

Vermont AGRICULTURAL EXPERIMENT STATION

AN UPDATE OF RESEARCH AT THE UVM PROCTOR MAPLE RESEARCH CENTER

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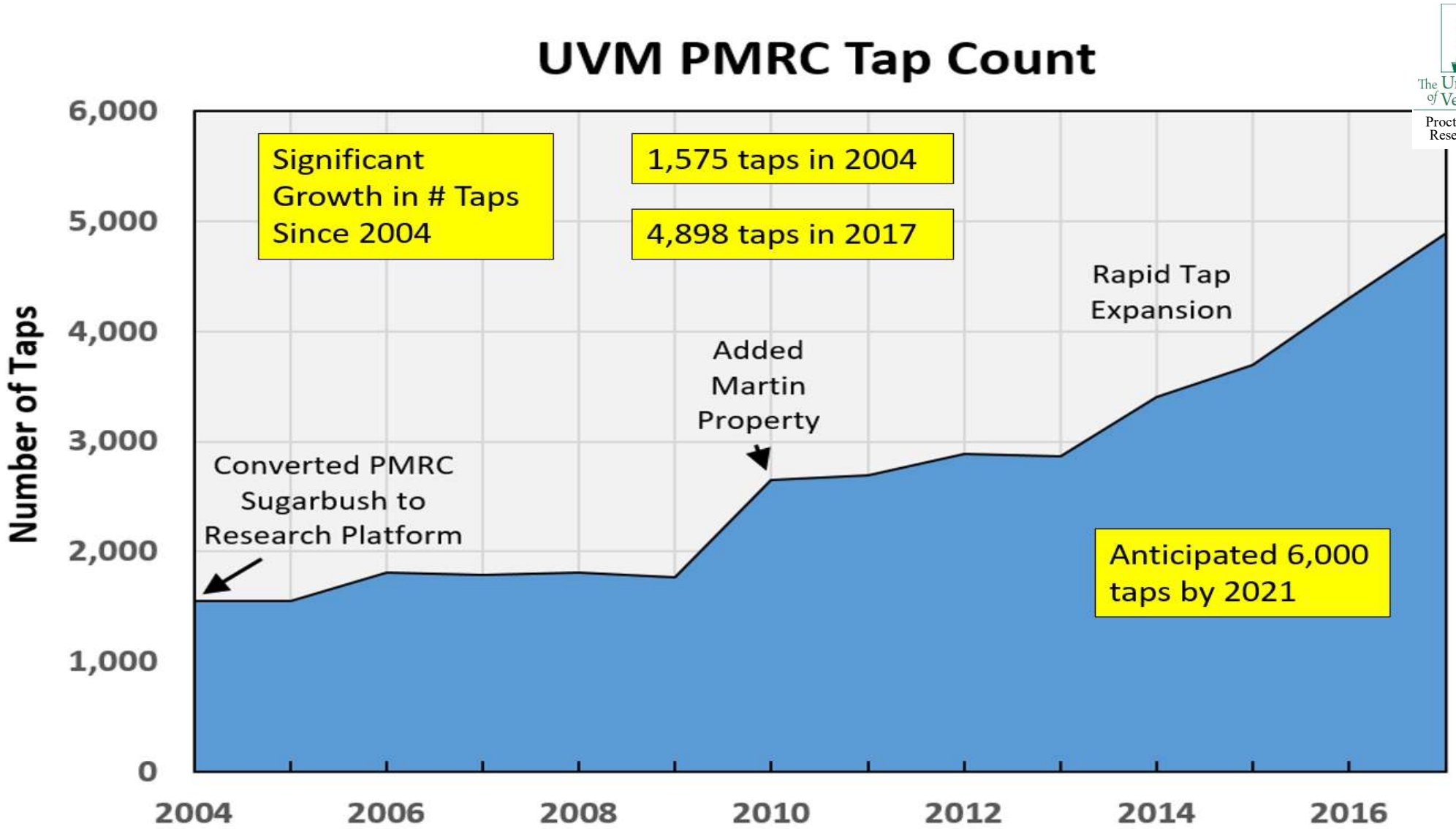
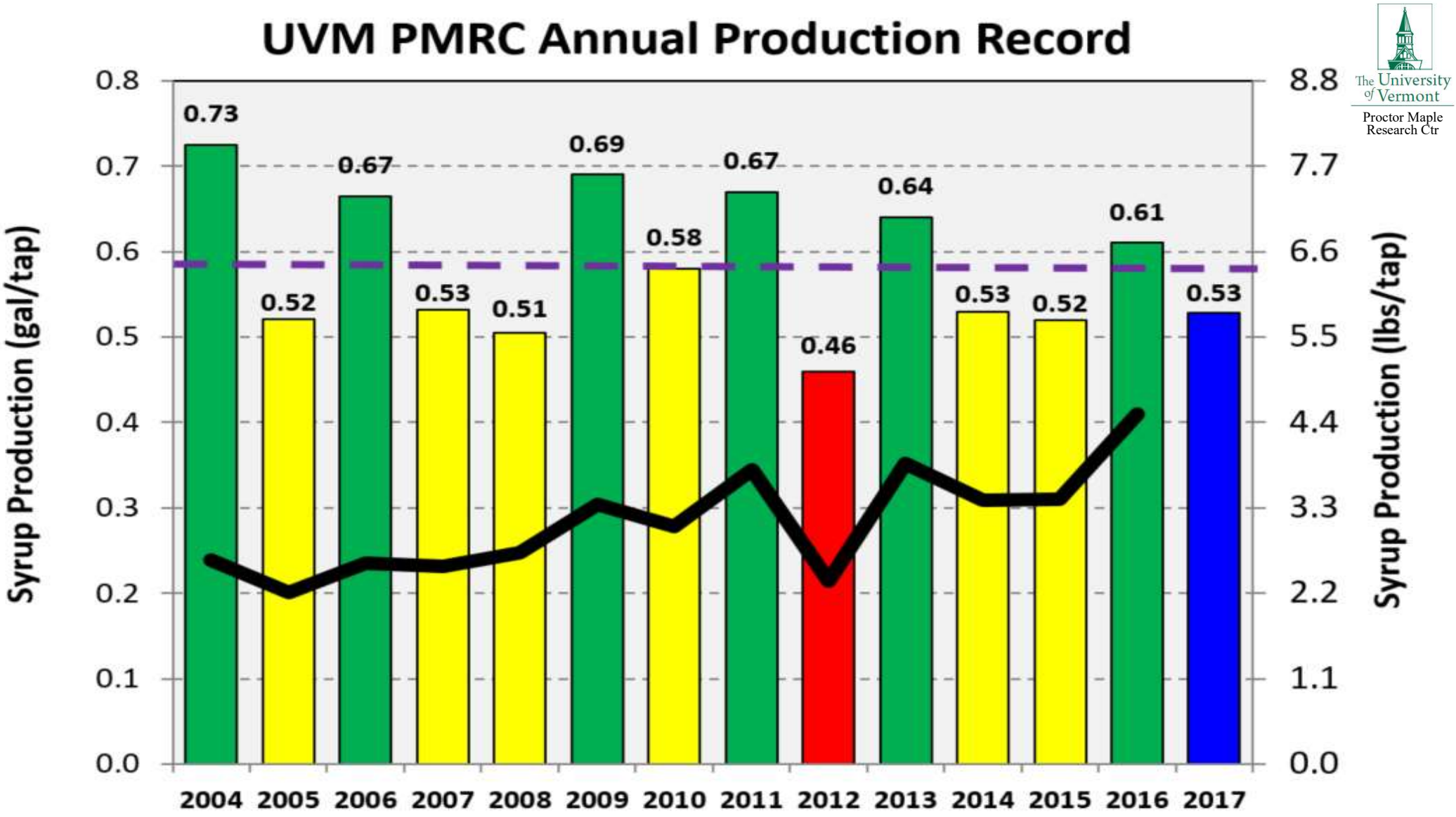
The University of Vermont EXTENSION



UVM PMRC Tap Count
The University of Vermont
Proctor Maple Research Ctr
Number of Taps
6,000
5,000
4,000
3,000
2,000
1,000
0
2004
2006
2008
2010
2012
2014
2016
Significant Growth in # Taps Since 2004
1,575 taps in 2004
4,898 taps in 2017
Rapid Tap Expansion
Added Martin Property
Converted PMRC Sugarbush to Research Platform
Anticipated 6,000 taps by 2021


UVM PMRC Annual Production Record
The University of Vermont
Proctor Maple Research Ctr
Syrup Production (gal/tap)
Syrup Production (lbs/tap)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1.1
2.2
3.3
4.4
5.5
6.6
7.7
8.8
0.73
0.52
0.67
0.53
0.51
0.69
0.58
0.67
0.46
0.64
0.53
0.52
0.61
0.53
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

Partnership with Lapierre Equipment 2017-2021

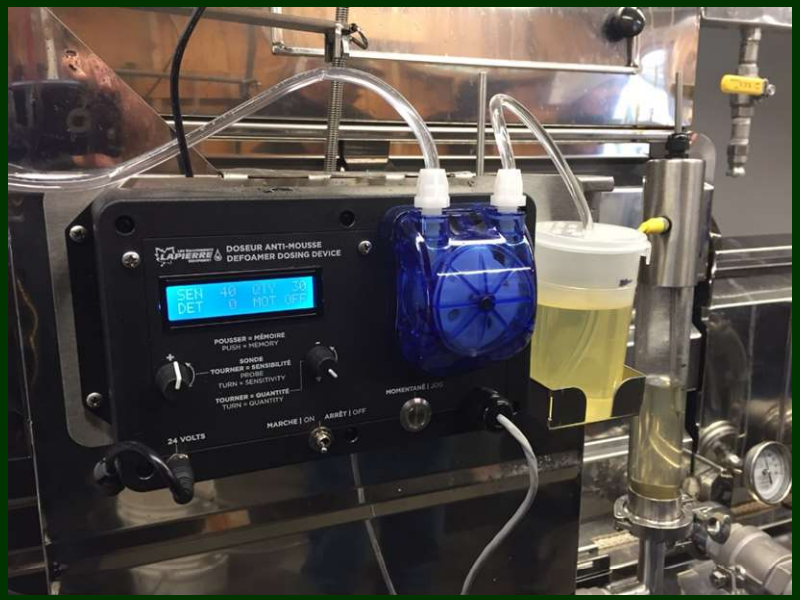
Five-Post HyperBrix Reverse Osmosis Machine

- 3 standard membranes
- 2 HyperBrix membranes
- Wash tank, Sap Pre-filter

Lapierre Volcano 2000 4’ x 12’ Evaporator

- 4’ Backpan,
- 8’ Front Pan (2)
- Riello Variable Oil-Fired Burner
- Hot water heating coil
- Reverse-flow option
- Modulating Auto-draw
- Automatic Defoamer
- Draw-off tanks
- Front/Backpan washer
- Permeate tanks

General Results



Processed over 100,000 gal of sap

Concentrated to 26.2-35.6°Brix

Reduced total boil time by 25%

Reduced maximum boil length by 45%

Reduced oil consumption by 33% (0.27 gal oil/gal syrup)

Average syrup production rate of 38 gal/hour, maximum 50 gal/hr

Produced a total of 2,634 gal syrup

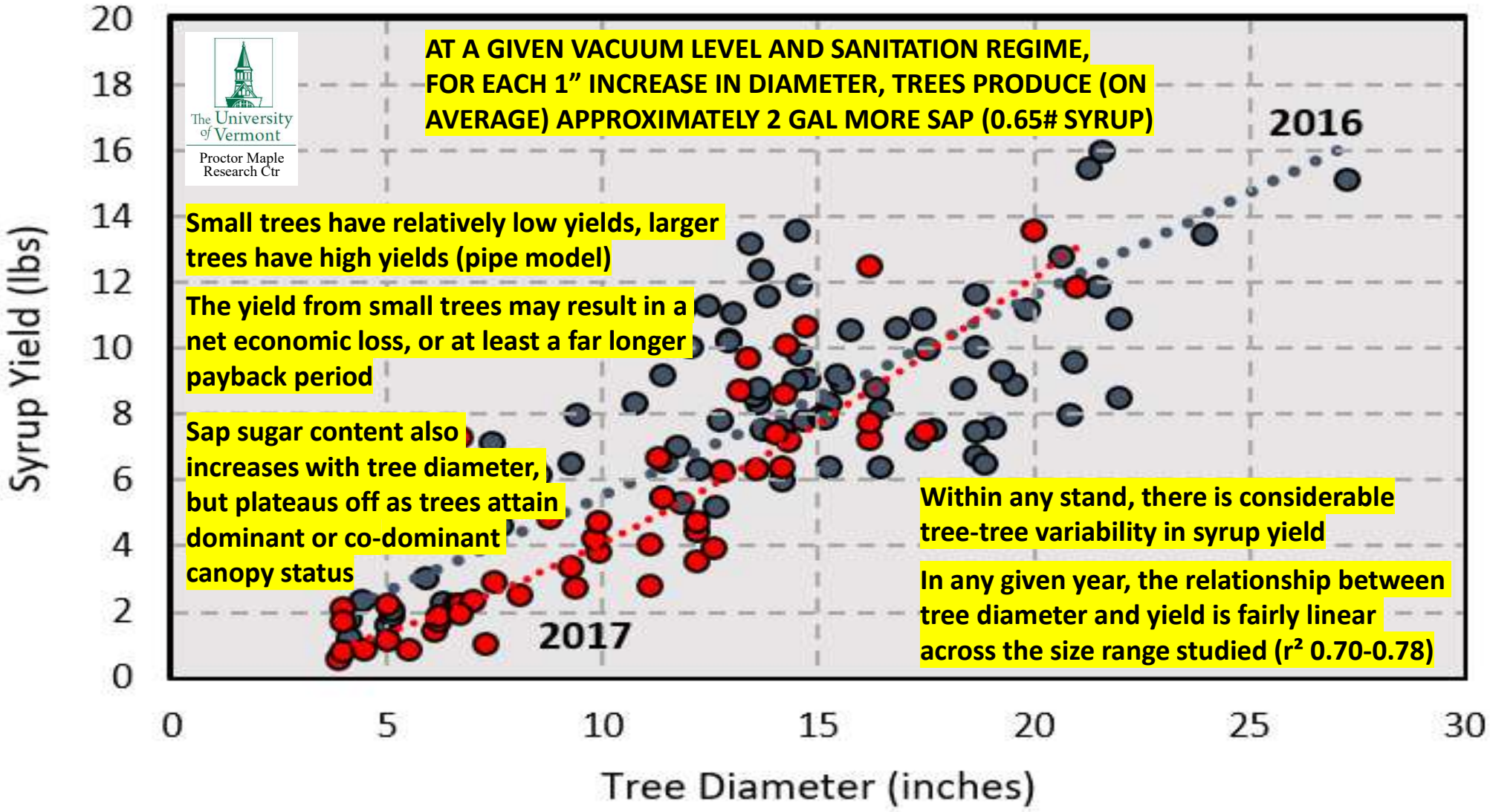
Used only 1/3 the amount of defoamer (organic safflower oil), foam was controllable through to the very end of the season

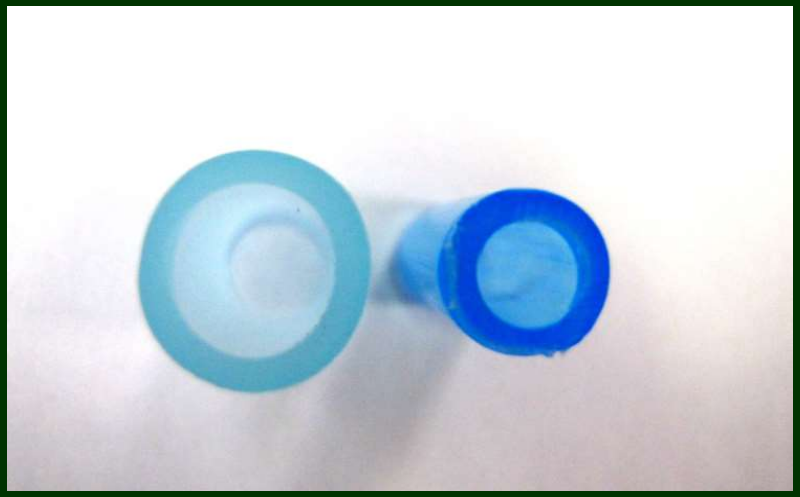
Planned Changes for 2018 Season

Refrigerated 600 gal concentrate tank
Motorized ball valves
Adding 6th post on RO
Inline refractometer on RO
New 2nd sap tank for main bush
New primary permeate tank
New “hot” permeate tank
Two new filter presses
Washable sugarhouse walls
Pan washer recirculation tank
Water-jacketed canning unit
SS Double-sink
Tool/fabrication and parts storage area

Effects of Tree Characteristics on Sap Yield 2016 - 2017

- Examine the relationship between tree size (diameter) and crown position on sap yield
- Goal to determine economic factors and cost-benefit ratio related to tapping small trees
- High vacuum (25” Hg)
- Wide range of sizes spanning from below tapping guidelines to large trees
- Measured with vacuum chambers, some measured ~weekly, some 2X during season
- Both sap volume and sugar content measured

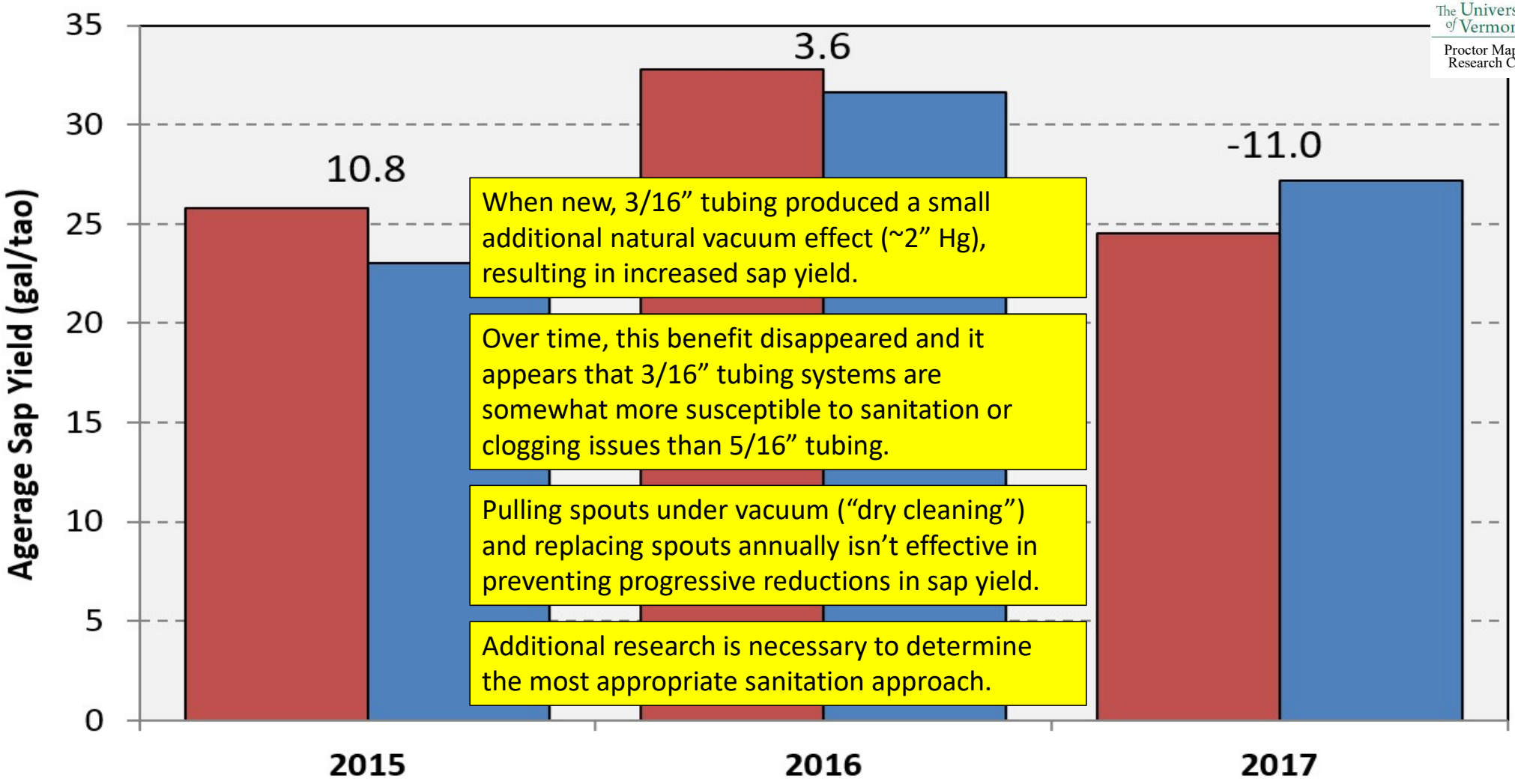

The University of Vermont
Proctor Maple Research Ctr
AT A GIVEN VACUUM LEVEL AND SANITATION REGIME, FOR EACH 1" INCREASE IN DIAMETER, TREES PRODUCE (ON AVERAGE) APPROXIMATELY 2 GAL MORE SAP (0.65# SYRUP)
2016
2017
Small trees have relatively low yields, larger trees have high yields (pipe model)
The yield from small trees may result in a net economic loss, or at least a far longer payback period
Sap sugar content also increases with tree diameter, but plateaus off as trees attain dominant or co-dominant canopy status
Within any stand, there is considerable tree-tree variability in syrup yield
In any given year, the relationship between tree diameter and yield is fairly linear across the size range studied (r^2 0.70-0.78)
Syrup Yield (lbs)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
30
Tree Diameter (inches)



3/16” versus 5/16” Tubing in a High Vacuum System

- 25+”Hg
- Not optimized for 3/16”
- 5 taps/lateral
- Relatively short laterals
- Moderately steep
- “Dry cleaned” (pulled spouts with vacuum on)
- New standard spouts each year
- Sap volume measured continuously throughout season with custom mini-releasers

3/16” Tubing in High Vacuum System



When new, 3/16” tubing produced a small additional natural vacuum effect (~2” Hg), resulting in increased sap yield.

Over time, this benefit disappeared and it appears that 3/16” tubing systems are somewhat more susceptible to sanitation or clogging issues than 5/16” tubing.

Pulling spouts under vacuum (“dry cleaning”) and replacing spouts annually isn’t effective in preventing progressive reductions in sap yield.

Additional research is necessary to determine the most appropriate sanitation approach.

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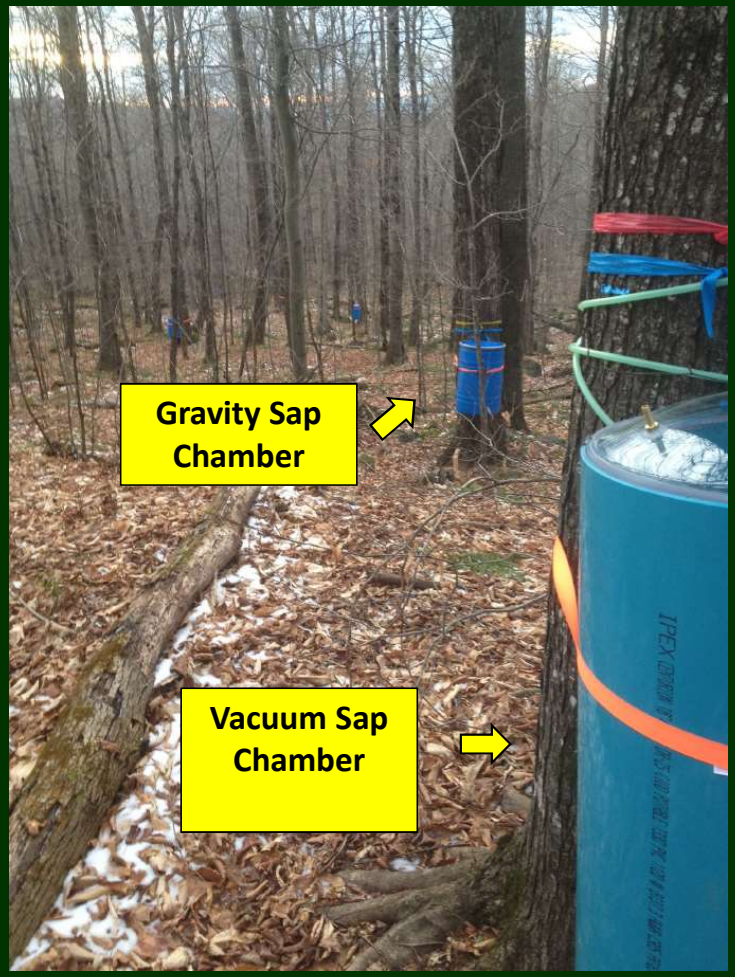
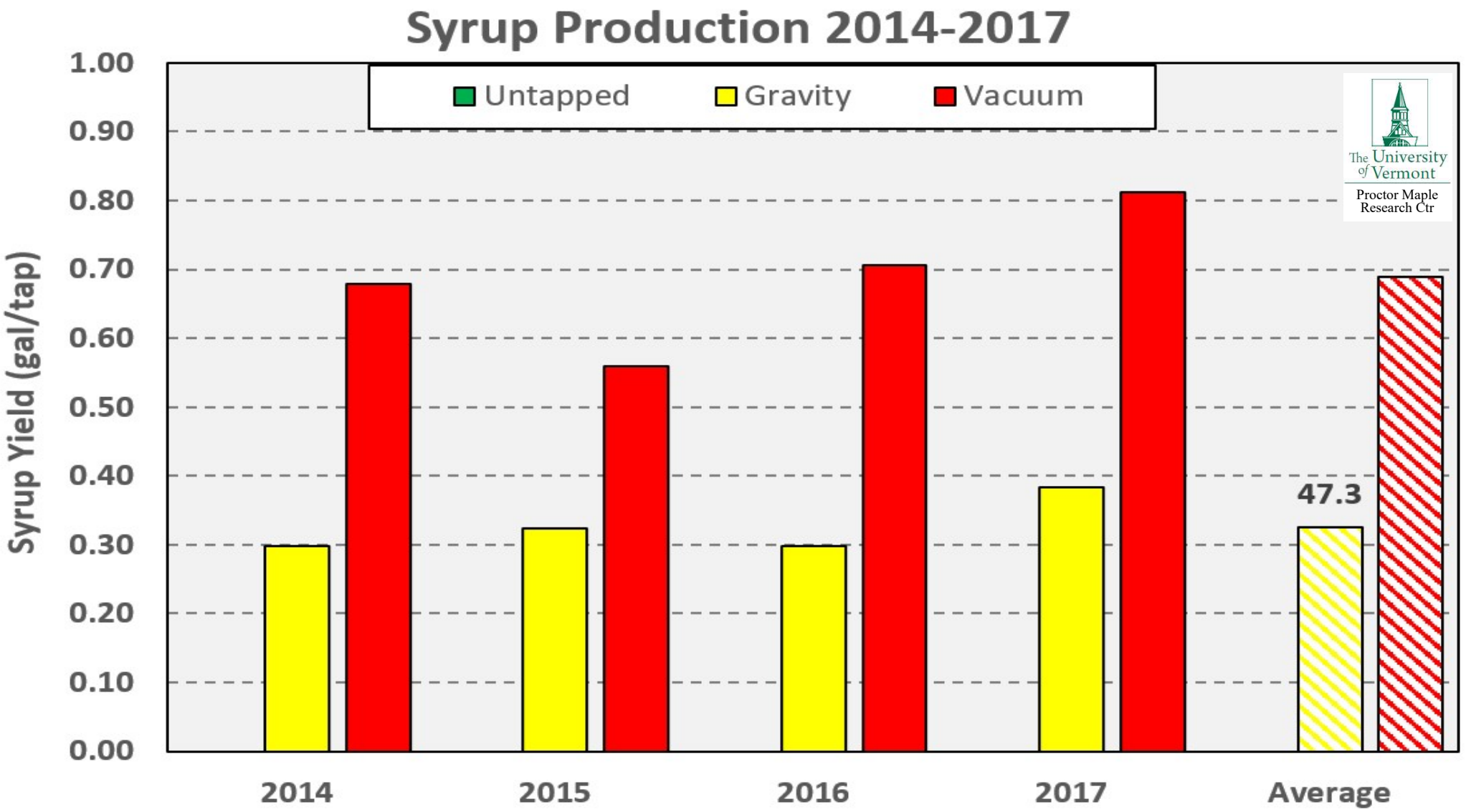
LTS - Effects of Sap Extraction on Tree Growth and Health



- 90 Trees
- Average 14.2” dbh in 2013 (within 0.6%)
- 3 Treatments
  - Untapped
  - Gravity Sap Collection
  - High-vacuum Sap Collection (25” Hg)
- Began in Fall 2013 (Starting Tree Diameter)
- Spring Measurements of Sap Yield and Sugar Content
- Fall Measurements of dbh and Taphole Closure
- Study Will Run 10+ Years


Syrup Production 2014-2017
Untapped
Gravity
Vacuum
The University of Vermont
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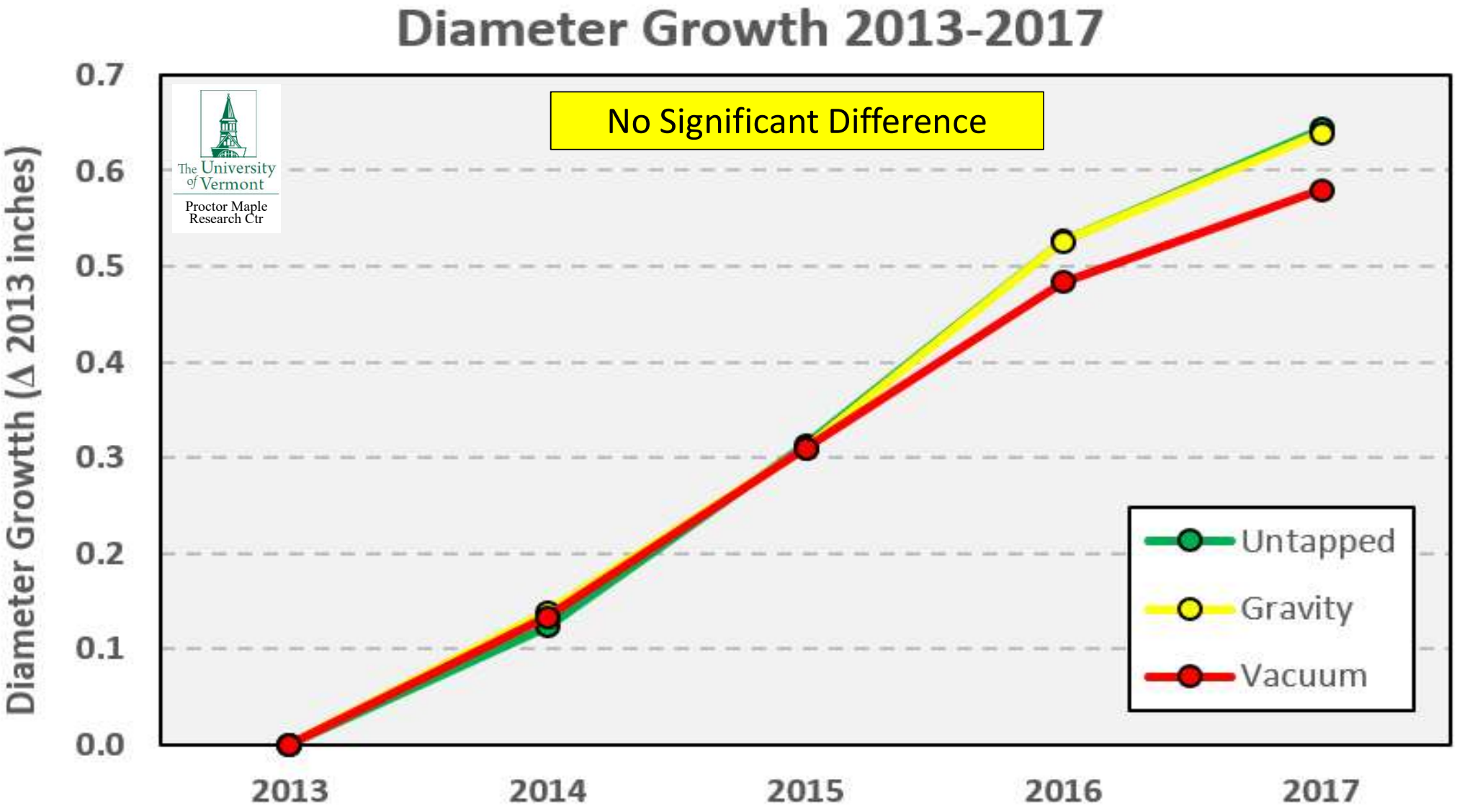
Syrup Yield (gal/tap)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
47.3
2014
2015
2016
2017
Average


Diameter Growth 2013-2017
The University of Vermont
Proctor Maple Research Ctr
No Significant Difference
Diameter Growth (Δ 2013 inches)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2013
2014
2015
2016
2017
Untapped
Gravity
Vacuum

ACER ACCESS & DEVELOPMENT PROGRAM

- Program Authorized Under the 2014 Farm Bill
  - Research and Education related to maple syrup production
  - Promotion of natural resource sustainability
  - Market promotion for maple syrup and maple sap
  - Encourage expansion and land-leasing
- $20M Annual Funding Approved
- No Funds Appropriated Until FY17, $1M – unknow whether it will continue
- Administered by USDA AMS (Agricultural Marketing Service)
- Request for Proposals Summer 2017
- Awards Announced September 30, 2017
  - University of Vermont Proctor Maple Res Ctr/UVM Extension $349k
  - West Virginia Dept of Agriculture $204k
  - Iowa State University $347k
- Projects Are All Primarily Focused on Producer Education
- 3 Year Grants Oct 2017-September 2020
- Initial Discussions Among Grantees to Coordinate Education Efforts

ACER ACCESS & DEVELOPMENT PROGRAM - UVM Project

The overall objective of the proposed project is to increase production per tap (yield) of maple syrup, increase total U.S. maple syrup production, and increase net revenue for producers throughout the maple producing region of the U.S. by increasing producer knowledge, awareness, and understanding of best, sustainable practices in maple production through the development and deployment of a multi-faceted education program and resources and to conduct new research to answer a critical need on sustainability of maple production given seasonal and climatic uncertainties.

- Develop a maple industry web portal to serve as an information hub for disseminating education to maple producers on best management practices (NAMSC Partner)
- Produce educational videos about maple production best management practices to increase yields per tap, total production, and net economic returns (Several Partners)
- Conduct research in critical areas to identify new maple tapping practices to increase and maintain yields and production given changing seasonal conditions and specific weather challenges
- Present research and information about best practices at maple conferences, meetings, and open-houses throughout the maple-producing region of the U.S.

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USDA AMS Funded

- Fall tapping – collect sap through spring
- Fall tapping (drilled deeper in spring)
- Early-winter tapping
- Early-winter tapping (drilled deeper in spring)
- Spring tapping (Control)

NAMSC Funded (Disastrous Seasons grant)

- Fall tapping 3/16" or 1/4" (reamed to 5/16" in spring)
- Fall tapping 3/16" or 1/4" (reamed to 5/16" and deeper)
- Fall tapping 5/16", capped/plugged with retapping (2" above previous taphole) in the spring

Lapierre Equipment Sponsor

Reaming – drilling out an existing taphole with a large diameter tapping bit later in the season

Deeper – drilling out an existing taphole to a deeper depth later in the season

Retapping – putting a second taphole in the same tree at a later time in the season

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Questions?