

# The TMR Feeding Program

**Dr. Jim Linn  
University of Minnesota  
St. Paul, Minnesota**





# Keys to a Successful Dairy Feeding Program

- 1. Properly formulated rations**
  - 2. Skilled and conscientious people feeding**
  - 3. Mixing and feeding accurate amounts of ration**
  - 4. High quality feeds**
  - 5. Good communication between technical experts and dairy manager**
  - 6. Good record keeping**
  - 7. Good working equipment**
- 



# What is a TMR?

- **Complete mix of all feed ingredients**
    - **Forages**
    - **Grains**
    - **Byproducts**
    - **Protein feeds**
    - **Minerals and Vitamins**
    - **Feed additives – yeast culture**
- 



# Why Feed a TMR?

- **Increase milk production**
  - **Decrease feed costs**
  - **Improve cow health**
  - **Ability to feed feeds that are:**
    - **Hard to feed individually**
    - **Fed in small amounts**
  - **Deliver consistent ration to cow every day**
- 

# The TMR Equation

**Formulated  
Ration**



**Feed  
Ingredients**

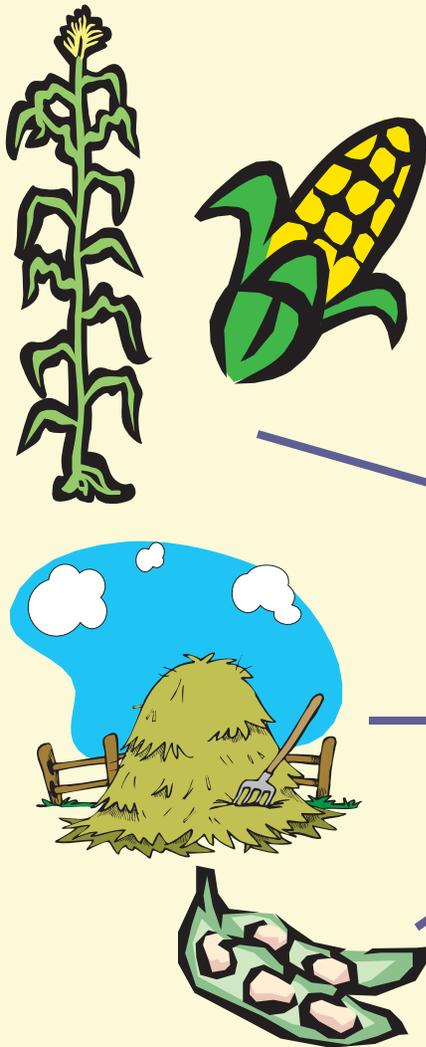
=

**Milk  
Production**



**Cow  
Health**

# Ration Formulation



## Cow Nutrient Requirements

Fiber  
Protein  
Energy  
Minerals

### RATION – Lactation – 35 kg/day

	Kg/day/cow
HAY	3.6
Corn silage - 35% DM	9.7
Haylage - 40% DM	18.2
CORN	8.4
COTTONSEED,FZ	2.5
PROTEIN MIX	3.8

### DRY MATTER NUTRIENT ANALYSIS

Wet Feed Intake kg	46.2
Ration DM %	48.7
DM Intake kg	22.5
Crude Protein %	16.5
NDF Fiber %	34.6
NDF From Forage %	23.8
NFC %	34.9
Fat %	5.3
TDN %	70.3
NE Lactation Mcal/kg	1.63
Calcium %	.93
Phosphorus %	.39
Magnesium %	.38
Potassium %	1.33
Salt %	.46
Iodine ppm	1.51
Selenium ppm	.34
Vitamin A, IU/ day	203437
Vitamin E, IU/day	990



# Formulating the Ration

- **Identify group of cows to be fed**
  - Milk production
  - Days in milk
  - **Dry Matter (DM) Intake**
- **Minimize variation in the group**
  - **Group cows that are similar in milk production and DM intake**

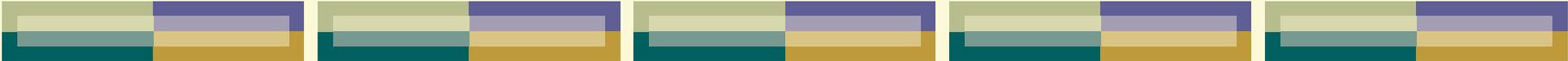




# Cow Groupings for TMR

## Lactating cow groups

- 1. Fresh Cow**
    - 1 to 21 days in milk
  - 2. 1<sup>st</sup> Lactation cows**
  - 3. High Production - older cows**
    - 21 to 180 days in milk
  - 4. Mid-lactation – older cows**
    - 180 to 250 days in milk
  - 5. Late Lactation**
    - Older and 1<sup>st</sup> lactation cows
    - 250 days in milk to dry off
- 



# Cow Groupings - Variations

## Lactating cow groups

### 1. Fresh Cow

- Low DM intake
- Dry forage (2 – 3 kg/cow/day)

### 2. 1<sup>st</sup> Lactation cows

- Smaller cows
- Low DM intake
- Slower to reach peak milk production and DM intake
- Persistent milk production and DM intake

### 3. High Production - older cows (21- 180 days in milk)

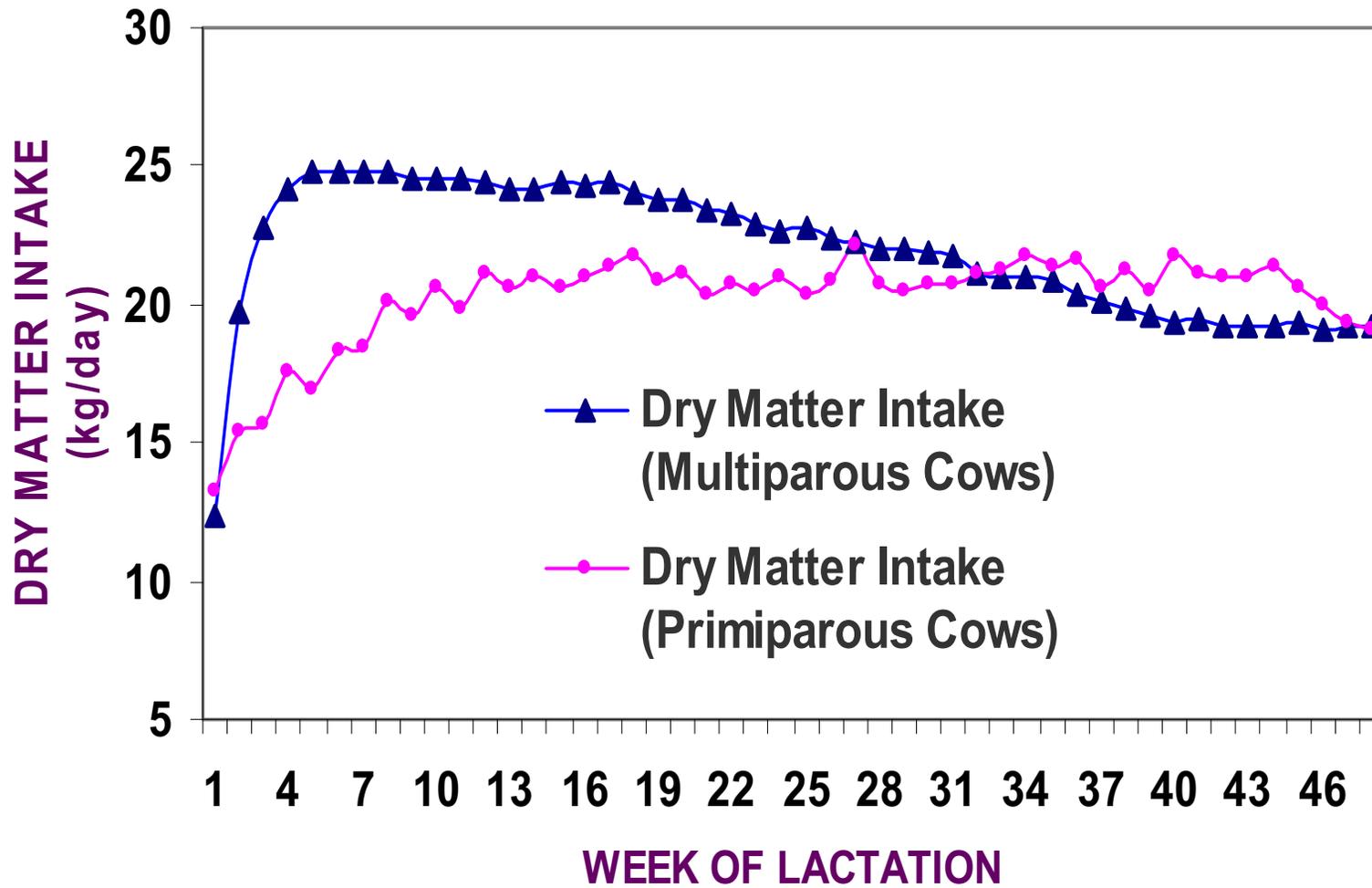
- Larger cows -
  - Reach peak milk production (> 40 kg/day) 45 days in milk
  - Reach peak DM intake (25 – 30 kg/day) by 60 days in milk
  - Breeding group
- 



# Cow Groupings - Variations

## Lactating cow groups

- 1. Mid-lactation – older cows**
    - 180 to 250 days in milk
    - Pregnant cows
    - Lower DM intake and milk production than high production group
  
  - 2. Late Lactation (250 days in milk to dry off)**
    - Older and 1<sup>st</sup> lactation cows similar DM intake and milk production
    - Avoid over conditioning of cows
    - High forage – medium energy ration
- 





# Cow Groupings for TMR

## Dry cow groups

### 1. Far Off dry cows

- 220 to 260 days pregnant
- High forage TMR

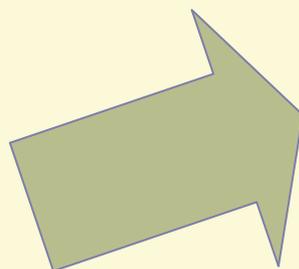
### 2. Close-up or Pre-Fresh cows

- 2 to 3 weeks before calving
  - Low DM intake – 10 kg/day
  - High fiber, nutrient dense TMR
    - 3 kg gain
    - 2-3 kg good quality forage
    - Minerals, Feed Additives and vitamins
- 

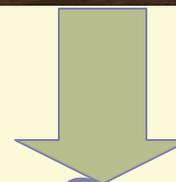
# The Feeding Objective

## Formulated ration

RATION – Lactation – 35 kg/day	
	Kg/day/cow
HAY	3.6
Corn silage - 35% DM	9.7
Haylage - 40% DM	18.2
CORN	8.4
COTTONSEED,FZ	2.5
PROTEIN MIX	3.8
DRY MATTER NUTRIENT ANALYSIS	
Wet Feed Intake kg	46.2
Ration DM %	48.7
DM Intake kg	22.5
Crude Protein %	16.5
NDF Fiber %	34.6
NDF From Forage %	23.8
NFC %	34.9
Fat %	5.3
TDN %	70.3
NE Lactation Mcal/kg	1.63
Calcium %	.93
Phosphorus %	.39
Magnesium %	.38
Potassium %	1.33
Salt %	.46
Iodine ppm	1.51
Selenium ppm	.34
Vitamin A, IU/ day	203437
Vitamin E, IU/day	990



## Ration Mixed



## Ration Cows Eat





# TMR Feeding Goal

✦ **Consistency is the key**

The *same* **AMOUNT** of

the *same* **MIX** at

the *same* **TIME** each day.



# Mixing the TMR

- **Dry matter of feeds – feed amounts**
- **Order of ingredient addition**
- **Mixer capacity**
- **Mixing time**



# Dry Matter

- **100-% moisture = % DM**



- **Nutrients are contained in DM**

- **Ration formulated on DM**
- **Cows consume DM**



**TMR ingredients are as fed  
DM errors result in over or under feeding as fed feeds**

# Check Forage DM

**Determine DM of forage at least once per week.**

**Adjust amounts of forage in TMR when DM changes more than 2% units**



# Common TMR Mixing Errors

## Scale and Weighing Inaccuracies

- **Scale not accurately weighing**
- **Feeder not accurately weighing feed amounts**



# TMR Mixing - Adding Ingredients

## Auger or Reel Mixers

### ● Ingredient Order

- Grains and proteins
- Small inclusion feeds
  - Minerals, vitamins
  - Feed additives
- Forages
  - Chopped hay
  - Ensiled forages



Maximum 200 kg long stem forage in 4500 kg TMR mix, about 2 kg/cow/day

**CHOP HAY BEFORE ADDING**

# TMR Mixing - Adding Ingredients

## Vertical or Screw mixers

### ● Ingredient order

- Long dry forage
- Grains and proteins
- Small inclusion feeds
  - Minerals, vitamins
  - Feed additives
- Ensiled forages

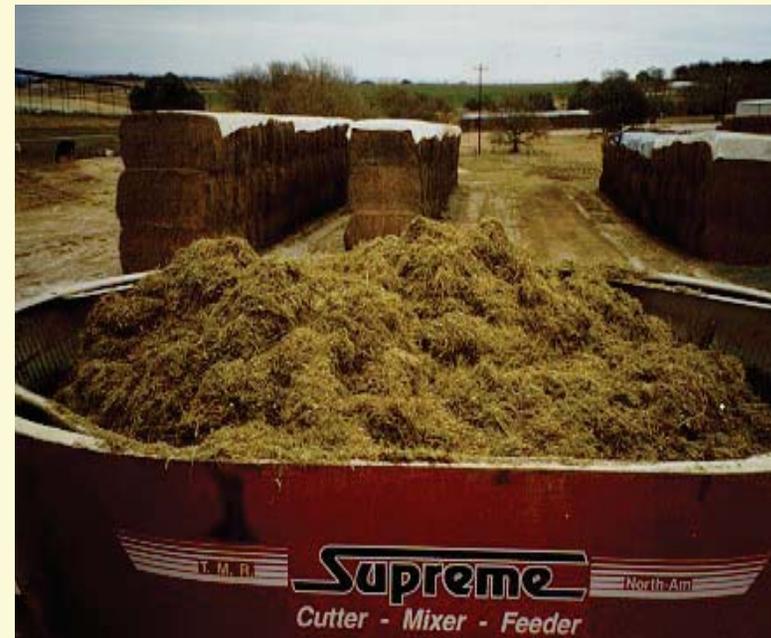


# Common TMR Mixing Errors

## Over Filling Mixers

### DO NOT OVERFILL

- Results in
  - Incomplete mixing
  - Sorting of feeds
  - Cows not getting balanced ration





# Common TMR Mixing Errors

## TMR Mixer Capacity

### ● TMR density

- 0.2 to 0.25 kg per cubic meter
- Average is 0.22 kg per cubic meter

### ● TMR mixer capacity per cow

- With 10% long dry forage - 0.2 cubic meters/cow
- No dry long forage – 0.14 cubic meters/cow

### ● Best mixing capacity – 70 to 80% of maximum



# Common TMR Mixing Errors

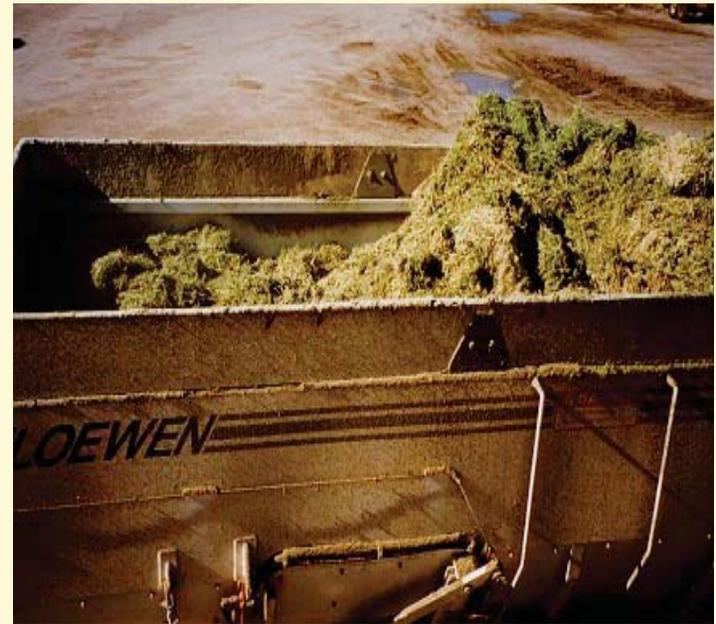
## Incorrect Mixing Times

### ● Incomplete mixing

- General guide is 3 to 5 minutes after last ingredient added

### ● Over mixing

- Reduces particle size



# Keys to Good TMR Mixing and Feeding

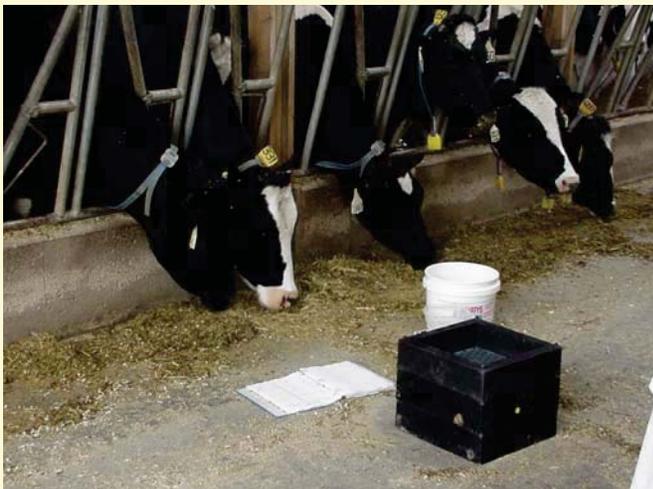
## Maintain Rumen “mat”

- stimulate rumen contractions
- maintain muscle tone
- stimulate cud chewing
- buffer the rumen

## Ration Physical Form

## Optimize Rumen Fermentation

- stimulate appetite
- max production of VFA's
- max microbial protein



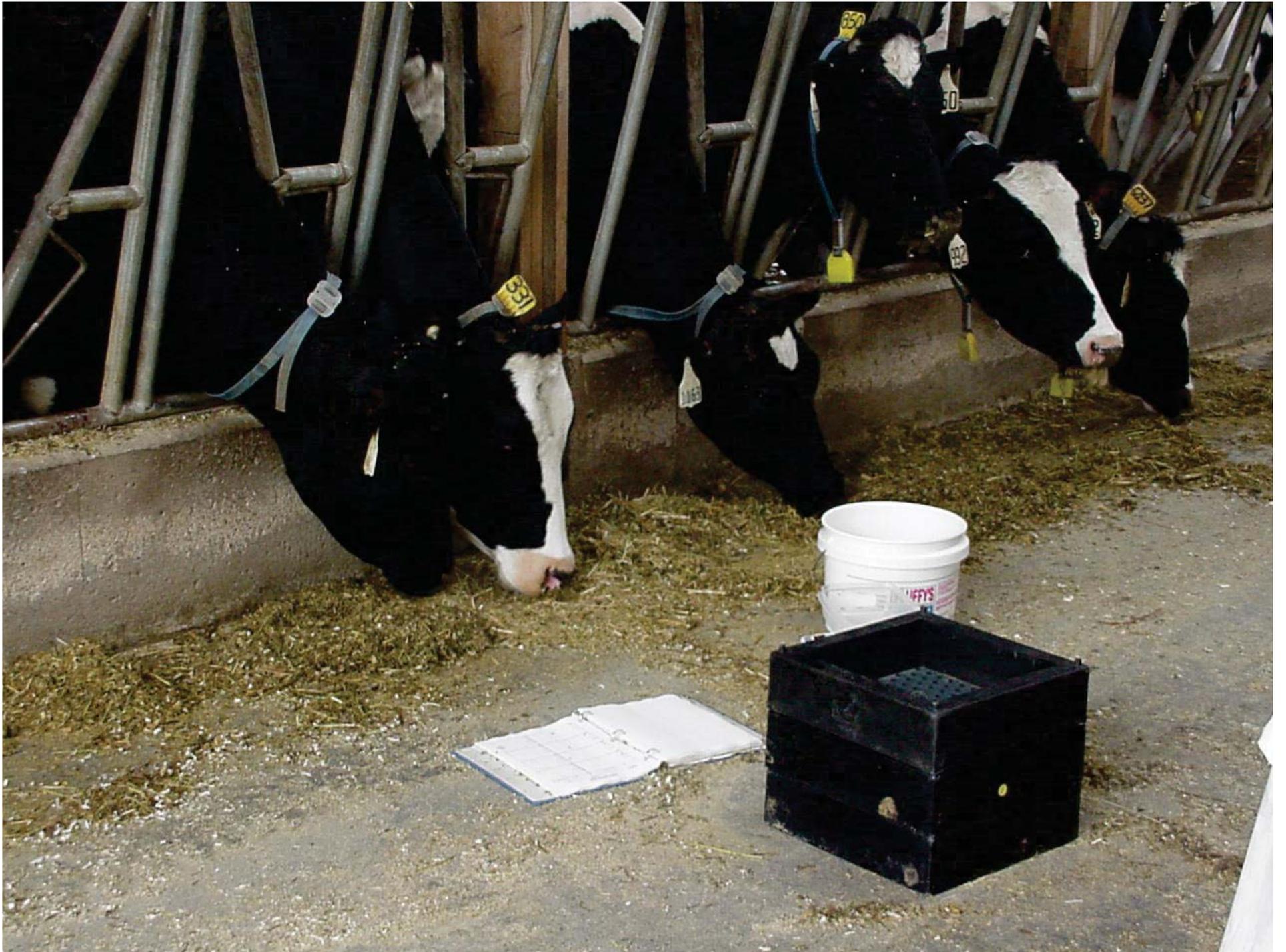
# Ration Physical Form

Physical characteristics of the ration that can greatly influence performance

✧ Physical Characteristics are affected by:

- ✓ Amount of forage
- ✓ Quality of forage
- ✓ Type of forage
- ✓ Level of NDF
- ✓ Moisture of ration
- ✓ Length and shape of particles
- ✓ **TMR mixing time**







2/27/2002 10:21am



# TMR Particle Size Recommendations

Sieve	3 Boxes	4 Boxes
	----- % -----	
Upper Sieve	6 - 8	6 - 10
Middle Sieve	>50	30 - 50
Lower Sieve	----	30 to 50
BottomPan	<40	<20

# TMR Ration - Particle Size



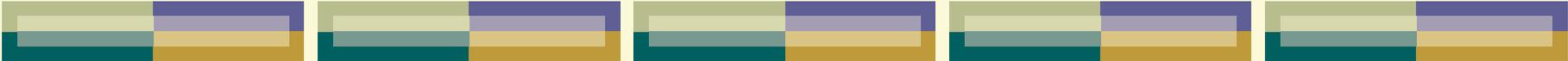


# Over Mixing - Example

- How can we tell? - Penn State Particle Separator

	<u>Actual</u>	<u>Goal</u>
● <b>Top</b> (Long Fiber)	<b>4.5%</b>	<b>6-8%</b>
● <b>Middle</b> (Short Fiber)	<b>39.0%</b>	<b>40-50%</b>
● <b>Bottom</b> (Fines)	<b>56.5%</b>	<b>&lt;50%</b>





# TOO FINE-OVERMIXING

## ● SYMPTOMS

- **Milk Production Decrease**
  - **Milk Fat:Protein Inversions**
  - **Consistently Loose Manure**
  - **Lack of Cud Chewing**
  - **Increase in free choice salt or buffer consumption**
  - **Eating of Bedding, Wood**
  - **Variable DM intake**
  - **Late Lactation Displaced Abomasums**
  - **Off-feed Cows**
  - **Lameness**
- 



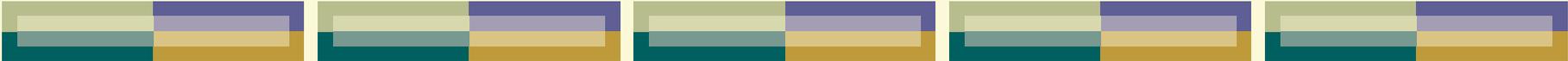
# TMR Evaluation - Too fine?

- **Check mix time- decrease if necessary**
  - **Dry long forage is very low in moisture – brittle and chops easily: reduce mix time**
  - **Mix order - add dry long forages last**
  - **Not enough forage in diet - check**
    - **Correct ration formulation**
    - **Forage moisture,**
      - As DM of forage decreases, less forage DM is being fed**
- 



# Symptoms of Under-Mixing

- **Clumping of ingredients such as hay, haylage**
  - **Cows sort feeds and slug fed grain**
  - **Inconsistent - loose manure**
  - **Off-feed cows**
  - **Variable DM intake**
  - **Lower fat test**
  - **Lameness**
- 



# Under Mixing - Too coarse

● How Can we tell - Penn State Particle Separator

	<u>Actual</u>	<u>Goal</u>
● <b>Top</b> (Long fiber)	<b>15.4%</b>	<b>6-8%</b>
● <b>Middle</b> (Short fiber)	<b>55.5%</b>	<b>40-50%</b>
● <b>Bottom</b> (Fines)	<b>29.1%</b>	<b>&lt;50%</b>





# TMR Evaluation - Too coarse?

- **Check mix time - increase if not over 6 minutes**
- **Dry forages over 15% moisture don't mix well without chopping before mixing**
- **Check wear on mixer knives- change if worn, add more knives if needed**
- **Mix order- add dry coarse forage earlier if possible**
- **Too much long coarse forage in mixer**
- **May require tub-grinding all dry forage if it is very coarse**

# Feeding the TMR

## Times per Day

### Number of times to feed per day

- Optimal – twice per day
- Once per day okay
  - Cool weather
  - Good feed push in
- Minimal benefit to more than twice per day



# Feed Bunk Management

## Evaluating the TMR Mix



# Uniform TMR Distribution



# Good feed bunk management:

- **Cows have access to feed at least 18-20 hours per day**
- **Cows have adequate bunk space**
  - 45 to 60 cm per milk cow**
  - 60 to 90 cm dry and transition cows**
  - 45 cm for heifers**





**Cows eat best off a smooth surface**

# Good feed bunk management:

**Push feed up at least 5 times per day if  
TMR is fed once per day.**

**If they can not  
reach the feed,  
They can not eat it**





# Good feed bunk management:

**24 hour refusal weight be  
less than 3% of fed TMR**

**Refusals should look like  
original TMR**



**Cow Goal:  
Unmix the  
TMR mix**





# Good feed bunk management:

- **Do not give cows the opportunity to sort feed**
  - **Push up feed often**
  - **Chop forages**
  - **Adequate moisture in ration**



**SORTING RESULTS IN SYMPTOMS COMMON TO BOTH UNDER AND OVER MIXING OF TMR**

# Feed Intake

**Measure daily**



# Weekly Feeding Record

Group: High		Week of:				
Date	Feeder initials	TMR Fed, kg	Time fed	Weighback, kg	Cow number	Feed comments
Mon	JL	2948	5:45	105	69	
Tues						
Wed						
Thur						
Fri						
Sat						
Sun						



# Feed Intake

- **Per cow amounts**

- **TMR = Formulated Ration**

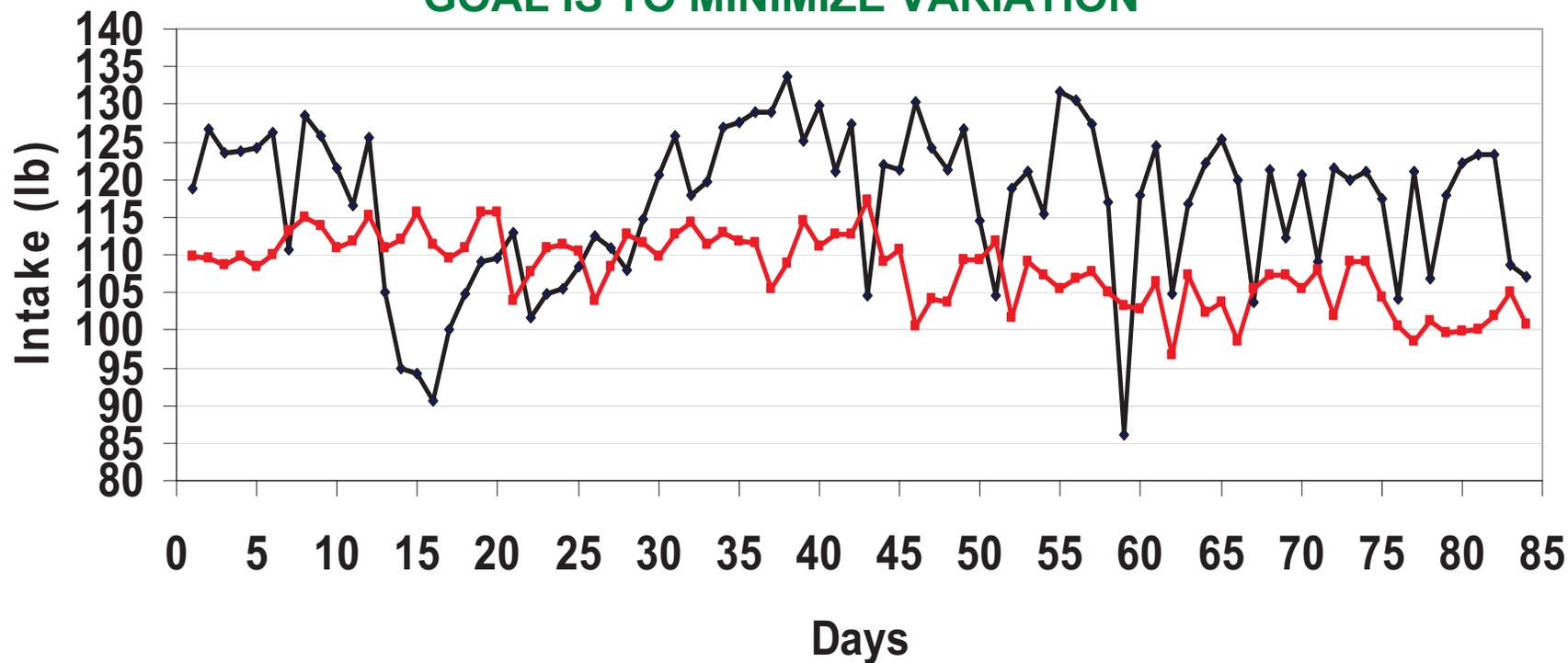
- **When amounts not equal**

- **Check forage moisture**
  - **Check number of cows fed TMR mix**
  - **Reformulate ration**
- 

## Daily As Fed Intake (lb)

—●— High Variation —■— Low Variation

**GOAL IS TO MINIMIZE VARIATION**





# **TMR Record Management**

## **Record Management**

**Daily feed information feeders should record**

- a. Date**
  - b. Feeder name**
  - c. Actual total amount of ration mixed and fed per pen or group**
  - d. Weighback amount from pen/group**
  - e. Number of animals in pen/group**
  - f. Time fed**
- 

# Adjusting TMR Feed Intakes

## Adjusting amount of TMR fed

- Change all feeds proportionally
  - Up or down
- **Maximum adjustment**
  - **3 kg/cow**
  - **8% of total weight**



# Forage Management

Feeding  
fresh,  
unspoiled  
forages  
every day  
is essential  
to TMR  
success



# Forage Management

- **Manage the feeding face of the bunker or pile**



**WANTED**  
**Smooth Surface**

## Smooth Faces Minimize DM and Nutrient Deviations Within a Silo

NDF  
44.5%

41.2%

36.6%

**20%  
variation in  
NDF from  
top to  
bottom**

From Bill Stone, NY

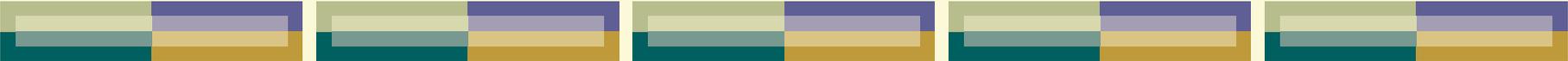


**Good Face Management  
and  
Top Cover**



# Silage Management

- ❖ **Keep face of pile smooth and straight**
  - ❖ **Feed a minimum of 15 cm off face daily**
  - ❖ **Remove no more than 1 m of top cover at a time**
  - ❖ **Remove and discard moldy or rotten silage before shaving pile**
  - ❖ **Inform technical expert of concerns or changes**
- 



# In Summary

- **A correctly formulated and fed TMR will**
    - **Provide excellent nutrition for the cow**
    - **Minimize feed cost**
    - **Optimize cow health and production**
  - **Management essentials for TMR Feeding**
    - **Correctly formulated ration**
    - **Quality forage and other feed ingredients**
    - **Accurate mixing of the TMR**
    - **Monitoring feed intakes**
    - **Good bunk management**
      - **Particle sizing**
      - **Feed availability – push ups**
    - **Good feed data recording**
  - **Communication between feeder, nutritionist and dairy manager**
- 

# Lets Go Feed The Cows!



THANK YOU