Abstract #81

# Influence of cutting height on nutrient composition and yield of whole-plant corn silage through a meta-analysis

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# Outline

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# Introduction

- Corn silage is a critical forage source for dairy cattle – provides both peNDF and energy
- Multiple factors contribute to corn silage quality:
  - Hybrid type
  - Crop maturity
  - Kernel processing
  - Cutting height

# Introduction

- **Increasing cutting height:**
  - ⬆ grain to stover ratio
  - ⬆ energy content
  - ⬆ NDFD
  - ⬇ yield

# Low vs. High Cut Corn Silage

| Average of 7 studies | | |
|---|---|---|
| | Low | High |
| Cutting height, cm | 16.9 | 52.3 |
| NDF, % of DM | 40.1 | 37.2 |
| Starch, % of DM | 31.5 | 34.5 |
| ivNDFD, % of NDF | 52.3 | 55.4 |
| Yield, Mg of DM/ha | 17.3 | 15.3 |

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Ferraretto et al., 2018

# Introduction

- **Increasing cutting height will:**
  - ⬆ grain: stover
  - ⬆ energy content
  - ⬆ NDFD
  - ⬇ yield
- **How do we decide if there is value in increasing cutting height at the expense of DM yield?**
- **A thorough evaluation of the benefits and drawbacks of increasing corn silage cutting height is needed**

# Objectives

- Several studies have evaluated the influence of cutting height on corn silage yield and quality
- However, an evaluation across multiple studies has yet to be conducted
- Our objective was to assess the influence of cutting height on nutrient composition and yield of whole-plant corn silage through a meta-analysis

# Materials and Methods

- Meta analytical approach using a dataset comprised of 10 published studies and 64 treatment means
- BMR treatment means were not included in the meta-analysis
- Independent variable: cutting height
- Dependent variables:
  - DM
  - Starch
  - NDF
  - NDFD (30 and 48 h ruminal in vitro and in situ)
  - DM yield (Mg/ha) and milk production (kg/Mg; Milk2006;Shaver et al., 2006)

# Materials and Methods

- Data analyzed using PROC MIXED in SAS
- Model included fixed effect of treatment and random effect of trial
- 17 variance-covariance structures were tested and Akaike's Information Criteria (AIC) was used to define best fit for final predictive equations

# Descriptive Statistics

| | No. of studies | No. of means | Mean | SD | Max | Min |
|---|---|---|---|---|---|---|
| Cutting height, cm | 10 | 64 | 36 | 21 | 100 | 10 |
| DM, % of as-fed | 9 | 62 | 36.4 | 4.3 | 46.9 | 28.7 |
| CP, % of DM | 10 | 64 | 7.8 | 0.7 | 8.9 | 6.4 |
| NDF, % of DM | 10 | 64 | 40.2 | 4.7 | 48.4 | 25.3 |
| Lignin, % of DM | 7 | 25 | 3.1 | 0.8 | 5.4 | 1.6 |
| Starch, % of DM | 8 | 55 | 25.3 | 9.3 | 47.0 | 9.2 |
| Ash, % of DM | 6 | 26 | 4.3 | 1.0 | 5.9 | 2.5 |
| NDFD, % of NDF | 7 | 49 | 58.9 | 12.8 | 78.8 | 30.3 |
| DM yield, Mg/ha | 8 | 52 | 15.0 | 2.5 | 23.0 | 10.8 |
| Milk yield, kg/Mg | 6 | 43 | 1682 | 289 | 2310 | 928 |

# Effect of cutting height on nutrient composition and yield

| Dependent variables | n | Intercept | SE | Slope | SE | *P* - value | AIC |
|---|---|---|---|---|---|---|---|
| DM, % of as-fed | 62 | 32.50 | 1.35 | 0.0859 | 0.032 | 0.02 | 390 |
| CP, % of DM | 64 | 7.71 | 0.17 | 0.004 | 0.002 | 0.11 | 92 |
| Starch, % of DM | 55 | 27.70 | 1.83 | 0.0819 | 0.0234 | 0.01 | 322 |
| NDF, % of DM | 64 | 43.54 | 1.00 | -0.0978 | 0.0189 | 0.001 | 339 |
| Lignin, % of DM | 25 | 3.65 | 0.34 | -0.0115 | 0.0058 | 0.08 | 63 |
| Ash, % of DM | 26 | 7.77 | 0.35 | -0.0117 | 0.0031 | 0.01 | 64 |

# Effect of cutting height on digestibility, DM yield, and milk production

| Dependent variables | n | Intercept | SE | Slope | SE | *P* - value | AIC |
|---|---|---|---|---|---|---|---|
| NDFD[1], % of NDF | 49 | 50.31 | 3.77 | 0.0796 | 0.0278 | 0.01 | 301 |
| DM yield, Mg/ha | 52 | 17.82 | 0.79 | -0.0481 | 0.0061 | 0.001 | 165 |
| Milk yield, kg/Mg[2] | 43 | 1,542 | 106 | 1.868 | 1.000 | 0.09 | 167 |

[1]NDFD=ruminal in vitro or in situ NDF digestibility at 30 or 48 h
[2]Estimated using Milk2006 (Shaver et al., 2006)

# Summary

- Yield of DM was reduced by 0.05 Mg/ha for each cm of increased cutting height
- For each cm increase in cutting height there was an increase of:
  - 0.09 % units in DM
  - 0.08 % units in Starch
  - 0.08 % units in NDFD

# Simulation

| | CS | High-cut CS | High-cut simulation |
|---|---|---|---|
| Cutting height, cm | 15 | 60 | 60 |
| NDF, % of DM | 37.7 | 33.8 ⟷ | 33.2 |
| Starch, % of DM | 37.5 | 41.7 ⟷ | 41.1 |
| NDFD, % of NDF | 49.6 | 52.7 ⟷ | 53.2 |
| Yield, DM Mg/ha | 22.0 | 20.0 ⟷ | 19.8 |

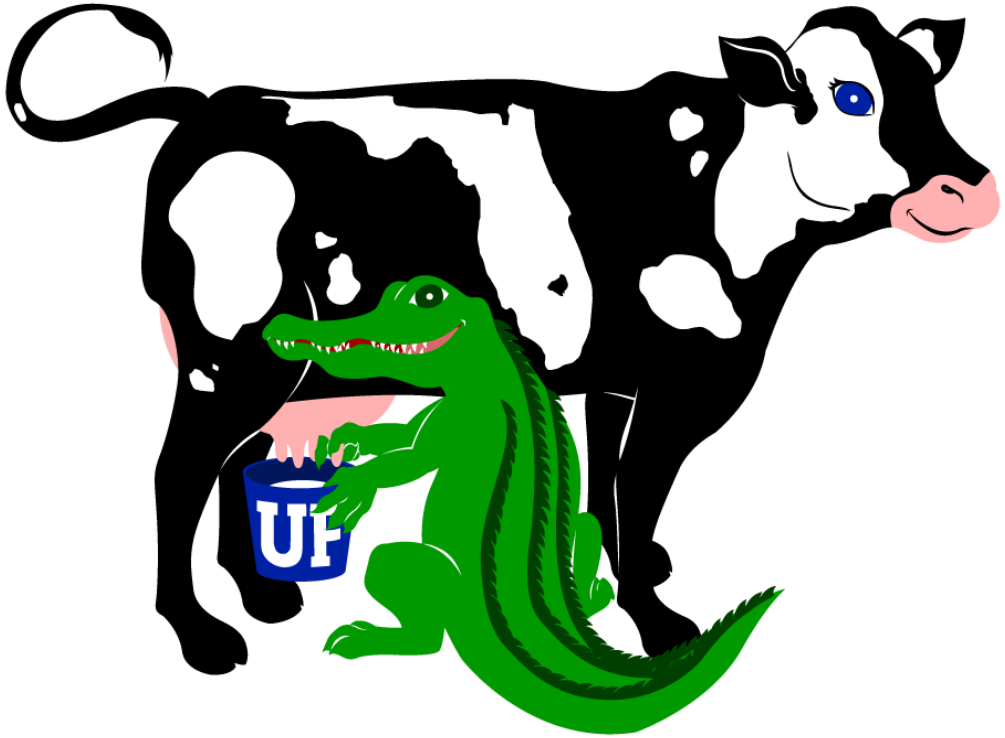
Data adapted from Ferraretto et al., 2017
Simulation performed with equations by Paula et al., 2019

# Conclusion and Implications

- These equations indicate that increasing cutting height improves forage quality at the expense of DM yield. Therefore, increasing cutting height should be done cautiously if planting area is limited.

- These equations have potential to be used as a management tool to help producers predict the nutritive value of their corn silage at different cutting heights.

# Thank you!

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