

# Effects of Temperature on Urediniospore Production in *Phakopsora pachyrhizi*

E.P. Mumma<sup>1</sup>, R.W. Schneider<sup>1</sup>, C.L.  
Robertson<sup>1</sup>, C.G. Giles<sup>1</sup>, J. J. Marois<sup>2</sup>,  
D. L. Wright<sup>2</sup>, and Tristan Mueller

Department of Plant Pathology & Crop Physiology  
Louisiana State University AgCenter<sup>1</sup>

North Florida Research and Education Center  
University of Florida<sup>2</sup>



# Objectives

- Examine the effects of temperature on spore production/collection using Burkard tape trap
- Determine what temperature range is conducive for optimum spore production under isothermal conditions
- Use results in spore deposition models

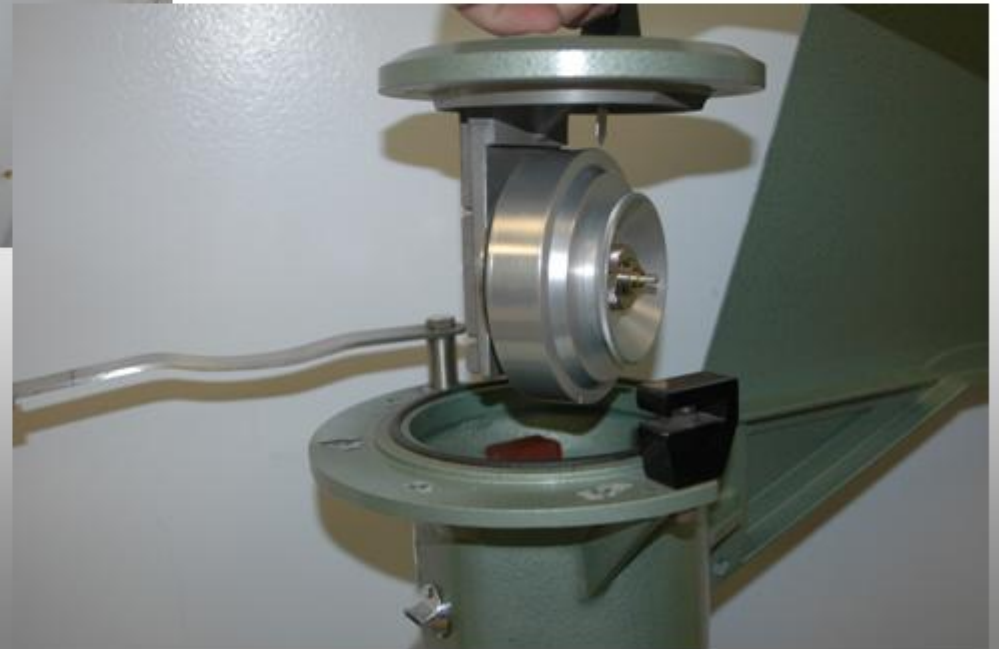
# Research Conducted at North Florida Research and Education Center



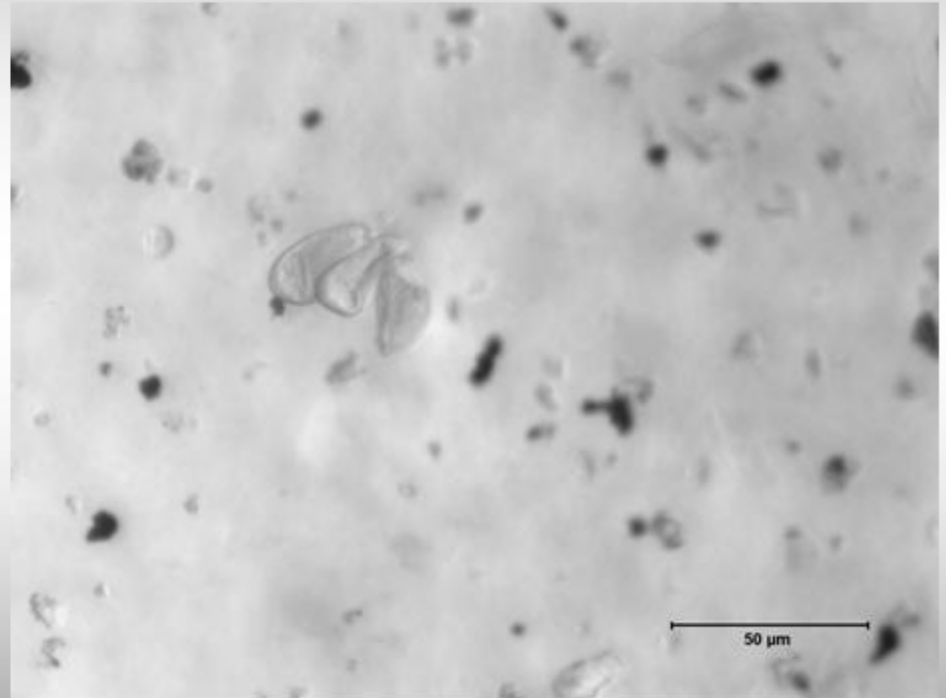
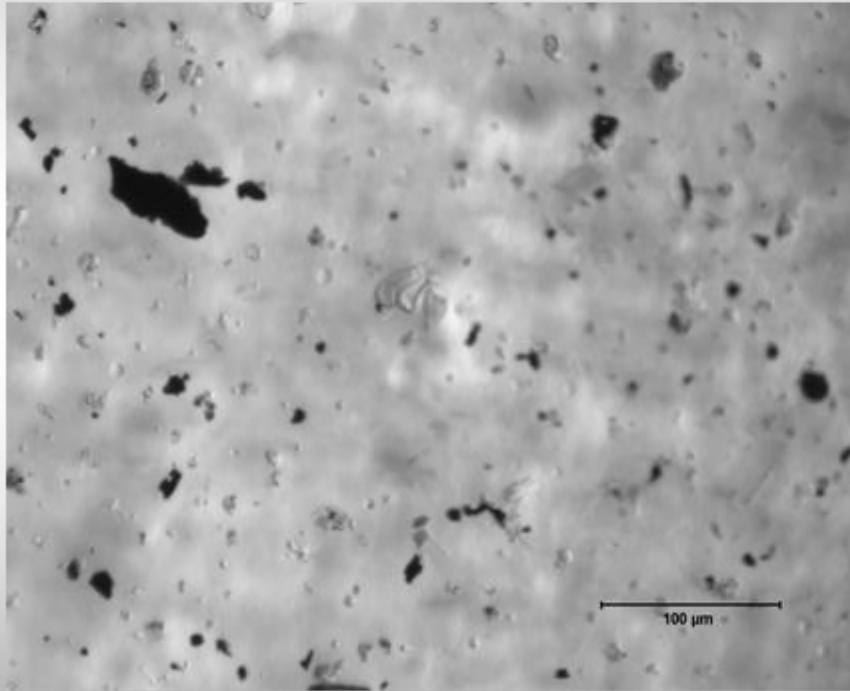
# Rust in Quincy, Florida



# Burkard Tape Trap and Clock Mechanism



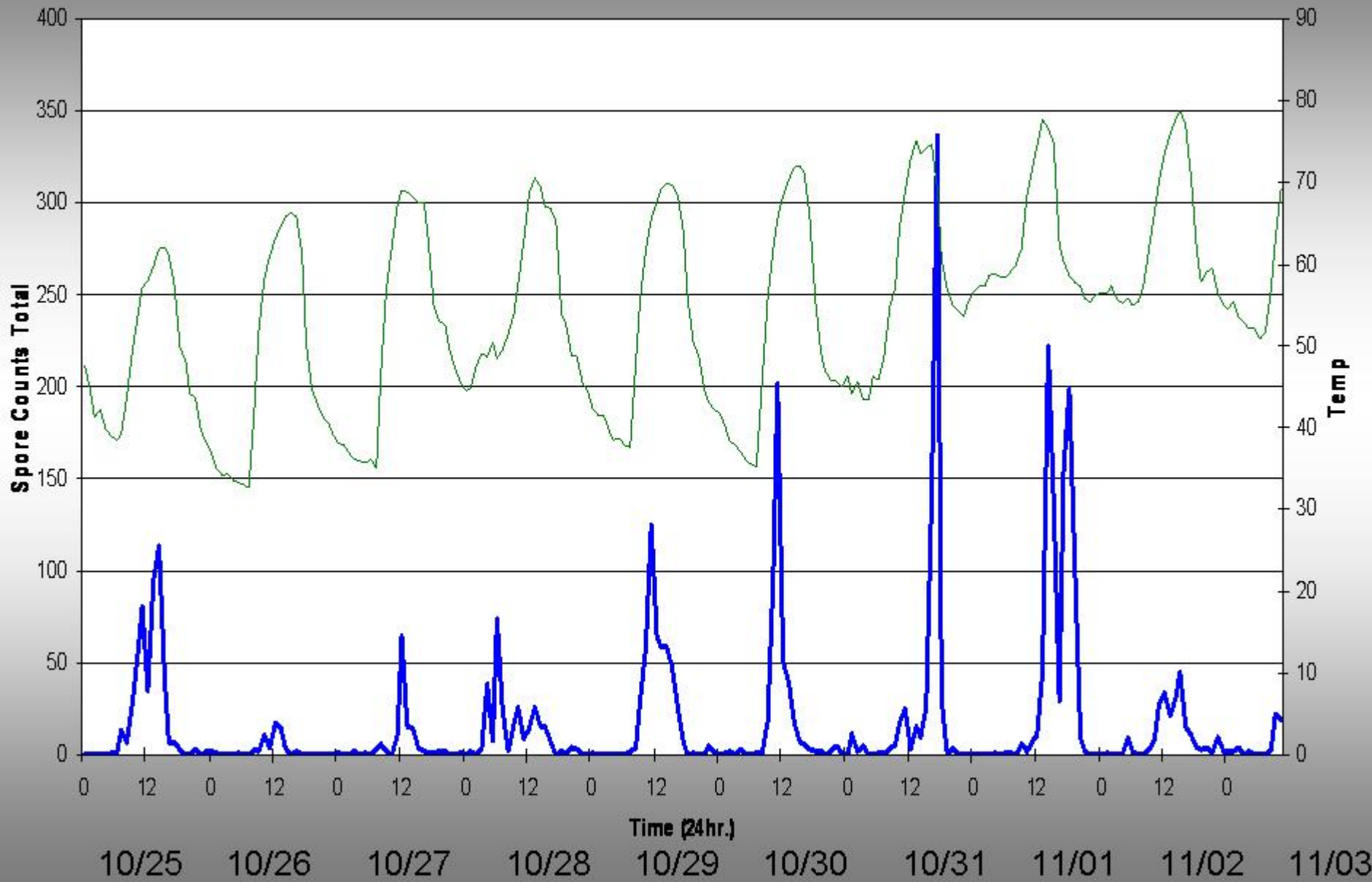
# Spores on Burkard Tape



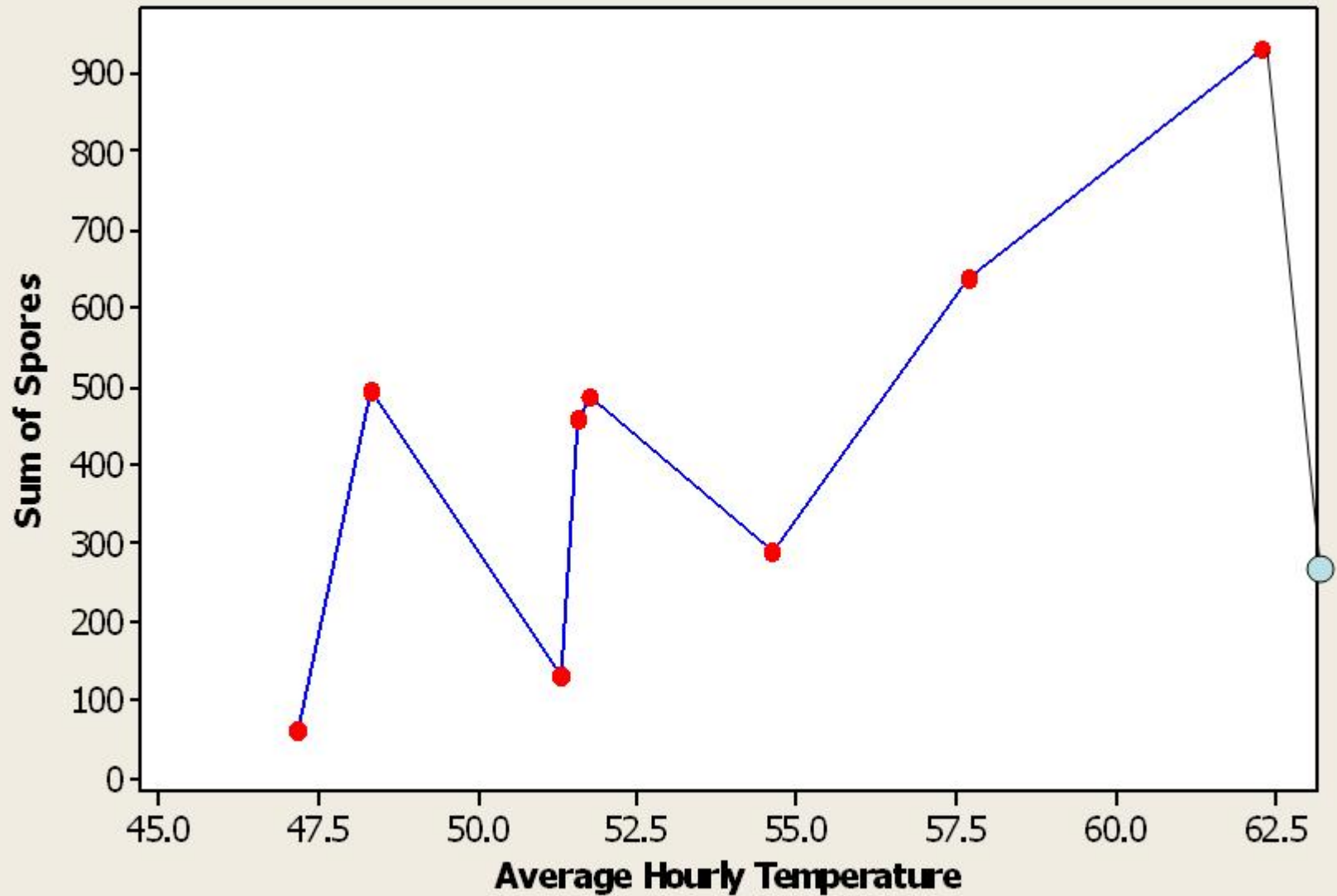
# Quincy, Florida 2006



# Burkard Tape Traps Avg Temp

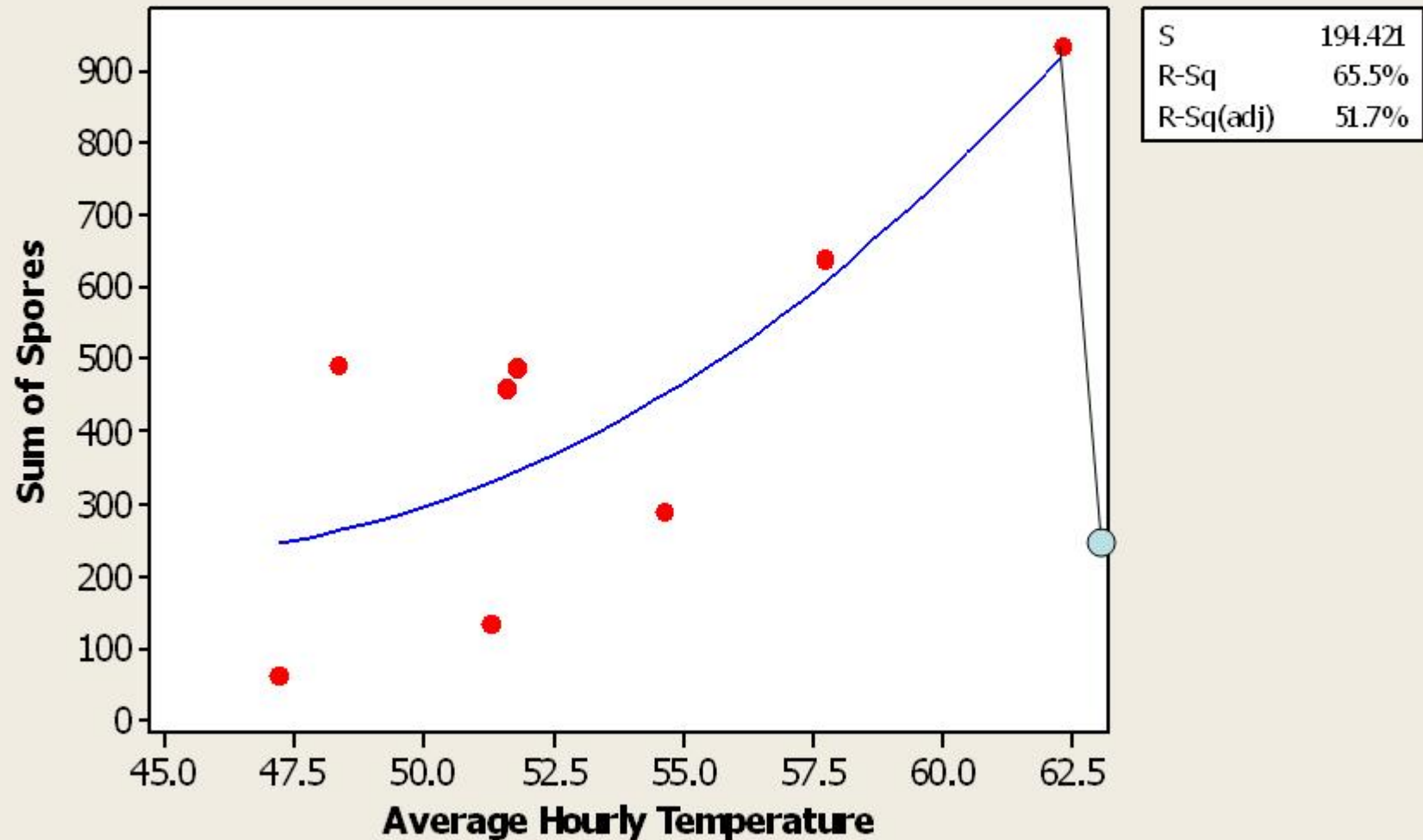


### Average Hourly Temperature Vs. Sum of Spores 2005 with Freeze Data

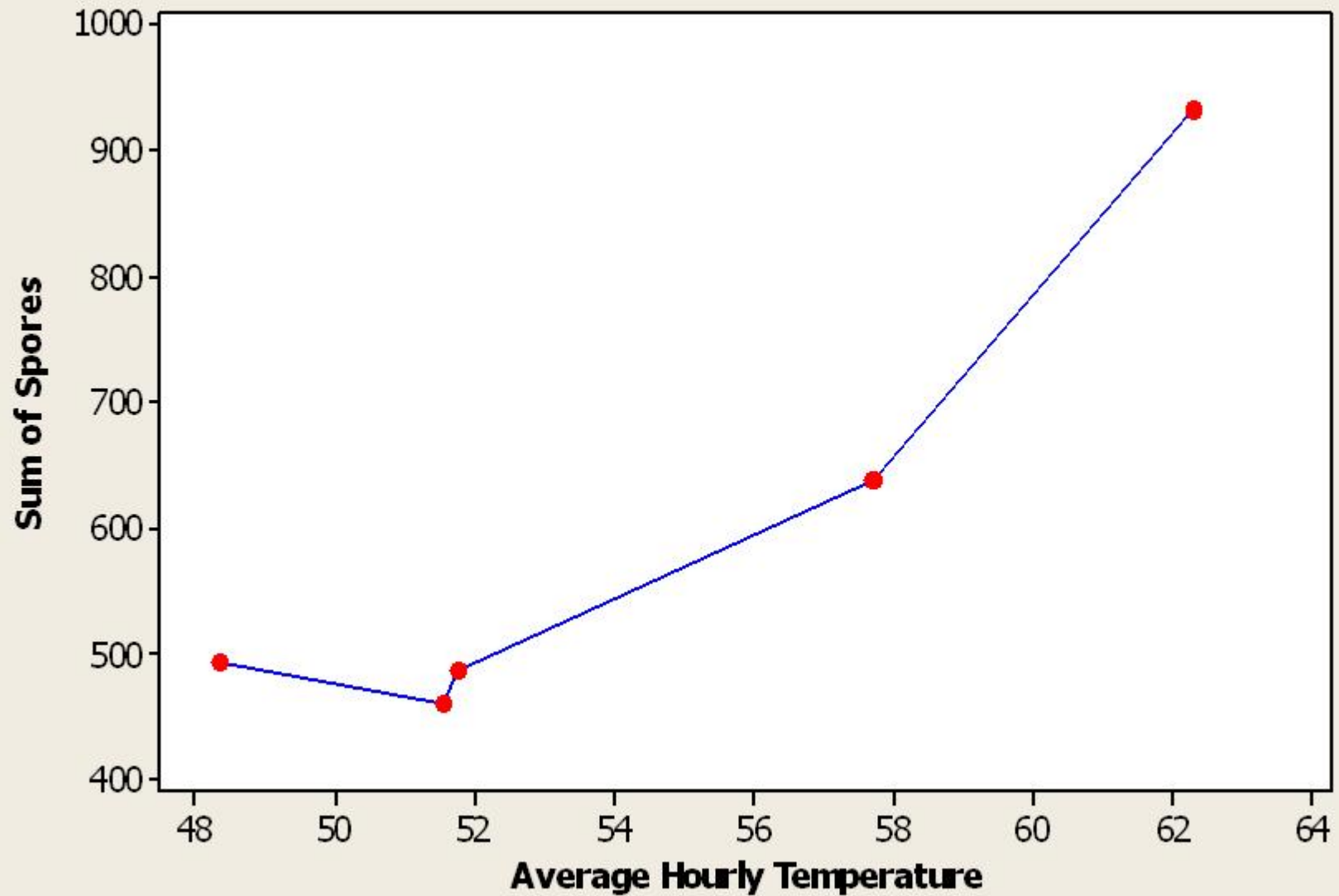


# Analysis of Average Temperature Vs. Sum of Spores 2005 with Freeze Data

$$C7 = 4745 - 201.3 C8 + 2.246 C8^{**2}$$

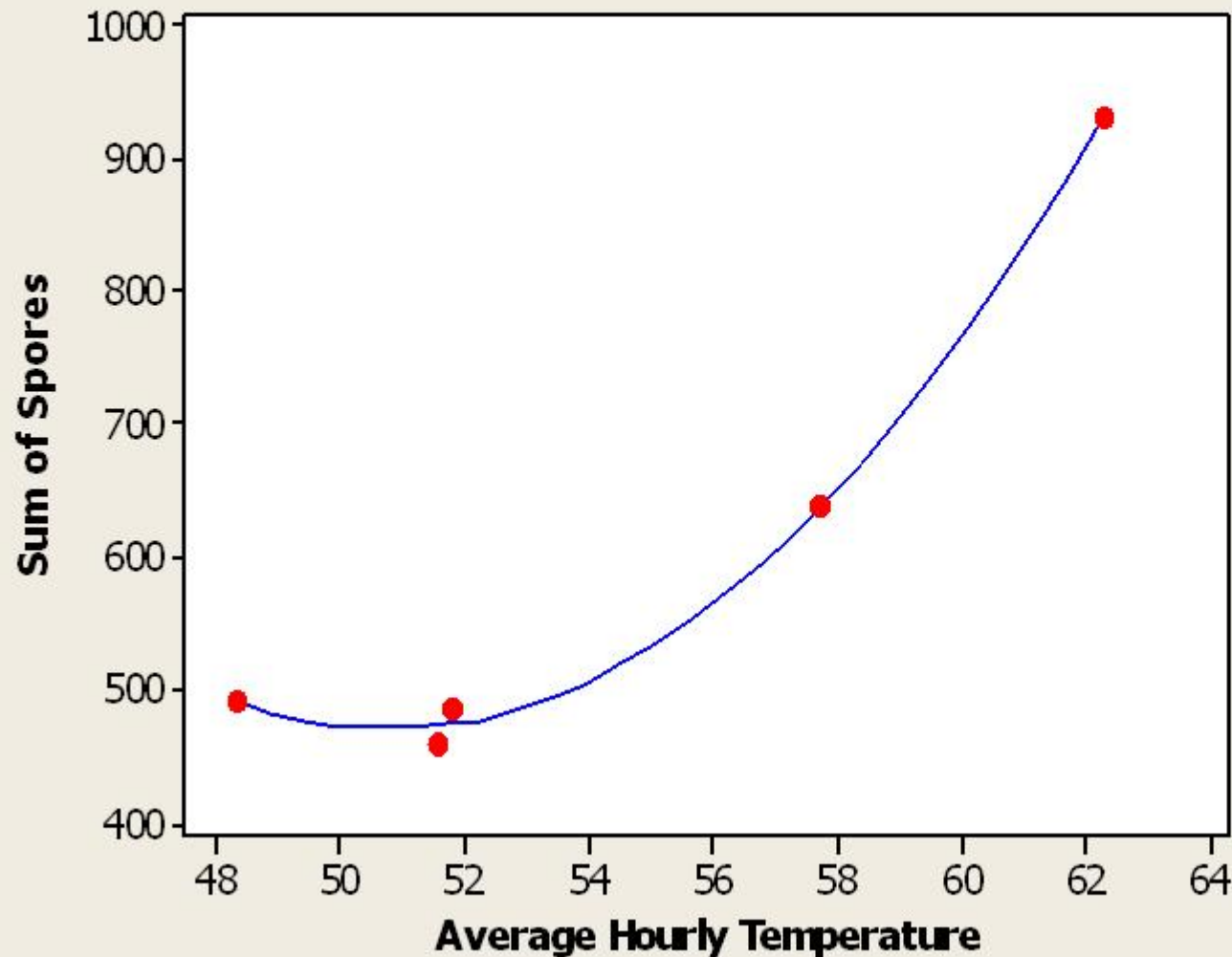


**Average Hourly Temperature Vs. Sum of Spores 2005 without Freeze Data**



# Analysis of Average Temperature Vs. Sum of Spores 2005 w/o Freeze Data

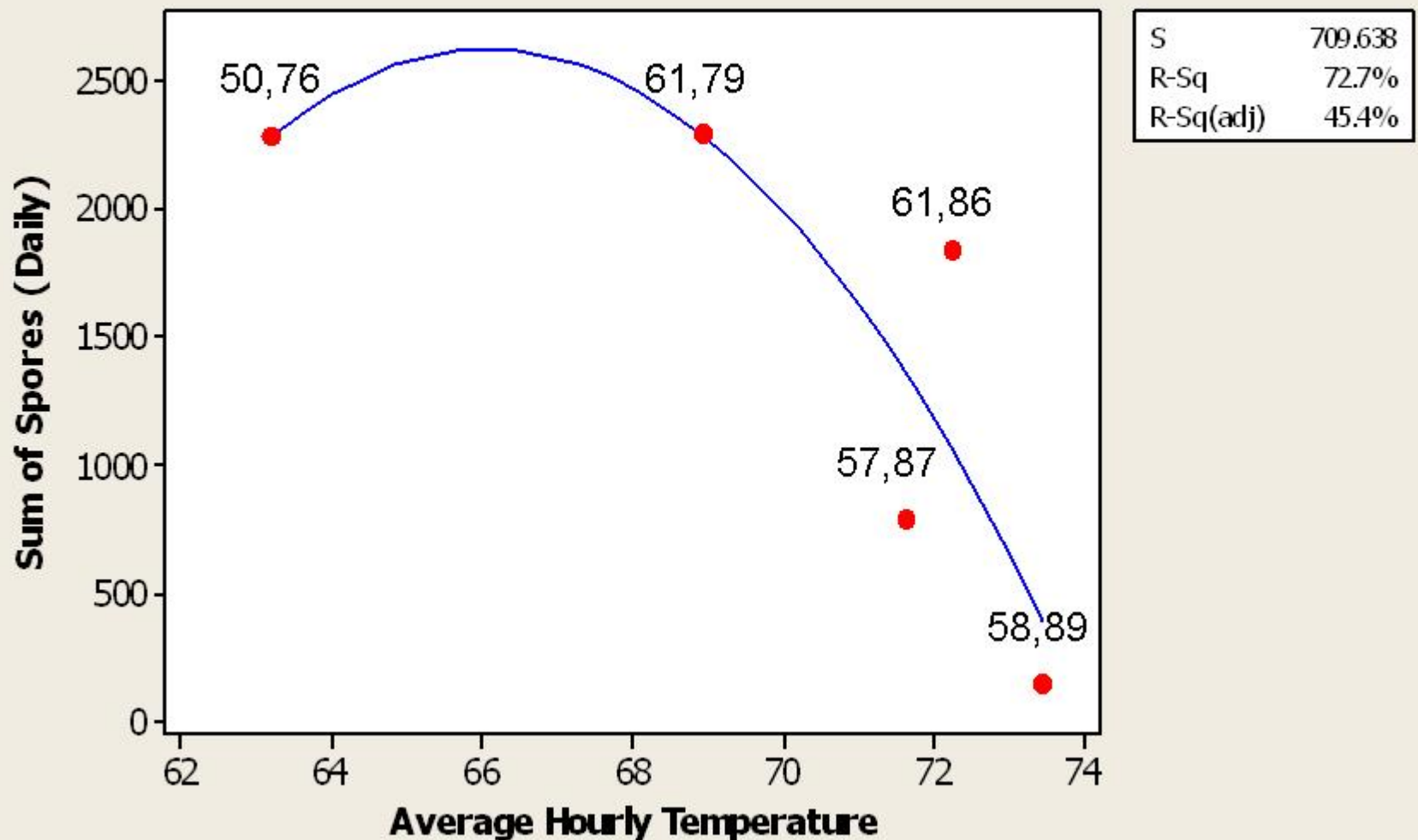
$$C4 = 9482 - 354.9 C5 + 3.494 C5^{**2}$$



S	12.9113
R-Sq	99.8%
R-Sq(adj)	99.6%

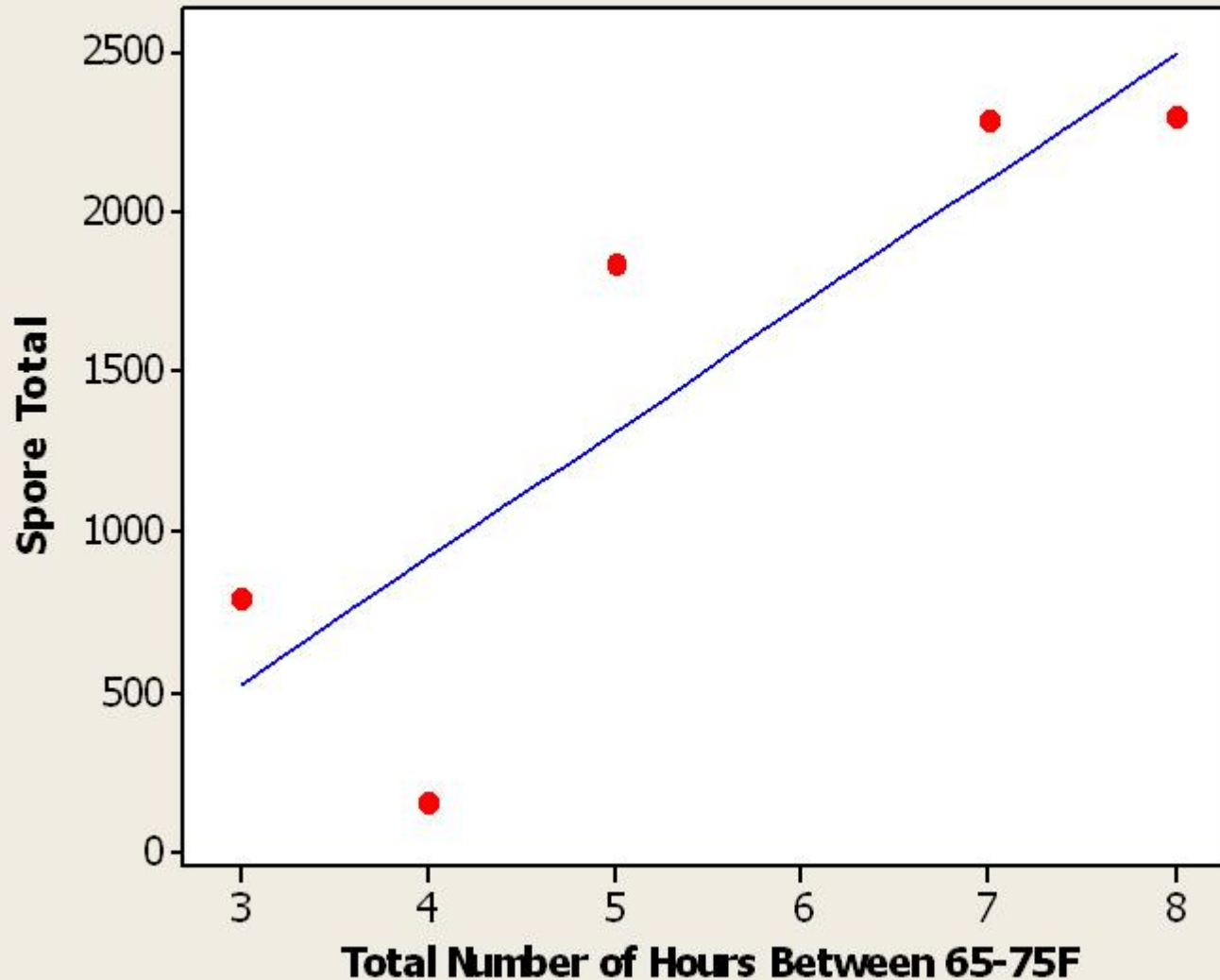
## Relationship Between Average Hourly Temperature and Total Spore Counts, 2006

$$C1 = -177160 + 5443 C2 - 41.20 C2^{**2}$$



# Relationship Between Total Number of Hours B/W 65-75F Vs. Spore Total

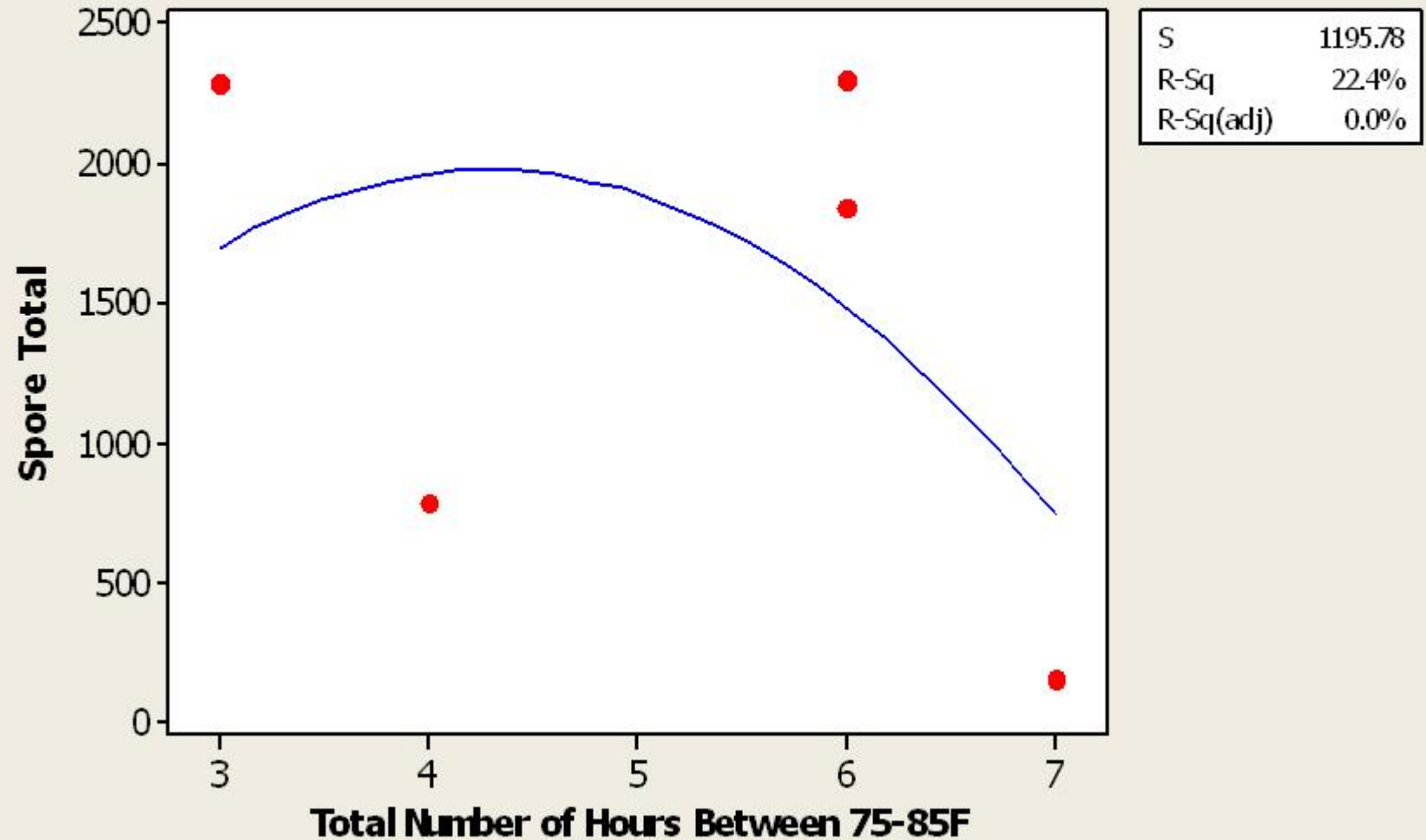
$$\text{sporetot} = -658.1 + 394.7 \text{ Hrb/w65-75}$$



S	579.127
R-Sq	72.7%
R-Sq(adj)	63.6%

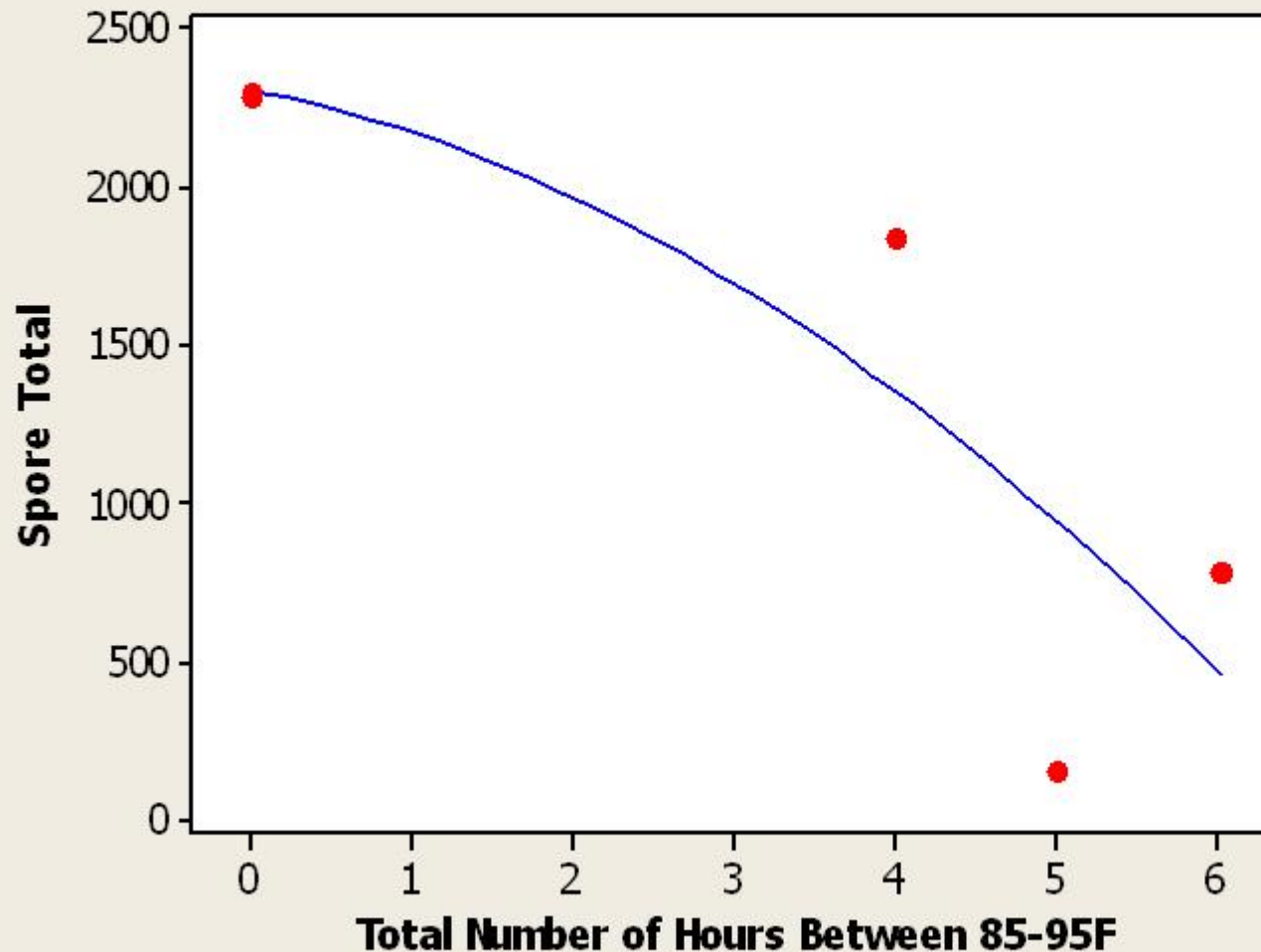
## Relationship Between Total Number of Hours B/W 75-85F Vs. Spore Total

$$\text{spore tot} = -1098 + 1434 \text{ hrb/w75-85} - 167.4 \text{ hrb/w75-85}^2$$



## Relationship Between Total Number of Hours B/W 85-95F Vs. Spore Total

$$\text{spore total} = 2308 - 102.9 \text{ HRB/w85-95} - 34.2 \text{ HRB/w85-95}^{**2}$$



S	694.934
R-Sq	73.8%
R-Sq(adj)	47.6%

Field Results  
with High  
Temperature

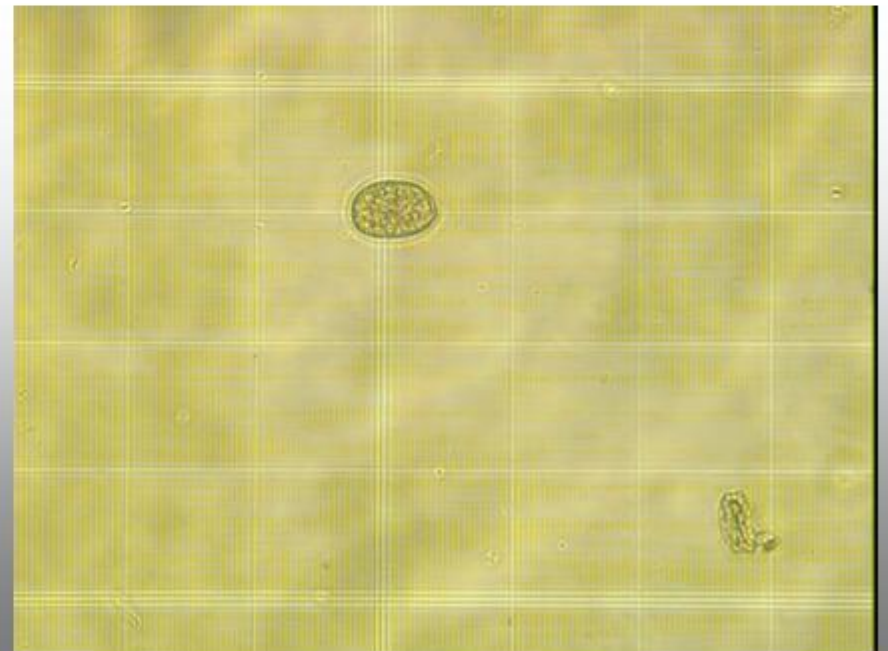
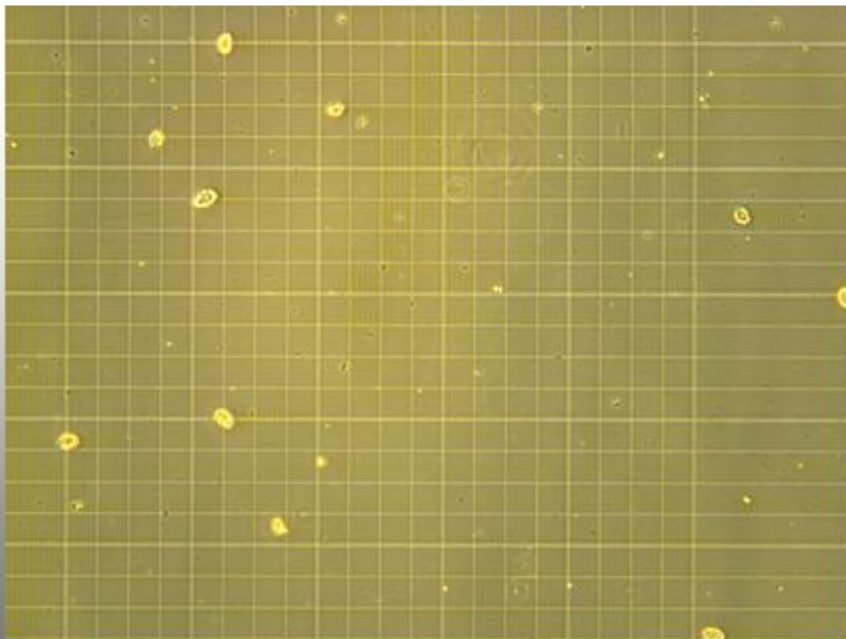
# Methods Incubator Study



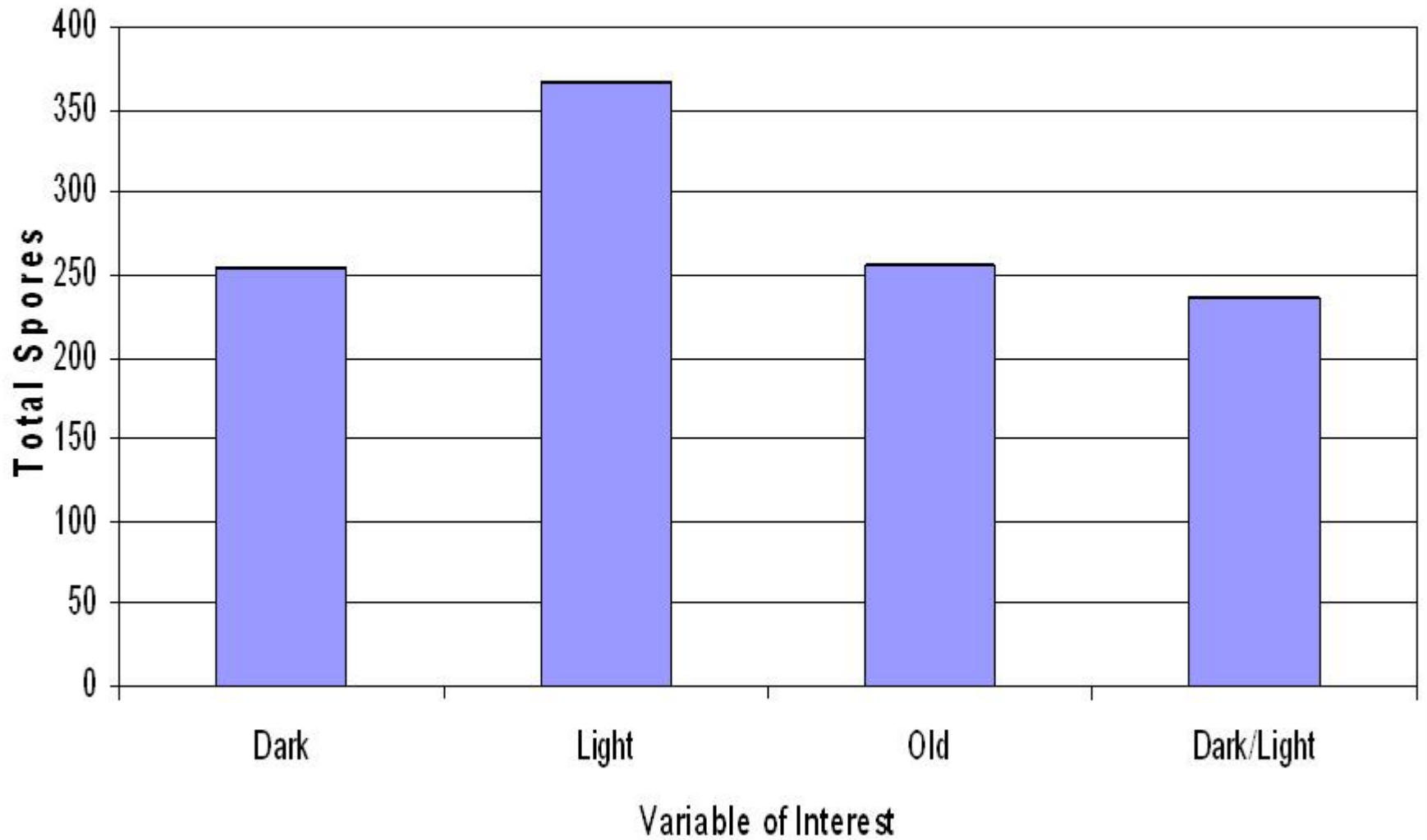
- Field collected leaves
- Moist chamber
- Incubator
- Spore collector
- Incubator 1,2,3 days
- Leaf disks

# Methods Incubator Study

- 1 ml vial
- Tween
- Vortexed
- Spores counted
- Data expressed as spores per pustule



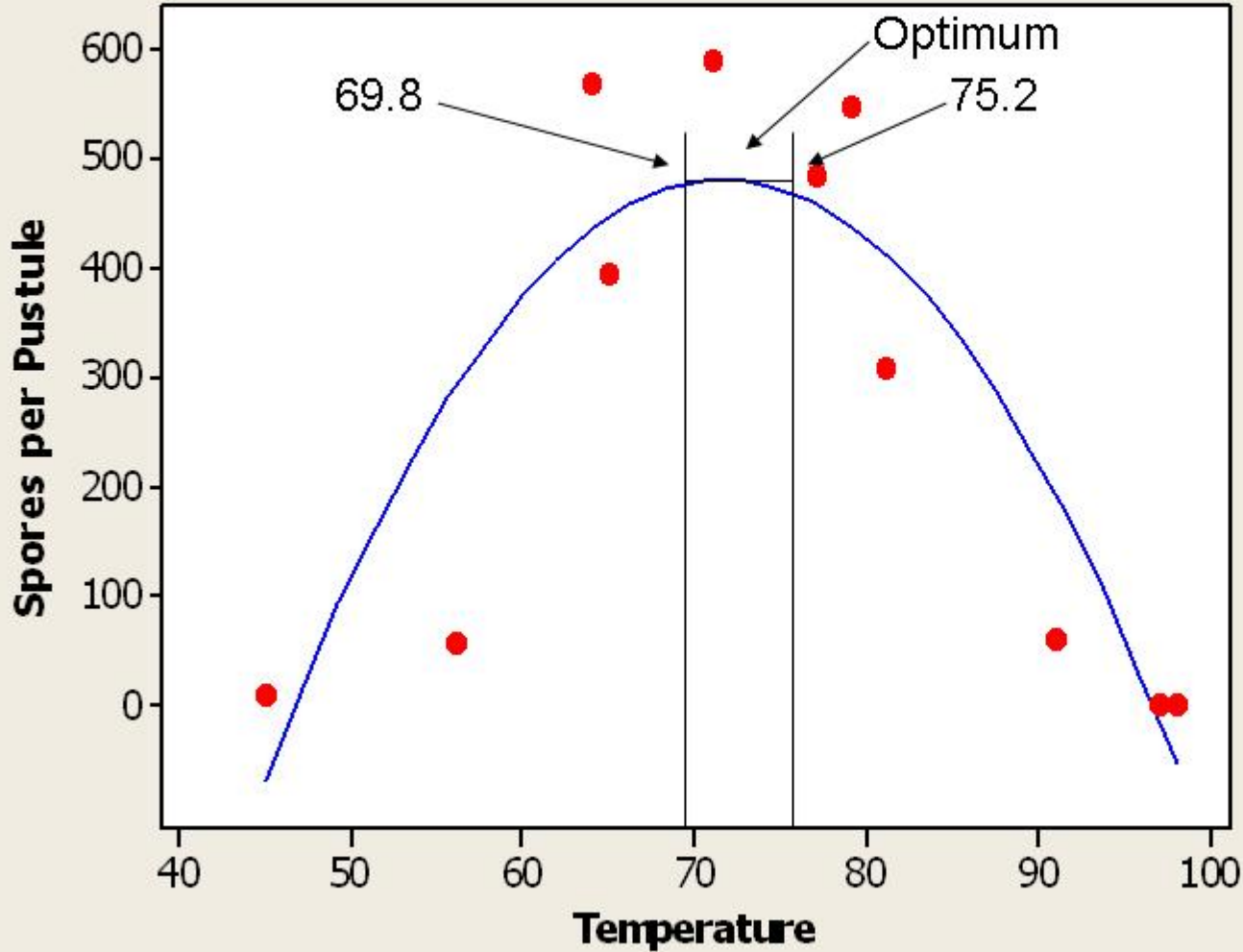
## Optimization of Experimental Variables



# Isothermal Incubator Results

$$\text{Sum Spores} = -3505 + 111.3 \text{ Sum Temp} - 0.7763 \text{ Sum Temp}^2$$

S	131.519
R-Sq	78.3%
R-Sq(adj)	72.9%

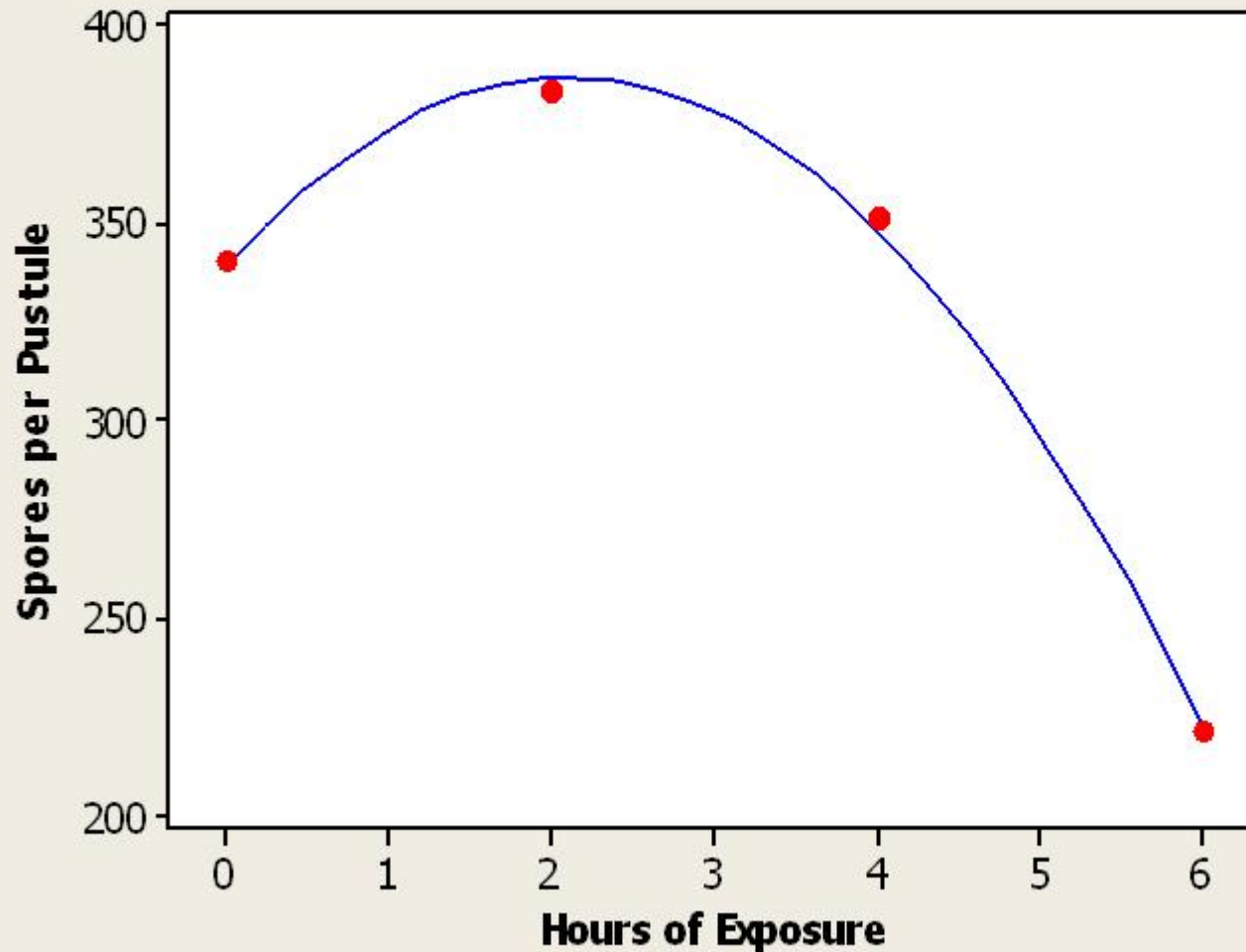


# Additional Incubator Studies

- Exposure to repressive temperature (90F)

## Effect of Exposure to Repressive Temperature (90F)

$$\text{total spores} = 339.7 + 45.75 \text{ heat hrs} - 10.88 \text{ heat hrs}^2$$



S	5.24705
R-Sq	99.89%
R-Sq(adj)	99.59%

Lab Results  
with High  
Temperature

# Conclusions

- Spore production is extremely sensitive to temperature
- Maximum spore production occurs between 65-75 F
- Results from field and incubator studies showed that short exposures (> 2 hours) to 90F severely repressed spore production
- Field and incubator studies are highly correlated
  - Incubator results are useful for model development

# Further Discussion

- Results from incubator studies can be used to identify periods during the growing season when pandemics may occur in different regions of the country
  - As well as areas in the country least likely to serve as sources of inoculum

**Any Questions?**

