Warm season grasses as emergency forages

2015 MIDWEST FORAGE ASSOCIATION
Tour de Forage

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BACKGROUND: ALFALFA

- Alfalfa is the most important perennial forage in the Midwest
  - 1.1 million acres in Minnesota (2014)
  - Livestock feed
  - Ecosystem services
  - Nitrogen contribution
BACKGROUND: CHALLENGES

- Perennial crop subject to winterkill
BACKGROUND: WINTER INJURY
Minimum Temperatures: Waseca 2015

- DEHARDING (a few days)
- WINTER INJURY

- 2" soil minimum
- Air minimum
Snow Cover: Waseca 2014-2015

Snow Cover (in)
BACKGROUND: CHALLENGES

- Shortage of quality feed
- Increasing environmental variability
- **Challenge:** identify annual forages to fill this gap
OBJECTIVES

1. Evaluate 8 warm season forage options no-till seeded into winterkilled alfalfa
   - Nitrogen Management
   - Intensive Cutting Management

2. Determine nitrogen contribution to emergency crop yield
METHODS

- **Planting**
  - May 28, 2014
  - Truax no-till drill

- **Fertility**
  - 0, 56, & 112 kg N/ha
  - Applied at planting

- **Cutting schedule**
  - 30 day intervals from the time of planting
<table>
<thead>
<tr>
<th>Forage</th>
<th>Seeding Rate (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Ryegrass</td>
<td>34</td>
</tr>
<tr>
<td>Italian Ryegrass</td>
<td>39</td>
</tr>
<tr>
<td>Teff</td>
<td>13</td>
</tr>
<tr>
<td>Japanese Millet</td>
<td>34</td>
</tr>
<tr>
<td>Sudangrass</td>
<td>50</td>
</tr>
<tr>
<td>Sorghum sudangrass</td>
<td>39</td>
</tr>
<tr>
<td>BMR Sorghum</td>
<td>39</td>
</tr>
<tr>
<td>Red clover / A. Ryegrass</td>
<td>9 / 17</td>
</tr>
</tbody>
</table>
SPECIES DESCRIPTIONS

• Sorghums
  • BMR Sorghum, Sudangrass, Sorghum-sudangrass
  • ‘Brown midrib’ gene mutation = lower lignin = higher digestibility
  • High yielding
  • Cutting height = 6 inches

• Ryegrasses
  • Annual Ryegrass, Italian Ryegrass
  • High yielding, high nutritive value
  • Excellent nutrient scavengers (but sensitive to low fertility)
  • Tolerates grazing and/or cutting well
  • Cutting height = 4 inches
SPECIES DESCRIPTIONS

• Red Clover
  • Companion crop with Annual Ryegrass
  • Leguminous N fixation (tolerates low fertility)
  • Tap roots

• Japanese Millet
  • Fast growing
  • Good nutritive value
  • Cutting height = 6 inches

• Teff
  • Drought and heat tolerant
  • High yielding
  • Tolerates low fertility and responds well to fertilization
  • Cutting height = 4 inches
EMERGENCY FORAGES

Italian ryegrass

Teff

BMR Sorghum
EMERGENCY FORAGES

Annual ryegrass/
Red clover

Sudangrass

Japanese millet
Annual ryegrass
RESULTS

- **Yield**
- **Nutritive value**
RESULTS: AVERAGE YIELD

- Averaged across all cutting events

### ANOVA: Yield

<table>
<thead>
<tr>
<th>Effect</th>
<th>Num DF</th>
<th>Den DF</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species (S)</td>
<td>7</td>
<td>24</td>
<td>3.75</td>
<td>0.0070</td>
</tr>
<tr>
<td>N Rate (N)</td>
<td>2</td>
<td>48</td>
<td>12.79</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>S X N</td>
<td>14</td>
<td>48</td>
<td>0.79</td>
<td>0.6739</td>
</tr>
</tbody>
</table>
**N RATE VS. YIELD**

- **C**
- **B**
- **A**

- Teff
- Annual Ryegrass
- Annual Ryegrass + Red Clover

Dry matter yield (tons/ac)

Nitrogen Rate (lbs/ac)
**ECONOMICS**

Current Reported Prices

- $465 $/ton urea = $0.51 $/lb N
- Dry fertilizer application cost = $6.00/ac
- “Good quality” grass hay = $100/ton

<table>
<thead>
<tr>
<th>N – Rate (lbs/ac)</th>
<th>Average Yield (t/ac)</th>
<th>Fertilizer ($/ac)</th>
<th>Net return ($/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.60</td>
<td>$0.00</td>
<td>$360.01</td>
</tr>
<tr>
<td>50</td>
<td>3.88</td>
<td>$31.50</td>
<td>$356.93</td>
</tr>
<tr>
<td>100</td>
<td>4.25</td>
<td>$57.00</td>
<td>$367.56</td>
</tr>
</tbody>
</table>

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RESULTS

- Yield
- Nutritive value
  - Crude protein
  - NDFD
  - Relative Forage Quality (RFQ)
NUTRITIVE VALUE DEFINITIONS

- **Crude Protein (CP)**
  - Approximate protein content based on total nitrogen content

- **Neutral Detergent Fiber Digestibility (NDFD)**
  - Percentage of Neutral Detergent Fiber (NDF) that is digestible (48 hours in vitro)
  - \( \text{NDF} = \text{Hemicellulose} + \text{Cellulose} + \text{Lignin} + \text{Cutin} \)
NUTRITIVE VALUE DEFINITIONS

- Relative Forage Quality (RFQ)
  - Generalized forage quality index based on the combined consideration of several nutritive values.
  - Commonly used in hay pricing standards
CRUDE PROTEIN (YIELD WEIGHTED)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Num DF</th>
<th>Den DF</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species (S)</td>
<td>7</td>
<td>21</td>
<td>16.87</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>N Rate (N)</td>
<td>2</td>
<td>48</td>
<td>14.36</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>S X N</td>
<td>14</td>
<td>48</td>
<td>1.84</td>
<td>0.0592</td>
</tr>
</tbody>
</table>

- Approximate protein content based on total nitrogen content
CRUDE PROTEIN: SPECIES EFFECTS

Species


% CP

0  2  4  6  8  10  12  14  16

BC  B-D  A  B  B  B  D  CD

0  10  20  30  40  50  60  70  80

Species
# NDFD (YIELD WEIGHTED)

## ANOVA: NDFD

<table>
<thead>
<tr>
<th>Effect</th>
<th>Num DF</th>
<th>Den DF</th>
<th>F Value</th>
<th>Pr &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species (S)</td>
<td>7</td>
<td>21</td>
<td>34.29</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>N Rate (N)</td>
<td>2</td>
<td>48</td>
<td>1.75</td>
<td>0.1843</td>
</tr>
<tr>
<td>S X N</td>
<td>14</td>
<td>48</td>
<td>1.79</td>
<td>0.0676</td>
</tr>
</tbody>
</table>

- Neutral Detergent Fiber Digestibility
- Digestible portion of total Neutral Detergent Fiber (NDF)
NDFD: SPECIES EFFECTS

% NDFD

Species


BC  BC  A  E  BC  B  C  D
RELATIVE FORAGE QUALITY (RFQ)

- Generalized forage quality index based on the combined consideration of several nutritive values.

- Commonly used in hay pricing standards
Relative Forage Quality (RFQ)

RFQ range: Hancock. 2011. University of Georgia
Relative Forage Quality across Harvest Events

RFQ range: Hancock. 2011. University of Georgia

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CONCLUSIONS: YIELD

- Think Flexibility!
- Greatest total yields
  - Teff
  - Annual ryegrass
  - Red clover + ryegrass
- Yield benefits from additional fertilization
  - No economic benefit with 56 kg N/ha
  - Yield increase with 112 kg N/ha showed to be economically beneficial
CONCLUSIONS: MANAGEMENT

- Previous research concluded that corn silage is often the best option for tonnage and nutritive value.

![Graph showing milk per ton of forages averaged across planting date and locations (Spooner, Marshfield, and Arlington, WI)]

Table 2. Milk per ton of forages averaged across planting date and locations (Spooner, Marshfield, and Arlington, WI)

[Graph showing the milk per ton for various forages, with Soybean RM 2.5 having the highest and Siberian Foxtail Millet having the lowest.]

CONCLUSIONS: MANAGEMENT

- Previous research* concluded that corn silage is often the best option for tonnage and nutritive value.

- Under intensive grazing or haying management, teff, sudangrass, and ryegrass options are more suitable.

* Peterson et al. 2004. Universities of MN and WI-Madison
TEFF

• Highest yielding
• Notable weed competition
FUTURE RESEARCH

- Weed suppression effects
Forage Production

http://z.umn.edu/forages

Forage and variety selection
Varietal trials, forage identification and selection, alfalfa history

Establishment
Seeding rates and dates, stand establishment

Growth and development
Growth and stand evaluation, weather and crop damage

Utilization and management
Hay, silages, pastures and grazing, biomass, stand termination

Soil and water management
Soil properties, benefits to soil, cover crops, irrigation management

Nutrient management
Nutrient guidelines, legume N fixation and credits

Pest management
Diseases, weeds, insects

Organic production
→ Organic Risk Management website for organic and transitioning producers

The University of Minnesota Extension forage team uses University research to help forage producers increase productivity, quality and profitability.

- About
- Team
- Forage Quarterly newsletter
- A to Z library
- U.S. Extension forage websites

Search Forage Production:

Forages for "U" workshops
Forage production topics for today's producers

Minnesota Field Crop Trials – 2014
The most recent variety performance data for crops
Forage Quarterly

A quarterly newsletter providing research-based information to Minnesota forage producers and their advisors.

Current Issue

January 2015, Vol. 2 No. 1 (2.8 MB PDF)

- Double-cropping with a pea–barley forage mixture
- Alternative annual forages
- Sorghum-sudangrass and teff as summer forages for livestock systems
- Stand age affects alfalfa nitrogen credits to first-year corn
- Winter feeding tips for horse owners
- Pasture rental and lease
Forage Production

2015 Dates and locations

University of Minnesota Extension will host three Forages for "U" workshops in areas that represent significant forage production and grazing acres:

Hutchinson, MN
Date & time: Tuesday, February 10, 10:00 a.m. – 2:30 p.m.
Location: McLeod County Fairgrounds, 840 Century Ave. S.W. Map
Program cost: $30 at the door, includes lunch
Contact: Nathan Winter (wint0146@umn.edu or 320-484-4303)

Fergus Falls, MN
Date & time: Tuesday, February 10, 5:00 – 9:00 p.m. (4:30 registration)
Location: Otter Tail Government Service Center, 500 Fir Ave W. Map
Program cost: $30 at the door, includes dinner
Contact: Doug Holen (holen009@umn.edu or 320-589-1711)

Rushford, MN
Date & time: Friday, February 20, 10:00 a.m. – 2:30 p.m. (9:30 registration)
Location: The Creamery, 407 S. Mill St. Map
Program cost: $30 at the door, includes lunch
Contact: Jake Overgaard (over0128@umn.edu or 507-457-6440)

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Questions?  http://z.umn.edu/forages

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