

Forages: what do we know and what are we learning about feeding alfalfa to dairy cows?

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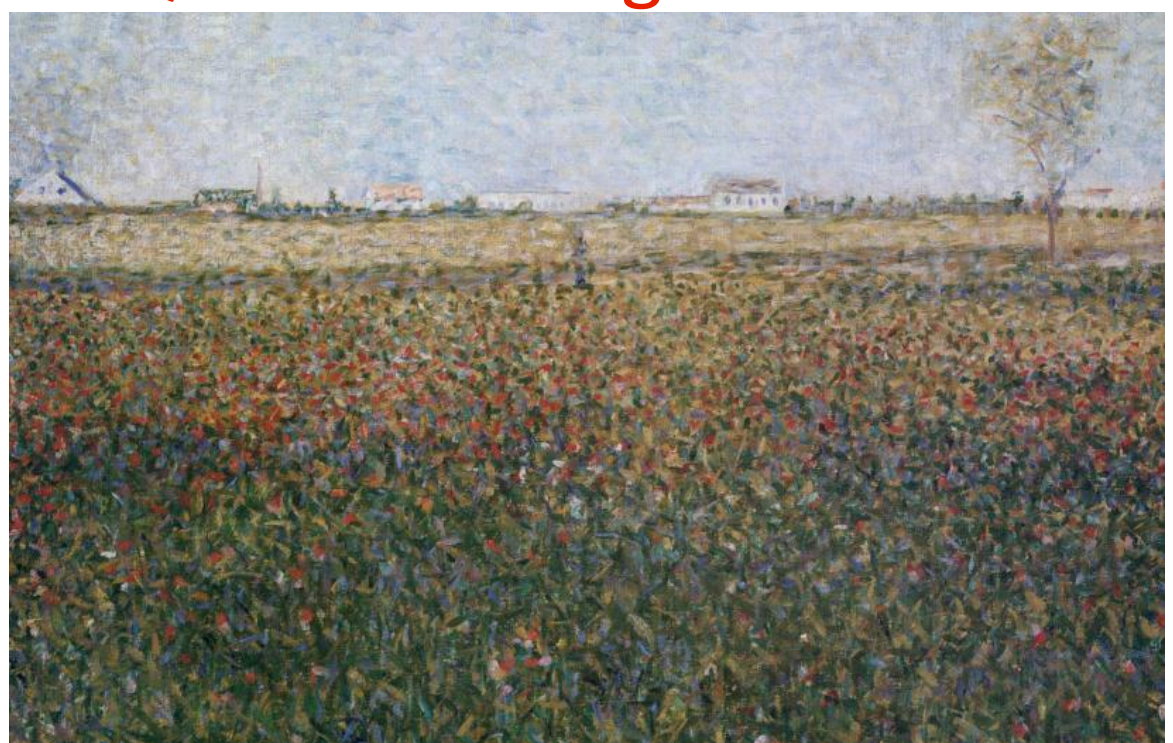
Four State Dairy Nutrition and Management Conference
 11:00-11:30 a.m. & 11:40-12:10 p.m.
 June 4, 2026
 Breakout Room C
 La Crosse Center
 La Crosse, WI



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History of alfalfa as the “Queen of Forages”

- Oldest forage crop we have a name for
- Early French writers would call it “healthy hay”
- Excellent animal feed
- Improves soil
- Increases yield of other crops
- Used as human food and medication
- Despite the existence of fertilizer it continues to be important



“The alfalfa field near St. Denis,” by Georges Seurat (1800’s)

Russelle, 2001



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Variables	NASEM High Cow	Alfalfa Hay ¹	Orchardgrass ¹	Corn Silage ²
CP, % DM	17.4	20.7	11.4	7.7
RDP, % DM	10	16	4.7	5
ADF, % DM	.	32	36.4	24
NDF, % DM	25-33	41.1	58.2	40.9
Hemi, % DM		9.1	21.8	16.9
ADF/NDF	.	0.78	0.63	0.58
Lignin, % DM	.	6.64	6.30	3.05
Starch, % DM	22-30	1.5	1.37	32.9
NDFD48, % NDF	.	52.4	53.3 (30h)	52.0
DE, Mcal/kg		2.63	2.37	2.93
ME, Mcal/kg	2.73	2.21	1.94	2.51

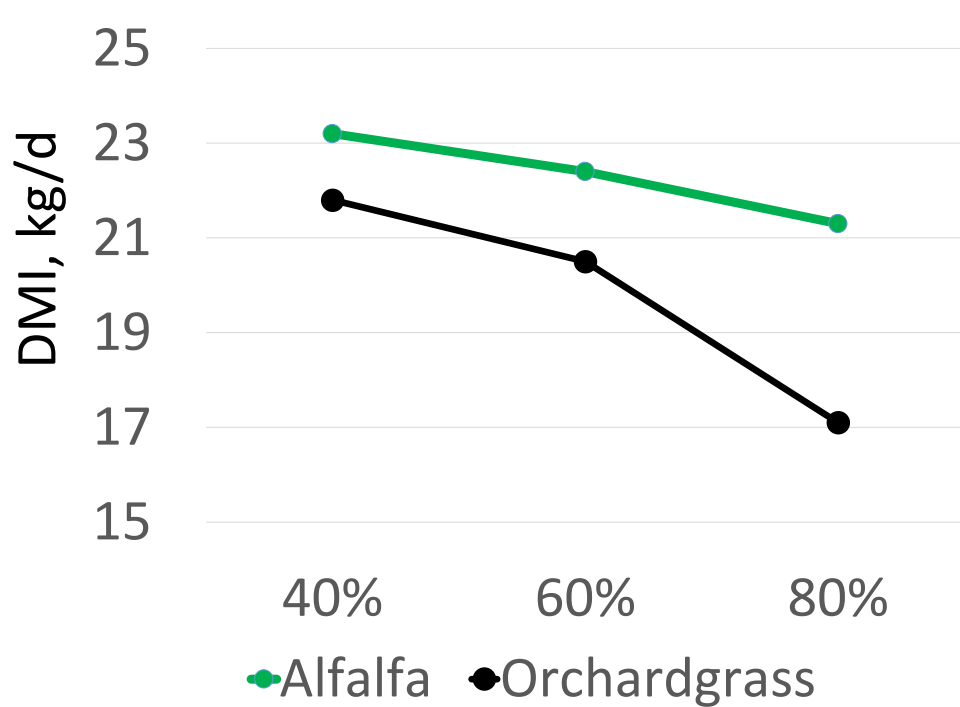
¹Kammes and Allen, 2012

²NASEM, 2021



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Alfalfa and Orchardgrass Silage, DMI Kg/d

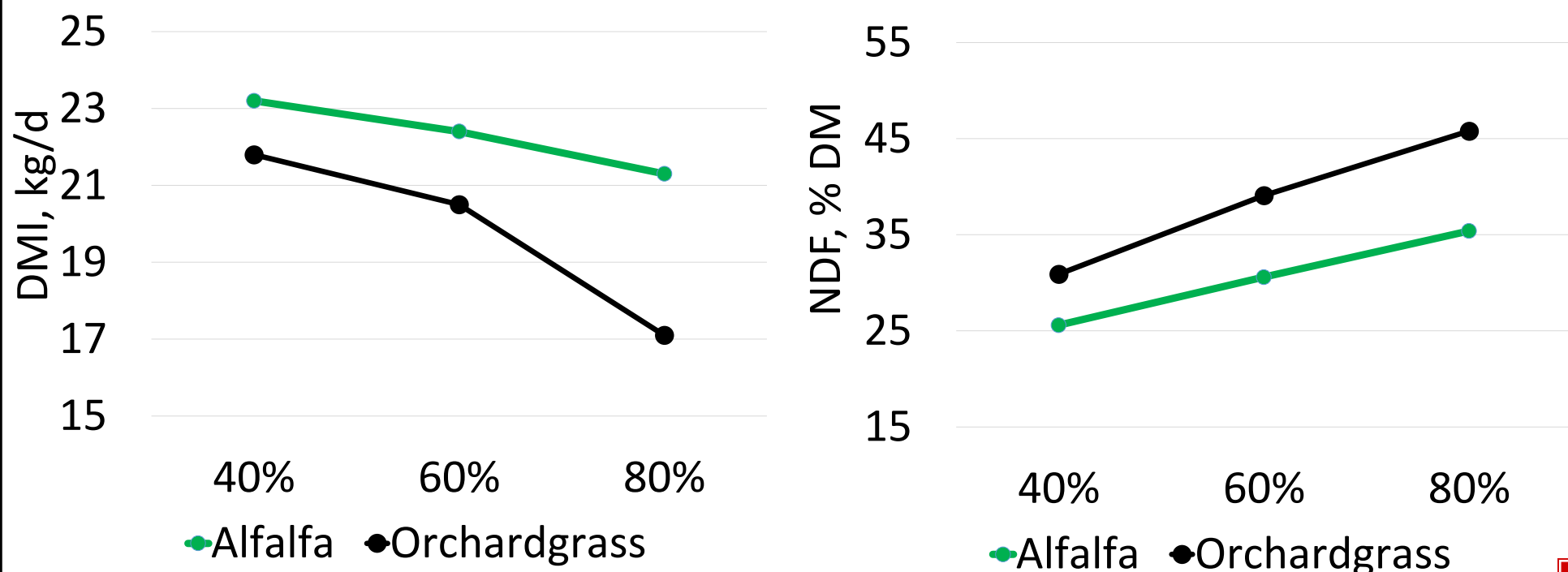


Weiss and Shockey, 1991



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Alfalfa and Orchardgrass Silage



Weiss and Shockey, 1991



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Kammes and Allen, 2012

- In general cows consuming grasses have lower DMI
- Many studies are confounded by concentration of NDF
- What happens if NDF is similar?
- We generally think
 - orchardgrass → more filling → lower DMI
 - alfalfa → less filling → higher DMI



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Alfalfa vs Orchardgrass silage, forage composition

Ingredient	Alfalfa silage	Orchardgrass silage
CP, % DM	22.5	11.4
ADF, % DM	35.0	36.4
NDF, % DM	42.3	58.2
Lignin, % DM	7.56	6.03
NDFD30, % NDF	38.3	53.3

Kammes and Allen, 2012



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Alfalfa vs Orchardgrass silage, diet formulation

Ingredient	Alfalfa	Orchardgrass
Alfalfa Silage	59.9	-
Orchardgrass silage		42.7
Corn	33.6	36.6
SBM, 48%	-	11.8
Exp Soybean	2.50	3.39
Urea	-	1.2
Min/Vit	3.99	3.99
CP, % DM	18.4	17.0
NDF, % DM	29.2	30.2
Forage NDF, % DM	25.3	24.9
iNDF, % DM	14.8	8.24
Starch, % DM	27.3	29.6

Kammes and Allen, 2012



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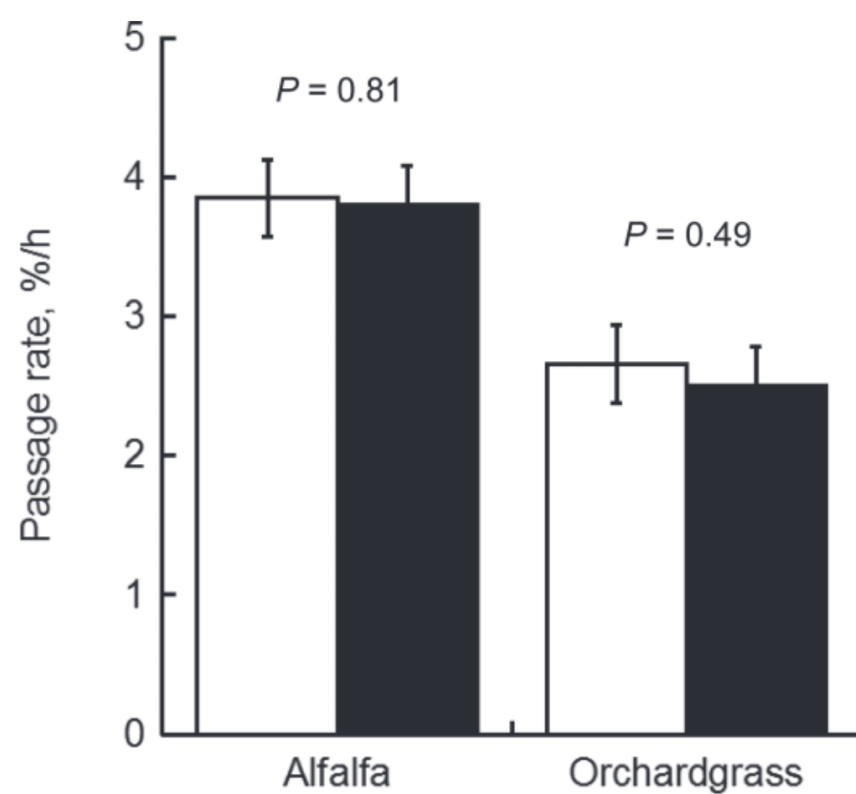


Figure 4. Passage rates of small (<2.36 mm) indigestible NDF particles (iNDF; white bars) and small potentially digestible NDF particles (pdNDF; black bars) for cows fed diets containing alfalfa or orchardgrass as the sole source of forage. Least squares means are shown and error bars represent standard error of the mean. *P*-values above each set of columns indicate significance for comparison of small iNDF and small pdNDF within alfalfa and orchardgrass based on analysis using a paired *t*-test.

Kammes and Allen, 2012

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Alfalfa vs Orchardgrass silage

Ingredient	Alfalfa	Orchardgrass	SEM	P-value
DMI, kg	24.2	23.2	0.63	0.13
Milk yield, kg	35.1	35.2	2.3	0.92
3.5% FCM, kg	36.7	36.5	2.1	0.84
Fat, kg/d	1.33	1.31	0.07	0.72
Protein, kg/d	1.08	1.05	0.04	0.29
TTNDFD, %	35.5	47.1	1.43	<0.01

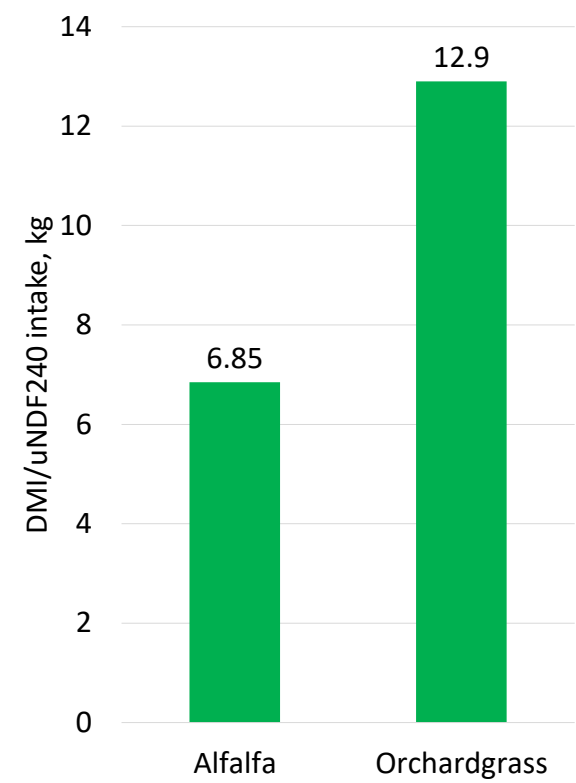
Kammes and Allen, 2012



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uNDF 240 h?

- Often used as a measure related to DMI (i.e. \uparrow uNDF240 = \uparrow DMI)
- Caution, the relationship may not hold across forage families
- Research by Kammes and Allen (2012)
- uNDF 240
 - Alfalfa = 23.0 % DM (55% NDF)
 - Orchardgrass = 16.1 % DM (28% NDF)



Allen (2018, 2021)

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Ruminal kinetics can override static uNDF concentration

Alfalfa contained more uNDF than orchardgrass

Yet cows consuming alfalfa:

- ate more DM
- had smaller rumen NDF pools,
- faster uNDF passage

Alfalfa fiber also had:

- shorter digestion lag
- faster pdNDF degradation
- shorter rumen retention time



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Ruminal passage rate and digestibility of fiber from dairy cows consuming diets containing alfalfa and orchardgrass hays with different concentrations of undegradable neutral detergent fiber

H. Galyon, B. A. Corl, and G. Ferreira*
 School of Animal Sciences, Virginia Tech, Blacksburg, VA 24061

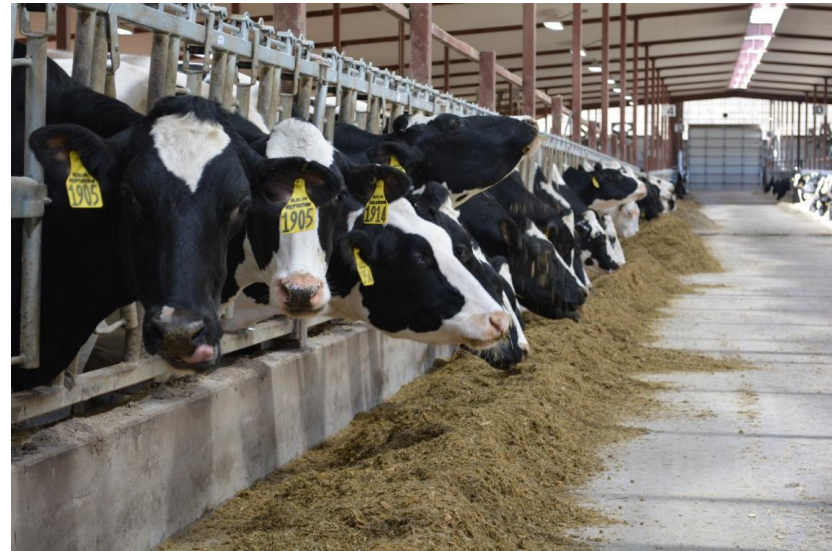
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Animal and Feed Factors [Eqtn 2.2, pg. 13]

$$\text{DMI (kg/d)} = 12.0 - 0.107 \times \text{fNDF} + 8.17 \times \text{ADF/NDF} + 0.0253 \times \text{fNDFD} - 0.328 \times (\text{ADF/NDF} - 0.602) \times (\text{fNDFD} - 48.3) + 0.225 \times \text{MY} + 0.00390 \times (\text{fNDFD} - 48.3) \times (\text{MY} - 33.1)$$

Diet filling effects are governed by

- Forage NDF content
- Fragility of forage NDF, ADF/NDF (Kammes and Allen, 2012)
 - Orchard grass ~ 0.63
 - Alfalfa ~ 0.82
 - Corn silage ~ 0.59
- NDF digestibility
- Not recommended for cows < 60 DIM



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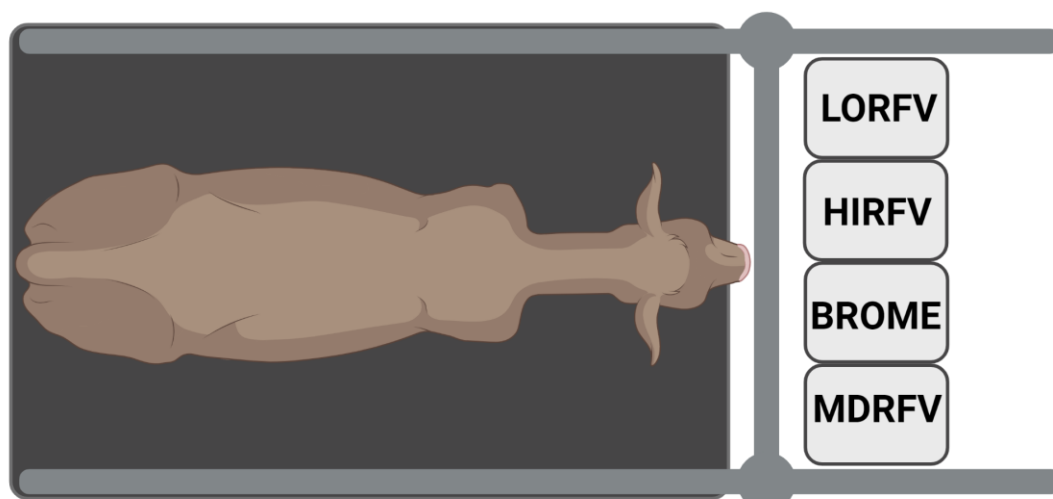
Feed preference studies

JDS
Communications®
2025; 6:223-226

<https://doi.org/10.3168/jdsc.2024-0653>
Short Communication
Animal Nutrition and Farm Systems

Testing preference of alfalfa hay of different relative feed value and brome hay in lactating Jersey cows

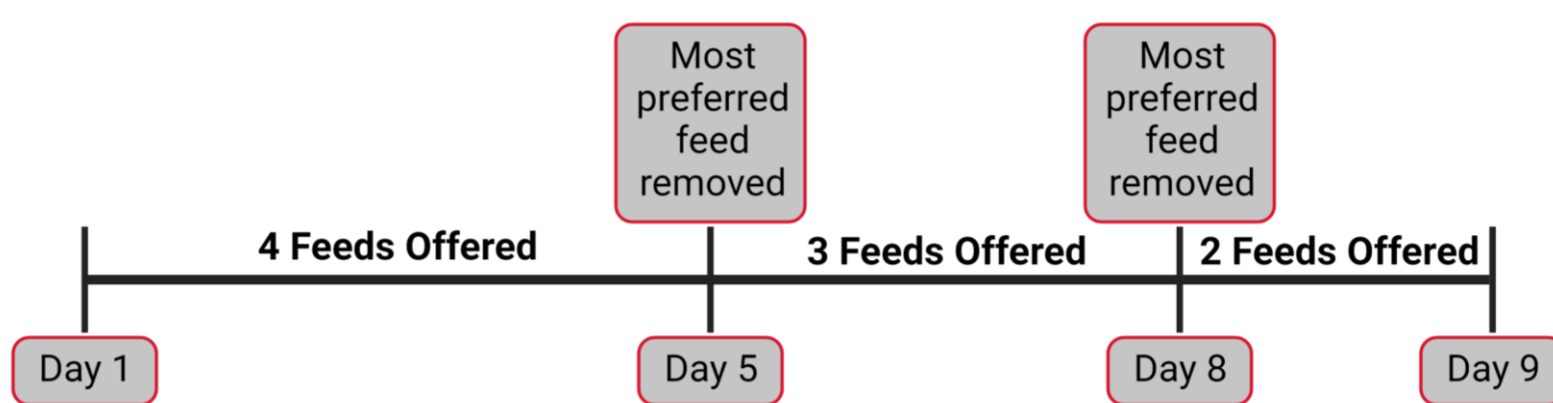
K. K. Buse and P. J. Kononoff*



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Feed preference, alfalfa and RFV

- High RFV alfalfa hay (**High RFV**; 213 RFV)
- Mid RFV alfalfa hay (**Med RFV**; 163 RFV)
- Low RFV alfalfa hay (**Low RFV**; 94 RFV)
- Brome grass hay (**Brome**; 75 RFV)
- Cows were offered 1.13 kg of each treatment in a random location within the feed bunk.



Buse et al., 2025

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Preference results between hays with differing RFVs

Item	Treatments ¹			
	High RFV	Med RFV	Low RFV	Brome
Sum	17	44	41	52
Mean rank (SD)	1.06 (0.25)	2.75 (0.58)	2.56 (0.63)	3.25 (0.93)
Prob. 1 st Choice (SEM) ¹	97.7 (0.79)	1.70 (0.38)	2.09 (0.38)	0.55 (0.46)



¹ P < 0.05

Buse et al., 2025

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Alfalfa and DDGS?

Items	Treatments ¹			
	Corn Silage		Alfalfa Haylage	
	DDGS (55% CP)	Exp Soy	DDGS (55% CP)	Exp Soy
Ingredients				
Corn silage	39.4	39.4	18.0	18.0
Alfalfa haylage	18.0	18.0	39.4	39.4
Corn grain, ground	16.1	16.1	25.0	25.0
Expellers soy	0	10.0	0	7.78
High protein coproduct ²	10.0	0	7.78	0
Soybean meal	3.33	3.33	0.83	0.83
Blood meal	0.78	0.78	0.67	0.67
Urea	0.49	0.40	0	0
Rumen protected MET ³	0.02	0.05	0.06	0.08
Soybean hulls, ground	2.58	3.31	0.91	1.34
Molasses, beet	2.10	2.10	1.83	1.81
Fat ⁴	3.11	3.11	3.11	3.11
Min/Vit	4.10	4.10	4.10	4.10

Buse et al., 2022



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Production

Item	Treatments				SEM	P-value ³		
	Corn Silage		Alfalfa Haylage			F	P	F×P
	DDGS	Exp Soy	DDGS	Exp Soy				
DMI, kg/d	19.6	19.7	19.9	19.6	0.44	0.79	0.77	0.46
Milk yield, kg/d	28.5	29.1	27.9	28.2	0.61	0.09	0.29	0.72
ECM, kg/d ³	36.4	36.1	36.7	36.1	0.60	0.77	0.29	0.60
Protein, %	3.56	3.46	3.45	3.45	0.06	0.07	0.11	0.11
Protein, kg/d	1.01	1.00	0.96	0.97	0.03	0.01	0.99	0.52

Buse et al., 2022



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Alfalfa silage and MP Supply

Ingredient	- MP + ME	+ MP + ME
Alfalfa silage	51.0	51.0
Corn Silage	17.0	17.0
Ground corn	12.6	20.3
Corn starch	13.6	0.0
SBM	0.0	7.6
Blood meal	2.4	1.1
Min/Vit/other	3.4	3.0

Laroche et al., 2019



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Alfalfa silage versus corn silage, diet composition (% DM)

Ingredient	- MP + ME	+ MP + ME	SEM	P-Value
DMI, kg	24.5	26.0	0.93	0.04
Milk yield, kg	30.2	33.6	1.84	< 0.01
ECM, kg	30.5	33.8	2.09	< 0.01
Composition				
Fat, kg/d	1.27	1.40	0.100	< 0.01
Protein, kg/d	1.00	1.11	0.059	< 0.01
MUN, mg/dL	10.5	16.2	0.56	< 0.01
Estimate AA Eff'n				
Met	0.60	0.61		
Lys	0.62	0.63		
Ile	0.75	0.66		

Laroche et al., 2019



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Feeds and AA composition

Nutrient	Unit	Alfalfa	Soybean meal, solvent	Bloodmeal
Arg	% CP	4.20	7.29	4.20
His	% CP	1.93	2.64	6.00
Ile	% CP	3.92	4.54	1.08
Leu	% CP	6.69	7.63	12.40
Lys	% CP	4.81	6.16	8.77
Met	% CP	1.33	1.38	1.15
Phe	% CP	4.59	5.03	6.79
Thr	% CP	4.03	3.95	4.55
Trp	% CP	1.38	1.38	1.58
Val	% CP	4.97	4.76	8.32



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Summary

- Alfalfa has many agronomic advantages
- Protein is highly soluble in the rumen
- Compared to *corn silage* alfalfa supplies less energy
 - DMI usually lower
- Compared to some forages like (i.e. *orchardgrass*) alfalfa fiber is more “fragile”
 - DMI usually higher
- Things not considered by some nutrition models
 - Fragility (ADF/NDF)
 - Palatability



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