Economics of Grain Supplementation for Organic Dairy Cows

Bradley J. Heins
University of Minnesota
West Central Research and Outreach Center Morris, MN

Rotational Grazing

- Seasonal management
- Seasonal diseases and health issues
- Long time between change and realization of effect

Seasonal challenges

- Feed requirements
- Weather
- Variation in feed quality
- Use of stored feeds
- Stocking rate

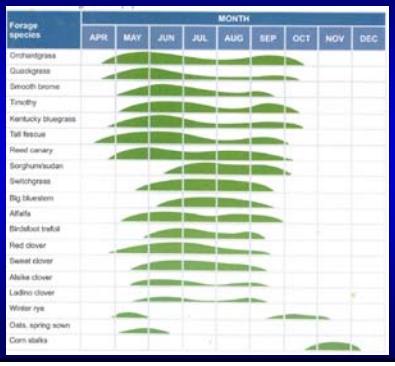
Grass species selection

- Grazing management
  - Continuous, rotational, MIG, mob, stockpile
- Fertility management
  - Under-fertilized grasses will disappoint
  - Recycling potential in pasture (N,P,K,others?)
- Varietal differences can be huge
- No single species has it all
- DIVERSITY is key, within and among pastures

Grass species selection factors

- Yield total (e.g. tall fescue)
- Yield distribution (e.g. orchardgrass)
- Palatability (e.g. timothy)
- Forage quality (e.g. meadow fescue)
- Persistence (e.g. reed canarygrass)
- Grazing tolerance (e.g. Kentucky bluegrass)
- Ease of establishment (e.g. ryegrass)

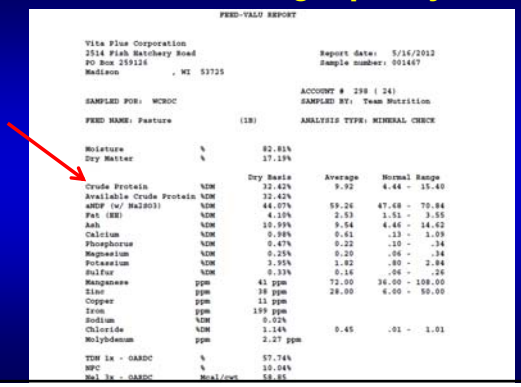
Pasture species production



Characteristics of productive pasture

- High leaf-area index
- High plant density/close plant spacing
- High plant diversity and pasture complexity
- Plant growth throughout grazing season
- Decreased unproductive plants (i.e. weeds)
- More perennial plants

Pasture forage quality



FEED-VALU REPORT

Vita Plus Corporation
2514 Fish Hatchery Road
PO Box 259126
Madison , WI 53725

Report date: 5/16/2012
Sample number: 001467

ACCOUNT # 298 (24)
SAMPLED FOR: WCROC
SAMPLED BY: Team Nutrition

FEED NAME: Pasture (1B)
ANALYSIS TYPE: MINERAL CHECK

Moisture	%	82.81%		
Dry Matter	%	17.19%		
		Dry Basis	Average	Normal Range
Crude Protein	%DM	32.42%	9.92	4.44 - 15.40
Available Crude Protein	%DM	32.42%		
aNDF (w/ NaLSO3)	%DM	44.07%	59.26	47.68 - 70.84
Fat (EE)	%DM	4.10%	2.53	1.51 - 3.55
Ash	%DM	10.99%	9.54	4.46 - 14.62
Calcium	%DM	0.98%	0.61	.13 - 1.09
Phosphorus	%DM	0.47%	0.22	.10 - .34
Magnesium	%DM	0.25%	0.20	.06 - .34
Potassium	%DM	3.95%	1.82	.80 - 2.84
Sulfur	%DM	0.33%	0.16	.06 - .26
Manganese	ppm	41 ppm	72.00	36.00 - 108.00
Zinc	ppm	38 ppm	28.00	6.00 - 50.00
Copper	ppm	11 ppm		
Iron	ppm	199 ppm		
Sodium	%DM	0.02%		
Chloride	%DM	1.14%	0.45	.01 - 1.01
Molybdenum	ppm	2.27 ppm		
TDN 1x - OARDC	%	57.74%		
NPC	%	10.04%		
Mcal 1x - OARDC	Mcal/cwt	58.85		

Pasture intake: Why worry?

- Pasture-based dairy cows have less milk yield due to reduced DMI and not forage quality
- How do you know what amount to supplement?
- You can only grow so much forage – don't waste it

Characteristics of Pasture	TMR
• 18-35% Protein • High degradable protein	• 16-19%
• .66-.80 Net Energy	• .76-.79
• 30-55% NDF	• <45% NDF
• 12-24% NSC	• 32-36% NSC

Factors Affecting Pasture DMI

Grazing time (GT)

x

Bites/min (BR)

x

Intake/bite (I/B)

=

Pasture intake

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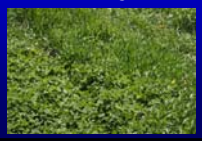
Factors Affecting Pasture DMI

Pasture DMI = GT x BR x IB

Animal Factors
- Size
- Milk production
- Genetic merit

Pasture Factors
- Height
- Density
- Diversity??



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Factors affecting pasture DMI

- Time spent grazing
  - Gut fill
  - 8-9 hours optimum (full pasture)
  - 12-13 hours max
- Grazing patterns
  - 3-5 major meals per day
  - 2-3 hours at dawn, 4-5 hours at dusk

Combs, 2001

Maximize Intake from Pasture

- Feed costs 45-60% of total costs of producing milk
- Pasture is cheap feed (maximize intake)
  - Keeps organic costs low
- Highly digestible
  - Cows will eat more
- High intakes
  - Allows more milk per cow
  - 1 lb. extra DMI = 2 lb. extra milk

100% Pasture Challenge

- Requires a high level of management skills
  - Greater detail to pasture quality/quantity
  - Less reliance on stored feed if mistake is made in pasture budgeting
  - Be able to anticipate changes
  - Keep your pastures and animals WELL

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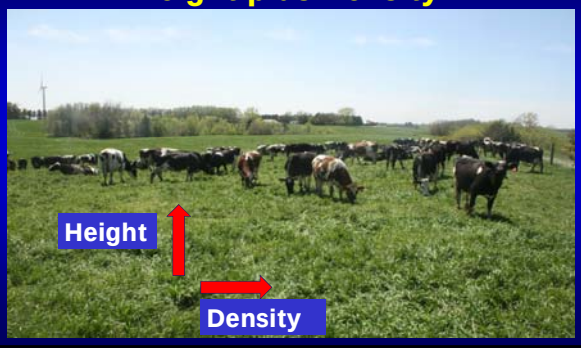
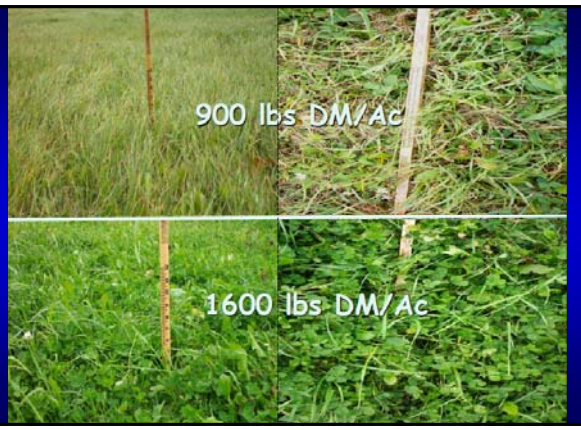
Strategies to consider

- Concentrate on DMI
- Maximize forage use
- Think in terms of cost per cwt.
- Additional milk is almost always the most profitable
- Don't do anything that loses milk production

Pasture Yield is a Function of Height plus Density





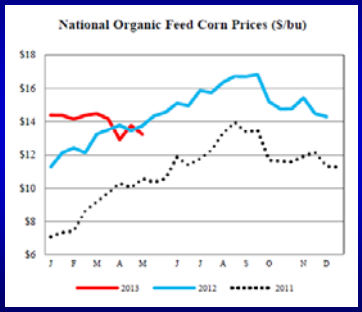
Pasture as the only Feedstuff

- Research has shown that pasture alone can support 40-50 lb. of milk in spring
  - High genetic potential of cows
  - What about cows genetically adapted to pastures?
- Cows will typically consume 3% of BW in forage (3.25% in high producing cows)
- Usually lose more body condition
- Long term effects on body condition and reproduction???

Should I Feed Grain?

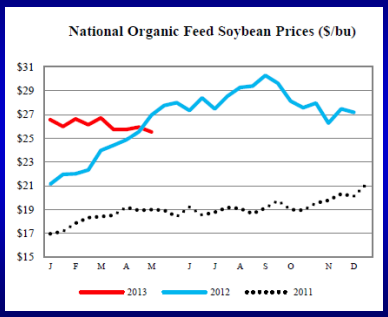
- Economics
  - What is the cost of 1 lb. of grain?
  - What is the value of 1 lb. of milk?
- Availability of organic grain
  - Purchased or home grown
  - Corn or alternative grains
- Philosophy

National organic corn price



USDA Livestock and Grain Market News, Des Moines, Iowa, May 2013

National organic soybean price



USDA Livestock and Grain Market News, Des Moines, Iowa, May 2013

Forages Alone Will Not Support Maximum Milk Production

Nutrient needs for cows in early lactation and what pastures supply

Nutrient	Recommend	Grass	Grass-Legume	Legume
NEL, Mcal/lb	0.70	0.65-0.70	0.66-0.72	0.68-0.74
CP, % of DM	16.1	27	19	26.5
RUP	6.4	4.3-4.6	4.2-5.7	4.6-5.0
NDF, % of DM	25-33	46	45	33
NFC[b], % of DM	36-44	15-20	15-20	20-25

[a]Based on NRC 1989 & 2001
[b]Nonfiber carbohydrate

Organic Grazing Study

- Evaluate the effects of organic grain supplementation on economic, behavior, and pest management strategies of organic dairy cows
- Three supplementation treatments
  - Grass (100% pasture) + free-choice minerals
  - Low grain (6 lbs of organic grain + TMR)
  - High grain (12 lbs of organic grain + TMR)
- TMR for supplemented group was 25 lbs of organic corn silage, 20 pounds of organic haylage, and 1.5 lbs organic mineral on an as-fed basis

Organic Grazing Study

- Body weights and BCS recorded every 2 weeks after morning milking
- Milk samples collected every 2 weeks, fatty acid samples once per month
- Low and high grain cows fed in compost barn after morning milking, grazed afternoon and over-night
- 100% pasture cows in pastures except for milking

WCROC Dairy Pastures

- Eastern Pasutres – Milking Cows and young heifers
  - 160 acres
- Western Pastures – Heifers and dry cows
  - 240 acres

Number of observations

Breed	Grass	Low	High
1964 Holstein	10	11	11
Holstein-sired crossbreds	10	8	9
Jersey-sired crossbreds	9	9	8
Scandinavian Red-sired Xbreds	3	4	4
Total cows	32	32	32

Organic grazing study

Rations for Organic Cows

Trait	Grass	Low grain	High grain
Cows	32	32	32
Corn Silage (lb)	0.0	23.0	23.0
Haylage (lb)	0.0	13.0	13.0
Organic corn (lb)	0.0	6.0	12.0
Mineral (lb)	FC	1.45	1.45

Feed ration are lbs per cow as-fed
Grass cows were fed free-choice mineral

Pasture species

- Smooth bromegrass (*Bromus inermis L.*)
- Orchardgrass (*Dactylis glomerata L.*)
- Alfalfa (*Medicago sativa)*
- Red clover (*Trifolium pratense L.*)
- Kura clover (*Trifolium ambiguum M. Bieb.*)

Mean pasture forage results

Trait	May	June	July	August	September
DM	17.2	22.4	29.3	30.2	27.9
Protein	27.3	22.2	21.7	24.1	22.7
NFC	26.3	15.7	18.9	21.3	26.3
Sugar	12.0	9.9	11.9	9.5	11.2

Averages are across the month and pasture during the grazing season; Adjusted for month and pasture (random)
NFC = Non-fiber carbohydrate

Mean pasture forage results

Trait	May	June	July	August	September
DM	17.2	22.4	29.3	30.2	27.9
NDF	34.4	48.6	45.3	41.2	37.7
NDFD	63.0	64.6	61.1	57.2	56.0
Lignin	5.3	5.2	6.5	5.8	5.5

Averages are across the month and pasture during the grazing season;
Adjusted for month and pasture (random)
DM = Dry matter
NDF = Neutral detergent fiber
NDFD = Neutral detergent fiber digestibility

Pasture herbage mass

- Pasture samples will be analyzed for dry matter, ash, crude protein, neutral detergent fiber, acid detergent fiber, starch, and minerals
- Pasture herbage mass recorded for each group using a Jenquip electronic pasture meter from New Zealand

Pasture herbage mass

Trait	Grass	Low grain	High grain
Cows	32	32	32
Pre-grazing HM	3,799	3,786	3,841
Post-grazing HM	2,399[a]	2,611[b]	2,661[b]
Forage intake	1,404[a]	1,211[b]	1,223[b]
DM / acre / day	630[a]	521[b]	529[b]

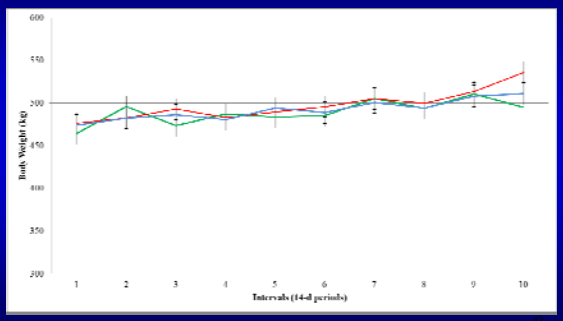
Herbage mass = Pounds of dry matter per acre
Rows with common superscripts are not different ($P < 0.05$)

Organic grazing body weights

Trait	Grass	Low grain	High grain
Cows	32	32	32
Week 1	1,022	1,043	1,050
Week 3	1,043	1,071	1,087
Week 5	1,067	1,090	1,081
Week 7	1,116	1,105	1,116
Week 9	1,131	1,123	1,136
Overall	1,079	1,080	1,089

Differences were not significant between groups
Averages are across the grazing season from May to August 2012

Body weight across periods



Organic grazing body condition score

Trait	Grass	Low grain	High grain
Cows	32	32	32
Week 1	3.12	3.12	3.23
Week 3	3.14[a]	3.34[b]	3.37[b]
Week 5	2.87[a]	2.97[a,b]	3.06[b]
Week 7	2.91[a]	3.12[b]	3.12[b]
Week 9	2.91[a]	3.04[a,b]	3.20[b]
Overall	3.00[a]	3.07[a,b]	3.15[b]

Averages are across the grazing season from May to August 2012
Means within rows with different superscripts are significantly different ($P < 0.05$)

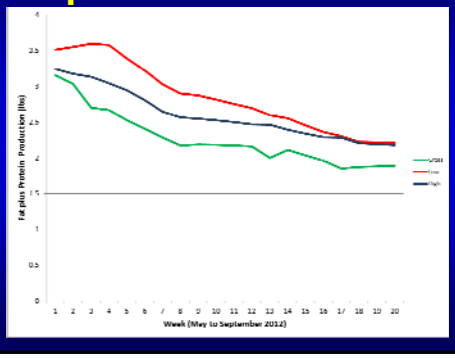
Production traits

Trait	Grass	Low grain	High grain
Cows	32	32	32
Milk (lb)	32.2[a]	40.4[b]	39.4[b]
Fat (%)	4.1[a]	3.6[a,b]	3.3[b]
Protein (%)	3.5	3.3	3.3
SCC (1,000s)	158	120	102
MUN	14.3[a]	10.1[b]	7.3[c]
Energy-corrected milk	32.2[a]	37.2[b]	36.3[b]

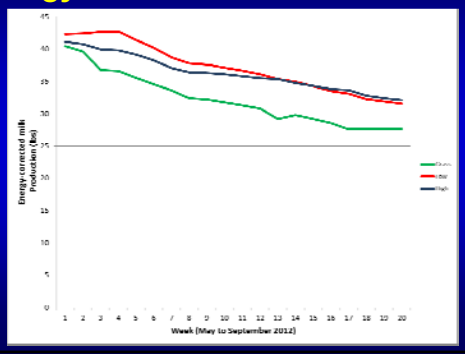
Averages are across the grazing season from May to August 2012
Means within rows with different superscripts are significantly different ($P < 0.05$)

Milk Production

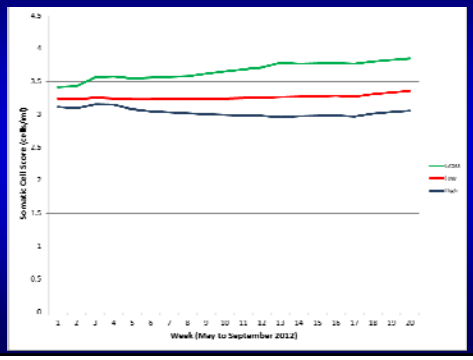
Fat plus Protein Production



Energy-Corrected Milk Production



Somatic Cell Score



Milk and energy corrected milk by breed and supplementation group

Trait	CH	HO-sired	JE-sired	SR-sired
Cows	33	26	26	11
Grass	30.7	35.9	33.7	28.5
Low grain	31.1	40.9	42.6	47.2
High grain	33.5	44.4	34.5	45.2
Grass	30.5	34.1	33.1	31.0
Low grain	31.0	37.4	39.0	41.3
High grain	33.0	38.9	33.5	39.8

Control Holstein, Holstein-sired, Jersey-sired, and Swedish Red-sired crossbreds

Milk fatty acids

Fatty acid	Grass	Low grain	High grain
	---------- (%) ----------		
Lauric (12:0)	2.28[a]	3.15[b]	3.43[b]
Myristic (14:0)	8.78[a]	10.70[b]	11.00[b]
Palmitic (16:0)	24.83[a]	29.18[b]	29.08[b]
Stearic (18:0)	13.63[a]	12.23[b]	11.85[b]
Oleic (18:1)	24.48[a]	21.60[b]	21.58[b]
Linoleic (18:2)	1.48[a]	1.63[a,b]	1.83[b]
Linolenic (18:3)	0.90[a]	0.73[a,b]	0.65[b]

Rows with common superscripts are not different ($P < 0.05$)

Milk fatty acids, continued

Fatty acid	Grass	Low grain	High grain
	---------- (%) ----------		
Monounsaturated	1.14[a]	0.93[b]	0.94[b]
Polyunsaturated	0.12[a]	0.11[b]	0.12[a]
Omega-3	0.05[a]	0.04[b]	0.03[b]
Omega-6	0.08[a]	0.07[b]	0.08[a]
Saturated fat	2.61[a]	2.61[b]	2.63[a]
Total fat triglycerides	4.46[a]	4.07[a,b]	4.10[a]
Trans fat	0.37[a]	0.22[a,b]	0.21[b]

Rows with common superscripts are not different ($P < 0.05$)

Profitability

Item	Grass	Low grain	High grain
	---------- ($/cow/day) ----------		
TMR	0.00[a]	3.18[b]	4.21[c]
Pasture	1.02[a]	0.87[b]	0.86[b]
Revenue	5.02[a]	6.35[b]	5.53[c]
IOFC	3.61[a]	2.20[b]	0.38[c]

Rows with common superscripts are not different ($P < 0.05$)

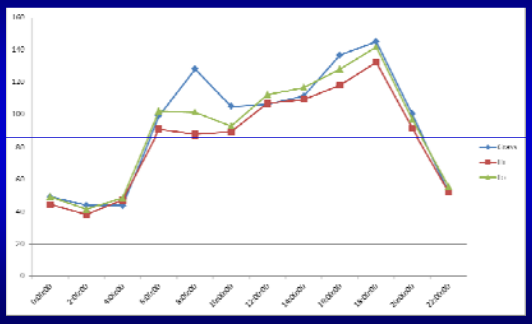
Reproductive Cycling of Cows

Trait	Grass	Low grain	High grain
Cows	32	32	32
Not cycling (%)	12.5[a]	0[b]	6.2[a,b]
Cycling (%)	87.5	100	93.8
Cows not cycling	4	0	2

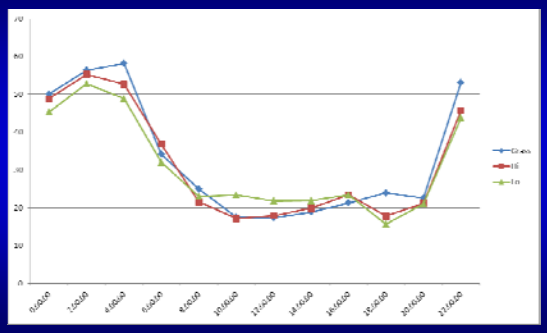
Birth Weights of Calves

Trait	Grass	Low grain	High grain
Cows	32	32	32
Weight (lb)	76.2	81.4	80.8

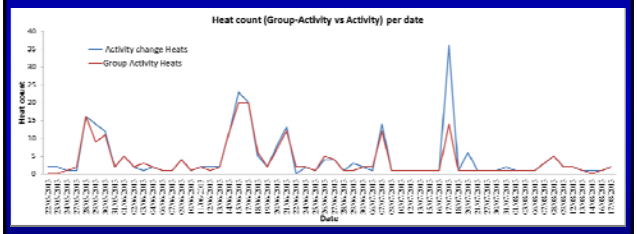
Activity of grazing cows



Rumination of grazing cows



Activity and rumination of grazing cows



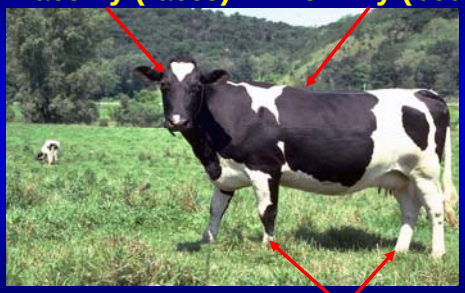
Does feeding grain change numbers of flies on grazing dairy cattle?

Flies 101…

- Different kinds of flies
- Do different things to cattle (and people around them)
- Come from different places

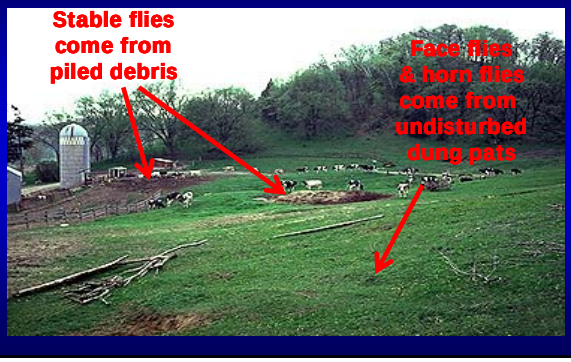
Flies 101…

Face fly (faces) Horn fly (bodies)

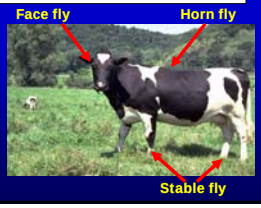


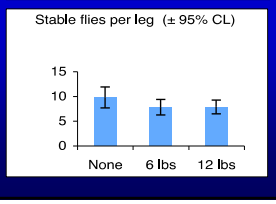
Stable fly (legs)

Confinement *vs.* pasture

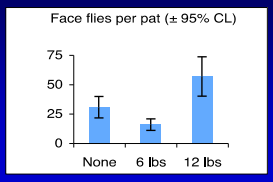


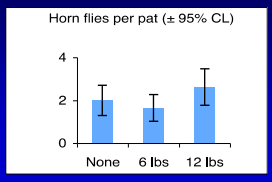
Grain supplements did not change attractancy of cows ($p > 0.2$)

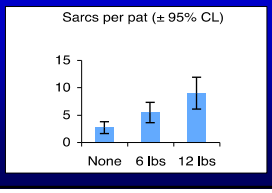




Supplements did not change fly production from field pats ($p > 0.16$)







Supplements did increase nutritional value, as measured by number and size of face flies raised in laboratory bioassays

Mean numbers* of size-adjusted face fly adults reared from maggots in standardized units of cow dung collected at Morris, MN, 2012

Group	July 11	July 25	August 8	Average
Grass	11	30	33	24
Low grain	30	49	39	39
High grain	36	68	25	43
Average	25	49	32	36

*LSD = ~ ± 20% of mean for any grain-date combination, n = 12 units each with 100 larvae per combination.

No Grain Take Home Message

- Don't go cold turkey
  - Ease into increased pasture intake
  - Gradually decrease supplements, allow system (pastures, animals, management) to adjust
- No-grain diet not recommended for beginning grazers
- Develop high quality pastures
- May need ~50% more pasture for no-grain diet
- Consider keeping a little grain in the ration unless economics or market dictates otherwise

Acknowledgements

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Brad Heins
hein0106@umn.edu
320-589-1711