Supplemental and Alternative Forage Options in Winter-Killed Alfalfa

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INTRODUCTION

Alfalfa is the most important perennial forage in the Midwest.

- **1.1 million acres in Minnesota (2014)**
- **Livestock feed**
- **Ecosystem services**
- **Nitrogen contribution**

Figure 1. Winterkilled alfalfa in Minnesota (2013). Note the surviving regions due to the snow catch created by strips of uncut stubble in the field.

Problem: Particularly in northern climates, alfalfa winter-injury and winter-kill can contribute to significant losses.

- This becomes a critical issue with increasing environmental variability.

Challenge: Identify alternative forage options to fill this gap.

- Alternative warm season annual forage crops can be planted in response to winterkill, although appropriate species and best management practices need to be established.

OBJECTIVES

1. **Evaluate 8 warm season forage options no-till seeded into winterkilled alfalfa**
2. **Determine nitrogen contribution to emergency crop yield**

MATERIALS & METHODS

Experimental Design

Randomized Complete Block Design

- Split-plot arrangement
- Four replications

Main plots: 8 warm season forage options

Split plots: 3 nitrogen rates

- 0, 56, and 112 kg N ha^{-1} (urea)

Emergency Forage Species
Annual Ryegrass (ARYE)
Italian Ryegrass (IRG)
Teff (TEFF)
Japanese Millet (JAPMIL)
Sudangrass (SUDAN)
Sorghum sudangrass (SSG)
BMR Sorghum (BMRS)
Red clover/A. Ryegrass (RC_ARYE)

Locations

- Waseca, MN and Rosemount, MN

Management

- No-till planted into simulated winter killed alfalfa (in late May)
- Harvested 3 times with target cutting intervals of 30 days

Parameters Measured	
Biomass yield (3 cuts)	Mg ha^{-1}
Nutritive status	CP, NDFD-48
Soil (prior to alfalfa termination)	NO_3-N
Soil (after final harvest)	NO_3-N

Figure 2. Annual forage grasses no-till planted into dead alfalfa in Rosemount, MN (2014)

RESULTS

2014 Yields (*Rosemount, MN*)

- Crop species and nitrogen rate each had a significant effect on yield ($\alpha = 0.05$).
- Teff (9.96 Mg ha^{-1}), annual ryegrass, and ryegrass + red clover were among the greatest total biomass.
- Average yields across species were greater with each incremental increase in applied nitrogen ($\alpha = 0.05$).

2015 Yields *(Rosemount and Waseca, MN)*

- The interaction between crop species and nitrogen rate had a significant effect on yield at both locations ($\alpha = 0.05$).
- The greatest yielding species differed from 2014 and varied across locations in 2015 (Figure 3).

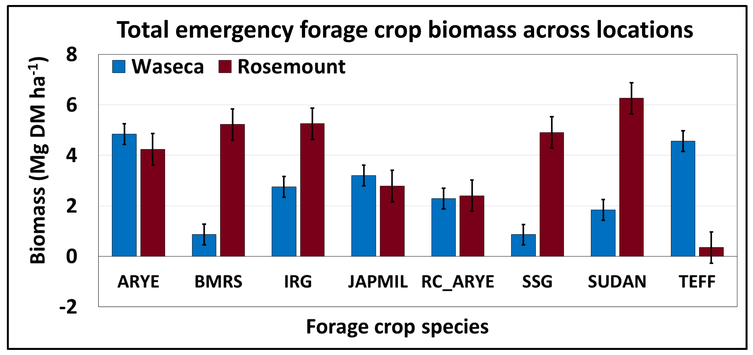

Figure 3. Total season forage yields across eight warm season forage options in Waseca, MN and Rosemount, MN (2015).

- The interaction between crop species and nitrogen rate indicates a negative response to added nitrogen in some species and a positive response in others, as illustrated by selected species in Figures 4 and 5.

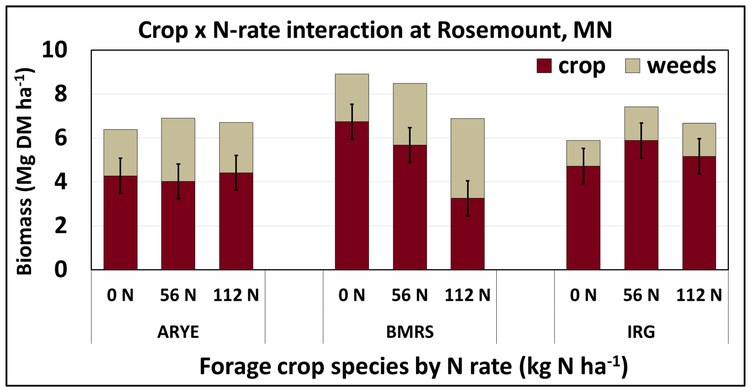

Figure 4. Selected forage species crop vs. weed biomass as affected by nitrogen rate in Rosemount, MN 2015.

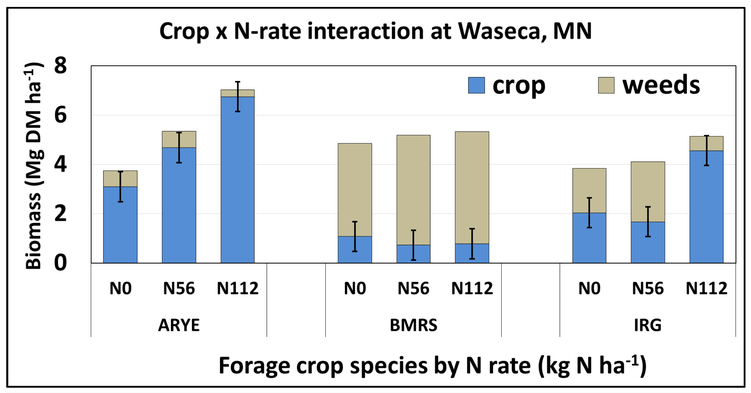

Figure 5. Selected forage species crop vs. weed biomass as affected by nitrogen rate in Waseca, MN 2015.

RESULTS

Quality (*2014 Rosemount, MN*)

- Crop species and nitrogen rate each had a significant effect on crude protein (CP).
- Neutral detergent fiber digestibility (NDFD) was only affected by crop species.
- Italian ryegrass returned the greatest mean CP and NDFD.

Crop	CP	NDFD_48
	%	%
TEFF	9.7 ^{cd}	57.9 ^{d}
BMRS	10.1 $^{b-d}$	65.8 ^{bc}
IRG	13.9 ^{a}	76.5 ^{a}
ARYE	10.6 ^{bc}	64.0 ^{bc}
JAPMIL	10.9 ^{b}	54.5 ^{e}
SSG	10.8 ^{b}	66.8 ^{b}
SUDAN	9.3 ^{d}	62.6 ^{c}
RC_ARYE	10.7 ^{b}	64.3 ^{bc}

- Forage quality parameters were generally acceptable across all species.

DISCUSSION

Species yield performance

- Across both years and locations annual ryegrass and teff were the most consistently productive species (with the exception of a failed teff stand in Rosemount, MN (2015).
  - These grasses exhibited the greatest cutting tolerance, and may be most suitable to supplement an injured stand of alfalfa and be managed on intensive cutting cycles.
- Brown-midrib sorghum and sudangrass also performed well, but generally did not regrow as well under intensive cutting regiment.
  - These grasses may be more suitable for fewer and longer cutting intervals or a one-cut system.

Figure 2. Teff prior to second harvest in Rosemount, MN (2014)

- High variability across locations in 2015 was partially due to varying stand establishment success. Further research may be required to identify critical components for successful stand establishment by species.
- The ryegrass options, as well as teff, generally exhibited greater weed suppression throughout the season, likely as a function of the dense, bunchgrass growth habit.

CONCLUSION

Warm season annual grasses can serve as viable supplemental forages in alfalfa winterkill situations.

Appropriate alternative forage options depend on:

- severity of winterkill
- fertility options
- target cutting frequency

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