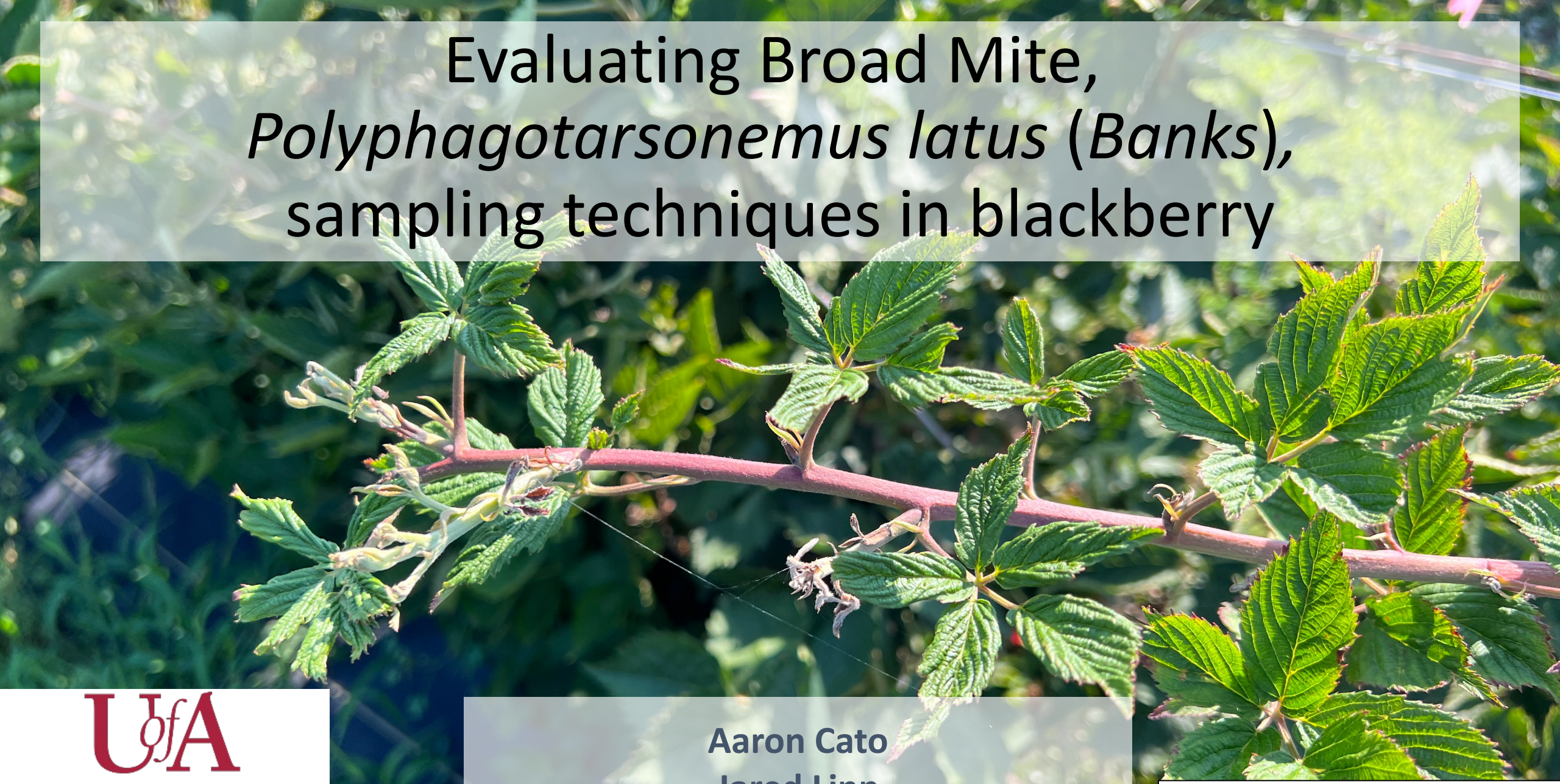
Evaluating Broad Mite, *Polyphagotarsonemus latus* (*Banks*), sampling techniques in blackberry



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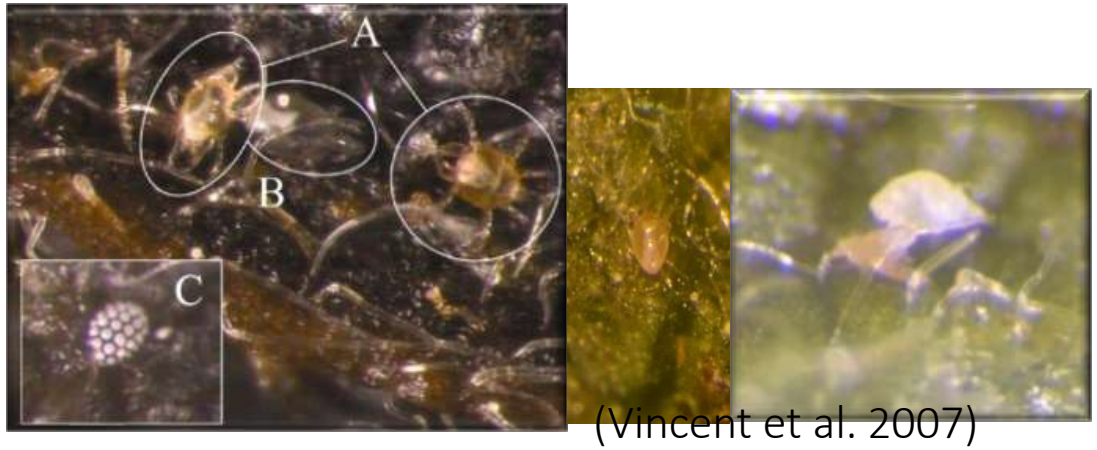
Broad Mite

- Serious pest across US and NA
  - First observed issues in 2007 in Arkansas
    - Mainly in tunnel production prior to early 2010s
  - Become more widespread in the last decade
    - Likely due to suppressed predatory mites and a shifting climate



(Vincent et al. 2007)

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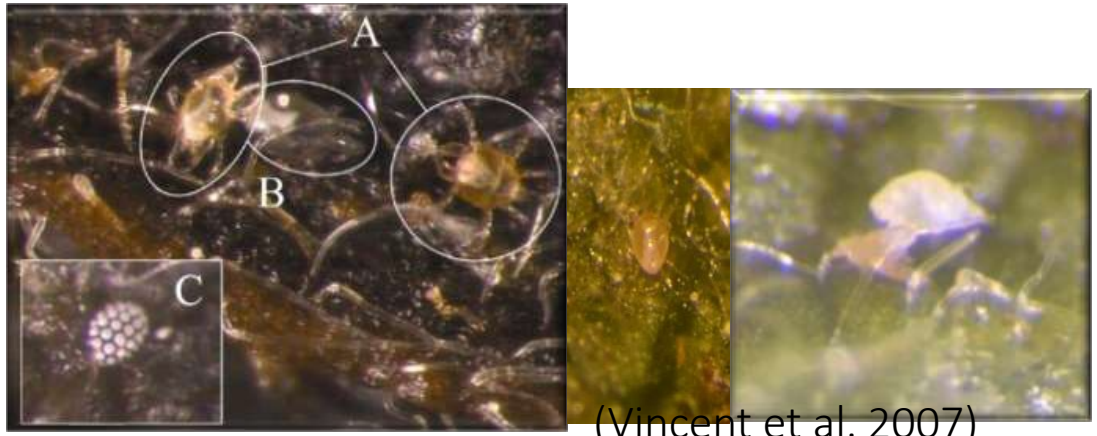
    - Likely due to suppressed predatory mites and a shifting climate
- Microscopic tarsonemid mite
  - Adult has white, dorsal stripe
  - Females are yellow, often seen being carried by males
  - Eggs are covered in white, raised spots
  - Highly mobile, quickly colonizes fields
- Damage resembles auxin herbicides injury



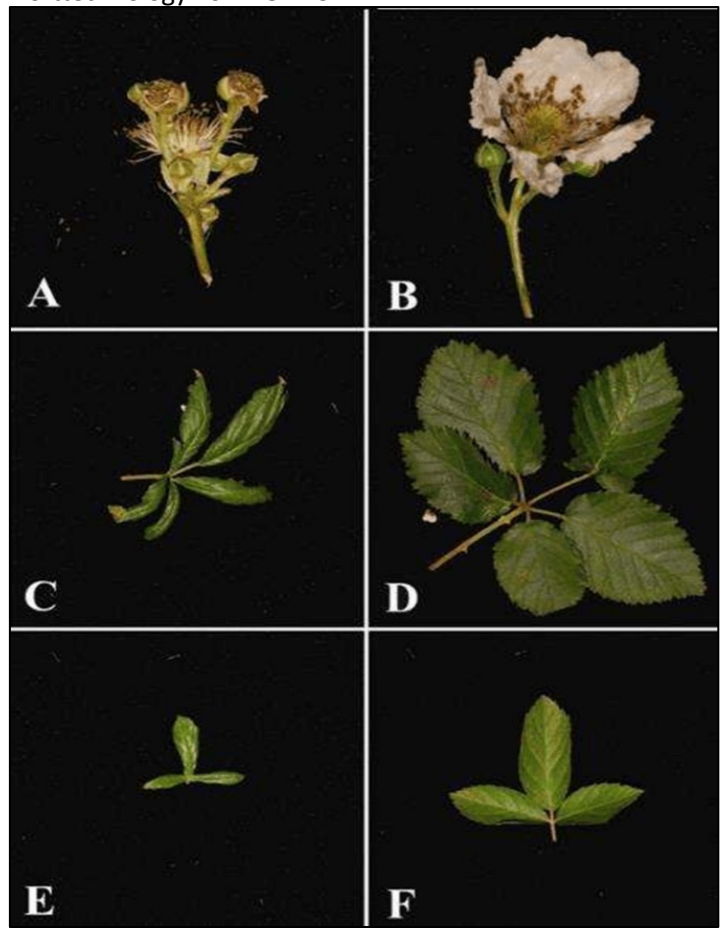
(Vincent et al. 2007)

What's the affect of broad mite on blackberry?

- Primocane Fruiters
  - Direct yield loss
  - Broad mite deforms flowers and other reproductive material

- Floricane Fruiters
  - Stunted growth in late summer
  - Tip dieback
  - Affected buds sometimes don't break

Horttechnology 20: 718-723



Current Broad Mite Recommendations

- Scout for symptomology
  - Terminal cupping, leaf death (similar to fire blight), and deformed flowers

- Scout for active mites
  - 1-5 mites/terminal leaflet (Threshold)
  - Visual Symptomology?

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- Required sample size is relatively unknown
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  - Requires a dissecting microscope
    - Low adoption rate
- Growers generally relying on visual signs of broad mite injury to make control decisions
  - No good scale for visual injury currently exists
  - Scouting using visual injury could save producers time and labor

Objectives

1. Determine how large of sample is necessary to estimate broad mite population densities in a blackberry field
   - Sample size – 5, 10, and 15 leaflets
   - Number of samples necessary for each sample size

2. Develop a visual rating scale for estimating broad mite injury in blackberry.

3. Determine if observed visual injury correlates with broad mite population density
   - How many visual assessments in a field are necessary for an accurate sample?

Methods

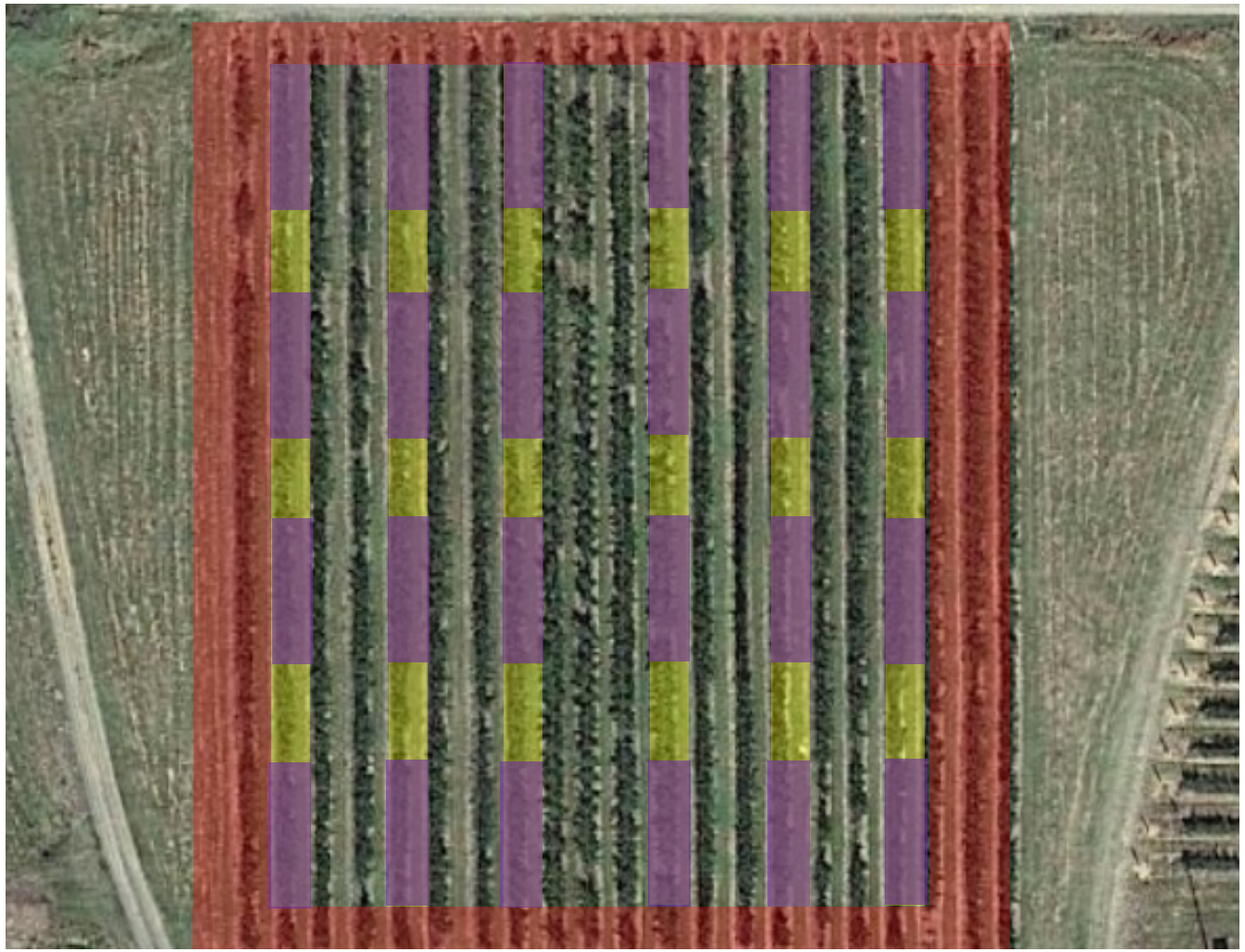
- This study was performed at two locations
  - 2022-2023
- 12 commercial blackberry fields were selected to compare leaflet and visual sampling
- 33 commercial blackberry fields for visual sampling only
- Developed injury scale based on initial observations from 2019-2021

Trial Design

- Six representative transects selected within each field

- Assessed broad mite number and visual injury in 12 fields (2022-2023)
  - Took four samples in each transect
  - 5, 10, and 15 leaflet samples
    - Counted broad mite adult, immature, and eggs
  - Visually assessed 10 blackberry canes

- Assessed visual injury only in 33 fields (2023)
  - Five, 10 cane samples in each transect
  - 300 canes assessed per field



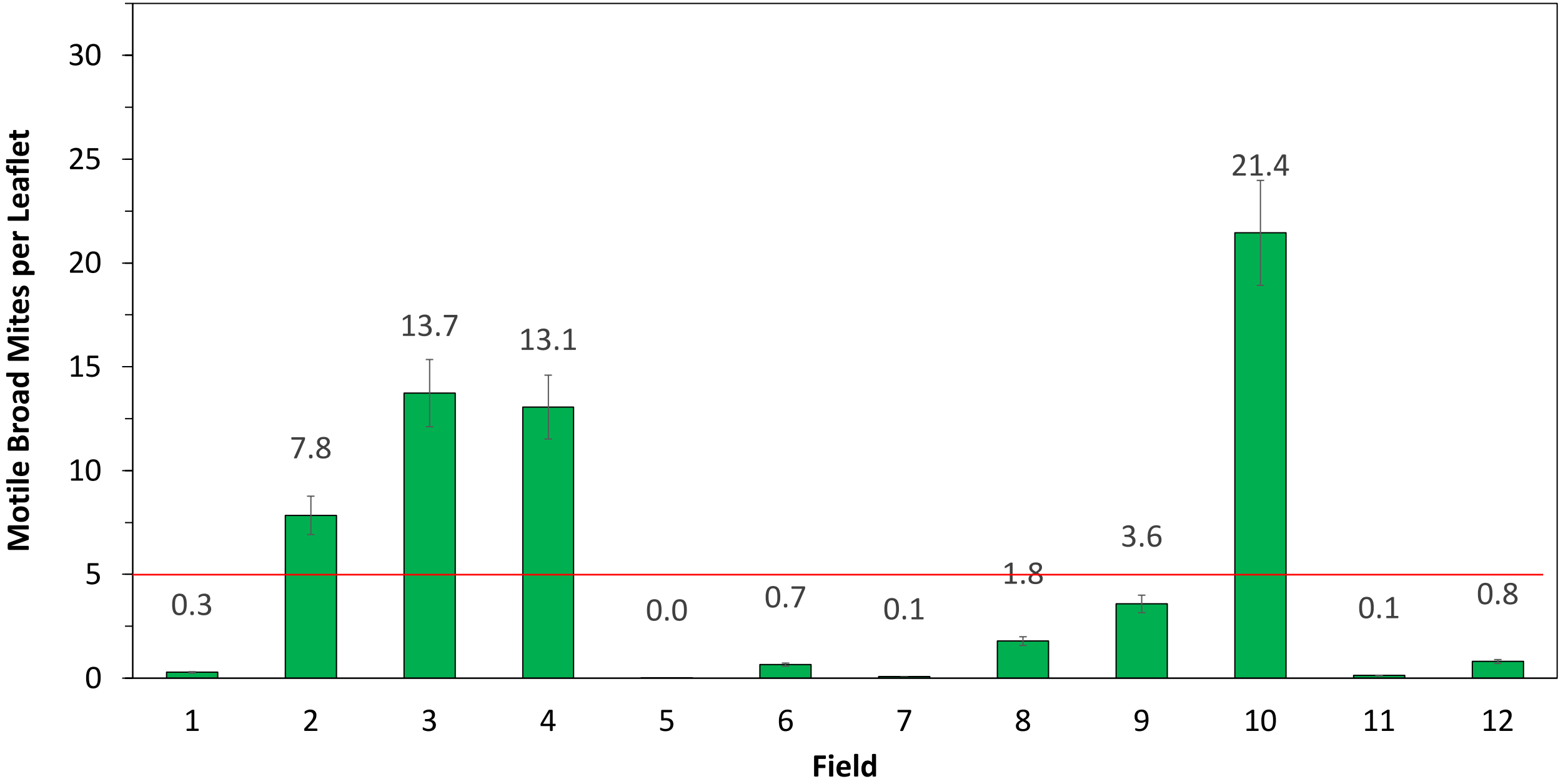
Visual Injury Rating Scale

Rating	Symptoms
1	no shortened internodes or leaf cupping
2	leaf bronzing, reduced internode length and the beginning of leaf cupping or upturned leaves
3*	excessive leaf cupping
4	leaves are beginning to become necrotic
5	tip-dieback and excessive necrosis of new leaves.

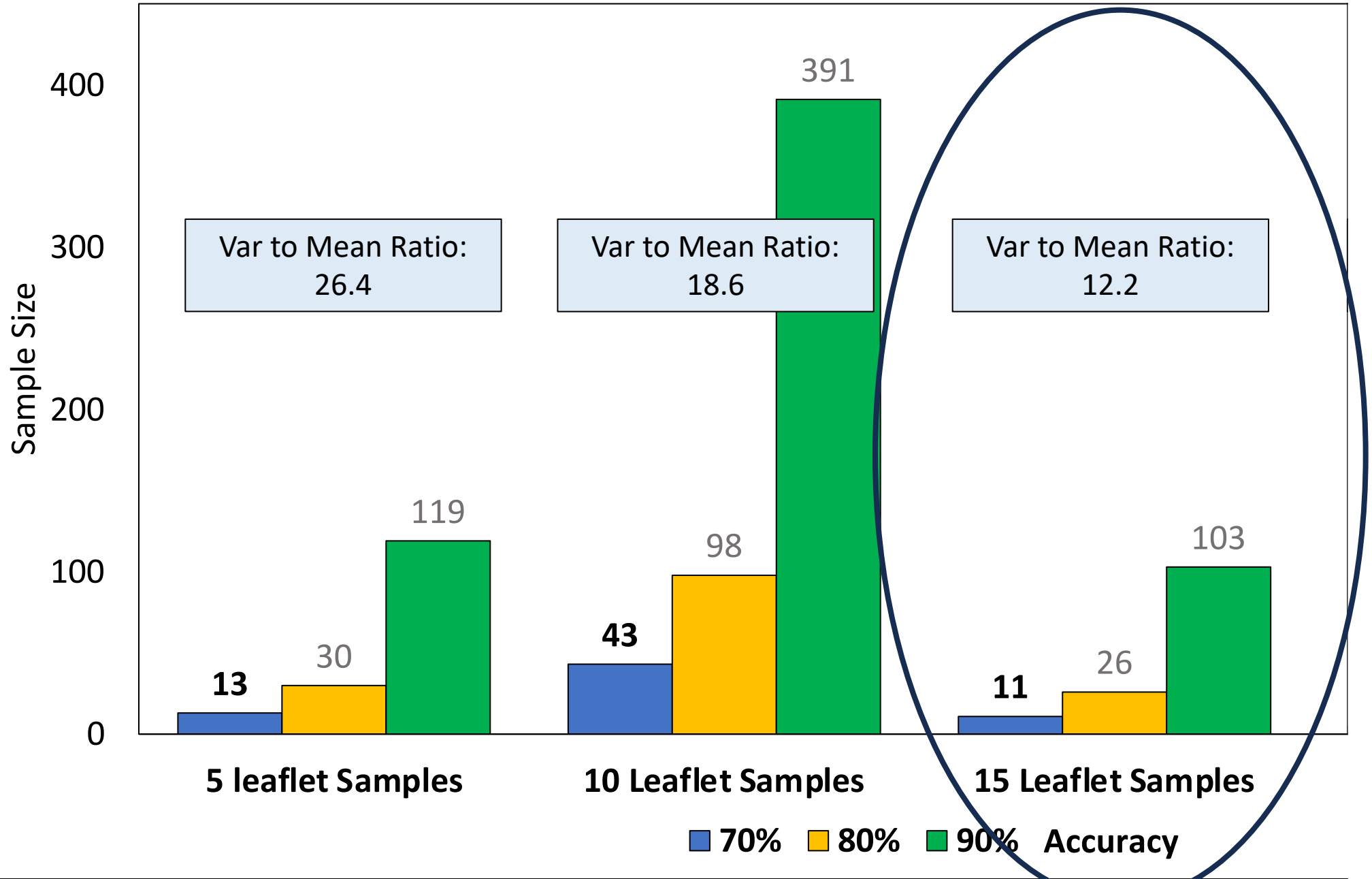
Statistical Methods

- Optimal sampling for both leaflet and visual techniques
  - Use statistical models to provide a sample size with a set accuracy
  - Spits out how many samples you would need for each sample size to achieve a specific level of accuracy
  - 70, 80, and 90% accuracy
  - Karandinos Equation ($n = \frac{t_{a/2} a x^{b-2}}{D_x^2}$)
    - $t_{\alpha/2}$ = Statistical standardization
    - ax^b = variance as defined by Taylor
    - D_x = Level of precision at 70, 80, and 90% of the mean
- Linear Regression (Proc Reg)
  - Compared damage ratings to life stage metrics to see if any correlations were present

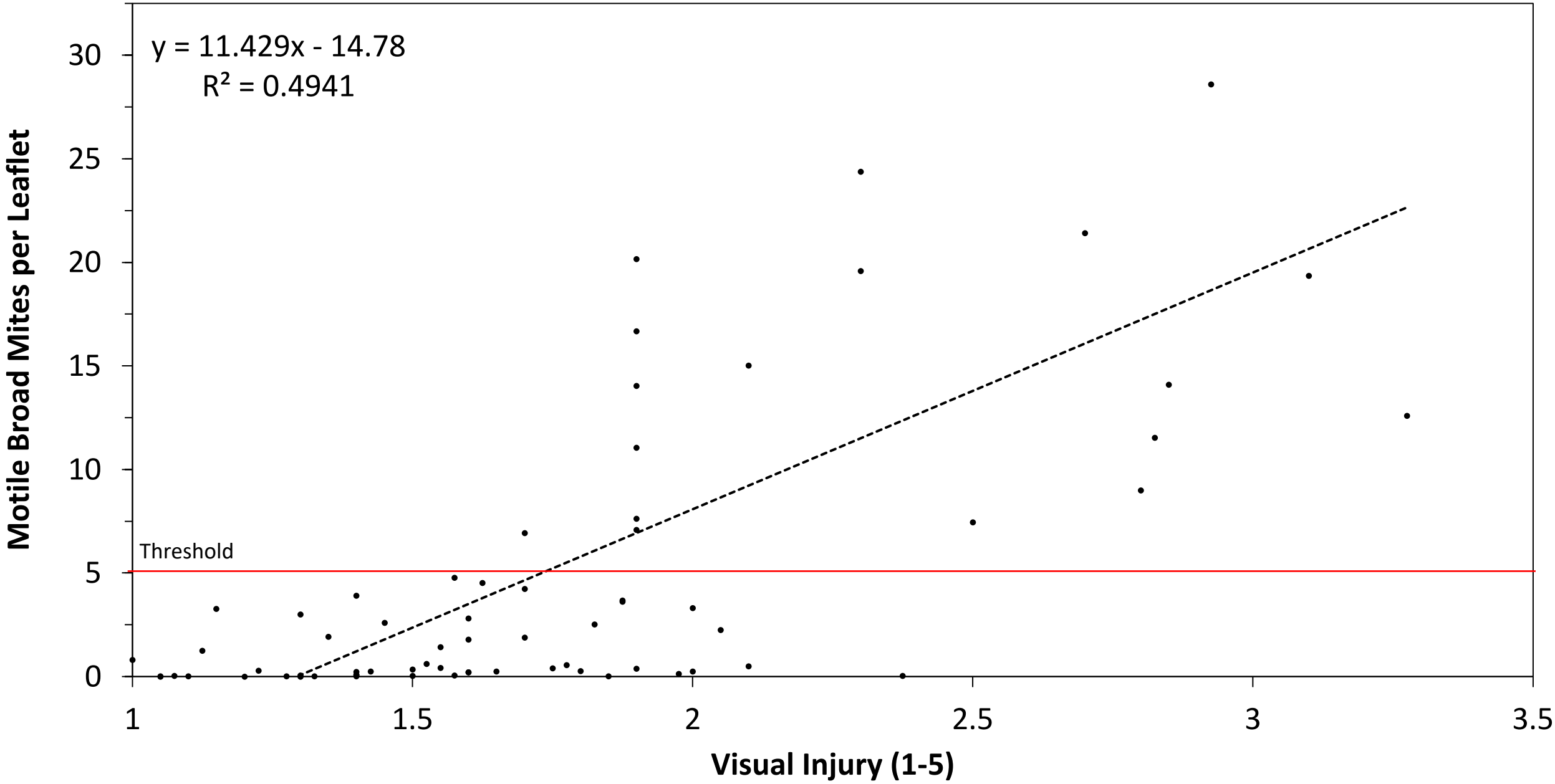
Broad Mite Population Density by Field



Optimum Sampling for Leaflet and Visual Sampling



Broad Mite Population Density vs. Visual Injury



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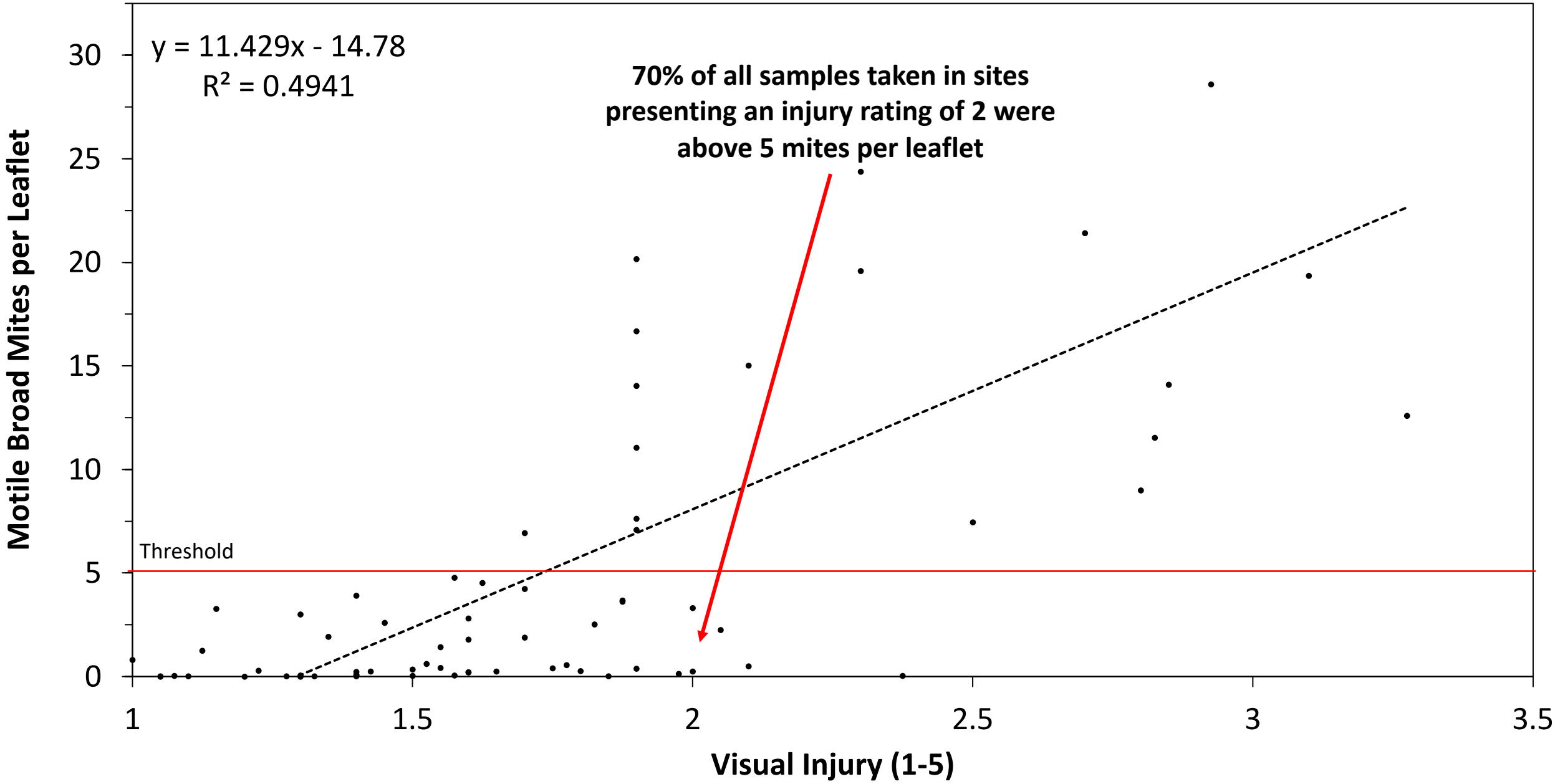
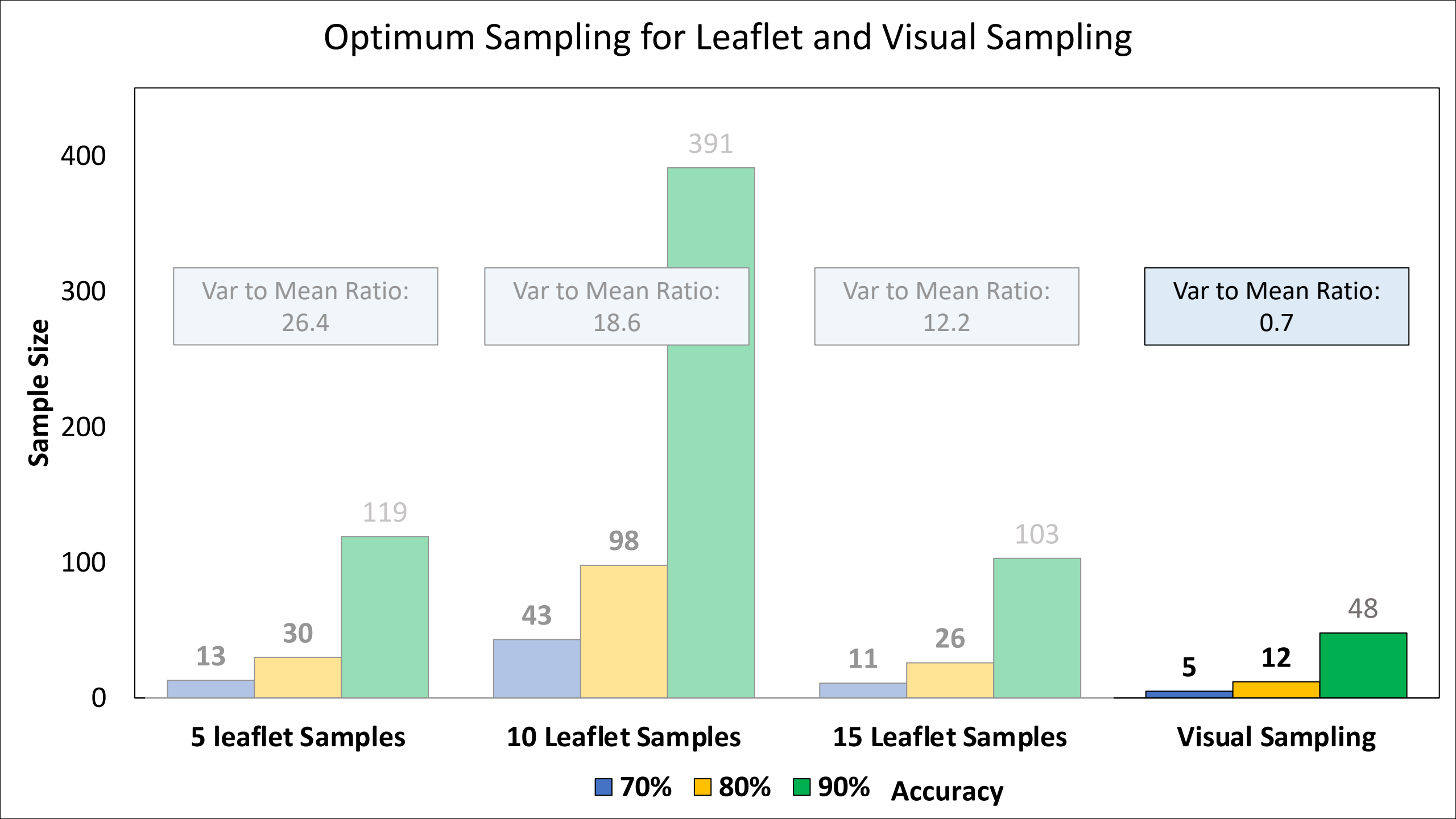
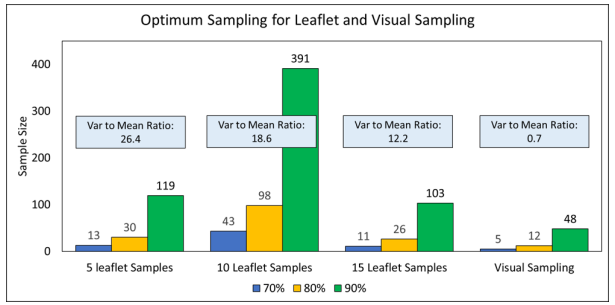
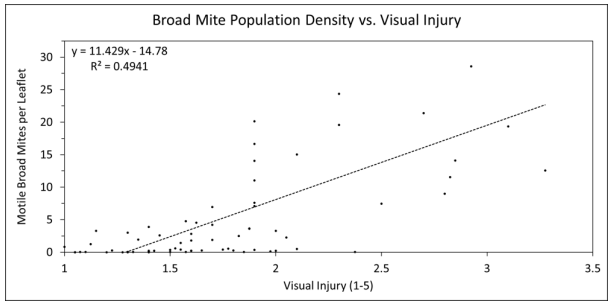



Optimum Sampling for Leaflet and Visual Sampling
Sample Size
400
300
200
100
0
Var to Mean Ratio: 26.4
Var to Mean Ratio: 18.6
Var to Mean Ratio: 12.2
Var to Mean Ratio: 0.7
13
30
119
43
98
391
11
26
103
5
12
48
5 leaflet Samples
10 Leaflet Samples
15 Leaflet Samples
Visual Sampling
70%
80%
90%
Accuracy

Conclusions





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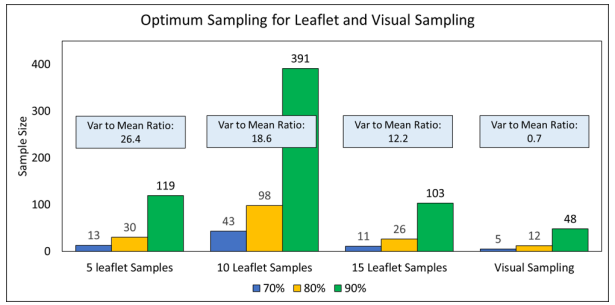

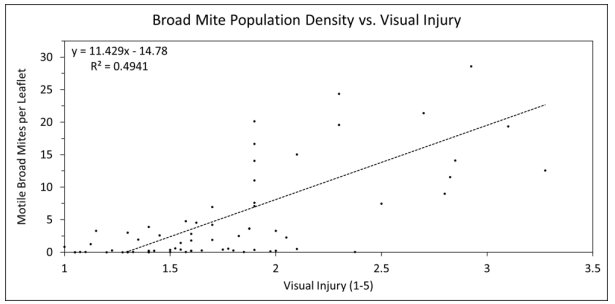

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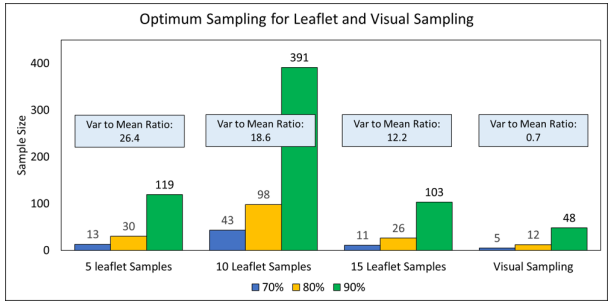

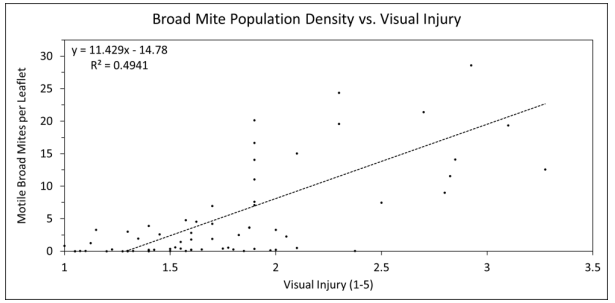

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  - Be wary about using for primocane fruiting varieties

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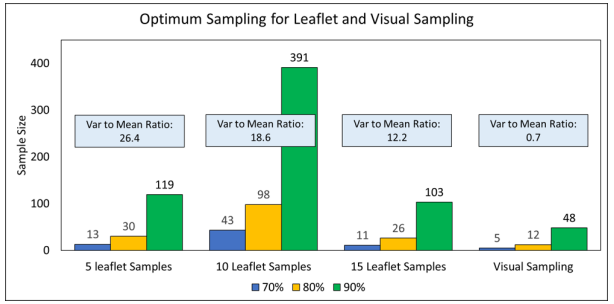

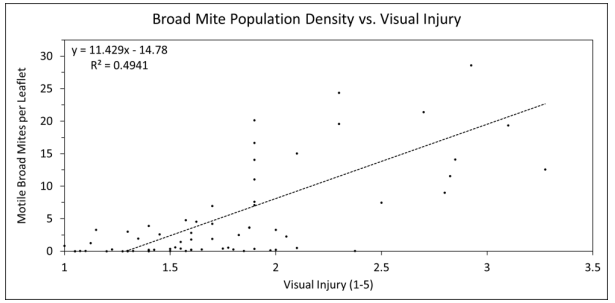

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  - Be wary about using for primocane fruiting varieties
- Leaflet scouting for broad mite is time-consuming but may still be necessary
  - 11 sets of 15-leaflet samples
  - Necessary for primocane fruiters

Questions

Special Thanks to…

- Jared Linn (M.S. Project)
- Ryan Keiffer and Mataya Duncan
- Growers who let us sample their fields

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