Mechanical harvest of stem-on sweet cherries for brine

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Cherry Bay, Send-Emeott, and Orchards

Primary Objective: To develop near-term strategies for improving stem-on retention on mechanically harvested fruit for the brine market.

- Hypotheses (based on grower observations):

1) Can the optimal window for mechanically harvesting stem-on fruit can be predicted? **By GDH; Fruit size, FRF, Soluble solids)?**

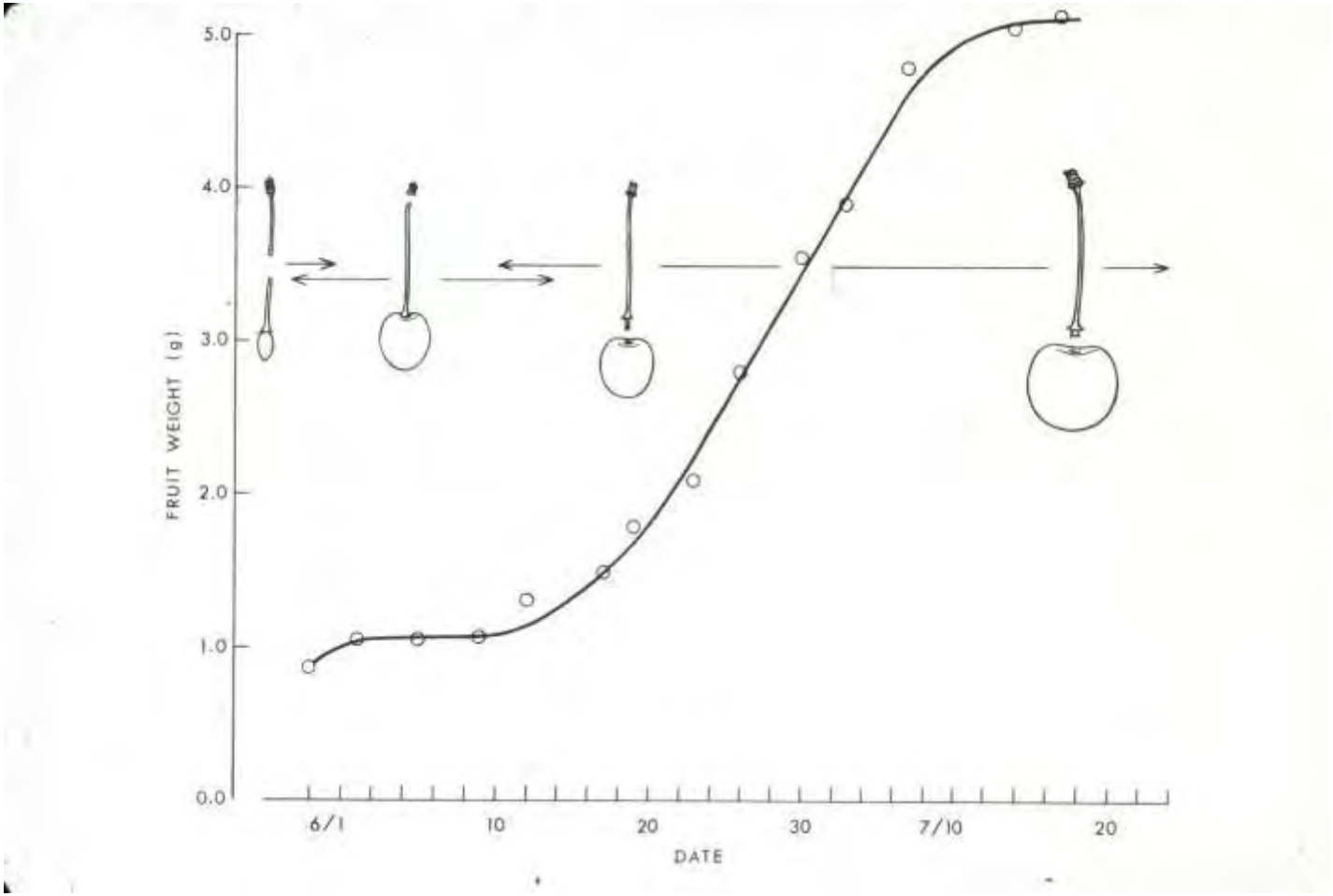
2) Are single fruits easier to harvest than spurs with multiple fruits?

3) Can pre-harvest application of plant growth regulators preferentially promote fruit separation at the branch-stem abscission zone?

4) Does ethylene or pectinase activity continue to work at the stem-fruit abscission zone in brine solution, causing increased stem loss in the brine pits?

How is the fruit removed?

Two abscission zones in Sweet Cherry



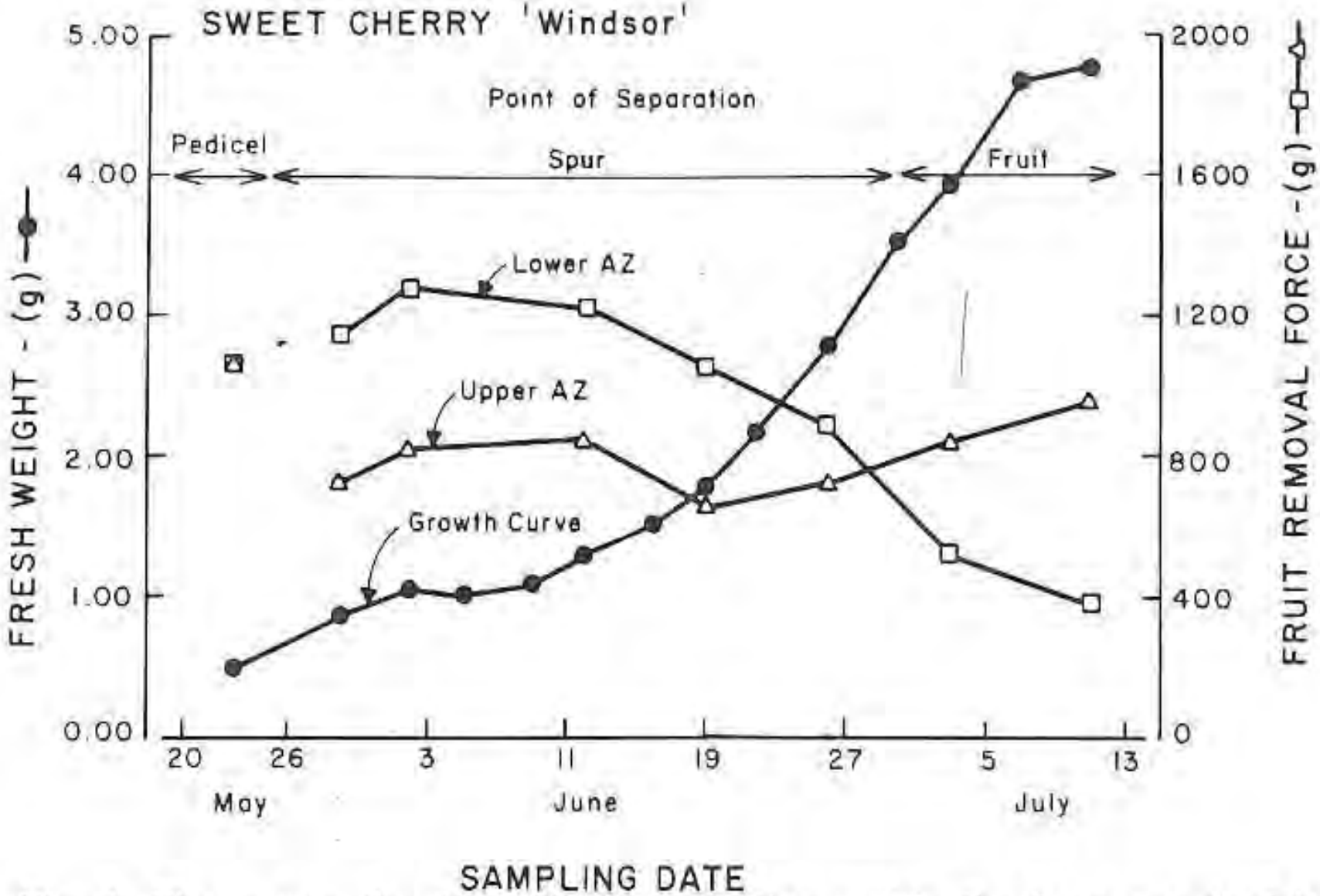
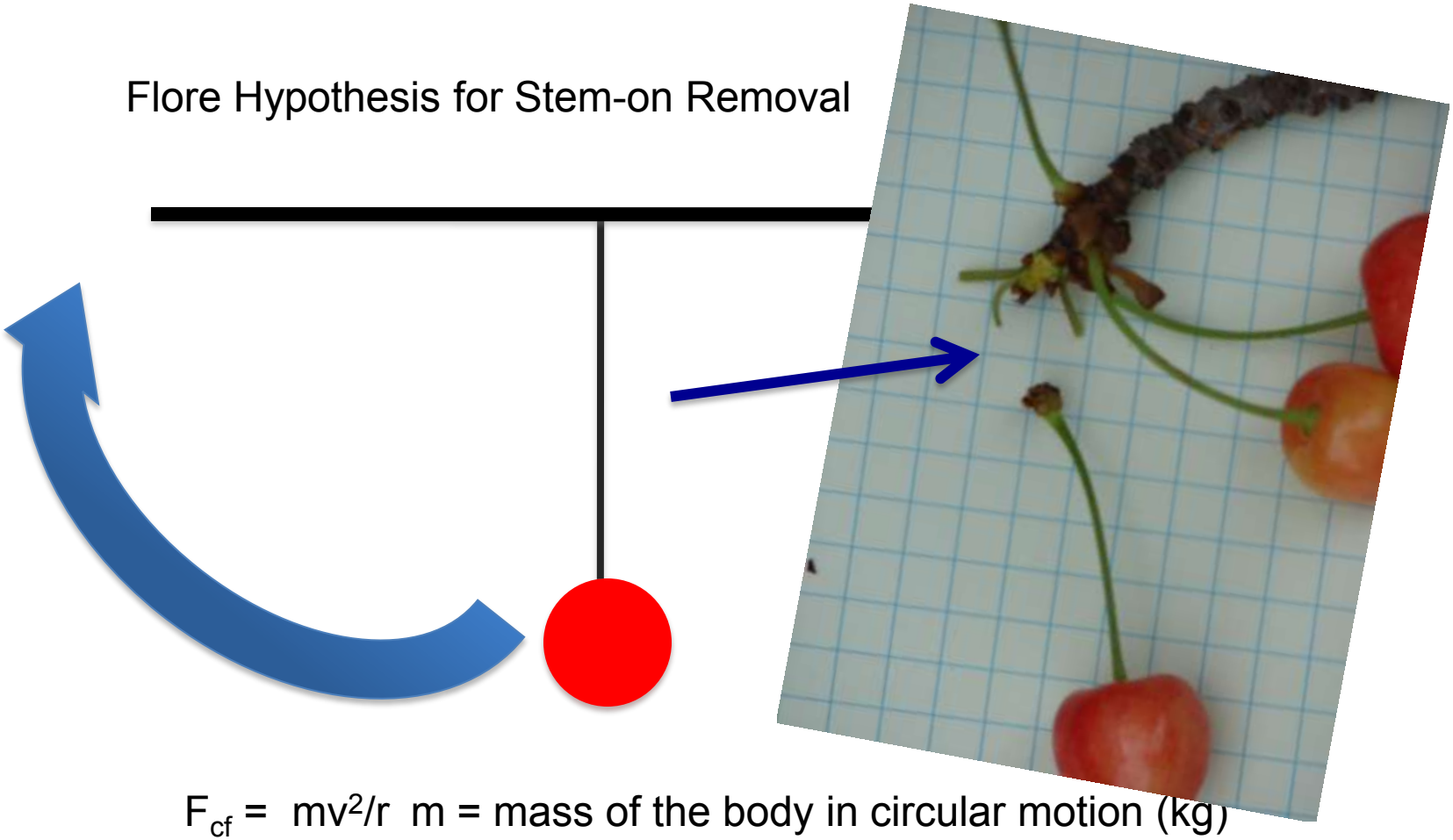


Fig. 1. Changes in the site of fruit separation and in the force required to effect separation at the upper and lower abscission zones of 'Windsor' sweet cherry as related to the development of the fruit.

Flore Hypothesis for Stem-on Removal



$F_{cf} = mv^2/r$ m = mass of the body in circular motion (kg) (Wt of Cherry) v = its linear velocity (m/s) (Velocity caused by the shaker) r = radius of the curve (m) (Length of the stem) **Requirements for stem-on abscission:**

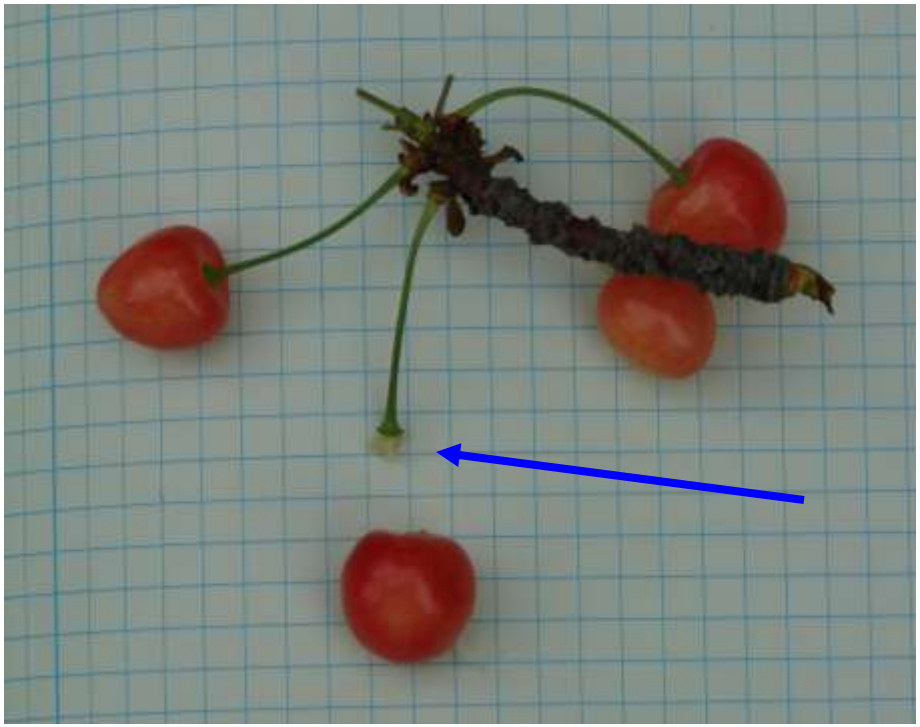
Fruit Mass X Shaker Velocity squared must be large enough to tear the pedicel from the shoot. The lower abscission zone FRF must be high enough that the fruit does not abscise from the pedicel.

Stem Abscission Zones

- Upper Zone

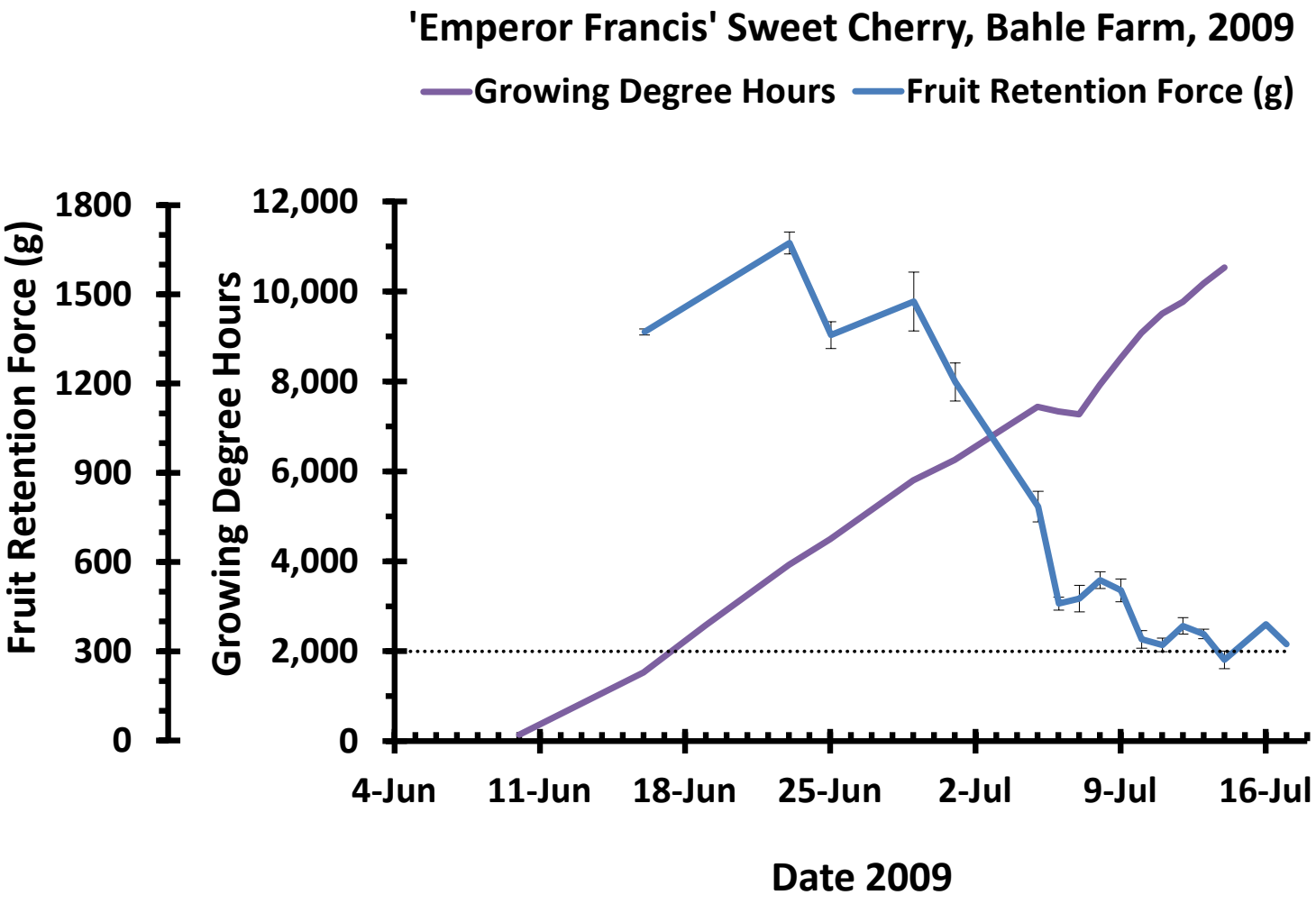
(‘Andersen’ stem separation was unusual)

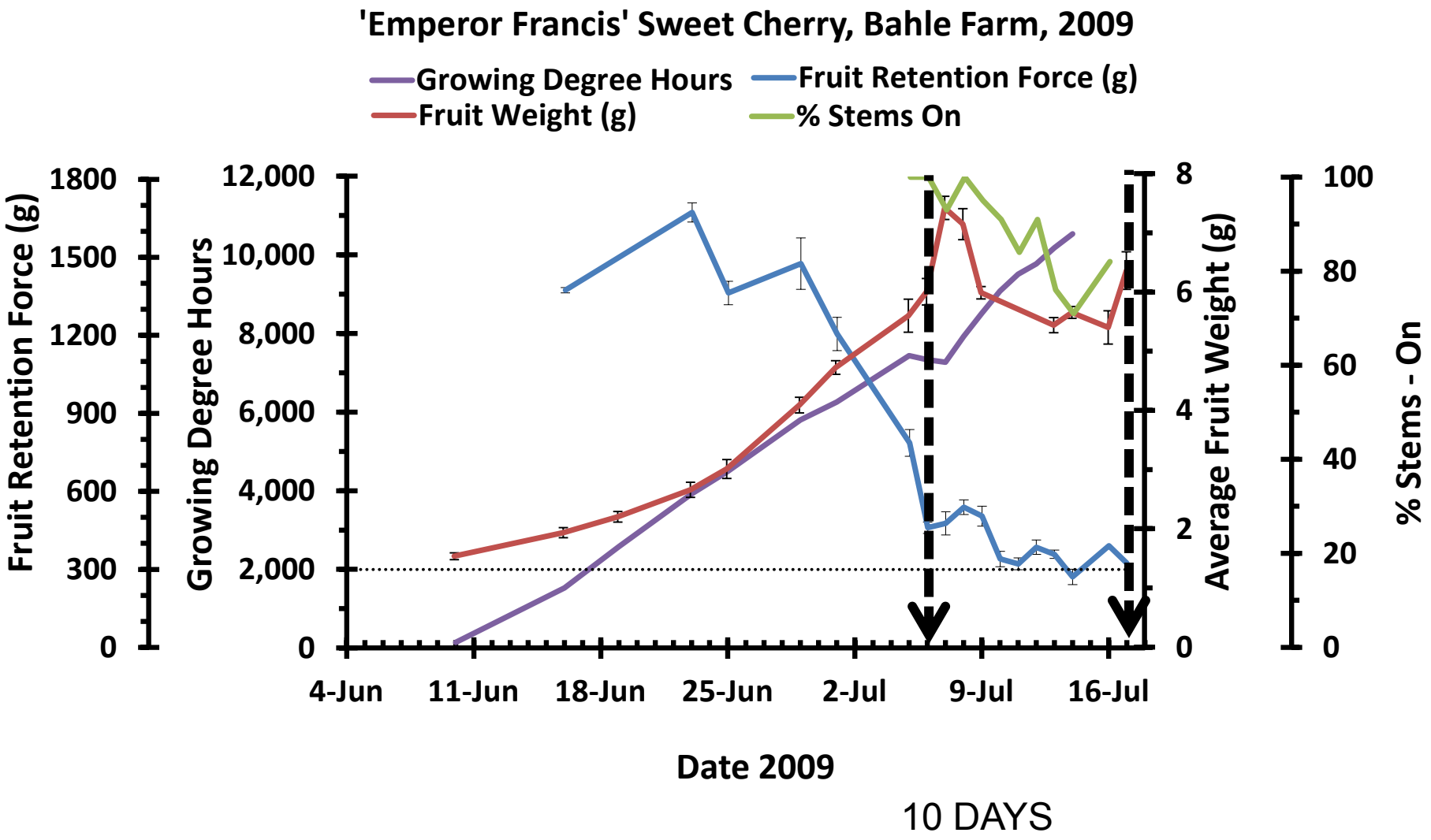
- Lower Zone

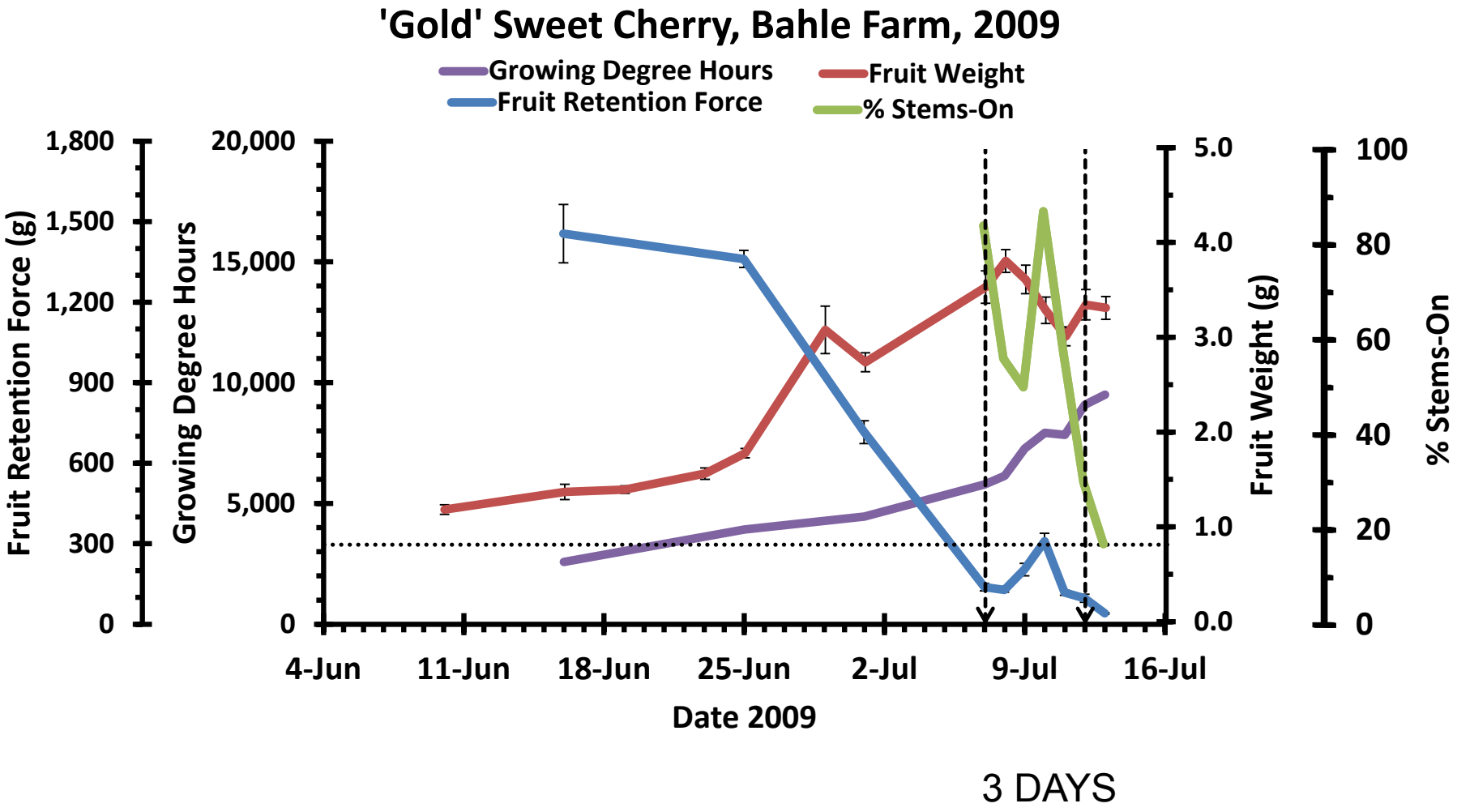


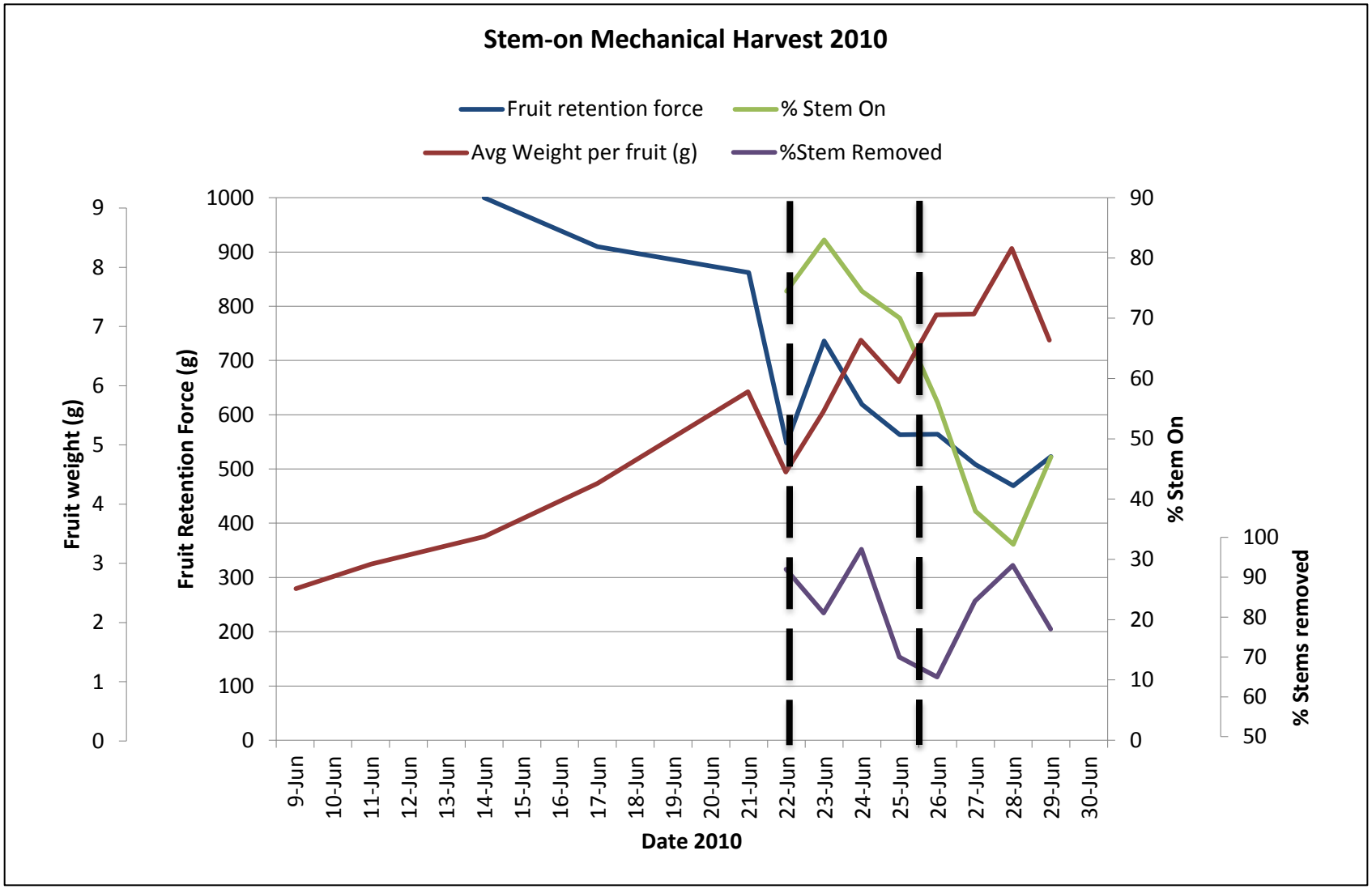
Experiment 1: Optimal Harvest Window Prediction Factors

- 2009,2010, 2011
- Measured Growing Degree Hours, fruit size, weight, soluble solids, and FRF (fruit-stem zone) of Emperor Francis, Gold, and Ulster


'Emperor Francis' Sweet Cherry, Bahle Farm, 2009
Growing Degree Hours
Fruit Retention Force (g)
Fruit Retention Force (g)
1800
1500
1200
900
600
300
0
Growing Degree Hours
12,000
10,000
8,000
6,000
4,000
2,000
0
4-Jun
11-Jun
18-Jun
25-Jun
2-Jul
9-Jul
16-Jul
Date 2009


'Emperor Francis' Sweet Cherry, Bahle Farm, 2009
Growing Degree Hours
Fruit Retention Force (g)
Fruit Weight (g)
% Stems On
Fruit Retention Force (g)
1800
1500
1200
900
600
300
0
Growing Degree Hours
12,000
10,000
8,000
6,000
4,000
2,000
0
Average Fruit Weight (g)
8
6
4
2
0
% Stems - On
100
80
60
40
20
0
4-Jun
11-Jun
18-Jun
25-Jun
2-Jul
9-Jul
16-Jul
Date 2009
10 DAYS

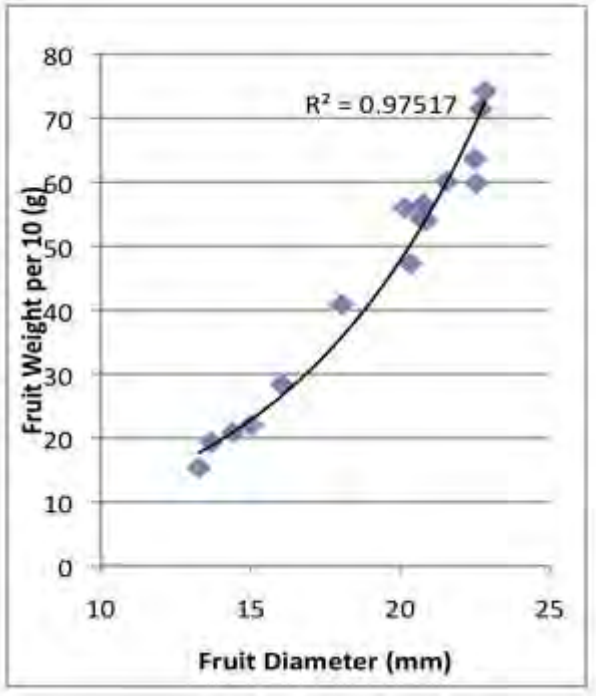

'Gold' Sweet Cherry, Bahle Farm, 2009
Growing Degree Hours
Fruit Weight
Fruit Retention Force
% Stems-On
Fruit Retention Force (g)
1,800
1,500
1,200
900
600
300
0
Growing Degree Hours
20,000
15,000
10,000
5,000
0
Fruit Weight (g)
5.0
4.0
3.0
2.0
1.0
0.0
% Stems-On
100
80
60
40
20
0
4-Jun
11-Jun
18-Jun
25-Jun
2-Jul
9-Jul
16-Jul
Date 2009
3 DAYS


Stem-on Mechanical Harvest 2010
Fruit retention force
% Stem On
Avg Weight per fruit (g)
%Stem Removed
Fruit weight (g)
Fruit Retention Force (g)
% Stem On
% Stems removed
Date 2010
9-Jun
10-Jun
11-Jun
12-Jun
13-Jun
14-Jun
15-Jun
16-Jun
17-Jun
18-Jun
19-Jun
20-Jun
21-Jun
22-Jun
23-Jun
24-Jun
25-Jun
26-Jun
27-Jun
28-Jun
29-Jun
30-Jun

3-4 DAYS

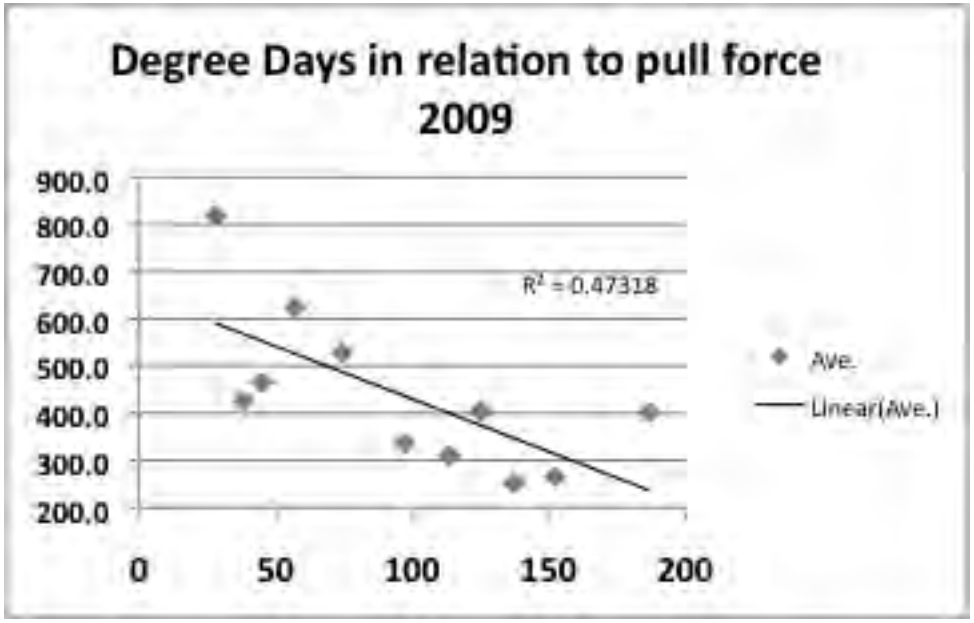
Stem-on in relation to fruit size

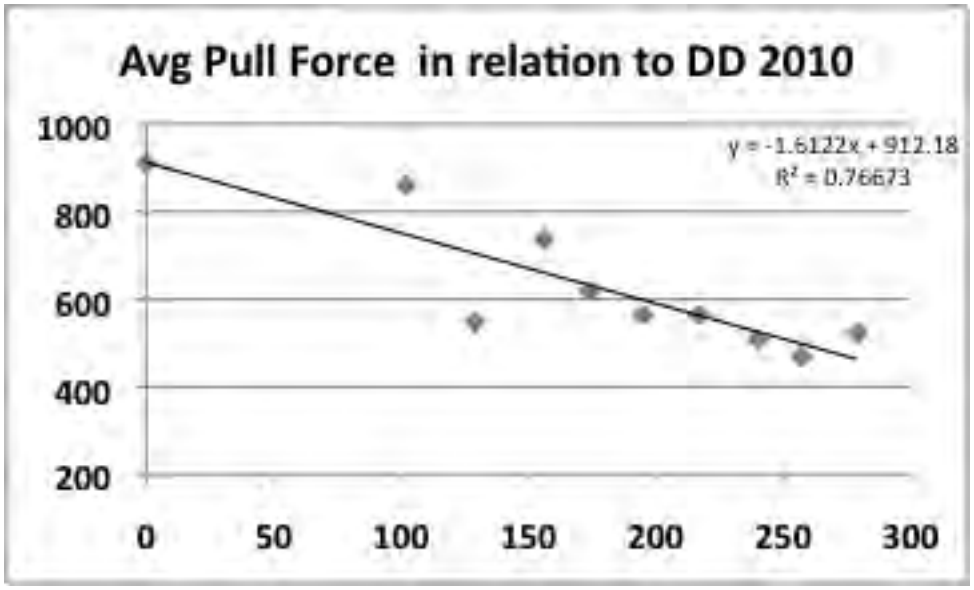
- Good Relationship between Fruit diameter and Fruit Weight.
- Can begin to harvest at 4.5 to 5 grams or 18-22 mm



2011

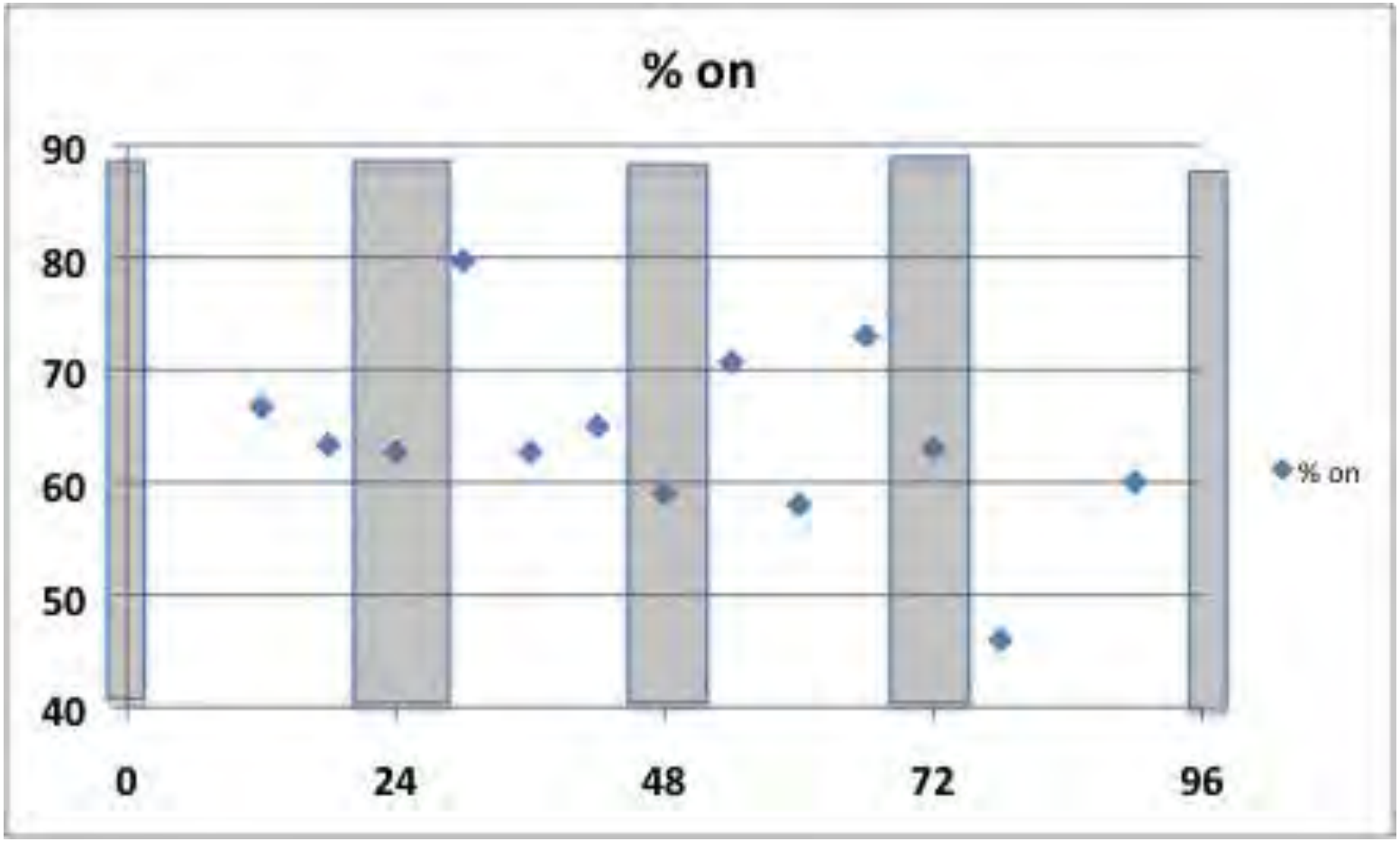
- Early year
- Harvest was ahead of normal
- Experiments: Harvest every day at Bahle,
- Determine if time of day has an affect on % Stem-on.


Degree Days in relation to pull force
2009
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
0
50
100
150
200
R² = 0.47318
Ave.
Linear(Ave.)


Avg Pull Force in relation to DD 2010
1000
800
600
400
200
0
50
100
150
200
250
300
y = -1.6122x + 912.18
R² = 0.76673

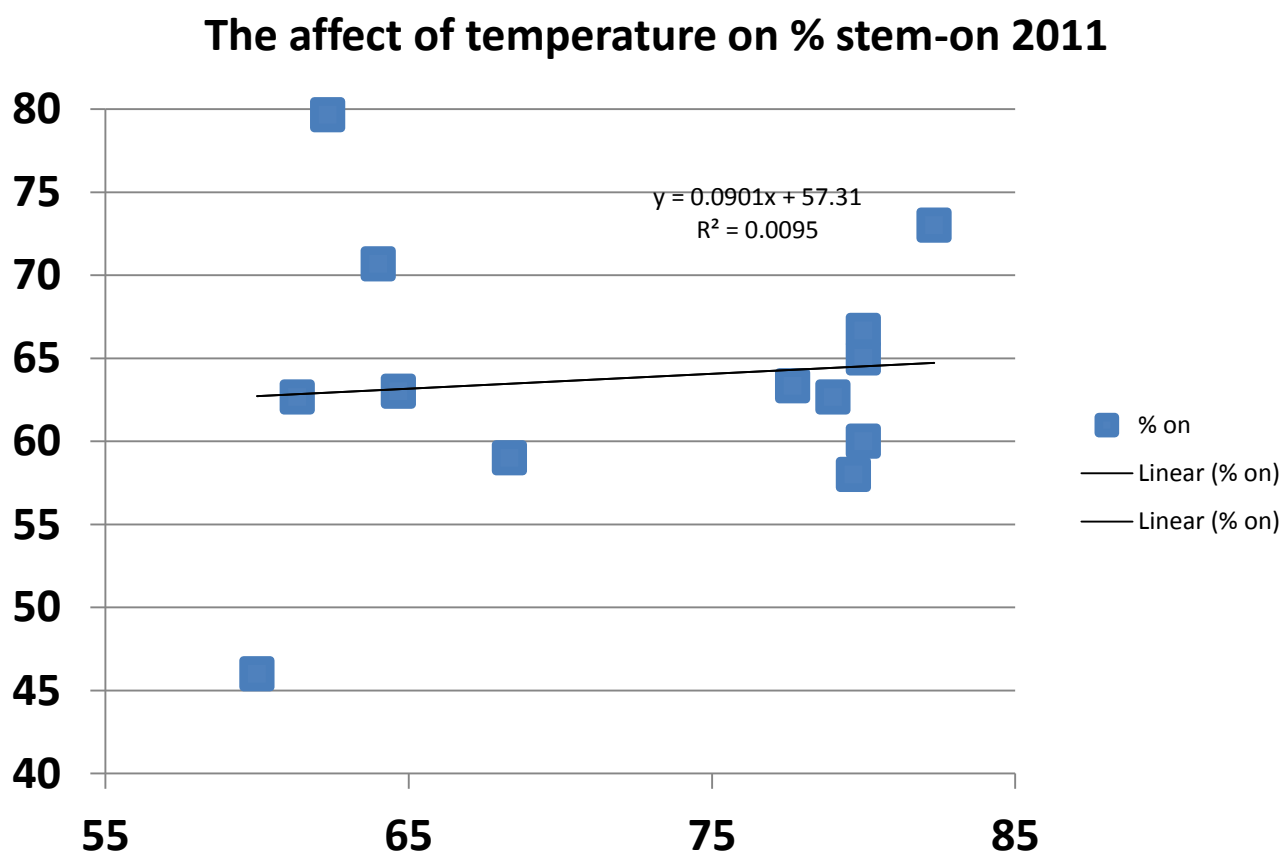
TIME OF DAY

Time of Day Study (24,48,72,96 = midnight) 2011

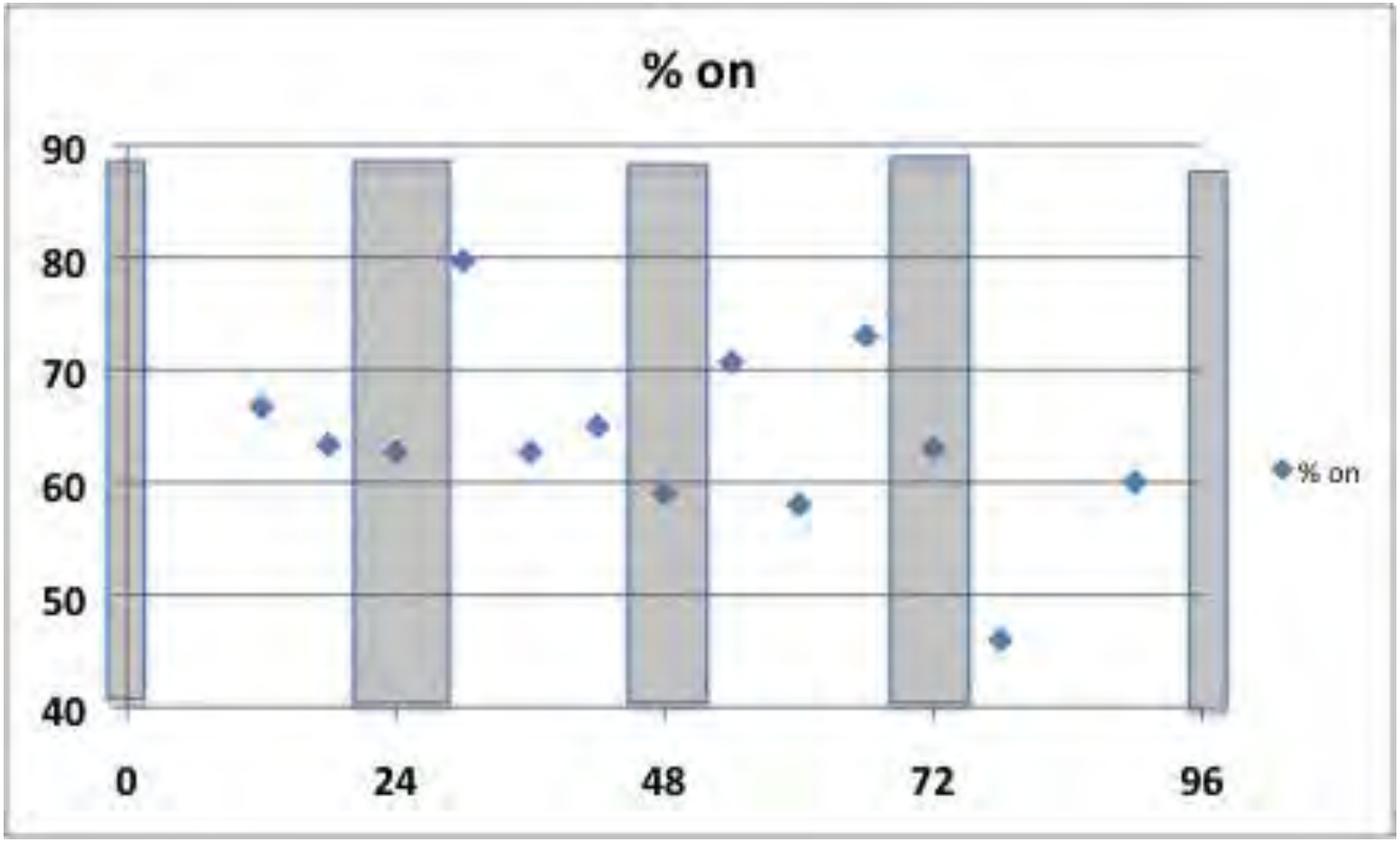


20.85 mm

23.04 mm


The affect of temperature on % stem-on 2011
80
75
70
65
60
55
50
45
40
55
65
75
85
y = 0.0901x + 57.31
R² = 0.0095
% on
Linear (% on)
Linear (% on)

Time of Day Study (24,48,72,96 = midnight) 2011



20.85 mm

23.04 mm

Early Recommendations

- 1. Be sure you have a home for the stem on fruit.
- 2. Choose the variety: Emperor Francis and Ulster were acceptable. Gold was not.
- 3. Prune the trees to stiffen them up.
- 4. Don’t use ethephon
- 5. Watch for a break in color of the fruit.
- 6. Begin harvest when fruit are 5-5.5 grams in weight.
- 7. Cool season is better than hot.