## Developing and Optimizing Sweet Cherry Training

### Systems for Efficiency and High Quality Fruit –Part 1

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#### **Cherry Training Systems**

Continuously evolving strategies to grow the best fruit, with high yields, most efficiently

Fruit tree growers have changed cherry trees from a naturally tall tree in the forest, to a moderated-sized pruned tree in the orchard, to a highly-structured fruiting wall that is easy to harvest and may allow partial mechanization



Sweet Cherry Trees in Nature

- A forest tree, tall with top vigor
- Slow to begin fruiting, 5-7 years
- The Cherry Revolution began in the 1990s with hybrid rootstocks to induce early fruiting and control tree size





Photo Courtesy of Mark and Ines Hanrahan

## Advantages and Drawbacks of High Density Sweet Cherry Systems



- Early bearing
- High yields
- Harvest efficiency and ease
- Tree efficiency (light and spray distribution)
- Easy to protect with covers

 Fruit quality?
Early return on investment and breakeven cost?





- High establishment cost
- High level of inputs (training labor)
- High level of knowledge
- Must protect from frost since trees are smaller
- Short lifespan?

Narrow "Fruiting Wall" Canopies for Space Efficiency under Protective Structures

MSU High Tunnel Cherries for Early Ripening and Rain Protection

## Cherry Systems Fundamentals: Growth and the Basic Fruiting Units



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Understanding this basic set of leaf populations and fruiting sites is a fundamental key to all training systems

Ayala and Lang, 2004







## Marlene Ayala



# Managing the Sugar Supply to Fruit





#### Beginning of Stage III (44 days after full bloom)



Fruit : 25% final size Shoot: 16 leaves



Ayala and Lang, 2004

### Leaf Area and Location



Large leaf size, close to the fruiting clusters, is critical to achieve maximum fruit size, firmness, and sweetness



Balanced crop loads improve uniformity of quality fruit

## **Basic Growth & Fruiting Units**





#### 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

### **Basic Growth & Fruiting Units**











Anticipation of the future unbalanced cropping sites can help in pre-emptive management to better balance leaf-to-fruit ratios and improve performance

A dormant heading cut to remove: 15 to 30% of last year's shoot will remove 25 to 40% of the future spur density

## **Basic Growth & Fruiting Units**









Heading cuts stimulate new shoot leaf populations and non-spur fruit populations, while reducing future spur fruit 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

#### Strategies to Optimize Precision Cropping: The Highly-Structured Tree



De-construct the tree canopy into a simplified fruiting unit to manage leaf-to-fruit ratios, then repeat many times





Fruiting Wall Cherries - A narrow canopy improves light penetration & distribution, producing fruit with higher sugar, color, firmness, and uniformity - improved spray coverage with reduced volume and drift









THE LOOP

#### Harvest Labor and Productivity



<sup>1</sup>Based on Assumed Yields

<sup>2</sup>Based on an 8-hr day for hand harvest and 16-hr day for machine; 33.34 acres to harvest in 4 days











#### System x Rootstock Effect on Tree Vigor (TCSA), Fall 2012





There is no single best system. Growers will be successful who understand the fundamental training rationale and fruiting units for each system, and how to adapt their system management for their specific needs: their orchard site, their variety characteristics, their markets, and their labor situation.

#### **Precise Fruiting Unit Formation**

Year 1- 10 to 15 lateral or upright shoots (future fruiting units)

Year 2 – 20 to 35 total future fruiting units

The greater the number of new shoots created in Years 1 and 2, the greater the diffusion of vigor.

This diffusion, and removal of any overly vigorous or weak shoots, results in more balanced and uniform fruiting units.





TSA Spacing: 5 x 11 ft

Heading of lateral shoots to balance crop load with leaf area.



Fruiting sites: both spur and non-spur

### Establishing the TSA Orchard: Nursery Trees

**TSA** 



Can use whip nursery trees; feathered nursery trees best if available





#### **Shoot Promotion**

The goal in forming shoots in Years 1-2 should be to establish fruiting units for Years 2-4:

- Heading (not desirable)
- Promalin (sensitive to climate)
- Bud selection
- Bud notching/scoring (susceptible to bacterial canker)





## **TSA Fruiting Unit Development**







Heading cuts stimulate new shoot leaf populations and non-spur fruit populations, while reducing future spur fruit populations



Lillrose and Lang, 2011 (preliminary data, not analyzed for publication)

## **MSU Tree Fruit Research (End Part 1)**

