both diseases are favored by high moisture in the growing season.
  – Not a major concern in most years.

• Management:
  – Orchard sanitation.
  – May require fungicide application in high rainfall seasons.
Questions?
Sources & Further Reading


University of California IPM Online: http://www.ipm.ucdavis.edu/index.html.