PISTACHIO CANOPY MANAGEMENT AND ITS EFFECT ON YIELD COMPONENTS

ROBERT H. BEEDE
UNIVERSITY OF CALIFORNIA
FARM ADVISOR
EMERITUS
Pistachio Orchard Yield Potential

Pounds/AC

Tree Age

Unlimited Light

Well Managed Canopy

Poorly Managed Canopy
Comparison of pistachio rootstock performance at the Kearney Agricultural Center, Parlier, CA. Yields represent an average of 90 trees per rootstock. Orchard age is 20 years. RH BEEDE P.I.
THE SEARCH FOR “SUPERIOR ROOTSTOCK”; WHAT IS YOUR DEFINITION OF “SUPERIOR”? GREATER YIELD? DISEASE, NEMATODE TOLERANCE?

IF YOU DEFINE “SUPERIOR” AS GREATER YIELD, THEN WHAT YIELD COMPONENT IS RESPONSIBLE?

1. GREATER FRUITING DENSITY? (i.e. more clusters per unit area)

2. GREATER NUMBER OF FILLED NUTS PER CLUSTER?

3. LARGER NUTS? OR…….. IS IT SIMPLY....

4. LARGER TREE WITH MORE SURFACE FOR FRUIT WOOD?
SPAIN’S AERIAL IMAGERY TEAM: KAC 2009
EFFECT OF PISTACHIO ROOTSTOCK PERCENT SHADED AREA ON TOTAL DRY WEIGHT PRODUCTION. BASED ON FOUR SINGLE TREE REPLICATIONS HAND DE-NUTTED. KAC (2009) RH BEEDE P.I.

$R^2 = 0.866$

PERCENT CANOPY

DRY WT (LBS)

=ATLANTICA

=PGi

=UCB-I
EFFECT OF PISTACHIO ROOTSTOCK PERCENT SHADED AREA ON TOTAL CLUSTER NUMBER. BASED ON FOUR SINGLE-TREE REPLICATIONS HAND DE-NUTTED. KAC (2009). RH BEEDE P.I.
EFFECT OF PISTACHIO ROOTSTOCK ON THE AVERAGE NUMBER OF CLUSTERS PER UNIT AREA (FT^2) OF TREE CANOPY. KAC (2009). RH BEEDE P.I.
SUMMARY OF ROOTSTOCK RESEARCH TO ASSESS REASON FOR YIELD SUPERIORITY OF UCB1 COMPARED TO P. INTEGERRIMA (e.g. PGI) AND P. ATLANTICA:

1. ASSESSMENT OF ROOTSTOCK YIELD BY PARTITIONING INDIVIDUAL TREES OF DIFFERENT CANOPY SIZE FOR DRY, IN-SHELL YIELD, TOTAL CLUSTER NUMBER, NUTS PER CLUSTER, AND NUT QUALITY PER CLUSTER REVEALS THAT PRODUCTION IS STRONGLY CORRELATED TO TREE SIZE, NOT GREATER FRUITING DENSITY (CLUSTERS PER UNIT AREA OF CANOPY).

2. YIELD DATA COLLECTED FROM THE UPPER AND LOWER HALF OF 20 YEAR OLD KERMAN TREES ON THREE DIFFERENT ROOTSTOCKS REVEALED THAT 75 PERCENT OF THE CROP IS IN THE UPPER HALF OF THE CANOPY. ATLANTICA TREES HAD ABOUT 30 PERCENT OF THE CROP IN THE LOWER HALF DUE TO THEIR SMALLER CANOPIES AND SUBSEQUENT GREATER LIGHT EXPOSURE IN THE BOTTOM OF THE CANOPY.

3. YIELD SUPERIORITY THEREFORE APPEARS TO SIMPLY BE A FUNCTION OF TREE SIZE.

Beede 2009
Pistachio Orchard Yield Potential

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Well Managed Canopy

Poorly Managed Canopy
Grower Goals for Pruning Mature Pistachios:

1. Control Tree Size
2. Facilitate Harvest
3. Improve Nut Removal
4. Maintain Fruitfulness
5. Minimize Yield Loss
Apical Dominance
GOALS FOR HAND PRUNING:

1. PRUNE THE CANOPY “BACK AND UP”

2. STIFFEN THE FRUITING BRANCHES TO ACHIEVE EFFICIENT REMOVAL

3. AVOID THE REMOVAL OF BRANCHES THAT CREATE “SNAKES” IN THE CANOPY

4. COMPRESS THE HEIGHT OF THE CANOPY BY PERFORMING HEADING CUTS DEEPER INTO THE UPPER PART OF THE TREE.

5. ELIMINATE “TRAFFIC”-CONGESTED BRANCHES SHADING ONE ANOTHER
MARVIN BRAND PRUNING HEAD; POPULAR DUE TO LIGHTER WEIGHT (CASTING RATHER THAN FORGING), WIDE ENOUGH MOUTH FOR MOST CUTS NOT NEEDING A SAW, AND REASONABLY PRICED. A SHARP BLADE IS A MUST FOR SPEED! CARRY A STONE, NOT A FILE!
Watch out for Snakes!
HEAVY CROP + APICAL DOMINANCE = MAJOR FRUITING LIMBS BENT OUT OF POSITION
PROPERLY CIRCLED TIED TREE: ONLY THE STRUCTURAL BRANCHES, NOT THE TEMPORARIES!
Effect of Mechanical Hedging on Pistachio Yield

L. Ferguson
B. Beede
J. Maranto
S. Goana
D. Castle
A. Garza
R. Fanucchi
## Effect of Mechanical Hedging

<table>
<thead>
<tr>
<th></th>
<th>Hand-Pruned</th>
<th>Hedged 1-Side</th>
<th>Hedged 2-Sides</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before ON</strong></td>
<td>29.2</td>
<td>29.5</td>
<td>25.2</td>
</tr>
<tr>
<td><strong>Before OFF</strong></td>
<td>37.0</td>
<td>37.4</td>
<td>36.9</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>33.1</td>
<td>33.4</td>
<td>31.0</td>
</tr>
</tbody>
</table>

Mean 2 years/2 sites at Paramount

From: Ferguson et al. 1991
Conclusions from Hand Pruning Experiment
Kings County

1. Severe thinning, heading or commercial pruning before the "on" year did not decrease yield compared to unpruned trees.

2. Pruned trees compensated for fruit bud reduction by setting more nuts per cluster. This is a unique pruning response for deciduous trees.
Conclusions from Hand Pruning Experiment Kings County

3. There was no carryover effect from "on" year pruning on fruit set, nut quality or yield for the following "off" year.

4. Thinned trees produced growth similar to those unpruned. Severely headed trees grew the least.
Pistachio Canopy Management Experiment

Cooperator: Munger Investment
Location: 17 miles south of Kettleman City
Project Began: 1996-97
Tree Age: 16 years
Pistachio Canopy Management Treatments

1. Hand pruned
2. Hedge 1 side
3. Hedge 1 side + top 1yr wood 50%
4. Hedge 1 side + top 1yr wood 100%
Pistachio Canopy Management Treatments

5. Hedge 2 sides
6. Hedge 2 sides + top 1yr wood 50%
7. Hedge 2 sides + top 1yr wood 100%
8. Top 1 yr wood 50%
9. Top 1 yr wood 100%
6 year Cumulative Yield  
- Hedging Trial -

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Total Dry Yield</th>
<th>Splits-Clean +Light Stain</th>
<th>Edible Closed Shell</th>
<th>Blanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hand Pruned</td>
<td>29469 a</td>
<td>18411 a</td>
<td>6808 b</td>
<td>1537 a</td>
</tr>
<tr>
<td>2. Hedge 1 side</td>
<td>28835 ab</td>
<td>17063 ab</td>
<td>7535 ab</td>
<td>1521 a</td>
</tr>
<tr>
<td>3. Hedge 1 side + mod. top</td>
<td>27087 bc</td>
<td>15889 bcd</td>
<td>7306 ab</td>
<td>1536 a</td>
</tr>
<tr>
<td>4. Hedge 1 side + severe top</td>
<td>24521 d</td>
<td>13672 e</td>
<td>6974 b</td>
<td>1568 a</td>
</tr>
<tr>
<td>5. Hedge 2 side</td>
<td>28221 ab</td>
<td>16488 bc</td>
<td>7805 a</td>
<td>1492 a</td>
</tr>
<tr>
<td>6. Hedge 2 side + mod. top</td>
<td>26806 bc</td>
<td>14982 cde</td>
<td>7907 a</td>
<td>1621 a</td>
</tr>
<tr>
<td>7. Hedge 2 side + severe top</td>
<td>25913 cd</td>
<td>14387 de</td>
<td>7497 ab</td>
<td>1475 a</td>
</tr>
<tr>
<td>8. Top one-year-old moderate</td>
<td>27275 bc</td>
<td>15751 bcd</td>
<td>7488 ab</td>
<td>1616 a</td>
</tr>
<tr>
<td>9. Top One-year old severe</td>
<td>24224 d</td>
<td>13329 e</td>
<td>6982 b</td>
<td>1570 a</td>
</tr>
<tr>
<td>LSD (P=0.05)</td>
<td>1986</td>
<td>1630</td>
<td>745</td>
<td>260</td>
</tr>
</tbody>
</table>
## 6 year Cumulative Yield

### Contrasts

<table>
<thead>
<tr>
<th></th>
<th>Total Dry Yield</th>
<th>Splits-clean +Light Stain</th>
<th>Edible Closed Shell</th>
<th>Blanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Hand Pruned</td>
<td>18411</td>
<td>6808</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
<tr>
<td>vs. 1 or 2 side hedging</td>
<td>N.S.</td>
<td>*</td>
<td>**</td>
<td>N.S.</td>
</tr>
<tr>
<td>2. Hedge 1 side</td>
<td>16775</td>
<td>7670</td>
<td>N.S.</td>
<td>N.S.</td>
</tr>
<tr>
<td>vs. hedge 2 sides</td>
<td>N.S.</td>
<td>N.S.</td>
<td>*</td>
<td>N.S.</td>
</tr>
<tr>
<td>3. Hand pruned mechanical</td>
<td>26610</td>
<td>15195</td>
<td>7437</td>
<td></td>
</tr>
<tr>
<td>vs. topped 50%</td>
<td>29469</td>
<td>18411</td>
<td>6808</td>
<td>N.S.</td>
</tr>
<tr>
<td>vs. topped 100%</td>
<td>27056</td>
<td>15541</td>
<td>7567</td>
<td>N.S.</td>
</tr>
</tbody>
</table>

N.S. = Not Significant at P = 0.05

* = Significant at P ≤ 0.05

** = Significant at P ≤ 0.01

*** = Significant at P ≤ 0.001
Mechanical Hedging Summary

• In this study, hand pruned trees were the most productive throughout the 6 year trial.

• Pistachios can be mechanically hedged without suffering economic yield loss.

• Fruit Buds lost from Pruning appeared partially compensated for by increased fruit set per remaining cluster.

• Less yield fluctuation by hedging one side every other year

• Fluctuation may lessen with repeated side hedging.
Mechanical Hedging Summary con’t

• Yield differences between single and double sided hedging in any given year is also affected by the potential crop. (i.e. Two sided hedging should not be performed prior to a low production year.

• Expect significant yield loss when mechanical topping is employed for managing pistachio canopy height.

• Yield loss from Topping is more correlated to the potential crop than physiological conditions associated with on and off-year bearing cycles.
Avoid Topping prior to an OFF year to minimize alternate bearing and excessively low yields.

Experimentation with in-season re-topping to control vigorous re-growth has promise.
REAL LIFE MECHANICAL PRUNING EXPERIENCE, KERN COUNTY
GOAL: MAINTAIN 80 PERCENT SHADED AREA

1. KERMAN ON PIONEER GOLD I PLANTED 1991 AT 20′ X 17′

2. EXPERTLY TRAINED TREES WITH COMPACT STRUCTURAL BRANCHES

3. HEDGING AND TOPPING PROGRAM BEGAN IN YEAR NINE:
   A. SIDE HEDGE EVERY OTHER ROW EVERY YEAR, SIX FOOT SWATH
   B. CROSS HEDGE EVERY OTHER TREE MIDDLE EVERY YEAR, THREE FOOT SWATH
   C. TOPPED HALF THE GROWTH IN THE BEGINNING, THEN TRYING TO HOLD THEM TO 15.5 FEET FROM YEAR TWELVE ON
   D. IN ADDITION, HANDPRUNING PERFORMED ANNUALLY TO MAINTAIN LIGHT THROUGH THE CENTER OF THE CANOPY.
   E. COST: $30-35 PER PASS FOR THE HEDGER/TOPPER, $250 PER ACRE FOR THE HANDPRUNING. TOTAL ANNUAL: ~ $350/AC.

4. RESULT: AVERAGE YIELD OVER EIGHT YEARS: 4000 LBS., WITH 10% NON-SPLITS.

5. ALTERNARIA PROBLEM GREATLY REDUCED
SIDE HEDGING (SIX FOOT SWATH) EVERY OTHER ROW EVERY YEAR
CROSS HEDGED THREE FEET EVERY OTHER ROW EVERY YEAR
RELIANCE SOLELY UPON MECHANICAL PRUNING CAN RESULT IN LOSS OF LOWER FRUIT WOOD AND LOTS OF DEAD LIMBS. EFFECT OF OPENING UP THE CENTER? REDUCTION IN LIMB LOSS, BUT NO DATA ON YIELD EFFECT.
THE ROTATING STAR MECHANICAL PRUNER IN ACTION. NOT SUITABLE FOR SIDE HEDGING LARGE WOOD
ROTATING HEAD MOVES TOO FAST TO CUT LARGER LIMBS BEFORE SPLITTING THEM. RECONSTRUCTIVE SIDE HEDGING BETTER PERFORMED WITH SAWS MOUNTED ON A STATIONARY BOOM.
MIKE PELHAM’S STATIONARY BOOM; 20 FEET OF SPINNING STEEL!
PISTACHIO REJUVENATION AND ALTERNATE BEARING TRIAL
BEEDE AND FERGUSON, PI’S

FIRST YEAR SIDE HEDGING CUT 6.5 FEET FROM TREE AXIS

INITIATED PRIOR TO THE OFF BEARING YEAR (2012)
REJUVANATION/ MITIGATION OF ALTERNATE BEARING TRIAL
KEARNEY AGRICULTURAL CENTER. INITIATED IN OFF YEAR 2012.
TOPPING PERFORMED AT 14 FEET. FIVE FEET REMOVED!
NEW DATA STILL IN THE PROCESS OF BEING SUMMARIZED

NOT AVAILABLE AT THE TIME OF BINDER PREPARATION
THANK YOU!

QUESTIONS?