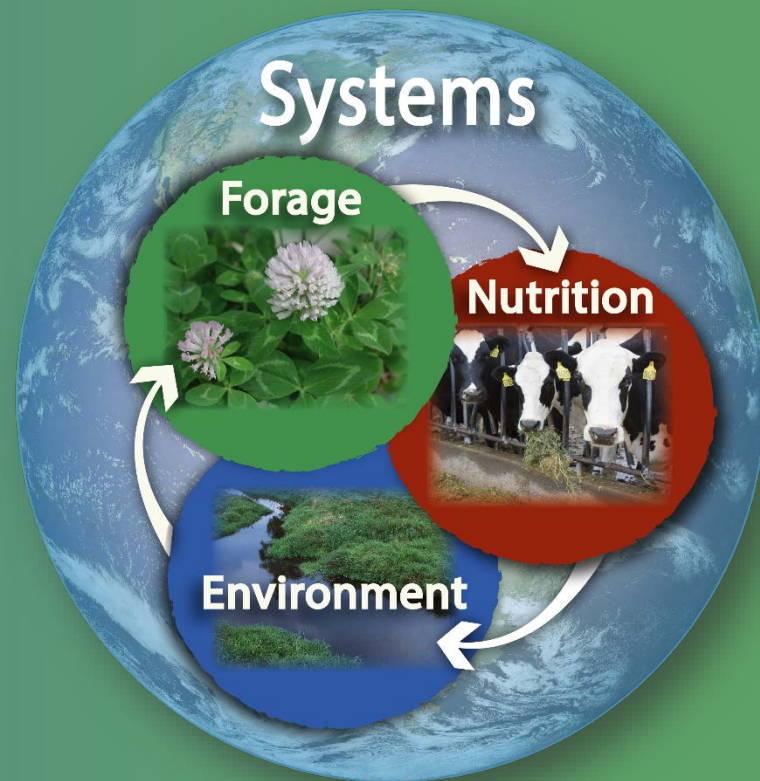


How Much Forage Can We Feed to Dairy Cows?

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Importance of forage

- Ruminants are biologically designed to convert forages and other fibrous feedstuffs into high quality products such as meat and milk.



Importance of forage

- Forages are the base which nutritionally sound, economically sound, and rumen-healthy diets are formulated.



Why feed more forage?

- **Potential benefits include:**
 - Higher milk components
 - Improved cow health (normal rumen function)
 - Lower incidence of acidosis and metabolic disorders
 - Less foot health problems
 - Lower culling rates (increased longevity)
 - Feed less purchased feeds
 - Improved income over feed costs (IOFC)

Why feed more forage?

- **Potential challenges include:**
 - Harvesting and storing more forage
 - More frequent forage analysis and ration adjustments will be needed
 - If forage quality is not sufficient:
 - Lower intake
 - Lower milk production
 - Reduced profitability

Examples of high forage diets

Examples of high-forage diets in northeastern U.S.

Item	Herd 1	Herd 2	Herd 3	Herd 4	Herd 5	Herd 6
Milk, lb./day	91	88	105	90	76	100
Milk fat, %	3.8	4.3	3.8	4.0	3.8	3.6
Milk true protein, %	3.10	3.10	3.10	3.25	3.15	2.90
Ration starch, % DM	27	24	26	24	24	24
Ration crude protein, % DM	15.5	15.7	18.3	17.3	16.3	17.2
Ration NDF, % DM	32.7	33.3	32.7	30.8	34.4	32.0
Forage NDF, % bodyweight	1.0	1.1	1.0	0.9	1.0	1.0
Forage, % of ration DM	65	64	62	70	75	62
Corn silage, % of forage DM	66	36	56*	60	61	56
Alfalfa silage, % of forage DM	34	0	29	0	0	40
Legume/grass forage, % forage DM	0	64	15	40	0	0
Grass silage, % forage DM	0	0	0	0	39	4

*BMR corn silage.

DM = dry matter.

Adapted from Chase and Grant (2013).

Mahanna (2014)

Feeding studies



Increasing Forage Concentration in the Diet

- **Schuler et al. (2013)**
 - Evaluated the optimum dietary forage concentration when using canola meal as a primary protein source.
 - Forage was increased from 42% to 66% of the diet.



Ingredient Composition

Ingredient (% of DM)	Forage %			
	42F	50F	58F	66F
Alfalfa haylage	12.6	15.0	17.4	19.8
Corn silage	29.4	35.0	40.6	46.2
Canola meal	11.0	11.0	11.0	11.0
Ground corn	17.7	16.7	15.7	14.6
Beet pulp	3.43	2.30	1.10	0
Corn gluten feed	10.30	6.90	3.40	0
Soy plus	2.00	2.70	3.50	4.20
Soybean hulls	9.30	6.20	3.10	0
Rumen inert fat	2.30	2.30	2.30	2.30
Vit/Min	1.97	1.97	1.97	1.97



Chemical Composition

Nutrient (% of DM)	Forage %			
	42F	50F	58F	66F
DM	56.0	52.9	49.9	46.6
CP	15.7	15.6	15.8	15.6
NDF	32.6	29.4	30.7	29.8
Forage NDF	16.8	20.0	23.2	26.4
ADF	19.2	17.3	19.1	19.1
Starch	23.0	23.6	24.6	25.8
EE	5.46	5.61	5.60	5.59
Ash	6.90	7.01	7.00	6.80

Schuler et al., 2013



Production Responses

Item	Forage %				SEM	Contrast
	42F	50F	58F	66F		P^a
DMI, kg	28.0	27.0	25.8	24.8	0.69	L
Milk, kg	40.1	40.4	40.8	39.1	1.12	NS
ECM, kg/d	38.0	38.4	39.5	38.7	1.23	NS
FE, (ECM/DMI)	1.36	1.44	1.54	1.57	0.047	L

^a L=Linear response ($P<0.05$).

Schuler et al., 2013



Milk Composition

Item	Forage %				SEM	Contrast
	42F	50F	58F	66F		P^a
Fat, %	3.17	3.22	3.37	3.52	0.17	L
Fat, kg/d	1.26	1.28	1.35	1.37	0.43	L
Protein, %	2.98	3.00	2.96	2.94	0.05	LT
Protein, kg/d	1.19	1.21	1.20	1.14	0.07	NS
MUN, mg/dl	8.30	9.00	8.40	8.90	0.43	NS

^a L=Linear response ($P<0.05$); LT=Linear trend ($P<0.10$).

Schuler et al., 2013



Income Over Feed Cost

Item	Forage %			
	42	50	58	66
FE (ECM/DMI)	1.36	1.44	1.54	1.57
Milk income (\$/cow/day)	12.96	13.17	13.42	13.01
Feed cost (\$/cow/day)	6.23	5.96	5.70	5.49
IOFC (\$/cow/day)	6.73	7.21	7.72	7.52

Based on average prices from 2003 to 2013.



Effect of forage level

- **50% forage vs. 60% forage (Martinez et al., 2009)**
 - Exp. 1: 55% alfalfa haylage:45% corn silage
 - Exp. 2: 70% corn silage:30% alfalfa hay

Effect of forage level

- **Exp. 1: 55% alfalfa haylage:45% corn silage**

Item	50F	60F	SEM	<i>P</i>
DMI, kg/d	29.7	27.3	0.95	<0.01
Milk, kg/d	47.0	45.8	2.91	0.29
Fat, %	3.40	3.51	0.13	0.04
Protein, %	3.12	3.07	0.06	0.02
MUN, mg/dl	9.36	9.71	0.88	0.47
3.5% FCM	46.6	46.8	2.84	0.86
FE, FCM/DMI	1.56	1.72	0.09	0.03

Martinez et al., 2009

Effect of forage level

- **Exp. 1: 55% alfalfa haylage:45% corn silage**

Item	50F	60F
Milk value, \$/cow	12.91	12.80
Feed costs, \$/cow	4.40	3.92
IOFC, \$/cow	8.51	8.88

Martinez et al., 2009

Effect of forage level

- **Exp. 2: 70% corn silage:30% alfalfa hay**

Item	50F	60F	SEM	<i>P</i>
DMI, kg/d	29.7	28.2	0.73	0.01
Milk, kg/d	40.8	41.1	2.45	0.76
Fat, %	3.68	3.73	0.18	0.55
Protein, %	3.17	3.15	0.09	0.35
MUN, mg/dl	7.87	8.12	0.46	0.47
3.5% FCM	46.6	46.8	2.84	0.86
FE, FCM/DMI	1.38	1.47	0.07	0.17

Martinez et al., 2009

Effect of forage level

- **Exp. 2: 70% corn silage:30% alfalfa hay**

Item	50F	60F
Milk value, \$/cow	11.65	11.79
Feed costs, \$/cow	5.00	4.72
IOFC, \$/cow	6.65	7.07

Martinez et al., 2009

What are the driving factors determining forage consumption?

- **Depends on:**
 - Forage quality (NDF concentration)
 - Forage digestion rate
 - Rate of passage
 - Particle size
 - Palatability
- **Animal body weight**

What are the driving factors determining forage consumption?

- **If digestibility is poor:**
 - Rate of digestion is reduced
 - Rate of passage is reduced
 - Intake is reduced because of rumen fill

Considerations for feeding higher forage diets

1. Strive for consistent quality with minimal variation. Variation in forage quality will greatly impact milk production.
2. Monitor forage inventory. Consider changes in cropping or feed sourcing program.
3. Allocate the highest and lowest quality forages to the most appropriate groups.
4. Frequently analyze forages including particle size and digestibility.
5. Adjust rations as needed based on forage analyses.
6. Target feeding management including silage face management, aerobic stability, palatability, and feed delivery.
7. Monitor TMR mixer management. Ration is bulkier creating the need for more mixes per day or the need for a larger mixer.

Grant and Chase (2013); Mahanna (2014)

Forages



QUESTIONS?

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