Feedlot Cattle Nutrition – Receiving to Finish

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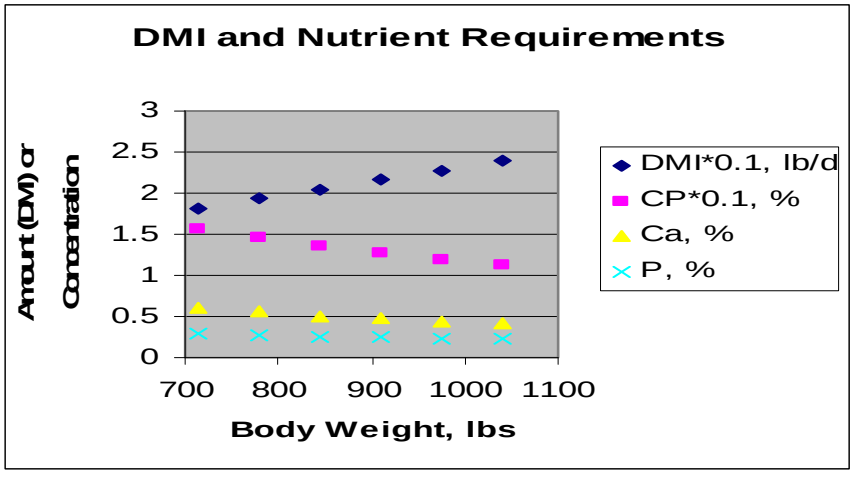
Outline

- Nutrient requirements
  - Mineral and vitamin nutrition
- Cattle type and market constraints
- Growing phase
  - Starting on feed and step-up
- Finishing phase
  - Energy feeds and diet energy density
  - Protein feeds
  - Complementarity among feeds

Nutrition of Growing & Finishing Cattle

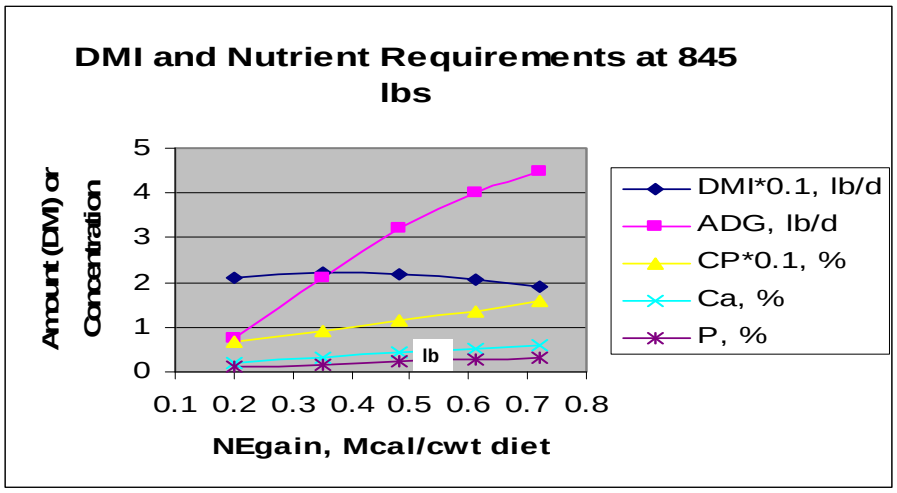
- "Growing/finishing" – traditional reference to a two-phase feeding program;
  - phase 1 emphasizes growth of skeleton and muscle;
  - phase 2 emphasizes diet with higher energy concentration for fattening/finishing



As body weight increases …

- DMI/day increases
- Crude protein reqt decreases
- Calcium reqt decreases
- Phosphorus reqt decreases

DMI and nutrient reqts based on animal that is 1300 lbs at 28% body fat, eating diet of 61 Mcal NEg/cwt, and gaining 3.99 lb/day



As "net energy" concentration in diet increases …

- ADG increases
- CP, Ca and P reqts increase

DMI and nutrient reqts based on animal that would attain 28% body fat at 1300 lbs

Nutrients of Interest for Diet Formulation

- Steers and heifers – energy (NE_{gain}), protein, calcium, phosphorus, potassium, sulfur, sodium and vitamin A

Nutrient Requirements

	NE_{gain}, Mcal/cwt	CP, %	Ca, %	P, %	K, %	S, %	Na, %	Vit A, IU
Grower	**56**	**14**	**0.6**	**0.3**	**0.6**	**0.15**	**.08**	**1,000/lb DMI**
Finisher	**62**	**11**	**0.4**	**0.2**				
Max						**0.3-0.5**		

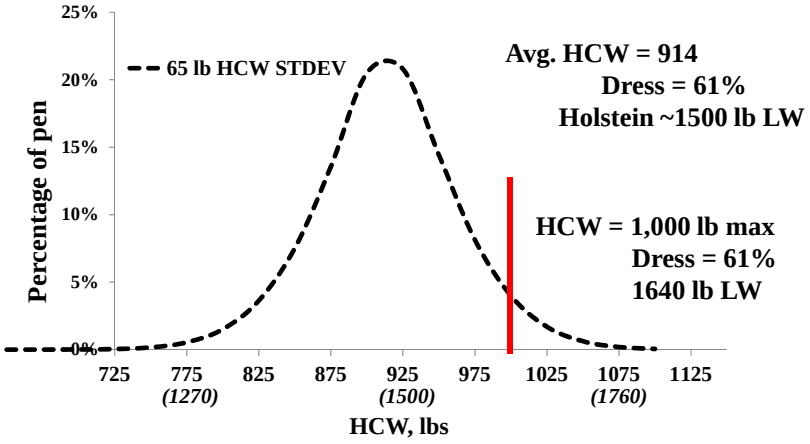
Nutrients of Interest – Sources

• Calcium	• Legumes, Limestone
• Phosphorus	
• Potassium	• Silage or hay, KCl
• Sulfur	
• Sodium	• Salt, 0.2% of diet DM
• Vitamin A	• Retinyl acetate

Cattle Type and Market Constraints

- A reasonable thumb rule is that the weight of finished steers is the same as the weight of their mature dams.
  - Steer finished weight > dam mature weight, if steers are implanted
  - Implanting causes feedlot cattle to achieve the desired carcass composition at 30-90 lb heavier live weight
- Carcass weight maximums, not minimums, are the concern

But in a pen of cattle, variation exists

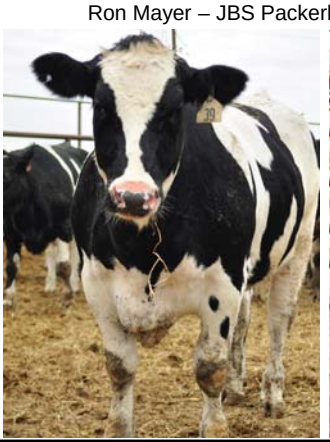


For current native cattle and Holsteins, beware of too much growth before finishing phase begins!

The System's Goal for a Holstein Steer

"Really ideal type of steer. Live weight 1415 lbs, dressed yield estimate 61.5%, Y3, High Choice, Muscle score 1-2. The ideal kind of steer that is desired by both the dairy steer harvesters and native cattle packers alike."

Ron Mayer – JBS Packerland



Management Guidelines for Feedlot Cattle

- Needs of the animal
  - Water, feed, and comfort (shelter and space)
- Performance enhancing strategies
  - Consistent ingredient composition fed at consistent time(s) of day
  - Ensure that all animals seeking access to feed bunk have access
  - Feed that is not dusty
  - Stable pecking order
  - Minimum energy expenditure for activity
  - For finishing-phase cattle, avoidance of excess fatness; sorting on entry or sorting on exit into uniform outcome groups

Growing Phase - Starting Cattle on Feed
Teaching Cattle to Drink and Eat

- Make water easy to find and consume, i.e., splashing water, no obstructions to access, like self-locking headgates
- Comfortable place to lie down; avoid loud noises and people

- Aroma of silages is foreign initially to cattle; grass hay is recognizable; oats and molasses are attractants
- Coccidiosis
  - Controlled through feed additives
    - Deccox (decoquinate)
    - Bovatec (lasalocid)
    - Rumensin (monensin)
  - Water additive
    - Corid (amprolium)

Adaptation to the Grower Diet

- Begin by using grass or grass-legume hay as forage source during days 1-5
- Introduce grower diet (silage or haylage, grain and supplement) with hay fed over the top during days 2-5
- As grower diet consumption increases, reduce hay fed; likely that hay feeding ends on day 5
- Grower diet continues to be fed to meet appetite of calves using good feed bunk management; more on this later
- Don’t rush to catch up to appetite of calves; pace of increase up to DMI of 2% of body weight can be quick, but then further increases should be a half the early pace
- Cattle are adapting to feeds, penmates, feeder, facility, and Rumensin

Net Energy$_{gain}$ (NEg) Concentrations in Feedlot Diets

Equivalencies between corn silage:high-moisture corn ratios and net energy for gain concentrations[1, 2].		
Corn silage	Corn, high-moisture	Net Energy$_{gain}$
Proportion (%)	Proportion (%)	Mcal/lb
10	60	0.65
15	55	0.64
20	50	0.63
25	45	0.61
30	40	0.60
40	30	0.57
50	20	0.54

[1] Based on diet DM formula as follows: corn silage proportion; high-moisture corn proportion; modified wet distillers grain with solubles, 25%; and supplement (5%).
[2] NEg values for diet ingredients (NASEM, 2016) were corn silage, 0.44 Mcal/lb; high-moisture corn grain, 0.71 Mcal/lb; and modified wet corn distillers grain with solubles, 0.74 Mcal/lb. Supplement was considered to be only minerals, vitamins and additives with zero NEg value.

When to end the Growing Phase?

- Depends upon
  - frame size and body condition score of cattle
  - energy density (NEg concentration) of the finishing diet, and
  - weight when 28% body fat (BCS = 7) is achieved
- If aiming for 1450 lb slaughter weight at BCS = 7 with large-frame steers and NEg = 62 Mcal/cwt, end growing phase at
  - 800 lb if BCS = 5
  - 750 lb if BCS = 4
- Don't wait too long!

Finishing Phase Goals

- Steers and heifers
  - Maintain health
  - Maximize growth rate
  - Minimize feed to weight gain ratio; “feed efficiency”
  - Attain carcass composition desired by market; 28% body fat, which is a body condition score of 7
  - Avoidance of excess fatness; sorting on entry or sorting on exit into uniform outcome groups

Adaptation to Grain Diet (Step-up)

- Begin by offering relatively high forage diet with low grain content
- Step-up grain component gradually over 14-28 d, allowing 3-5 d adaptation for each “step”; yearlings step-up faster than calves
- 30, then 60, 75, 80, 85 (and 90%?) concentrates on diet DM basis
- 2.5% of body wt is approx. max DM intake for 7-8
- Since Rumensin is not palatable, introduce Rumensin at half-dose

Alternative Diet Adaptation Strategy

- Instead of five diets for step-up, prepare only lowest and highest concentrate diets and then mix these two diets prior to delivery to achieve the targeted diet energy density.

Feed Bunk Management

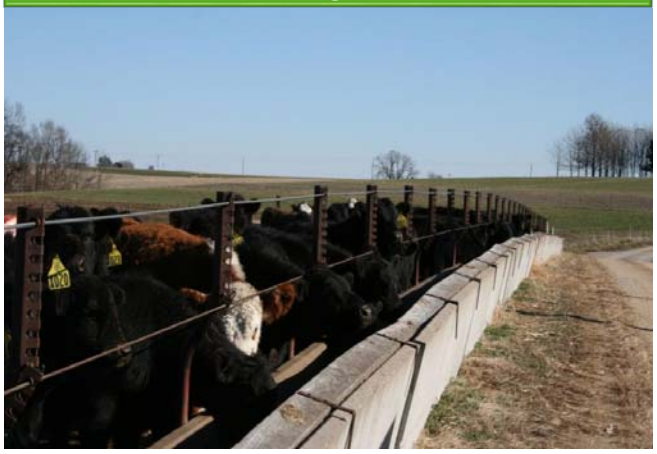
OBJECTIVES

Keep animals eating a consistent amount of feed

Maximize animal performance

Minimize digestive disorders

The Most Important Daily Task in Finishing Cattle!



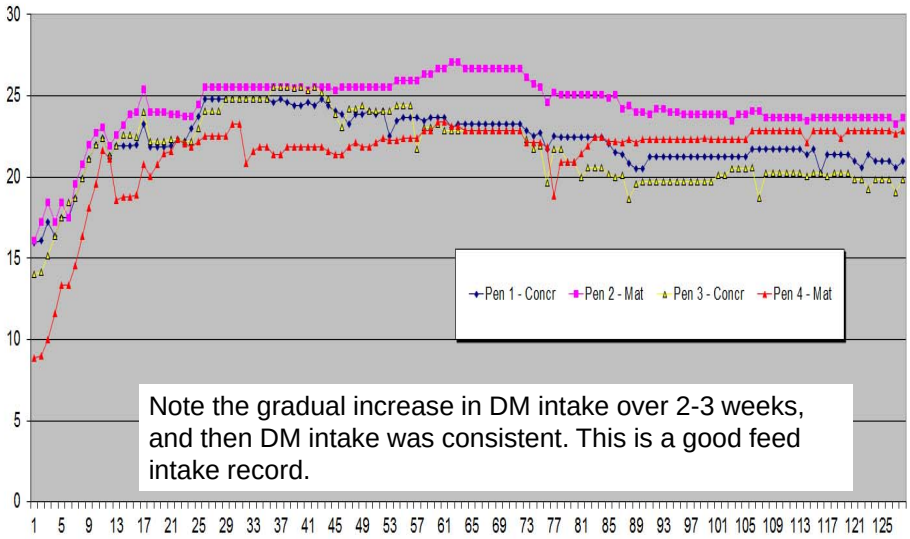
If cattle are fed in the morning, what should the feed bunk look like the next morning?

Cattle Feeding Management

- Routine
  - Consistent time, amount, and ingredient composition
- If feeding once daily, bunk should have only crumbs remaining prior to next day's feeding
- Makes changes to amount and ingredient composition **gradually**
  - Small, slow changes
  - But don't limit intake; satisfy appetite, but don't overfeed
  - Steady intakes lead to sustained growth

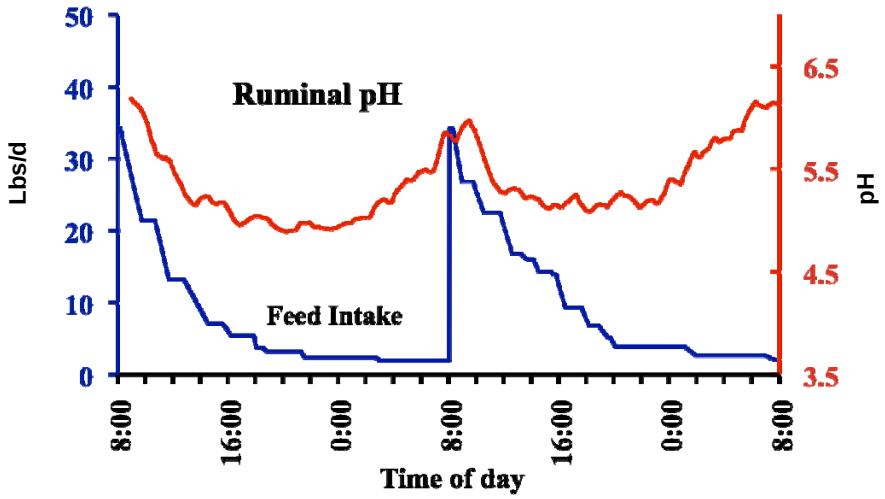
DM Intake (lb/hd daily)

Pen Feed Intake Record

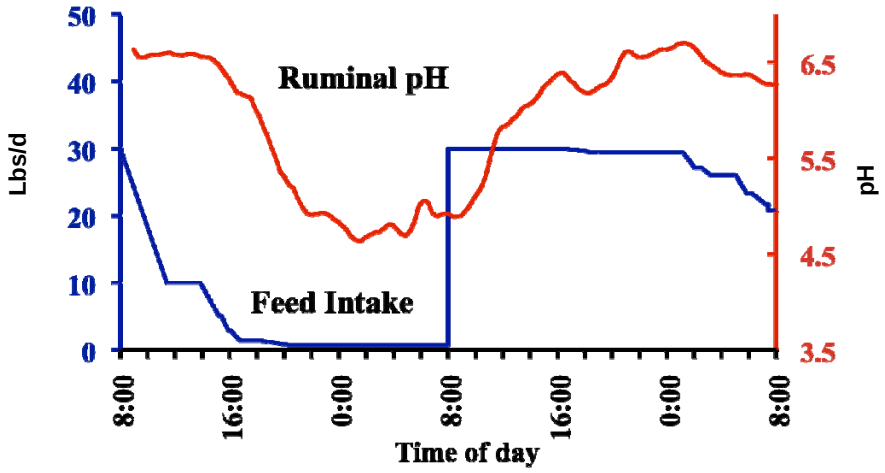


Day on Feed

Ideal Daily Feed Consumption



Erratic Consumption Leads to Subacute Acidosis



Acidosis

- Acidosis is due to the metabolism of the animal being overloaded with acid (e.g., lactic acid, acetic acid, propionic acid, butyric acid)
- Acidosis is caused by an <u>abrupt upshift in intake of fermentable energy</u>
  - Switching from whole corn to ground corn
  - Switching from pasture to corn silage
  - Many more …..

Grains ranked by starch digestion rate

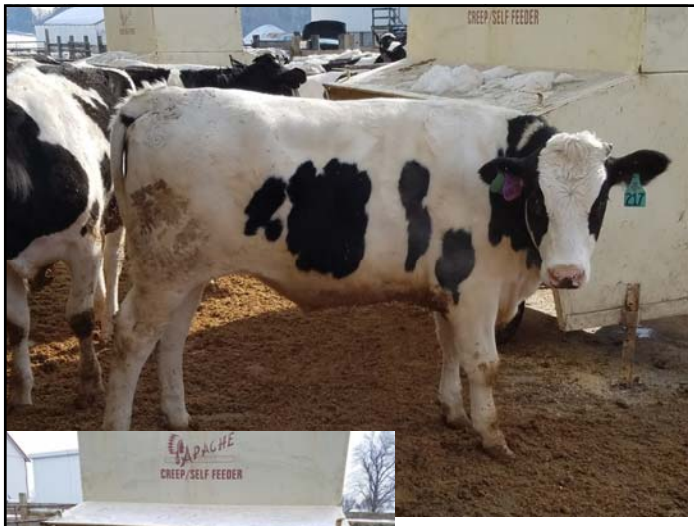
FAST

Wheat
Barley
Processed high moisture corn
Steam-flaked corn, HMC (stored whole)
Dry rolled corn
Dry whole corn

SLOW

Acidosis

- **Acute**
  - Laminitis, founder (sore feet)
  - Will not return to expected feed intake amt (anorexic)
  - Listlessness, diarrhea
- **Chronic or subacute**
  - Sporadic feed intake, poor doers
  - Excessive hoof growth; loss of agility
- **Long term effect (?)**
  - Rumenitis: more problems with longer-fed cattle (but not if there is consistently good bunk management!)



Self-Feeders

- Advantages?
  - Low labor
  - No feed bunks or feeding equipment
- Disadvantages?
  - Only dry feeds
  - Creep feeders don't necessarily make efficient self-feeders
  - No way of knowing if all cattle are eating

Nutrient of Interest - Energy

- Goal – Maximize ADG and feed conversion efficiency
  - feed energy-dense diets
  - maximize dry matter intake, therefore palatability is important
- "Energy" accounts for largest component of required nutrients
- "Energy" feeds of lowest cost are desired

Energy Concentrations in Grains and Forages

Feed	NEg (Mcal/cwt DM)	Ratio to Corn
Corn, whole, dry-rolled	68	100
Corn, ~28% moisture	71	105
Corn, wet distiller's grains	74	109
Oats	62	92
Barley	64	94
Corn gluten feed	59	87
Corn silage	44	64
Alfalfa hay, mid-bloom	38	56

Beef Cattle Nutrient Requirement Model, 2016

Starch Digestibility of Corn in Feedlot Cattle

Owens & Zinn, SWNC, 2005

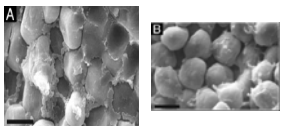
	Dry Rolled	High Moisture	Steam Flaked
# of Diet Observations	26	7	93
% of Starch Intake			
Ruminal	61	91	84
Post-Ruminal	28 (0.90)	8 (0.90)	15 (0.94)
Total Tract	89 (69:31)	99 (92:8)	99 (85:15)

Primary Factors Influencing Starch Digestibility in Corn Grain

Processing
i.e. Particle size; Steam Treatment

Harvest/Storage
i.e. Dry vs. HMC
DM of HM/Maturity; Fermentation Time

Endosperm Type
i.e. Prolamin; Prolamin-starch matrix; Hardness



Adapted from Pat Hoffman, UW Madison Dairy Sci. Dept.

Light table opaque endosperm scores

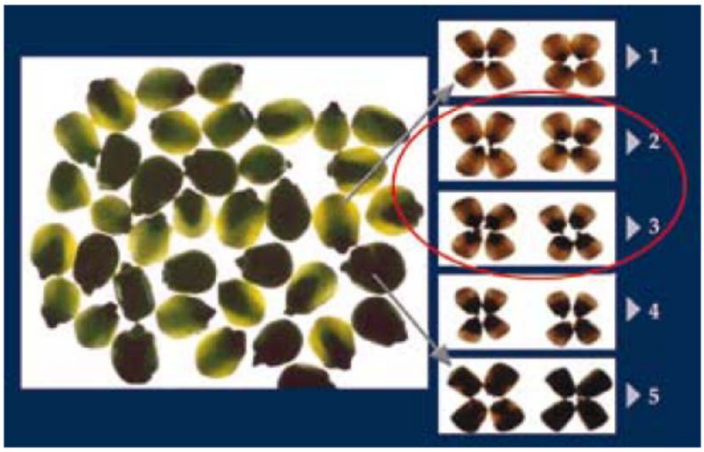


Figure 17. Kernels on a light table (left) and modification classes in F2 seed from normal x QPM donors.
Source: Adapted from Krivanek and Vivek (2006).

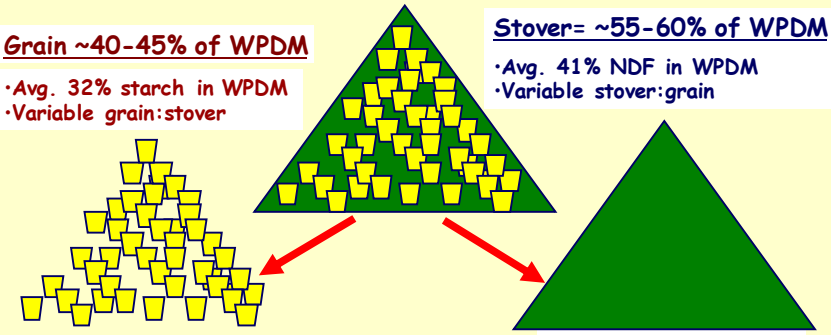
Whole-Plant Corn Silage

Grain ~40-45% of WPDM

- Avg. 32% starch in WPDM
- Variable grain:stover

Stover= ~55-60% of WPDM

- Avg. 41% NDF in WPDM
- Variable stover:grain



80 to 98% StarchD

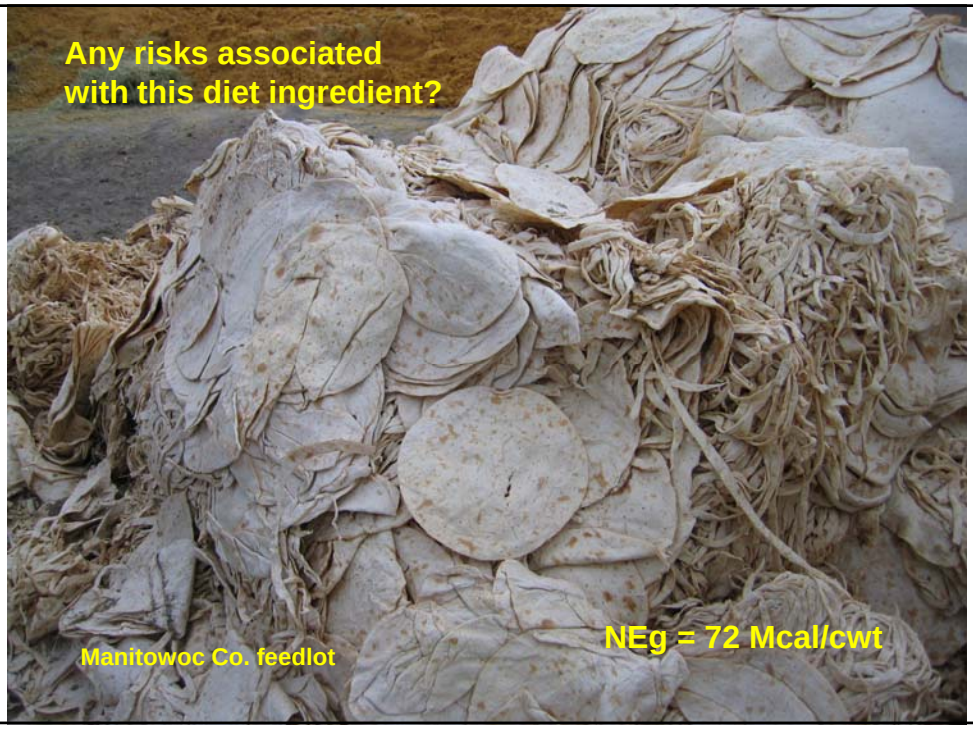
- Kernel particle size
- Duration of silage fermentation
- Kernel maturity
- Endosperm properties
- Additives (exp.)

40 to 70% IVNDFD

- Lignin/NDF
  - ✓ Hybrid Type
  - ✓ Environment; G × E
  - ✓ Maturity
- Cutting height
- Additives (exp.)

Variable peNDF as per chop length

Adapted from Joe Lauer, UW Madison Agronomy Dept.



Corn Co-Products

- Ruminants can utilize many by-products better than non-ruminants, and they fit growing/finishing better than dairy
- Corn co-products (corn starch component has been removed)
  - High-fructose corn syrup
    - Corn gluten feed
  - Ethanol production
    - Dried distillers grain with solubles (DDGS)
    - Corn syrup
- Corn screenings from terminal corn markets

Corn distillers grain is still good, but changing

- In terms of feeding value of distillers grain, “wetter is better”
- Values shown below are for normal oil content

	Dried	Modified Wet	Wet	Syrup
DM, %	92	49	35	34
Starch, %	3	3	4	-
Crude protein, %	30	31	31	17
Oil, %	10	11	11	23
NEg, Mcal/cwt DM	77	80	93	87

Iowa Beef Center, IBCR 200A, 2014

Corn distillers grain is still good, but changing

- Now, ethanol plants have retained more corn oil; DDGS now is 5-8% corn oil

	Dried	Modified Wet	Wet	Syrup
Normal, oil %	**10**	**11**	**11**	**23**
Normal NEg	**77**	**80**	**93**	**87**
Low fat, oil %	**7**	**8**	**8**	**-**
Low fat, NEg	**74**	**77**	**77**	**-**
De-oiled, oil %	**4**	**-**	**3**	**10**
De-oiled, NEg	**72**	**-**	**77**	**78**

Iowa Beef Center, IBCR 200A, 2014

Cost per Mcal of Dry Corn NEg

- Bushel of dry corn = 56 lbs @15% H_20
- 56 lbs * 0.85 lb DM/lb as-fed = 47.6 lb DM
- Dry corn: 0.68 Mcal NEg/lb DM
- 47.6 lb DM * 0.68 Mcal NEg/lb DM = 32.37 Mcal NEg
- Corn price = $3.20/ bushel
- $3.20/ 32.37 Mcal = $0.099/Mcal NEg

Cost per Unit of Net Energy for Gain

Feed	Unit	DM,%	$/unit	$/Mcal NEg
Corn, dry	Bu	85	3.20	0.099
Corn, HM	Bu		3.20	0.095
Corn silage	Ton	35	32.00	0.104
Alf. hay	Ton	88	120.00	0.179

•Because the NEg value of high-moisture corn is greater than that of dry-rolled corn, the cost/Mcal NEg is less.

•Corn silage calories have similar cost as dry corn and are definitely less expensive than alfalfa hay calories.

Alfalfa can have a role in finishing cattle

- Corn and alfalfa complementary in terms of CP, Ca and K
- Complementarity works best only for a growing diet in middle wts (400-700 lbs)

Feedstuff or Diet	CP, %	Ca, %	K, %	NE, Mcal/cwt
Corn	9	0.02	0.4	68
Alfalfa	20	1.5	2.7	38
10 alf: 72 corn: 14 DDG: 4 suppl	13	0.5	0.77	62
40 alf: 59 corn: 1 suppl	13	0.6	1.3	53.5

- When 40% alfalfa included, there is no need for supplemental CP or Ca

Holstein Steer Budget Comparisons

- Prices in Examples
  - Corn silage - $32/ ton
  - Alfalfa haylage - $60/ ton grower; $90/ ton finisher
  - Rolled Corn - $3.20/ bu
  - DDGS - $116/ ton
  - Mineral Supplement - $800/ ton
  - Feeders - 4 & 5 wts @ $90/ cwt; 8 wts @ $75/cwt
  - Choice Feds - $90/ cwt
  - Bedding - 5 lb/ head per day at $35/ ton
  - Yardage - $0.49/ head per day

Bill Halfman, UW Extension, Monroe County, 2017

Backgrounding Program Comparisons

Program	Corn Silage	Alfalfa Haylage	Corn Silage Finished
Forage:corn: supplement*	39:59:2	70:29:1	43:55:2
Start weight	400	400	500
End weight	800	800	1500
Rate of gain	2.2	2.2	2.2
Feed to gain	6.7	6.7	10.0
Days on feed	182	182	455
Feed cost/ pound of gain	$0.27	$0.37	$0.37

* Assume corn silage is 50% roughage

Backgrounding Program Comparisons

Program	Corn Silage	Alfalfa Haylage	Corn Silage Finished
Income	$600	$600	$1125
Feeder value	$360	$360	$450
Total feed	$107.94	$148	$373
Other costs*	$104	$104	$185
Yardage	$89	$89	$223
Return to labor & mgt	-$63	-$90	-$100
Turns/year	2.0	2.0	0.7

*Other costs include death loss, interest on feed and cattle, veterinary, bedding, health products, implants, transportation, and marketing

Finishing Program Comparisons

Program	Calf-fed High Energy Corn Silage	Yearlings High Energy Corn Silage	Calf-fed High Energy Alfalfa Haylage	Yearlings High Energy Alfalfa Haylage
Forage:corn: supplement	10:87:3	10:87:3	10:88:2	10:88:2
Start weight	500	850	500	850
End weight	1500	1500	1500	1500
Rate of gain	2.8	3.2	2.8	3.2
Feed to gain	7.4	7.3	7.4	7.3
Days on feed	357	203	357	203
Feed cost/ pound of gain	$0.49	$0.49	$0.49	$0.49

Finishing Program Comparisons

Program	Calf-fed High Energy Corn Silage	Yearlings High Energy Corn Silage	Calf-fed High Energy Alfalfa Haylage	Yearlings High Energy Alfalfa Haylage
Income	$1350	$1350	$1350	$1350
Feeder value	$450	$637	$450	$637
Total feed	$492	$316	$492	$316
Other costs*	$159	$134	$159	$134
Yardage	$175	$99	$175	$99
Return to labor & mgt	$67	$160	$67	$160
Turns/year	1.0	1.8	1.8	1.8

*Other costs include death loss, interest on feed and cattle, veterinary, bedding, health products, implants, transportation, and marketing

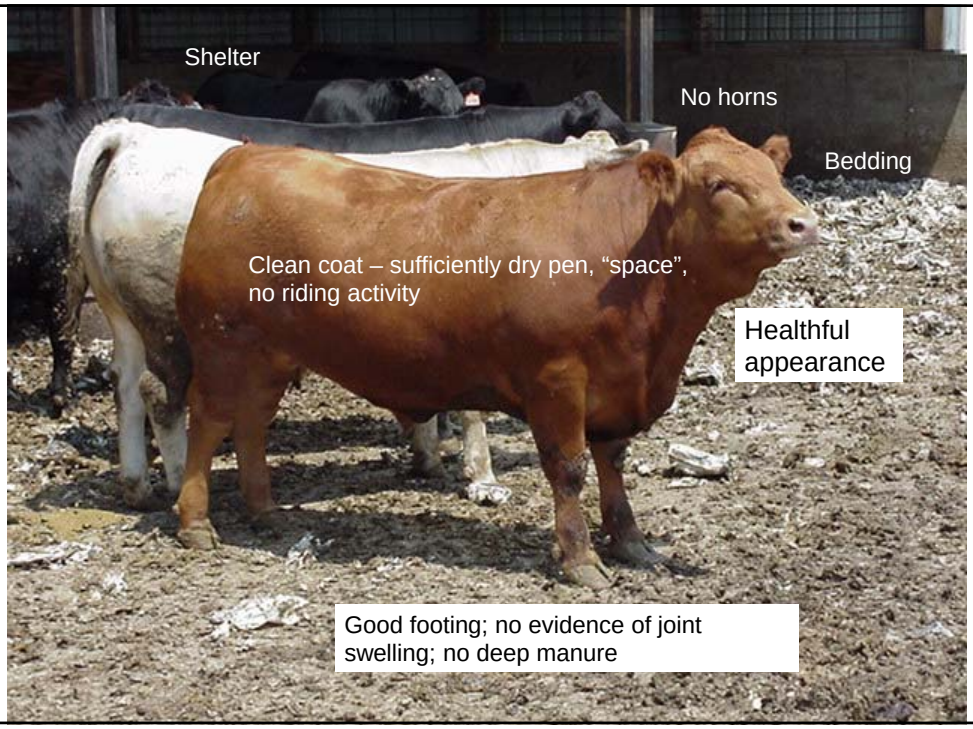
Beta-agonist Feed Additives

Trait	Optaflexx	Zilmax
Active ingredient	ractopamine	zilpaterol
Dose (mg/hd daily)	70-430	60-90
Feeding duration (days)	28-42	20-40
Withdrawal (days)	0	3
Projected live wt gain (lbs)	22	18
Projected carcass wt gain (lbs)	20	30
Increase in ribeye area (sq. in.)	0.47	1.3
Reduction in marbling score	9 (very little)	43 (almost half a marbling score)

There are currently no markets accepting cattle fed Zilmax.

Deliver Carcass Composition Desired by Market

- Avoid over-fat, under-finished, too heavy and too light-weight cattle
  - Each animal has a window of time in which its market value is optimal
  - Sort cattle from finish pen for slaughter to achieve uniformly finished cattle
- Avoid stags, pregnant heifers, grubs, manure-caked hides
- Respect drug withdrawals



UW Extension WI Beef Information Center
http://fyi.uwex.edu/wbic/feedlot/