Dairy Extension

Educating the dairy industry on today's and tomorrow's dairy technologies.

Feeding Dairy Cows
Current Trends and Future Challenges

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Dairy Nutrition Objectives

- Match nutrient requirements of cows with feed nutrients
  - Environmental nutritionist
  - Avoid excess and deficient nutrient feeding
- Optimize cow health and production
- Maximize forage feeding
- Cost efficient

Dairy Ration Overview

% OF DM

40	FORAGES	FIBER Physical & Chemical Protein, minerals, CHO
20	FORAGE, GRAIN OR BYPRODUCTS	Nutrient needs and $
40	CONCENTRATES · CORN · PROTEIN · MINERALS/ADDITIVES	NON-FIBER CHO Starch Protein RDP & RUP Minerals

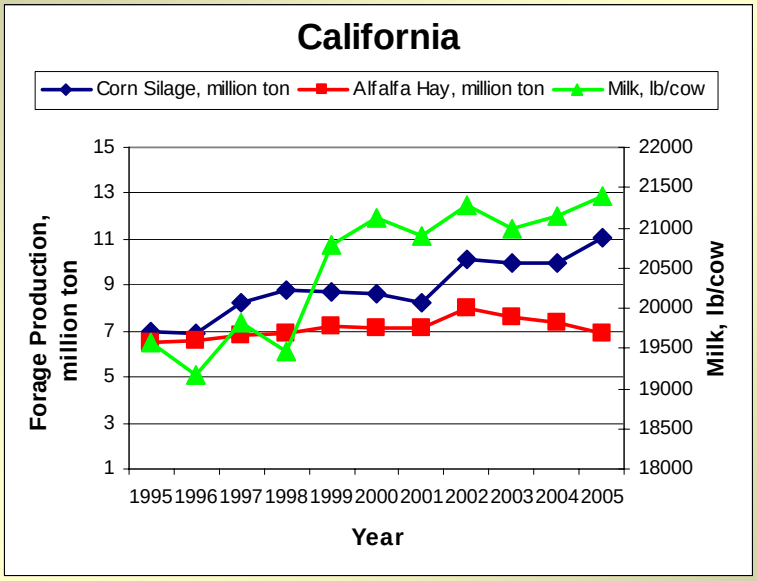
I. Trends in Forage Feeding

Increased Use of Corn Silage in Dairy Cow Diets

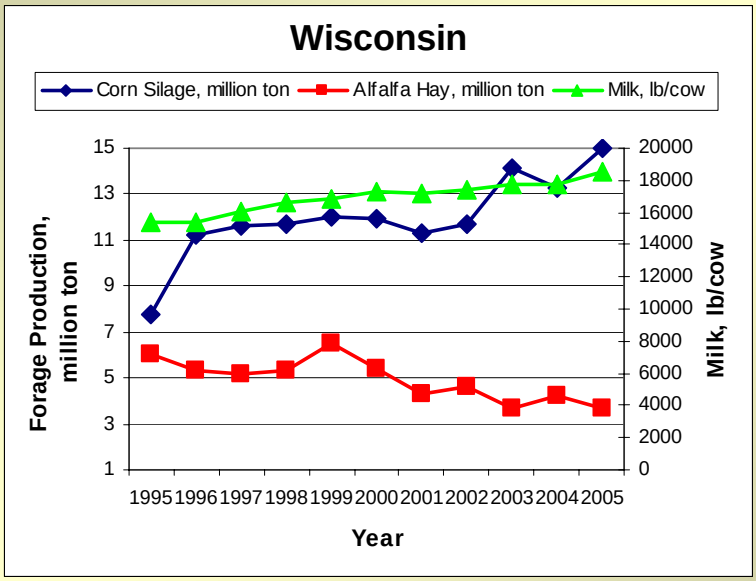
Corn silage vs. alfalfa production

Look at Top 6 States in Milk Production

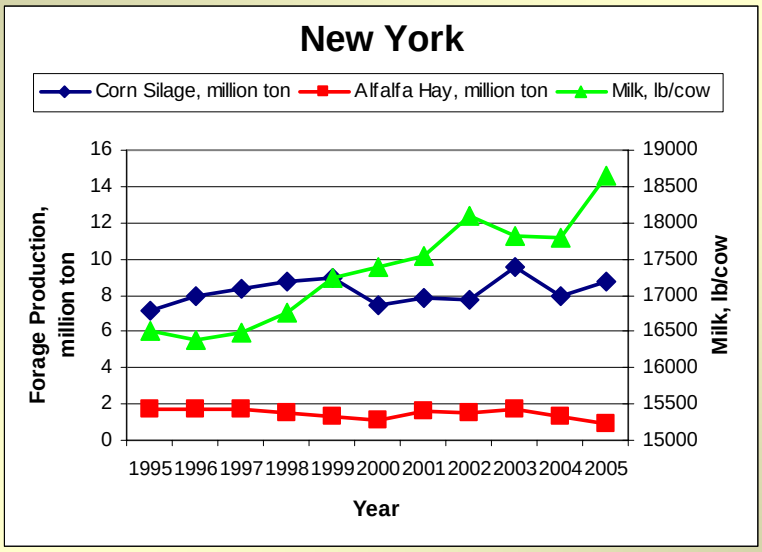
2005 – Ranked #1 in Milk Production



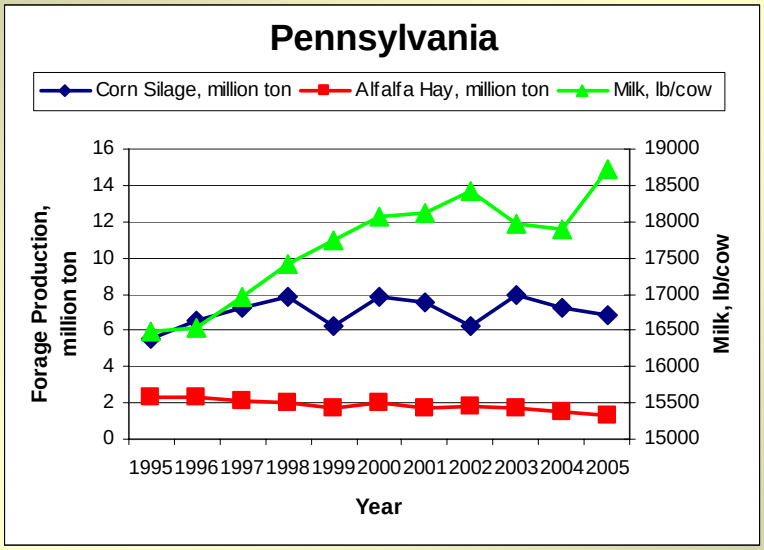
2005 – Ranked #2 in Milk Production



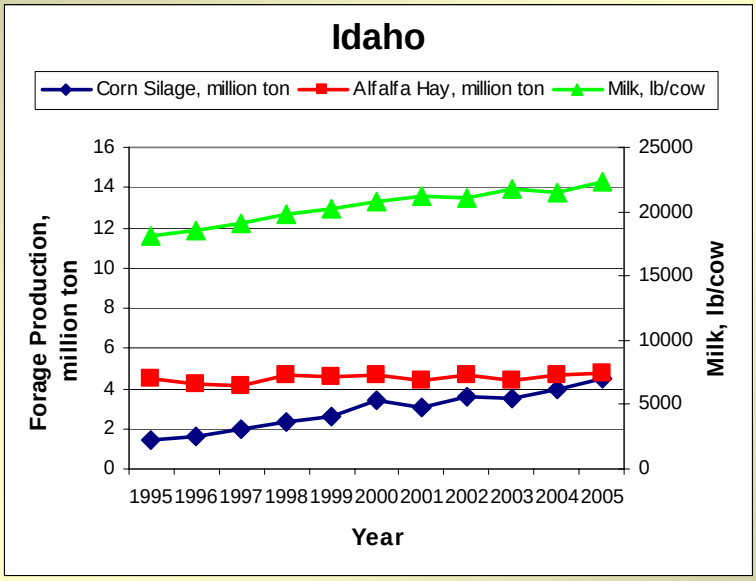
2005 – Ranked #3 in Milk Production



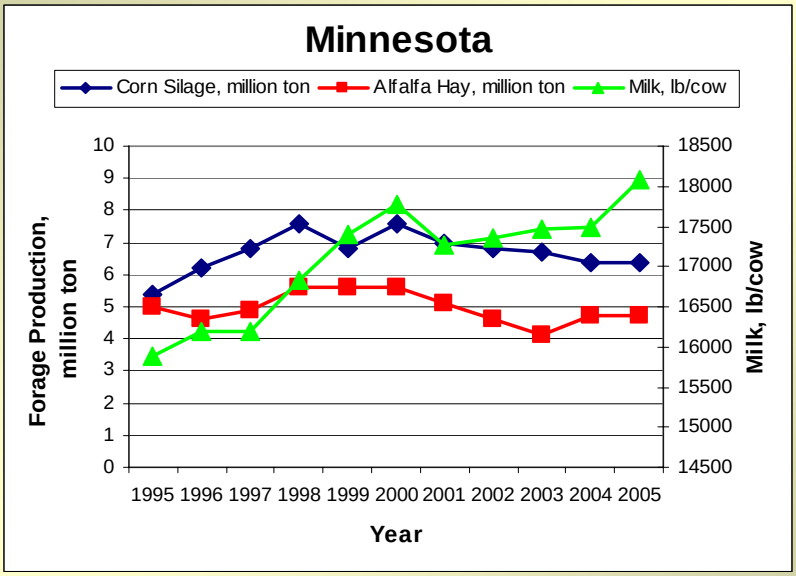
2005 – Ranked #4 in Milk Production



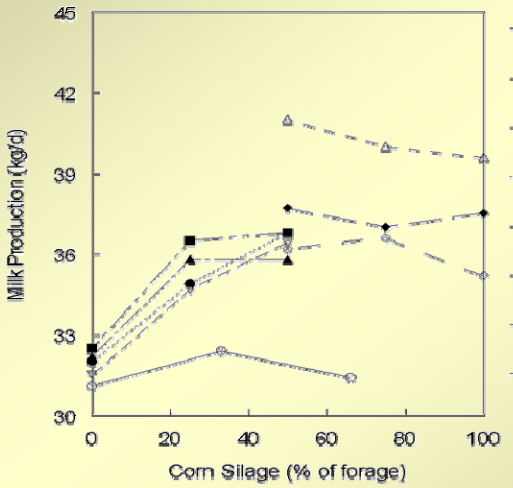
2005 – Ranked #5 in Milk Production



2005 – Ranked #6 in Milk Production



Research Trend – Milk Production Increase with Corn Silage



Dhiman and Satter. 1997. JDS 80:2069.

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Groff and Wu. 2005. JDS 88:3619.

Groff and Wu. 2005. JDS 88:3619.

Groff and Wu. 2005. JDS 88:3619.

Onetti et al. 2002. JDS 85:632.

Onetti et al. 2002. JDS 85:632.

Jung, 2006

Why the Trend for Increased Corn Silage Feeding?

Agronomic Factors

	ALFALFA	CORN SILAGE
Planting	Tri-annual?	Annual
Harvest	3 – 4/year	1/year
process	Cut	Cut/Chop
	Rake/Merge	
	Chop/Bale	
Yield	3.5 Ton/acre[1]	16 Ton/acre[1]

[1] As Fed Basis –2005 USDA National Ag. Stat. Service for (MN stats).

Why the Trend for Increased Corn Silage Feeding?

Feeding Management

	ALFALFA	CORN SILAGE
Silage feed out	Mechanized	Mechanized
TMR feeding		
Silage/Haylage	Easy	Easy
Hay	Process?	
Forage Quality	Variable	Consistent

Why the Trend for Increased Corn Silage Feeding?

Other Considerations

	ALFALFA	CORN SILAGE
Manure	Yes?	Yes
Articles	Journal of Dairy Science	
2002 - 2006	17	52

Increased Use of Straw in Dairy Cow Diets

Nutrient value = <u>low</u>

- Why feed?

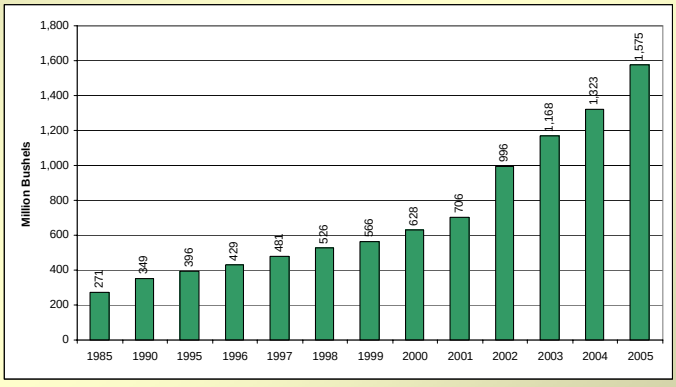
Provides a source of "effective" fiber

- **Corn silage = low to medium effective fiber source**
  - Fed at ~ 2 to 8% DM
  - Chopped to prevent sorting
  - Wheat and barley most common source

II. Trends in Grain Feeding

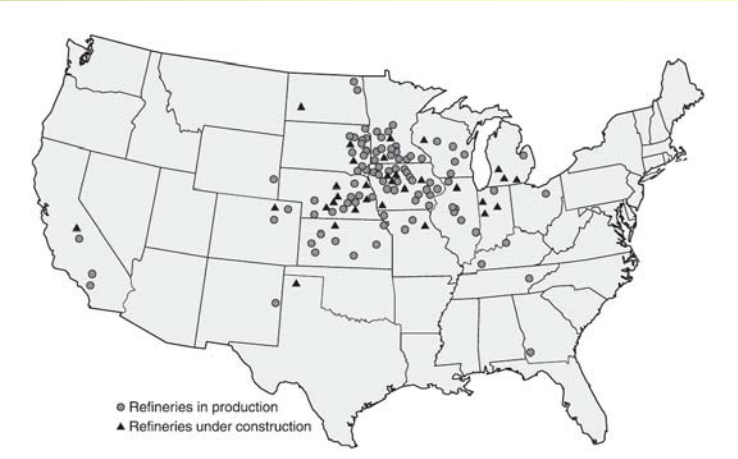
Competition for Grain

Why? – Increased use of corn grain in the ethanol industry



Source: National Corn Growers Association, 2005

Ethanol Plants in the U.S.



2006 – 101 Plants operating, 34 being built and 7 expansions (CAST, 2006)

Future Projections

	2006-07	2007-08	2010-11
Ethanol Prod. (Billion Gallons)	5.9	7.0	9.7
Corn Required (Billion Bushels)	2.11	2.51	3.46
Corn Crop (Billion Bushels)	10.7	11.5	12.5
% of corn crop	19.6 %	21.8 %	27.6 %
Corn Price ($/bushel)	$2.33	$2.54	$2.64

CAST, 2006

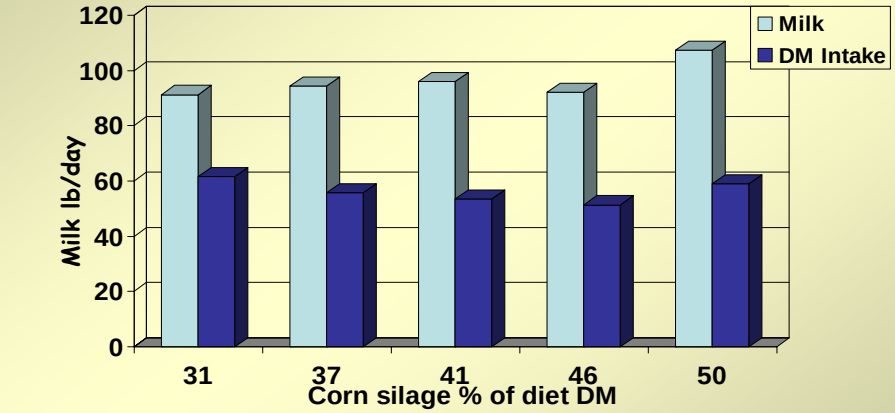
Potential Alternative to Feeding Corn Grain

Feed more corn silage and fewer legumes and grass forages.

Corn Silage
- Fiber Source
- Starch Source

Cows don't need corn grain if they have good corn silage

Production Response to Corn Silage Multiparous Cows – Early Lactation



Corn, %	22	16	12	6	0
Alf hay %	13	→			13

Allen (2001), University of Minnesota

Production Response to Corn Silage Multiparous Cows – Early Lactation

Important Study Details:

- Cows were placed on their respective diet <u>immediately</u> after calving
- As corn grain in the diet was decreased, additional fat was added to diets to achieve an equal energy level to the high corn diet.

III. Trends in Co-Product Feeding

Increased Availability of Co-Products

Why?

Increased production from the ethanol, biodiesel and food industry

- **Can replace some forage or concentrate in the diet**

Limitations to Feeding Co-Products

Starch

- ~ 25% diet DM for top milk production (10-15 lb corn grain/cow)
- Utilized in the ethanol and food industry
- Most co-products have <u>little to no starch</u>

Feed	% starch (as fed)
Corn	62
Beet Pulp, Dry	2
Brewers Grains	10
Corn Gluten Feed	12
Cottonseed	1
Distillers Grains	10
Soybean Hulls	1
Wheat Midds	21

Limitations to Feeding Co-Products

Phosphorus

- Most co-products 2-3x corn
- Feeding P above animal requirements
  - Increased P excretion in manure

Feed	% P (as fed)
Corn	0.27
Beet Pulp, Dry	0.10
Brewers Grains	0.60
Corn Gluten Feed	1.00
Cottonseed	0.60
Distillers Grains	0.70
Soybean Hulls	0.10
Wheat Midds	0.80

Limitations to Feeding Co-Products

Protein

- Most co-products 2-4 x corn
- If co-products replace low CP feeds
  - Rations 18% CP or >
  - Especially if alfalfa major forage in ration
  - Increased N excretion

Feed	% CP (as fed)
Corn	9
Beet Pulp, Dry	9
Brewers Grains	22
Corn Gluten Feed	24
Cottonseed	24
Distillers Grains	28
High Pro Distillers	45
Soybean Hulls	10
Wheat Midds	19

Distillers Grains

Co-product of ethanol industry

1 bushel of corn

- 18 lbs (2.72 gallons ethanol)
- 17 lbs DDGS

Currently 245 lbs distillers/cow in U.S. produced

Nutrient Composition

CP	~ 28% (54% of CP is RUP)
NDF	~ 42%
EE	~ 11%
Starch	~ 10%

How Much Distillers Grains Can We Feed?

n[1]	DG, (% of DM)	DMI, (lb/d)	Milk, (lb/d)	Fat, (%)	Protein, (%)
29	0	48.9^{b}	72.8^{ab}	3.39	2.95^{a}
13	4 to 10	52.2^{a}	73.6^{a}	3.43	2.96^{a}
34	10 to 20	51.6^{ab}	73.2^{ab}	3.41	2.94^{a}
15	20 to 30	50.3^{ab}	73.9^{a}	3.33	2.97^{a}
7	>30	46.1^{c}	71.0^{b}	3.47	2.82^{b}

[1]n= # of treatments included in meta-analysis (24 total studies)

^{ab} Means in columns with different superscripts differ ($P < 0.05$)

Kalcheur et al., 2005

Distillers Grains (DG)

Research (2006-2007) JDS

Limited Research With High Producing Cows

	Control	10% DDGS	20% DDGS	10% WDGS	20% WDGS
Milk, lb/d	87.8	90.2	93.7	93.7	95.9
DMI, lb/d	51.6	50.3	49.6	50.7	48.3
Fat, %	3.23	3.16	3.28	3.55	3.40
Protein, %	3.05	3.01	3.02	3.11	3.06

Anderson et al., 2006

Things to Consider When Feeding DG

- **Nutrient Composition**
  - may be variable
- **Wet DG**
  - can lead to a wet ration (limiting intake)
  - concern in high corn silage diets
- **Energy Value similar for corn and DG**
  - Corn = starch
  - DG = fat

Replacing corn with DG = lower dietary starch levels which may <u>decrease milk yield</u>

Things to Consider When Feeding DG

- DG = does not have 'effective' fiber
  - stimulate rumination and maintain rumen function
- High oil diets can depress milk fat/protein
  - special concern with Rumensin use
- Lysine may be limiting
  - lysine low in corn products
- High P concentration
  - may affect crop nutrient management plans

Economics of Distillers Grain Use

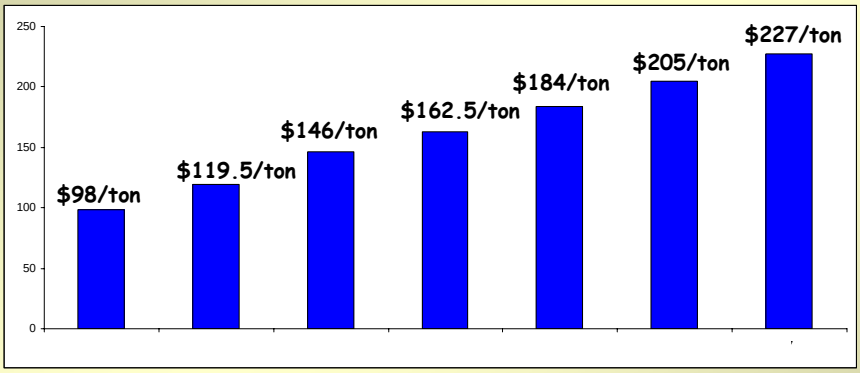
Distillers Grains

- generally replaces corn and soybean meal
- CP (28%) and Energy (0.80 Mcal/lb) ~ same as a 50:50 mix of corn and 47% soybean meal

Therefore, on an energy and CP basis

1 lb DDGS replaces:
0.5 lb corn and 0.5 lb SBM

Break-even Cost of Distillers Grains When Replacing Corn and Soybean Meal (SBM)



Corn*	$2.00	$2.50	$3.00	$3.50	$4.00	$4.50	$5.00
SBM*	$125.0	$150.0	$175.0	$200.0	$225.0	$250.0	$275.0

* Corn = $/bushel, SBM = $/ton

IV. Future Challenges Feeding Dairy Cows

Dairy Nutritionist Survey

MAJOR CHALLENGES

- Forage quality - consistency
- N and P excretion
- Ration formulation – modeling
- Ethanol – starch and distillers grains
- Transition cows
- Fiber digestion
- Milk price and feed cost
- Water availability

Hutjens – 2006 ADSA meeting

Future Challenges for Minnesota Dairy Producers

Co-product use

Forage Programs
- matching forages with feeds fed on farm

Overcoming limitation of co-product use.

Nutrient Excretion

What are we going to do with the nutrients?

Obtaining an Economical Starch Source

- Corn price estimated around $3.00 for next 10 years.
- May reach $4.00-$5.00 at times during 2007.

(Feedstuffs, 2006)

Future Challenges for Minnesota Dairy Producers

On the Horizon

Biodiesel

Future projections:

- U.S. will produce 1 billion gallons of biodiesel within the next 5 years.
- Half will be made from animal fat

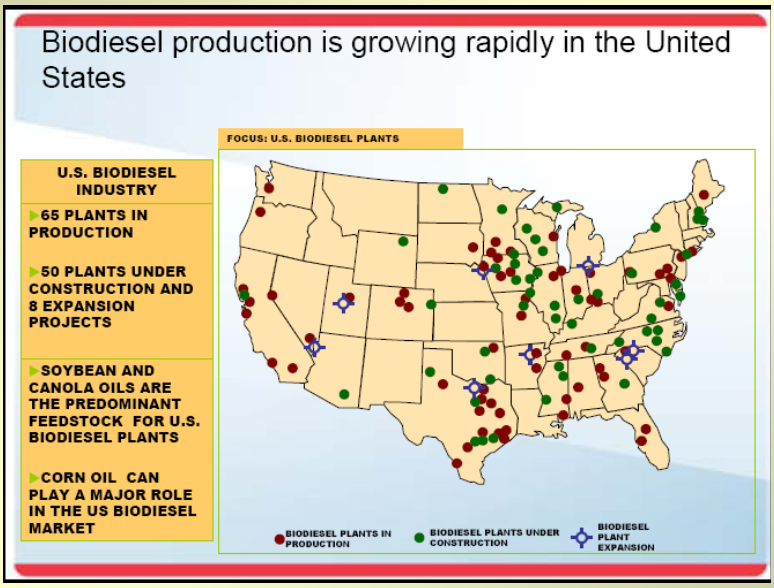
Will this limit the availability of animal fats in livestock diets in the future?

THANK YOU!

http://www.extension.umn.edu/dairy/

"Your father is coming! Quick, put it back in your nose!"

Biodiesel



Hartnell, 2007

Distillers Grains (DG)
Research (2006-2007)

Additional Research with Milk Yield <80 lb/d

Carvalho et al., 2006 – 0, 7 and 14% dried DDGS
- No effect on milk yield (avg =74 lb milk/d)
- No effect on DMI or milk fat %
- Decreased milk protein % (3.12 vs. 2.87)

Kleinschmit et al., 2006 – 20% dried DDGS
- Increased milk yield (69 to 76 lb/d)
- No effect on DMI or milk fat %
- Decreased milk protein % (3.28 vs. 3.21)

Allen (2001)

Diet information:

Leafy Corn silage hybrid

Tallow

1.3 % of diet DM

Megalac

0 to 1.8% of diet DM

NDF

32 to 38% of diet DM

CP

17.6 % across all diets

EE

4.0 to 5.6 % of diet DM

Allen (2001)

Cow information:

Multiparous/Primiparous

n=6 /n=4

Days on Trial

120

Primiparous DMI

45.1 lb/d (P>0.10)

Primiparous Milk Yield

72 lb/d (P>0.10)

BW and BW change

P>0.10 for multiparous and primiparous