Impact of Shade on the Yield and Botanical Composition of Forage Mixtures for Silvopastures

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How does shade affect forage yield?
Species Selection

• Light Saturation
  – Increasing light does not improve photosynthetic rate above a threshold
• Cool season (C₃) = 50% full sun
• Warm season (C₄) = 85% full sun
Objectives

To evaluate the impact of shade on:

– nutritive value
– ergot alkaloid concentration
– yield
– botanical composition
– soil temperature & moisture
– ground cover

of cool-season forage mixtures for silvopastures
Randomized Complete Block with 2 Factor Factorial (4 reps)  
\[ \alpha = 0.05 \]

**3 Forage Mixtures**

- **Simple**
  - Tall Fescue
  - White Clover
  - Red Clover
  - Orchardgrass

- **Intermediate**
  - Tall Fescue
  - White Clover
  - Red Clover
  - Orchardgrass

- **Complex**
  - Tall Fescue
  - White Clover
  - Red Clover
  - Orchardgrass
  - Kentucky Bluegrass
  - Alfalfa
  - Birdsfoot Trefoil

**4 Shade Levels**

- Full Sun (control)
- 30% shade
- 50% shade
- 70% shade

Species:
- *F. arundinacea*
- *T. repens*
- *T. Pratense*
- *D. Glomerata*
- *P. pratensis*
- *M. sativa*
- *L. corniculatus*
Harvest Procedures
Cut at 15” to 3-4” residual heights
Collect subsamples for:
yield & nutritive value
botanical composition
ergot alkaloid concentration
Botanical Separations
Heavy Shade Reduces Yield

Yield (kg dry matter/hectare)

- 0% Shade
- 30% Shade
- 50% Shade
- 70% Shade

Harvest Date

- June 2015
- August 2015
- April 2016
- May 2016

Legend:
- different letters indicate significant differences
Mixture Rarely Affects Yield
Mixture x Shade Interactions (June 2016)

- **Simple**
  - Equation: $y = -0.0072x^2 - 8.878x + 1483.1$
  - $R^2 = 0.5673$ $p < 0.01$

- **Intermediate**
  - Equation: $y = -0.7078x^2 + 39.451x + 1596.4$
  - $R^2 = 0.6879$ $p < 0.01$

- **Complex**
  - Equation: $y = -0.3912x^2 + 19.075x + 1572.2$
  - $R^2 = 0.3985$ $p < 0.04$
Simple Mixture Composition (August 2016)

- Tall Fescue
- White Clover
- Weeds

![Graph showing the composition of different mixtures under varying shades.](image-url)
Summary

• Yield reduced under high shade
• More complex mixtures may increase yield
• Weeds were reduced with more complex mixtures
• Orchardgrass and red clover are well-suited to shaded conditions, while white clover is not
• Seasonal botanical variations
Thank you!

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