

## Fat Feeding

Some slides adapted from Dairy Nutrition & Management (ANSCI 200/492), University of Illinois at Urbana-Champaign, Dr. Jim Drackley & Mike Hutjens

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Base ration components (forages and grains) will average about 3% fat.

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## Use Supplemental Fats

1. Increase diet energy density while maintaining adequate fiber content
2. Improve energetic efficiency
3. Improve energy balance
4. Improve reproduction

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	<b>Ground Corn</b>	<b>Fat</b>	<b>Fat/Corn</b>
	<b>(Mcal/lb)</b>		
Gross energy	1.90	4.30	2.25
Digestible energy	1.70	3.31	1.95
Metabolizable energy	1.52	3.31	2.18
Net energy	0.89	2.70	3.00

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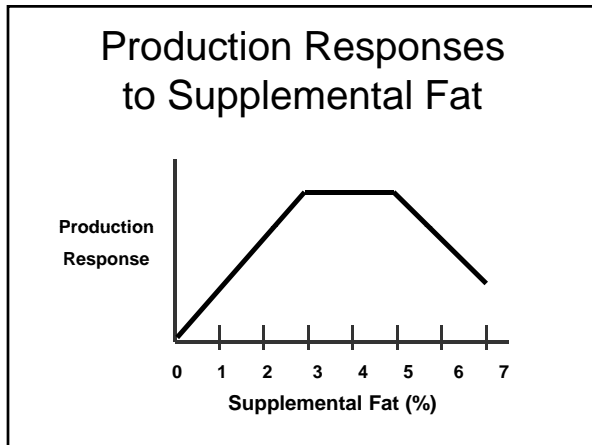
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### DIETARY FAT AND MILK COMPOSITION

- Milk fat:
  - Dietary fat may increase 0.1 to 0.3%
    - (If rumen fermentation is not disrupted)
  - Yield often increased
- Milk protein:
  - Dietary fat may decrease 0.1%
  - Yield usually unchanged
    - dilution of protein production as milk yield increases

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## Sources of Fat in Diets for Dairy Cows

1. Basal ingredients (forages, grains)
2. High-fat by-product feeds
3. Oilseeds
4. Animal fats
5. Granular (inert) fats

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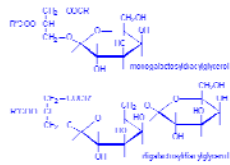
## Dietary Lipids



Triglycerides



Phospholipids



Glycolipids

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## Properties of Fat that Need to be Considered

- Digestibility
  - Post-ruminal digestion and absorption
- Palatability and effects on intake
- Ruminal inertness
  - Saturated vs. unsaturated

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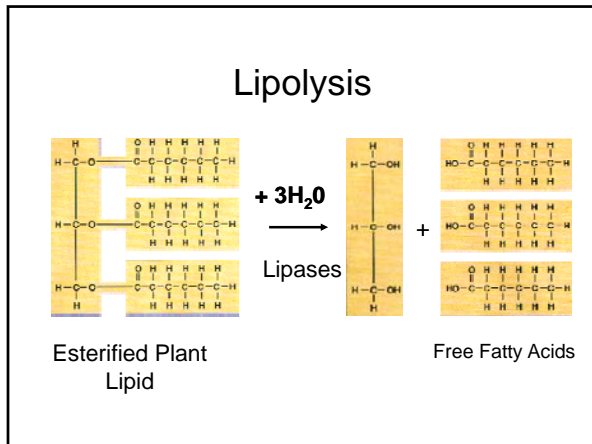
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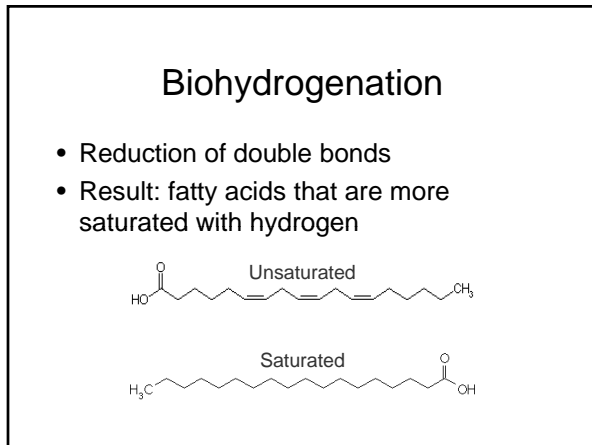
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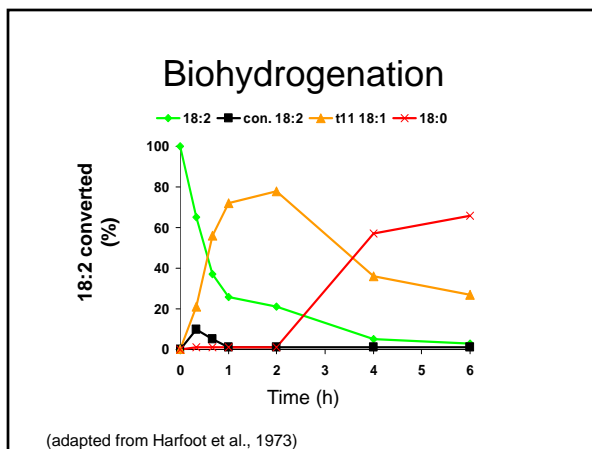
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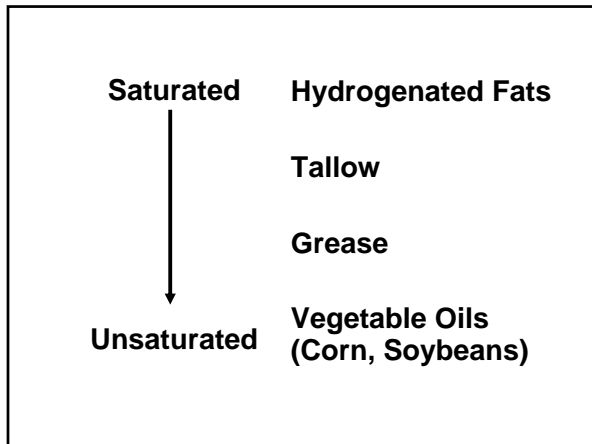
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**Fatty Acid Content**

- High energy component of fat
- 5 – 8 common fatty acids
- Energy content is ~9.4 kcal/g
- Amount of fatty acids in fat supplement is important in determining energy value of supplement

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**Diet**

Fatty acid	Alfalfa hay	Grass pasture	Soybean (seed)	Corn (seed)
(Weight %)				
Myristic C <sub>14:0</sub>	0.9	1.1	...	...
Palmitic C <sub>16:0</sub>	33.9	15.9	12.4	14.3
Palmitoleic C <sub>16:1</sub>	1.2	2.5	...	0.1
Stearic C <sub>18:0</sub>	3.8	2.0	3.7	1.9
Oleic C <sub>18:1</sub>	3.0	3.4	25.4	39.0
Linoleic C <sub>18:2</sub>	24.0	13.2	50.6	43.5
Linolenic C <sub>18:3</sub>	31.0	61.3	7.9	1.1

(Palmquist and Jenkins, 1980)

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## Fat Supplements

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- ### Advantages of Oilseeds
1. Provide other key nutrients (protein, digestible fiber)
  2. Economical
  3. Ease of handling (except cottonseed)
  4. Slow release of oil in rumen

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### Fat Content and Feeding Rates of Oilseeds

Type	Fat content	Maximum lb to feed daily
Cottonseed	18 - 20%	4 to 6
Soybeans	18 - 20%	3 to 5
Canola	40 - 55%	2 to 3
Sunflower	38 - 50%	2 to 3
High oil corn	6.5 - 10%	-----

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## Types of Feed-Grade Fats

- Tallow
- Choice white grease
- Yellow grease
- Blended animal and vegetable fats

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## Feed-grade Commodity Fats

### Advantages:

1. Low cost (\$.25 to .30 per pound)
2. High-quality fats are acceptably inert in rumen and are highly digestible

### Disadvantages:

1. Handling and mixing difficult
2. Quality control - variable
3. Low-quality fats can disrupt fiber digestion, decrease intake, decrease milk fat percentage

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## Quality Standards for Tallow

- The more saturated, the better
  - Iodine value (IV) < 50  
prefer 38 to 45
- Free fatty acids < 5%

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## Commercial Granular Fats

- Advantages:
  1. Easy to handle and mix
  2. Quality control
  3. Few effects in rumen
- Disadvantages:
  1. High cost (\$ .35 to .45 per pound)
  2. Some are less digestible

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## Relative Digestibility of Commercial Fats (Highest to lowest)

Type of fat	Product names	Percent fatty acids
Calcium salts of fatty acids	Megalac, EnerGII	80
Saturated free fatty acid pills	Energy Booster	99
Palm fatty acid distillates	Biopass	95

72-78% digestible

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## Choose Fat Sources on the Basis of:

1. Cost
2. Convenience
3. Characteristics of fat

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### How Much Fat Should Be Fed?

Thumb rule #1:

**Total fat fed = milk fat produced**

Example:

**90 lbs milk, 3.5% fat = 3.15 lbs fat**

**50 lbs feed DM, 3% fat = 1.5 lbs basal fat**

So, could supplement 1.5 to 1.65 lbs fat

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### How Much Fat Should Be Fed?

Other thumb rules for maximums:

- up to 8% total fat in diet DM
- up to 5% supplemental fat
- 1 pound commodity fat, .5 to 1 pound of granular (inert) fat

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### Production Responses to Supplemental Fat



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What is an Economical Amount of Fat to Feed?

- Up to 3% of total diet DM or 1.5 pounds per cow daily
- If high corn silage, up to 2.5% of total DM or 1.25 pounds

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Other Considerations

- Reproduction
- Milk fat depression
- Consumer health

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Reproduction

- ↑ conception and pregnancy rates
- ↓ days open
- Provide additional energy?
- Energy independent response
  - PUFA used in prostaglandin synthesis

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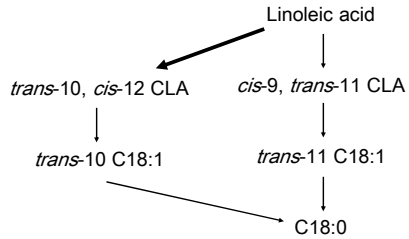
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## Milk Fat Depression



Need change in rumen fermentation (lower pH) and PUFA

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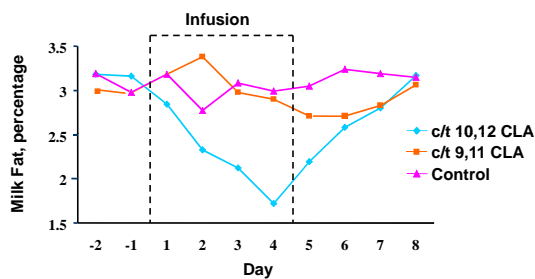
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## Effect of CLA isomers on milk fat %



Baumgard et al. (2000)

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## Human Health

- Milk fatty acids
  - ~70% saturated, ~30% unsaturated
  - Oleic acid makes up ~70% of unsaturated fatty acids

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## Human Health

- CLA
  - Anticarcinogen
  - Antioxidant
  - Antiatherosclerosis

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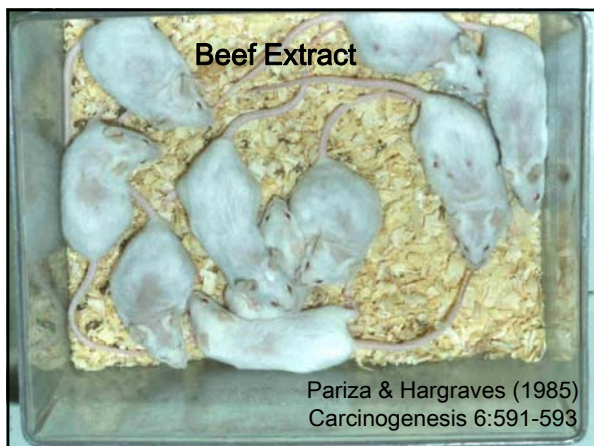
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## Human Health

- CLA content of milk can be enhanced through dietary means
- Increase in CLA arises from inhibition *trans*-11 18:1 reduction
- Enriched CLA milk associated with increased *trans* fatty acid content
  - Might not be advantageous for the industry
- CLA could be a management tool

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