

A large dairy farm with many cows in a milking parlor. The cows are arranged in rows, and a person is visible in the background. The scene is dimly lit, with the focus on the cows and the milking equipment.

Dairy Ration Optimization to Improve Milk production

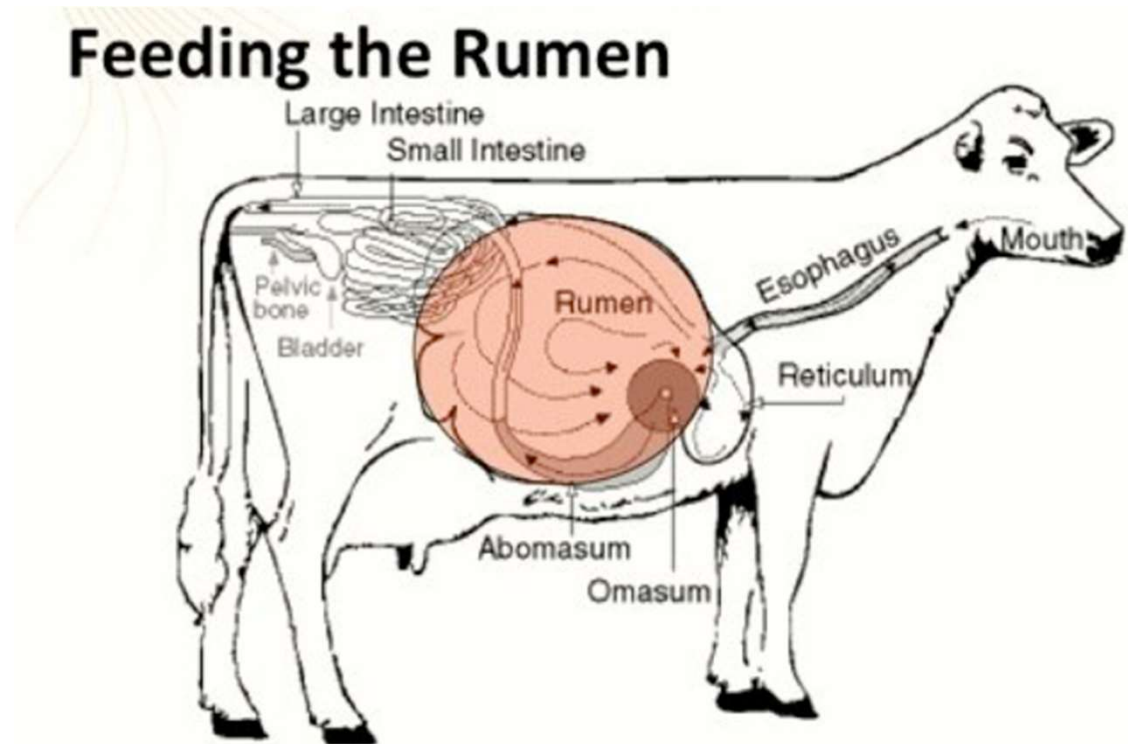
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Outline of Presentation

- Understanding ruminant digestive system
- What is optimal dairy ration?
- What to consider when formulate dairy rations?
- Examples of dairy rations
- Opportunities to optimize dairy ration

Understand Ruminant Digestive System

- Feeding cows is basically feeding the rumen
- Rumen microbial fermentation breaks down the feeds and produces:
 - volatile fatty acids- acetic acid, propionic acid and butyric acid
 - Microbial protein



What is Optimal Ration

- Maximizing rumen fermentation that yields highest amount of VFAs and rumen microbial protein
- Optimizing nutrient digestibility while maximizing dry matter intake
- Maintaining optimal rumen health
- Feed cost is part of the consideration but not the determining factor
 - Least cost ration is often not a good ration and optimal ration is not always the lowest cost per cow per day
 - Optimal ration aims for highest milk production thus reduce cost per liter of milk
- Ration looks good on paper doesn't necessary a good ration.

What to Consider When Formulate Dairy Rations for High Producing Dairy Cows?

- Run nutrient analysis for all feed ingredients
- Select good quality feed ingredients and feeds that can complement each other
- Focus on forage quality specially NDF digestibility and rate of passage
- Check source of grain processing and particle size



What to Consider When Formulate Dairy Rations for High Producing Dairy Cows?



CP, Crude Fiber, TDN



CP, NEL, RDP, RUP, ADF, NDF, NFC



MP, ME, RDP, RUP, Amino Acids, aNDF, peNDF, uNDF240, Starch, Rumen Fermentable Starch, Sugar, MUN and more

Key for Optimizing Dairy Rations



High quality forage



Rumen fermentable starch



Balanced ruminal degradable protein and amino acids



Certain feed additives such as Rumensin, buffer, bypass fat



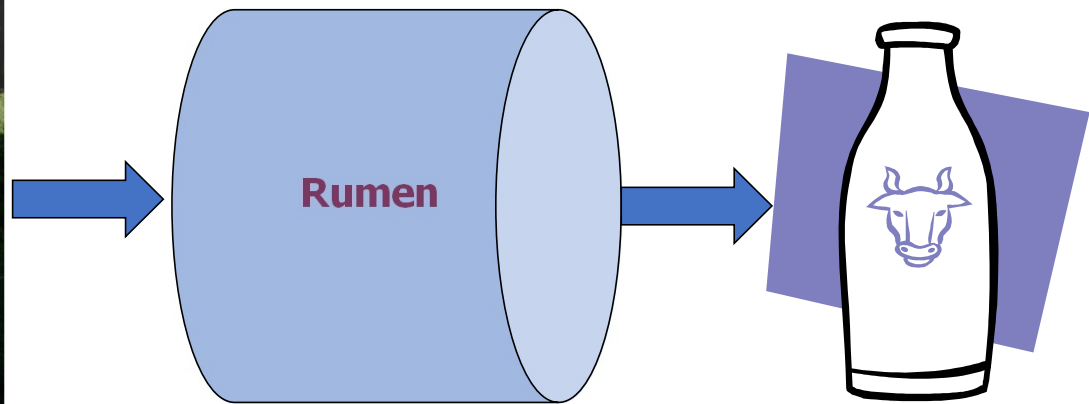
Forage NDF Digestibility and Cow Performance

For every 1 percent-unit increase in NDF digestibility

- DMI increases 0.18kg
- Milk increases 0.25kg

High Quality Forage Increases Dry Matter Intake

Higher digestibility
Emptying rumen faster
More intake=more milk



2024/1/23

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Provide Adequate Starch in the Ration

- Starch is the primary source of energy in dairy rations.
- Cereal grains like corn provide most of the starch in dairy cattle diets
- The source and processing method of the starch will determine how it will be digested in the rumen.



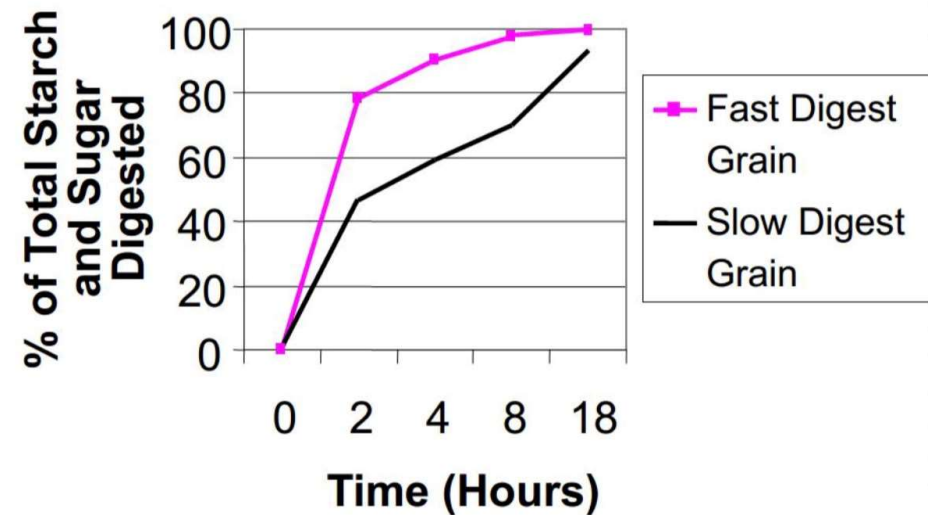
Why is Starch Important?

- Twice as much energy as forage
- Highly digestible and passage rate
- Increases Dry Matter Intake
- Fuels to the rumen microbial fermentation
- Produce more VFA, especially propionic acids
- Drives milk production

Rate and Extent of Starch Digestion

- Is affected by
 - Type of grains
 - Grain processing
 - Genetics of grains
 - DM Intake
 - NDF content of the diet

Starch and Sugar Digestibility



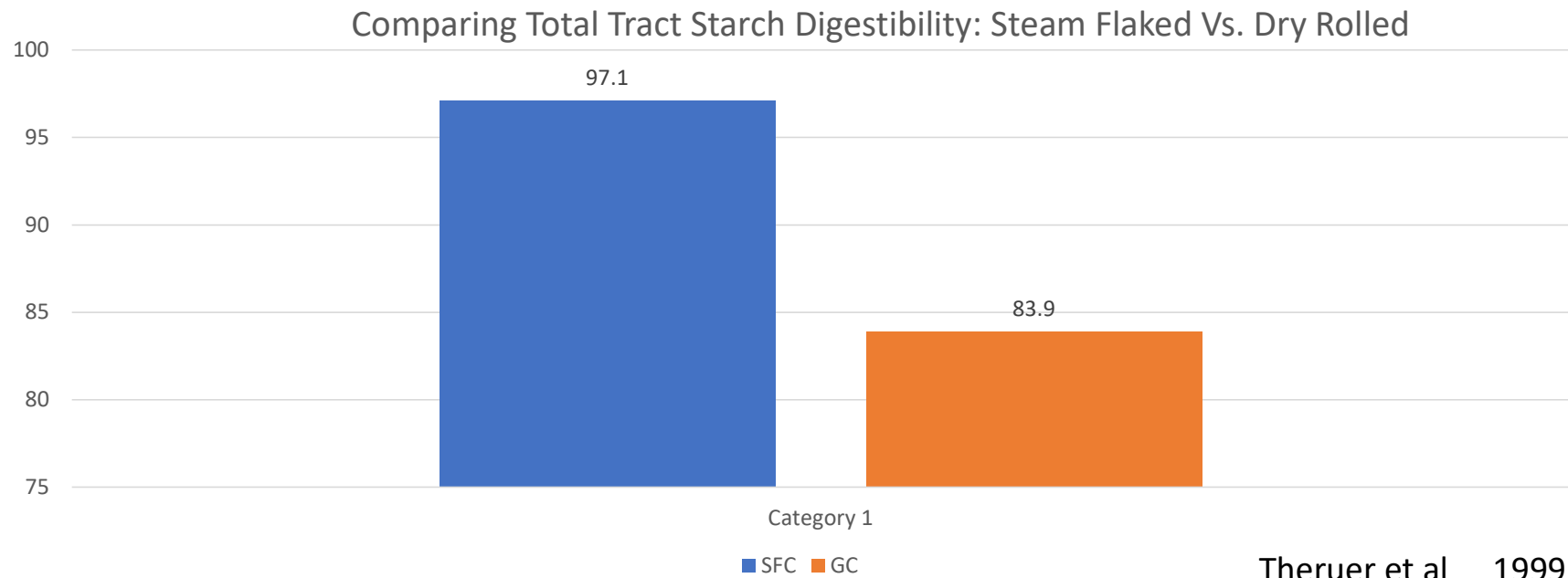
Source of Grains on Starch Degradation Rates

Wheat>Oat>Barley>Corn>Sorghum

	<u>Starch, % DM</u>		<u>Kd, %/h</u>
Corn	76	72 – 78	6.4
Sorghum	71	68 – 78	3.1
Wheat	70	67 – 77	23.5
Barley	64	60 – 74	8.8
Oat	58	52 – 69	15.1

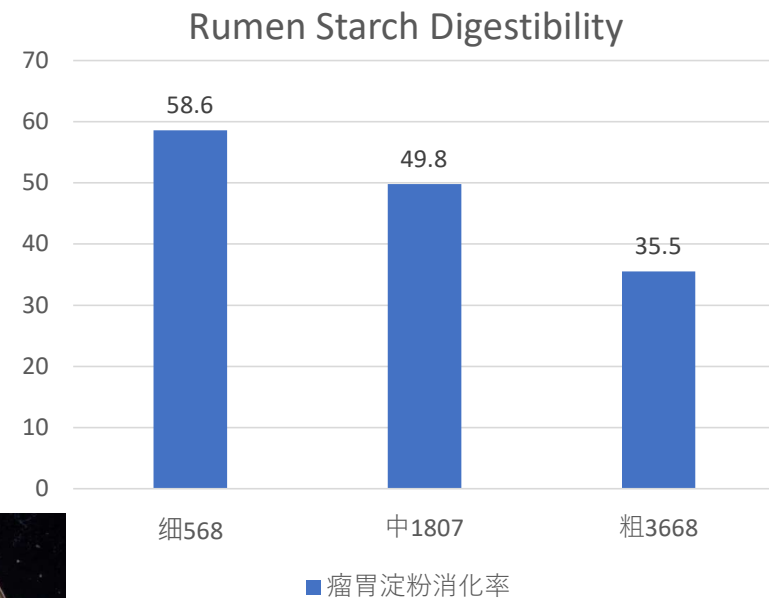
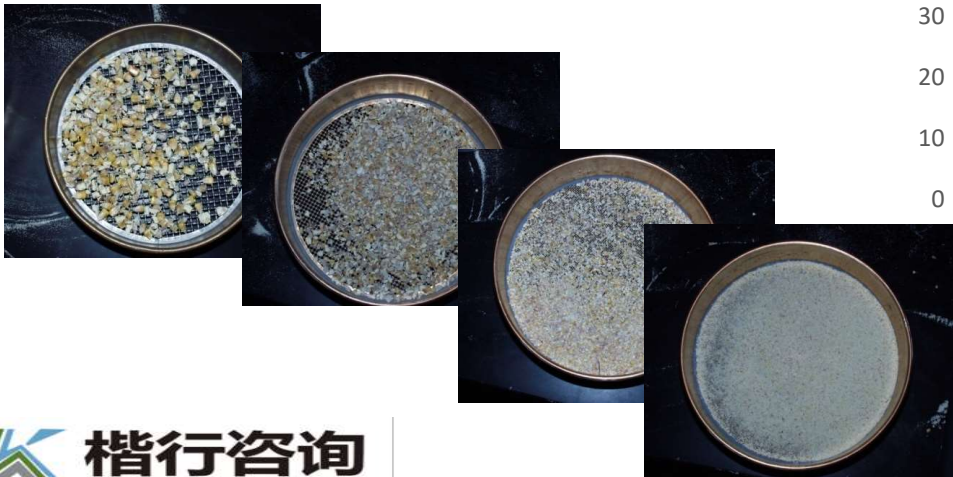
Herrera-Saldana JDS 73:1990

Steam Flaked Sorghum Improves Starch Digestibility By 16%



Extend of Grinding On Starch Digestion

- The finer it gets the higher starch digestion in both the rumen and the total tract
- Microbial yield also increases



Remond 2004

No Corn Pieces Visible in Manure

- Finely ground corn should 100% pass 1mm sieves (average particle size 500-700 um)
- Steam-flaked corn <340g/kg density
- 70% corn silage kennels processed to <4.75mm
- High moisture shelled corn<1000um



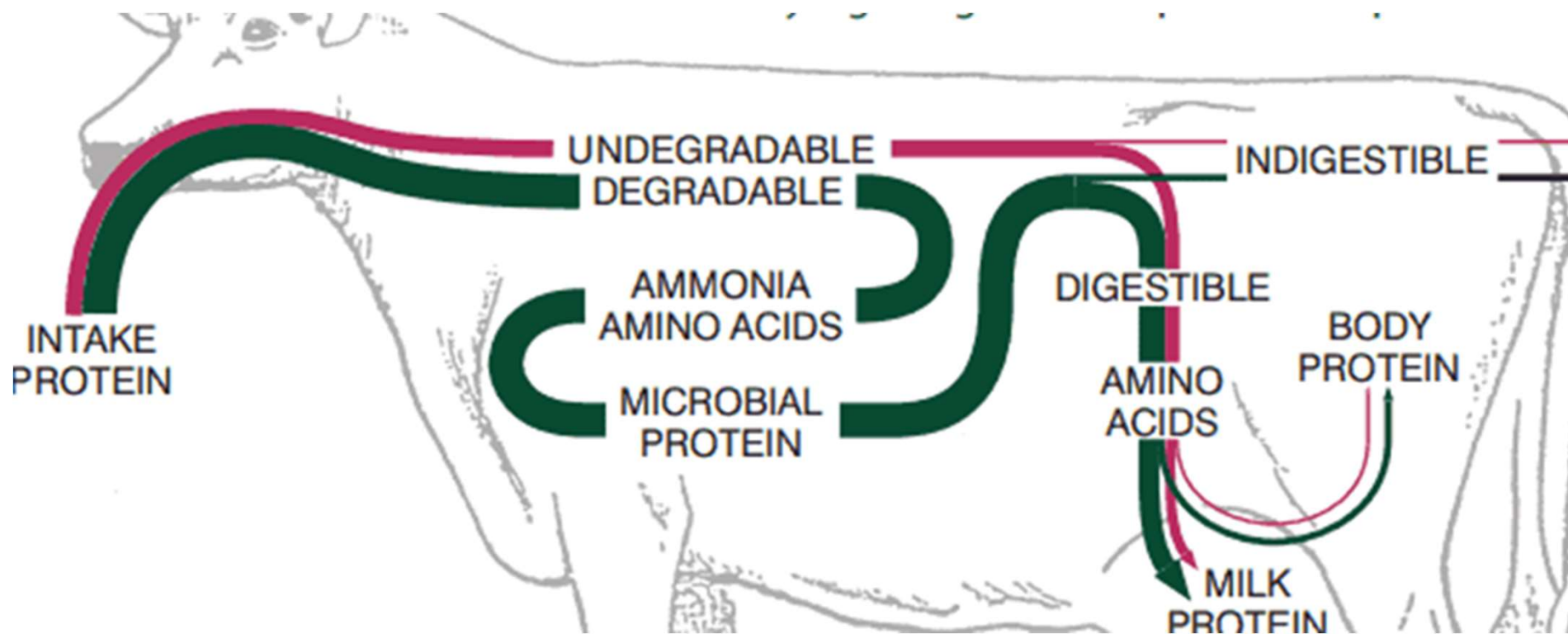
Finely Ground Corn



Steam Flaked Corn



Steam Flaked Sorghum



Soybean Meal



Distiller Dried Grain Soluble or DDGS



Canola Meal

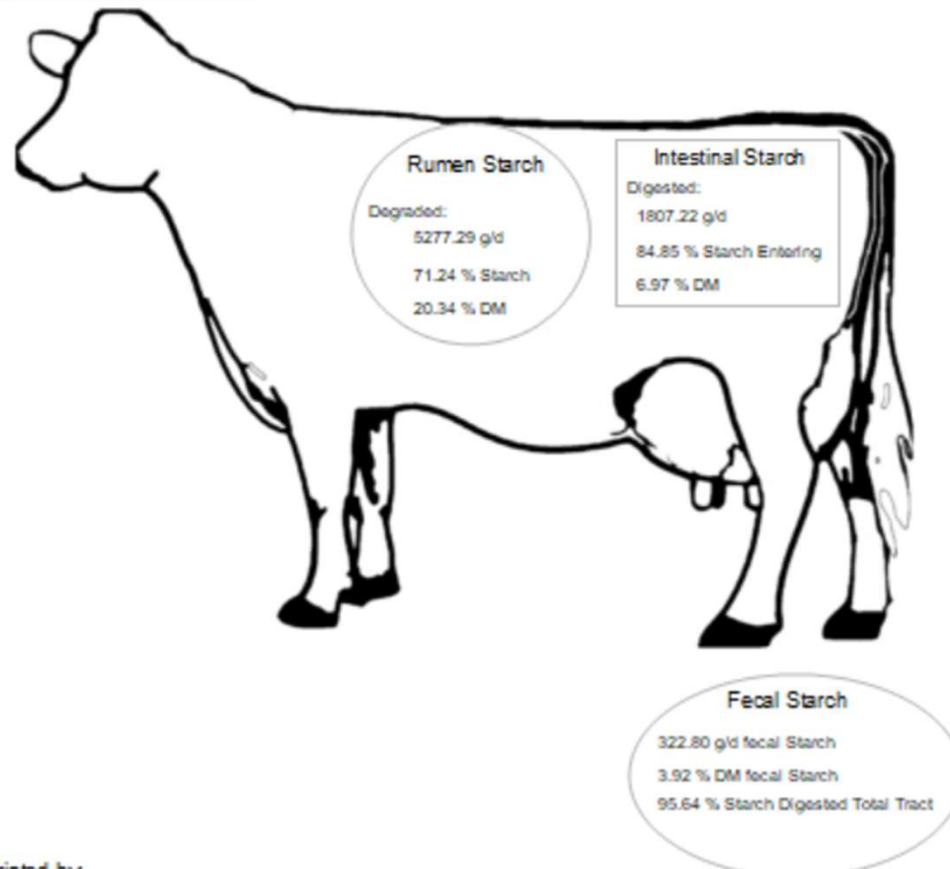


Palm Kernel Meal



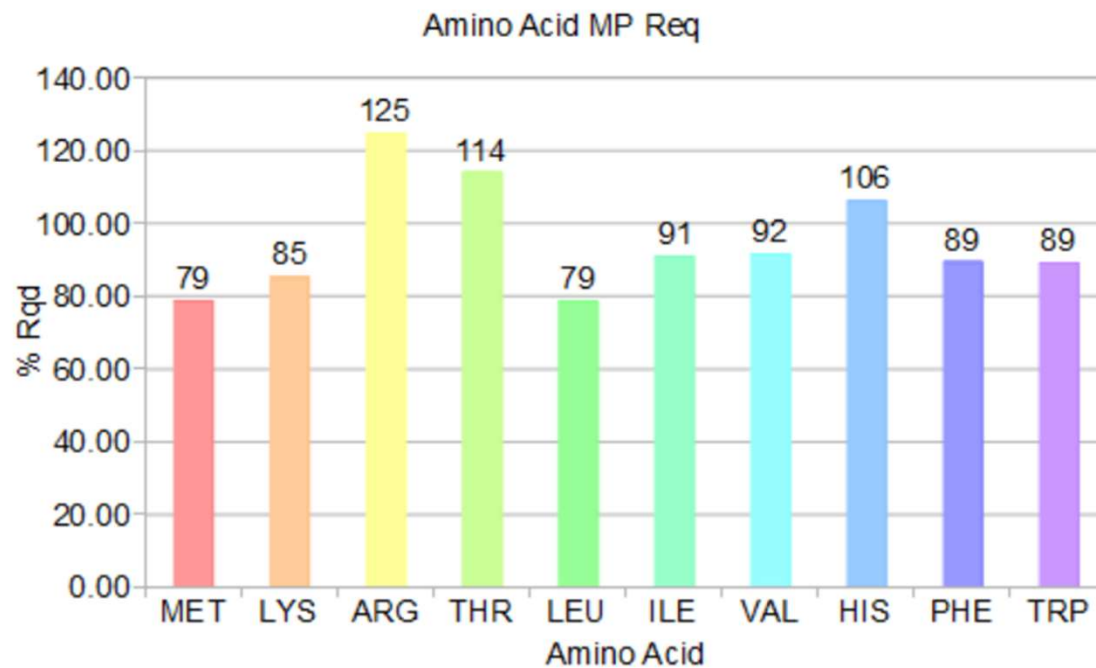
Starch Intake and Site of Digestion

Starch Intake, g/d: 7407.31



Amino Acid Balancing

LYS:MET 3.06



Recommend

MET	21 - 25
LYS	6.15 - 7.2
ARG	>5
THR	>4.6
LEU	<8.7
ILE	4.7 - 5.0
VAL	>5.8
HIS	2.5 - 5.1
PHE	4.9 - 5.1
TRP	<1.4

Example of High Producing Dairy Cow Ration

Nutrient Analysis

Dry Matter (%)	52.96
CP (%)	16.98
RUP (%CP)	42.44
RUP (%DM)	7.21
RDP (%CP)	57.56
RDP (%DM)	9.77
Sol. CP(%CP)	30.41
Urea (kg)	0
MP Supply (g)	2965.22
LYS (%MP)	6.40
MET (%MP)	2.09
LYS:MET	3.06
ME Milk Prod(kg/day)	41.64
MP Milk Prod(kg/day)	43.81
aNDFom (%DM)	25.70
ADF (%DM)	16.08
Forage (%DM)	38.74
Forage NDF (%DM)	14.74
peNDF (%DM)	18.30
Lignin (%DM)	3.50
NFC (%DM)	43.39
SugarA2(%DM)	5.49
StarchB2(%DM)	28.55
Sol. Fiber B2 (%DM)	6.55
Ferm. CHO (%DM)	40.90
Fat Total(%DM)	6.28
ME (Mcal/kg)	2.66
Ca (%DM)	0.66
P (%DM)	0.45
Mg (%DM)	0.35
K (%DM)	1.51
S (%DM)	0.23
Na (%DM)	0.51
Cl (%DM)	0.47
Salt (%DM)	0.36
DCAD1 (meq/kg)	330.50
Co (ppm)	1.08
Cu (ppm)	21.07
I (ppm)	1.06
Fe (ppm)	221.61
Mn (ppm)	66.50
Zn (ppm)	86.33
Se Added (ppm)	9.82
Vit-A (KIU/day)	98.23
Vit-D (KIU/day)	29.47

Nutrient Amounts

As-Fed Intake(kg/day)	48.99	Sil Acids (A1) (kg/day)	0.42
DM Intake(kg/day)	25.94	Sugar (A2) (kg/day)	1.43
Crude Protein(kg/day)	4.40	Starch (B1) (kg/day)	7.41
RUP	1869.33	Sol Fiber (B2) (kg/day)	1.70
RDP (g)	2.54	Fat Total (%DM)	6.28
Sol. CP(%CP)	30.41	Fat Veg Unpr (%DM)	1222.40
Sol. CP(%DM)	5.16	NEI (Mcal)	44.36
Urea (g)	0.00	NEg (Mcal)	29.10
ADF (%DM)	16.08	NEm (Mcal)	45.17
aNDFom (%DM)	25.70	Ca (g)	171.70
Forage (%DM)	38.74	P (g)	116.41
Forage NDF (%DM)	14.74	Mg (g)	91.79
peNDF (%DM)	18.30	K (g)	390.94
Lignin (%DM)	12.14	S (g)	59.90
NFC (g)	11256.75		
NFC+NDIP (g)	11257.23		

ID	Ingredient	As-Fed	Ingredient DM Percent	DM Fed	Feed Cost	(SMT)	%DM	%AF	%Cost
01044	苕片玉米	4.60	87.00	4.00	14.44	3140	15.43	9.39	16.10
04041	驻马店玉米青贮	24.00	32.50	7.80	18.00	750	30.07	48.99	20.07
02013	湿啤酒糟	6.00	23.00	1.38	3.48	580	5.32	12.24	3.88
04042	进口苜蓿	2.50	90.00	2.25	12.00	4800	8.67	5.10	13.38
01108	Sugar Sucrose 蔗糖	0.16	98.00	0.15	0.00	0	0.59	0.32	0
12003	Diamond V XP	0.02	90.00	0.02	0.99	48000	0.07	0.04	1.11
09008	Megalac 美加力	0.14	97.00	0.14	0.00	0	0.52	0.28	0
02026	46%豆粕	3.21	88.00	2.82	16.03	5000	10.87	6.54	17.87
02018	全棉籽	1.86	90.00	1.68	7.04	3780	6.46	3.80	7.84
02031	膨化大豆	0.52	90.00	0.47	3.22	6230	1.79	1.06	3.59
01039	玉米粉	3.00	87.00	2.61	9.42	3140	10.06	6.12	10.50
09012	Bergafat T 300	0.21	99.00	0.20	2.29	11050	0.79	0.42	2.55
05070	小苏打	0.26	99.50	0.26	0.54	2100	0.99	0.53	0.60
		46.46		23.77	87.45				

Typical Southeast Asia Dairy Ration Analysis

Output	Min	Value	Max	Status
IOFC	0.00	-2.13	1000.00	LOW
IOpurFC	0.00	-2.13	1000.00	LOW
Cost/hd	0.00	22.98	1000.00	OK
Purchased Cost/hd	0.00	22.98	1000.00	OK
Forage (%DM)	0.00	35.34	100.00	OK
Forage NDF (%BW)	0.00	0.49	1.00	OK
Forage NDF (%NDF)	0.00	47.13	100.00	OK
DM (%)	20.00	44.36	80.00	OK
Dry Matter Intake (kg/day)	0.00	13.75	100.00	OK
ME Allowable Milk (kg/day)	9.90	5.64	10.10	LOW
MP Allowable Milk (kg/day)	9.90	14.53	10.10	HIGH
ME (%Rqd)	99.00	85.31	101.00	LOW
MP (%Rqd)	99.00	118.07	101.00	HIGH
MP Supply (g)	500.00	1368.27	3000.00	OK
MP supply (g/kg DM)	0.00	99.50	1000.00	OK
Rumen NH3 (%Rqd)	100.00	220.31	250.00	OK
NFC (%DM)	0.00	21.36	40.00	OK
peNDF (%DM)	22.00	17.59	35.00	LOW
Lactic (%DM)	0.00	0.00	4.00	OK
Sugar (%DM)	0.00	4.85	12.00	OK
Starch (%DM)	0.00	11.24	30.00	OK
Sugar + Starch (%DM)	0.00	16.09	42.00	OK
Soluble Fiber (%DM)	0.00	5.27	10.00	OK
Ferm. CHO (%DM)	10.00	35.53	70.00	OK
Ferm. Fiber (%DM)	10.00	17.81	70.00	OK
Ferm. Starch (%DM)	20.00	9.28	70.00	LOW
Ferm. Starch (%Starch)	20.00	82.59	70.00	HIGH
Ferm. Sugar (%DM)	5.00	3.94	70.00	LOW

Cost/MT As-Fed: \$741.29

Name	\$/head	% DM	DM kg/day	AF kg/day
Napier Young	4.80	20.00%	4.00	20.00
Palm Kernel Expeller NZ	0.00		0.00	0.00
Soybean Meal 44 Solvent	0.00		0.00	0.00
Corn Dist Ethanol	0.00		0.00	0.00
Corn Grain Ground Fine	0.00		0.00	0.00
Rice Staw	1.18	86.00%	0.86	1.00
Commercial Concentrate Mix	17.00	88.92%	8.89	10.00
Soybean Hulls Pellet	0.00		0.00	0.00
Corn Silage Processed 30 DM 41 NDF Medium	0.00		0.00	0.00
	22.98	44.36%	13.75	31.00

Analysis of Concentrates

CERTIFICATE OF ANALYSIS

Company:	US GRAINS COUNCIL 14-1 WISMA UOA DAMANSARA II NO. 6 CHANGKAT SEMANTAN DAMANSARA HEIGHTS 50490 KUALA LUMPUR MALAYSIA	Report No: 2022-04-05-013 Report Date: APRIL 14, 2022 Samples Received Date: APRIL 05, 2022
Contact:	LEE CHUIN SHERN	
AF05294	Dairy Compound Feed 1	
	Starch	% 16.30
	<i>Method: Polarimetry</i>	
	Neutral Detergent Fibre	% 45.99
	<i>Method: Gravimetry</i>	
AF05295	Dairy Compound Feed 2	
	Starch	% 15.22
	<i>Method: Polarimetry</i>	
	Neutral Detergent Fibre	% 49.29
	<i>Method: Gravimetry</i>	
AF05296	Dairy Compound Feed 3	
	Starch	% 11.09
	<i>Method: Polarimetry</i>	
	Neutral Detergent Fibre	% 66.08
	<i>Method: Gravimetry</i>	

Opportunities to Improve the Dairy Rations

- Feed corn silage –high starch content and high fiber digestibility
- Formulate concentrates around what forage and byproducts feed the farms are feeding
 - Need corn/barley/sorghum to boost starch content
 - Improve protein quality by incorporating soybean meal, DDGS to maximizing utilization of other local protein by products