

Quality Consideration of Local Ingredients for Dairy

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Outline

- Introduction
- Corn harvest quality 23/24
- Implication for livestock feeding
- Sorghum harvest quality 22/23
- Potential use of US sorghum
- Conclusion

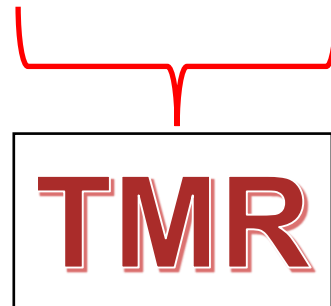
Feed for Dairy Cows

Roughage

- Source of fiber
- Mainly grasses (cultivated or natural), corn forage (fresh or silage), cereal straw, Palm
- Require 40% forage and 60% concentrate

Concentrate

- Mainly protein, minerals and vitamins source but contribute to ME
- There are > 15 nutrients should be considered

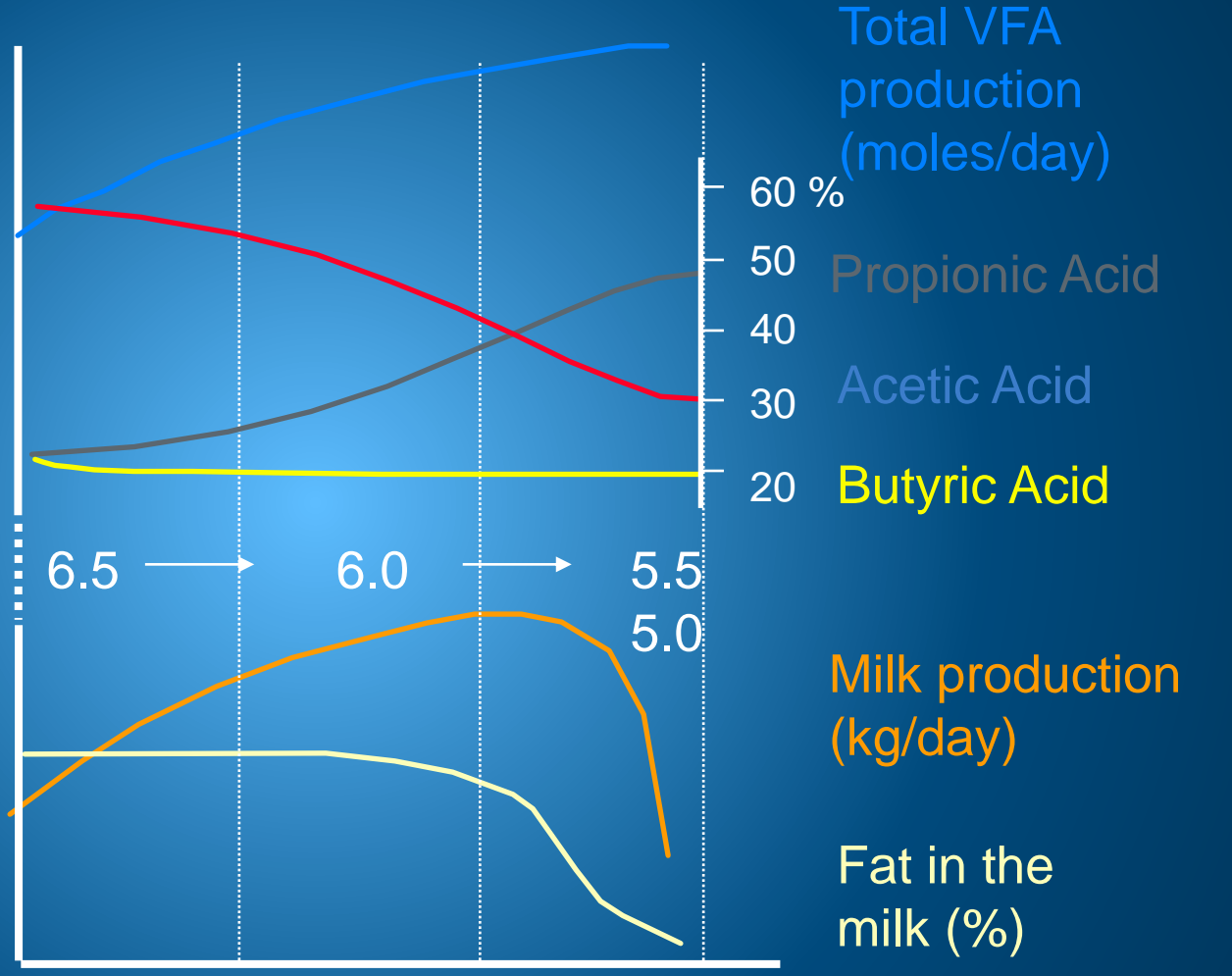


Effects of Forage to Concentrate Ratio

Volatile fatty acids (VFA) produced in the rumen

Rumen pH

Milk production and composition



Concentrates	20	40	60	80	% ration dry matter
Forages	80	60	40	20	% ration dry matter

Feed for Dairy at Farmers

- Poor quality forages
- Poor quality concentrate feed (use by products, low protein, energy and high fiber)
- Concentrate qualities are varied and little emphasize on animal requirements
- Cows do not consume sufficient feed with high quality

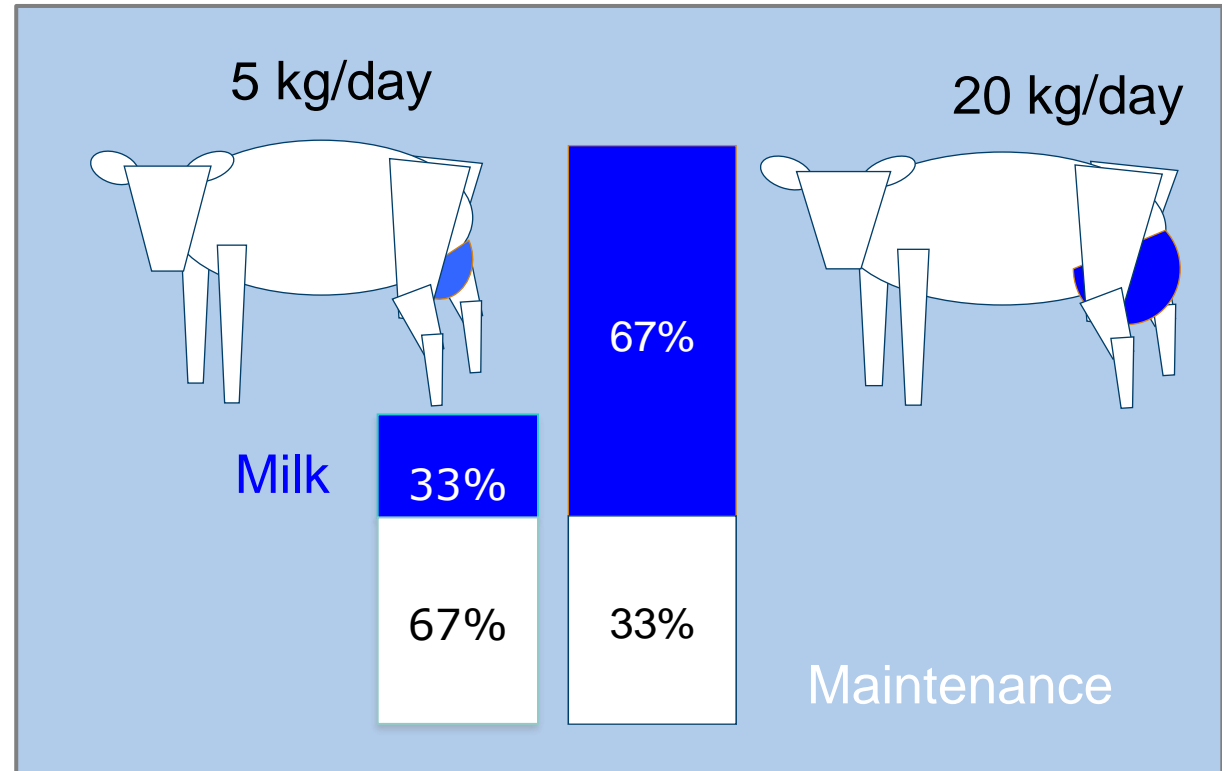
Why should we improve feeding?

- Why keep a cow that produce only 5kg milk/day?

**But breed is critical!!!
Also diseases**

Very inefficient!

Maintenance for a cow with 5 or 20 kg is the same, considering their weight is the same.



What is quality?

Product characteristic that can be maintained to satisfy the consumers in bound to price and time frame

Quality = Money

Feedmill can produce good feed?

Can they produce all the time?

Major problem with Feedmill

Can not control variability

1/23/2024

Quality Measurement of Feed

- **Physicals:** Color, Smell, Appearance, Density, Caking, Lump, **NIRS** to estimate chemical components and also digestibility
- **Chemicals:**
 - Proximate: Moisture, Protein, Fat, Crude Fiber, Ash, NFE
 - Fiber components: NDF, ADF, Cellulose, Lignin, eNDF, ADICP
- ***In Vitro*** Digestibility: DMD, OMD, Protein Dig.
- ***In Sacco*** Digestibility: Rate Disappearance (DM, OM, Protein, Fiber etc)
- ***In Vivo*:**
 - Digestibility Total Collection, using Markers (Ti, AIA, Cr.)
 - Feeding trial: Growth, Efficiency, Carcass

Hay Quality



Good (leafy/color/etc)



Questionable (stems/etc)



Mature (seed heads/etc)



Issues (color/heat{?}/etc)

Green Feed (pasture and chop)



Green Pasture (any forage)

Green Chop (fresh)



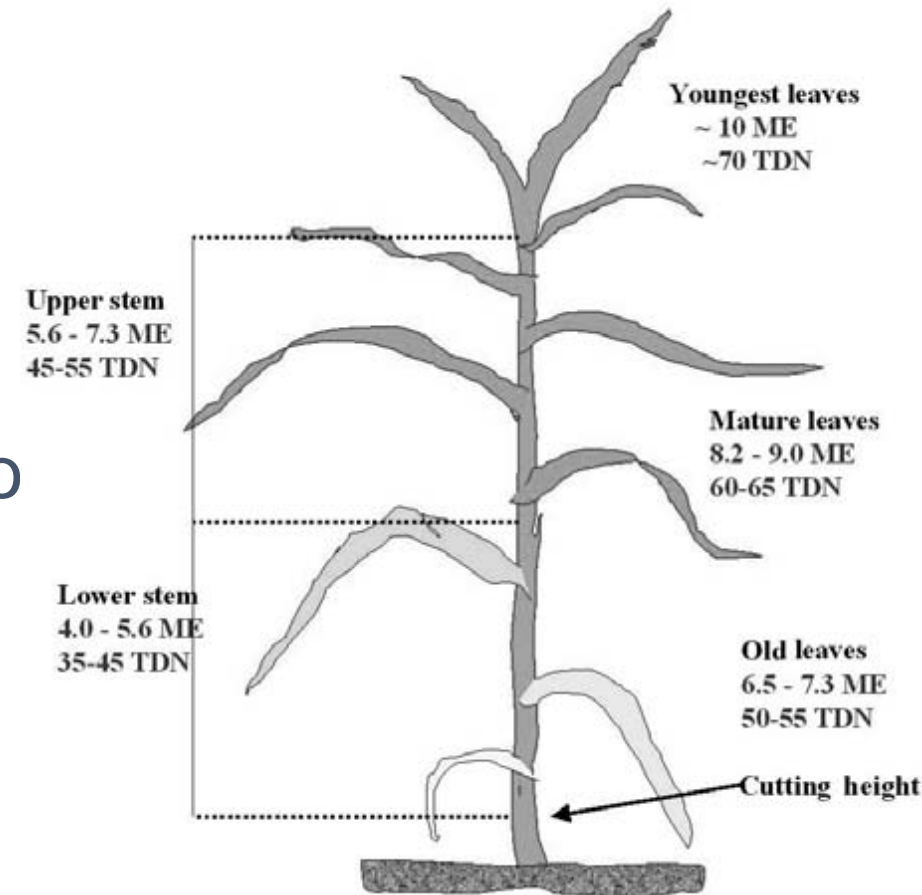
Roughage/Forage

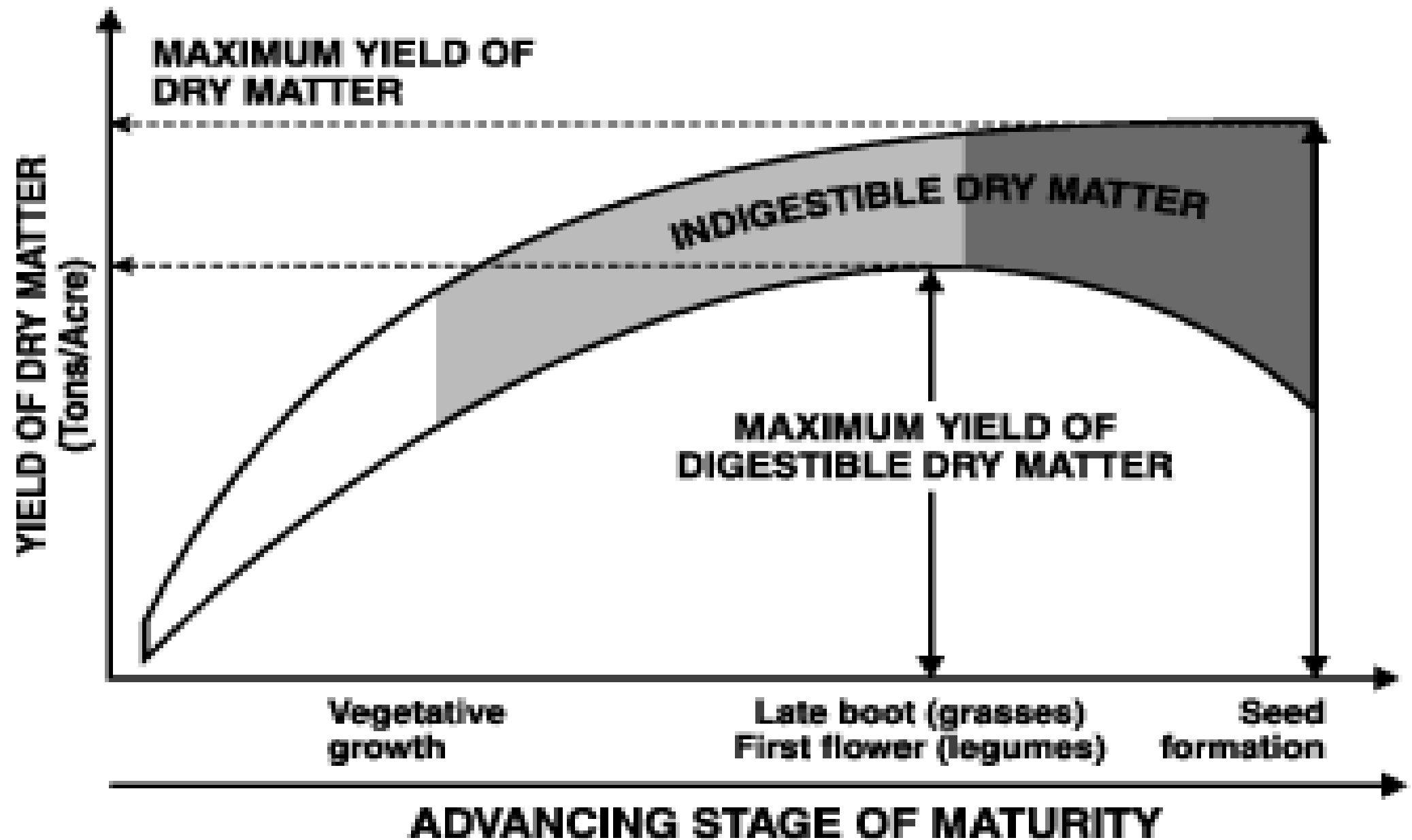
- **Low quality forages:**
 - Corn stalks
 - Wheat straw
 - Rice straw
 - Soybean stubble
 - Milo stalks
 - Dormant grass
- 1st limiting nutrient???
 - Protein...

- **High quality forages:**
 - Corn or sorghum forage
 - Silage
 - Young grasses and well fertilized
 - Forage legumes
- High ME (TDN), higher protein and digestibility

Different parts of a forage has different energy

- Highest energy in young shoot
- Effect of age
- Stem has lower energy
- Ratio leaves to stem affect the quality
- Moisture content can be different, being yo moisture
- Season may also affect moisture





Forage yield and quality of King Grass at different harvest

	Harvest Interval (wks)			
	4	6	8	10
<u>Forage trial</u>				
DM yield (kg/ha/wk)	179	236	345	525
DM content (%)	13.2	13.2	14.9	17.7
CP content (%)	15.5	11.4	7.7	6.8
NDF content (%)	63.6	69.6	72.6	75.3
Leaf blade (% DM)	71	60	50	44
<u>Feeding trials</u>				
DM intake (kg/100 kg LWt)	2.06	2.18	2.00	-
DM digestibility (%)	65.2	64.6	57.7	-
CP digestibility (%)	69.7	53.7	44.9	-
ME Content (MJ/kf DM)	9.1	9.0	7.8	-
Digest. CP yield (kg/ha/wk)	19.3	14.4	11.8	-
ME yield (000 MJ/ha/wk)	1.63	2.12	2.69	-

Quality of Napier grass fertilized at two rate (0 and 110 kgN/ha)

Regrowth	40 days		60 days	
	0	110	0	110
Fertilizer (kg N/ha)				
Protein (%)	8.6	12.7	7.1	10.8
NDF (%)	70.6	73.6	78.3	79.1
ME (MJ/kg DM)	7.2	8.4	6.6	6.3
TDN (%)	49	56	46	44
Hay intake (kg DM/day)	7.5	8.9	6.5	7.8

Effect of chopping Napier grass harvested during wet and dry season on intake and digestibility

	Whole	Chopped
<i>Wet Season</i>		
Dry Matter intake (% LWt)	1.9	2.0
Dry Matter digestibility (%)	54.3	56.0*
ME content (MJ/kg DM)	7.2	7.5*
Consumed CP content (%)	7.8	7.6
Consumed NDF content (%)	63.1	63.5*
<i>Dry Season</i>		
Dry Matter intake (% LWt)	2.2	2.5*
Dry Matter digestibility (%)	58.5	56.0*
ME content (MJ/kg DM)	7.9	7.5*
Consumed CP content (%)	6.6	6.2**
Consumed NDF content (%)	64.3	65.2**

Effect of wilting Napier Grass on digestibility by cattle or buffaloes

	Fresh	Wilted
Forage DM content (%)	12.0	14.6
Dry Matter Intake – DMI (% LWt)	2.0	2.3
DM digestibility (%)	58.2	64.2
CP digestibility (%)	64.0	70.6
NDF digestibility (%)	54.3	60.8
ME content (MJ/kg DM)	7.9	8.9

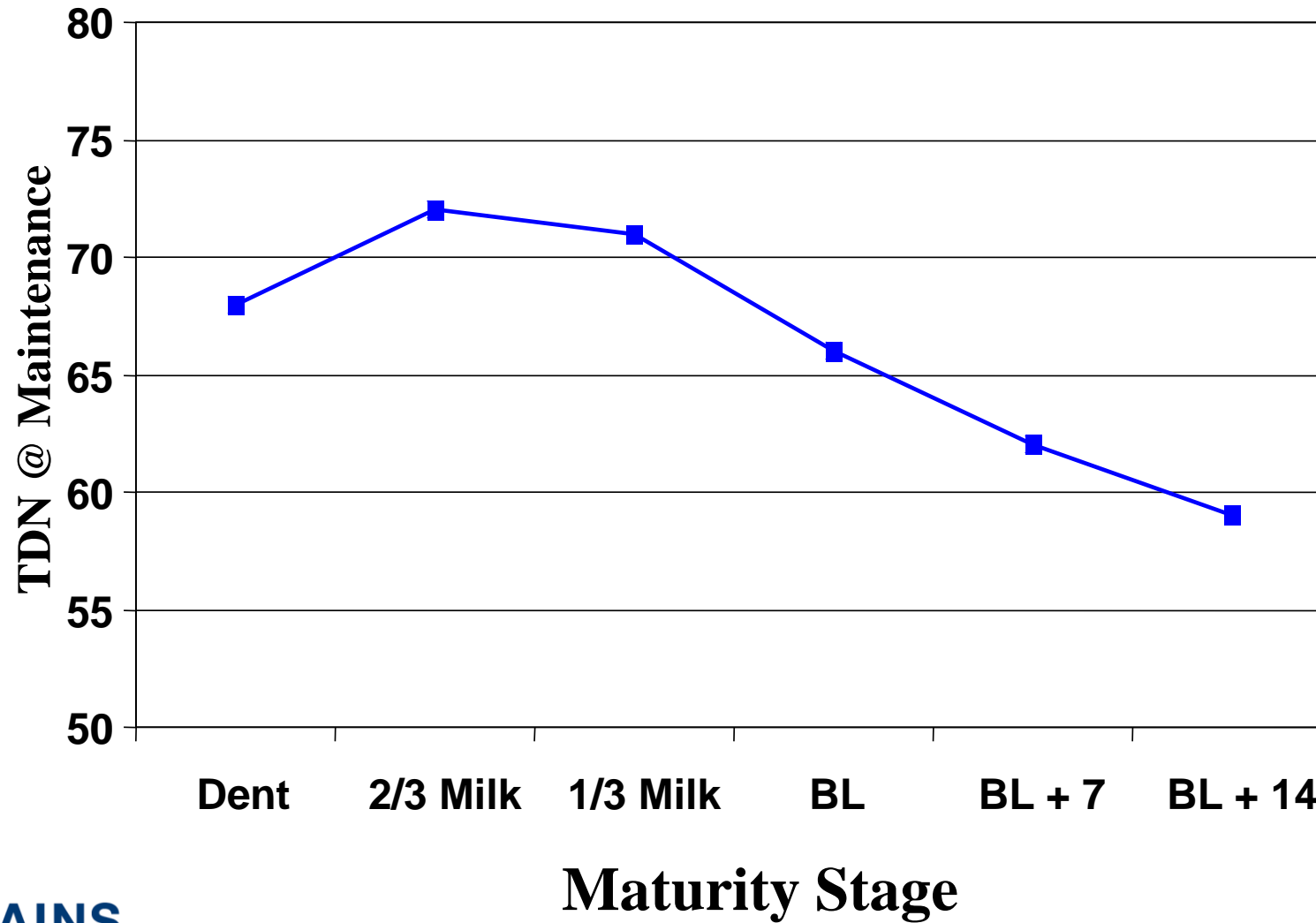
Source: Grant et al., 1974

Optimum Harvest Time for Corn Silage

32 to 35% whole plant DM
Good starch content and digestibility
Good fiber digestion
Good packing in the silo



Maturity Effects on Forage Energy Content (Corn Silage)



Effect of Age to height and nutrient of Elephant Grass (*Pennisetum purperium*)

Age (Days)	Height (cm)	DM content (%)	CP (%)	NDF content (%)	ME (MJ/kg)	ME (Kcal/kg)
99	128	20	6	68	7.1	1.697
63	95	17	9	63	7.7	1.840
53	61	16	12	61	8.3	1.984
30	42	14	15	54	8.9	2.127

Forage quality

- The ultimate measure of forage quality is animal performance
- Animal performance is determined by
 - feed availability
 - feed nutrient content
 - Intake
 - extent of digestion
 - metabolism of the feed digested
-
- Availability and intake most often determine animal performance
 - A cow never produced milk or a steer never grew on feed that it didn't eat!

Challenges in using local ingredients for **Concentrate**



Seasonality

Quality standard (SNI – not relevant)

Consistency

Collectability

Adulteration

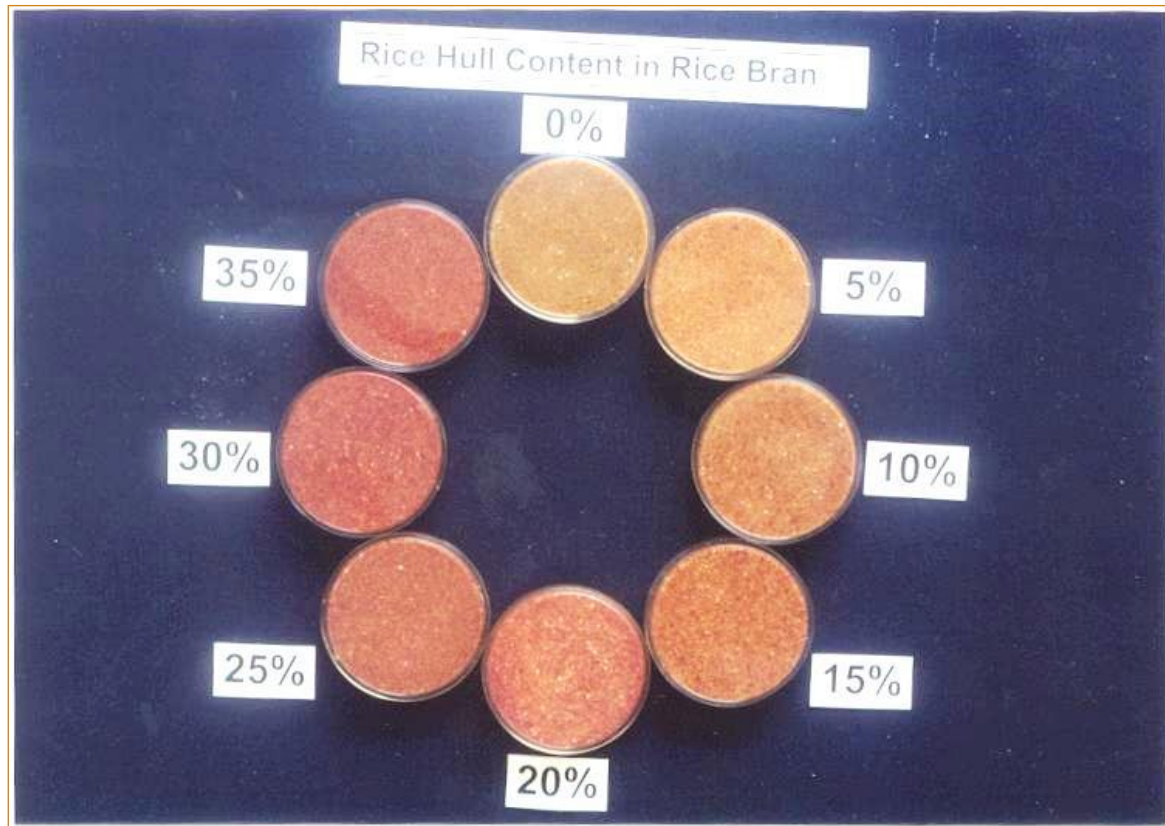
Corn grade in Indonesia



Case of rice bran

Nutrient	Rice bran	Rice hull
Moisture (%)	13	13
M E (kcal/kg)	2527	62
Protein (%)	12.4	2.9
Fat (%)	12.43-15.0	-
Crude Fiber (%)	6.69	37.32

Develop a series of standard contain different level hull



Cassava, potential ruminant feed

- Source of Energy
- Source of Starch (fermentable) depending upon the processing and spoilage
- Low in Protein
- Cyanide Glycoside for bitter cassava
- Waste is commonly used as it is cheap material
- Qualities are Critical as affecting nutritive values



Different Quality of Cassava and Waste

Rotten Cassava



Waste: machine or hand?



Skin and Waste

YAM AND CASSAVA WASTE



Palm Kernel Meal

- A by-product of palm kernel oil extraction process
- Abundant quantities in Indonesia and Malaysia
- Highly fibrous (up to 20%) and medium grade protein (<16%)
- Palm kernel resulting from mechanical extraction contains 5-12% oil and solvent-extracted palm kernel meal contains 0.5-3% oil (Chin, 2001)
- Deficient in Lys and Met
- Limited use for young animal



PKM problem with Shell and residual fat



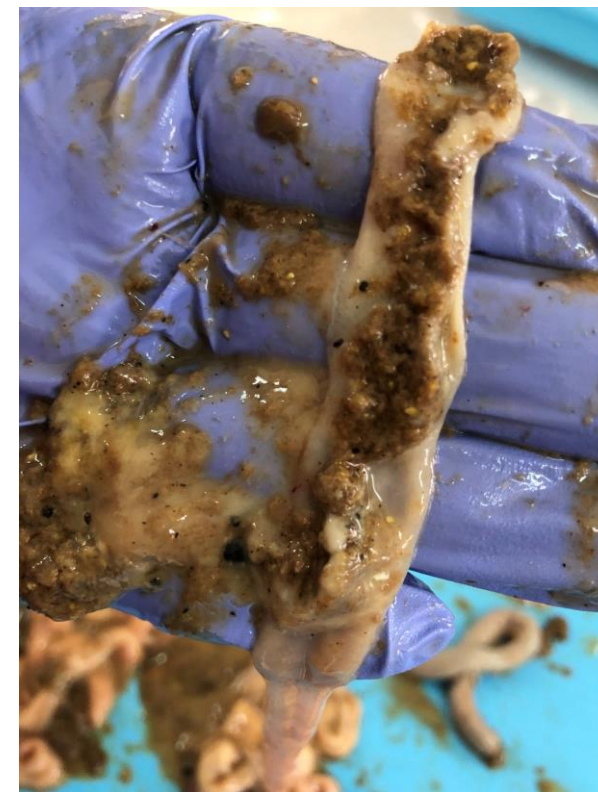
Pictures of palm kernel meal after sieving and blowing

- Palm Kernel used Expeller to extract Kernel Oil
- Residual Oil may vary depending upon efficiency of Expelling
- Analyze Residual Oil as it affects Energy content

Other consideration in using PKM

PKM

- ❖ Different oil content affect ME value
- ❖ Amount of shell that can't be digested by animal. Stuck in digestive tract
- ❖ Over heating, lower digestibility



Copra Meal

- A by-product from coconut oil production. Depending on the oil extraction method, the oil residue in the marketed product ranges from 1% to 22% (Göhl, 1982)
- High in fiber and low in essential amino acids
- Presence of mannan and glactomannan
- Limit its inclusion to 5-25 percent, increasing with the age of the animal
- Digestibility of most amino acids is less than in soybean meal but close to that in corn. The digestibility of Lys is low due to Maillard reactions due to overheating during drying. Copra meal should be less than 5 % in diets fed to weanling pigs and less than 25 % in diets for growing-finishing pigs (Stein et. al, 2015)
- A valuable source of protein in the diet for finishing pigs and may replace other protein sources in pig diets to a considerable extent (Kim et al, 2001)

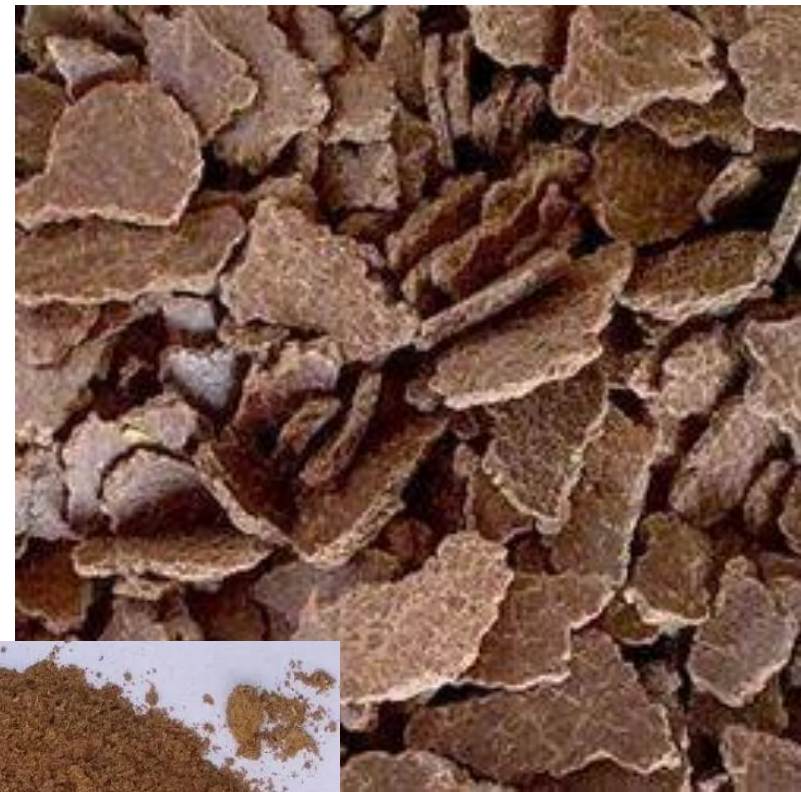


Copra or coconut meal

- **Challenges:**

- Rancidity
- Residual oil
- Aflatoxin

- Higher ME compare to PKM



Molasses



- How much moisture content?
- Is it from sulphuration or carbonation, affect S content
- Mineral content
- Sugar content

Tofu Waste (Okara)



- Wet material, how much moisture content?
- Residual protein
- Residual fiber
- How long has been stored, pH may change

Minerals

Trace Mineral
(TM) Salt



Dicalcium
Phosphate



Deflourinated
Phosphate



Plain Salt



Steamed Bone Meal



Limestone



Di-calcium Phosphate

- Normally mixture of di and mono Cal. Phos
- Minimum P level 18% for DCP and 21 % for MCP.
- Calcium level for DCP 20-24% for MCP 15-18%
- Max fluorine content 0.2%
- Ask for availability data from trial
- Adulterated with limestone or rock phosphate

Test for DCP



Many Nutrients

Nutrients		Restrictions		Actual
		Min	Max	
DM	%	0	100	98.8
TDN	%	70.0	100.0	74.0
DE	Mcal/kg	.0	5.0	2.47
ME	Mcal/kg	.0	5.0	2.83
Nem	Mcal/kg	1.8	5	1.89
Neg	Mcal/kg	.0	99	1.22
Nel	Mcal/kg	1.8	5	1.83
CP	%	18.0	99	18.0
CF	%	.00	99	15.6
NDF	%	20.0	99	39.7
ADF	%	10.0	99	24.6
Starch	%	15.00	99	15.0
Ca	%	.80	99	0.91
P	%	.40	99	0.47
K	%	.00	99.00	0.92
Na	%	.35	99	0.39
S	%	.20	0.4	0.20
Zn	mg/kg	.0	99	36.8
DIP	%	8.0	99	9.3
UIP	%	7.0	99	7.0
NPN	%	.0	1.5	1.5
Vit A	mg/kg	0	5000	0.1
Vit E	mg/kg	0	99	2.0

Conclusion

- Dairy cows required complete and balance nutrient that derived from roughage and concentrate made from different protein, minerals and vitamins source of ingredients.
- Quality of feed is utmost important to maintain high milk production and quality of feed ingredients should be compared to standard.
- Qualities can be measured physically, chemically and biologically from feeding to livestock
- Locally available ingredients must be evaluated carefully to optimize the usage in formulation.

Building a Tradition

Thank You!



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