Hay production options for cow-calf producers

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Outline

- What are some forage options besides the traditional alfalfa or grass hay?
- How do these forages compare to our traditional forages?
- How well can cattle do on these alternative forages?
- What are other options besides hay for feeding?

What are some options?

- Alternative legumes
  - Sainfoin
  - Birdsfoot trefoil
- Annuals
  - Warm-season annuals
  - Cereal forages
  - Corn

Sainfoin
Onobrychis viciifolia

- Well-drained, deep soils
- pH 7.0-8.0
- > 13” precipitation
- Good on calcareous soils
- May be a good substitute for alfalfa in areas with limited irrigation

Table 1. Summary of Delaney Sainfoin Yields (Tons Dry Matter/Acre/Year) in Montana Trials, 1998-2006

Location:	Bozeman.	Bozeman	Bozeman.	Kalispell	Moccasin	Bozeman.	Moccasin	Bozeman.
Production Type:	Irrigated	Dryland	Irrigated	Irrigated	Dryland	Irrigated	Dryland	Irrigated
Year Seeded:	1998	1998	1999	1999	1999	2000	2000	2004
Years Harvested:	1998-2001	1998-2001	2000-2001	1999-2002	2000-2002	2001-2003	2001-2002	2005-2006
No. Harvests:	11	7	6	11	3	10	2	6
	tons/A	tons/A	tons/A	tons/A	tons/A	tons/A	tons/A	tons/A
Delaney sainfoin	**4.89**	**1.77**	**4.26**	**6.45**	0.38	**5.74**	0.89	**6.32**
Shoshone sainfoin	4.33	**1.68**	**4.11**	5.75	0.40	**5.43**	0.94	5.58
Remont sainfoin	**5.03**	**1.65**	**3.96**	**5.81**	0.33	5.04	0.85	5.46
97MT-1 sainfoin	**4.82**	1.49	**4.24**	**5.83**	0.42	-	-	-
Nova sainfoin	-	-	-	-	-	5.00	0.92	-
Eski sainfoin	4.30	1.58	3.27	2.75	0.28	4.90	0.81	5.59
Ladak 65 alfalfa	-	-	-	5.03	**0.81**	4.70	**1.33**	-
Shaw alfalfa	-	-	-	-	-	4.78	**1.40**	-
L-2 Syn1 birdsfoot trefoil	-	-	-	3.03	0.36	3.21	0.31	-
Windsor cicer milkvetch	-	-	-	4.23	0.20	2.29	0.47	-
Lutana cicer milkvetch	-	-	-	3.93	0.28	2.45	0.33	-
Tretana birdsfoot trefoil	-	-	-	2.26	0.28	3.16	0.19	-
Monarch cicer milkvetch	-	-	-	3.94	0.26	2.07	0.30	-
AC Grazeland alfalfa	-	-	-	5.19	**0.81**	-	-	-

Bold values within a column denote values not significantly different from the highest yield.

How do alfalfa and sainfoin differ?

- Sanfoin-
  - Non-bloating due to presence of condensed tannins
  - Retains its lower leaves and stems remain succulent
  - Growth occurs up to full bloom
  - Irrigation management different
    - 50% of water that would be applied to alfalfa

Harvest Management

- Sainfoin
  - Doesn't store carbohydrates during summer
  - Fall harvest management still critical

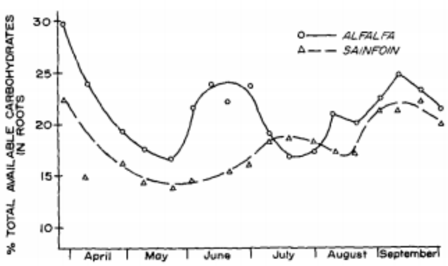


Fig. 1. Total available carbohydrates in roots of uncut alfalfa and sainfoin during 1966 growing season.

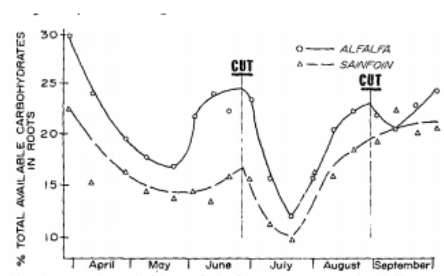


Fig. 2. Total available carbohydrates in roots of alfalfa and sainfoin cut twice for hay in 1966.

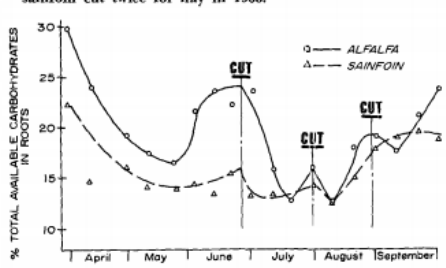


Fig. 3. Total available carbohydrates in roots of alfalfa and sainfoin cut once for hay and twice to simulate pasturing in 1966.

Sainfoin

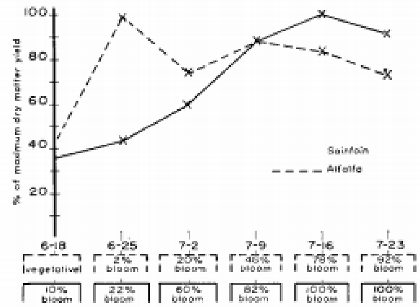


Fig. 1. Dry matter accumulation of sainfoin and alfalfa with increasing maturity on irrigated land expressed as a percentage of maximum yield.

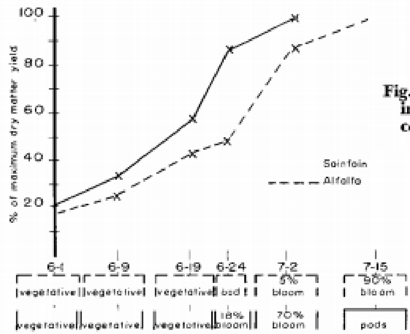


Fig. 2. Dry matter accumulation of sainfoin and alfalfa with increasing maturity on dryland expressed as a percentage of maximum yield.

Sainfoin

Table 2. Feed analysis of sainfoin and alfalfa at three stages of maturity when grown on irrigated land.

Species	Bloom	H_2O	Protein	Ether extract	Ash	Fiber	NFE	TDN*	Ca	P
		%								
Alfalfa	10	5.9	16.8	1.2	8.5	32.0	35.6	53.4	.95	.27
Sainfoin	10	5.9	14.9	1.1	6.7	22.0	49.4	57.4	.68	.33
Alfalfa	50	6.3	15.8	1.3	7.5	33.6	35.5	53.4	.88	.20
Sainfoin	50	5.9	12.1	1.2	5.7	27.6	47.5	56.5	.71	.27
Alfalfa	100	6.0	12.9	1.2	7.5	35.5	36.9	51.4	.81	.09
Sainfoin	100	4.8	10.6	1.1	5.5	32.0	46.0	54.4	.80	.17

* Digestion coefficients for alfalfa were used in the calculations of TDN for both species.

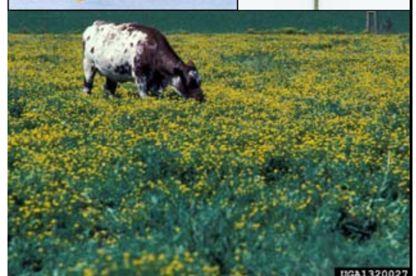
Table 3. Feed analysis of sainfoin and alfalfa at three stages of maturity when grown on dryland.

Species	Bloom	H_2O	Protein	Ether extract	Ash	Fiber	NFE	TDN*	Ca	P
		%								
Alfalfa	10	6.4	15.9	1.1	10.0	31.8	34.8	52.1	2.05	.19
Sainfoin	10	6.5	11.9	0.8	6.7	27.4	46.7	55.4	2.08	.13
Alfalfa	50	6.8	13.8	1.1	9.1	32.2	37.0	52.3	1.20	.15
Sainfoin	50	6.4	11.4	0.9	7.2	30.2	43.9	54.4	1.00	.17
Alfalfa	100	6.1	12.0	0.8	7.4	36.6	36.9	54.7	1.80	.14
Sainfoin	100	6.6	10.3	1.1	6.6	31.9	43.5	52.4	.95	.27

* Digestion coefficients for alfalfa were used in the calculations of TDN for both species.

Birdsfoot Trefoil
Lotus corniculata

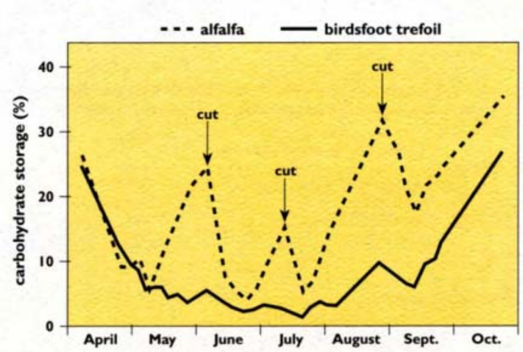
- Persists well in poorly drained or acid soils
  - pH range of 4.5-8.2
- Winter hardy
- Tolerates drought
  - 20-30 d flood tolerance
- Can tolerate saline soils
- Non-bloating

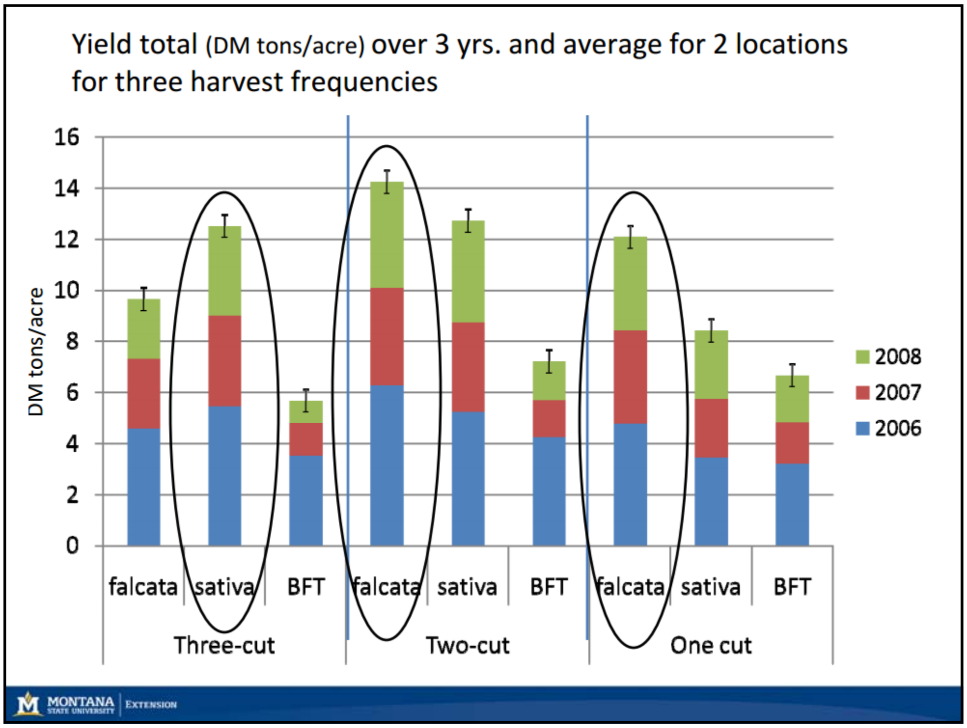


Birdsfoot Trefoil
Lotus corniculata

- Does not accumulate carbohydrates through growing season

Figure 6. Comparison of carbohydrate storage in Empire birdsfoot trefoil and Vernal alfalfa in Iowa. *Source: Greub and Wedin, 1971.*




Yield total (DM tons/acre) over 3 yrs. and average for 2 locations for three harvest frequencies
DM tons/acre
16
14
12
10
8
6
4
2
0
falcata
sativa
BFT
falcata
sativa
BFT
falcata
sativa
BFT
Three-cut
Two-cut
One cut
2008
2007
2006
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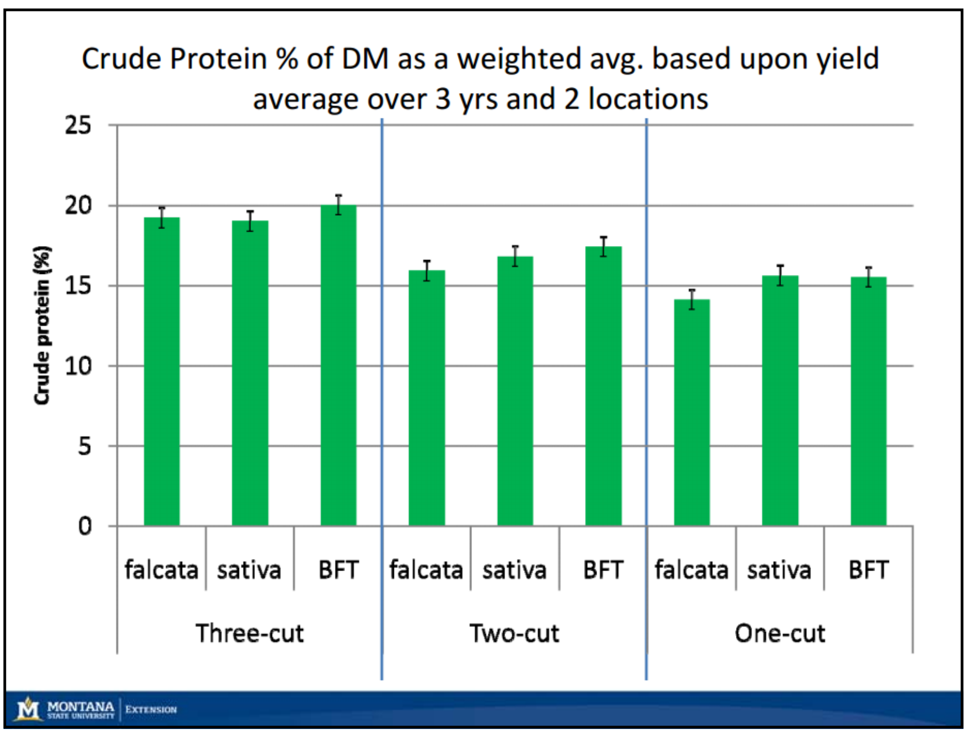
Crude Protein % of DM as a weighted avg. based upon yield average over 3 yrs and 2 locations
Crude protein (%)
25
20
15
10
5
0
falcata
sativa
BFT
falcata
sativa
BFT
falcata
sativa
BFT
Three-cut
Two-cut
One-cut
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Relative forage quality (RFQ) weighted average over 3 yrs. and 2 locations

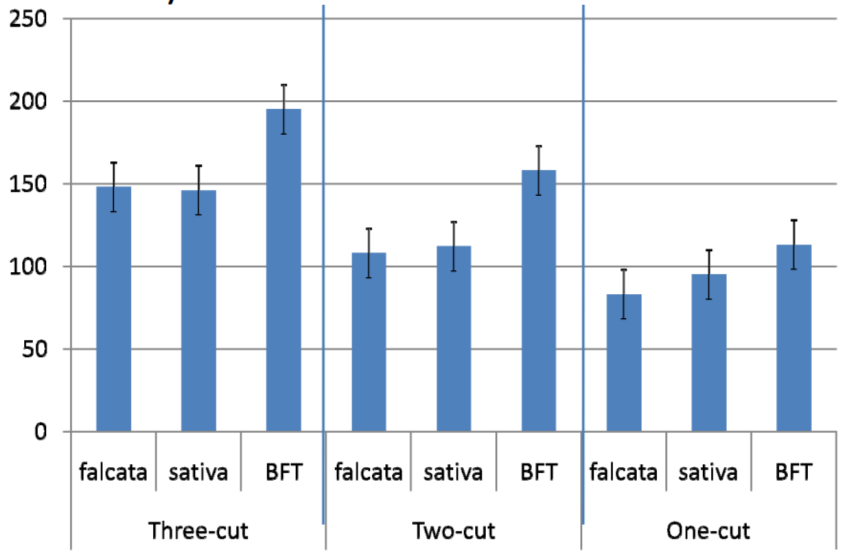
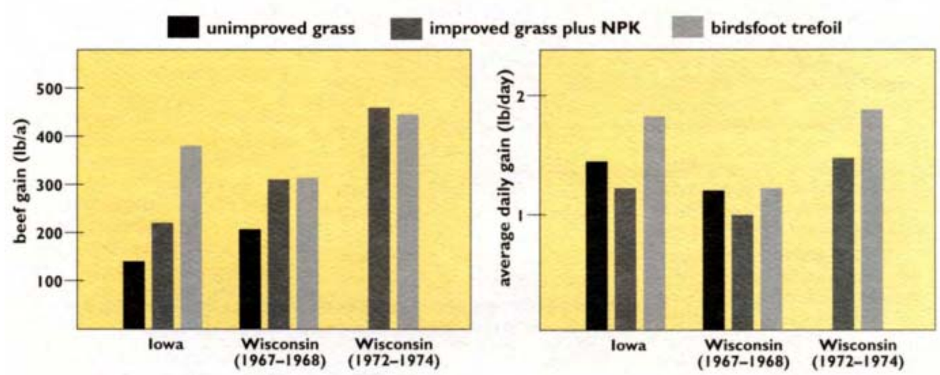
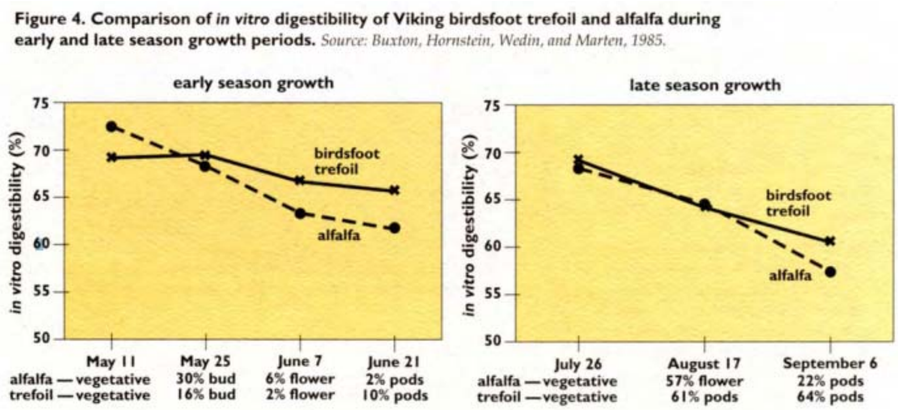


Figure 3. Animal performance in Iowa and Wisconsin on birdsfoot trefoil pastures.





Annual forages

Crop	Seeding Rate	Emergence time (days)	First grazing (week)	Hay yield (ton/ acre)	Palatability
Sudangrass	25	10	4	3-4	High
Sorghum x Sudangrass	20	10	4	4-5	Med- high
Pearl millet	20	7	4-5	3	High
Winter wheat	120	7	4	2-4	High
Winter rye	112	7	4	2-4	Med
Winter barley	100	7	4	2-3	Med to high
Spring oats	96	10	4	2-3	High

Annual forages

Species	Yield (t ha^{-1})
Oat	4.35[a]
Spring Wheat	3.91[a]
Annual Ryegrass	3.24[ab]
Barley	3.19[ab]
Winter Wheat	1.91[b]

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Annual forages

Species	ADF	CP	NSC
		% DM	
Annual Ryegrass	28[c]	18[b]	18[a]
Barley	30[b]	19[b]	15[b]
Oat	31[ab]	16[c]	16[ab]
Spring Wheat	32[a]	18[b]	11[c]
Winter Wheat	25[d]	24[a]	17[ab]

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Annual forages

Species	% Removal
Winter Wheat	93[a]
Annual Ryegrass	65[b]
Barley	62[b]
Spring Wheat	60[b]
Oat	22[c]

Winter Wheat

Pre-grazing

Post-grazing

Oat

Pre-grazing

Post-grazing

Table 1. Dietary ingredient and nutrient compositions of diets fed to crossbred steer calves (DM basis)

	Diets			
Ingredient	Barley Silage	Barley Hay	Oat Hay	Wheat Hay
Barley Silage, %	63.30	---	---	---
Barley Hay, %	---	56.08	---	---
Oat Hay, %	---	---	54.27	---
Wheat Hay, %	---	---	---	58.75
Barley grain, %	31.48	37.67	39.22	35.38
30% CP supplement[a], %	4.02	4.82	5.01	4.52
Deccox med. crumbles, %	1.2	1.43	1.49	1.35
Nutrient Concentration				
DM, %	58.2	84.5	83.8	87.7
CP, %	13.6	12.4	9.56	11.2
NE_m, Mcal/kg	1.72	1.36	1.17	1.58
NE_g, Mcal/kg	1.1	0.79	0.59	0.99
OM, %	89.8	78.1	71.6	85.2
NDF, %	30.6	39.1	62.4	46.2
ADF, %	18.0	24.7	46	26.2
Ca, %	1.24	1.02	0.93	0.71
P, %	0.4	0.3	0.28	0.3
Nitrate, ppm	900	400	500	300
Deccox, mg	170	170	170	170
Rumensin, mg	213	213	213	213

[a] 30% Commercial supplement (as fed): 29.0% CP, Ca 17.0%, P 0.45%, K 1.2%, Mg 0.7%, Vitamin A 110,000 IU/kg, Vitamin D_3 11,000 IU/kg, Vitamin E 330 IU/kg, Cu 550 ppm, Zn 930 ppm, and Mn 1000 ppm.

Stamm, et al. Profitable calf backgrounding integrating annual forage crops. Unpublished data.

Table 2. Forage source influence on backgrounding -steer performance, nutrient intake and in vivo digestibility

Item	Treatments[a] BH	BS	OH	WH	SEM[b]	*P* -value[c]
Initial Wt, lbs	686	674	674	677	8.4	0.74
Final Wt, lbs	844^{xy}	858^{y}	824^{x}	820^{x}	11.6	0.07
Feed intake as % BW	2.66	2.48	2.65	2.44	0.097	0.31
Gain, lbs	159^{x}	183^{y}	150^{x}	143^{x}	7.02	< 0.01
ADG, lbs/d	2.78^{x}	3.22^{y}	2.63^{x}	2.51^{x}	0.122	< 0.01
Gain: feed	0.138^{x}	0.17^{y}	0.135^{x}	0.135^{x}	0.009	0.02
Feed cost of gain, $/lb	0.34^{x}	0.35^{x}	0.32^{x}	0.41^{y}	0.02	0.04
Total cost of gain, $/lb	0.51^{x}	0.49^{x}	0.52^{x}	0.62^{y}	0.03	0.03
Dietary Intake, lbs/d						
DM	20.4	19.0	19.8	18.3	0.821	0.33
OM	14.8	15.8	15.2	14.8	0.80	0.78
N	0.35^{x}	0.39^{y}	0.32^{x}	0.32^{x}	0.017	0.03
ADF	5.92^{x}	4.45^{y}	6.11^{x}	6.72^{x}	0.356	< 0.01
NDF	9.92^{x}	8.12^{y}	10.0^{x}	10.64^{x}	0.575	< 0.05
In vivo digestibility, %						
DM	41.7^{x}	57.1^{y}	50.0^{z}	48.0^{z}	1.50	< 0.005
OM	41.5^{x}	59.6^{y}	51.4^{z}	48.1^{z}	2.05	< 0.005
N	25.2^{x}	52.0^{y}	40.3^{z}	37.5^{z}	2.45	< 0.005
ADF	29.5	26.5	28.6	31.8	1.88	0.29
NDF	37.0	42.8	39.9	41.4	1.74	0.17
Digestible intake, lbs/d						
DM	8.09^{xz}	10.92^{y}	9.77^{yz}	9.25^{xyz}	0.52	0.02
OM	6.12^{xz}	9.42^{y}	7.87^{z}	7.09^{xz}	0.53	< 0.01
N	0.09^{x}	0.21^{y}	0.13^{z}	0.12^{z}	0.009	< 0.005
ADF	1.75^{x}	1.19^{y}	1.76^{x}	2.14^{x}	0.168	0.013
NDF	3.67	3.49	4.03	4.39	0.302	0.214

[a] BH = Barley Hay; BS = Barley Silage; OH = Oat Hay; WH = Winter Wheat Hay.
[b] n = 4.
[c] *P*-value for *F*-test of treatment.
[x,y,z] Within a row, means without a common superscript differ ($P < 0.10$).

Stamm, et al. Profitable calf backgrounding integrating annual forage crops. Unpublished data.

Table 2. Performance and intake by steers fed cereal forages harvested as hay, 2005

Item	Haybet	Hays	WW Silage	WW Hay	SEM	*P*-value
No. of pens	4	4	4	4		
Weight, kg						
Initial	343.8	343.9	344.1	341.0	3.89	0.95
34-d	360.9	359.9	353.7	353.4	4.66	0.53
66-d	400.2	399.4	386.5	388.6	4.85	0.10
ADG, kg						
Per. 1	1.53	1.49	1.28	1.36	0.65	0.030
Per. 2	1.31	1.32	1.09	1.18	0.74	0.13
Overall	1.29^{a}	1.28^{a}	1.08^{c}	1.15^{b}	0.04	0.002
DMI, kg	8.37^{b}	9.39^{b}	15.53^{a}	8.84^{b}	1.11	0.009
FE, kg of gain/100 kg of feed	15.70^{a}	13.60^{b}	6.95^{c}	13.05^{b}	1.29	0.001
Intake, % BW	1.74^{b}	1.96^{b}	3.35^{a}	1.89^{b}	0.28	0.006

[a,b,c] Within a row, means lacking a common superscript letter differ ($P < 0.10$).

Todd, et al. Backgrounding calves with annual forage crops. WSASAS 2007.

Table 4. Performance and intake by steers fed cereal forages harvested as hay, 2006

Item	Haybet	Alf/grass	Trit	WW Hay	SEM	*P*-value
No. of pens	4	4	4	4		
Weight, kg						
Initial	286.1	287.7	285.1	286.8	10.64	0.98
29-d	324.9	322.1	317.7	327.0	11.95	0.68
62-d	386.1	371.7	367.8	383.1	14.29	0.15
ADG, kg						
Per. 1	1.34	1.19	1.12	1.39	0.25	0.39
Per. 2	1.75[a]	1.42[c]	1.35[c]	1.60[b]	0.15	0.003
Overall	1.56[a]	1.31[b]	1.23[b]	1.51[a]	0.15	0.01
DMI, kg	11.81	8.18	10.62	10.22	0.76	0.33
FE, kg of gain/100 kg of feed	13.23	16.05	12.17	14.74	1.53	0.19
Intake, % BW	3.05	2.20	2.89	2.67	0.21	0.33

[a,b,c] Within a row, means lacking a common superscript letter differ ($P < 0.10$).

Todd, et al. Backgrounding calves with annual forage crops. WSASAS 2007.

Table 1. Average yield, consumption, chemical composition, and morphological characteristics of sorghum species and crosses over four grazing periods for both cattle and sheep trials.

Variety*	Yield g/sq. m	Consumption %	HCN %	Dry matter %	Total sugars %	Leaf width cm	Stem diam. cm	Leaf %
Beef cattle trials								
Piper	304a	52. 2a	. 020b	20. 4a	16. 0ab	2. 10d	. 45c	61. 4d
Trudan 2	292a	37. 8ab	. 025b	19. 7ab	15. 9ab	2. 46c	. 53b	65. 7c
Nebraska 280 S	286a	35. 5b	. 025b	17. 5c	10. 0d	3. 40ab	. 69a	66. 7bc
T.E. Grazemaster	250ab	10. 0c	. 050a	18. 3abc	11. 7c	3. 31b	. 69a	71. 2ab
3 Little Indians	230b	11. 5c	. 056a	17. 9bc	16. 3a	3. 69a	. 75a	72. 8a
Sudax Sx 11	257ab	6. 5c	. 049a	18. 6abc	14. 3b	3. 52ab	. 73a	70. 4ab
Sheep trials								
Piper	191ab	80. 3a	. 023b	23. 7a	12. 3a	1. 91c	. 42c	63. 0b
Trudan 2	197ab	55. 0b	. 025b	22. 3a	12. 1a	2. 11c	. 47c	66. 2ab
Nebraska 280 S	223a	65. 4b	. 027b	20. 3a	8. 6b	3. 36ab	. 72b	64. 8b
T.E. Grazemaster	181ab	34. 7c	. 053a	22. 1a	7. 8b	3. 19b	. 70b	67. 8ab
3 Little Indians	162b	29. 9c	. 064a	21. 0a	9. 1b	3. 71a	. 85a	70. 8a
Sudax Sx 11	170b	31. 1c	. 066a	21. 6a	11. 4a	3. 29b	. 77ab	71. 2a

* Figures within a column followed by different letters are different at the 5% level of probability.

Rabas, et al. Relationship of chemical composition and morphological characteristics to palatability in sudangrass and sorghum x sudangrass hybrids. 1970.

Forage Corn

Table 2. Corn hybrid forage yield and quality response in Wisconsin (1994–1996).†

Hybrid	Harvested plant density	DM yield	IVTD	CP	NDF	ADF	Cell wall digestibility	Milk Mg^{-1}	Milk ha^{-1}
	plants ha^{-1}	Mg ha^{-1}	g kg^{-1}					kg Mg^{-1}	kg ha^{-1}
				Southern Wisconsin‡					
Cargill 4327	75 800	19.5	772	71	443	221	485	1023	19 980
Pioneer 3417	73 200	19.3	763	72	471	232	497	937	17 949
LSD (0.05)	1 420	NS	6	1	12	6	6	43	1 103
				Central Wisconsin					
Pioneer 3757	73 600	14.7	812	75	417	199	524	1192	17 694
Jacques 4120	71 900	14.7	796	70	452	212	546	1071	15 747
LSD (0.05)	1 520	NS	5	2	10	6	8	34	837
				Northern Wisconsin					
Pioneer 3921	73 700	17.1	735	68	511	265	480	768	13 073
Pioneer 3902	74 400	17.2	730	68	513	268	474	749	12 825
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

† DM, dry matter; HI, harvest index; IVTD, in vitro true digestibility; CP, crude protein; NDF, neutral-detergent fiber; ADF, acid-detergent fiber.
‡ Southern Wisconsin: Lancaster and Arlington. Central Wisconsin: Marshfield and Valders. Northern Wisconsin: Spooner and Ashland.

Forage Corn

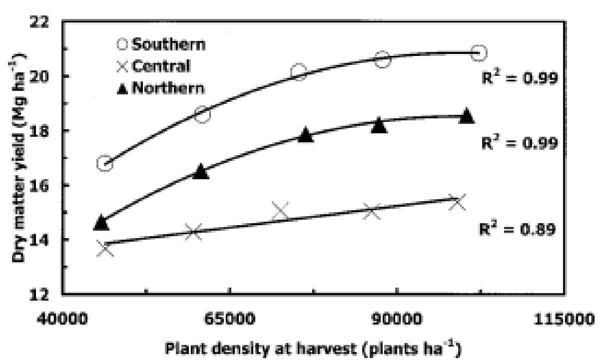

Fig. 1. Relationship between corn forage dry matter yield and plant density at harvest in three Wisconsin production zones (1994–1996). Data are averaged across year, location, hybrid, and replication; each point is the mean of 48 plots. For regression equations, see Table 3.

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Problems with warm-season annuals

- Nitrates
- Prussic acid poisoning

Anti-quality factors

- Prussic acid poisoning
- Species contain cyanogenic glycosides
  - Converted to hydrocyanic acid
  - Decreased respiration
  - Death from respiratory paralysis

- Sorghum, sorghum-sudangrass hybrid, sudangrass

Anti-quality factors

- Nitrate toxicity
  - Nitrates converted to nitrite in rumen
  - If excess consumption, nitrite absorbed into bloodstream
  - Hemoglobin ⟶ methemoglobin
  - Rapid breathing, weak heartbeat, tremors, staggering, and death
- Oats, barley, wheat, millet

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Anti-quality factors

- Don't graze if plant stressed
  - Drought, frost
- Don't graze sorghums/ sudans until > 18 inches
- Don't overgraze
- Ensile plants
  - Wait 6-8 weeks after ensiling
- Rule of thumb:
  - Nitrates will not decline with storage
  - Prussic acid will decline with storage

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Anti-quality factors

- Do NOT feed sorghum, sudangrass, or sorghum-sudangrass to horses
  - Small amounts
  - “dilute” feeding
- Cause of poisoning unknown
- Staggering gait, urine dribbling, abortion

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Haying versus ensiling

- Benefits of ensiling:
  - Shorter window for harvesting
  - Less DM lost at harvesting and feedout
  - Flexible system
- Negatives of ensiling:
  - Requires specific storage conditions
  - May need to purchase additional equipment
  - May have lower acceptance/ palatability

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Haying versus ensiling

TABLE 1

Chemical composition of forages fed in Experiments I and II

Forage	Trial	Dry matter	Crude fiber	Crude protein	pH
		(%)	*(% of DM)*		
Experiment I					
Alfalfa silage	1	22.5	31.2	17.1	4.5
Alfalfa hay	1	87.2	32.2	17.2	....
Alfalfa silage	2	24.5	31.9	19.0	4.8
Alfalfa hay	2	87.1	34.0	19.4	....
Experiment II					
Alfalfa silage	1	24.7	34.2	18.8	4.2
Alfalfa hay	1	86.6	30.1	18.3	....

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Haying versus ensiling

TABLE 2

Average daily dry matter intake, 4% FCM production, and body weight change of cows in Experiment 1 (average of two trials)

Ration	Dry matter intake Total	Dry matter intake lb/100 lb body wt	4% FCM production	Body weight change
	(lb)		*(lb)*	*(lb)*
All silage	25.8	2.27	27.6	−0.8
25% Hay	26.6	2.49	27.6	−0.6
50% Hay	32.0	2.87	28.6	−0.1
75% Hay	35.8	3.10	29.4	+0.4
All hay	37.7	3.23	29.4	+0.2

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Haying versus ensiling

Table 1. Chemical composition of the forages (DM basis)

	Alfalfa		Timothy		Mixture		
	Silage	Hay	Silage	Hay	Silage	Hay	S_x†
Gross energy (kcal/g)	4.5	4.4	4.6	4.5	4.5	4.4	0.41
Protein (%)	20.1*e*	18.5*d*	12.7*b*	10.4*a*	18.5*d*	15.0*c*	0.15
Ether extract (%)	3.4*c*	2.2*a*	3.4*c*	2.9*bc*	3.2*c*	2.4*ab*	0.02
Crude fiber (CF) (%)	30.2*a*	30.4*ab*	34.7*b*	33.2*ab*	32.3*ab*	32.5*ab*	0.91
Nitrogen-free extract (%)	37.0*a*	38.3*ab*	42.7*bc*	47.3*c*	36.9*a*	42.2*b*	1.50
Cell contents (%)	57.5*e*	53.6*d*	40.2*ab*	37.3*a*	45.7*c*	43.6*bc*	0.82
Cell walls (NDF) (%)	42.5*a*	46.4*b*	59.8*de*	62.7*e*	54.3*c*	56.4*cd*	0.82
Acid detergent fiber (ADF) (%)	32.3*a*	36.7*a*	39.8*b*	39.4*b*	40.8*b*	39.8*b*	0.47
Acid detergent lignin (ADL) (%)	5.6*bc*	6.7*c*	3.9*a*	4.4*ab*	4.7*ab*	4.7*ab*	0.12
Hemicellulose (%)	6.2*a*	9.8*b*	20.0*e*	23.3*f*	13.6*e*	16.6*d*	0.39
Cellulose (%)	30.7*c*	30.0*a*	35.9*b*	35.0*b*	36.4*b*	35.3*b*	0.49
Lignified nitrogen (N-ADF) (%)	0.5*ab*	0.6*b*	0.5*ab*	0.5*ab*	0.8*c*	0.5*ab*	0.03
Organic matter (%)	90.6*a*	90.4*a*	93.5*b*	93.8*b*	90.9*a*	92.0*b*	0.14
Ash (%)	9.6*c*	9.4*c*	6.6*a*	6.2*a*	9.1*c*	8.0*b*	0.07
N-ADF (% of total N)	16.0*a*	19.3*b*	25.9*c*	26.8*c*	26.1*c*	21.9*b*	1.21

†S_x = standard error of the mean.
a-f Means with different letters within a parameter were statistically different ($P<0.05$).

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Haying versus ensiling

Table 3. Voluntary intake of forage constituents as affected by the type of forage and the method of conservation (DM basis)

	Alfalfa			Timothy			Mixture			All species		
	Silage	Hay	Avg	Silage	Hay	Avg	Silage	Hay	Avg	Silage	Hay	S_x†
Dry matter (g/kg$^{0.75}$)	104.6	99.3	101.9*a*	91.0	86.3	88.6*b*	78.6	86.3	83.8*b*	91.4	91.5	2.30
Energy (kcal/kg$^{0.75}$)	480.1	442.2	461.2*a*	409.4	398.1	403.8*b*	354.2	394.8	374.5*c*	414.6	411.7	1.00
TDN (g/kg$^{0.75}$)	60.7	57.6	59.2	55.7	51.6	53.7	45.3	53.4	49.3	53.9	54.2	1.46
Protein (g/kg$^{0.75}$)	21.5	18.6	20.1*a*	11.9	8.8	10.3*b*	14.5	12.7	13.6*c*	16.0	13.4*	0.78
Cell walls (g/kg$^{0.75}$)	42.2	46.3	44.2*a*	53.9	54.4	54.2*b*	43.0	51.0	47.0*c*	46.4	50.6*	1.27
Cell constituents (g/kg$^{0.75}$)	62.3	53.0	57.7*a*	37.2	31.8	34.5*b*	35.7	38.9	36.8*b*	45.1	40.9**	2.03

†S_x = standard error of the mean.
a-c Main effect of species ($P<0.05$).
* Main effect of conservation ($P<0.05$).
** Interaction between species and conservation ($P<0.05$).

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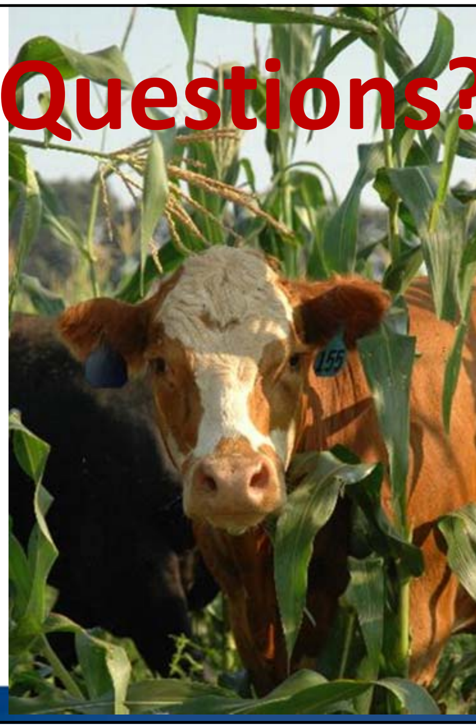
Questions?