

Determining Silage Density

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Why Know Silage Density?

1. Inventory feed supplies

How long feed will last

Estimate yields

How much is sold/bought

2. Dry matter loss is related

3. Storage capacity is related

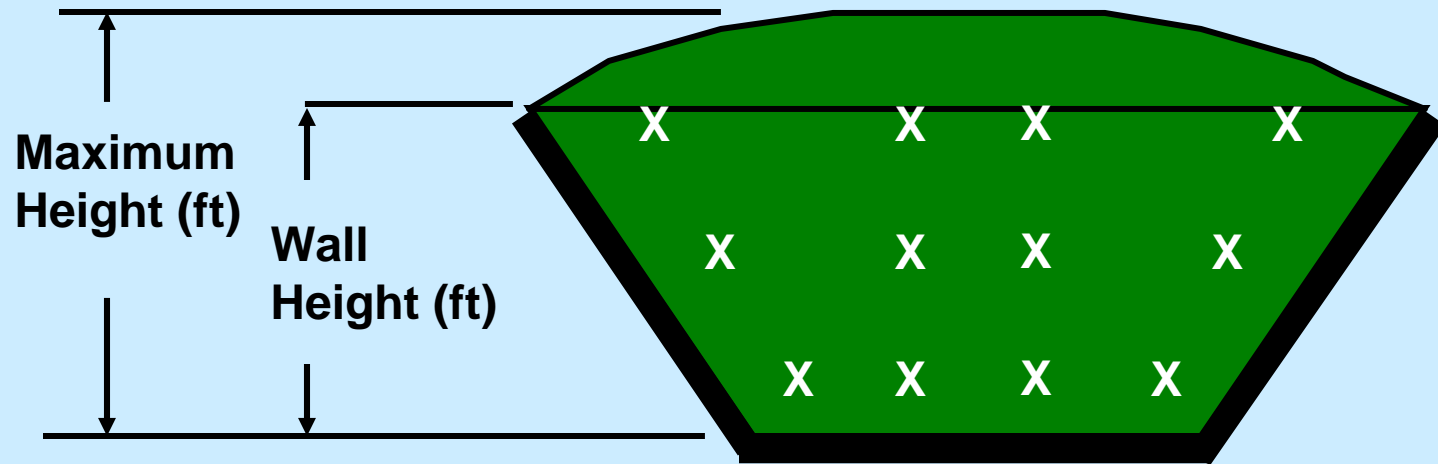
Silage Density Coring Method

Procedure:

1. Core sample at face to depth of 12 inches (0.305 m) at multiple sites
2. Weigh samples
3. Dry Samples
4. Weigh dry samples
5. Calculate core density and average



Suggested Coring Locations



Silage Face Coring Method

Benefits

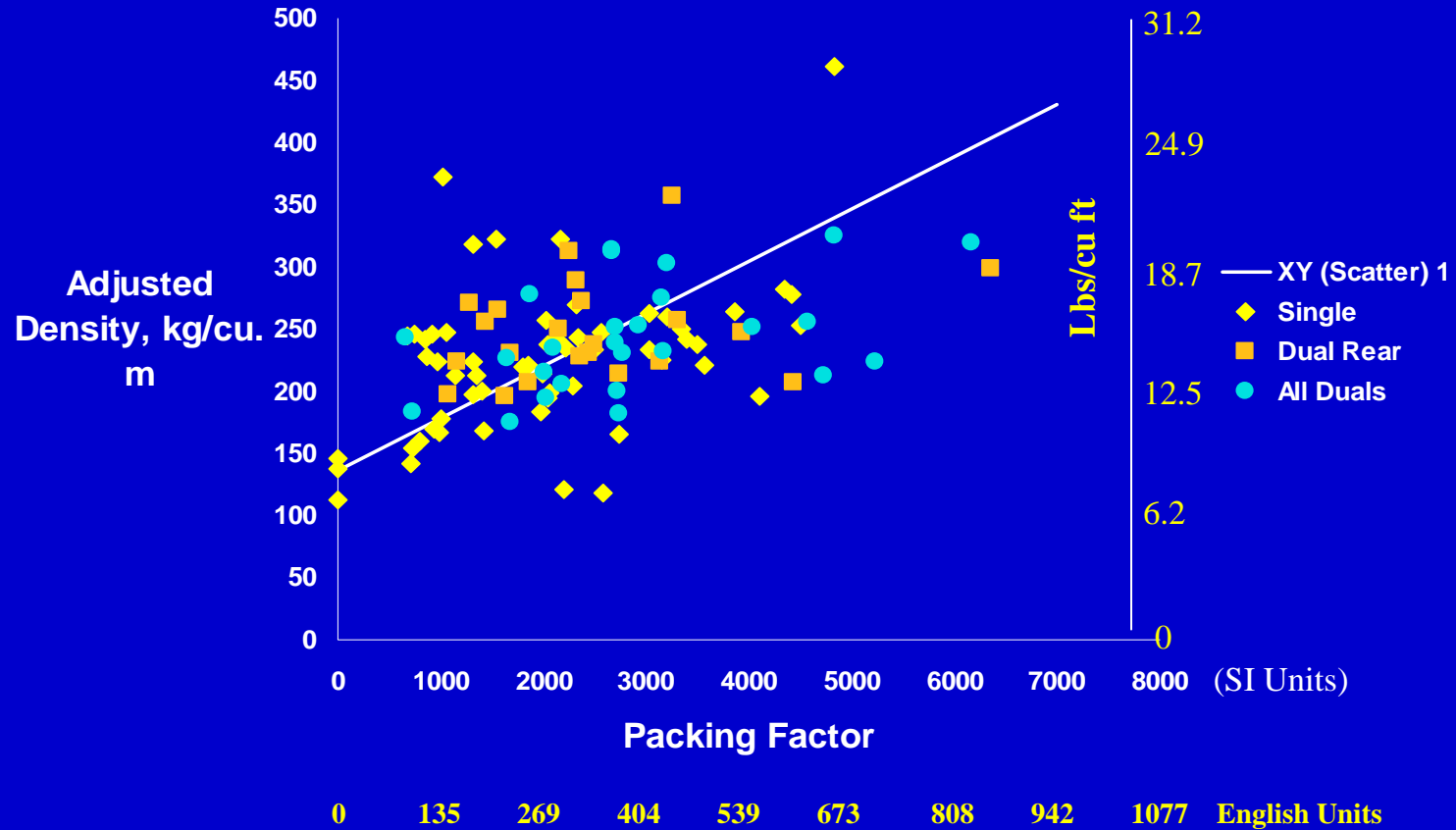
1. Accurate at point

Limitations

1. Dangerous
2. Site specific
Height
Walls
Fissures
3. Requires special tools
4. Time consuming
5. Many cores required
6. After filling/removal

Silage Density Calculator Method

Adjusted Density in Relation to the Packing Factor



Combined Packing Factor

- Looked at various combinations of factors to find the best explanation of variability in density

$$PF = \frac{W}{L} \sqrt{T \cdot D}$$

W = Avg. Tractor Weight (lbs or Kg)

L = Initial Layer Thickness (inches or cm)

T = Packing Time,

Tractor Hours/Tonne or Ton As Fed

D = Dry Matter Content (decimal)



Predicted Average Silo Densities

- Using the packing factor (P) and silage height (H), predicted silo density is:

$$\rho = (136.3 - 0.042P) \cdot (0.818 + 0.0446H) \text{ Metric}$$

$$\rho = (8.5 - 0.016P) \cdot (0.818 + 0.0136H) \text{ English}$$

- Spreadsheet available at:

<http://www.uwex.edu/ces/crops/uwforage/storage.htm>



Silage Density Calculator Method

Procedure:

1. Establish packing procedure:

Tractor weight(s)

Number Tractors

Percent packing time

Layer thickness

Harvest rate

Dry matter content

Wall height

Peak height

2. Calculate average density with spreadsheet



Silage Density Calculator Method

Benefits

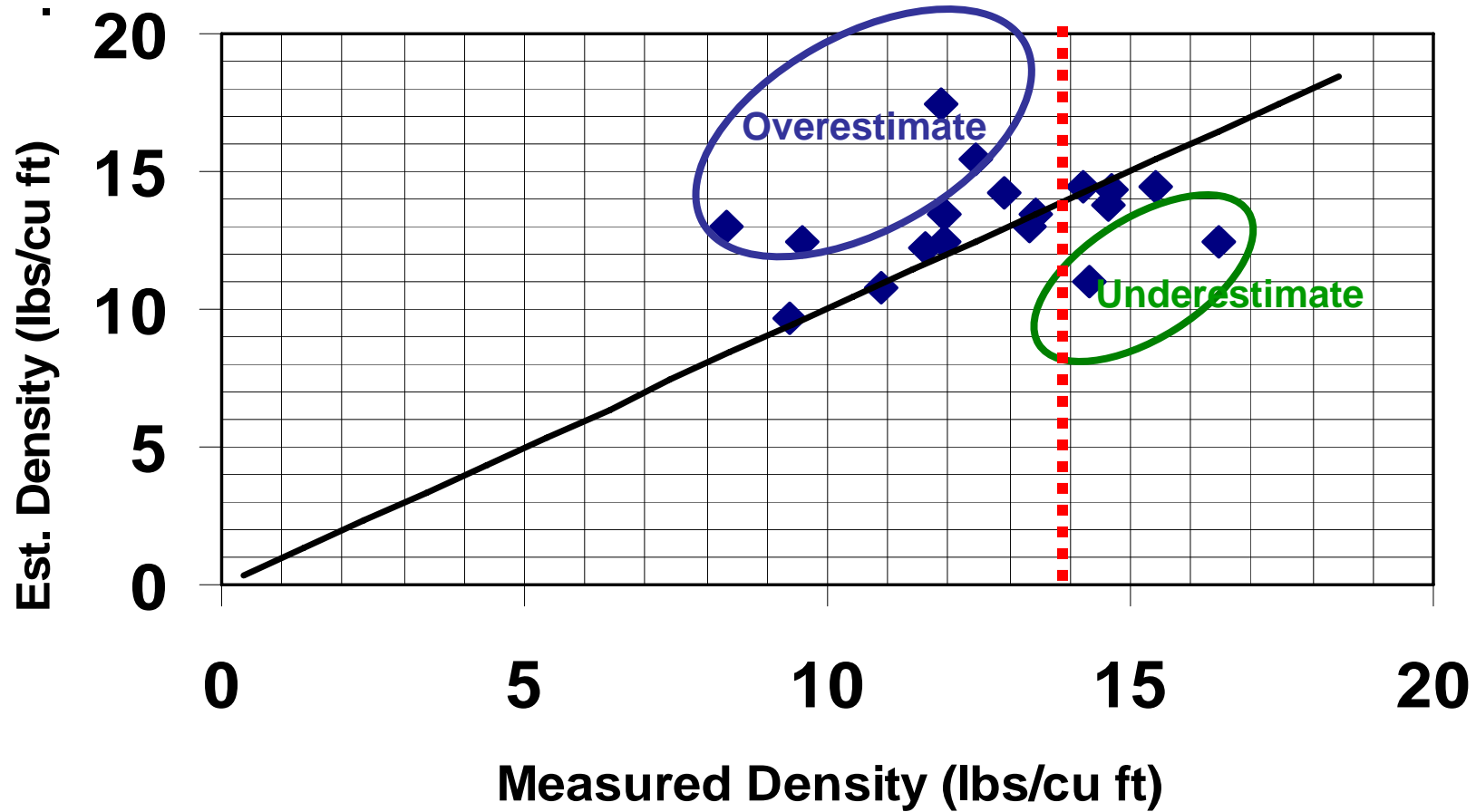
1. Average Density
2. What If? before filling
3. Time efficient
4. Any time
5. Safe

Limitations

1. Not site specific
2. Requires filling procedures
3. Not consistently accurate

Est Density VS Measured Density

2004 Dauphin Co. Study



◆ Pennsylvania Results — $Y = X$

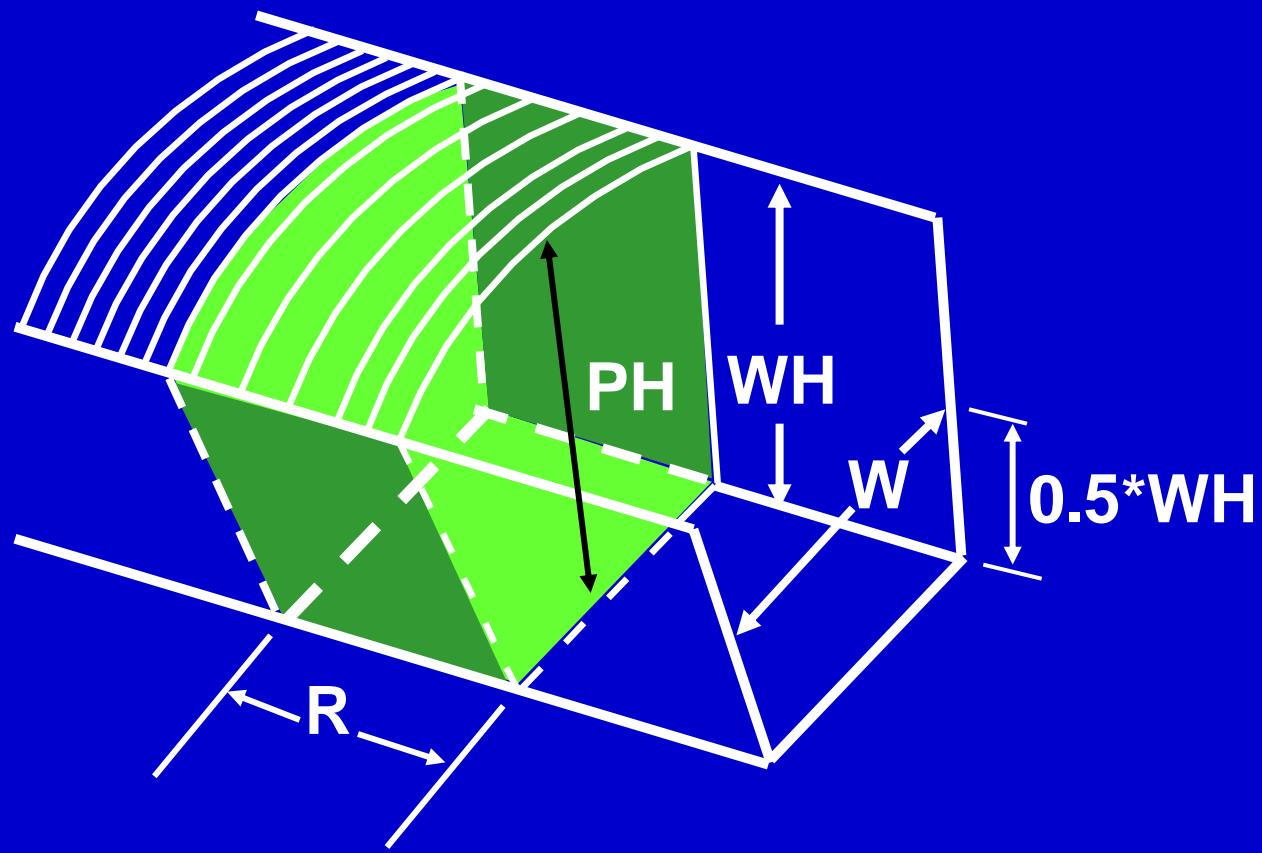


Silage Density Feed Out Method

Average Density

$$\text{Volume Removed} = R * W * (PH + WH) / 2$$

$$\text{Av. Density} = \text{Weight Removed} / \text{Volume Removed}$$



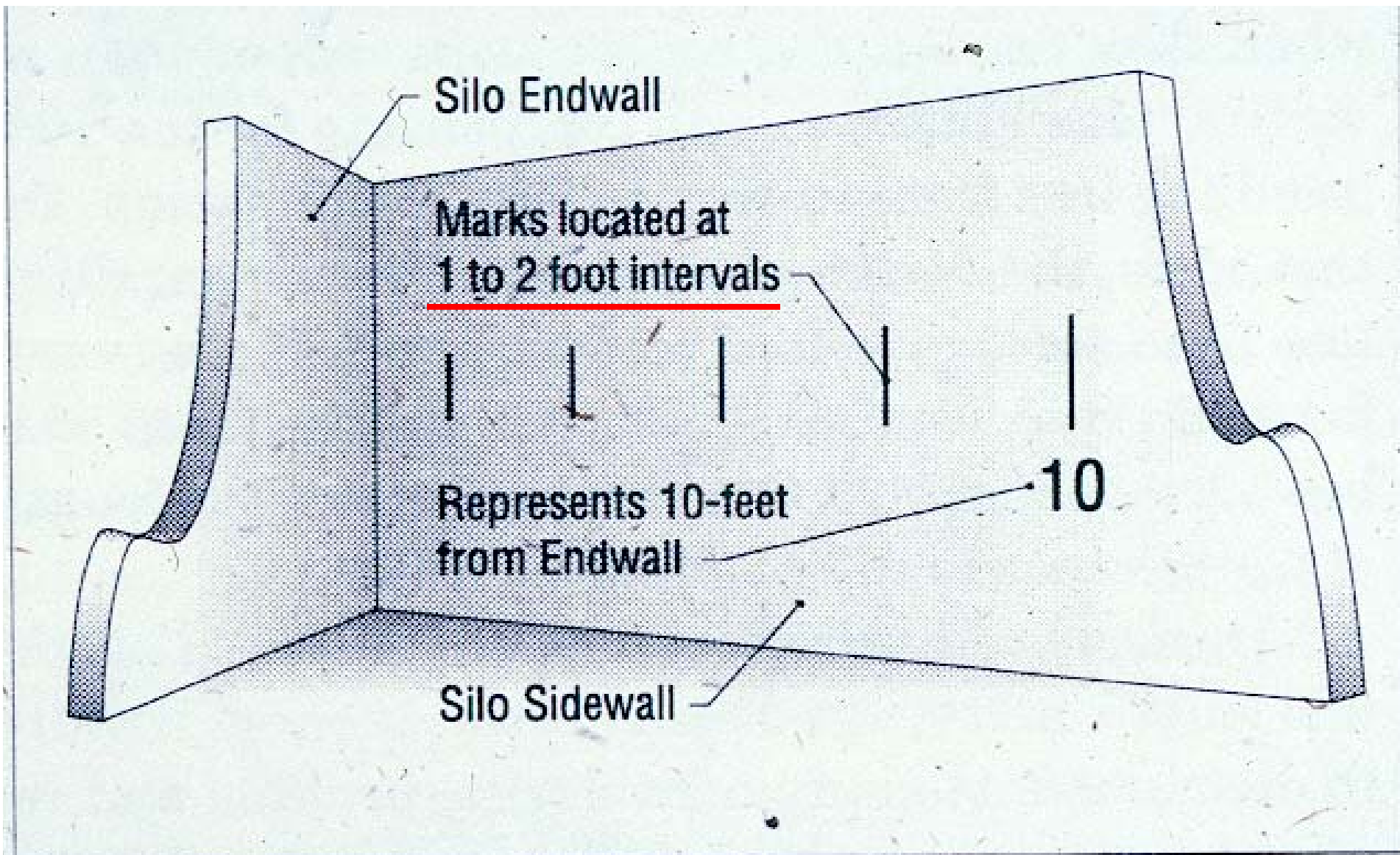


Figure 10. Marks painted on the sidewall to aid in determining feeding rates and remaining capacity.

Silage Density Feed Out Method

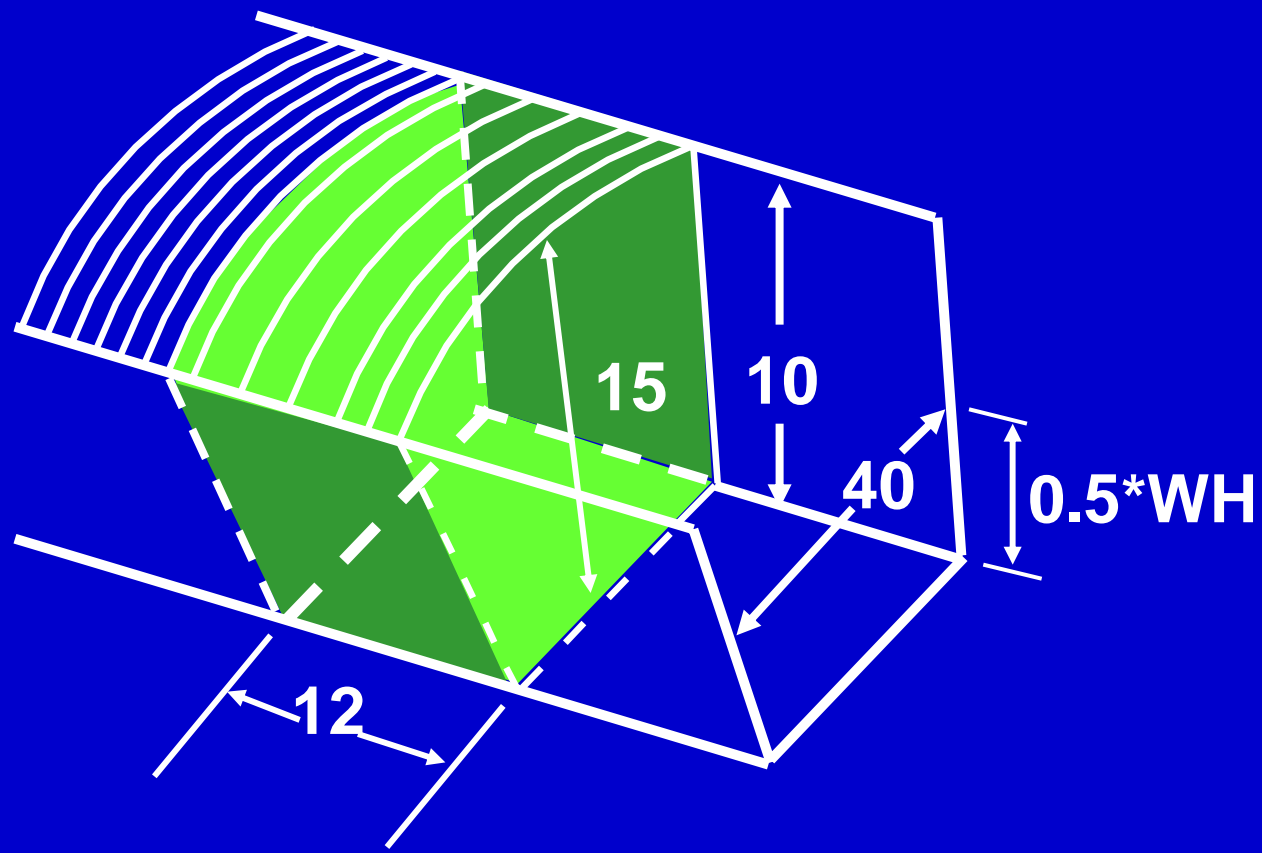
Procedure:

1. Mark location of feed out face day #1
2. Feed out for several days and weigh feed into each load
3. Measure distance face moves
4. Measure face dimensions (wall height, peak height, average width, etc.)
5. Calculate volume removed
6. Sum weights removed
7. Divide weight removed by volume removed to get average AF density
8. For DM density, moisture sampling is needed

Example Average Density

Volume Removed = $12' \times 40' \times (15' + 10') / 2 = 6,000$ cu ft

Av. Density = $90,000$ lb DM / $6,000$ cu ft = 15 lbs DM / cu ft



Silage Density Feedout Method

Benefits

1. Average Density
2. Safe
3. TMR scales

Limitations

1. Not site specific
2. TMR scales
3. During Feedout
4. Feeder commitment
5. Start/End w smooth & vertical face



Comparing three different methods for assessing corn silage density.

R.J. Norell, M. Chahine, S. Hines, T. Fife,
M. De Hario, and S. C. Parkinson

University of Idaho

Methods

Eighteen storages were studied.

Three core samples were collected twice.

Core samples were collected at mid height at the center, left, and right of the silage face.

Inputs for the Silage Density Calculator were obtained.

Methods

Silage face measurements and face location were obtained during three farm visits (10 to 14 day intervals).

Area calculated using digital image.

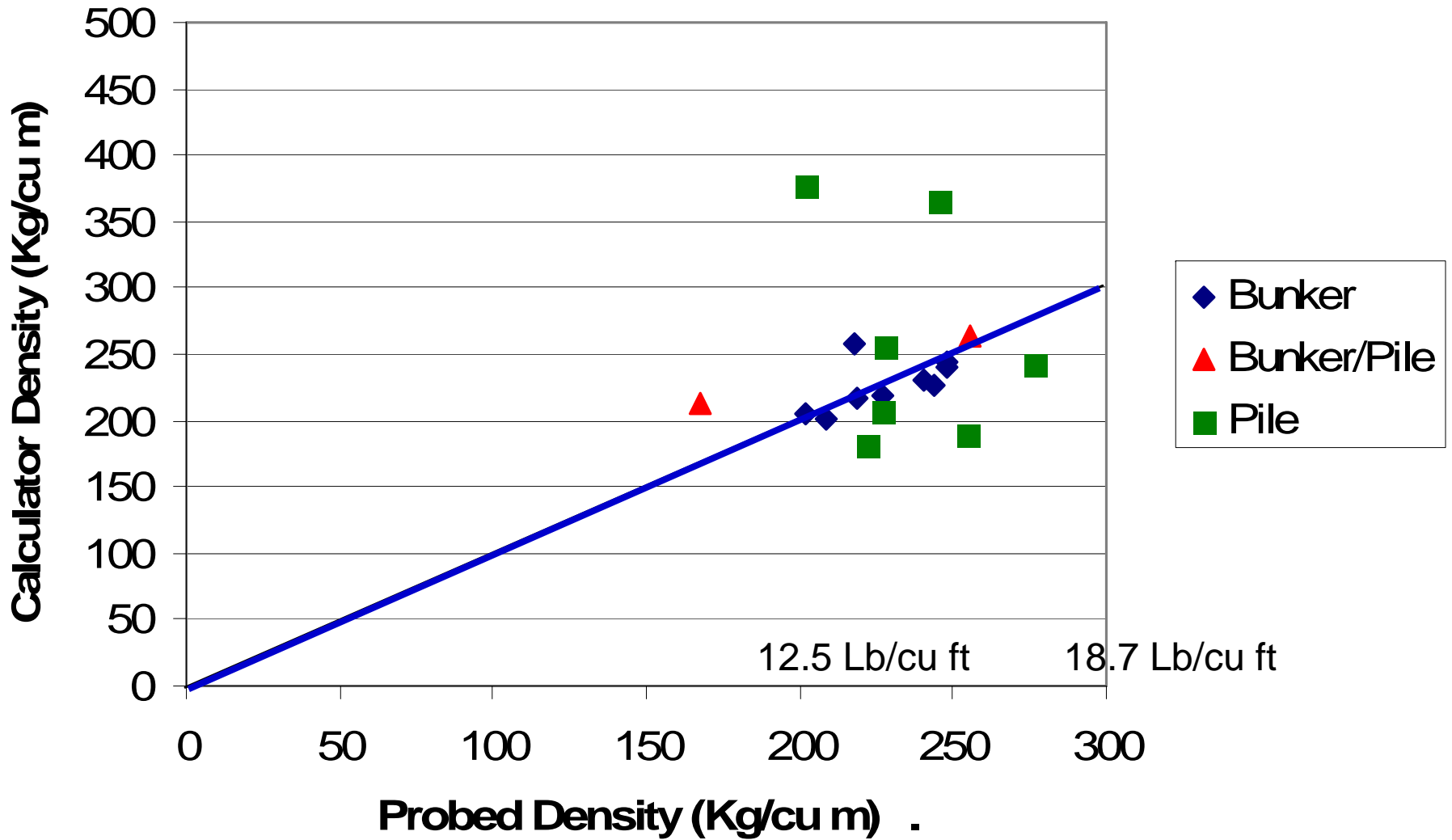
Silage weight removed was the sum of weight specified for each load on the load sheet for one day.

Density was calculated by dividing the weight of silage fed by the volume of silage removed during the interval between farm visits.

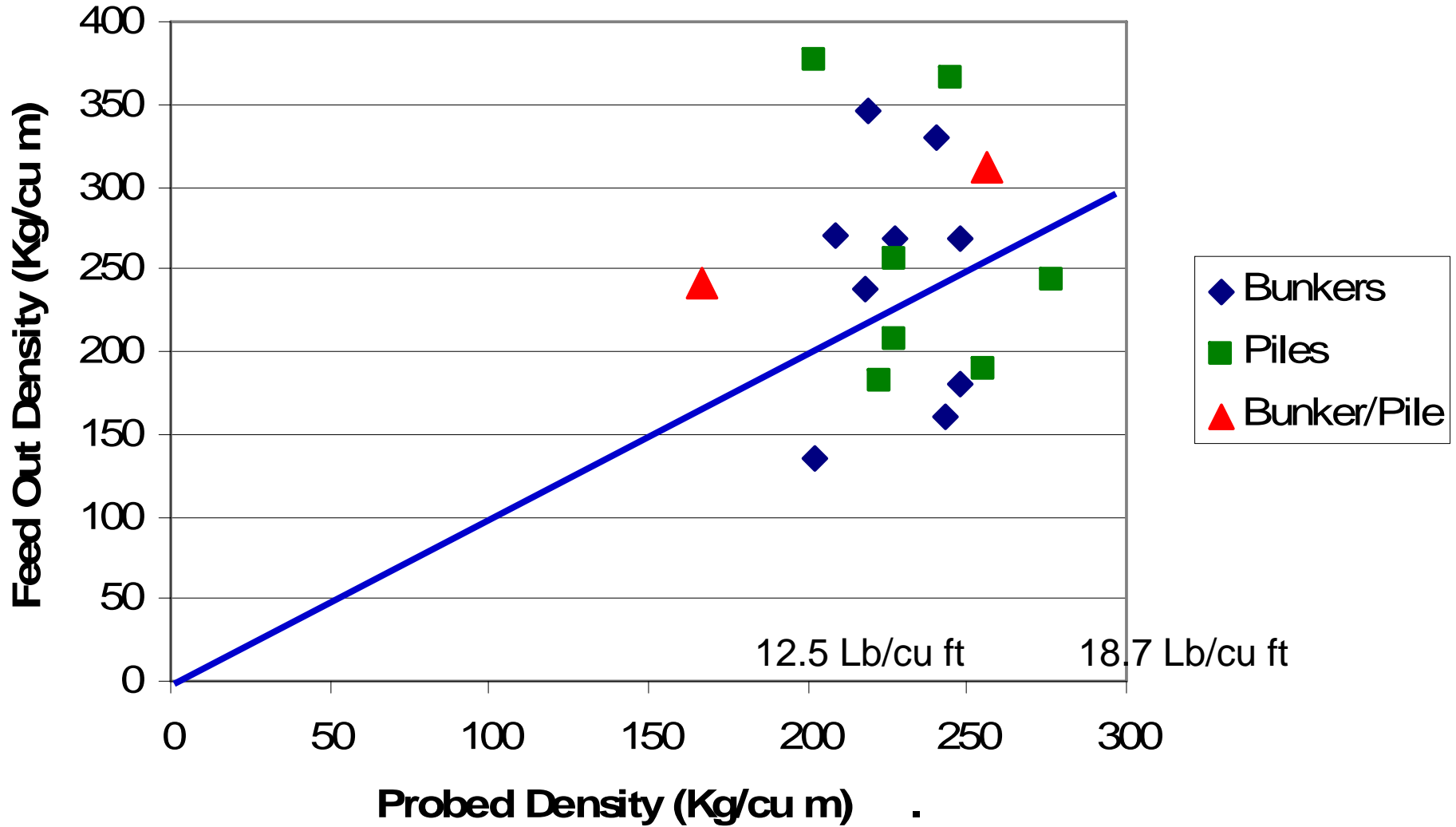


Calibration Board

Calculator Density vs Probed Density



Feedout Density vs Probed Density



Results

- **Variation in density between storages was significantly higher for Feedout method than core sampling or calculator methods ($p < 0.001$).**
- **Core density measurements were highly correlated with Calculator estimates ($r = 0.71$, $p < 0.001$) but not with Feedout density estimates ($r = -0.06$, $p < 0.82$).**

Results

- Feedout method did not perform satisfactorily due to non-uniform silage faces and the inherent challenges in measuring volume of silage fed at the farm level .
- Feedout method may provide more reliable estimates on operations utilizing silage facers (more uniform face).
- It is challenging to obtain reliable inputs for the calculator method at the farm level.

Conclusions

- Core sampling and calculator methods provide reasonably similar estimates of silage density.
- Collecting duplicate samples is needed to accurately assess core sample density.
- Feedout method was a poor predictor of silage density and is not recommended.

Conclusions

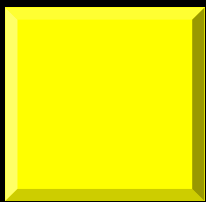
Taking care to keep a vertical uniform face and weigh all loads with TMR scales will improve accuracy significantly.

-- BJH

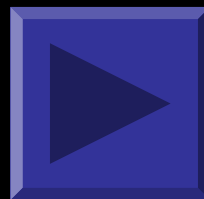
Conclusions

- **Core sampling is recommended for directly assessing silage density and the calculator method is recommended for evaluating alternative management strategies during the filling and packing process.**

Run Silage Stored Density Spreadsheet?



YES



NO

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<http://www.uwex.edu/ces/crops/teamforage/index.html>

QUESTIONS?