

***University of Vermont***  
***Proctor Maple Research Center***  
*Underhill Center, Vermont*

**Spout & Drop  
Sanitation –  
Which  
Approach  
Produces the  
Best Results**



***Vermont Maple  
Conferences 2018***

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<http://www.uvm.edu/~pmrc>

Dr. Timothy Perkins & Dr. Abby van den Berg, UVM Proctor Maple Res Ctr  
Steve Childs – Cornell Maple Program



# UVM Proctor Maple Research Center

## Major Factors Affecting Sap Yield

### **Tapping Factors/Sustainability**

Size and Health of Tree

Growth Rate / Sugar Content

Number of Taps/Tree

Depth of Taphole

### **Vacuum**

System Design & Layout

System Installation

System Operation & Maintenance

### **Sanitation**

Spout, Tubing Replacement

Tubing Cleaning





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## Sanitation

*Goal is to improve  
sap yield and quality  
and increase producer  
net profit*

**Replacement** – “uncontaminated” material near tree  
(new drop effect, new spout effect, CV effect)

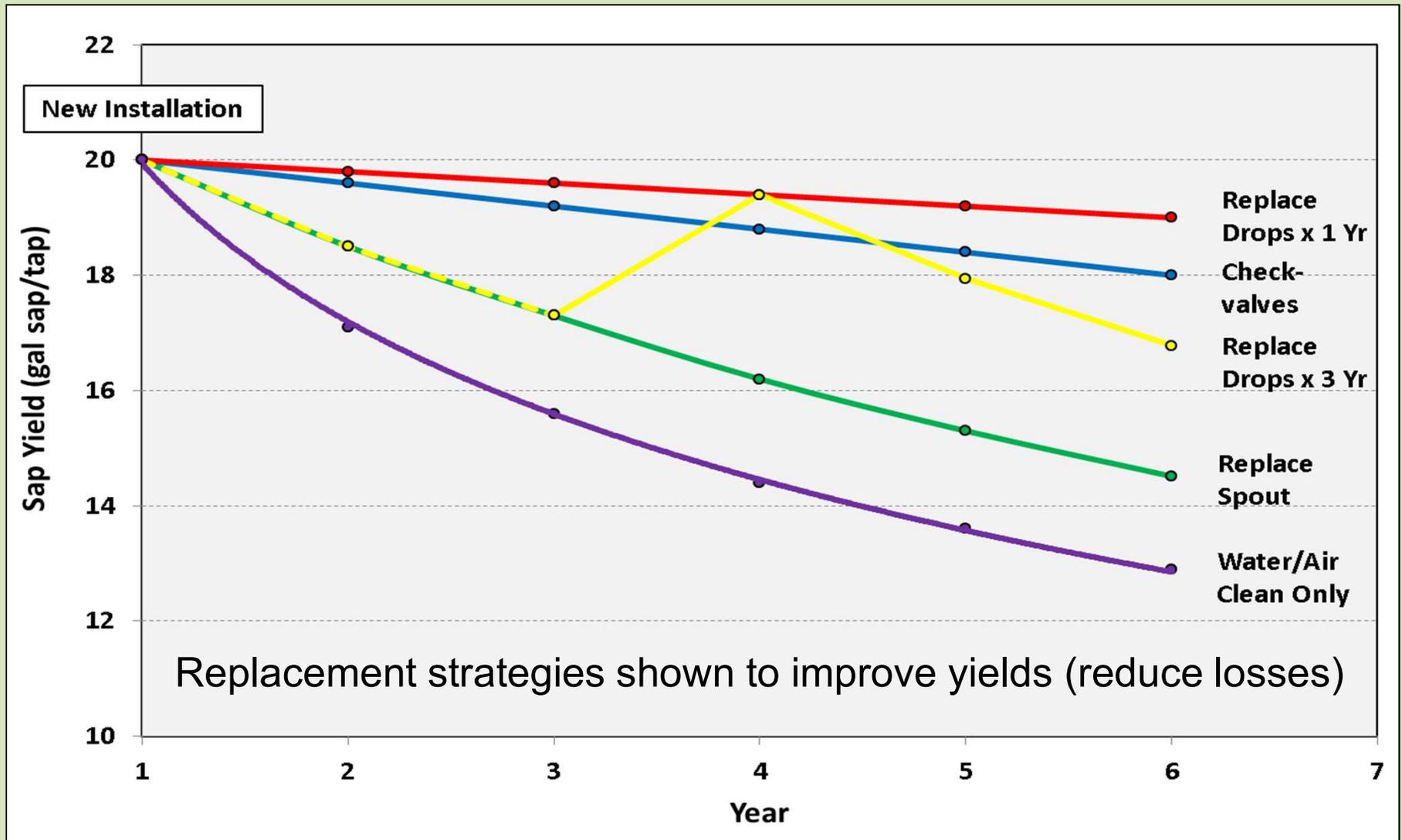
**Cleaning/Sanitation** – reduce contamination

- 1) Removal of debris (cleaning effect) *and*
- 2) Reduction in microbe level (sanitizing effect)



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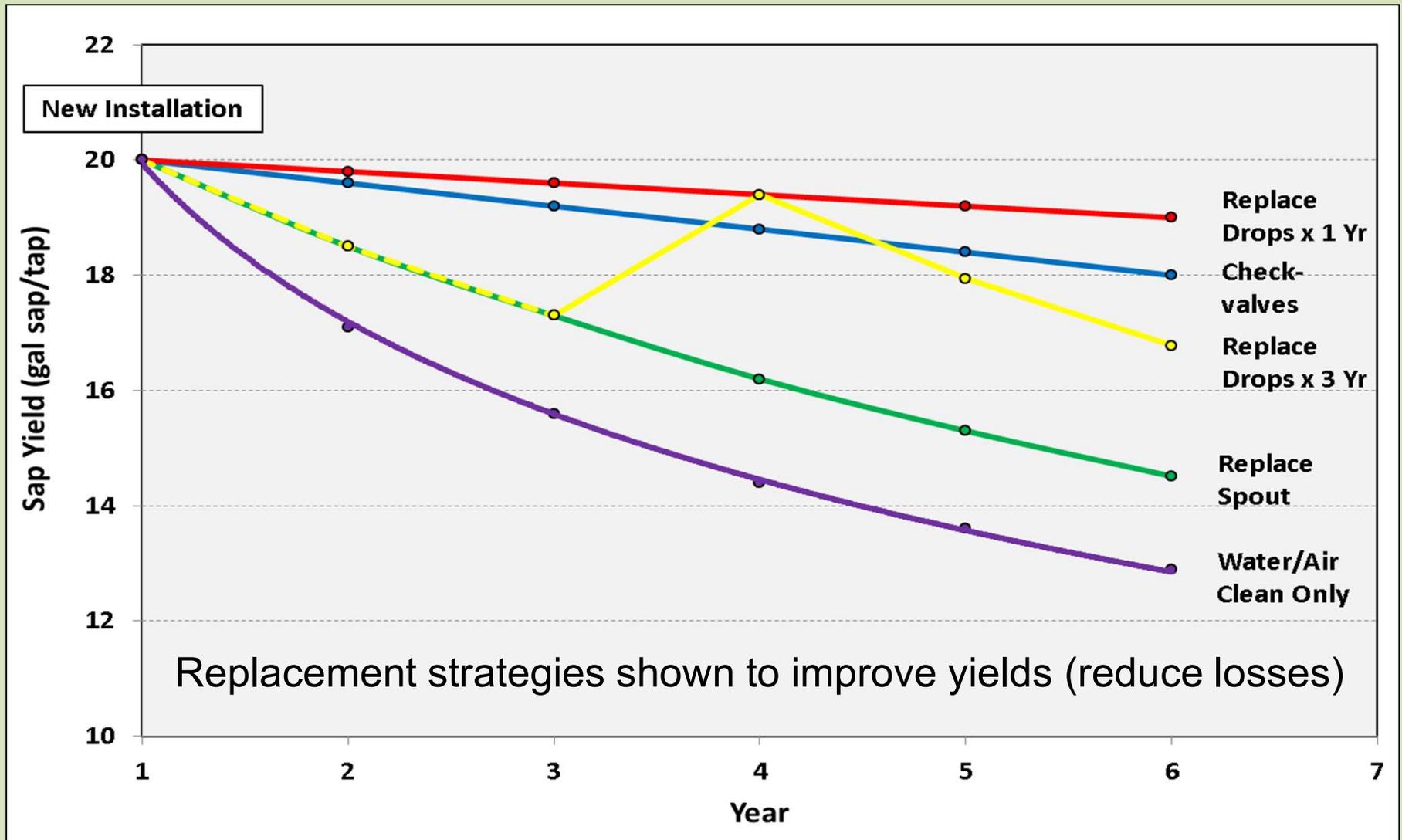
Sap yields decrease after tubing installation (microbial contamination)





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Sap yields decrease after tubing installation (microbial contamination)





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## Economic model of sap yield and replacement strategies

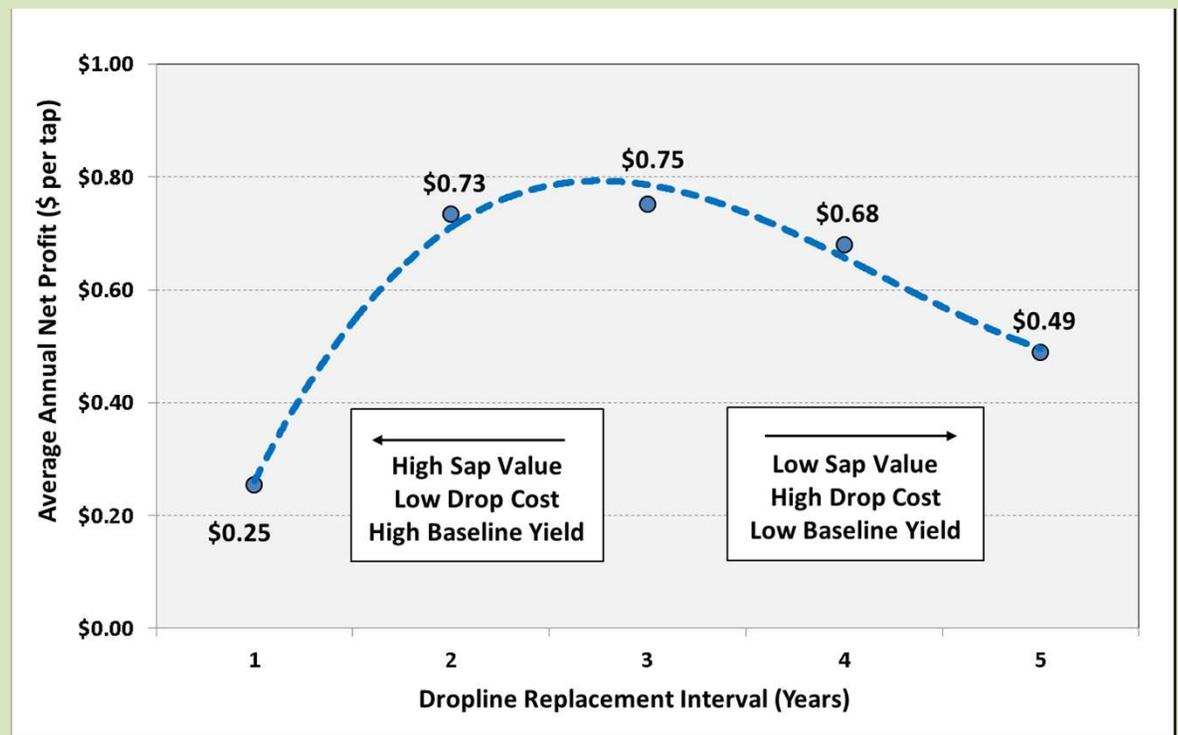
Input values – labor rate,  
baseline sap yields

Output net profit/loss for  
various strategies  
(replacing spouts,  
droplines, etc.)



Microsoft Excel  
Worksheet

<http://www.uvm.edu/~pmrc>



*Dr. Timothy Perkins*



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Economic model  
of sap yield and  
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strategies

Input values – labor  
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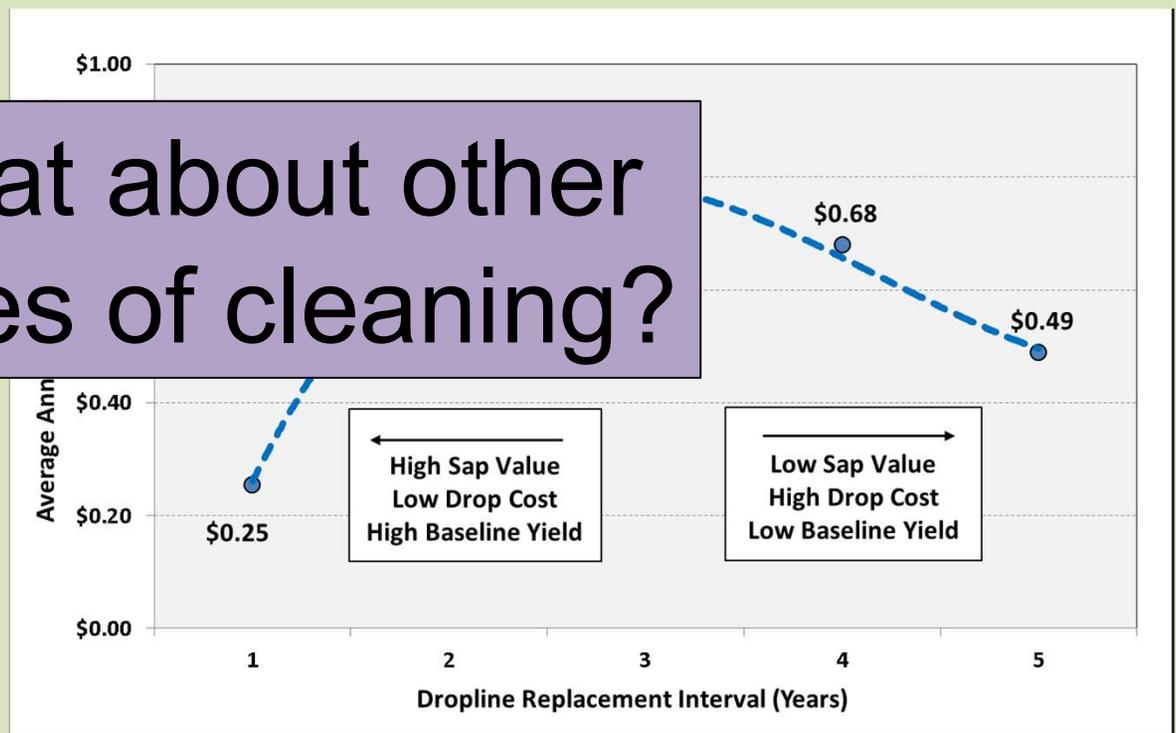
Output net profit/loss for  
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Microsoft Excel  
Worksheet

<http://www.uvm.edu/~pmrc>

What about other  
types of cleaning?



*Dr. Timothy Perkins*



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## Tubing Cleaning Research

### **Study Objective:**

Determine which tubing cleaning practice results in the greatest increase in yield and net value (versus control, no treatment)

Study at PMRC funded by the North American Maple Syrup Council (NAMSC) Research Fund  
(van den Berg and Perkins)



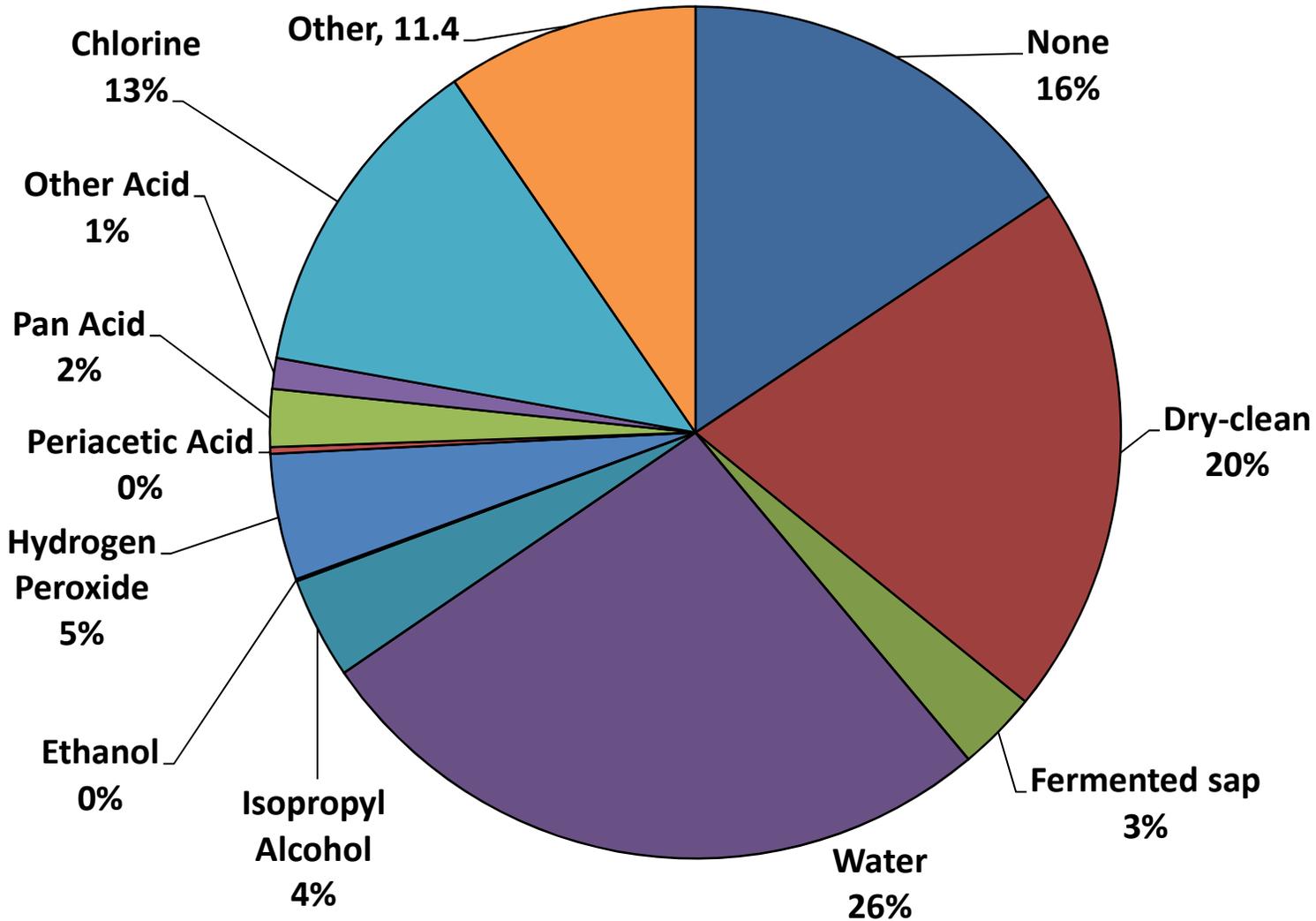
**Additional funding to expand study from  
Northeastern Sustainable Agriculture Research and Education (NESARE) grant:**  
Compare cleaning and replacement treatments and combinations  
Add additional year & replication site (Cornell Arnot Forest, Stephen Childs)  
Research Phase, Education Phase



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## Tubing Cleaning Methods

2013-2014 Survey Primarily U.S. & Ontario Producers

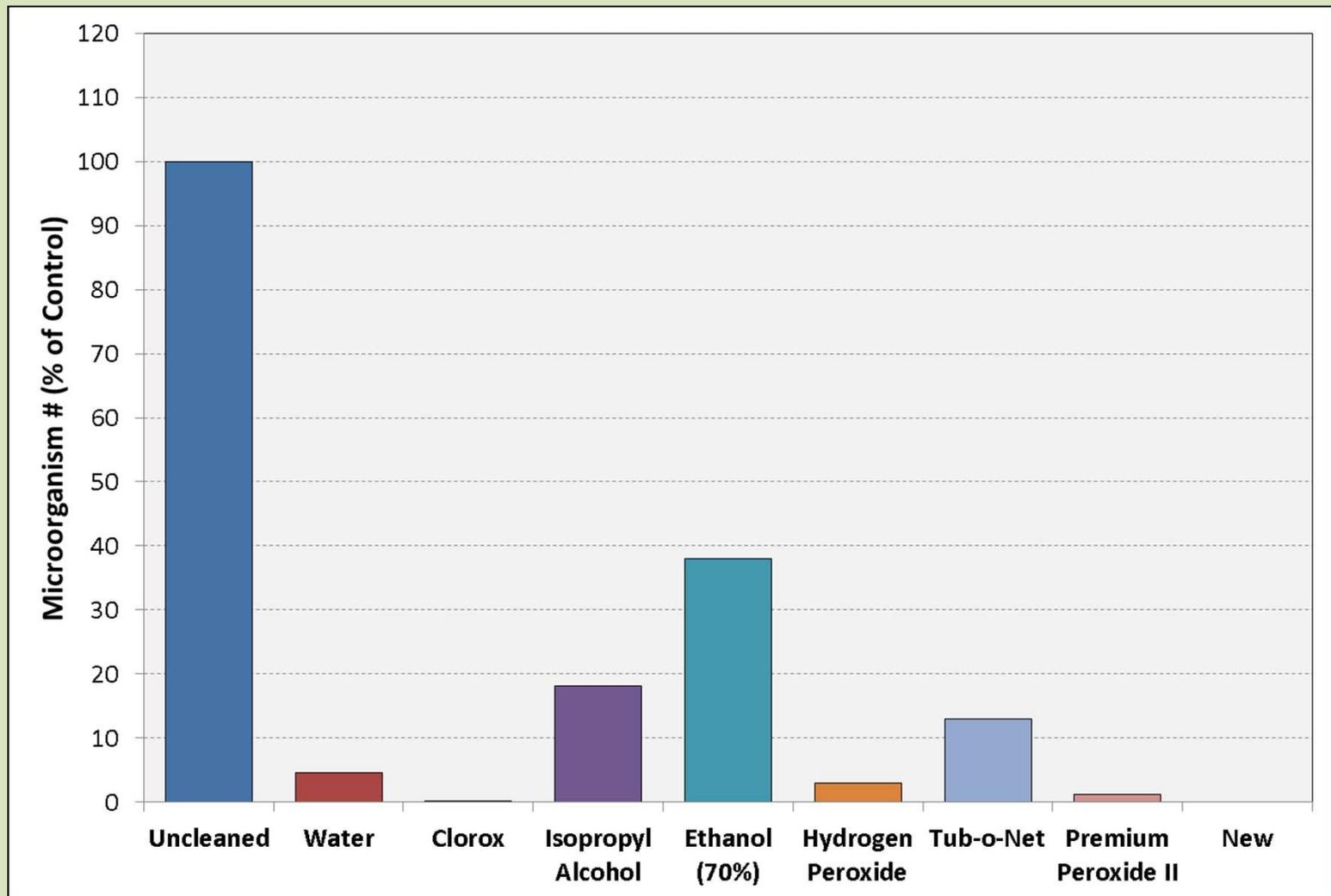




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## Preliminary studies:

Which cleaning treatments are most effective at reducing microbial counts?





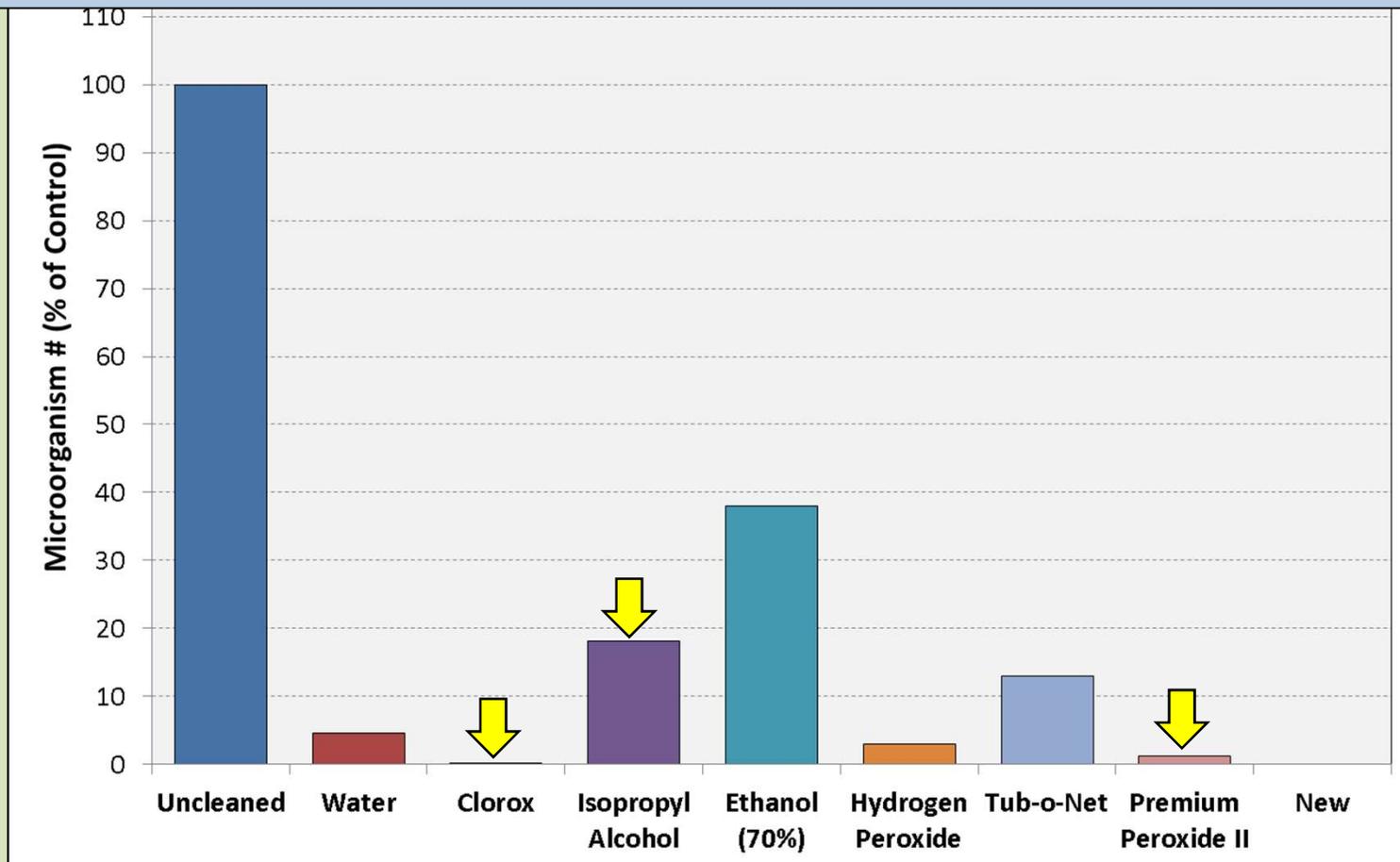
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## Cleaning Treatments Chosen:

Bleach (Calcium-based)

Premium Peroxide II (Hydrogen peroxide with periacetic acid)

Isopropyl Alcohol (70%)





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Cleaning, Replacement, Cleaning+Replacement:  
***11 treatments***

**Control (used dropline and spout)**

**Cleaning**

**Bleach (Calcium Hypochlorite)**

**Peroxide (Premium Peroxide II)**

**Isopropyl Alcohol (70%)**

**Replacement**

**Spout**

**Check-valve Spout**

**Dropline**

**Cleaning & Replacment**

**Clean with Bleach & Replace Spout**

**Clean with Peroxide & Replace Spout**

**Clean with Isopropyl Alcohol & Replace Spout**

**Rinse with Water & Replace Spout**



# Treatments

## PMRC

### ***Used:***

30P Droplines (6 Yrs)  
Darveau/H<sub>2</sub>O (6 Yrs)

### ***New:***

Lapierre ZML Clear  
Check-valve = Leader Clear CV

### ***Cleaning Treatments:***

15 ml of solution sucked into tubing  
Allowed to drain, plugged  
(Some IPA residue allowed to remain in tubing until installed)



## Cornell

### ***Used:***

30P Droplines (4 Yrs)  
Leader Adapter (2 Yrs)

### ***New:***

Leader Tree Saver  
CV = Leader CV Adapter

### ***Cleaning Treatments:***

Yr 1. Drops (tubing/spouts) immersed for 30 min then rinsed and installed  
Yr 2. System flooded with solution





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**44 plots - 3 trees per plot**  
(4 replications each of the 11 treatments)

UVM PMRC (Perkins & van den Berg)  
Cornell Arnot Forest (Childs)

Common vacuum source  
~25"Hg (PMRC), 19"Hg (Arnot)

Measured sap volume after each  
flow period throughout season

Total sap volume for each plot,  
average for each treatment

***Repeated in 2014 and 2015 seasons***



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## VACUUM CHAMBER STUDIES

Only at PMRC

Total of 110 trees (10 trees per treatment)

Same 11 Treatments

Average 11.5" dbh

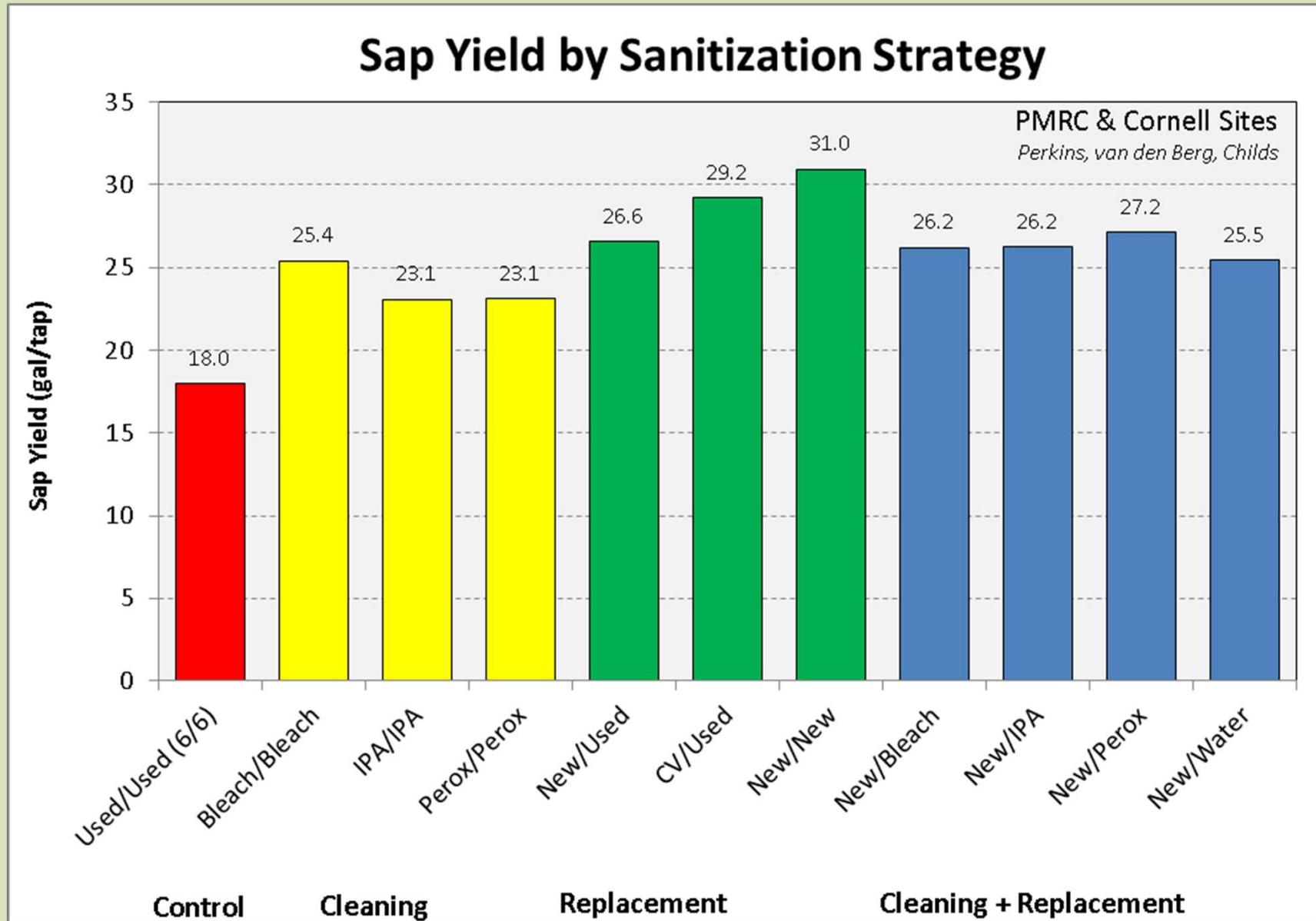
One chamber per tree

Common vacuum source (~25" Hg)

Measured sap volume after each flow period throughout the 2014 and 2015 seasons



# Results: 2014-2015

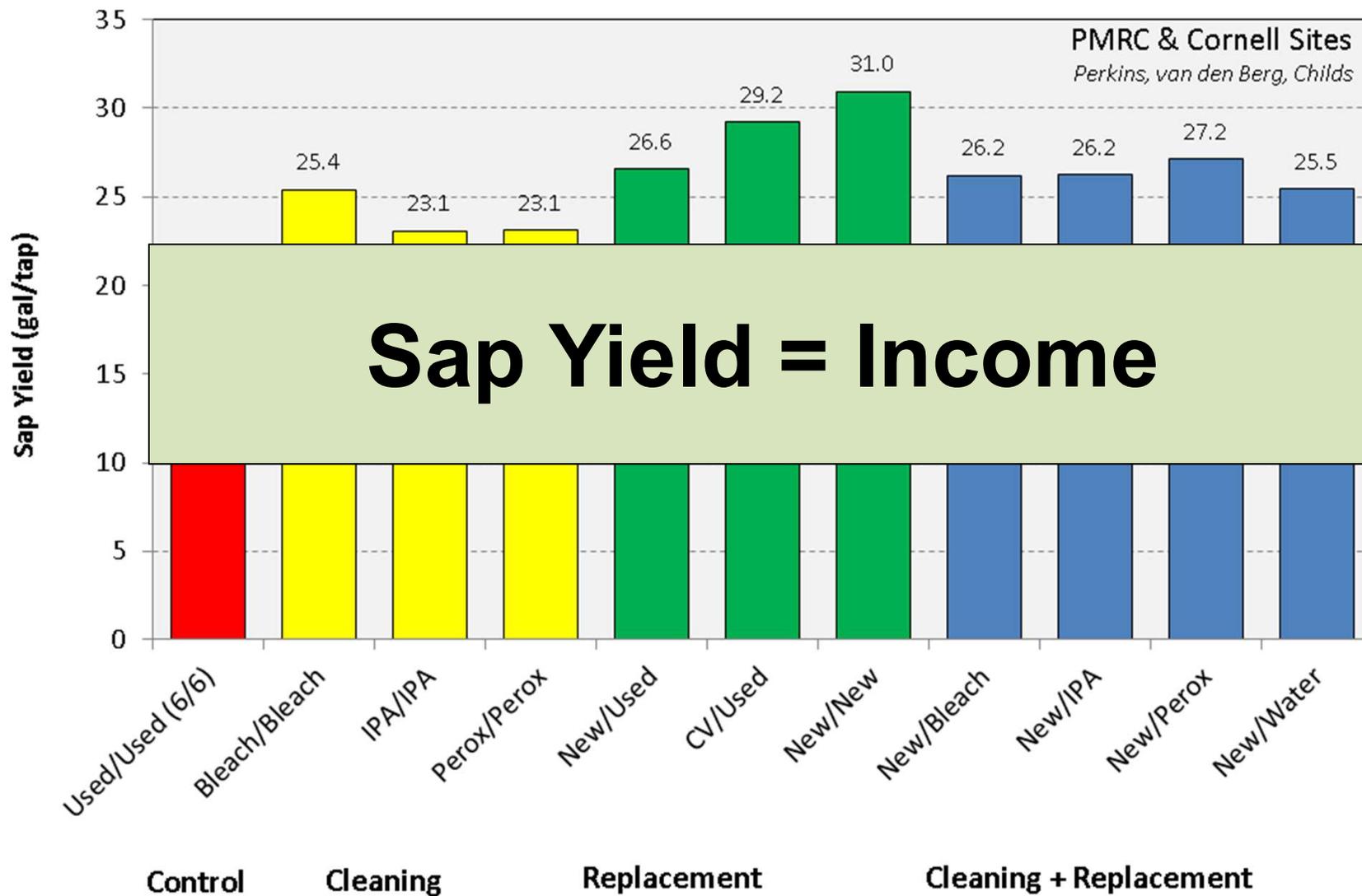




# Results: 2014-2015

## Sap Yield by Sanitization Strategy

PMRC & Cornell Sites  
*Perkins, van den Berg, Childs*

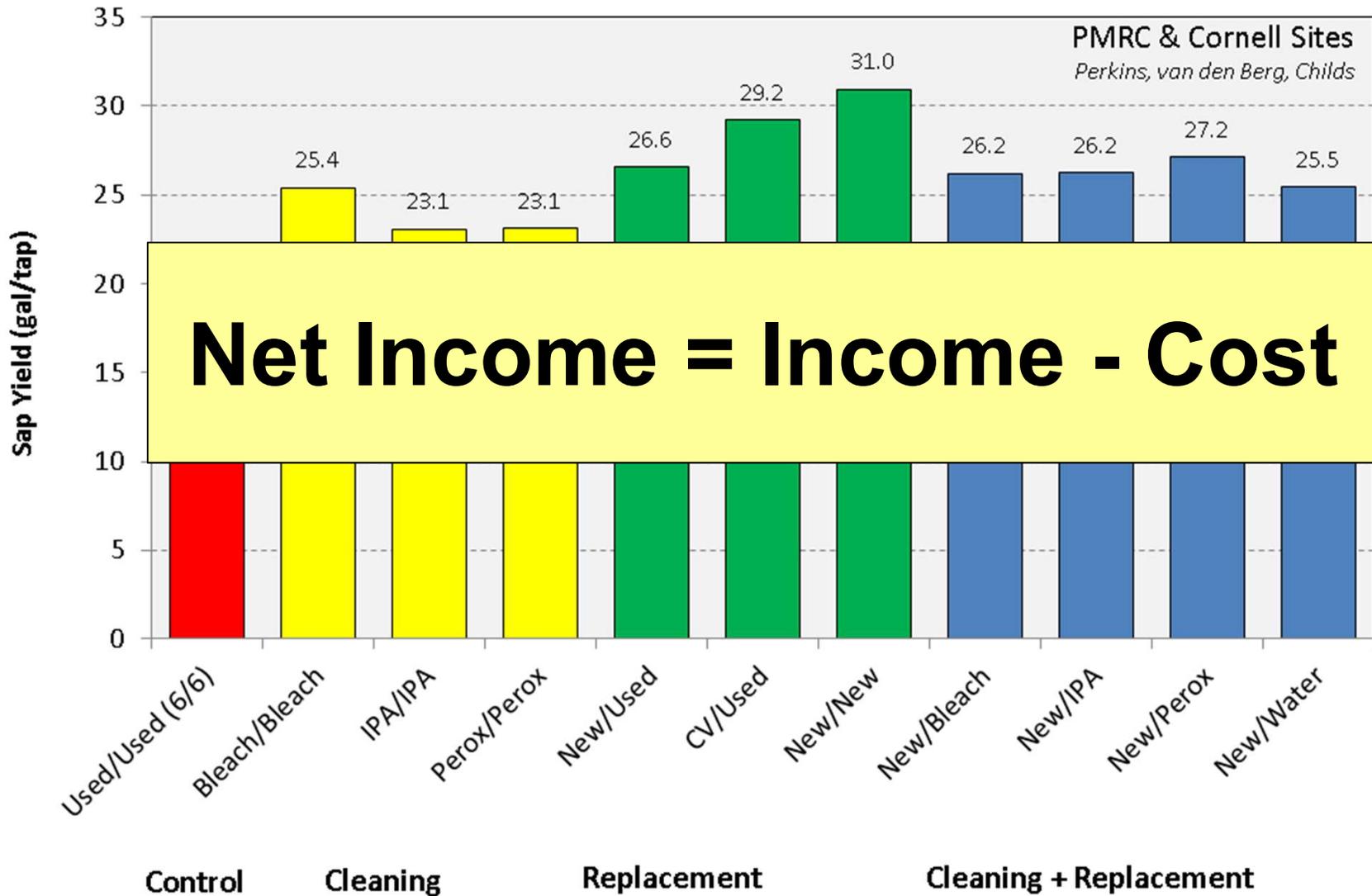




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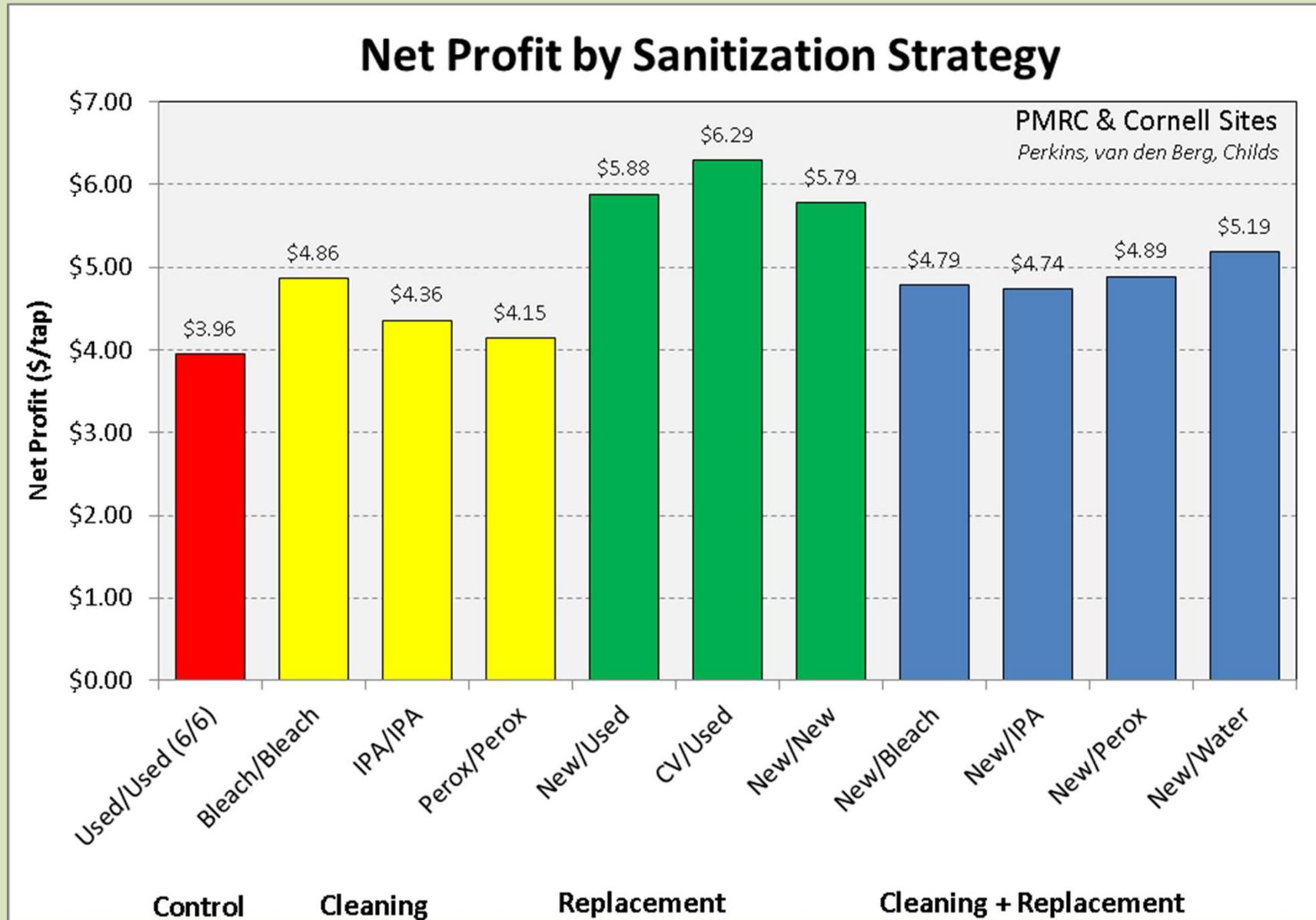


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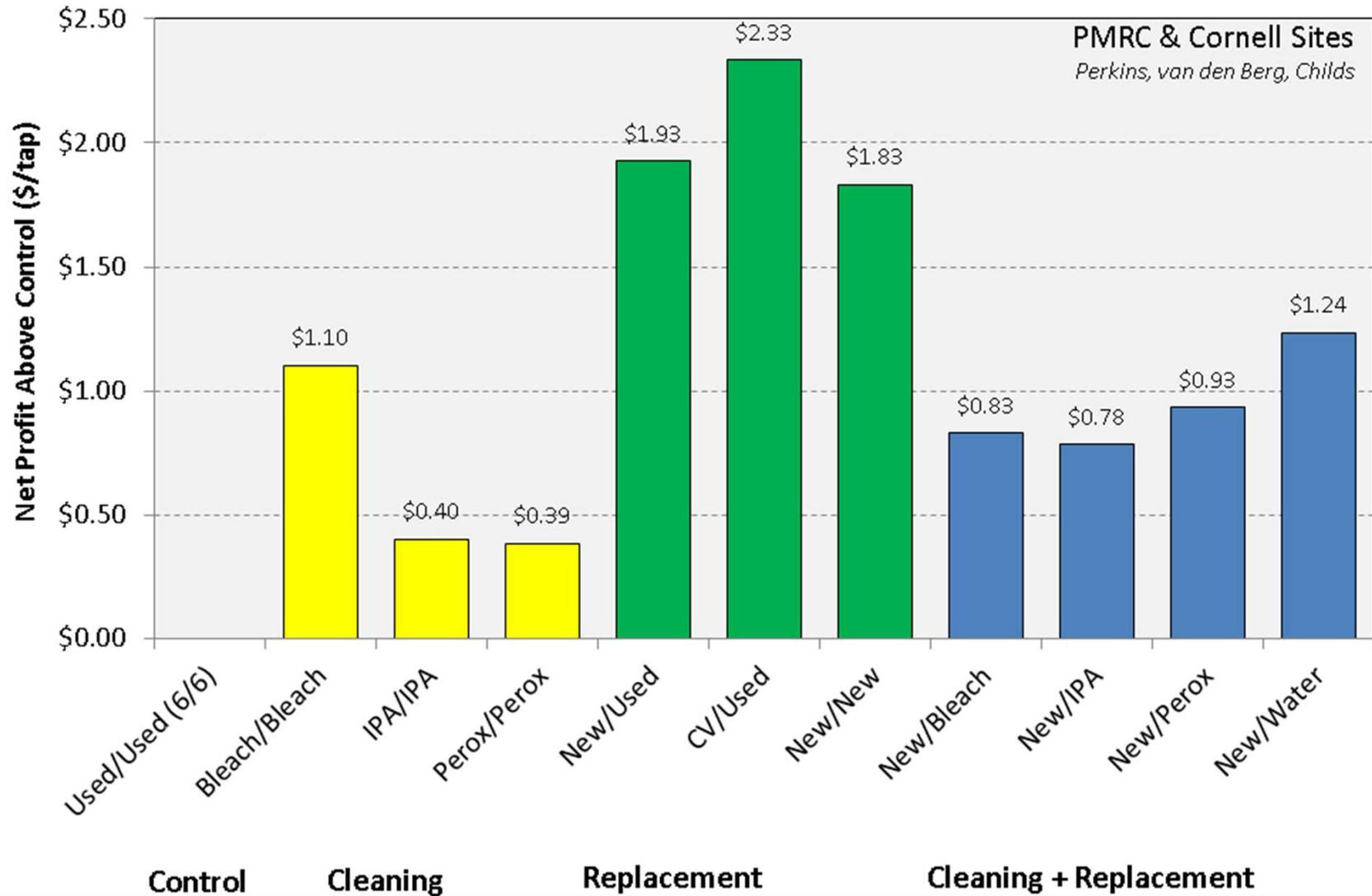
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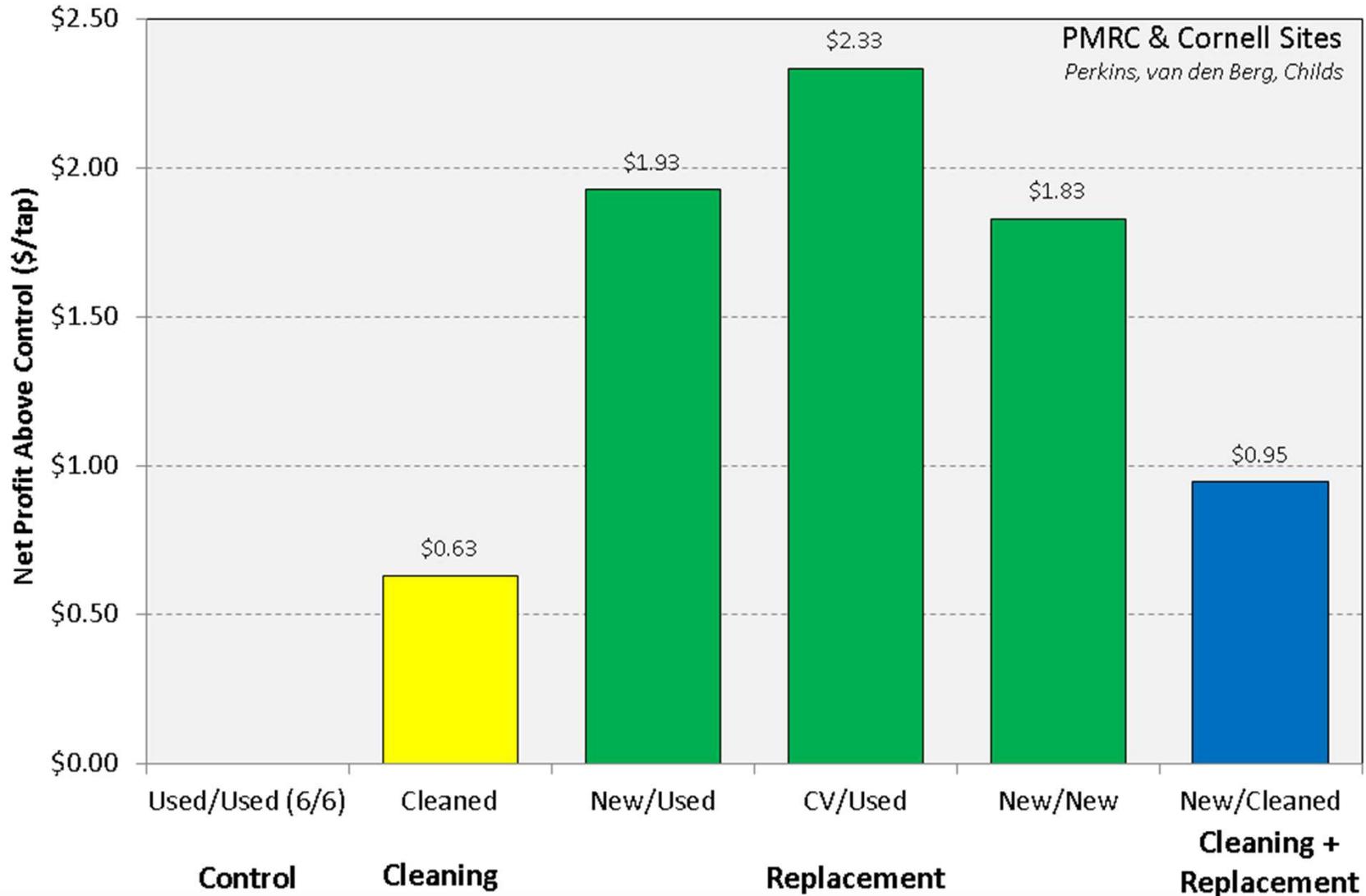
## Net Profit by Sanitization Strategy Above Control





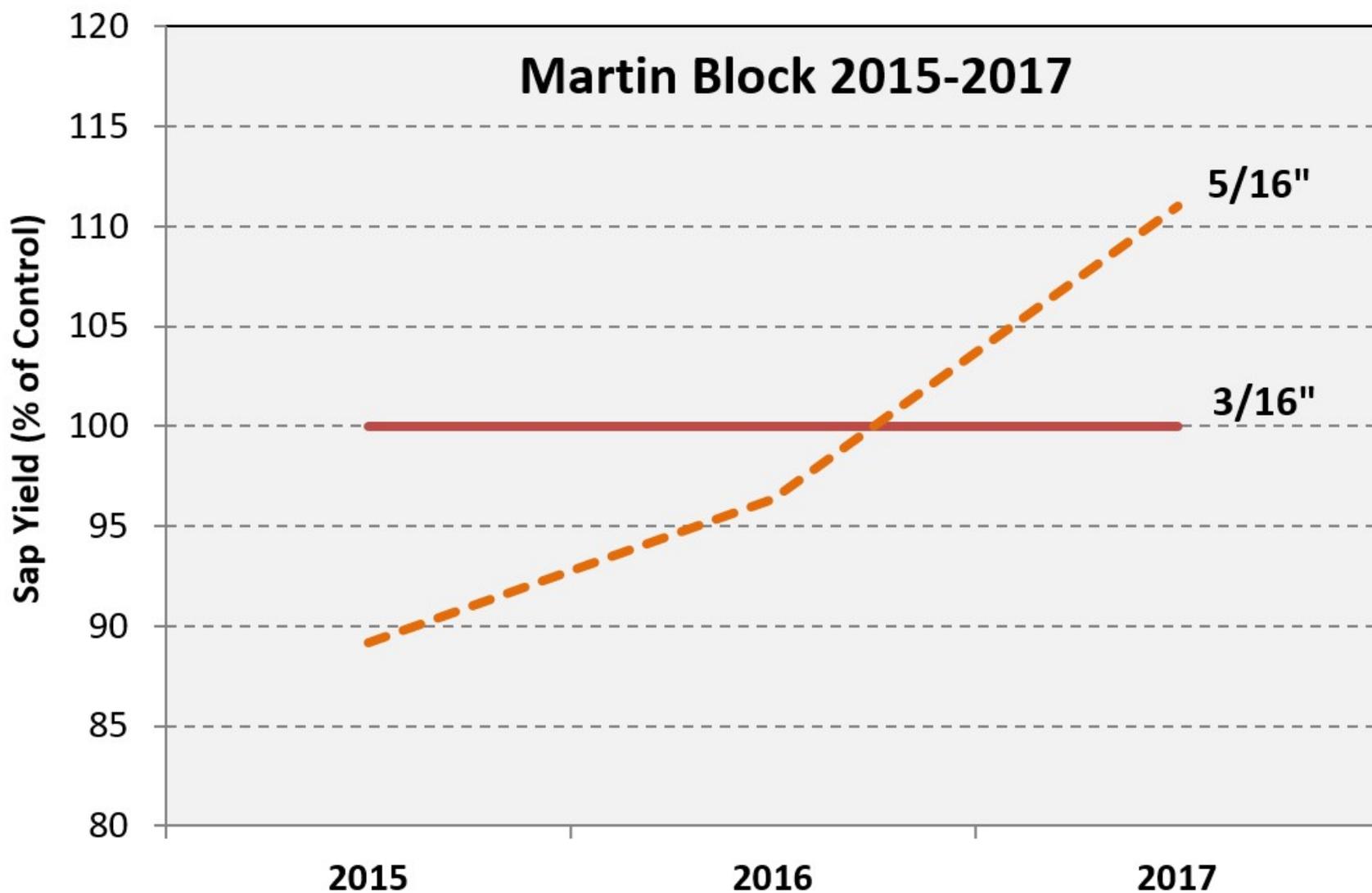
# Results: 2014-2015

## Net Profit by Sanitization Strategy (Summarized)





# 3/16" Tubing





# Conclusions:

*Various replacement and cleaning strategies result in differing levels of improvement in sap yield and net profit.*



**(IPA not approved in U.S.)**



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*Replacement strategies are typically more cost-effective (produce a higher net profit) than cleaning strategies.*

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*Cleaning is more effective with increased contact times. Cleaning in place (CIP) by sucking sanitizer in under vacuum is far less effective than soaking or flooding.*

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*Cleaning in low yield operations can often result in negative net profits.*

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*The longer the season, the more “impact” any sanitation or replacement strategy has on sap yield.*

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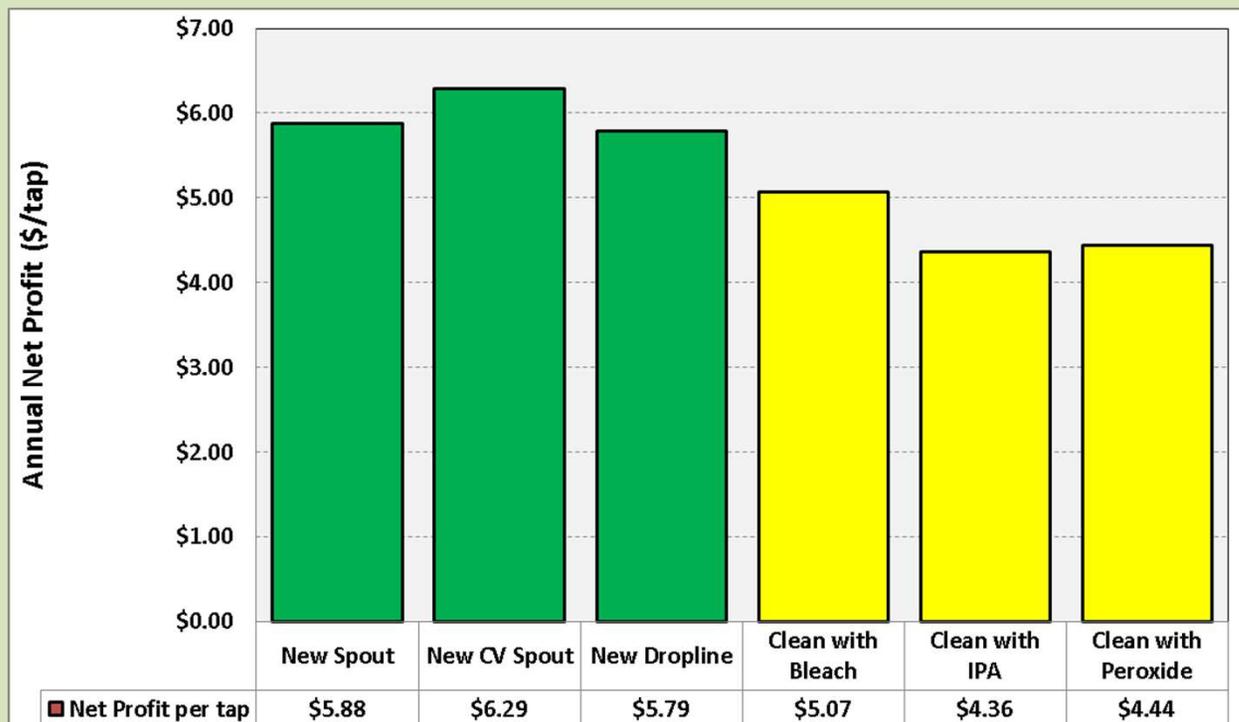
*Maple producers should select a strategy that fits their needs and results in the highest net profits for their operation.*



# Next steps:

Spreadsheet tool:  
Input sap value,  
baseline sap  
yields, labor rate

Which strategy  
will result in the  
best net value?



Model Input Variables	
Pay rate/hr (\$)	\$ 14.00
Baseline Sap/Tap (gal)	20 gal (estimated or actual production of sap first year after re-tubing)
Value of Sap/Gal (\$)	\$ 0.25 (price per gallon you value your sap)



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*Thank you!*

