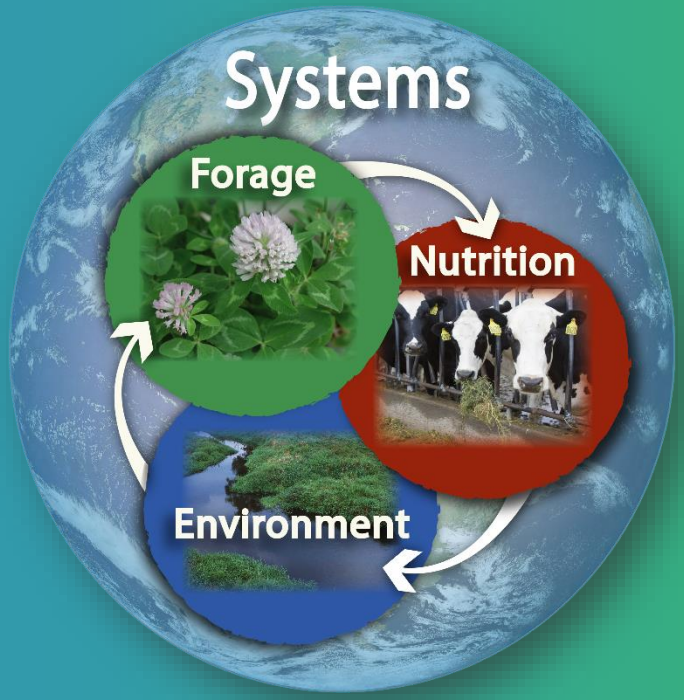
USDA
United States Department of Agriculture

Dairy Nutrition Research Update



Kenneth F. Kalscheur, USDA-ARS

U.S. Dairy Forage Research Center
USDA Agricultural Research Service

Research Projects

1. **Increasing the utilization of forage and fiber in dairy cow diets**

2. **Feed efficiency of lactating dairy cows fed different diets**

3. **Use of canola meal in dairy cow diets**

1. Increasing the utilization of forage and fiber in dairy cow diets

Importance of forages and fiber in dairy cow diets

- **Forages are critical for providing necessary fiber for dairy cow diets**
  - Provides energy
  - Regulates the intake of feed
  - Stimulates chewing, saliva production, and rumination
  - Increases buffering of the rumen
  - Regulates rumen function
  - Provides a source of precursors for milk fat

Reasons to increase forages in diets of lactating dairy cows

1. There is a need to increase animal productivity to meet the increasing demand for animal-sourced food.
2. Increase utilization of feeds that are not in direct competition with human food, monogastric feed, and biofuel feedstock.
3. Lower the cost of the diet.

Fiber

- **Limitation:**
  - High fiber concentration or poor digestibility of fiber limits intake of high producing dairy cow resulting in less than desirable milk production.

Corn silage: Brown mid-rib (BMR) varieties

- BMR mutation reduces lignin concentration
- Characteristic brown mid-rib color on the leaf
- Improvement in digestibility outweighs negative agronomic characteristics (lower yield, potential for lodging, more stressed by drought, and more susceptible to northern corn leaf blight).

- Lower in lignin content, higher in fiber digestibility, results in greater DMI (Holt et al., 2013).

Value of low-lignin alfalfa varieties

- **Wider harvest window?**
- **Later harvest**
  - Greater tonnage per cutting
  - Make use of full growing season
  - Reduce number of cuttings
    - a 15 to 18% lignin reduction means we could harvest 8 to 10 days later
- **Improved forage quality**

Feeding low-lignin alfalfa silage with BMR corn silage

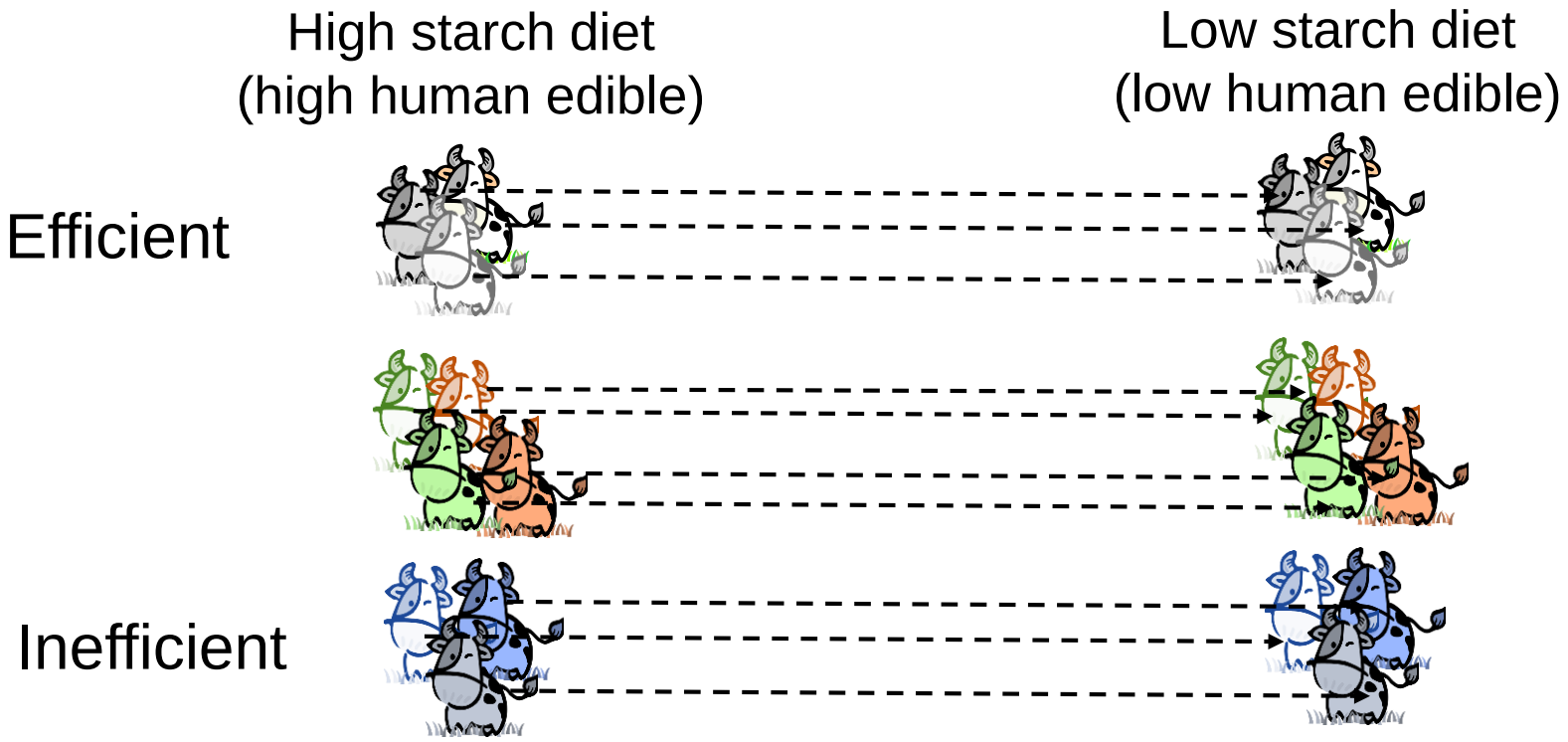
- **Interest to combine both of these varieties to continue to increase silages in diets.**
- **No feeding study data to date.**

2. Feed efficiency of lactating dairy cows fed different diets

On-going project at USDA DFRC

Objective 1

Do the cows **maintain their efficiency** when switching from a **typical high starch diet to a less human edible diet** (high fiber-low starch) ?



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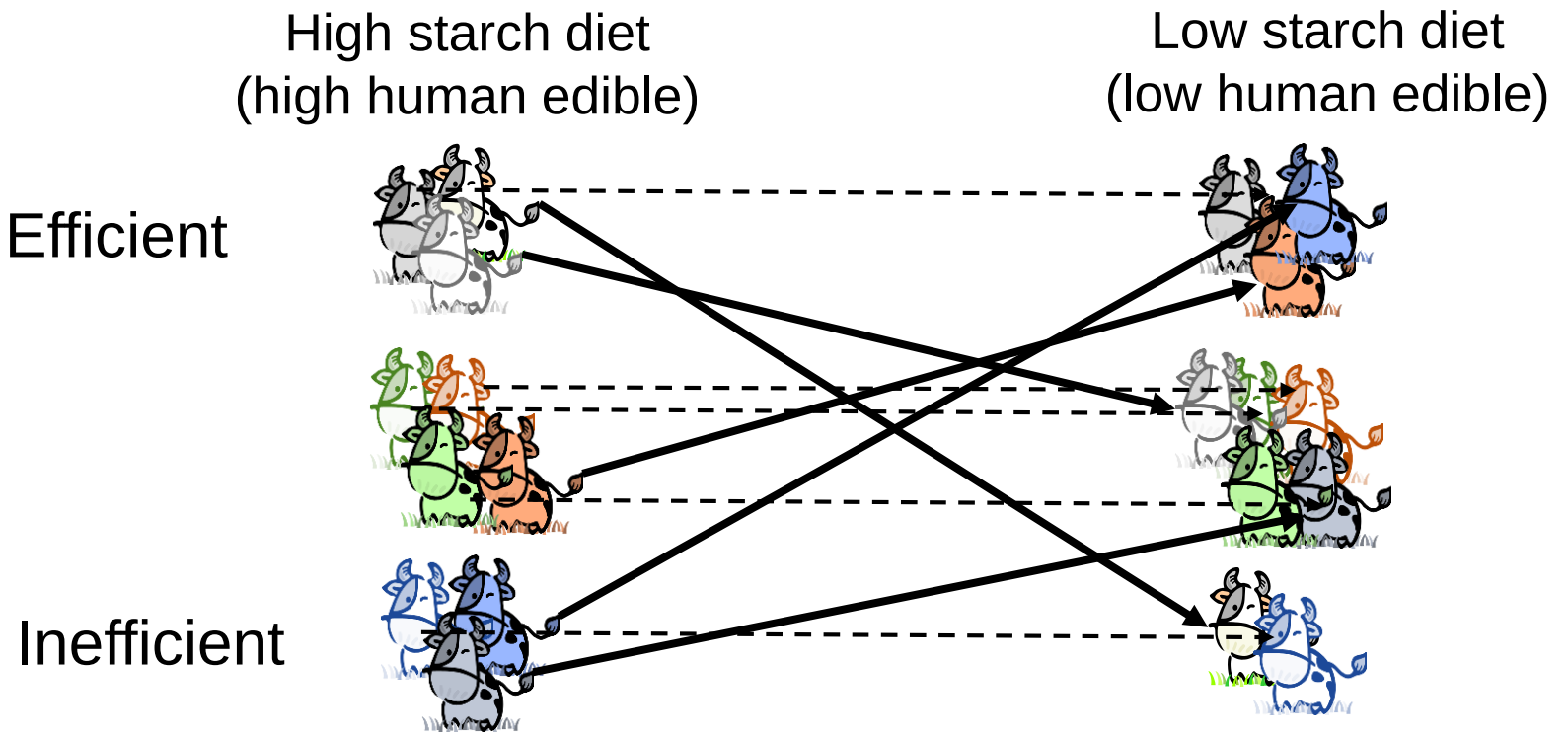
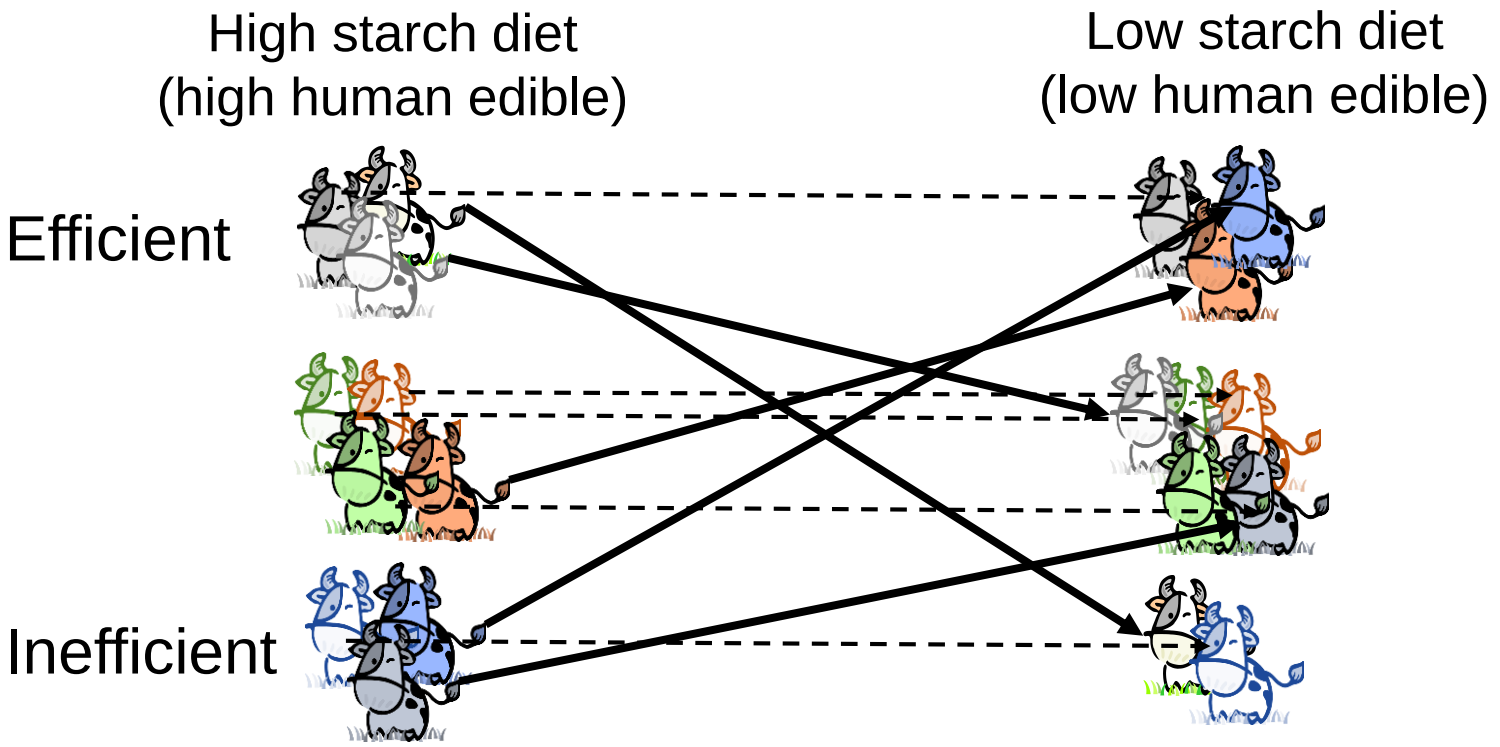


On-going project at USDA DFRC

Objective 2

Why are **some cows able to maintain efficiency and not the others** ?

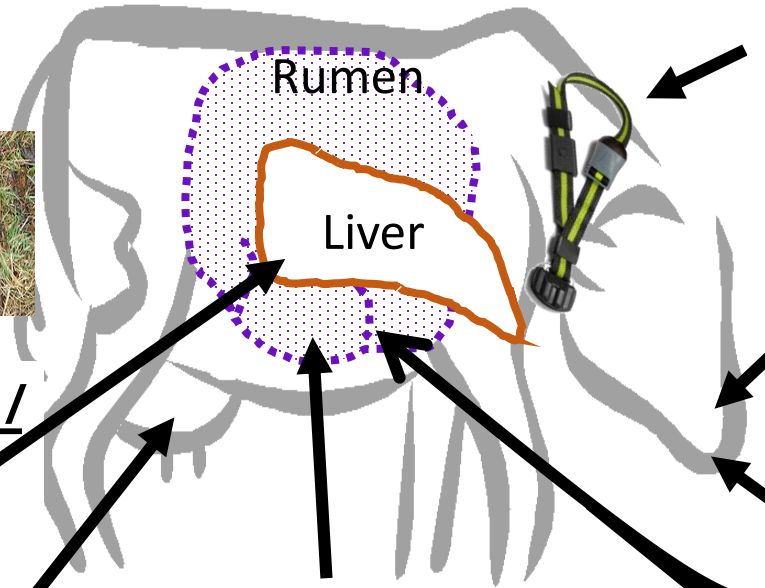


On-going project at USDA DFRC

Objective

Why are **some cows able to maintain efficiency and not the others** ?

Digestibility



Feeding behavior

- Automatic **continuous** recording
- Sorting behavior

Methane/CO2 emissions

Rumen microbiota

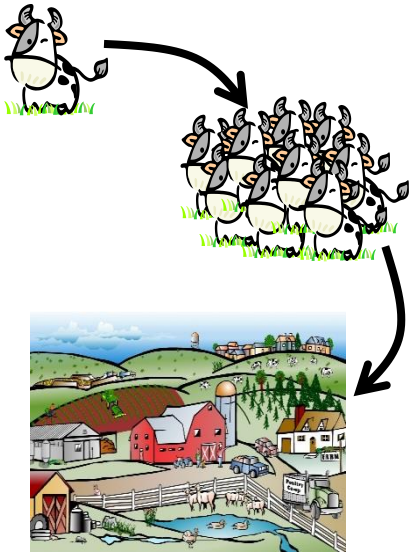
- Buccal swabs
- Rumen liquid + solid samples
- Rumen wall microbiota

Metabolic activity / health

- Blood
- Liver
- Mammary gland

Rumen passage rate

Take home message



- Feed efficiency can be approached **at different levels** (from animal to system)

3. Use of canola meal in dairy cow diets

What is canola meal?

- Variety of rapeseed
- *Brassica* genus
- Co-product of canola oil processing (for human consumption)
- Nomenclature
  - Canola meal
  - Double-low rapeseed meal
- Low in…
  - erucic acid (oil; <2%)
  - glucosinolates (meal; <30µmol/g)

Image source: canoloacouncil.org

Objective

- **Determine the effect of protein source in early lactation on production and utilization of body reserves using canola and soybean meals as the primary sources.**

Materials & Methods

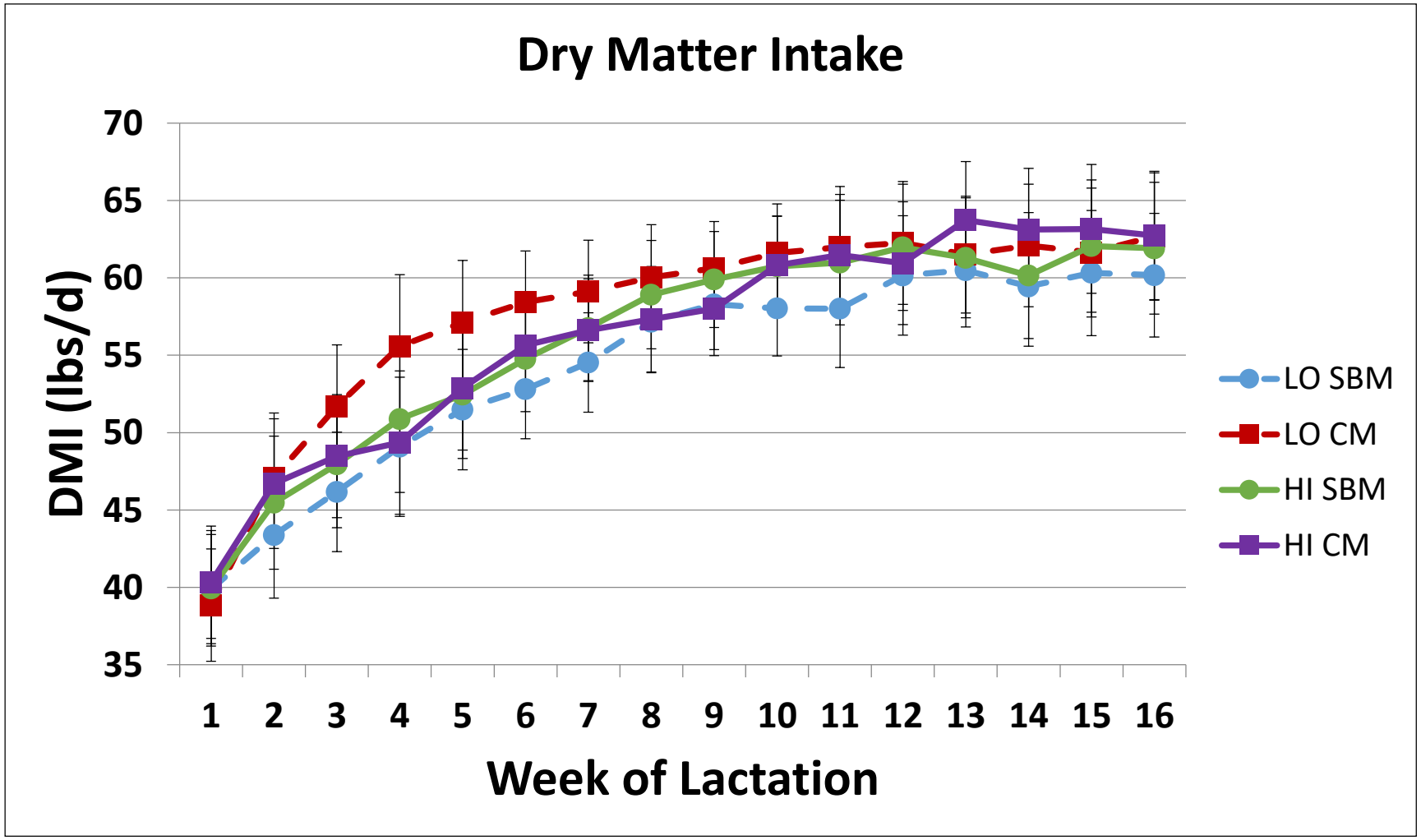
- Multiparous Holstein cows (n = 79)
  - Average parity 2.76 ± 0.87
- Cows received 1 of 4 diets
  - Low protein (16% CP) – Soybean meal diet
  - Low protein (16% CP) – Canola meal diet
  - High protein (18% CP) – Soybean meal diet
  - High protein (18% CP) – Canola meal diet
- Cows received same diet for first 16 weeks of lactation

DMI tended to be greater for cows on CM diets

	LO		HI			*P*<		
Item	**SBM**	**CM**	**SBM**	**CM**	**SEM**	**CP**	**S**	**CP X S**
DMI, kg/d	24.6	26.1	25.4	25.6	0.49	0.87	0.09	0.17
Milk yield, kg/d	50.1	54.8	52.3	56.5	1.41	0.16	<0.01	0.83
FCM, kg/d	50.7	54.8	51.3	55.1	1.36	0.73	<0.01	0.90
ECM, kg/d	53.1	57.4	54.1	57.8	1.38	0.61	<0.01	0.87
Feed Efficiency	2.16	2.22	2.17	2.31	0.06	0.34	0.06	0.52

CM > SBM : 0.80 ± 0.34 kg/d

DMI tended to be greater for cows on CM diets

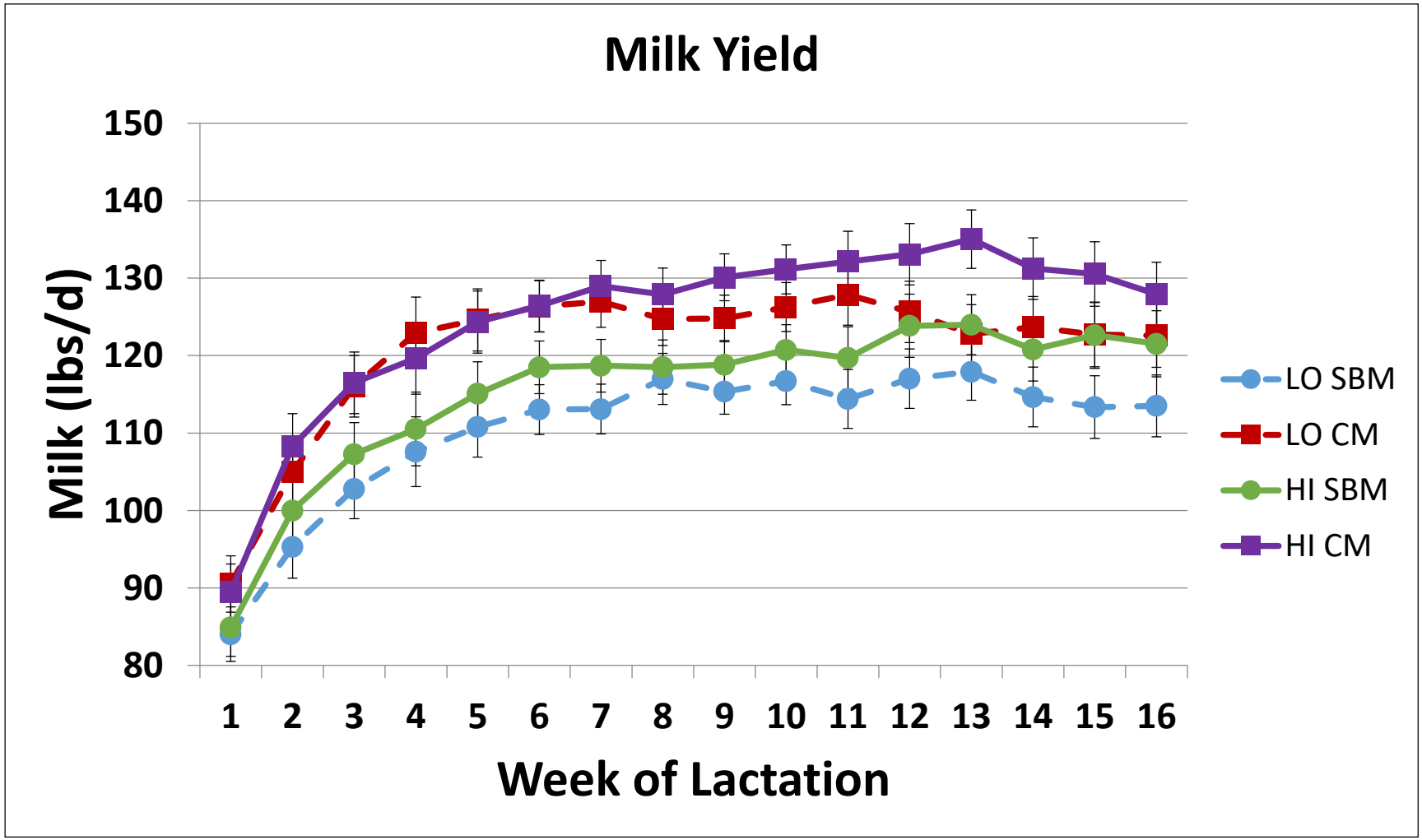


Cows fed CM diets had greater milk yield

	LO		HI			*P*<		
Item	**SBM**	**CM**	**SBM**	**CM**	**SEM**	**CP**	**S**	**CP X S**
DMI, kg/d	24.6	26.1	25.4	25.6	0.49	0.87	0.09	0.17
Milk yield, kg/d	50.1	54.8	52.3	56.5	1.41	0.16	<0.01	0.83
FCM, kg/d	50.7	54.8	51.3	55.1	1.36	0.73	<0.01	0.90
ECM, kg/d	53.1	57.4	54.1	57.8	1.38	0.61	<0.01	0.87
Feed Efficiency	2.16	2.22	2.17	2.31	0.06	0.34	0.06	0.52

CM > SBM : 4.45 ± 0.97 kg/d

Cows fed CM diets had greater milk yield

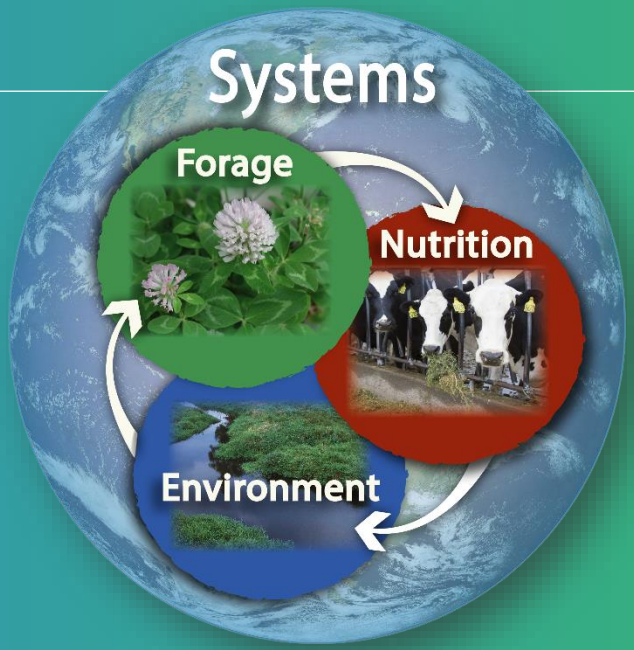


Tendency for CM fed cows to be more efficient

	LO		HI			*P*<		
Item	**SBM**	**CM**	**SBM**	**CM**	**SEM**	**CP**	**S**	**CP X S**
DMI, kg/d	24.6	26.1	25.4	25.6	0.49	0.87	0.09	0.17
Milk yield, kg/d	50.1	54.8	52.3	56.5	1.41	0.16	<0.01	0.83
FCM, kg/d	50.7	54.8	51.3	55.1	1.36	0.73	<0.01	0.90
ECM, kg/d	53.1	57.4	54.1	57.8	1.38	0.61	<0.01	0.87
Feed efficiency	2.16	2.22	2.17	2.31	0.06	0.34	0.06	0.52

CM > SBM : 0.10 ± 0.04

QUESTIONS?



Leading the world in integrated dairy forage systems research.

U.S. Dairy Forage Research Center

www.ars.usda.gov/mwa/madison/dfrc

Methods to improve NDF digestibility to increase silage utilization in dairy cow diets

- **Physical treatments**
  - Chopping, shredding, grinding, pelleting, steaming
- **Biological treatments**
  - Enzymes, inoculants, yeast, fungi
- **Chemical treatments**
  - Acids, hydrolyzing alkalis
- **Genetic technologies**
  - Variety selections available to producers