

## Precision Feeding Dairy Cows



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## Outline

- Why should you be concerned?
- Phosphorus
  - Nutrition
  - P-index
- Nitrogen
  - Policy
  - Nutrition



## Nutrients and Water Quality

About 4,000 miles of PA streams impaired by agricultural non-point source pollution, primarily excessive nutrients from livestock manure.



## Nutrients and Water Quality

- Agriculture is the source of approximately 50% of the N and 60% of the P that PA contributes to the Chesapeake Bay.
- PA agreed to reductions of **37 million pounds** of nitrogen and **1.3 million pounds** of phosphorus to the Chesapeake Bay annually.



## Cost-effective reduction of manure impacts

“By far, the most cost-effective way to minimize the environmental impact of the large volumes of manure generated within the watershed is through adjusting feed formulation for poultry and livestock...  
N reductions of 30-50% and  
P reductions of 40-60 % are achievable using a variety of diet modification techniques for poultry, dairy cattle and swine.”

Cost-Effective Strategies for the Bay: 6 Smart Investments for Nutrient and Sediment Reduction, Chesapeake Bay Commission, December 2004.

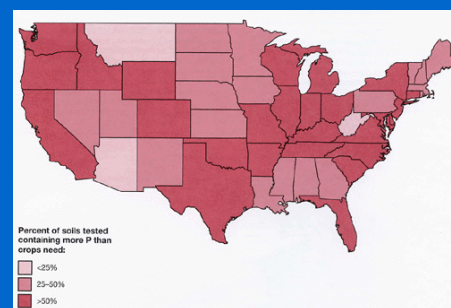
## Managing Phosphorus via Nutrition and the P-Index

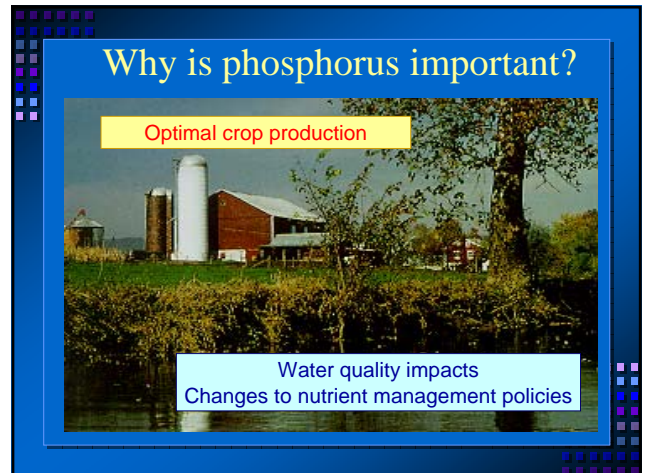
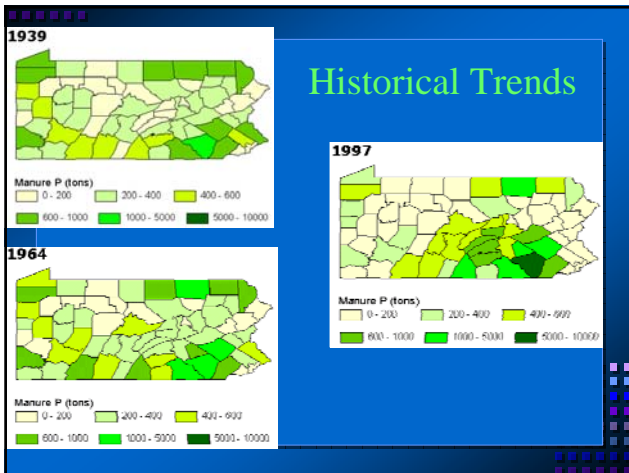
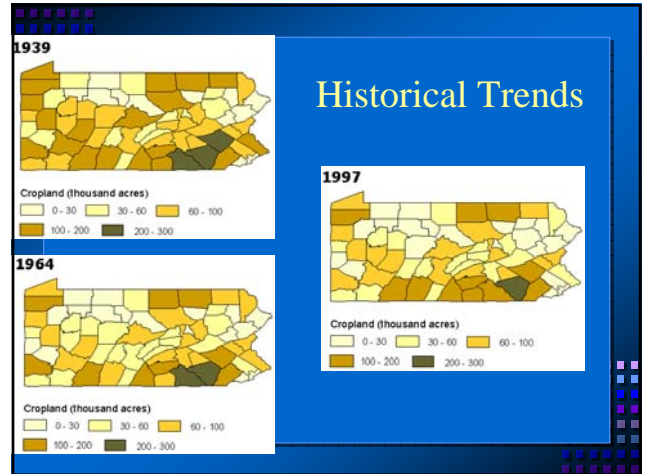
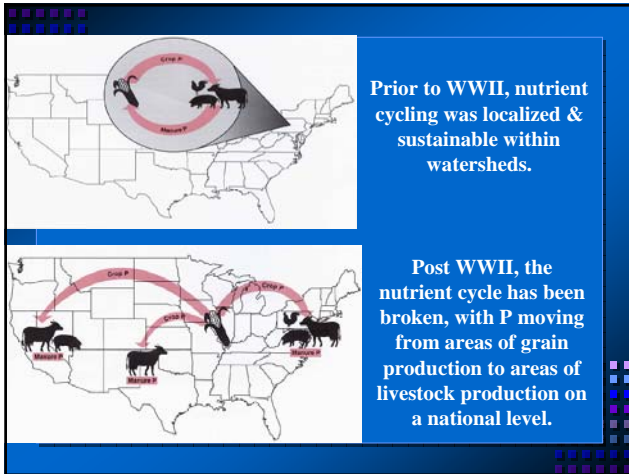


## What is the big deal over phosphorus?

- Eutrophication - nutrient enrichment of lakes or streams or water bodies.
- Affects surface water
- Increased growth of undesirable algae and aquatic weeds
- Oxygen shortage from plant dying off and decomposing, kills fish
- Restricts water use for fisheries, recreation, industry and drinking

## Who's to blame for the P problem?





## Why is phosphorus important?

- Bone remineralization
- Growth
- Milk secretion
- Energy metabolism
- Fatty acid transport
- Phospholipid synthesis
- AA metabolism
- Protein synthesis
- Cellulose digestion by rumen bugs

P has more known biological functions than any other mineral element

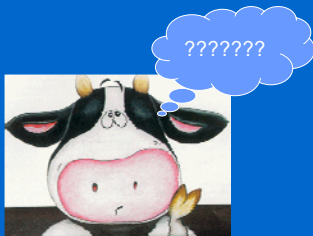


AEU –  
CAO –  
CAFO –



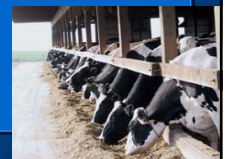
- ✓ What does percent me...
- What is the P availability?
  - ✓ What is the DMI?
  - ✓ What is milk production and components?
  - ✓ What's the cow's stage of lactation?
  - ✓ What is the P source?
- Is the herd a CAFO or CAO?
- Is the farm in a protected watershed?
- Do many fields require a P-based nutrient management approach? (Use of the P-index)

## How many Dairy CAOs and CAFOs are in Pennsylvania?



## Monitor dry matter... on all high moisture ingredients & intakes

- The key to controlling P intake is making sure that cows are being offered the actual dry matter pounds of high moisture forages and feeds that have been formulated.
  - Adjust rations accordingly.
- Monitor dry matter intakes
  - Know the refusals



## Monitor dry matters on all high moisture ingredients

- PSU Herd TMR P levels -0.36%
- TMR results (DM basis):

Date - 10/06	P %	P actual lbs.	P required lbs.
Happy Valley (hi CS)	0.40	.22	16
Joppa	0.36	.23	.18
PSU	0.42	.24	.19
Nittany (hi Hlg)	0.36	.17	19
Ag Hill	0.35	.18	.17
Blue & White	0.39	.21	.18

*Avg 130% of required*  
*Avg 103% of required*



## Nutrient Management Triage

- Examine the whole farm - accumulating P
  - **Nutrition**
  - **Amount of P in manure that is in excess of the local crop utilization potential.**
    - Another way to look at the accumulating P on a dairy farm is to evaluate the amount of purchased phosphorus.

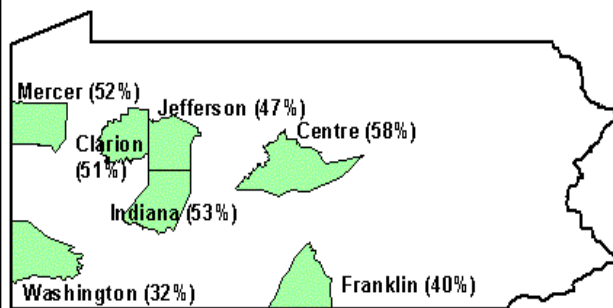


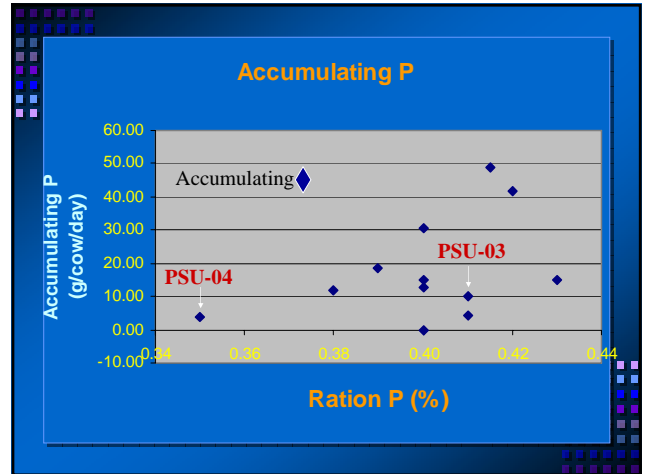
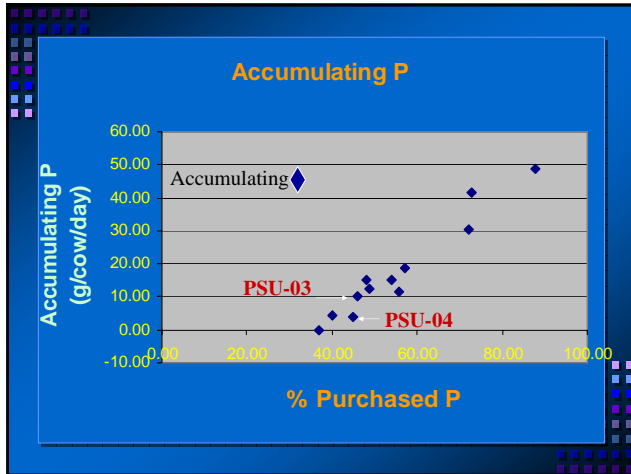
## Nutrient Management Triage

- Data was collected from 11 diverse dairy farms.
- Accumulating P was determined by the difference between total P in the diet, the P in the milk (exported from the farm) and in the home grown crops.




Counties where study farms are located with dairy manure P as a percentage of total manure P.





## Nutrient Management Triage

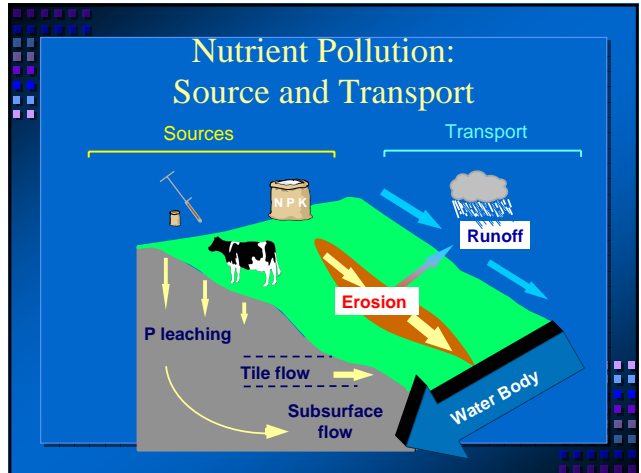
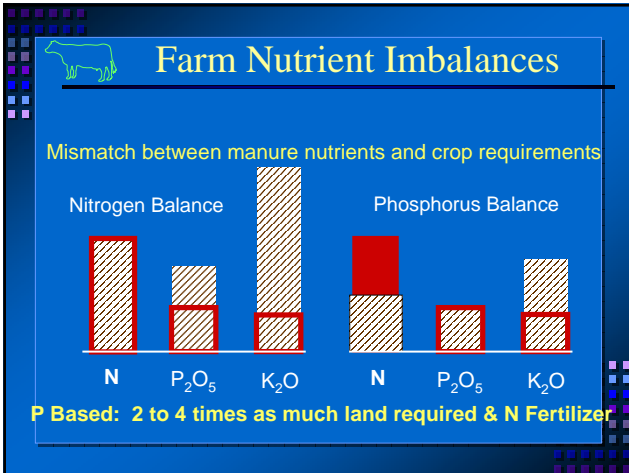
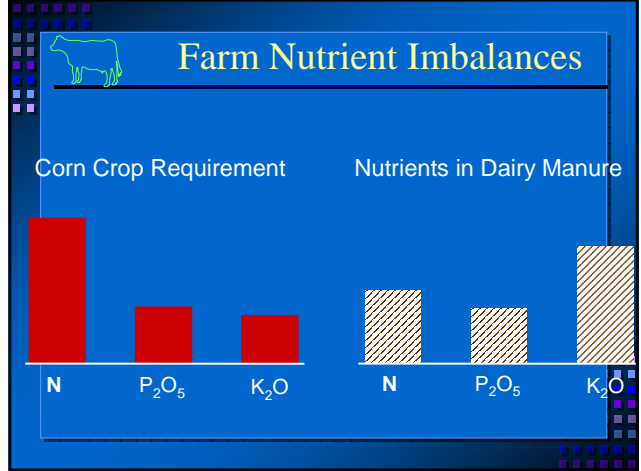


- From these preliminary evaluations, the herds with the highest percentage of purchased P were not feeding the highest ration P levels.
  - Reducing dietary P alone will not solve the nutrient loading problem for herds facing the biggest challenges to comply with more restrictive manure application guidelines.
- Ration P percent alone is not a good criteria to use in deciding if or when to address P in dairy rations.

## Nutrient Management Triage



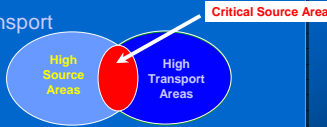
- A better triage
  - Look broadly at the herd and the farm before implementing drastic ration changes.
  - Evaluate purchased P and the amount of P accumulating could be a key to making decisions on a whole farm basis (nutritionally and agronomically) to find the most cost effective solutions.



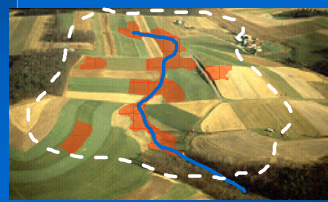
## Phosphorus Management

### Critical source area management

Integrates **Source** and Transport



Identify and manage **Critical Areas** based on P






## Phosphorus Index

### P Source Factors

- Environmental Soil Test P
- P Fertilizer
  - P Fertilizer Rate and Appl. Method
- Organic P
  - Organic P Availability, Rate and Appl. Method


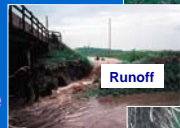
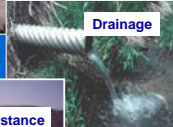
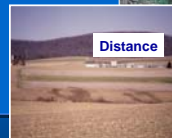
Taken Directly from the N based plan

## Phosphorus Index

### P Transport Factors

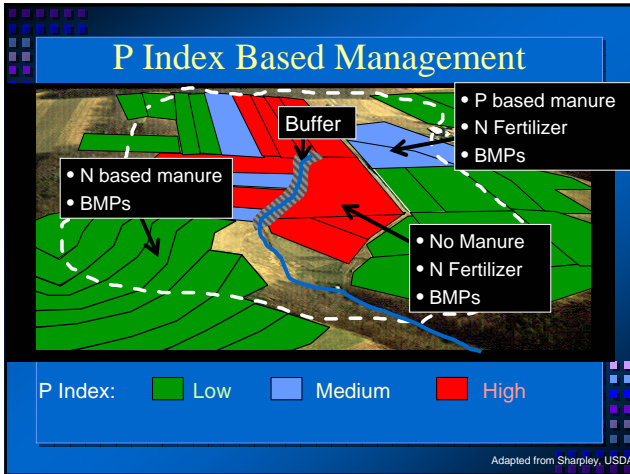
- Soil Erosion
- Runoff Class
- Sub-surface Drainage
- Contributing Distance
- Modified Connectivity







## The PA Phosphorus Index


P Index Interpretation

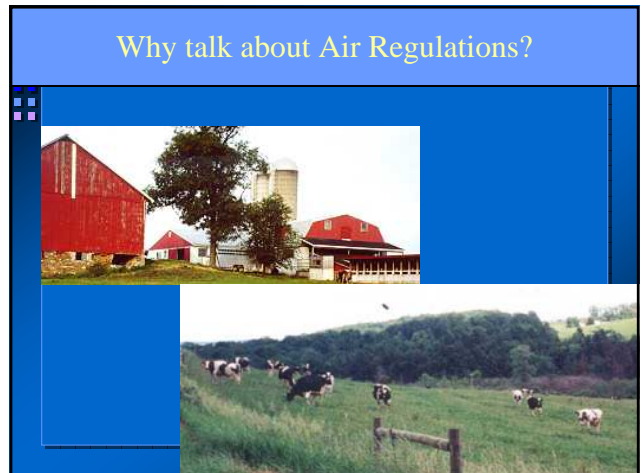
P Index Values	P Index Rating	Mgmt. Guidance
< 59	Low	N based management
60 to 79	Medium	N based management
80 to 99	High	P limited to crop removal
> 100	Very High	No P applied

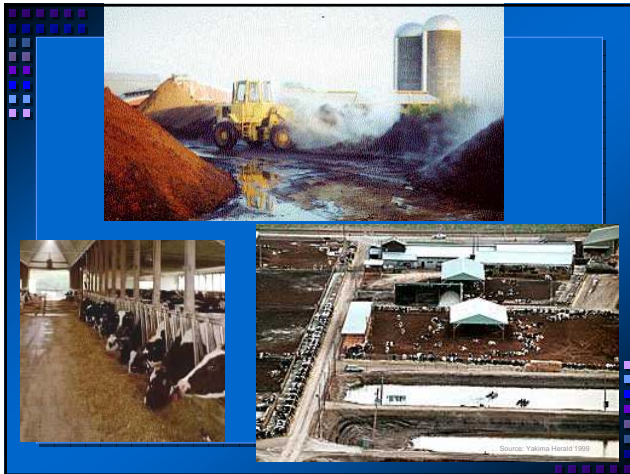


- ### Phosphorus Nutrient Management
- Ultimately we need to move toward nutrient balance
  - Integrate N and P based planning
    - **Work on source reduction**
      - Improve feeding programs
      - Reduce imported P onto farms
      - Options for dealing with excess manure
    - **Minimizing transport**
      - Continue emphasis on BMPs
    - **Critical source area management**
      - P Index
      - Target efforts for maximum effect
- 

### Air Regulations, Ammonia Emissions and Dairy Cattle Nutrition







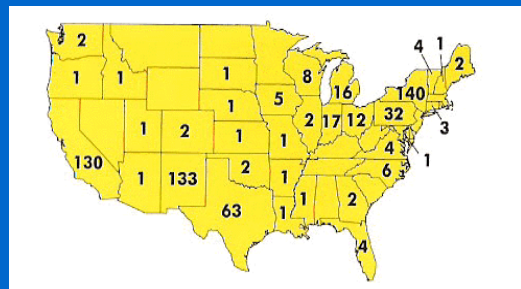
## Air Quality Consent Agreement (AQCA)

- Court decisions have determined that existing federal air regulations apply to AFOs and the *Air Quality Compliance Agreement* is part of EPA's response.
  - EPA has worked with industry representatives and other stakeholders to develop this proposed agreement.
    - Offered to AFOs in the egg, broiler chicken, turkey, dairy and swine industries
  - Currently a gap in scientific data to properly quantify air emissions from AFOs.

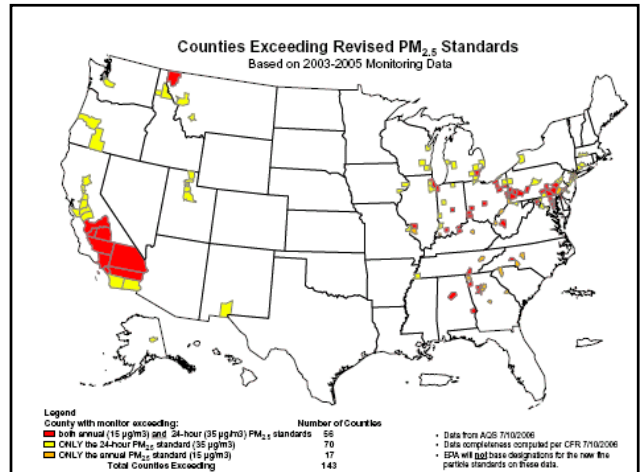
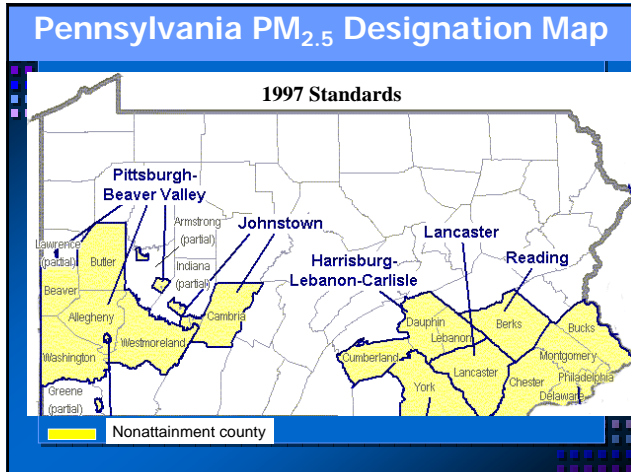
## Primary Goals

- Reduce air pollution
- Ensure compliance with Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Environmental Planning and Community Right-to-Know Act (EPCRA)
  - Hydrogen sulfide and ammonia
    - Exceed 100 lbs in a 24 hour period
    - Worse case scenario - 100 cow dairies

## 600 dairy farms sign the AQCA







### What tools are available to improve N balance on the farm

- Feeding strategies for grains and forages.
  - Minimize the feeding of all haycrop forages.
  - Match protein and CHO sources to optimize N utilization.
  - Improve nitrogen efficiency.

### What tools are available to improve N balance on the farm

- Follow good feeding management practices.
  - Regular testing of forages and concentrates for N and P
  - Monitoring dry matters on high moisture ingredients
  - Measure dry matter intakes
  - Feed bunk management

## What tools are available to improve N balance on the farm



- Protein nutrition
  - Focus on MP, RUP and RDP
    - Get away from balancing for crude protein in rations.
  - Evaluate the use of bypass amino acids.
  - Use MUNs to monitor protein nutrition.

March 2007 Data	BMR-based TMR (60 cows)	Conventional-based TMR Dry matter basis (60 cows)
<b>Animal performance</b>		
DMI - actual	61.0	62.9
DMI - predicted	61.3	61.3
<b>Protein profile<sup>1</sup></b>		
MP required (lbs./day)	6.32	6.32
MP supplied (lbs./day)	6.49	6.47
RDP (lbs./day)	5.96	5.95
RUP (lbs./day)	3.71	3.72
Balance RDP (lbs./day)	+0.15	+0.16
Balance RUP (lbs./day)	+0.20	+0.18
CP- RDP % dry matter	10.2	10.2
CP-RUP % dry matter	6.3	6.4
CP - % DM	16.5	16.5

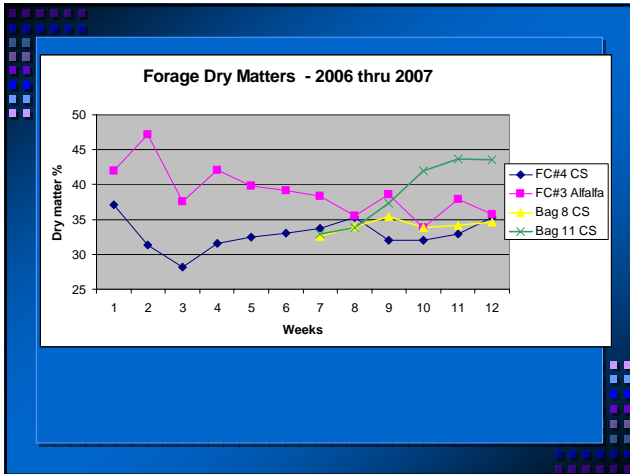
<b>Carbohydrate profile<sup>2</sup></b>		
Sugar, %	8.2	8.2
Starch, %	27.1	26.5
Soluble fiber, %	5.0	5.0
NDF, %	30.9	31.3
NFC, %	43.8	43.5

<sup>1</sup>Protein profile based on the 2001 NRC. MP=metabolizable protein; RDP=rumen degradable protein; RUP=rumen undegradable protein; CP=crude protein.  
<sup>2</sup>Carbohydrate profile based on CPM dairy ration analyzer.

Feed	BMR CS	Conventional CS
	Lbs DM	
BMR CS	19.3	-
Conventional CS	-	19.8
Alfalfa haylage	9.3	9.6
Gras hay/straw combo	4.9	5.1
Corn	8.5	8.0
Cookie	4.2	4.3
Sugar	2.6	2.7
Turbo meal	2.8	2.7
Roasted beans	4.9	5.3
Canola	2.5	3.3
Mineral mix	2.0	2.1
	61.0	62.9
ECM, lbs.	96	98
DME	1.58	1.61
Feed cost, \$/cow	\$4.58	\$4.93
IOFC, \$/cow	\$9.79	\$9.68
MUNS, mg/dl	6.0	7.0

## TMR Analysis (3/29/07)

	BMR CS	Conventional CS
Dry matter, % DM	56.2	51.1
Crude protein, % DM	14.9	15.8
Soluble protein, % CP	35.0	40.4
ADF, % DM	23.0	23.0
NDF, % DM	34.0	34.1
Phosphorus, % DM	0.32	0.33



## More Questions than Answers

**How will emissions be measured?**

**Monitored?**

**What will be the cost of compliance?**

**Are there benefits to controlling emissions on the whole farm?**

## Will Water and Air Policies Mesh?

### It's a Jungle out there!

by HAGEN

So long losers!  
I'm off to India to live like a Goddess...

Hagen Cartoons <http://www.hagencartoons.com>