Measuring Legume Content in Pastures Using Digital Photographs.

Ed RAYBURN
Extension Forage Agronomist
West Virginia University
Morgantown, WV
erayburn@wvu.edu

What is the legume content in this photo?

16%
Legume

What is the legume content in this photo?

32%
Legume

What is the legume content in this photo?

54%
Legume

Comparison of point count measurement of legume content in digital photos to hand separated legume content of clipped samples from pastures.

Field collection of samples

- Twenty-four samples were clipped from an orchardgrass-clover pasture prior to grazing, representing a range in legume content.
- Legged quadrat (30.5 x 30.5 cm) was place to mark the sample area.
- Digital photograph was taken of the area.
- Same size flat quadrate was placed at ground level.
- Forage was clipped at ground level.

R10-22-97
1-10

Hand separation of clipped samples

- Clipped samples were frozen.
- Samples were hand separated into grass, legume, broadleaf weed, and dead fractions.
- Botanical fractions were dried at 60° C to determine dry matter yield.

Point count of digital images

- Photo was brought into MS PowerPoint.
- Point count grid overlain on photo.
- Points touching grass, legume, and broadleaf weeds were counted (40-50 points).
- Grid was moved for a second count.
- Four counts/photo were taken averaging 168 points on grass, legume, and broadleaf weeds.

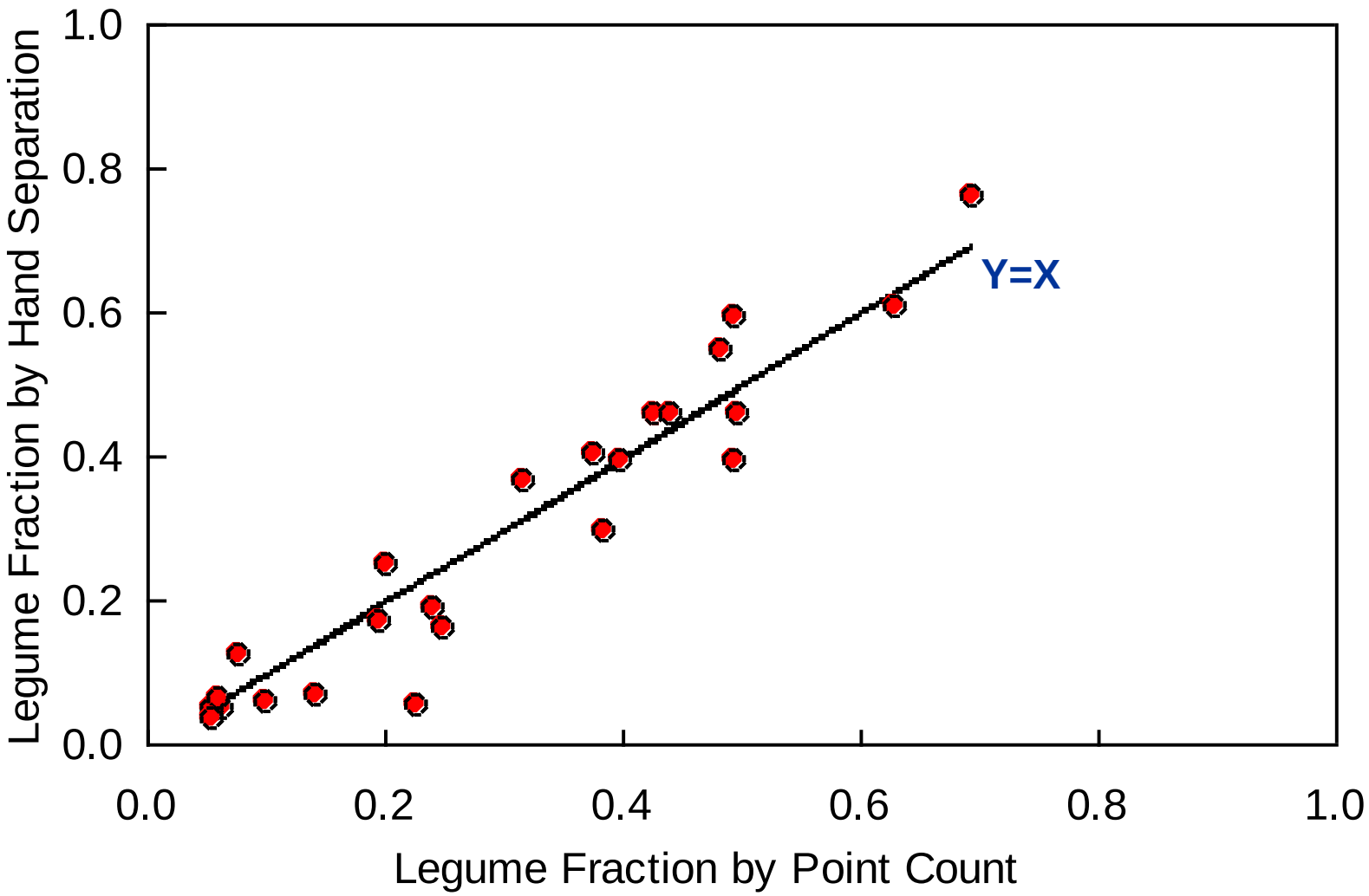
R10-22-97
1-10

V V V V V V V V V
V V V V V V V V V
V V V V V V V V V
V V V V V V V V V
V V V V V V V V V
V V V V V V V V V
V V V V V V V V V
V V V V V V V V V

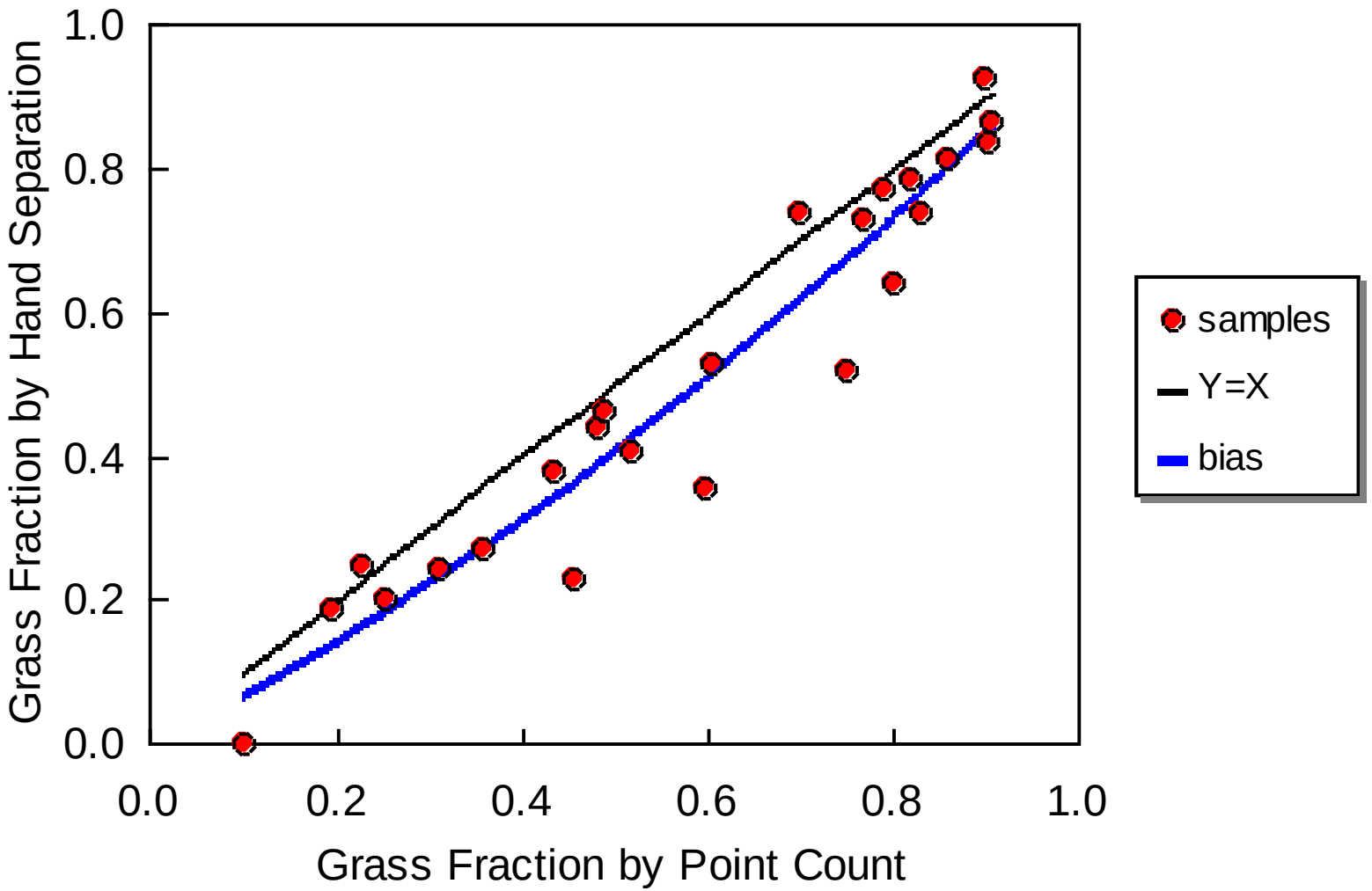
T-10

Results

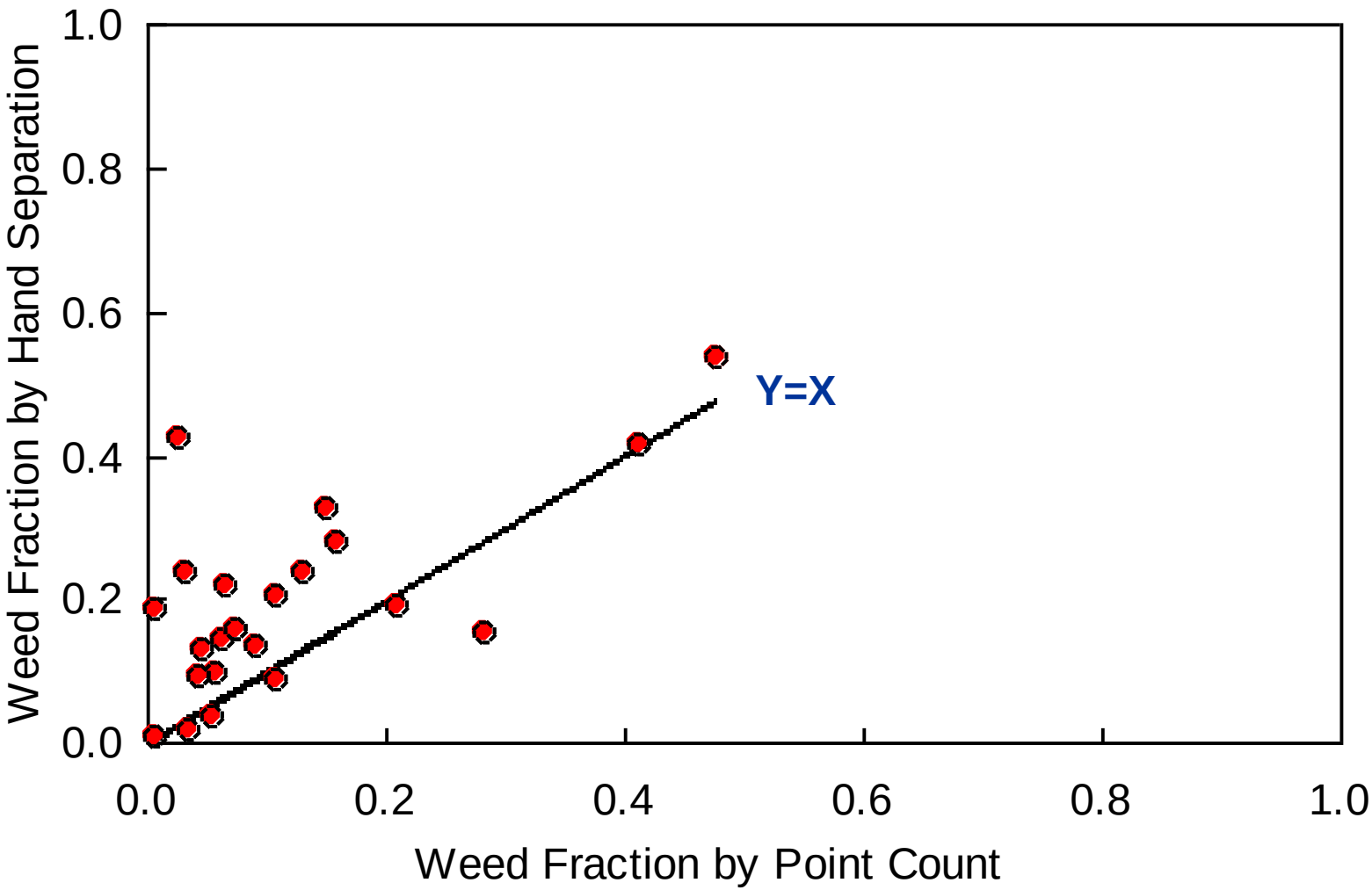
Point Count - Legume Fraction



Point Count - Grass Fraction



Point Count - Weed Fraction



Hand separation

- Considered standard method.
- Takes considerable time and effort depending on degree of separation made (by species or botanical group).

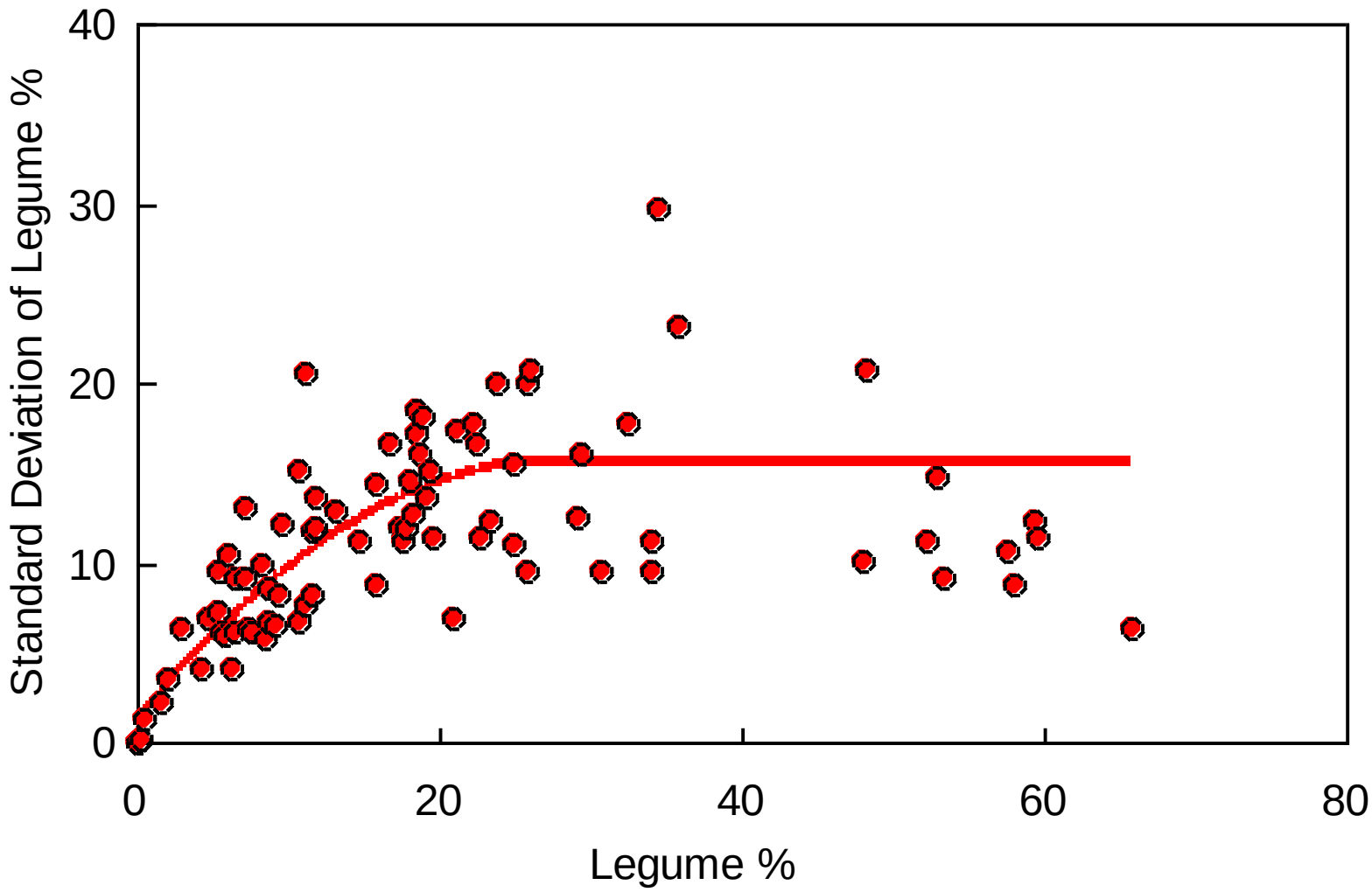
Point Count

- Relatively easy and cost effective alternative to hand separation.
- Use digital camera and conventional computer software.
- Need about 12-30 clips over a range of botanical content to calibrate point count surface cover to hand separated botanical content.
- For good precision in applying calibrated method to pastures we recommend 10-20 photos/pasture and 100 points/photo.

How many photos should be taken of each pasture?

- How precise an average is needed?
- How variable is the legume content across the pasture?

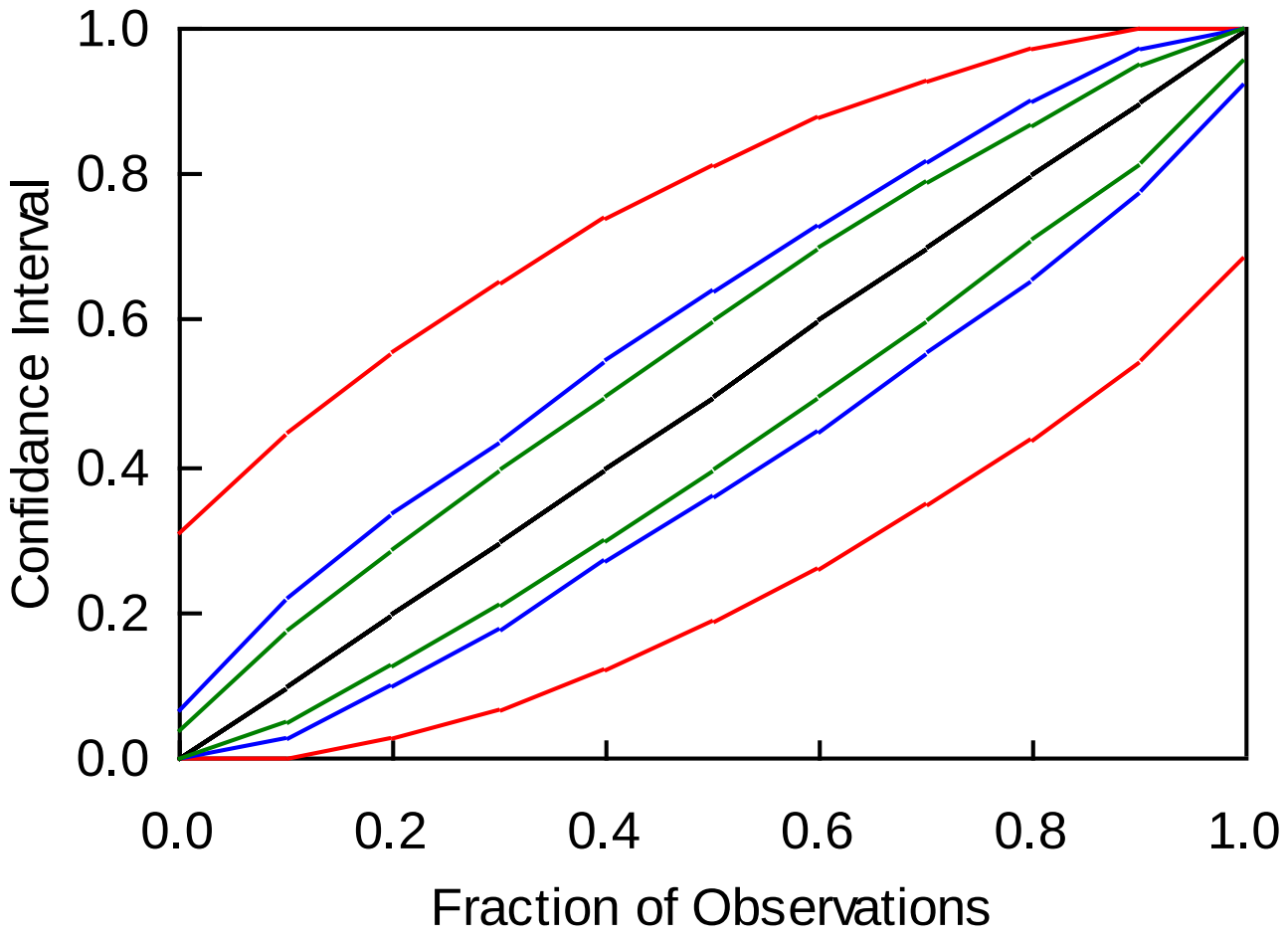
Mean Legume on Legume Standard Deviation



How many points should be counted on each photo?

- How precise an average is needed?

Effect of Sample Size on the Confidence Interval - Binomial Distribution

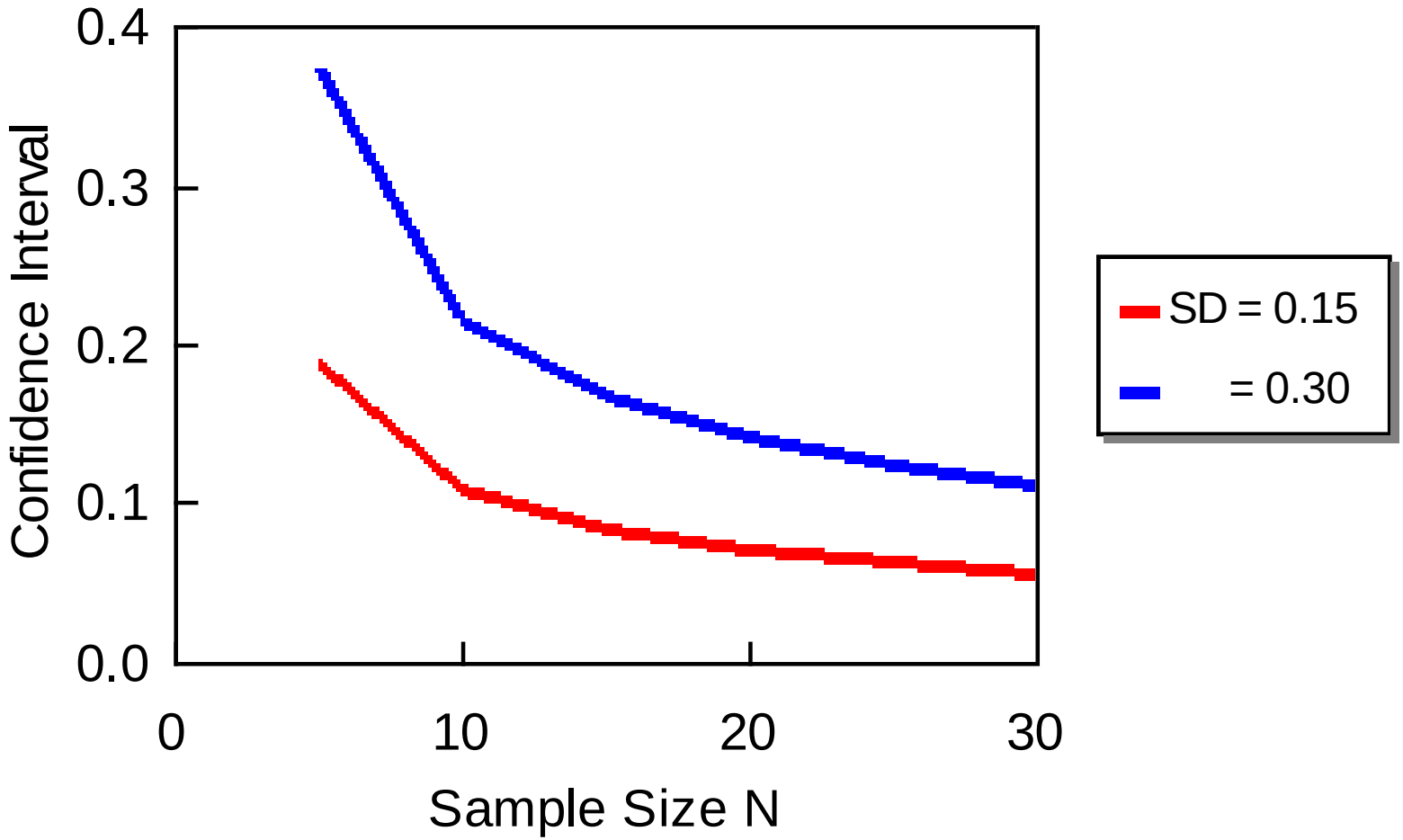


The confidence interval decreases greatly as the number of points counted increases from 10 to 50 and decreases slightly more as the count increases to 100.

Calculating the confidence interval (CI) of a mean.

- The statistical mean lies with in the calculated mean + and – the CI. For samples from large populations:
- $CI = t_{0.05}\ SD / N^{0.5}$
- $t_{0.05}$ is the Student t value at the 0.05 probability level for N-1 degrees of freedom.
- SD is the standard deviation.
- N is the number of samples.

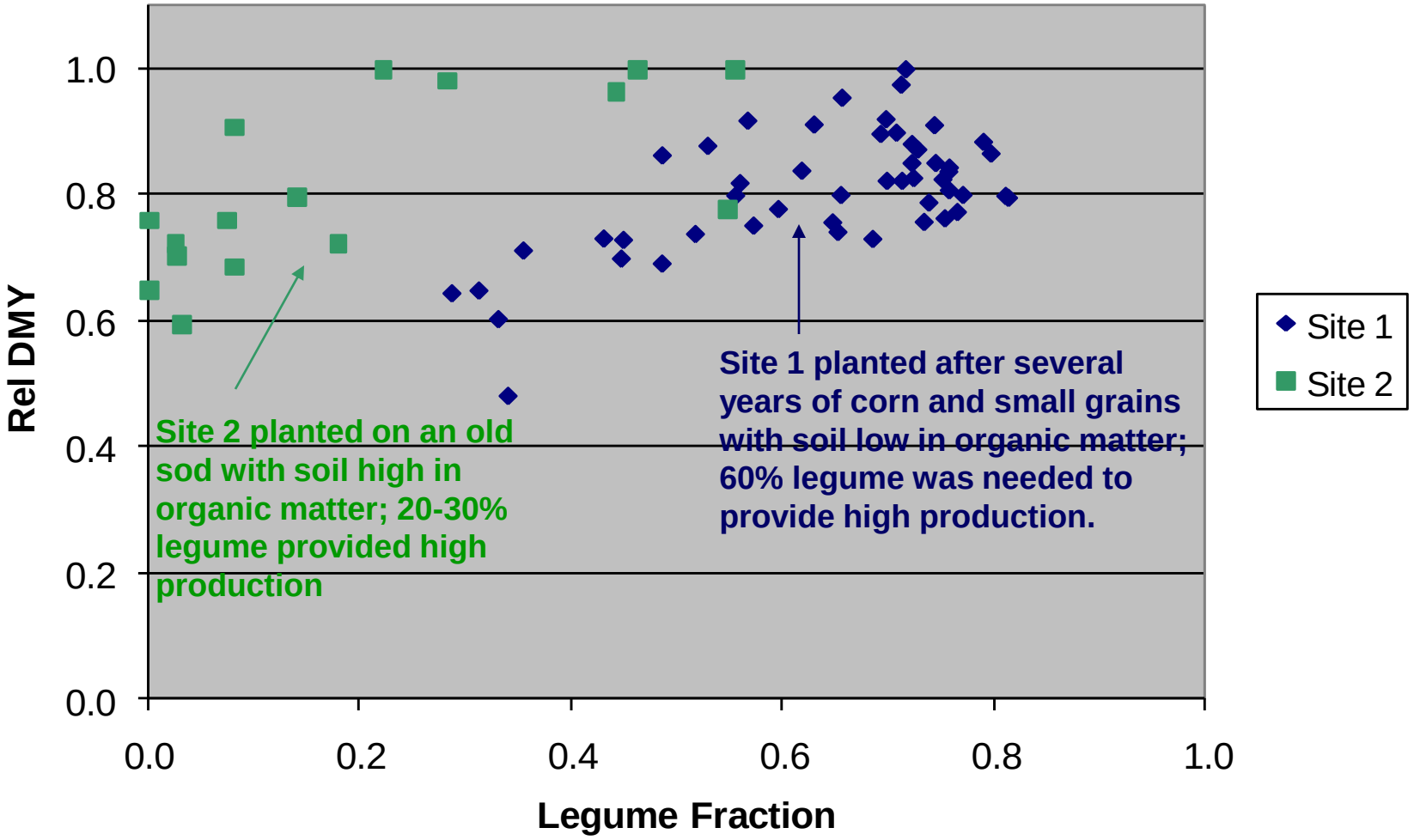
Effect of Sample Size on the Confidence Interval - Normal Distribution



What legume percentage is needed in a stand for optimum production?

Red Clover and Birdsfoot Treefoil-Grass Yield

It Depends!



Conclusion

Legume content is an important pasture characteristic that determines in part forage production, grazing days/acre, and animal performance/head. The methodology of using digital photos and readily available software provides a low cost method for extension advisors, researchers, and producers to measure the surface cover of legumes in pastures. Legume surface cover is highly related to the hand separated legume content. Being familiar with legume content in pasture and its effect on forage production, forage quality, and animal performance and quantifying the effects of management on legume content is important to improving legume management in pastures and meadows.