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Alfalfa-grass mixtures performance in North Dakota

*Marisol Berti, Robert Nudell, and Alfredo Aponte
Dep. of Plant Sciences, North Dakota State University
Dan Undersander, Extension and Research Forage Agronomist,
University of Wisconsin

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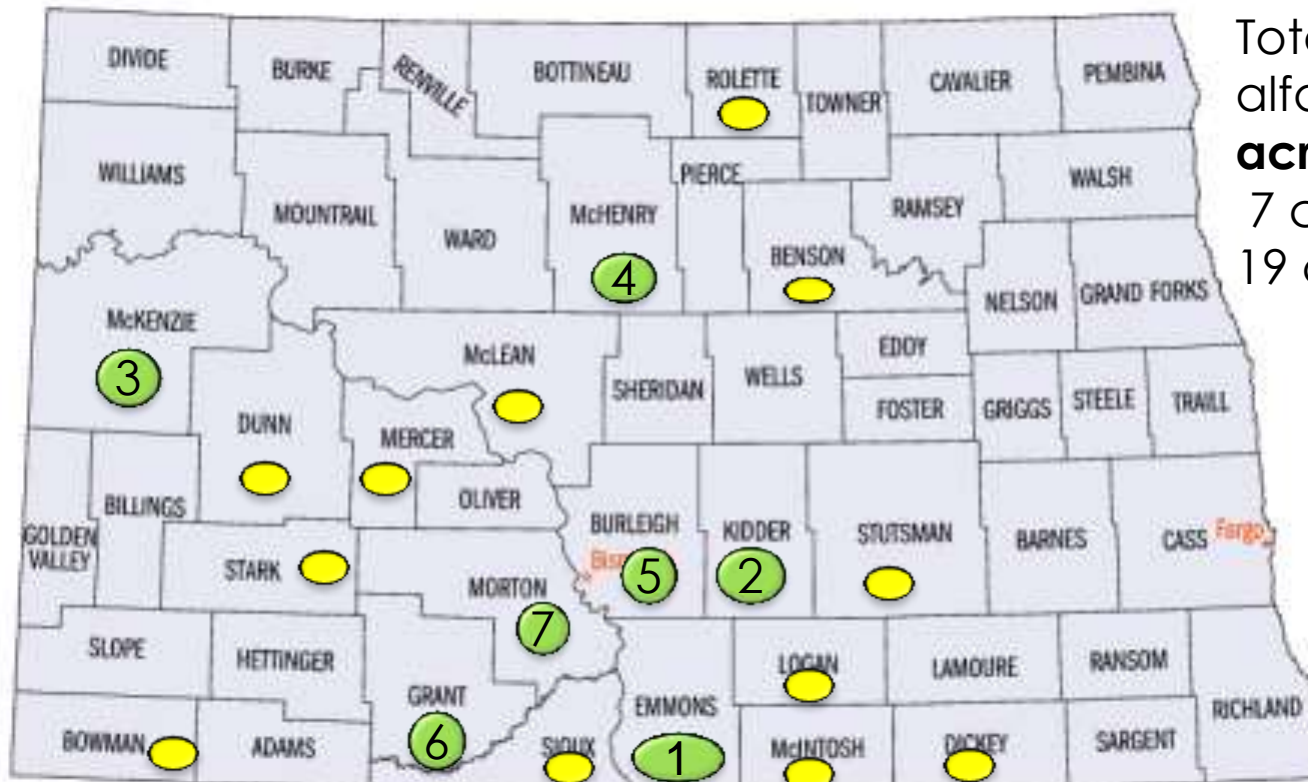
North Dakota Forage Production

- Alfalfa only 494,258 acres
- Alfalfa/grass mixtures 179,922 acres 26%
- **Total** **674,180 acres**
- Grass/mix with less than 25% alfalfa 836,541 acres
- Legume/grass mixture 1,767 acres
- Mixed forage 2,392,306 acres



NASS, 2011

Alfalfa production area in North Dakota 2011



Total acreage alfalfa - **494,258 acres**

7 counties - 33%
19 counties - 61%

counties > 20,000 acres ○
counties 10,000-19,999 acres ●

Why alfalfa-grass mixtures?

Forage scientist/extensionist point of view

- Aids alfalfa establishment
- Prevents alfalfa from frost heaving in heavy clay soils
- Forage yield similar to alfalfa but higher fiber digestibility
- No need to fertilize the grass with nitrogen
- High biomass yield- a potential feedstock for bioenergy
- In North Dakota, no research data to make recommendations

Why alfalfa-grass ?

- North Dakota beef producers point of view
 - Cows like it
 - Easier to manage-dries faster
 - Alfalfa survives better
 - Higher forage yield (Smooth brome)



Streeter, ND

- We think they might be better alternatives to smooth brome
 - smooth brome has most of its yield in the first cut
 - Lower forage quality

Objectives

- The objective of this study was to determine the performance of alfalfa grass/mixtures in North Dakota as forage and feedstock for bioenergy.



Materials and Methods

- Replicated plots of 24 alfalfa-grass mixtures treatments were seeded on 2 June at Fargo and Prosper, and 3 June at Carrington, ND, in 2010.
-  An aerial photograph of a large agricultural field. A red rectangle highlights a specific area in the center-left of the field, which contains several rows of young plants, likely the experimental plots mentioned in the text. The surrounding field is mostly green, with some brown patches and a road on the right side.
- Seeding rates were 18 kg /ha of alfalfa and between 14 and 20 kg/ha for the grasses in monoculture.
- In mixtures the seeding rate was half of the full seeding rate for both the alfalfa and grass.

Materials and Methods

- ✓ Treatments included 13 grasses in monoculture, alfalfa in monoculture, and 9 alfalfa-grass mixtures.
- ✓ Grasses used for the mixtures were:
 - Smooth brome (*Bromus inermis* L.) (SB)
 - Meadow brome (MB) (*Bromus biebersteinii* Roem. &Schult.)
 - Orchardgrass (*Dactylis glomerata* L.) (OG)
 - Reed canary grass (RCG) (*Phalaris arundinacea* L.) (RCG)
 - Tall fescue (*Festuca arundinacea* L.) (TF)
 - Meadow fescue (*Festuca pratensis* L.) (MF)
 - Intermediate wheatgrass [*Thinopyrum intermedium* (Host.) Barkworth & D.R. Dewey] (IWG)
 - Crested wheatgrass (CWG) [*Agropyron cristatum* (L.) Gaertn.] (CWG)
 - Tall wheatgrass [*Thinopyrum ponticum* (Podp.)Z.-W. Liu &R.C. Wang] (TWG)
 - Western wheat grass (*Pascopyrum smithii* (Rydb.) A. Love.(WWG)
- ✓ Grasses were compared to alfalfa monoculture and each of the grass monocultures.

Materials and Methods



Plot planter- 8 rows at 15 cm apart. Plots 1.5 m wide x 6 m long.
Only grasses were fertilized with 80 kg N/ha.



Forage harvester- Carter flail harvester 1 m wide, scale incorporated.
Alfalfa and alfalfa grass mixtures: 4 harvests.
Harvest at 10 % bloom of the alfalfa
Grasses alone: Only 2 harvests.
First week of June and first week of August.

Forage quality



- Forage quality- CP, ADF, NDF, TDN, RFQ, %grass and % alfalfa were determined at the University of Wisconsin with the NIRS. Mixed prediction equation, 5% error.

Forage Yield- 2011 first year

Species	Cultivar	Fargo	Prosper	Carrington	Combined
		-----Mg/ha-----			
Smooth brome	VNS	11.5	14.1	8.7	11.4
Meadow brome	Mac Beth	10.7	11.6	10.6	11.0
Orchardgrass	Intensiv	10.2	11.4	10.9	10.8
Orchardgrass	Potomac	10.7	9.1	8.9	9.6
Orchardgrass	Baridana	9.7	11.1	7.1	9.3
Reed canarygrass	Palaton	13.6	15.9	12.6	14.0
Tall fescue	Bar Elite	11.1	14.2	7.8	11.0
Tall fescue	Bar Optima Plus E34	11.1	14.3	9.8	11.7
Meadow fescue	Pradel	9.7	11.0	8.2	9.6
Intermediate wheatgrass	Oahe	12.2	14.4	10.5	12.4
Crested wheatgrass	Hycrest	11.3	8.9	9.8	10.0
Tall wheatgrass	Alkar	11.6	14.0	10.4	12.0
Western wheatgrass	VNS	13.3	14.7	10.4	12.8
Alfalfa	55V48	13.6	18.6	5.5	12.6
Smooth brome + alfalfa	VNS + 55V48	12.2	17.9	6.9	12.3
Orchardgrass + alfalfa	Potomac + 55V48	12.1	17.0	7.6	12.2
Orchardgrass + alfalfa	Baridana + 55V48	12.9	13.3	7.1	11.1
Reed canarygrass + alfalfa	Palaton + 55V48	14.0	18.1	8.4	13.5
Tall fescue + alfalfa	Bar Elite + 55V48	13.8	18.5	6.5	12.9
Meadow fescue + alfalfa	Pradel + 55V48	12.6	15.7	7.5	11.9
Intermediate wheatgrass + alfalfa	Oahe + 55V48	13.8	14.4	9.0	12.4
Crested wheatgrass + alfalfa	Hycrest + 55V48	14.5	11.7	6.9	11.1
Tall wheatgrass + alfalfa	Alkar + 55V48	13.9	15.7	7.0	12.2
Western wheatgrass + alfalfa	VNS + 55V48	13.3	14.8	5.6	11.2
Mean grasses		11.3	12.7	9.7	11.2
Mean alfalfa-grass		13.3	16.0	7.1	12.1
LSD (0.05)		2.3	4.1	2.8	3.4
VNS= Variety not stated.					

Forage Yield-2011

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Alfalfa	55V48	13.6	18.6	5.5	12.6
Smooth brome + alfalfa	VNS + 55V48	12.2	17.9	6.9	12.3
Reed canarygrass + alfalfa	Palaton + 55V48	14.0	18.1	8.4	13.5
Tall fescue + alfalfa	Bar Elite + 55V48	13.8	18.5	6.5	12.9
Intermediate wheatgrass + alfalfa	Oahe + 55V48	13.8	14.4	9.0	12.4
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Summary Forage Yield Results

- ✓ The 2011 results indicated a strong interaction between treatments and environment.
- ✓ The Carrington environment was much dryer than the Fargo and Prosper environments and the sole alfalfa and the alfalfa-grass mixtures had much lower biomass yield than the grasses in monoculture, due to the high water requirements for alfalfa growth .
- ✓ At Prosper, the highest biomass yield was for the alfalfa monoculture treatment although not significantly different than alfalfa grown in mixture with TF or RCG.
- ✓ The combined analysis indicated highest forage yield was for RCG sole (14 Mg/ha) or in mixture with alfalfa (13.5 Mg/ha) treatments.

Quality- First harvest-combined

Specie	CP	TDN	RFQ	Alfalfa	Grass
	%	%		%	%
Alfalfa	21.8	61.5	163	100	0
Mean grass	14.2	60.3	127	0	82
Mean alfalfa-grass	17.2	60.8	138	61	39
Min grass	12.6 (SB)	56.6 (SB)	104(SB)	.	72 (RCG)
Min alfalfa-grass	15.2 (OG)	57.8 (SB)	116(SB)	46 (SB)	21 (WWG)
Max grass	16.2 (TF)	63.0 (TF)	150 (TF)	.	93 (TWG)
Max alfalfa-grass	19.1 (WWG)	62.4 (TF)	150 (TF)	79 (WWG)	54(SB)
LSD (0.05)	3.5	2.5	19	21	21

Quality- Third harvest

Specie	CP	TDN	RFQ	Alfalfa	Grass
	%	%		%	%
Alfalfa	21.1	58.4	143	100	0
Mean grass	12.4	56.4	109	.	84
Mean alfalfa-grass	19.5	60.1	144	82	18
Min grass	10.6 (TWG)	50.9 (TWG)	86 (TWG)	.	72 (RCG)
Min alfalfa-grass	17.5 (OG)	57.9 (SB)	130 (OG)	69 (RCG)	2 (CWG)
Max grass	13.6 (TF)	61.2 (MF)	127 (TF)	.	92 (MB)
Max alfalfa-grass	21.0 (RCG)	62.2 (TF)	157 (RCG)	98 (CWG)	31 (RCG)
LSD (0.05)	2.5	2.0	13	14	14

Summary Forage Quality Results

- First harvest:
 - Lowest forage quality: smooth brome
 - Greatest forage quality: tall fescue

- Third harvest:
 - Lowest forage quality:
 - Tall wheat grass – monoculture
 - Orchardgrass- mixture
 - Greatest forage quality
 - Tall fescue in monoculture
 - Reed canary grass in mixture

Conclusions

- Using alfalfa-grass mixtures:
 - enhances biomass yield compared to grass monoculture
 - Improves forage quality
 - decreases the need of additional nitrogen fertilizer
 - therefore reduces the biomass feedstock costs important for producing bioenergy.

A sunset over a field with farm buildings in the distance. The sun is low on the horizon, partially obscured by a large, dark cloud. The sky is filled with scattered clouds, some illuminated by the setting sun. The foreground is a dark, green field.

**“The best forage is an alfalfa-grass mixture”
J.H. Cherney, 2012**

**Thank you for your attention.
QUESTIONS???**

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