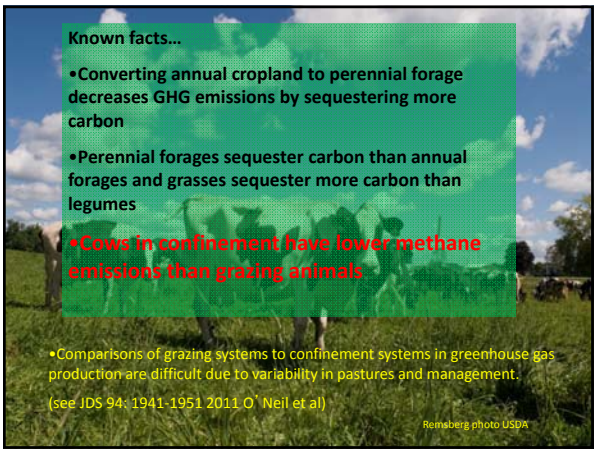
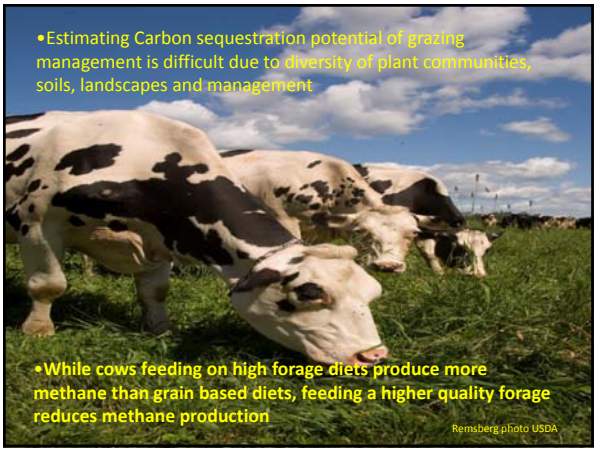
Livestock Nutrition & Grazing Management

Rick Kersbergen
UMaine Cooperative Extension
1-5-16

THE UNIVERSITY OF MAINE Cooperative Extension





So what are the challenges to a <u>new</u> grazing dairy farm…

- Land resources that are accessible
- Feeding decisions…
- Do hayfields make good pastures?
- "My animals stand at the fence and bellow to come back to the barn"
- "My milk production dropped and I can't cover my outstanding operating loans"
- Milk production varies from day to day…

Other questions and concerns..

- "how to I supplement the cows to maintain production, body condition and reproduction efficiency?"
- "Can I group my cows like I do in the barn?"
- "What happens when the pastures dry up in the summer?"
- "Will dry matter intake go down?
- "What about water?"

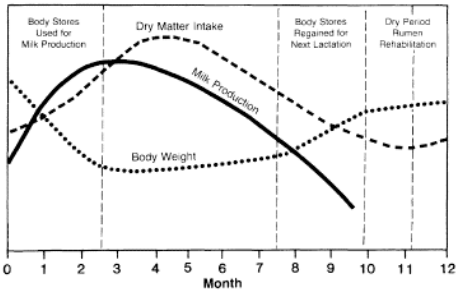
Managing Pasture Quality?

- Grazing animals will always select the highest quality diet possible from the pasture forage available to them
- Challenges:
  - Too little forage available—limits dry matter intake
  - Too mature—limits nutritive value of dry matter intake and rate of passage

Dry Matter Intake……why dry matter?

- Using dry matter removes water out of nutrient calculations, since many feeds fed to cows contain various amounts of water….
- 4500 pounds of 85% moisture pasture is how much dry matter?
- 4500 X 0.15 = 675 lbs dry matter
- While we care about water, we need to know the amount of nutrients going into the cow….amounts are always more important than percentages…

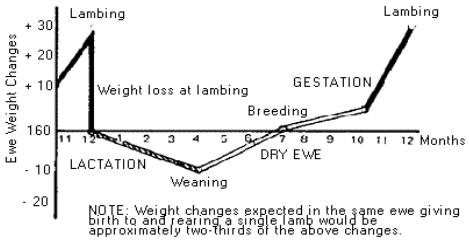
Dairy Cow lactation curves/DMI/Body weight



Challenges… Pasture Quality Characteristics

Nutrient	Pasture	TMR	Notes
Crude protein	18 – 34%	16 – 19%	High soluble protein
Net energy, Mcal	0.66 – 0.80	0.76 – 0.79	Potential Energy deficit
NDF	30 – 55%	< 45%	
NFC	12 – 24%	32 – 36%	low NFC

Weight changes normally expected in a year for a 160 pound ewe giving birth to and rearing twin lambs.



NOTE: Weight changes expected in the same ewe giving birth to and rearing a single lamb would be approximately two-thirds of the above changes.

Sheep	Percent Protein (CP)	Percent Energy (TDN)
Maintenance (154 lb. mature ewe)	9.6	57.6
Late Gestation 180-225% lamb crop expected	11.2	66.7
Lactation Nursing Twins	14.8	64.5
Early Weaned Lambs (66 lbs.) Moderate growth High Growth	14.5	75.8
Lamb Finishing 88 lbs., 4-7 mos of age	11.7	77.1
Yearlings (110 lbs.)	9.1	57.6

Source: Sixth Revised Edition, National Research Council, 1985.

Maintenance

BW	DMI, lbs.	DMI, %	TDN, lbs.	CP, lbs.
125	2.3	1.7	1.26	0.22
150	2.6	1.7	1.45	0.25
175	2.9	1.7	1.62	0.28
200	3.2	1.6	1.79	0.31
225	3.5	1.6	1.96	0.33

Source: Nutrient Requirements of Sheep, 6th revised Edition, 1985.

200 lb ewe at Maintenance only needs a CP % of 10%....

Lactation - three or more lambs

BW	DMI, lbs.	DMI, %	TDN, lbs.	CP, lbs.	Ca, lbs.
125	5.6	4.5	3.41	0.91	0.0229
150	6.5	4.3	4.19	1.11	0.0262
175	7.4	4.2	4.93	1.31	0.0293
200	8.1	4.1	5.71	1.51	0.0323

Source: Nutrient Requirements of Sheep, 6th revised Edition, 1985.

Same 200 lb ewe with triplets needs CP of 18.5 %

Beef cow cow/calf cycles

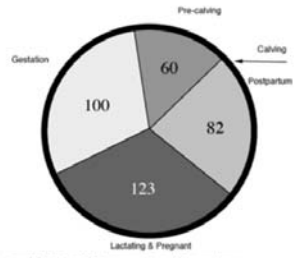


Figure 1. Nutritional & Management phase of the annual cow production cycle.

Why is DMI so important?

- 1 pound improved DMI will result in about 2 pounds extra milk for cow in early lactation and peak milk
- Every pound of milk at peak equals about 200 pounds of milk for the entire lactation.
- Maximum DMI at Peak for Holsteins on pasture alone is about 40 pounds…Can be about 53 or more if concentrates are added to the diet

Factors that affecting Dry Matter Intake

- Animal factors

--Size (wt) of animal…expressed as % of BW
--Stage of Lactation
--Milk yield and composition
--Body Condition (gain or loss)
--Stage of pregnancy

Traditionally we think of two factors that limit or control intake…

- 1) Physical or "bulk fill"

2) Chemical/chemostatic regulation

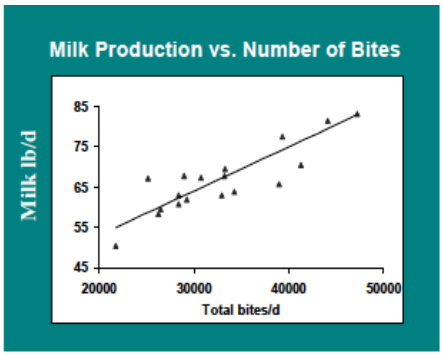
But in pastures…we find intake is limited by eating ability…how effective the cow harvests the pasture in the field!

Major factor is the amount of feed/forage taken per bite!

Grazing Time (minutes/day)[a]	*500-700 min/day*
✖	
Biting Rate (bites/minute)[a]	*About 65/min*
✖	
Bite Mass (g intake/bite)[b]	
⇩	
Pasture Intake	

[a]Primarily animal factors
[b]Primarily influenced by sward factors

Bite size is determined by grass height, the density of the sward and proportion of green leaf in the sward



Pasture and Feed Factors that influence DMI

- Pasture quality (higher quality..higher NDFD…higher passage rate and intake of nutrients)
- Pasture availability
- Sward Density
- Time allowed for grazing
- Supplement type and amount (increased total dry matter intake when pastures are supplemented with concentrates)
- Forage digestibility NDFD

Bite size is determined by grass height, the density of the sward and proportion of green leaf in the sward

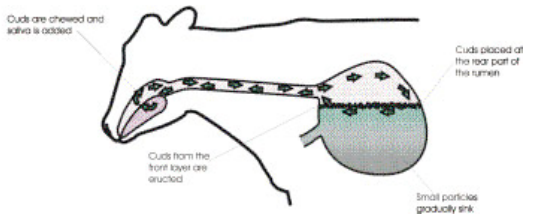
Don't forget environmental factors

- Temperature
- Humidity
- Rainfall
- Availability of shade
- Access to water

PeNDF Physically effective NDF

- NDF that contributes to the forage mat for rumen integrity
- 5 lbs forage >1 inch
- 50 chews per cud
- 450 minutes of rumination/day

Cud chewing…particle size reduction and saliva production



F-NDF (oh yeah…another NDF term!!)

- Forage NDF is related to DMI…
- Average F-NDF of cows on pasture is about 1.1% to 1.3% of Body wt. of animal
- 1300 pound cow…that means she will eat about 14-17 pounds of F-NDF per day and produce about 45-55 pounds of milk (if forage quality is excellent)

FORAGE TESTING LABORATORY
DAIRY ONE, INC.
730 WARREN ROAD
ITHACA, NEW YORK 14850
607-257-1272 (fax 607-257-1350)

Sampled	Recvd	Printed	ST	CO
	09/29/14	09/29/14		

MORRISON
UNIV OF MAINE - KERSBERGEN, RICHRD
COOP EXT PO 5100198135
5741 LIBBY HALL ROOM 105 B
ORONO, ME 04469

ENERGY TABLE - NRC 2001

	Mcal/lb	Mcal/Kg
DE, 1X	1.21	2.67
ME, 1X	1.02	2.25
NEL, 3X	0.58	1.27
NEM, 3X	0.60	1.33

Sample Description	Farm	Code	Sample
MMG PASTURE		012D	20880470

PASTURE 7/28/14

Analysis Results

Components	As Fed	DM
% Moisture	7.0	
% Dry Matter	93.0	
% Crude Protein	18.1	19.5
% Available Protein	16.7	18.0
% ADICP	1.4	1.5
% Adjusted Crude Protein	17.6	19.0
Soluble Protein % CP		29
Degradable Protein%CP		65
% NDICP	5.4	5.8
% Acid Detergent Fiber	32.5	35.0
% Neutral Detergent Fiber	51.3	55.1
% Lignin	5.4	5.8
% NFC	10.6	11.4
% Starch	2.1	2.2
% WSC (Water Sol. Carbs.)	8.0	8.6

Forage is 55% NDF

- 1400 pound cow X 0.012 = 16.8 pounds of forage NDF
- This means that our cow can really only consume about 30.5 pounds of dry matter from this pasture!
- Is our sample representative of what the cow actually is grazing?

How do you sample pastures?

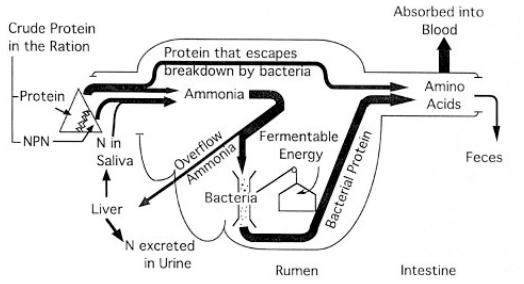
Table 1. Concentration of nutrients (dry matter basis) in orchardgrass harvested in October from the Northeast U.S. (data from Karen Hoffman, eOrganic eXtension Webinar 9/16/2010).

Total plant height was 9 inches	Crude Protein (%)	NDF (%)	NEL (Mcal/lb)
Top one-third	27.4	38.5	0.79
Middle one-third	22.9	44.6	0.76
Bottom one-third	14.0	60.0	0.67

Balancing Rations

- Pasture DMI is not known
- Nutrient intake is not known (diet selection)
- DM/nutrient intake may change from day to day
- Pasture is usually energy deficient..protein surplus
  - No-grain farms???
- Too much protein, particularly degradable protein

Nitrogen Utilization



Challenges…
Pasture Quality Characteristics

Nutrient	Pasture	TMR	Notes
Crude protein	18 – 34%	16 – 19%	High soluble protein
Net energy, Mcal	0.66 – 0.80	0.76 – 0.79	Potential Energy deficit
NDF	30 – 55%	< 45%	
NFC	12 – 24%	32 – 36%	low NFC

Average nutrient composition for cool season grass pasture and legumes

Nutrient	*Predominately grass (cool season)*		*Predominately legume*	
	Spring	*Summer*	*Spring*	*Summer*
Total protein (TP),%DM	*21-25*	*18-22*	*22-26*	*20-24*
RUP[b], % of TP	*20-25*	*25-30*	*20-25*	*25-30*
sol. P[c], % of TP	*35-40*	*25-30*	*30-35*	*25-30*
NDF, %DM	*40-45*	*48-55*	*30-36*	*35-45*
NE, Mcal/lb, %DM	*.72-.78*	*.66-.72*	*.74-.80*	*.70-.74*
Non fiber carbohydrate (NFC), %DM	*15-20*	*12-15*	*18-24*	*15-20*
Ca, %DM	*.50-.75*		*1.1-1.3*	
P, %DM	*.30-.35*		*.30-.35*	
Mg, %DM	*.15-.20*		*.18-.24*	

[a]Summarized from Fales et al., 1995; Hoffman et al., 1993; Holden et al., 1994; Hongerholt et al., 1998; Kolver et al., 1998; Rayburn, 1991
[b]Rumen undegradable protein
[c]Soluble protein

Excess protein costs in…

- Use of energy for excretion of surplus N from soluble and NPN sources
- Potentially detrimental to reproductive performance
- Utilize MUN (Milk Urea Nitrogen) or BUN (Blood Urea Nitrogen) as a monitor

Dairy One

FORAGE TESTING LABORATORY
DAIRY ONE, INC.
730 WARREN ROAD
ITHACA, NEW YORK 14850
607-257-1272 (fax 607-257-1350)

Sample Description	Farm	Code	Sample #
MMG PASTURE		012D	20880440

PASTURE 8/27/14

Analysis Results

Sampled	Recvd	Printed	ST	CO
	09/29/14	09/29/14		

Components	As Fed	DM
Moisture	6.9	
Dry Matter	93.1	
Crude Protein	20.9	22.4
Available Protein	19.9	21.4
ADICP	1.0	1.0
Adjusted Crude Protein	20.9	22.4
Soluble Protein % CP		33
Degradable Protein%CP		67
NDICP	6.7	7.2
Acid Detergent Fiber	30.7	32.9
Neutral Detergent Fiber	51.6	55.5
Lignin	5.2	5.5
NFC	7.2	7.7
Starch	1.8	2.0

MORRISON
UNIV OF MAINE - KERSBERGEN, RICHRD
COOP EXT PO 5100198135
5741 LIBBY HALL ROOM 105 B
ORONO, ME 04469

ENERGY TABLE - NRC 2001

	Mcal/Lb	Mcal/Kg
DE, 1X	1.27	2.79
ME, 1X	1.08	2.38
NEL, 3X	0.62	1.36

Dairy One

FORAGE TESTING LABORATORY
DAIRY ONE, INC.
730 WARREN ROAD
ITHACA, NEW YORK 14850
607-257-1272 (fax 607-257-1350)

Sample Description	Farm	Code	Sample #
MMG PASTURE		012D	20880470

PASTURE 7/28/14

Analysis Results

Sampled	Recvd	Printed	ST	CO
	09/29/14	09/29/14		

Components	As Fed	DM
Moisture	7.0	
Dry Matter	93.0	
Crude Protein	18.1	19.5
Available Protein	16.7	18.0
ADICP	1.4	1.5
Adjusted Crude Protein	17.6	19.0
Soluble Protein % CP		29
Degradable Protein%CP		65
NDICP	5.4	5.8
Acid Detergent Fiber	32.5	35.0
Neutral Detergent Fiber	51.3	55.1
Lignin	5.4	5.8
NFC	10.6	11.4
Starch	2.1	2.2
WSC (Water Sol. Carbs.)	8.0	8.6
ESC (Simple Sugars)	4.1	4.4
Crude Fat	3.2	3.4
Ash	9.91	10.65

MORRISON
UNIV OF MAINE - KERSBERGEN, RICHRD
COOP EXT PO 5100198135
5741 LIBBY HALL ROOM 105 B
ORONO, ME 04469

ENERGY TABLE - NRC 2001

	Mcal/Lb	Mcal/Kg
DE, 1X	1.21	2.67
ME, 1X	1.02	2.25
NEL, 3X	0.58	1.27
NEM, 3X	0.60	1.33
NEG, 3X	0.34	0.75
TDN1X, %	58	

Spartan Ration Balancer

For 65 lbs of milk (3.5 FCM) - 1400 lb cow

Requirement	*44 lbs of pasture dry matter provides*
CP 7.2 lbs	*10.12 lbs CP*
Ne_L 33 Mcals	*33.44 Mcals Ne_L*
NSC 16.8 lbs	*7.92 lbs NSC*

Carbohydrate (Grain) Supplementation of Pasture

- Provides fermentable carbohydrate in the rumen to utilize N and increase rumen microbial yield
- Increase milk yield
  - Increase N output in milk
- Decrease urinary N excretion
- Decrease milk urea nitrogen
- Income over feed costs

Accounting for Pasture

- Ration needs to be adjusted
  - Both amounts of other feeds and nutrients supplied
  - Why pasture samples are helpful
- Nutritionists struggle
  - "Don't know what or how much they're eating"
  - "Can't balance a ration"

Systems

- Total mixed ration ("TMR")
  - All forages and grain mixed together so every bite is "complete"
    - Different TMR's for different production groups
  - Becomes a partial TMR during grazing season
- Component feeding
  - Each forage and grain fed individually
    - Amounts can be tailored to each cows' needs
  - Many trips around the barn

Accounting for Supplement

- Substitution effect of supplement
  - Decreases amount of pasture consumed
  - Forages 1:1 substitution
  - Grain 1:0.5 substitution

Mike Hutjens pasture guidelines

- If you want 90% of expected milk production…feed 50% of DMI from quality pasture
- If you want 75% of expected production…. feed 75% of DMI from quality pasture
- If you want 50% of expected production…… feed 90% of DMI from pasture

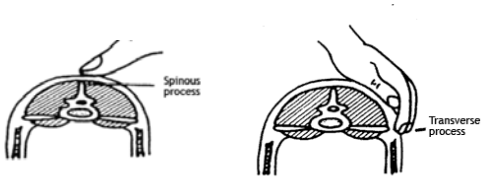
Minerals - where and how do they fit in?

- Usually look at Ca, P, Mg, S, Cu, Zn, Se and salt
- Mg is essential to reduce risk of grass tetany (dolomitic limestone)
- Most producers supplement with commercial 2:1 mix (Ca to Phos)
- Free choice?

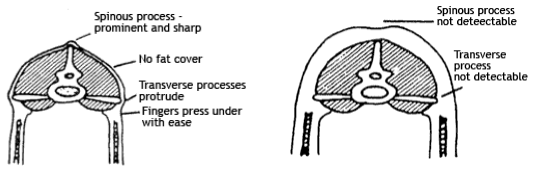
No 'cookie cutter'

- Every farm is different
- Must optimize resources available on farm
  - Land
  - Animals
  - Feeds/Forages
  - Management

Body Condition Scoring



Body Condition Scoring



Questions??

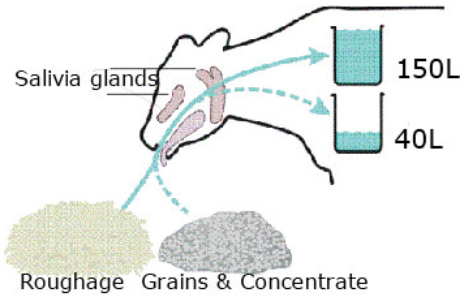
Rumen Physiology

- Two types of bacteria
  - Fiber digester – cellulytic – higher when fed high forage diets. Most active pH >6
  - Starch digester – amylolytic – higher when fed high grain/starch diets. Most active pH 5-6
- Anything affecting rumen pH affects rumen function and how feeds are digested

Rumen Physiology

- Balance between acid production and removal as well as the buffers available to neutralize acids
- Rapid carbohydrate digestion → rapid VFA production that exceeds removal and decrease in pH reducing forage digestion and reduces intake because of fill. Look at CHO availability
- Saliva is a major source of buffer (Bicarbonate and phosphate ions)

New England Forage & Weed ID and Management Training Project



Roughage particle size will determine the extent of saliva production

New England Forage & Weed ID and Management Training Project