DESIGN OF EFFICIENT PISTACHIO ORCHARDS

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And

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Pre-planting decisions (these topics are covered in other presentations)

• Where is the money for the farm and 5 or 6 years of a negative balance sheet coming from?
• Who will farm them? the underemployed son-in-law?
• Who will buy the nuts? Where is the processor?
• Does the farm have suitable soils?
• Is suitable and sufficient water available? – type of irrigation system
• Does the farm have a suitable climate? – heat units, low rainfall, sufficient chilling
• Does the farm have power for pumps? How soon can you get it?
Pre-Planting Considerations Discussed in this presentation:

Tree Density,
Tree Design,
Pollinizer Placement
And an Orchard Floor Management System.
The Well Designed Orchard Should Create a Farm That Ensures:

- earliest economic return per acre
- maximum production per acre at tree maturity
- Least management cost
The leaf canopy is what catches the light to produce nuts -

The questions are:

• How long will it take an orchard to achieve full leaf canopy

• How many tree trunks do you need to hold the leaf canopy up at maturity?
If trees are too close,

• Trees crowd together shading the lower tree canopy (nuts borne higher in tree and air flow restricted)
• Pruning costs increase to maintain equipment access to the orchard and tree isolation
• You paid for too many rootstocks, budded too many trees and now have to prune too many trees.
If trees are too far apart,

- Potential per acre yield may be permanently reduced or delayed for many years.
- If trees are too far apart and grow too large, nuts will fall outside of the catching frame.
- How big a trunk circumference can we shake efficiently?
Decision! Upon which option will I base initial tree density?

HIGH DENSITY
- LATER REMOVAL REQUIRED

Maximize early economic returns. Expensive tree removal later.

AVOID INITIAL CRITICISM
- DENSITY SOMEWHERE INBETWEEN

Trees too close to manage and harvest efficiently and too far apart to thin.

LOW DENSITY – PLANT TO FINAL DENSITY

Longer wait for economic returns. No costly tree thinning later. Fewer trees to train, prune and shake.
Pistachio harvesting equipment is large. Space rows of trees 20 ft. or so apart.
Square design (109 trees/acre at this spacing)
Spacing the trees closer together in the row may be pay off where trees grow slower due to hardpans, high salt, excessively high boron, or for other reasons,

Slow growing trees take longer to provide full canopy leaf cover, so early yields will greatly benefit by higher tree numbers.
Rectangular planting
(121 trees/acre at this spacing)

Mechanical cross-hedging still possible with trees 18 ft apart.
Offset square design (109 trees/acre at this spacing)

Row direction ->
Hexagonal planting (97 trees/acre at this spacing)
Hexagonal Planting Design

126 Trees/Acre

Trees too close for easy equipment passage
## Number of Trees Per Acre at Different Rectangular Plantings

<table>
<thead>
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<th>Row x Tree Spacing</th>
<th>Trees/acre</th>
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<td>20 x 10</td>
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<tr>
<td>20 x 17</td>
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<tr>
<td>20 x 18</td>
<td>121</td>
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<tr>
<td>20 x 19</td>
<td>115</td>
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<td>21 x 18</td>
<td>115</td>
</tr>
<tr>
<td>21 x 19</td>
<td>109</td>
</tr>
<tr>
<td>21 x 20</td>
<td>104</td>
</tr>
</tbody>
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\text{r.s. (ft) x t.s (ft)} = 43560
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In pistachio, male and female flowers are borne on different cultivars.

There are male trees and female trees. Male trees do not bear nuts.

Male trees have to be dispersed through the orchard so that female trees are pollinated.

Pollen is blown to female trees. Bees are not involved, although they do gather pollen from male trees.
Currently (2005) in the SJV, males ⭐️ are frequently interplanted with ♂♀ females every 5th tree in every 5th row.
An orchard design showing tree thinning strategy

prevailing wind

row direction

= permanent male

= temporary male
Row Length?

Rows longer than 1/4 mile should have a break (access road) to allow equipment to turn around if necessary.

Reason - A bank out wagon on an “on” year cannot carry all the production from a row over a quarter mile in a length.
Have a harvest loading site -

A loading site should be contiguous to every 40 acre block. A single loading site can service 160 acres. A loading site is typically 50 ft x 500 ft.
Loading site in action
Somebody snuck in another row of citrus trees.
Design to minimize existing obstructions.

This pole interferes with harvesting equipment, grading, irrigation, weed control, etc.
This air-release valve is still too tall in the tree row.

Buried vaults in the tree row protect valves, air release valves, etc. from shaker and mechanical cross-hedging.
Potential liability from pesticide drift should be considered. Is a buffer needed between the orchard and neighboring schools, houses, county or state roads?
Various road-surfacing materials are available that can be used both to reduce dust and/or improve wet-weather access to the orchard.
The suitability of a material for a given road application varies with the following:

• the native soil of the road,
• the current condition of the road,
• seasonal rainfall patterns, amounts and drainage,
• frequency that the road is traveled,
• material cost,
• and ability to grade, blade, replace or repair.
Some of the materials used to control dust on farm service roads are as follows:

• Water
• Lignosulfate dust binders
• New or recycled asphalt
• Heavy road oil
• Washed gravel
• Crushed rock or decomposed granite
• Vinyl/acrylic emulsion/polymers
• Organic materials
Leave plenty of room around county roads, poles, reservoirs, filters, and pumps so that harvesting and other equipment can turn or pass easily.

Poles in tree rows are susceptible to topping.
Leave room to turn equipment.

35 feet
OPTIONS FOR ORCHARD FLOOR MANAGEMENT

- Complete cultivation (irrigation hose concerns?)
- Complete cover (disease concerns?)
- Complete herbicide control
- Strip herbicide control with cultivation
- Strip herbicide control with cover crops
- Intercropping
Strip herbicide control with cultivation
Terracing complicates harvest.

So can high berms
STRIP HERBICIDE CONTROL WITH COVER CROPS
Cover crops do not necessarily use a lot of water.
Cover crops may have multiple effects:

- insect/mite control (+/-)
- water relations (+/-)
- disease (+/-)
- nutrition (+/-)
- erosion control (+)
- vertebrate pests (gophers) (-)

We’ve got a lot to learn about cover crops.
Interplanting in young pistachios

Because pistachio take more years to come into production than other perennial crops, some growers are interplanting cotton or other crops between rows of young pistachio trees.

Blake Sanden, UCCE Farm Advisor in Kern County, has been exploring the economics of this.
There can be financial advantages to interplanting when the pistachios are young, but make sure that you know how to grow the interplanted crop before attempting this at home. Potential problems:

- weed control (herbicides) and pest control
- phytotoxicity, registration
- fertilizers, irrigation, discing roots, harvest timing, etc.
- shading

Pistachios (July 2005):
Drip tape 0.25m below surface and 0.48m either side of pistachios.

Slide courtesy of Blake Sanden.