Small-Scale Cherry Production,
Big Time Market Opportunities

Gregory Lang
Michigan State University

Funding includes support from the USDA’s National Institute of Food and Agriculture Hatch projects #MICL01305 and #MICL02002
5 Important HEALTH BENEFITS of Cherries

Healthy Benefits of Cherries
The little red fruit with a powerful health punch

1. Rich source of antioxidants
2. Anoside & gout
3. High in dietary fiber
4. Improves memory
5. Helps in reducing migraines
6. Anti-inflammatory properties
7. Helps in reducing cholesterol
8. Supports blood flow to brain
9. Boosts libido in men & women

5 Health Benefits of CHERRIES!

1. Cherries are perfect if you have sleep problems as they contain a natural melatonin that aids sleep.
2. Cherries are high in beta carotene, containing 10 times more than blueberries or strawberries. This helps significantly to protect your skin from burning and encourages a natural glowing tan.
3. Researchers have found cherries to be cancer fighters thanks to their high level of an antioxidant called cyanidin. Cyanidin is an important free radical scavenger.
4. By helping to reduce inflammation in the body, the anthocyanins and phenol antioxidants in cherries also help eliminate migraine headaches. These compounds are known to have similar activity to aspirin and ibuprofen without the negative side effects.
5. Cherries are extremely good at reducing inflammation in the body so they are perfect for those with arthritis & gout. 20m per day or more is recommended.

Cherry Smoothie
3 cups sliced cherries
1 tsp vanilla extract
1/2 tsp cinnamon
1 cup coconut water
Blend & serve

Health Benefits of Cherries
- Anti-Aging & Free Radicals
- Infections & Immunity
- Cancer
- Eye Care
- Brain Function and Nervous System
- Constipation & Digestion

PositiveDrugs.com
HEALTH BENEFITS OF SWEET CHERRIES

Sweet NW cherries may be considered a summer treat, but they’re easy to enjoy all year long and boost plenty of health benefits you may not know about. Aside from being high in fiber and low in calories, they can protect against serious diseases. See how this superfruit benefits both your body and your taste buds!

7 SWEET REWARDS OF THIS SWEET SUPERFRUIT

PROTECT AGAINST ALZHEIMER'S:
Flavonoids and procyanidin can help guard neuronal cells, reducing oxidant stress and fighting dementia

WARD OFF CANCER:
Fiber + vitamin C + carotenoids + anthocyanins = anti-cancer team
- Cyanidin and quercetin help by reducing free radicals

COMBAT HYPERTENSION AND STROKE:
Potassium may reduce these risks, and cherries have more potassium (270 mg) than strawberries (254 mg) or apples (148 mg)
Sweet cherries 270 mg
Strawberries 254 mg
Apples 148 mg

FIGHT CARDIOVASCULAR DISEASE:
Anthocyanin also reduces inflammation, plaque and nitric oxide, keeping your heart strong and healthy.
- Quercetin's fight against free radicals helps ward off heart disease

DISCOURAGE DIABETES:
Anthocyanin may reduce insulin resistance and increase glucose tolerance

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Glycemic Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet cherries</td>
<td>22</td>
</tr>
<tr>
<td>Plums</td>
<td>39</td>
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<tr>
<td>Blueberries</td>
<td>40</td>
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<tr>
<td>Peaches</td>
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<tr>
<td>Grapes</td>
<td>46</td>
</tr>
<tr>
<td>Apricots</td>
<td>57</td>
</tr>
</tbody>
</table>

REDUCE INFLAMMATION:
Phytochemicals inhibit inflammation-causing enzymes, reducing pain from arthritis, injury and other ailments

SLEEP BETTER AND BATTLE JET LAG:
Melatonin regulates circadian rhythm, helping you get truly restful sleep while reducing the tiring effects of jet lag.
8 HEALTH BENEFITS OF CHERRIES

- Improves Digestion
- Improve Immunity
- Relieves pain
- Fights Cancer cells
- Rich in Anti-Oxidant

Nutrition Facts

Amount Per Serving
Calories 97
Total Fat 0g
Saturated Fat 0g
Trans Fat 0g
Cholesterol 0mg
Sodium 0mg
Total Carbohydrates 20g
Dietary Fiber 3g
Sugar 1g

Protein 3g

8% of Daily Value

- Promotes Weight Loss
- Ensures a Healthy Heart

Cherries: An Authentically Nourishing Food

- Help promote relaxation and sleep
- Useful in preventing gout
- Rich in antioxidants to help fight inflammation
- Contain anthocyanins to help regulate blood sugar levels
- Dark cherries contain pterostilbene alcohol that can prevent certain cancers
- Helpful for those with arthritis
- Can boost brain function and improve memory

Please Tag on Facebook: Authentic Self Wellness
10 Health Benefits of... Cherries

1. Improves Kidneys & Liver Health
2. Improves Heart Health
3. Full of Antioxidants
4. Anti-Inflammatory
5. Reduces Cholesterol
6. Improves Immunity
7. Great for Arthritis
8. Anti-Aging
9. Full of Vitamin A
10. Eases Digestion

Amazing Health Benefits Of CHERRIES!
1. Promote Liver Health
2. Keep Your Heart Healthy
3. Help Fight Cancer
4. Arthritis Relief
5. Bone Density
6. Gout Relief
7. Anti-Inflammatory
8. Reduction In Diabetes Symptoms
9. Promote Kidney Health
10. Improved Sleep

herbs-info.com
pinterest.com/herbsinfohealth

Don’t forget to share!

Ten Great Health Benefits of Eating Cherries

1. Cherries, known as a "super fruit", are packed with antioxidants called anthocyanins which aid in the reduction of heart disease and cancer.
2. Cherries are one of the few food sources that contain melatonin, an antioxidant that helps regulate heart rhythms and the body’s sleep cycles.
3. Cherries are an excellent source of beta carotene (vitamin A). In fact they contain 19 times more beta carotene than blueberries and strawberries.
4. Cherries are rich in vitamins C, E, potassium, magnesium, iron, folic acid and fiber.
5. Cherries are referred to as "brain food", aiding in brain health and in the prevention of memory loss.
6. Because cherries contain anthocyanins, they can reduce inflammation and symptoms of arthritis and gout.
7. Eating cherries reduces the risk of diabetes.
8. Cherries are a good source of fiber which is important for digestive health.
9. Cherries are a great snack or dessert choice important for weight maintenance.
10. Because of their powerful anti-inflammatory benefits, cherries are said to reduce pain and joint stiffness for runners and athletes after workouts.

Vegans Do It For Love
Löve of themselves, love for the planet, and love for all sentient beings.
PLACE LOVE RESPECT VEGAN
Buddhist Students for a Vegan Rinpoche
The Health Benefits of CHERRIES

* Great source of Dietary Fiber
* Aids in Exercise Recovery
* Excellent source of Antioxidants
* Anti-Inflammatory Benefits
* Low Calorie
* Natural source of Melatonin
* Contain Boron for Bone Health
* Low Fat Snack
* Cancer Prevention
* Quercetin prevents Oxidative Damage
* Helps fight LDL 'Bad' Cholesterol
* Tart Cherries contain Anthocyanins for Pancreatic Health

fitnessfueltraining.com
Fruit Quality: Cherry Size Affects Wholesale Value

<table>
<thead>
<tr>
<th>Year</th>
<th>Average</th>
<th>At 7.5 tons/acre, that is $10,050 more per acre</th>
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<tbody>
<tr>
<td>2007</td>
<td>$2.78</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>$2.56</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>$2.85</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>$2.73</td>
<td>$2.43 $2.20 $2.06</td>
</tr>
</tbody>
</table>

Average price differential between 24 mm and 28 mm fruit size:

USDA, Detroit Terminal Market data
Traditional Cherry Trees

Large, deep root systems

Extensive area for extraction of soil nutrients and water

25 ft
Narrow canopies improve light penetration & distribution, producing fruit with higher sugar, color, firmness, and uniformity. Spray coverage is improved, with reduced volume and drift.
Protective Covers for Rain and Birds
Improvised Worker Platforms
BlackPearl is the best cherry it's season, ripening 10 days before Bing, with Chelan. (-10) It has exceptional flavor and is extremely firm and crunchy. The fruit is medium size with 20% sugar. BlackPearl has amazing storage qualities and keeps better than almost any other cherry. It is hardy and canker resistant with low cracking. Early season bloom, S4 unknown.

- Early ripening season (week 3)
- Very good flavor and firmness
- Less susceptibility to rain cracking
Santina

- Self-fertile
- Firm, large size
- Early ripening season (week 3)
- Moderately tolerant to rain cracking
Cornell Stone Fruit

Burgundy Pearl™ NY 38L

A large, high quality, very firm, crack resistant cherry with a tough, grower-friendly tree. Burgundy Pearl ripens 3 to 5 days before Bing. (-3) It has large, firm, crunchy, 12g fruit with 20.5% sugar. The tree is vigorous, productive, and canker resistant. Burgundy Pearl has superior quality, storability and excellent crack resistance, averaging 4% cracking with 1” of rain in 2008. Early midseason bloom, S3S4

• Early-mid ripening season (week 4)
• Early-mid ripening season (week 4)

**Cornell Stone Fruit**

**EbonyPearl™ NY 32**

EbonyPearl is a large, very high quality cherry that ripens 3 days ahead of Bing. (-3) It has excellent crack resistance, averaging 4% cracking with 1” of rain in 2008. The tree is hardy, vigorous and canker resistant. Very large fruit averages 9.5 row, 11.6g with exceptional flavor and quality and has long, firmly attached stems. EbonyPearl has a early mid-season bloom. S1S4.
Benton

- Self-fertile
- Firm, large fruit size
- High sugar, excellent flavor

- Blooms late, mid-ripening season (week 5)
- Less susceptible to rain cracking
Sandra Rose

- Blooms mid-season, **mid-ripening season (week 5)**
- Medium firm, large fruit size
- Self-fertile
- Susceptible to rain cracking
Attika (Kordia)

- Blooms late, mid-late ripening season (week 6), not self-fertile
- Very firm, large, heart-shaped fruit, excellent flavor
- Less susceptible to rain cracking; more susceptible to frost
Skeena

• Very firm, large fruit size

• Self-fertile

• Blooms mid-season, mid-late ripening season (week 6)

• Very susceptible to rain cracking
Regina

- Very firm, large fruit

- Blooms late, *late ripening season (week 7)*

- Low susceptibility to rain cracking

- Productivity can be a problem; pollen-compatible with Sam, Blackgold, Attika, Sylvia
Sweetheart

- Self-fertile
- Blooms early, very late ripening season (week 8)

- Precocious, highly productive, very horizontal growth habit
- Medium to large fruit, moderately susceptible to rain cracking
Rainier

- Highest value cherry in the market
- Blooms early, mid-ripening season (week 5-6)
- Precocious, highly productive, large fruit
- Excellent bud and wood cold hardiness

Radiance Pearl

RadiancePearl™ is a Rainier type cherry that ripens 7 to 10 days ahead of Bing (-7-10) and has exceptional flavor and quality. The fruit averages 11g with 20% sugar and has exceptional flavor and low rate cracking. It has a vigorous, hardy and productive tree. RadiancePearl™ has an early mid-season bloom, S1 Unknown. It is perfect for fresh market and u-pick operations.
Rain and Cherry Cracking

2005 MSU Clarksville
Crop Value (6-yr-old trees):
$31,590 / acre

46 to 54% Culls due to Rain

Crop Loss Due to Rain =
$15,795 per acre

Are Rain Covers Affordable?

Photo courtesy of Stuff.co.nz (probably Lapins fruit)
Rain Covers in Norway
High Tunnels (Haygrove) in the United Kingdom

- Protection from rain, hail, and wind; greater heat retention in spring
Two Types of Cherry Fruit Cracking

**Type 1: Rain on Fruit Skin**
Cracking at the tip (stylan end) or bowl (stem end) due to long fruit contact with rainwater.
Eliminated with protective covers (reduced with some water-resistant fruit coatings)
Two Types of Cherry Fruit Cracking

**Type 1: Rain on Fruit Skin**
Cracking at the tip (styal end) or bowl (stem end) due to long fruit contact with rainwater. Eliminated with protective covers (reduced with some water-resistant fruit coatings)

**Type 2: Excessive Water in the Soil**
Fruit side cracking (due to rain or irrigation water taken up by the roots and pumped into the fruit *[especially when leaves have low evapotranspiration]*). Can occur even with protective covers; must manage soil moisture and drainage
Management of Rain Run-off from Tunnels to Reduce Type 2 Cracking

Leg-row drainage tile and gravel channels

Also beneficial: Planting on berms or raised beds

Slide from Ben Gluck (2012)
Automated Retractable Roof Panels with Gutters Close in Response to Rain, Wind, and High and Low Temperature Set-Points
What is the Basic Cherry Fruiting Unit?

Year 1 - New shoot growth with single leaves

Year 2 – First season growth forms non-fruiting spurs, with greater spur density in the terminal portion and a few basal non-spur fruit buds

Year 3 – First season growth forms fruiting spurs, with more flower buds per spur (and greater spur density) in the terminal portion
**Fruit Quality: Managing Leaf-to-Fruit Ratios**

**Year 3:**
- **Fruit** populations: 1 spur (e.g., 75 total), 1 non-spur (e.g., 10 total)
- **Leaf** populations: 2 spur (e.g., 120 total), 1 shoot (e.g., 10 x 2X)
- **Leaf-to-Fruit Ratio:** 1.65

**Year 4:**
- **Fruit** populations: 2 spur (e.g., 150 total), 1 non-spur (e.g., 10)
- **Leaf** populations: 3 spur (e.g., 180 total), 1 shoot (e.g., 10 x 2X)
- **Leaf-to-Fruit Ratio:** 1.25

A 25% reduction yields smaller fruit.
Anticipation of the future unbalanced cropping sites can be pre-emptively managed to better balance leaf-to-fruit ratios.

A dormant heading cut to remove: 15 to 30% of last year’s shoot will therefore remove: 25 to 40% of the future flower density.
Precision Management of Leaf-to-Fruit Ratios

This heading cut reduces future spur fruit populations.....
This heading cut reduces future spur fruit populations.....
This heading cut not only reduces future spur fruit populations, but also promotes new shoot leaf populations.

Year 3:
- **Fruit** populations: 1 spur (e.g., 40 total), 2 non-spur (e.g., 20 total)
- **Leaf** populations: 3 spur (e.g., 166 total), 2 shoot (e.g., 20 x 2X)
- Leaf-to-Fruit Ratio: **2.75**
Bud Selection

Promalin
(BA+GA_{4+7})

- Live Bud
- Bud Removed
Notching / Scoring

Pegs for Crotch Angles
TSA Year 1

Planting of nursery tree, removal of any lateral branches ("feathers")
After planting, removal of lowest buds for weed spray clearance.

Remove ~5 buds below the terminal, then select a bud every 4 to 4.5 inches for activation by Promalin, scoring, or removal of intervening buds.
After bud selection for activation by Promalin, scoring, or bud removal
TSA Year 1

Spring shoot growth from activated buds
TSA Year 2

Tree canopy prior to dormant pruning before 2\textsuperscript{nd} growing season in orchard
Bud selection of the previous season’s terminal growth and dormant pruning of the previous season’s lateral shoots
TSA Year 2

Spring shoot growth
TSA Year 2

Spring shoot growth; fruiting at base of last season’s shoot growth and on spurs on portion of the leader that grew in the nursery
TSA Year 2
Summer shoot extension growth
TSA Year 3

Tree canopy prior to dormant pruning before 3rd growing season in orchard
TSA Year 3

Dormant-prune for: 1) future crop load management, and 2) to thin out any overlapping shoots (promote good light distribution)
TSA Year 3

Fruiting at base of last season’s shoot growth and on spurs from Year 1 shoot growth
TSA Year 3

Summer-prune any overlapping shoots to minimize shading of developing flower buds
Strategies to Optimize Precision Cropping: The Highly-Structured Tree for Fruiting Wall Architectures

De-construct the tree canopy into a simple fruiting unit to manage leaf-to-fruit ratios, then repeat many times
**UFO Fruiting Units and Yield**

*Ultimately, easier to manage 1000 simplified small trees/acre than 150 large trees with high variability in branching and orientation*

Tree Spacing: 5 ft x 8 ft  1,079 trees/acre

Fruiting unit (upright shoot) spacing: 8 inches

<table>
<thead>
<tr>
<th>Fruiting Units</th>
<th>Target Yield</th>
<th>Fruit Size</th>
<th>Crop Load</th>
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<tbody>
<tr>
<td>(shoots / acre)</td>
<td>(ton / acre)</td>
<td>(g/fruit)</td>
<td>(fruit/upright)</td>
</tr>
<tr>
<td>7,555</td>
<td>8.0</td>
<td>10.0</td>
<td>107</td>
</tr>
<tr>
<td>7,555</td>
<td>7.0</td>
<td>11.0</td>
<td>85</td>
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<tr>
<td>7,555</td>
<td>6.0</td>
<td>12.0</td>
<td>67</td>
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</table>
UFO in California
NC140 Sweet Cherry Canopy Systems Trial

KGB

Kym Green Bush

TSA

Tall Spindle Axe

SSA

Super Slender Axe

UFO

Upright Fruiting Offshoots

Rootstock Vigor:

Gisela 3 – very dwarfting
Gisela 5 – dwarfting
Gisela 6 – vigorous

2010 Spacing: 5 x 11 ft
(SSA) 2.5 x 11 ft
**Cultivar: Skeena**
- Summerland, British Columbia
- Kentville, Nova Scotia

**Cultivar: Regina**
- Geneva, New York
- Hudson Valley, New York

**Cultivar: Benton**
- Clarksville, Michigan
- (Walnut Grove, California)

**Other Collaborative Trials**
- Italy, Turkey, Chile, New Zealand

NC140 Sweet Cherry Canopy Architecture Trial Sites (13 Planted in 2010)
KGB Fundamental Fruiting Unit
TSA Fundamental Fruiting Unit

TSA
SSA Fundamental Fruiting Unit
UFO Fundamental Fruiting Unit
Number Flower Buds 2011 (Year 2)

Lillrose and Lang, 2011 (preliminary data, not analyzed for publication)
### 2013 (Year 4) Yields, Michigan

#### Proposed modified orchard spacing (ft)
- KGB: 5.7 x 13
- TSA: 5 x 11.3
- SSA: 2.5 x 9
- UFO: 5 x 8.1

#### Trees/acre
- KGB: 719
- TSA: 770
- SSA: 1962
- UFO: 1079

#### Rootstock

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>KGB</th>
<th>TSA</th>
<th>SSA</th>
<th>UFO</th>
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<tbody>
<tr>
<td>Gi3</td>
<td>0.6</td>
<td>3.2</td>
<td>4.2</td>
<td>1.7</td>
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<tr>
<td>Gi5</td>
<td>0.3</td>
<td>1.0</td>
<td>-</td>
<td>0.4</td>
</tr>
<tr>
<td>Gi6</td>
<td>0.05</td>
<td>0.6</td>
<td>1.6</td>
<td>0.5</td>
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</tbody>
</table>

#### Orchard yield (ton/acre)

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>KGB</th>
<th>TSA</th>
<th>SSA</th>
<th>UFO</th>
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<tbody>
<tr>
<td>Gi3</td>
<td>0.6</td>
<td>3.2</td>
<td>4.2</td>
<td>1.7</td>
</tr>
<tr>
<td>Gi5</td>
<td>0.3</td>
<td>1.0</td>
<td>-</td>
<td>0.4</td>
</tr>
<tr>
<td>Gi6</td>
<td>0.05</td>
<td>0.6</td>
<td>1.6</td>
<td>0.5</td>
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</table>
**Estimated Year 4 Yield Potential**

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>KGB</th>
<th>TSA</th>
<th>SSA</th>
<th>UFO</th>
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<tr>
<td>Gi3</td>
<td>2.5 – 3.4</td>
<td><strong>4.6 – 5.3</strong></td>
<td><strong>5.7 – 6.5</strong></td>
<td>3.7 – 4.7</td>
</tr>
<tr>
<td>Gi5</td>
<td>2.2 – 3.1</td>
<td>2.4 – 3.1</td>
<td>-</td>
<td>2.4 – 3.4</td>
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<tr>
<td>Gi6</td>
<td>1.9 – 2.8</td>
<td>2.0 – 2.7</td>
<td><strong>3.1 – 3.9</strong></td>
<td>2.5 – 3.5</td>
</tr>
</tbody>
</table>

*Tree density and spacing information.*

- **Trees/acre**:
  - KGB: 719
  - TSA: 770
  - SSA: 1962
  - UFO: 1079

- **Proposed modified orchard spacing (ft)**:
  - KGB: 5.7 x 13
  - TSA: 5 x 11.3
  - SSA: 2.5 x 9
  - UFO: 5 x 8.1

*Potential yield accounting for 2012 spur loss.*
## Estimated Year 5 Yield Potential*

<table>
<thead>
<tr>
<th>Proposed modified orchard spacing (ft)</th>
<th>KGB</th>
<th>TSA</th>
<th>SSA</th>
<th>UFO</th>
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</thead>
<tbody>
<tr>
<td>5.7 x 13</td>
<td>5 x 11.3</td>
<td>2.5 x 9</td>
<td>5 x 8.1</td>
<td></td>
</tr>
<tr>
<td>Trees/acre</td>
<td>719</td>
<td>770</td>
<td>1962</td>
<td>1079</td>
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**Rootstock**

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>KGB</th>
<th>TSA</th>
<th>SSA</th>
<th>UFO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi3</td>
<td>4.6 – 5.5</td>
<td>5.6 – 6.3</td>
<td>4.4 – 5.2</td>
<td>5.7 – 6.7</td>
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<tr>
<td>Gi5</td>
<td>3.8 – 4.7</td>
<td>5.6 – 6.3</td>
<td>-</td>
<td>6.4 – 7.4</td>
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<tr>
<td>Gi6</td>
<td>3.3 – 4.2</td>
<td>4.5 – 5.2</td>
<td>2.4 – 3.2</td>
<td>4.6 – 5.6</td>
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*Potential yield accounting for 2012 spur loss
2014 Dormant + Summer Pruning Time (per tree & cost per acre)

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<thead>
<tr>
<th>Variety</th>
<th>Pruning Time (min/tree)</th>
<th>Cost per Acre</th>
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<tbody>
<tr>
<td>KGB</td>
<td>*</td>
<td>$1,134 (+27%)</td>
</tr>
<tr>
<td>TSA</td>
<td>*</td>
<td>$895 (+71%)</td>
</tr>
<tr>
<td>SSA</td>
<td>**</td>
<td>$1,534 (+17%)</td>
</tr>
<tr>
<td>UFO</td>
<td>*</td>
<td>$1,053 (+17%)</td>
</tr>
</tbody>
</table>

*hand-pruned  ** hedged
MSU Tree Fruit Research

Other support from:
USDA-NIFA Hatch project MICL01305, USDA-Small Farms, Haygrove Tunnels, Cravo Greenhouses, VOEN

Training video clips at:
www.giselacherry.com

www.cherries.msu.edu