Using Programmed Feeding of High Concentrate TMRs to Grow Calves

Growing Calves Without Wheat Pasture

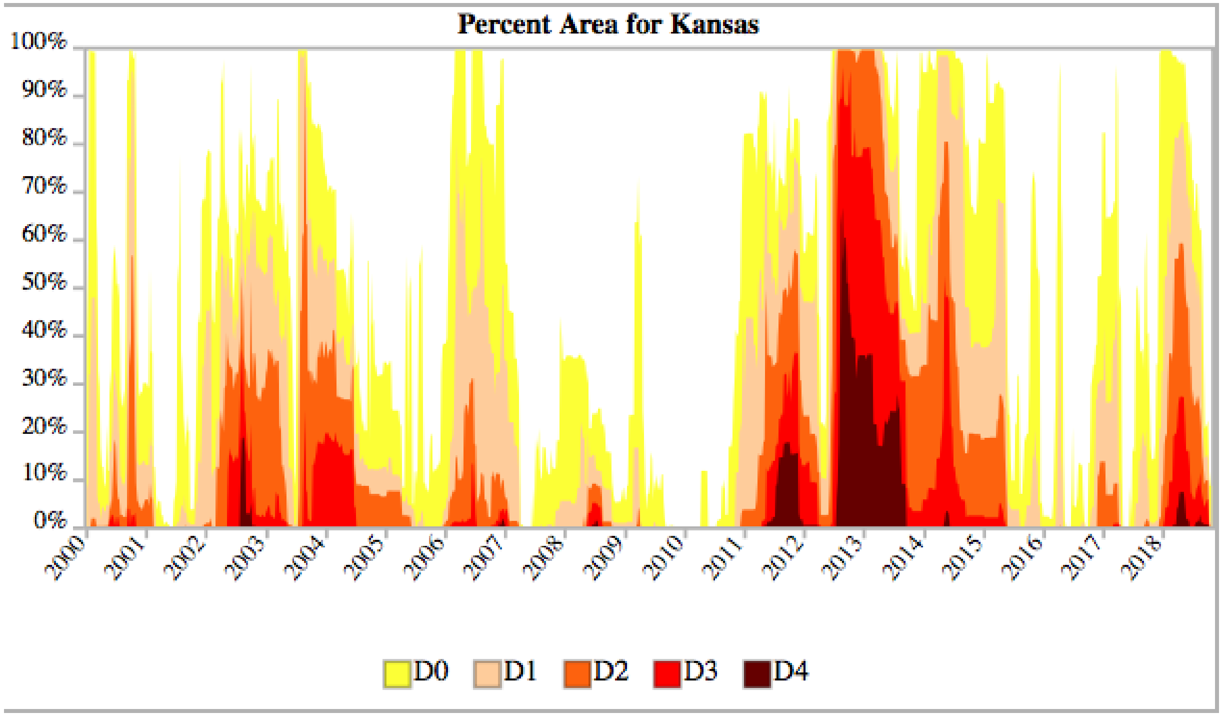
Rancher's Thursday Lunchtime Series

Dale A. Blasi, PhD

Kansas State University

OSU EXTENSION

Drought in Kansas (2000 – 2018)

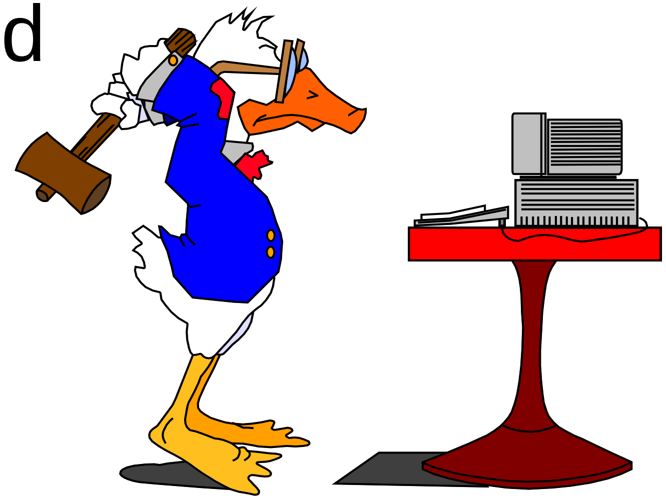


https://www.drought.gov/drought/states/kansas


BEEF
STOCKER

Starting Calves on Feed

Do not Compound Stress!!!!!!!



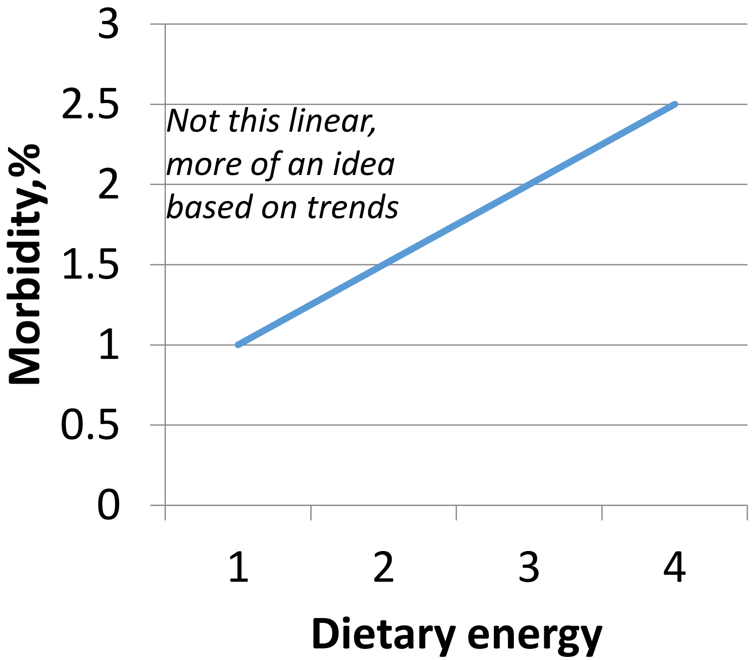
pappas

DM intake (% of BW) of Newly Arrived Calves

Day of arrival, d	Healthy (SD)	Diseased (SD)
0 to 7	1.55 (0.51)	0.90 (0.75)
0 to 14	1.90 (0.50)	1.43 (0.70)
0 to 28	2.71 (0.50)	1.84 (0.66)
0 to 56	3.03 (0.43)	2.68 (0.68)

Hutcheson and Cole, 1986

Nutrition Paradigms

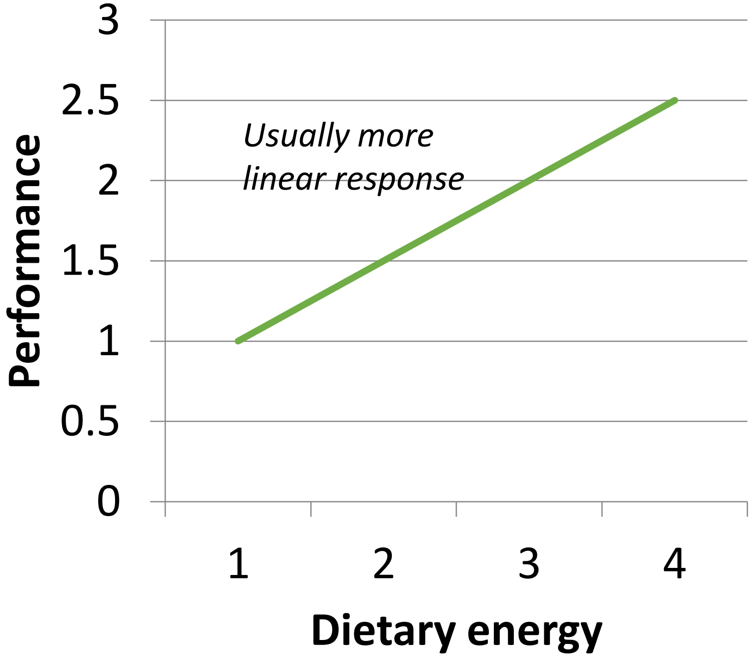


- **Possible causes**
  - Removal of roughage
  - Replacement with fermentable carbohydrate
    - Cereal grains (starch)

Increased incidence or severity of subacute and acute ruminal acidosis

Lofgreen et al., 1975 and Rivera et al., 2005

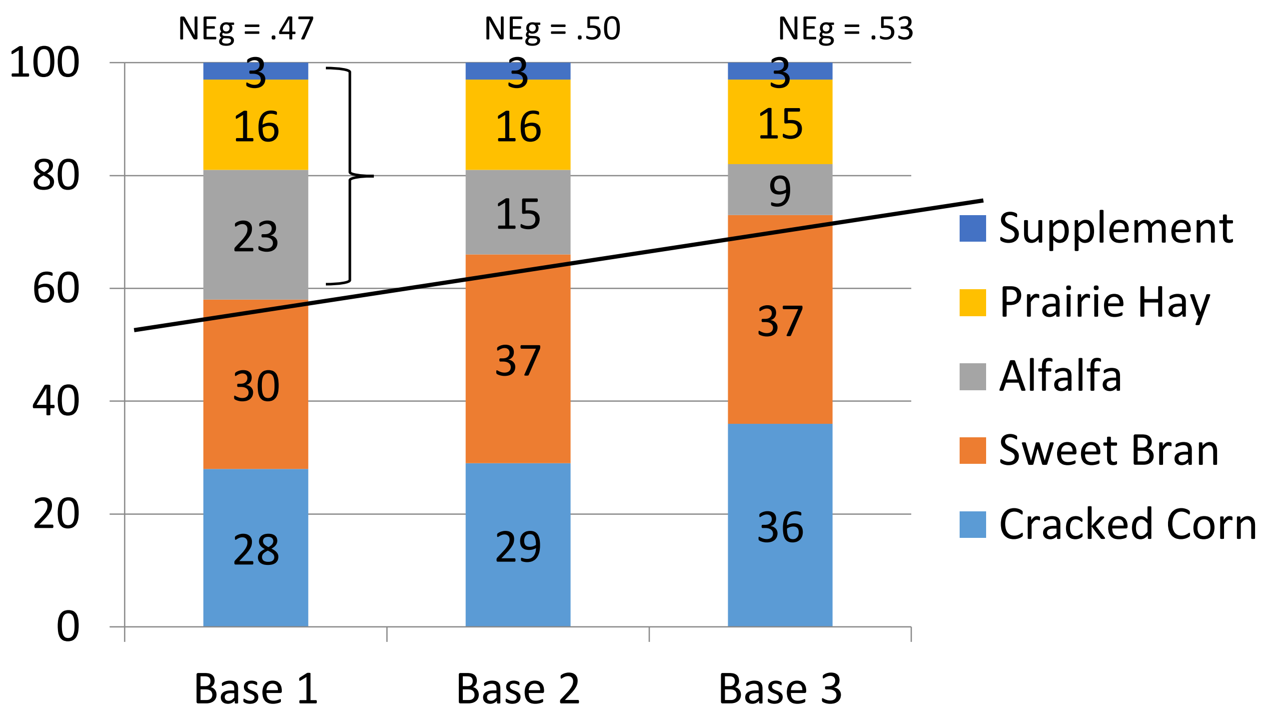
But….



- **Increased dietary energy often offsets slight increases in morbidity**

- **Use of high-energy diets in receiving protocols is still cautioned by nutritionists**

Traditional KSU Beef Stocker Unit Diets

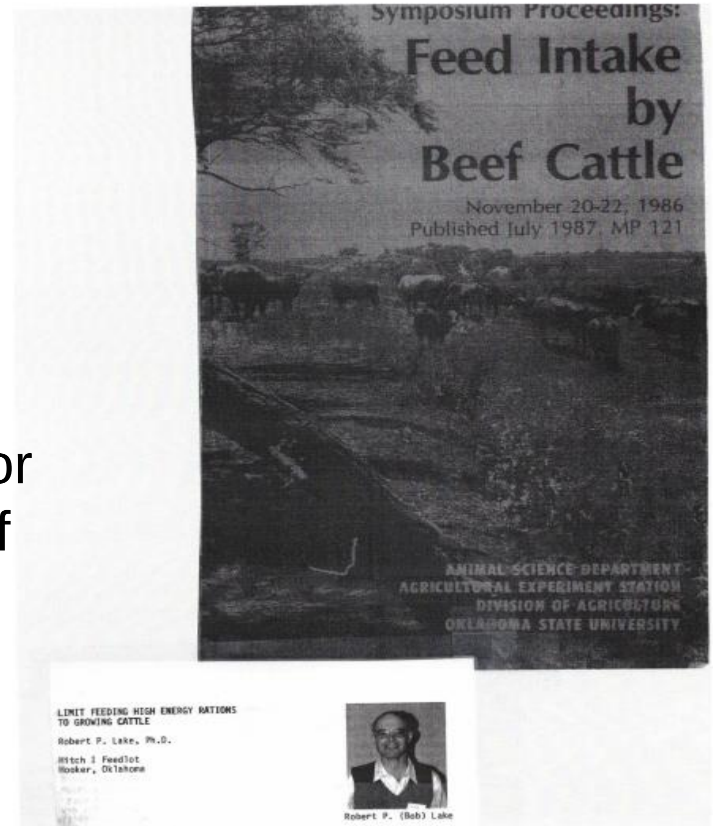


Limit Feeding:

Been around a long time

Definition: Feeding method in which net energy equations are used to calculate the quantities of feed required to meet the needs for maintenance and a specific rate of gain.

1986



Limit feeding

- Feeding practice since the 1980's
- Improvements in feed efficiency
- No negative effects on health, improved morbidity detection
- Decreases in feed costs, waste removal, and expertise for bunk management
- Flexibility in commodity trading
- Less roughage and manure handling
- Decreased feed wastage
- Less labor, equipment and feeding expense
- Marketing

Loerch, 1990
Galyean et al., 1999
Spore et al., 2019

All night All you can eat buffet

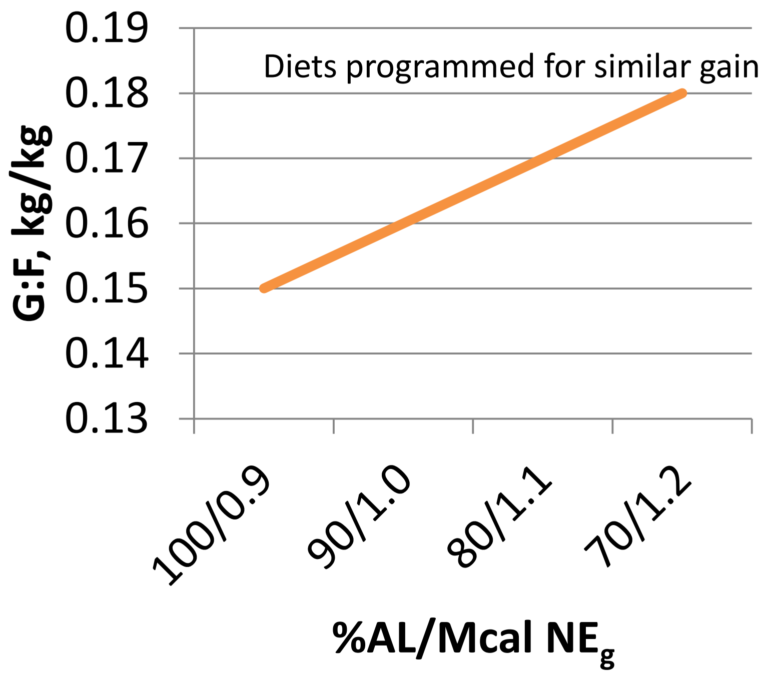
“Vegas Baby”

VS.

Boot camp breakfast

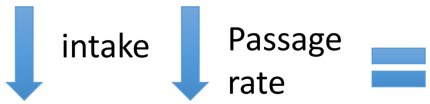
“Camp Pendleton”

Limit-feeding while increasing dietary energy



Causes

- **Passage rate is a function of intake**



Improved digestibility

Higher-energy diets are usually already more digestible based on ingredients (by-products, cereal grains etc.)

Limit Feeding – Then and Now………

Then

- Cattle started slowly @ 14 days post arrival
- High Fermentable carbohydrates

	DM %
Rolled corn	66.2
Cottonseed meal	13.7
Alfalfa pellets	8.0
Cottonseed hulls	5.0

NEg = 58 mcal/100 lb

Crude protein = 16%

Our approach

- 1% BW, DM basis grass hay on day of arrival
- Start "Camp Pendleton" @ 1% body weight next day and increase .25% per day to 2.2% body weight (Day 5)
- High co-product inclusion is CRITICAL! (40% DM basis)

NEg = 60 mcal/100 lb

Crude protein = 17%

Iowa State University
Extension and Outreach
Iowa Beef Center

Prepared by: 0
0
0
0
0

Feedyard Limit Feeding Sheet

Dale Test Drive ***Ration:*** **limitfeed** *0*

0

0

Method	% of body wt.	
Target	2.0	%
Head	100	hd
Step Up	0.0	% of mix
	daily	

Date	DoF	Wt	ADG	DMI	AFI	$/lb Gain Feed	$/lb Gain Total	Acc.$/Hd Total	Group Feed Delivery
3/21/19	1	552	2.28	11.0	20.3	$0.52	$0.74	$1.70	2030
3/22/19	2	555	2.28	11.0	20.4	$0.53	$0.74	$3.39	2038
3/23/19	3	557	2.29	11.1	20.5	$0.53	$0.75	$5.09	2047
3/24/19	4	559	2.29	11.1	20.6	$0.53	$0.75	$6.80	2055
3/25/19	5	561	2.30	11.2	20.6	$0.53	$0.75	$8.51	2064
3/26/19	6	564	2.30	11.2	20.7	$0.53	$0.75	$10.23	2072
3/27/19	7	566	2.31	11.3	20.8	$0.53	$0.75	$11.95	2081
3/28/19	8	568	2.31	11.3	20.9	$0.53	$0.75	$13.67	2089
3/29/19	9	571	2.32	11.4	21.0	$0.53	$0.75	$15.41	2098
3/30/19	10	573	2.32	11.4	21.1	$0.53	$0.75	$17.14	2106
3/31/19	11	575	2.33	11.5	21.1	$0.54	$0.75	$18.88	2115
4/1/19	12	578	2.33	11.5	21.2	$0.54	$0.75	$20.63	2123
4/2/19	13	580	2.34	11.6	21.3	$0.54	$0.75	$22.38	2132
4/3/19	14	582	2.34	11.6	21.4	$0.54	$0.75	$24.14	2141
4/4/19	15	585	2.35	11.6	21.5	$0.54	$0.75	$25.90	2149
4/5/19	16	587	2.35	11.7	21.6	$0.54	$0.75	$27.66	2158
4/6/19	17	589	2.36	11.7	21.7	$0.54	$0.75	$29.44	2167
4/7/19	18	592	2.36	11.8	21.8	$0.54	$0.76	$31.21	2175
4/8/19	19	594	2.36	11.8	21.8	$0.54	$0.76	$33.00	2184
4/9/19	20	596	2.37	11.9	21.9	$0.55	$0.76	$34.78	2193
4/10/19	21	599	2.37	11.9	22.0	$0.55	$0.76	$36.57	2201
4/11/19	22	601	2.38	12.0	22.1	$0.55	$0.76	$38.37	2210
4/12/19	23	604	2.38	12.0	22.2	$0.55	$0.76	$40.17	2219
4/13/19	24	606	2.39	12.1	22.3	$0.55	$0.76	$41.98	2228
4/14/19	25	608	2.39	12.1	22.4	$0.55	$0.76	$43.79	2237
4/15/19	26	611	2.40	12.2	22.5	$0.55	$0.76	$45.61	2245
4/16/19	27	613	2.40	12.2	22.5	$0.55	$0.76	$47.44	2254
4/17/19	28	616	2.41	12.3	22.6	$0.55	$0.76	$49.26	2263
4/18/19	29	618	2.41	12.3	22.7	$0.56	$0.76	$51.10	2272
4/19/19	30	620	2.42	12.4	22.8	$0.56	$0.76	$52.94	2281

OKLAHOMA COOPERATIVE EXTENSION SERVICE ANSI-3025

Limit Feeding Light-Weight Cattle High-Nutrient Density Diets Programmed Feeding for Calves (PROGFED2) (Revision 2)

Chris Richards
Associate Professor, Animal Science

David L. Lalman
Extension Beef Cattle Specialist

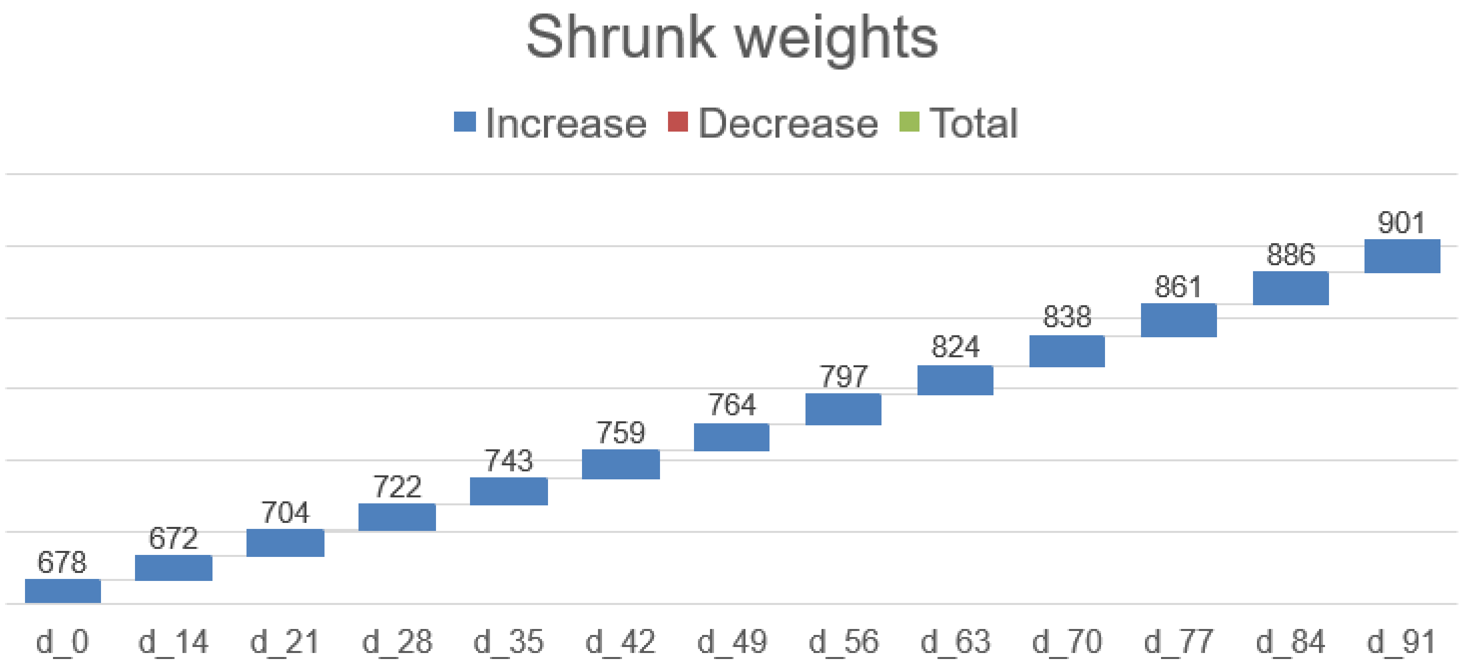
Special Note: *This revision adds five new equations to the program to more accurately predict the gain of medium and large frame cattle with greater growth potential. The original version of this program used the 1974 NRC equations which were developed in the 1960's for steers and heifer calves. Through the years, additional growth potential has been bred into cattle. For example, a group of large frame heifer calves, program fed at Pawhuska Research Station with the 74 equation and feeding for 2 pounds per day, actually gained 2.68 pounds per day. Others have reported the feeding schedules developed by the original program underestimated gains of many cattle. With the additional five equations published in the 1984 NRC Nutrient Requirements of Beef Cattle, the user should be able to better match this program to the cattle being fed. The two original equations are retained for reference and for the many cattle to which they still apply.*

For a cattleman, who has light-weight cattle and does not have adequate forage to maintain growth for some limited period of time, but has sound economic reason to retain the cattle for pasture or feeding at a later date, limit feeding

Feeding Management. Limit feeding of cattle requires special skills and facilities. Minimum requirements are:

1. Adequate bunk space so most cattle can eat at one time.
2. Pens small enough so cattle come up to the bunk when fed.
3. Scales or other methods of weighing out the daily feed.
4. Roughage feeds to work the cattle up to a high-concentrate diet.
5. Skill on the part of the manager.
6. Sufficient business management skill to assess the economic limitations and opportunities in limit feeding of cattle.
7. A sound plan for the use or sale of the cattle following limit growing.

First, a ration must be formulated or purchased. It is simplest to calculate the ration's net energy values (NEm & NEg) on a dry matter basis. Appendix I gives the energy values on a number of common feeds which may be used. Rations used for limited intake growing programs require special formulation. The levels of protein, vitamins, and minerals must be increased over the levels used in ad libitum fed


Shrunk weights
Increase
Decrease
Total
678
672
704
722
743
759
764
797
824
838
861
886
901
d_0
d_14
d_21
d_28
d_35
d_42
d_49
d_56
d_63
d_70
d_77
d_84
d_91

Effects of Dietary Energy Level and Intake of Corn By-Product Based Diets on Newly Received Growing Cattle: I. Performance, Health, and Digestion

Spore, T. J., S. P. Montgomery, E. C. Titgemeyer, G. A. Hanzlicek, C. I. Vahl, T. G. Nagaraja, K. T. Cavalli, W. R. Hollenbeck, R. A. Wahl, and D. A. Blasi

Research Objectives

- <u>Evaluate</u> the effects of high-energy limit-fed diets based on corn by-products on <u>performance</u> of newly received growing cattle
- <u>Analyze</u> effects on <u>overall health</u>
- <u>Examine</u> parameters of <u>digestion</u> and characteristics of fermentation
- <u>Identify</u> dietary <u>effects</u> on <u>immune function</u>, the acute phase protein response, and stress
- <u>Characterize</u> the <u>immunocompetency</u> of healthy and morbid animals under the different dietary conditions

Material and Methods

- Experiment 1. Performance and health study
  - 354 crossbred heifers (BW = 490 lb)
  - 41 d study with a 14-d gut-fill equalization period (55 d total)
  - Auction markets from AL and TN, assembled by order buyer at Dickson, TN (1,086 km)
  - 4 Treatments
    - 0.45 = formulated to provide 0.45 Mcal NE_g/kg DM offered to ensure ad libitum intakes
    - 0.50 = 0.50 Mcal NE_g/kg DM offered at 95% of ad libitum treatment
    - 0.55 = 0.55 Mcal NE_g/kg DM offered at 90% of ad libitum treatment
    - 0.60 = 0.60 Mcal Ne_g/kg DM offered at 85% of ad libitum treatment
  - Refusals from pens offered the 0.99/100 treatment were removed and weighed daily to determine DMI and adjust intakes of the remaining treatments accordingly

Experimental Diets

	Intake level, % of *ad libitum*			
	100	95	90	85
	Mcal NEg/lb DM			
Item	0.45	0.50	0.55	0.60
Ingredient, % DM				
Alfalfa	22.50	17.00	12.00	6.50
Prairie Hay	22.50	17.00	12.00	6.50
Dry rolled corn	8.57	19.08	28.50	38.82
Sweet Bran	40.00	40.00	40.00	40.00
Supplement	6.43	6.92	7.50	8.18

- Fed once daily, programmed to gain 2.2 lb/day
- Common diet fed the last 14 days of the trial

Effects of Dietary NEg and Intake

	Dietary NEg Treatment[a]			
Treatments	.45 NEg	.50 NEg	.55 NEg	.60 NEg
Diet	Ad Lib	Limit	Limit	Limit
% of Ad Libitum	100	95	90	85
Avg. DMI, % BW	2.62	2.43	2.33	2.25
Initial BW, lb	490	493	490	491
Final BW, lb	614	617	616	623
DMI, lb	14.51[b]	13.51[bc]	12.88[c]	12.51[c]
ADG, lb	2.26	2.25	2.29	2.40
Feed:Gain	6.48[b]	6.12[b]	5.65[bc]	5.22[c]

Spore et al. (2016).

Effects of Dietary Energy on Health

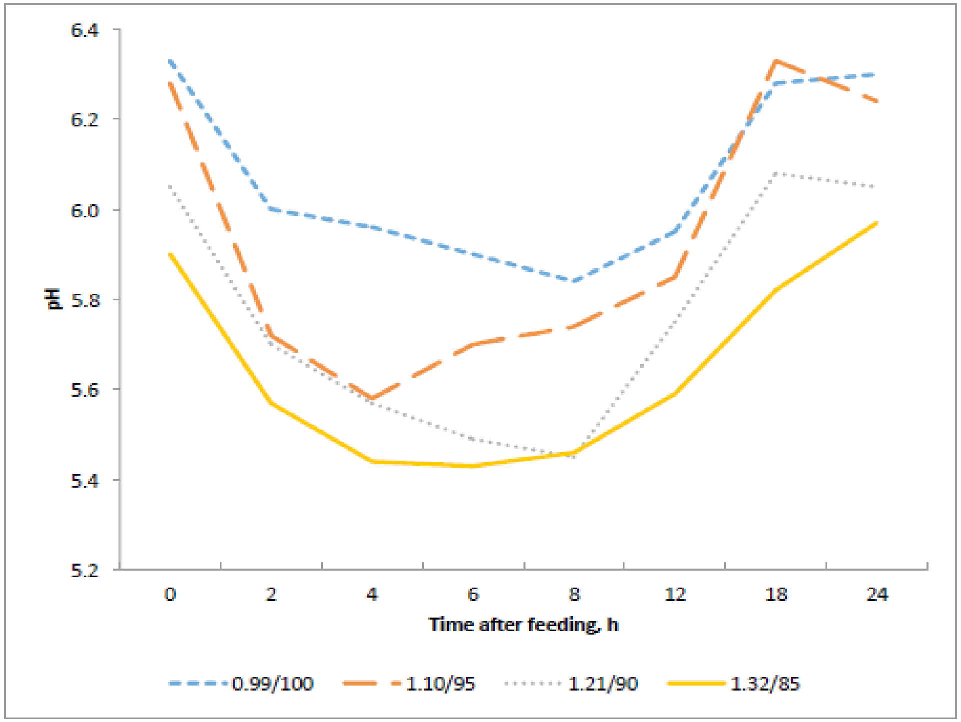
	Dietary NEg Treatment (Mcal/lb)					
Item	0.45	0.50	0.55	0.60	SEM	*P* - Value
Morbidity, %						
Treated once	11.2	12.6	12.3	12.6	4.6	0.99
Treated twice	3.6	4.8	2.8	4.8	2.9	0.86
Chronic	2.6	3.7	1.8	2.7	2.5	0.86
Mortality, %	4.2	4.4	2.1	4.3	2.1	0.83

Effects of Energy Level on Ruminal pH

	Diet[2]					P-value		
Item	0.45	0.50	0.55	0.60	SEM[3]	Linear	Quadratic	Cubic
Number of observations	6	6	5	6				
Ruminal pH								
Average[4]	5.2	5.1	4.8	4.7	0.21	<0.01	0.92	0.62
Minimum[5]	4.7	4.6	4.2	4.3	0.21	<0.01	0.22	0.18
Maximum[6]	5.6	5.6	5.6	5.4	0.20	0.13	0.28	0.93
Time below 5.5, min[7]	542	622	789	764	133	<0.01	0.41	0.35

[1]Ruminal pH continuously measured every 10 min using indwelling ruminal bolus (SmaxTec®, Graz, Austria.
[2] Diets formulated to supply 0.45, 0.50, 0.55, or 0.60 Mcal NE_g/kg DM.
[3]Largest value among treatments is reported.
[4]Average pH during last 2 days of period for each animal.
[5]Average minimum pH over last two days of each period for each animal.
[6]Average maximum pH over last two days of each period for each animal.
[7]Average number of minutes ruminal pH measured below 5.5.

Effects of Energy Level on Ruminal pH



Measurements taken using indwelling pH monitoring bolus (smaXtec, Graz, Austria).

What happens at the feed yard?

Influence of Previous Backgrounding Treatment on Carcass Traits				
	Treatment[1]			
Item	45	60	SEM	P – value
Carcass Traits				
Live Weight, lb	1279.9	1286.2	13.9	0.75
Hot Carcass Weight, lb	830.4	840.8	9.0	0.42
Backfat, in	0.65[a]	0.71[b]	0.01	< 0.01
Quality Grade				
Select, %	5.0	4.5	1.7	0.84
Choice, %	85.7	89.7	2.7	0.27
Prime, %	8.8	5.2	2.2	0.19
Liver Score				
No Abscesses, %	86.2	87.8	2.5	0.65
A-, %	5.5	5.7	1.7	0.94
A, %	0.0	1.0	0.7	0.97
A+, %	7.8	3.5	1.9	0.17

- Nutrient Management Plan issues
- No till
    - Weed load
    - Soil compaction

Ad libitum intake or limit-fed?

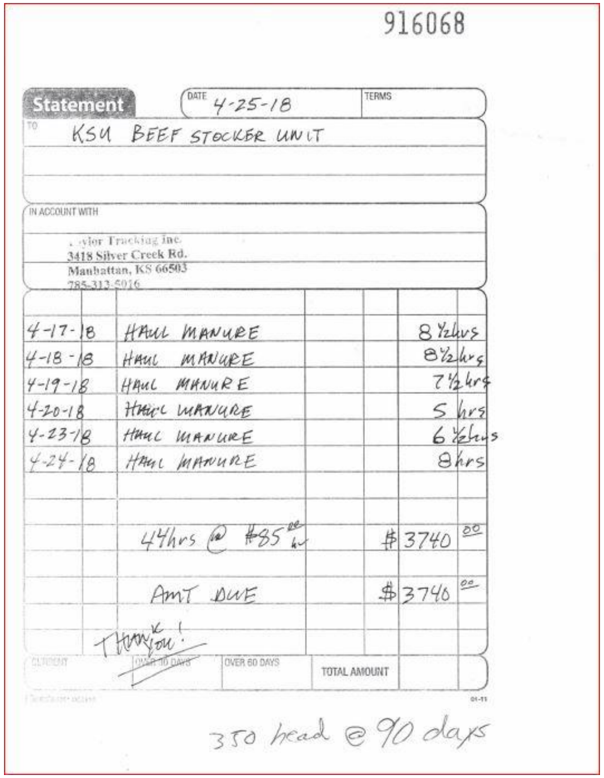
Photo Credit: Dr. Dale Blasi

Intake and Digestibility Study

Item	45 NEg	60 NEg
Dry Matter Intake, lbs	20.2	14.8
OMI, lbs	18.7	14.0
NDFI, lbs	7.96	3.81
ADFI, lbs	4.11	1.58
DM Digestibility, %	0.62	0.71
OM Digestibility, %	0.65	0.73
NDF Digestibility, %	0.58	0.56
ADF Digestibility, %	0.55	0.54
Fecal DM output, lbs	7.52	4.34

58% reduction

Full Fed – Ad Lib Diets



916068

Statement

DATE 4-25-18 TERMS

TO KSU BEEF STOCKER UNIT

IN ACCOUNT WITH

ylor Trucking Inc.
3418 Silver Creek Rd.
Manhattan, KS 66503
785-313-5016

4-17-18	HAUL MANURE	8 ½ hrs
4-18-18	HAUL MANURE	8 ½ hrs
4-19-18	HAUL MANURE	7 ½ hrs
4-20-18	HAUL MANURE	5 hrs
4-23-18	HAUL MANURE	6 ½ hrs
4-24-18	HAUL MANURE	8 hrs
	44 hrs @ $85.00/hr	$3740.00
	AMT DUE	$3740.00

Thank you!

CURRENT | OVER 30 DAYS | OVER 60 DAYS | TOTAL AMOUNT

350 head @ 90 days

350 head x 90 days= 31,500 pen days

Full Fed:

$3,740.00 / 31,500 pen days = 11.87 cents/hd/day

Limit Fed:

$2,169.20 / 31,500 pen days = 6.89 cents/hd/day

Savings:

$1,571.00 or 4.99 cents/hd/day

Bunk Management – Limit Feeding

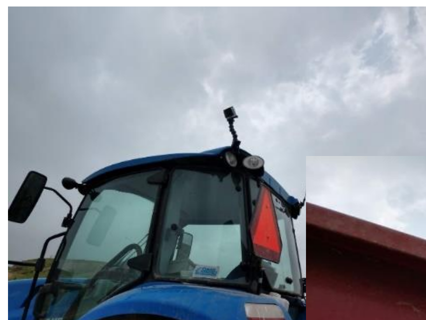
- Adequate bunk space - How much?
- Empty bunks and hungry, aggressive cattle waiting for feed ~~can~~ will be nerve wracking
- Bunks will be licked slick within 4 - 5 hours post feeding and will be clean for the next 20 hr

Effects of bunk-space allotment on performance of growing calves limit-fed a high energy corn, corn co-product diet during the receiving period

	Treatment – Inches/animal					*P*-value		
Item,	10	15	20	25	SEM	Lin	Quad	Cubic
Body Weight, lbs								
Day 0	472	475	473	475	7.6	0.77	0.94	0.69
Day 29	524	531	536	535	8.4	0.15	0.49	0.92
Day 58	566	572	580	572	9.6	0.37	0.29	0.58
ADG, lbs/d	1.6	1.7	1.9	1.7	0.10	0.23	0.10	0.13

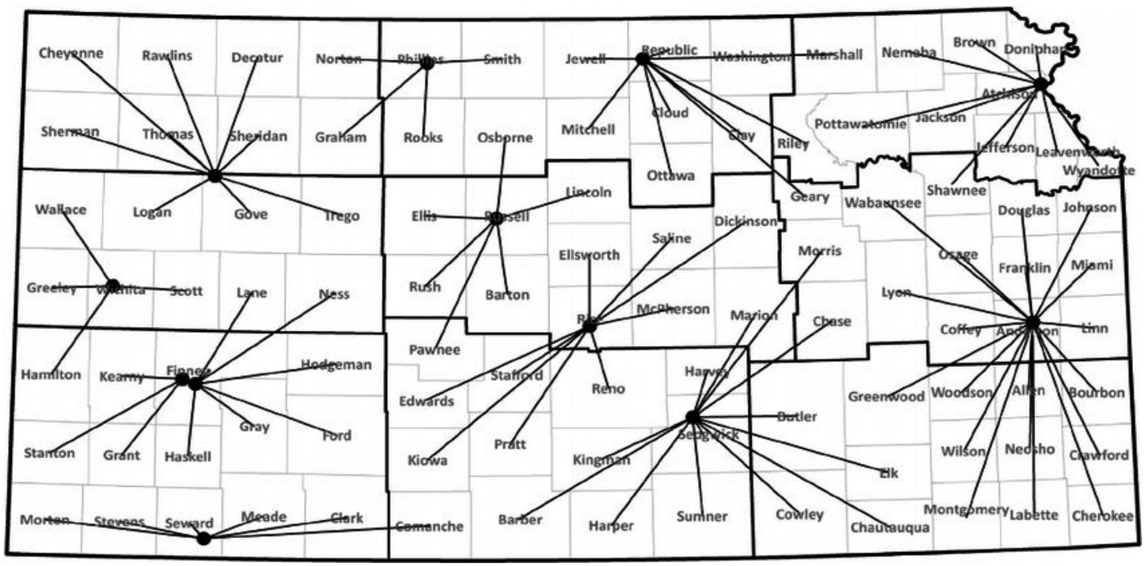
Feeding logistics/efficiency

- Time to feed – Mixing time, etc.
- Number of loads to deliver – Energy density



- Feeding waste

What about corn by-products other than Sweet Bran®?



Each dot represents an ethanol plant

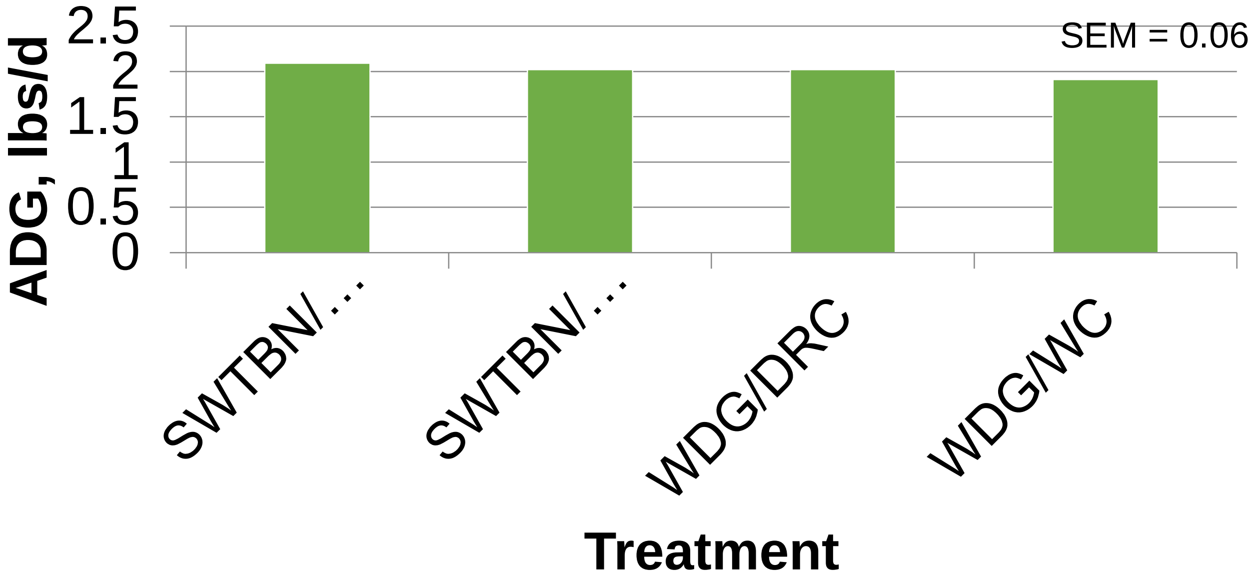
Brown et al., 2014

Materials and Methods

Performance and Health Study

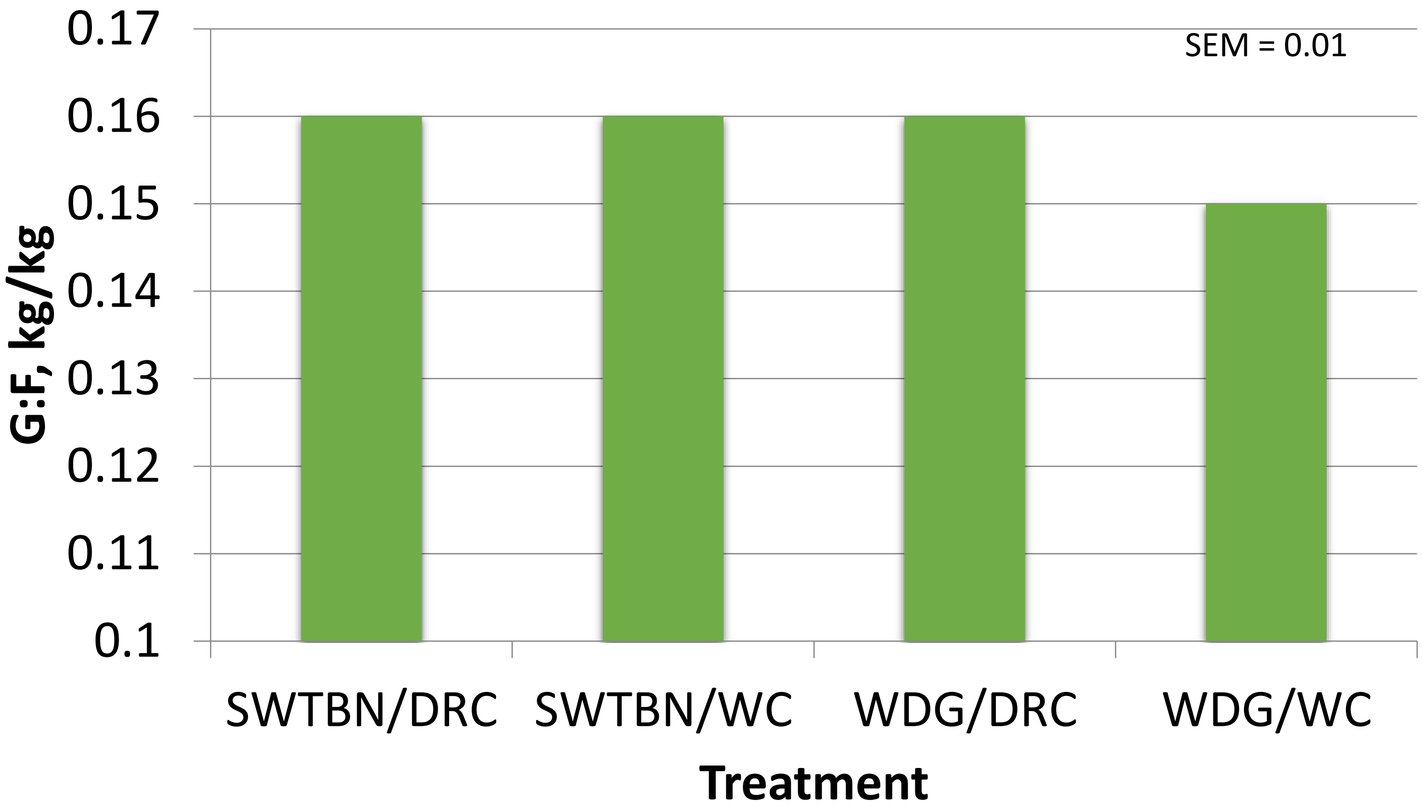
- 70 d
- 320 crossbred steers (BW = 559 lbs) – Superior Livestock
  - Two loads from Groesbeck, TX (590 miles)
  - Two loads from Hatch, NM (886 miles)
- 2 x 2 factorial design
- Two varieties of corn by-products
  - Wet distiller's grains plus solubles
  - Sweet Bran
- Two levels of corn processing
  - Whole shelled corn
  - Dry-rolled corn
- All four diets formulated to provide 0.60 Mcal NE_g/lb DM
- 8 pens / treatment combination
- Pen weights collected weekly using pen scale and DMI adjusted accordingly

ADG not affected by corn processing or by-product



[a]By-product effect *P* = 0.34,
Corn processing effect *P* = 0.34, Interaction *P* = 0.93

Efficiency of gain equal between treatments

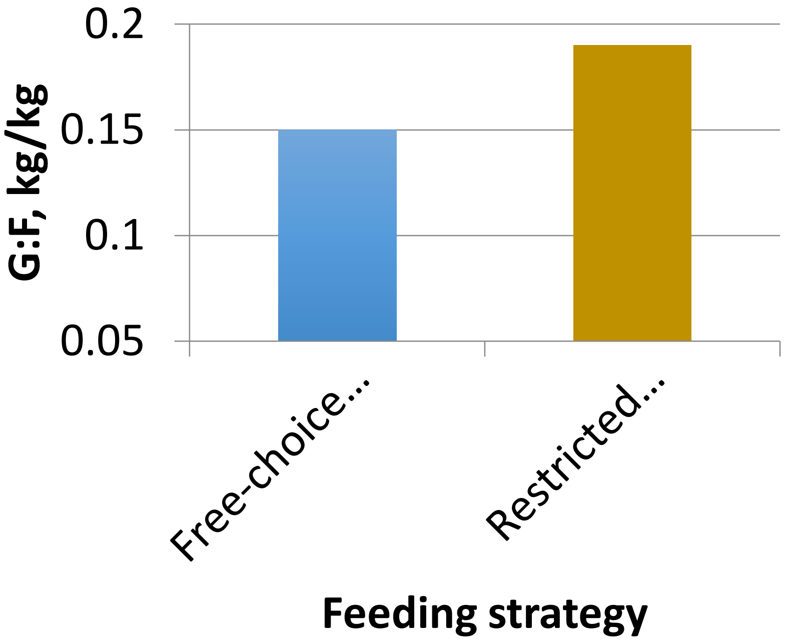


[a]By-product effect *P* = 0.46,
Corn processing effect *P* = 0.38, Interaction *P* = 0.51

Conclusions

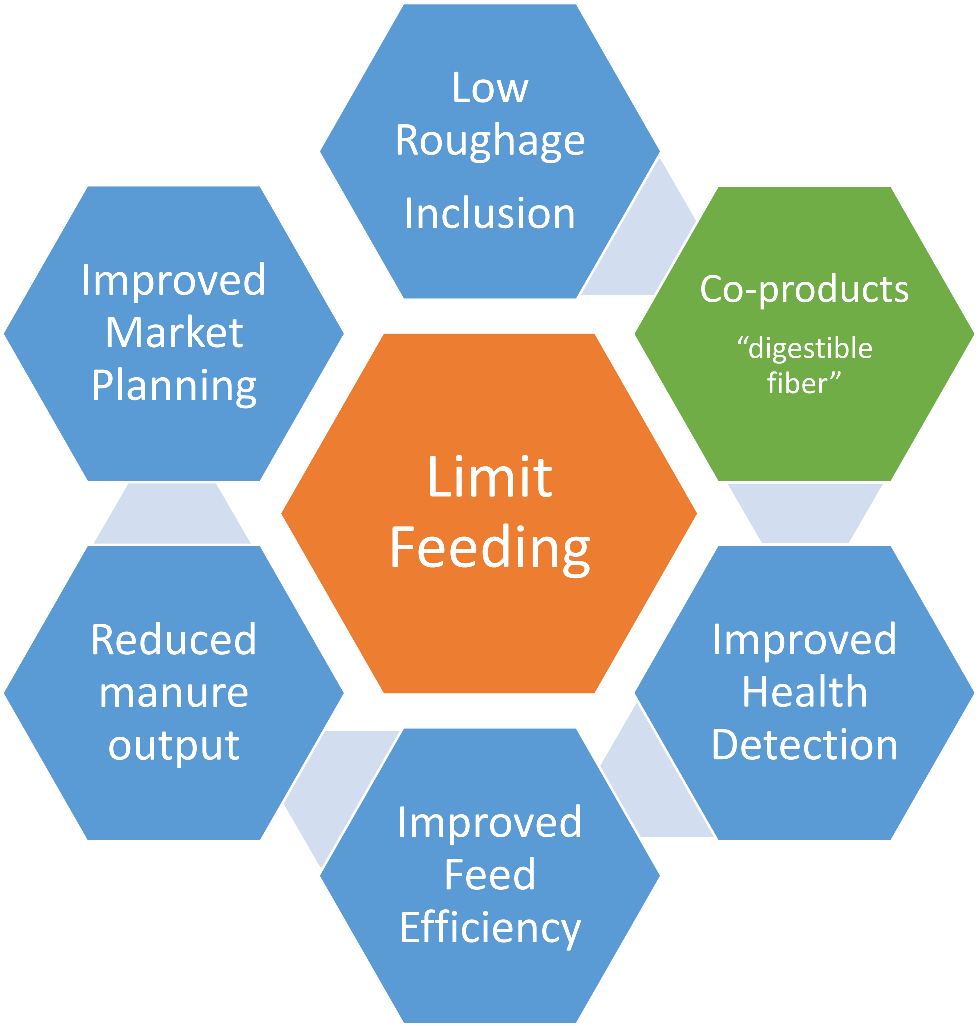
- High-energy diets based primarily on Sweet Bran or wet distiller's grains plus solubles yield similar performance
- No affects on health
- Relatively lower overall efficiencies
  - 2% of BW could be too restricted
- Extent of corn processing does not affect performance

Research Summary – 9 trials and ongoing



No adverse effects on health

27% improvement in efficiency


Low
Roughage
Inclusion
Co-products
"digestible
fiber"
Improved
Market
Planning
Limit
Feeding
Reduced
manure
output
Improved
Health
Detection
Improved
Feed
Efficiency

Questions ?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