



# *Crop Estimation Tailgate*

## **Theory and Assumptions Behind Sampling**

*Dr. Craig Macmillan*

*Technical Program Manager*

*Vineyard Team*

Thursday, March 15, 2018

At Byron Winery





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***The future already exists...***





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# ***Predicting the future***

- **The harvest is already out there (conceptually)**
- **What things go into the weight of that harvest?**
  - **Vine count**
  - **Cluster count**
  - **Cluster weight**
  - **Berry weight**





# The Guessing Game

Vine Count X Cluster Count X Cluster Weight = Yield

Relatively Certain X Decent Estimate X Informed Guess = Prediction

+/- Sum of the differences from reality of the guesses

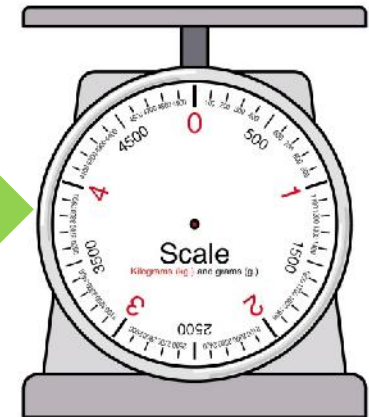
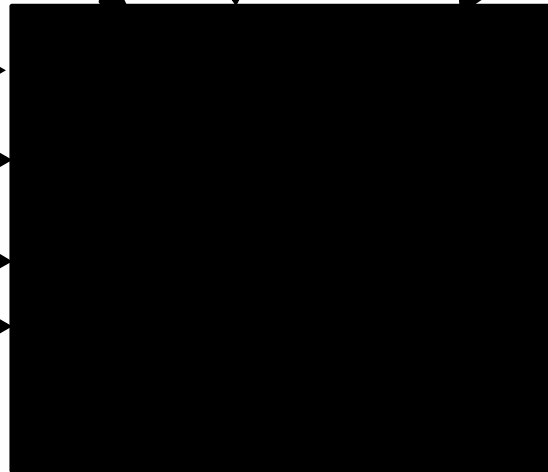


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## *What about changes approaching harvest?*

Vine Count   Cluster Count   Cluster Weight

Birds →  
Raisins →  
Mold →  
Sugar →





# Looking Back to Look Forward

- Historical Information
  - Correlations of variable to variable in the past
    - Cluster weights
  - Sentinel Vines
- Limitations



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# Three Estimates

Reality = 9.6 TPA

Estimate is off by...

## 2017 Grenache/1103P

Vines / AC	2017 Pre-Bloom Cluster Counts	Hist. Cluster Wt	Pre-Bloom TPA	
959*	31	0.35	5.18	-46%
	2017 Post Set Cluster Counts	Hist. Cluster Wt	Post Set TPA	
959*	26	0.35	5.59	-42%
	Lag Phase Cluster Counts	Lag Phase- Predicted Cluster Wt.**	Lag Phase TPA	
959*	36	0.525	9.06	-6%

\*(968 w/ 1% missing)

\*\*Lag Phase Cluster Wt (0.35) X Lag Phase Factor (1.5)



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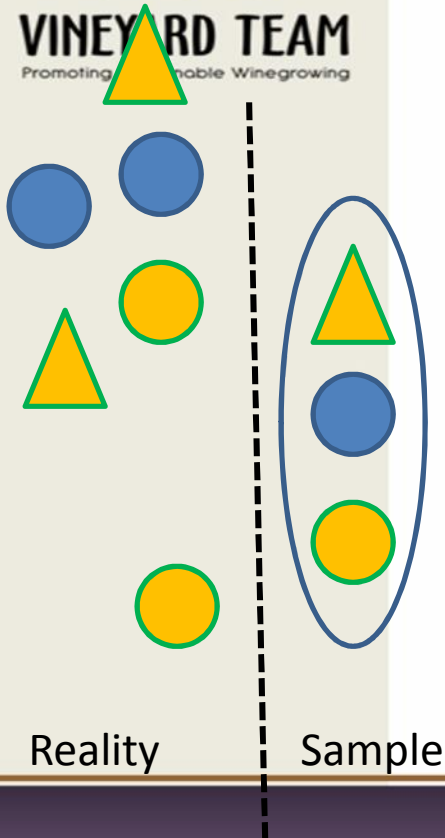
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What are we going to do with our historical cluster weight?





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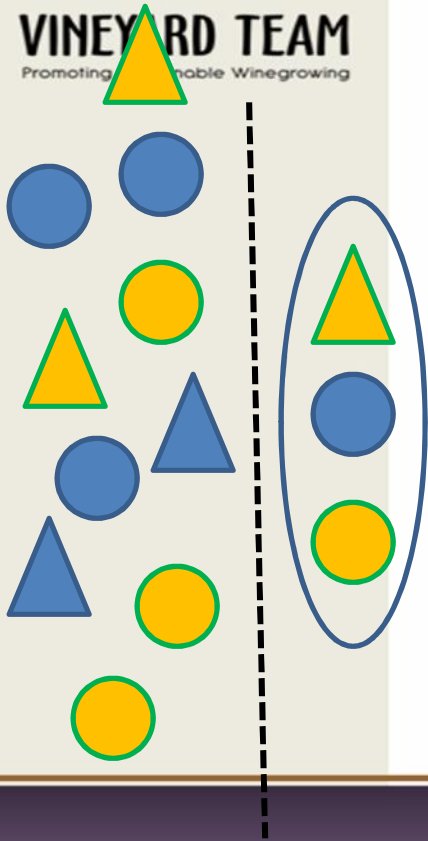


## ***The Theory Behind Sampling***

- A group of individuals selected from a population (all individuals) are representative of the population
- There is nothing special about any individual that influences whether they are selected
- We can know the characteristics of the population from the characteristics of the sample



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## ***The Theory Behind Sampling***

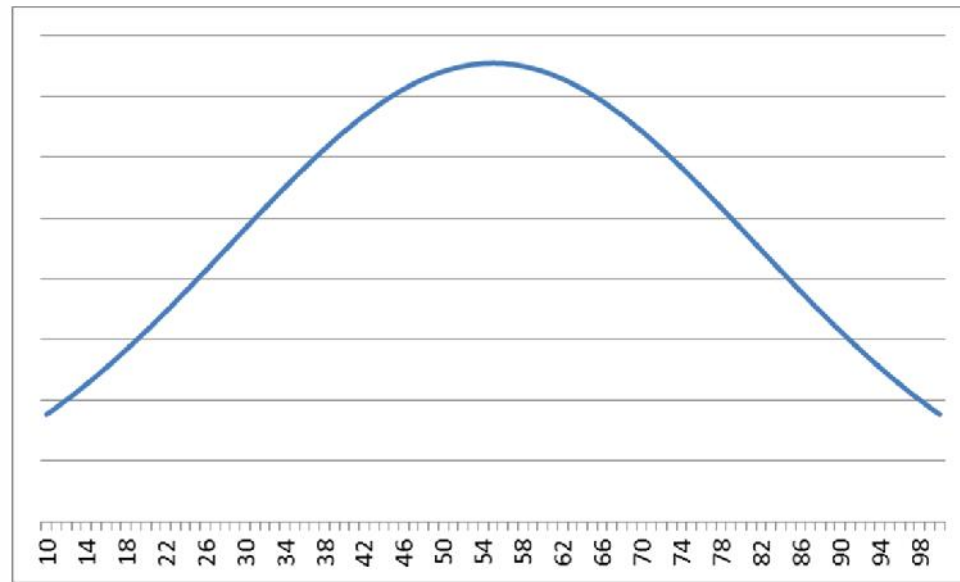
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# *Normal Distribution*

- Let us call it “the Bell Curve”
- What is it?
- Why is it important?
- What does it tell us?

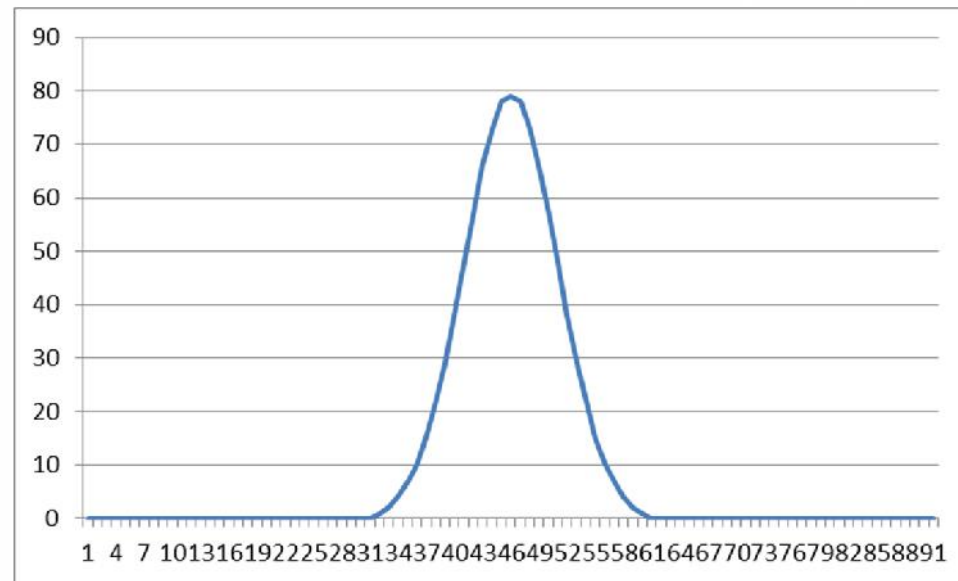




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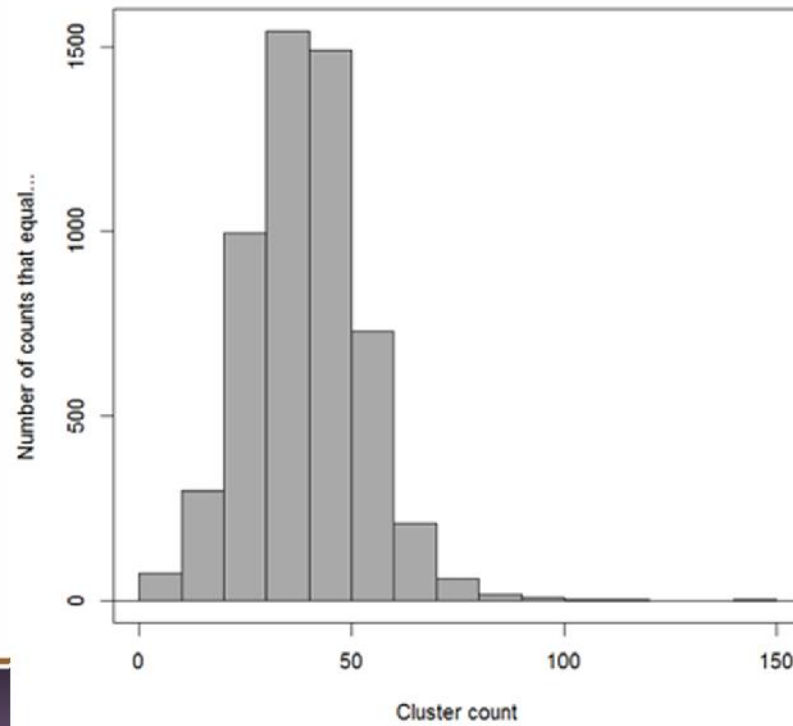




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# Reality

Clusters per vine- Chardonnay

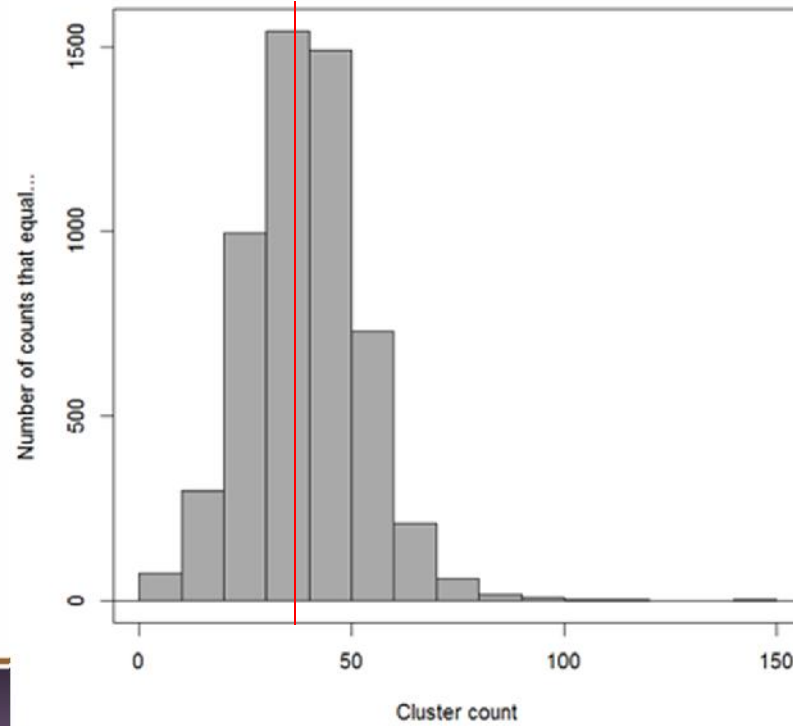




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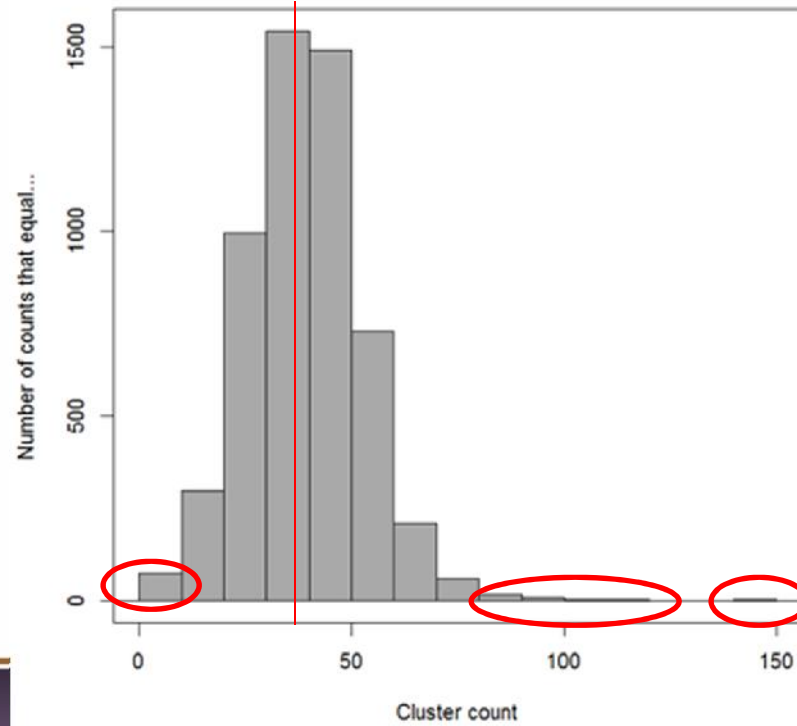




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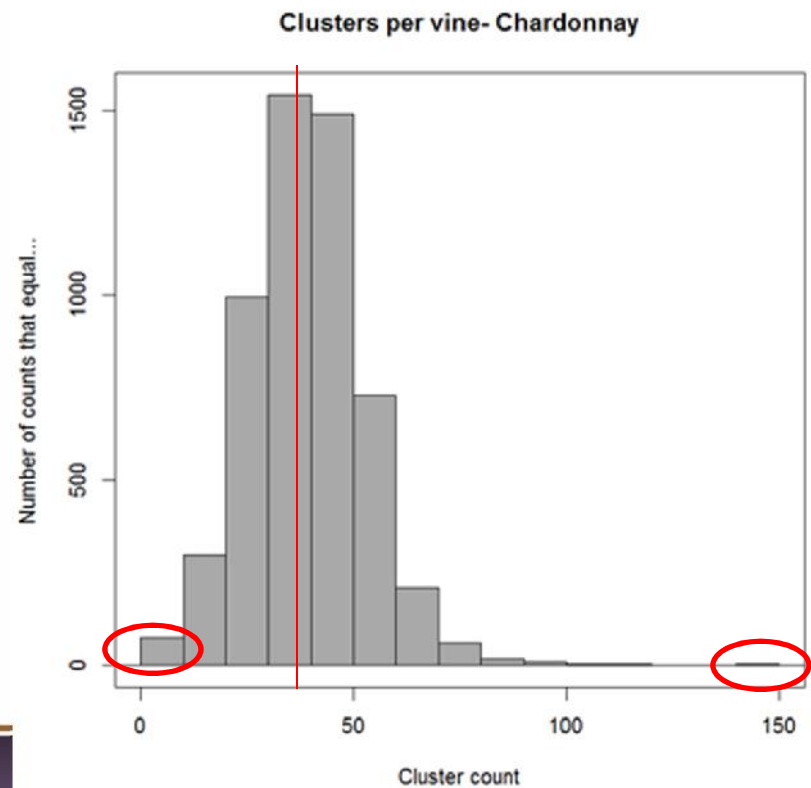
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=AVERAGE(number 1, number 2,)

=MIN(number 1, number 2,)

=MAX(number 1, number 2,)

## ***Average, Minimum, Maximum***



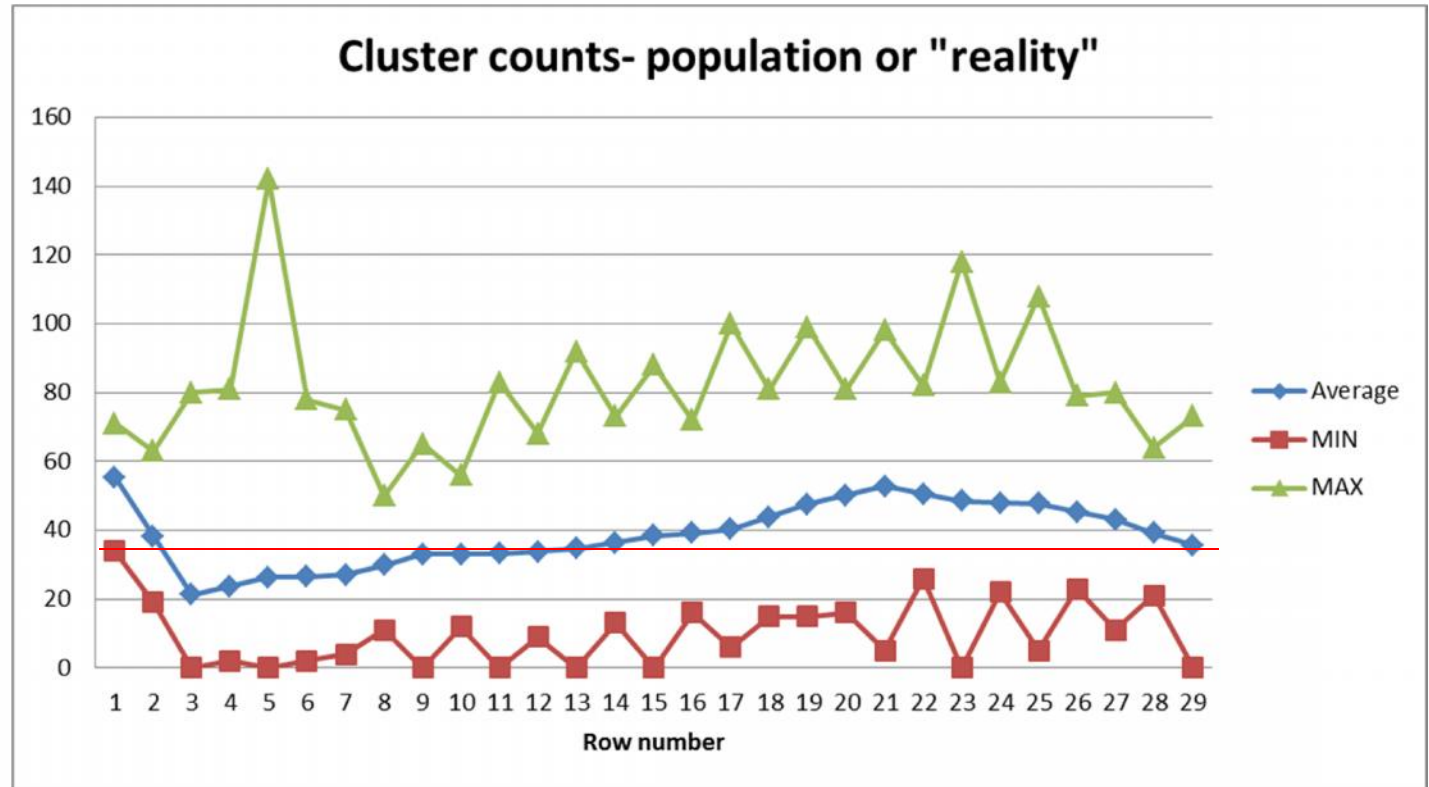




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Maximum=142  
Average=39.39  
Minimum=0

***This is not a sample; this is reality.***

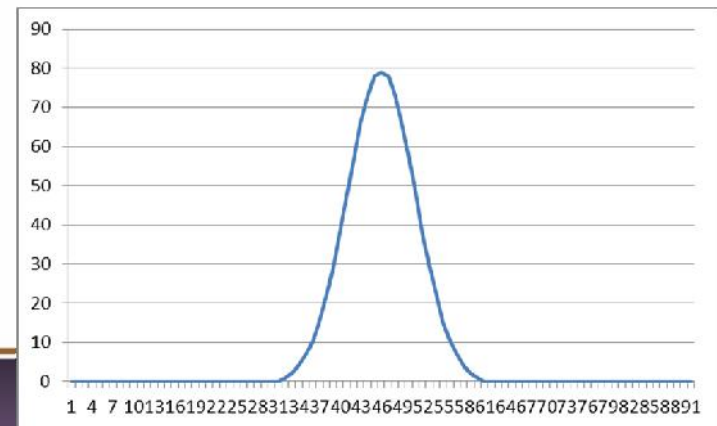
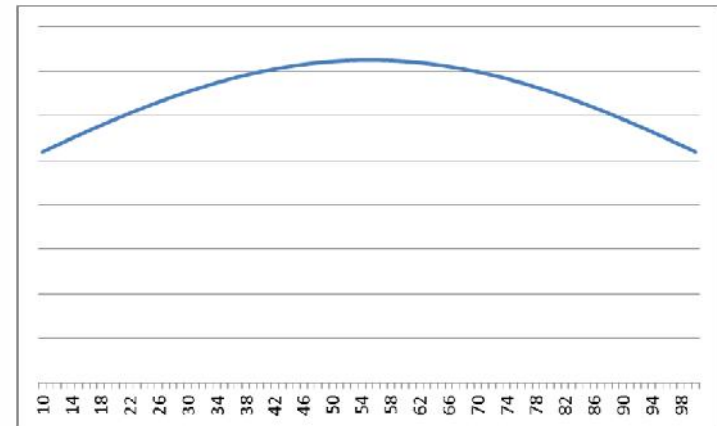




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# *Variation*

- How consistent is the population?
- How consistent are the measurements?
  - Area to area
  - Vine to vine
  - Cluster to cluster





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# *Sampling Theory*

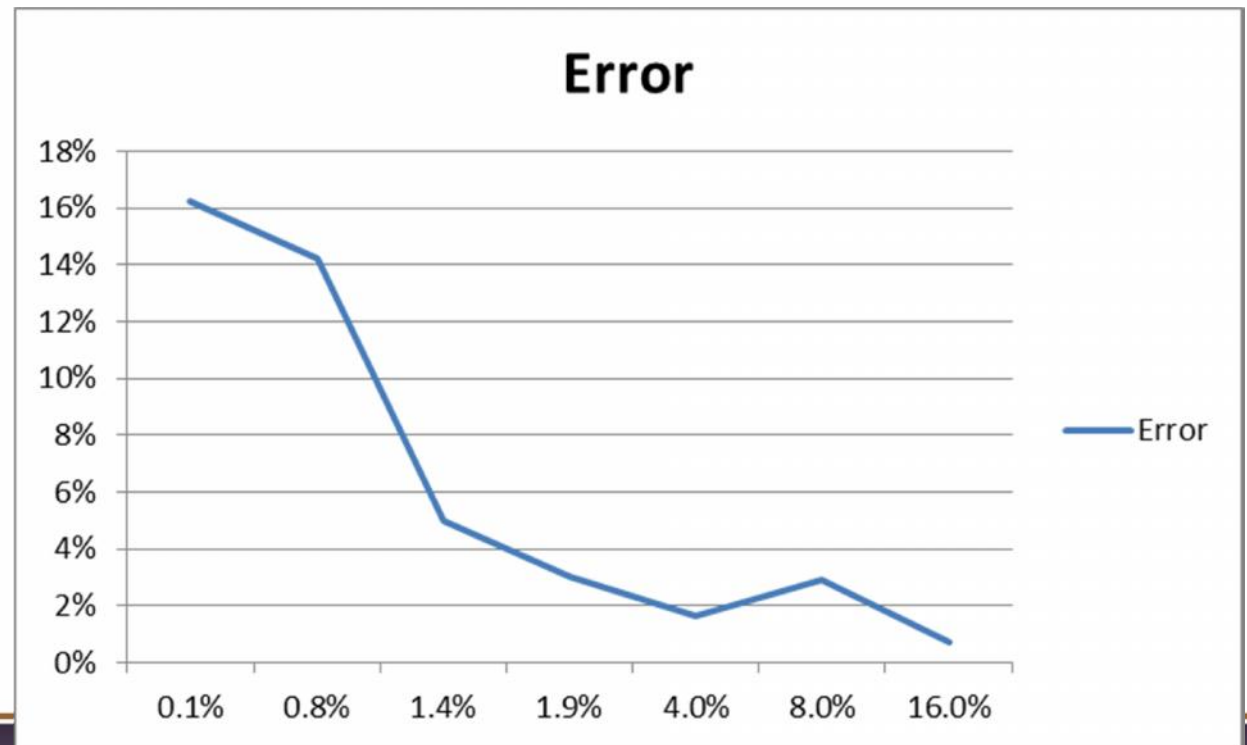
- Assumption:  
Sampling from a normally distributed population
- Sampling from an “other than normal” distribution
- Method
  - Random vs. Systematic
- Sample size
  - *The election poll example*
- Using zones



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# of vines	% of vines	Error
6	0.1%	16%
45	0.8%	14%
75	1.4%	5%
105	1.9%	3%
216	4.0%	2%
432	8.0%	3%
864	16.0%	1%

# Too Much or Not Enough

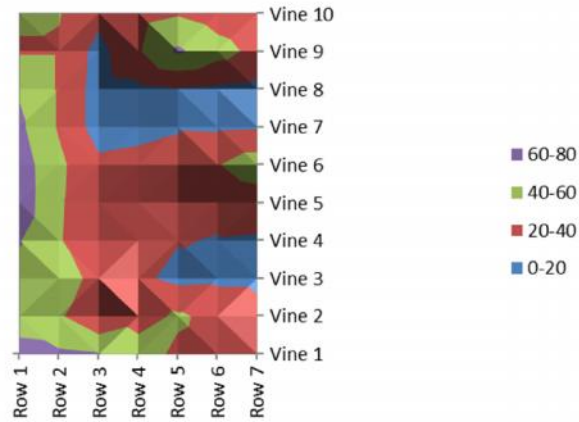
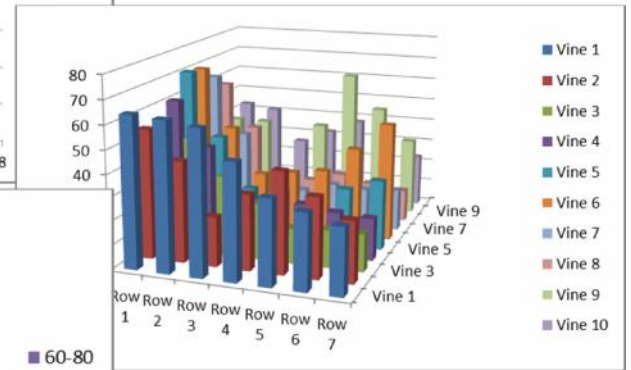
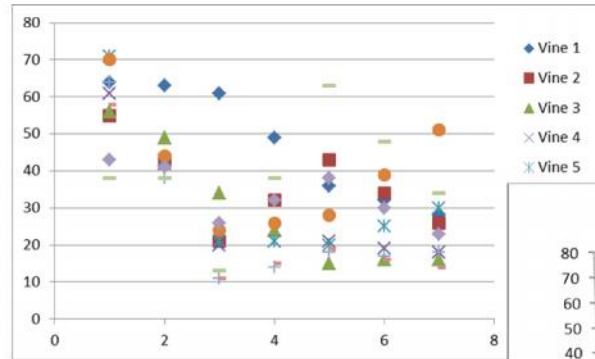
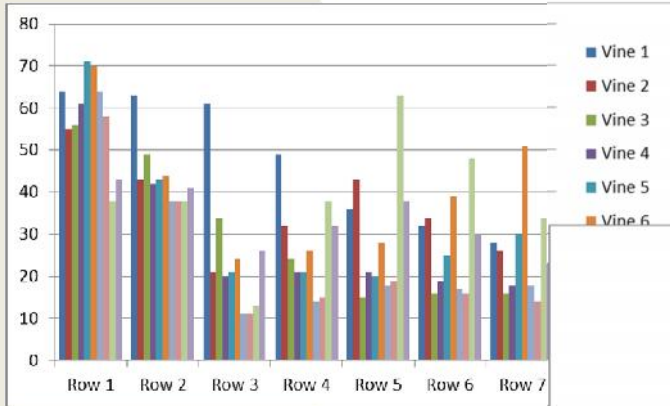




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# Visualizing data

	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7
.....							
Vine 1	64	63	61	49	36	32	28
Vine 2	55	43	21	32	43	34	26
Vine 3	56	49	34	24	15	16	16
Vine 4	61	42	20	21	21	19	18
Vine 5	71	43	21	21	20	25	30
Vine 6	70	44	24	29	28	29	31
Vine 7	64	38	11	14	18	17	18
Vine 8	58	38	11	15	19	16	14
Vine 9	38	38	13	38	43	48	34
Vine 10	43	41	26	32	38	30	23





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