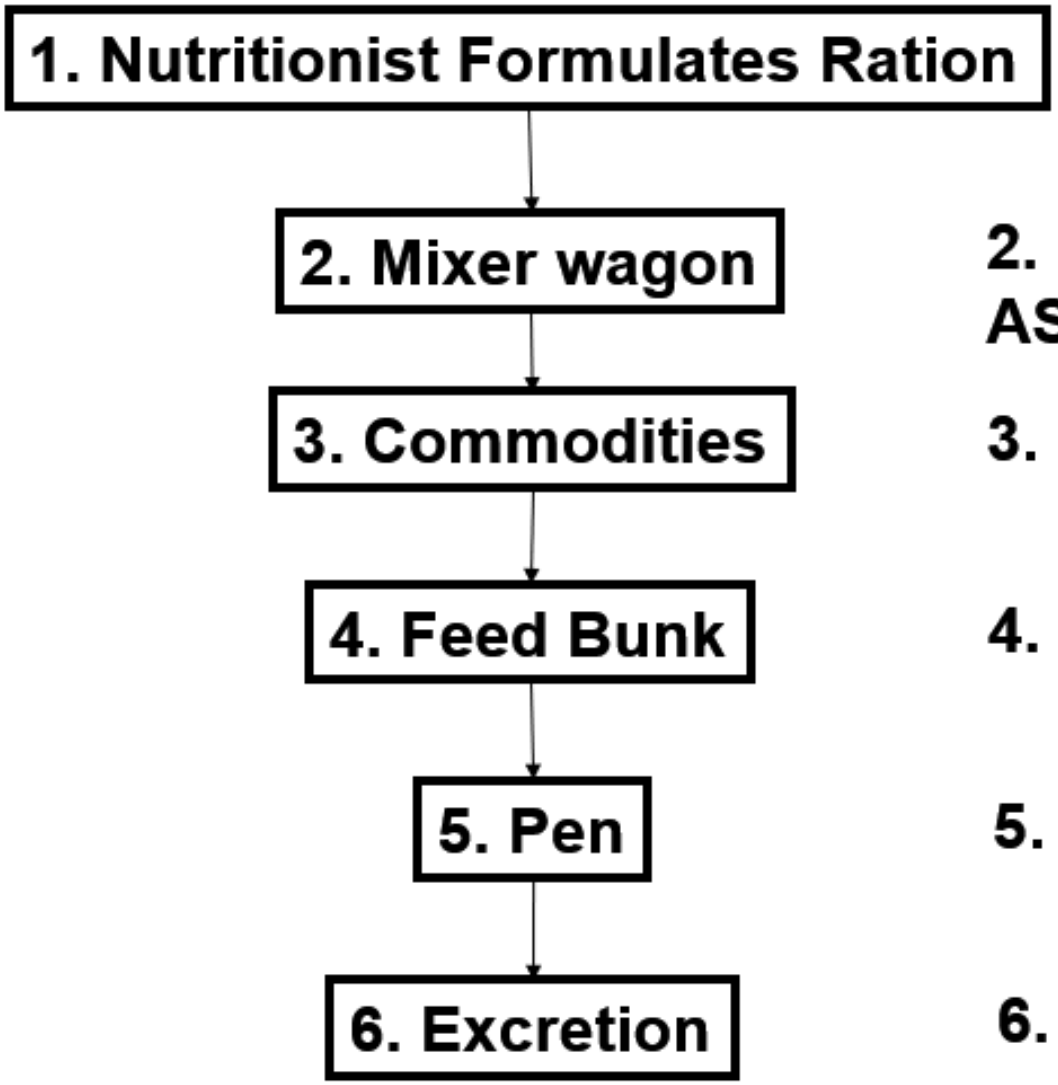
Climate Smart Feed Management - Dairy



1. Ingredients and nutrients
   DRY MATTER

2. Mixer wagon function
   AS FED = Loads, Mixes, Delivers

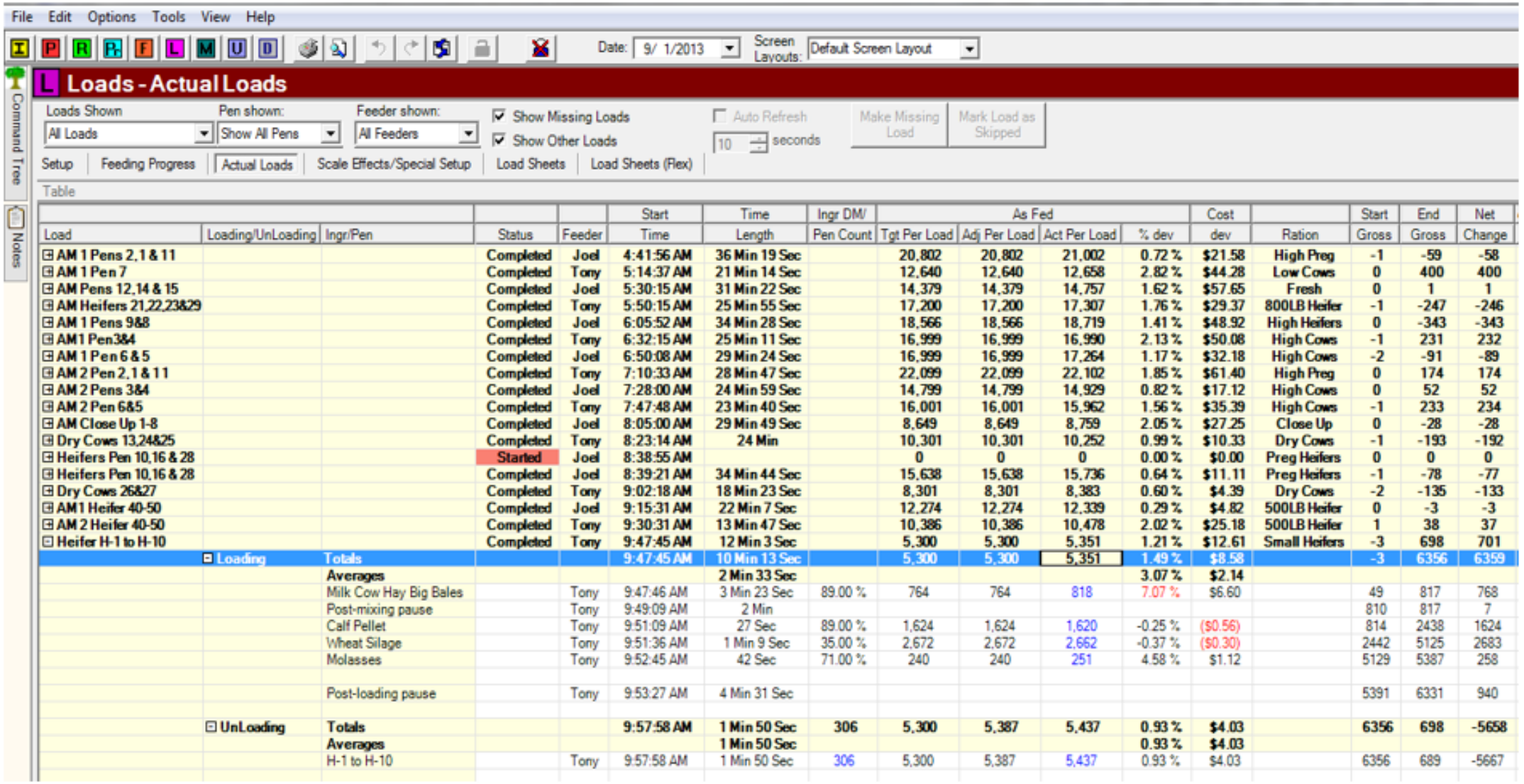
3. Feed quality

4. Bunk management

5. Cows eat / ruminate / eructate
   Dairy may refeed residual

6. Manure, N, P

Feed management software



Load	Loading/UnLoading	Ingr/Pen	Status	Feeder	Start Time	Time Length	Ingr DM/ Pen Count	As Fed Tgt Per Load	As Fed Adj Per Load	As Fed Act Per Load	As Fed % dev	Cost dev	Ration	Start Gross	End Gross	Net Change
AM 1 Pens 2,1 & 11			Completed	Joel	4:41:56 AM	36 Min 19 Sec		20,802	20,802	21,002	0.72 %	$21.58	High Preg	-1	-59	-58
AM 1 Pen 7			Completed	Tony	5:14:37 AM	21 Min 14 Sec		12,640	12,640	12,658	2.82 %	$44.28	Low Cows	0	400	400
AM Pens 12,14 & 15			Completed	Joel	5:30:15 AM	31 Min 22 Sec		14,379	14,379	14,757	1.62 %	$57.65	Fresh	0	1	1
AM Heifers 21,22,23&29			Completed	Tony	5:50:15 AM	25 Min 55 Sec		17,200	17,200	17,307	1.76 %	$29.37	800LB Heifer	-1	-247	-246
AM 1 Pens 9&8			Completed	Joel	6:05:52 AM	34 Min 28 Sec		18,566	18,566	18,719	1.41 %	$48.92	High Heifers	0	-343	-343
AM1 Pen3&4			Completed	Tony	6:32:15 AM	25 Min 11 Sec		16,999	16,999	16,990	2.13 %	$50.08	High Cows	-1	231	232
AM 1 Pen 6 & 5			Completed	Joel	6:50:08 AM	29 Min 24 Sec		16,999	16,999	17,264	1.17 %	$32.18	High Cows	-2	-91	-89
AM 2 Pen 2,1 & 11			Completed	Tony	7:10:33 AM	28 Min 47 Sec		22,099	22,099	22,102	1.85 %	$61.40	High Preg	0	174	174
AM 2 Pens 3&4			Completed	Joel	7:28:00 AM	24 Min 59 Sec		14,799	14,799	14,929	0.82 %	$17.12	High Cows	0	52	52
AM 2 Pen 6&5			Completed	Tony	7:47:48 AM	23 Min 40 Sec		16,001	16,001	15,962	1.56 %	$35.39	High Cows	-1	233	234
AM Close Up 1-8			Completed	Joel	8:05:00 AM	29 Min 49 Sec		8,649	8,649	8,759	2.05 %	$27.25	Close Up	0	-28	-28
Dry Cows 13,24&25			Completed	Tony	8:23:14 AM	24 Min		10,301	10,301	10,252	0.99 %	$10.33	Dry Cows	-1	-193	-192
Heifers Pen 10,16 & 28			Started	Joel	8:38:55 AM			0	0	0	0.00 %	$0.00	Preg Heifers	0	0	0
Heifers Pen 10,16 & 28			Completed	Joel	8:39:21 AM	34 Min 44 Sec		15,638	15,638	15,736	0.64 %	$11.11	Preg Heifers	-1	-78	-77
Dry Cows 26&27			Completed	Tony	9:02:18 AM	18 Min 23 Sec		8,301	8,301	8,383	0.60 %	$4.39	Dry Cows	-2	-135	-133
AM1 Heifer 40-50			Completed	Joel	9:15:31 AM	22 Min 7 Sec		12,274	12,274	12,339	0.29 %	$4.82	500LB Heifer	0	-3	-3
AM 2 Heifer 40-50			Completed	Tony	9:30:31 AM	13 Min 47 Sec		10,386	10,386	10,478	2.02 %	$25.18	500LB Heifer	1	38	37
Heifer H-1 to H-10			Completed	Tony	9:47:45 AM	12 Min 3 Sec		5,300	5,300	5,351	1.21 %	$12.61	Small Heifers	-3	698	701
	Loading	Totals			9:47:45 AM	10 Min 13 Sec		5,300	5,300	5,351	1.49 %	$8.58		-3	6356	6359
		Averages				2 Min 33 Sec					3.07 %	$2.14				
		Milk Cow Hay Big Bales		Tony	9:47:46 AM	3 Min 23 Sec	89.00 %	764	764	818	7.07 %	$6.60		49	817	768
		Post-mixing pause		Tony	9:49:09 AM	2 Min								810	817	7
		Calf Pellet		Tony	9:51:09 AM	27 Sec	89.00 %	1,624	1,624	1,620	-0.25 %	($0.56)		814	2438	1624
		Wheat Silage		Tony	9:51:36 AM	1 Min 9 Sec	35.00 %	2,672	2,672	2,662	-0.37 %	($0.30)		2442	5125	2683
		Molasses		Tony	9:52:45 AM	42 Sec	71.00 %	240	240	251	4.58 %	$1.12		5129	5387	258
		Post-loading pause		Tony	9:53:27 AM	4 Min 31 Sec								5391	6331	940
	UnLoading	Totals			9:57:58 AM	1 Min 50 Sec	306	5,300	5,387	5,437	0.93 %	$4.03		6356	698	-5658
		Averages				1 Min 50 Sec					0.93 %	$4.03				
		H-1 to H-10		Tony	9:57:58 AM	1 Min 50 Sec	306	5,300	5,387	5,437	0.93 %	$4.03		6356	689	-5667

Rations fed on a dairy

Calf Starter	Grain Mix	0 - 60d
Calf ration	Grain + Forage (10%)	61d - 120d
Grow Heifer	Grain + Forage (50%)	121 - 13 mo
	Pregnant	
Bred Heifer	Grain + Forage (50%)	13 - 23 mo
Far off	Gain + Forage (60%)	22 - 23 mo
Closeup	Grain + Forage (50%)	23 - 24 mo
	Calving	
Fresh cow	Grain + Forage (40%)	0 - 21 DIM
High cow	Grain + Forage (35%)	22 - 180 DIM
	Pregnant	
Low cow	Grain + Forage (40%)	180 - End DIM

CU

High

Ration Formulation vs. Feeding

1. Nutritionist Formulates Ration
2. Mixer wagon
3. Commodities
4. Feed Bunk
5. Pen
6. Excretion

1. Ingredients and nutrients DRY MATTER
2. Mixer wagon AS FED
3. Feed quality
4. Bunk management
5. Cows eat / ruminate
6. Manure, N, P

The most important measure = % Dry Matter

Dry Sponge vs. Wet Sponge

DRY MATTER

AS FED

- Feeds pick up water (rain, humidity)
- As water content ↑, nutrient concentration ↓
- Feeds are bought on AS FED basis
- Dry Matter % = 100*(As Fed – water)/As Fed

Alfalfa Hay = 85-90% Corn Silage = 30-45%

Corn grain = 88-91%

Crude Protein is estimated from N

CP = [N] * 6.25 (=1/16 Nitrogen in plant protein)

CP directly translates to N intake

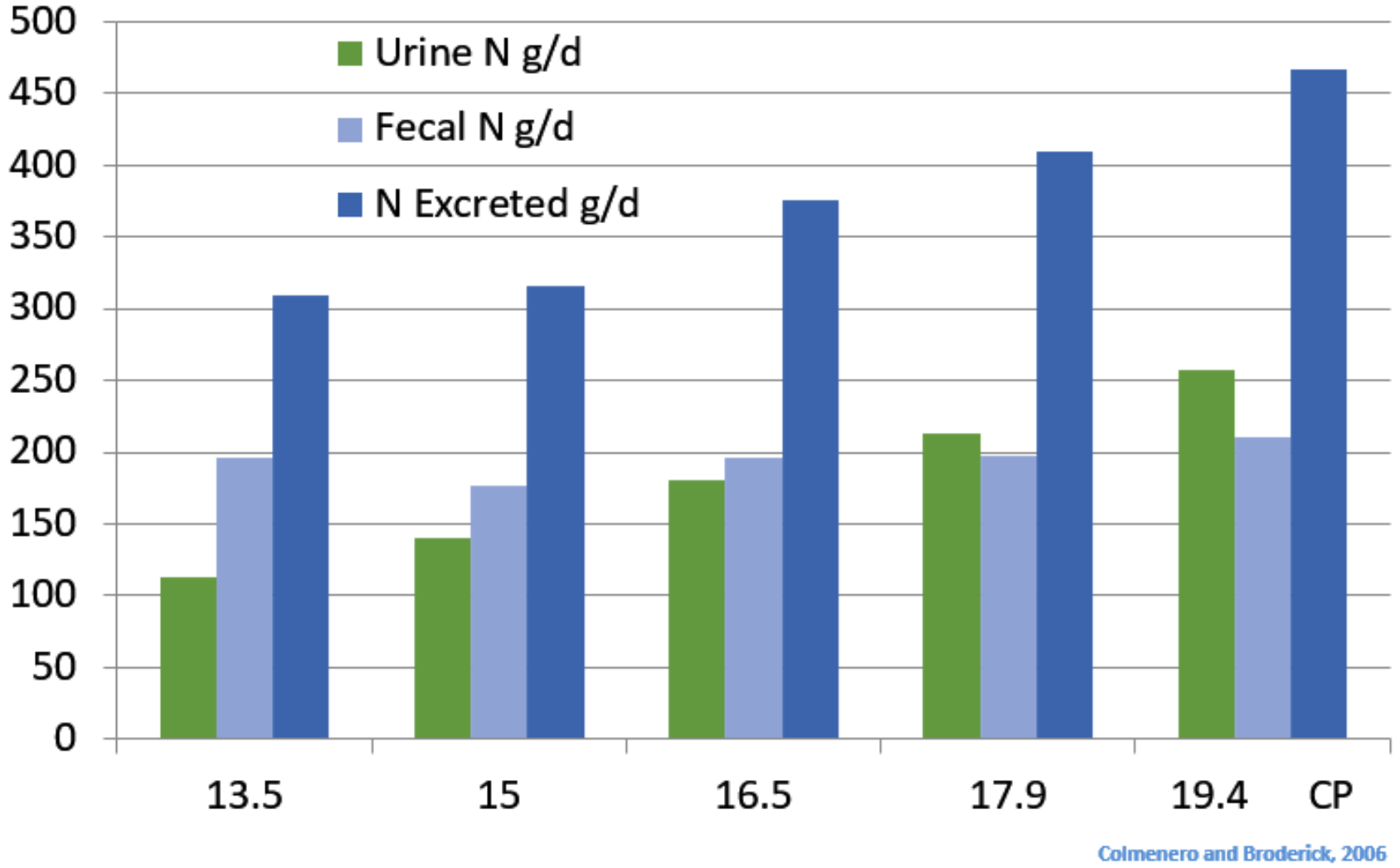
NOTE: Metabolizable Protein (MP) represents protein absorption

Rumen undegradable protein (RUP)

Rumen degradable protein (RDP)

	CP	RUP	RDP
Alfalfa Hay	16-23%	60%	40%
Corn Silage	8-10%	70%	30%
Corn grain	9-10%	80%	20%

Low protein diets (15%)



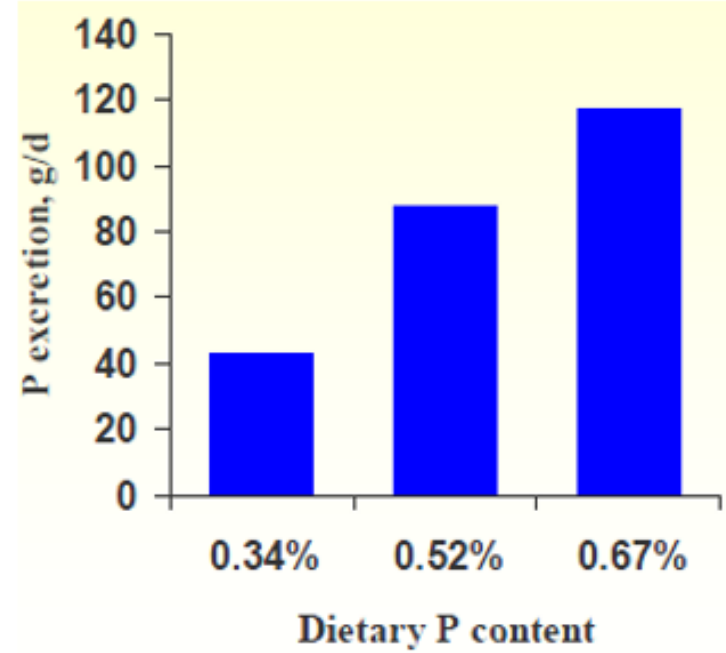
Colmenero and Broderick, 2006

Phosphorus

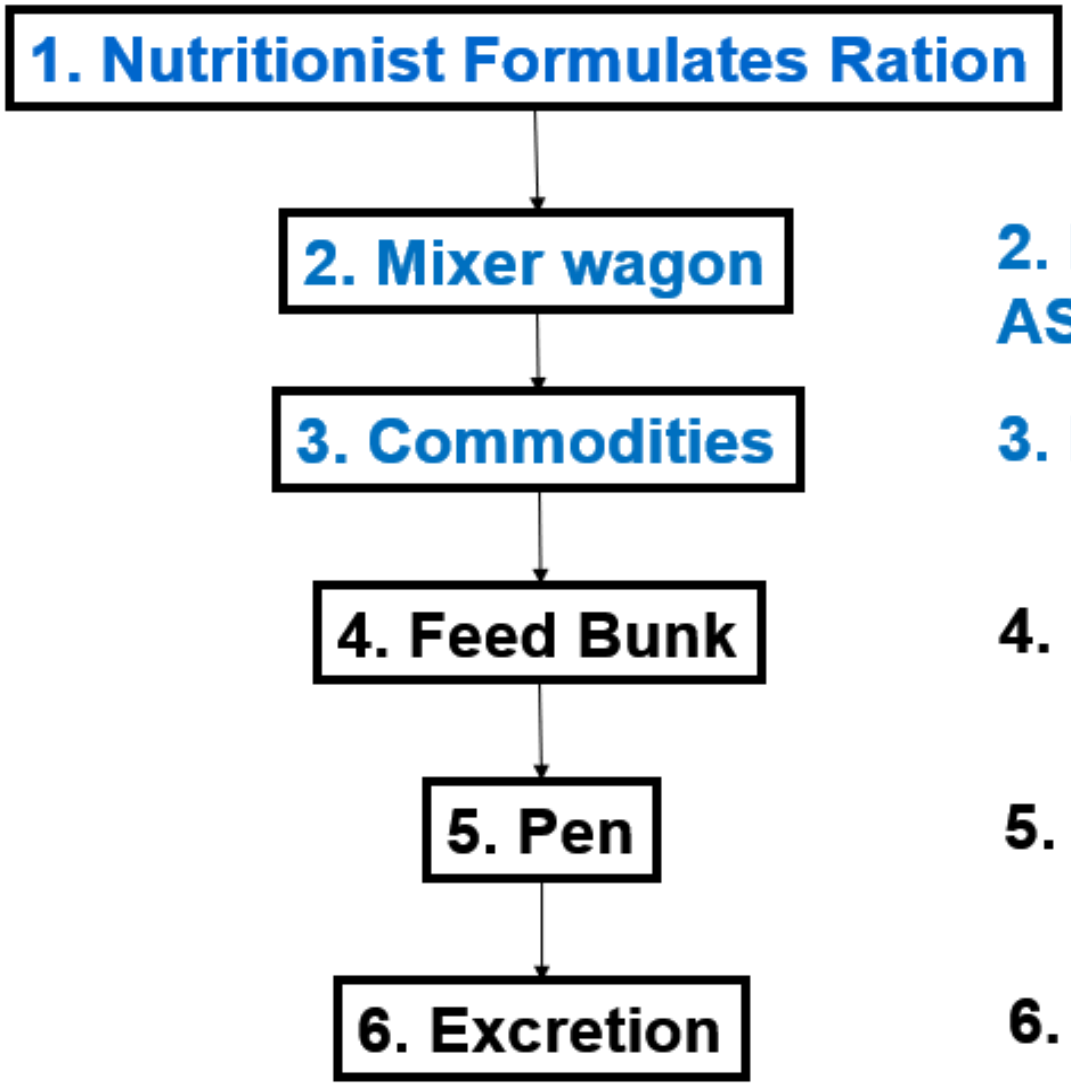
Plant sources are in phytate form which only microbes can break down (by enzyme phytase)

Inorganic forms are easily absorbed
Excretion can be decreased by decreasing amount
Important in growth and lactation

	P
Alfalfa Hay	0.29%
Corn Silage	0.22%
Corn grain	0.3%



Feed Quality (Commodity Storage)



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Feed Quality Indicators

Digestibility = How much feed / nutrients are absorbed and don't show up in feces

= 100*(Intake – Feces) / Intake

Alfalfa Digestibility Example

Stage	%Digestibility
Pre-bud	66.8
Bud	65
Early Bloom	63.1
Mid-Bloom	61.3
Full-Bloom	59.4
Late-Bloom	57.5
Mature	55.8

Digestibility example

Feed Quality Indicators

1. Stem diameter
2. Amount of leaves vs stems
3. Amount of leaves still on stems (too dry = shatter)
4. % Bloom
5. Weeds
6. Mold (possible leaching of nutrients)
7. Dust



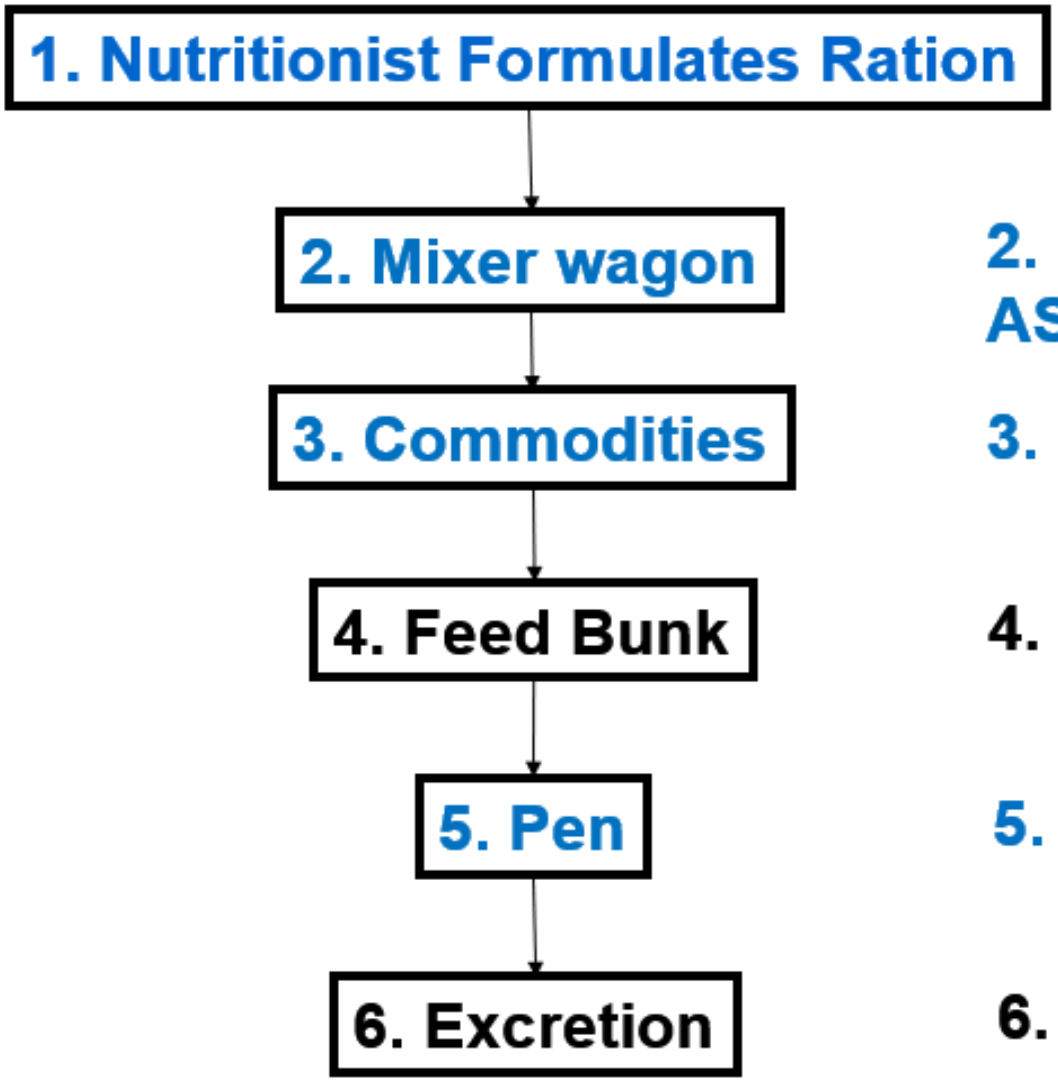
Most problematic feeds

Silage and Almond hulls easily accumulate mold, mycotoxins, aflatoxin






Rumination / Eructation



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Rumination / Eructation

Fermentation produces….

Forage = Acetate CH_3COOH + CO2 + CH4

Grains = Propionate CH_3CH_2COOH

High forage diet = 70% of gases = CH4

High grain diet = 30% of gases = CH4

Always, [Acetate] > [Propionate]

High milking ration

Ingredient	Feed Type
Alfalfa Hay	Forage
Corn Silage	Forage
Rolled Corn	Concentrate
Whole Cottonseed	Byproduct (protein / fat)
Soybean Hulls	Byproduct (forage?)
Dried distillers grains	Byproduct (protein / fat)
Wheat mill run	Byproduct (concentrate?)
Canola oil meal	Byproduct (protein / fat)
Soybean meal	Byproduct (protein / fat)
Almond hulls	Byproduct (forage/concentrate?)
Citrus pulp	Byproduct (?)

Modifying Diets to Inhibit Methanogens

1. Ionophores (monensin) inhibit acetate forming microbes and decreases production of CH_4

2. High starch (high grain) diets promote lactic acid production and increase rumen acidity which inhibits methanogens decreasing CH_4.

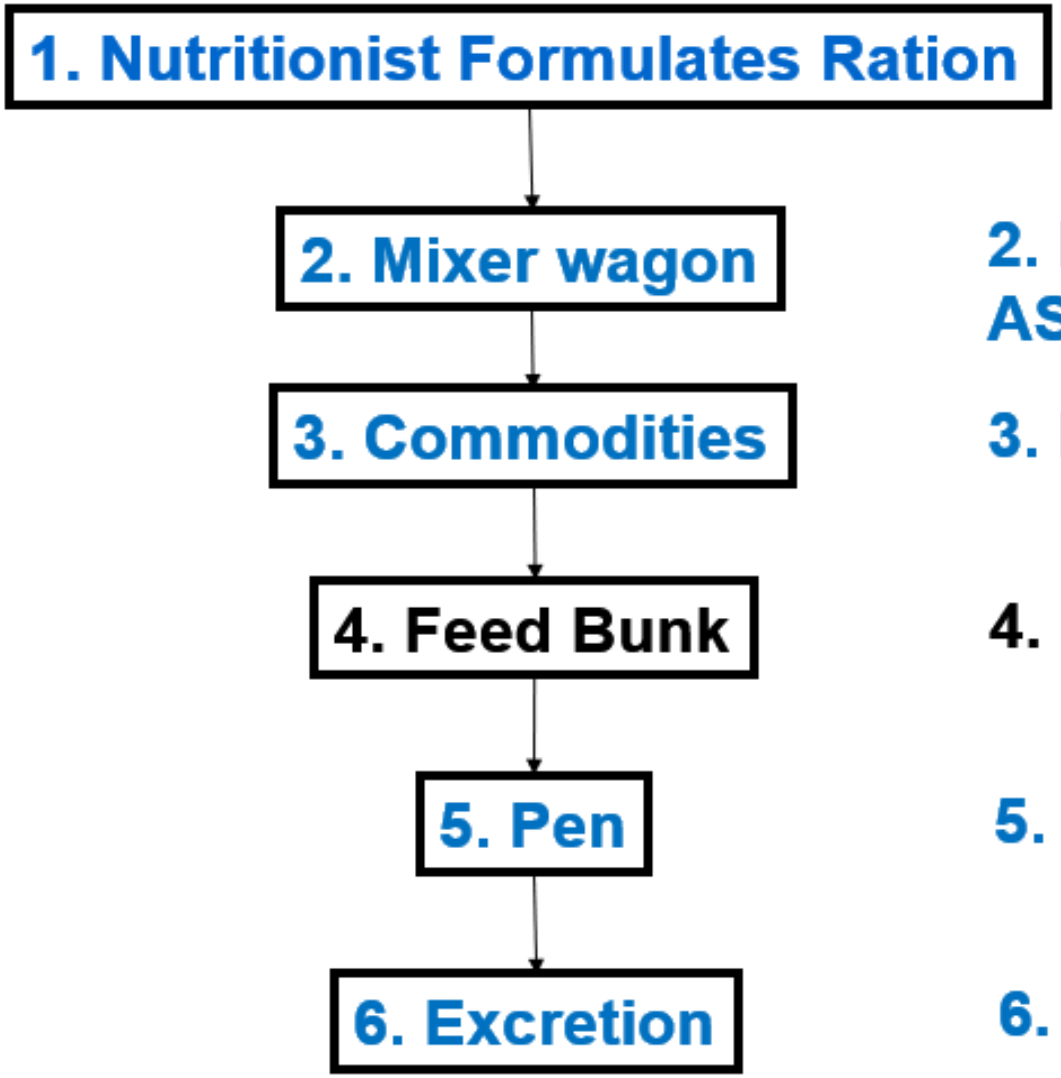
3. Unsaturated fatty acids can pick up hydrogen reducing CH_4 formation but can only be fed at 2-5% of the diet

4. 3NOP inhibits CH_4 formation

5. Essential Oils (Agolin: 0-15%)

Cows off feed will increase efficiency and decrease CH_4

The feeding process



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Guidelines

Nitrogen Use Efficiency

NUE < 30% = N in milk / N in feed

Increase milk or decrease diet N

Feed Conversion Efficiency

FCE > 1.6 = kg milk / kg DMI

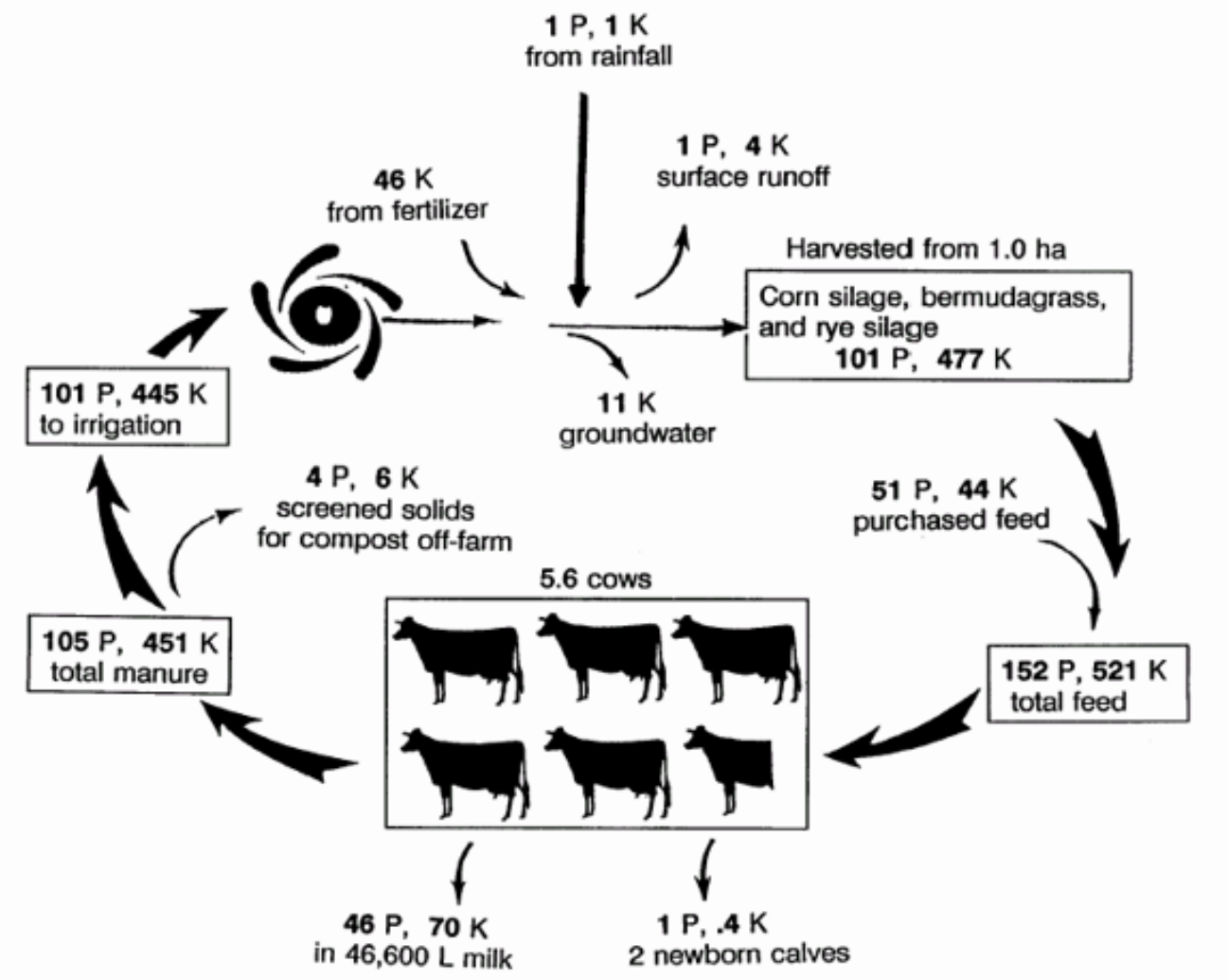
Urea Recycling, Milk Urea Nitrogen

MUN > 18 mg/dL then CP too high, C limiting

MUN < 12 mg/dL then CP low, C excess

Nutrient Balance = Import ≤ Export
(No Net Buildup)

FARM



From Van Horn et al. 1994

What makes the difference?

1. Feed to requirements; cow groupings
2. Monitor DM changes, analyze feeds (forage)
3. Reformulate for forage quality
4. Use feed processing, additives as necessary
5. Use consistent feeding processes
6. Consider protein fraction (CP, RDP-RUP) + P
7. Consider feeding method (TMR, PMR)
8. Monitor NUE, FCE, MUN
9. Analyze manure, Export > Import
10. Formulate for max nutrient efficiency to meet goals of the nutrient management plan