# Feeding byproducts of bio-diesel production (canola & sunflower oil meals & glycerol) to dairy cows

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# Average Nutrient Composition

| DM basis | SB | SBM exp. | CNL | CNM mech. | SFL | SFM *solv.* |
|---|---|---|---|---|---|---|
| CP, % | 39.2 | 46.3 | 20.5 | 37.8 | 19.2 | 28.4 |
| RUP, % of CP | 30 | 69 | 21 | 36 | 11 | 16 |
| Fat, % | 19.2 | 8.1 | 40.5 | 5.4 | 41.9 | 1.4 |
| NEL, Mcal/lb. | 1.25 | 1.08 | 1.60 | 0.80 | 1.54 | 0.63 |
| NDF, % | 19.5 | 21.7 | 17.8 | 29.8 | 24.0 | 40.3 |
| P, % | 0.60 | 0.66 | 0.68 | 1.10 | 0.51 | 1.00 |

**NRC-01**

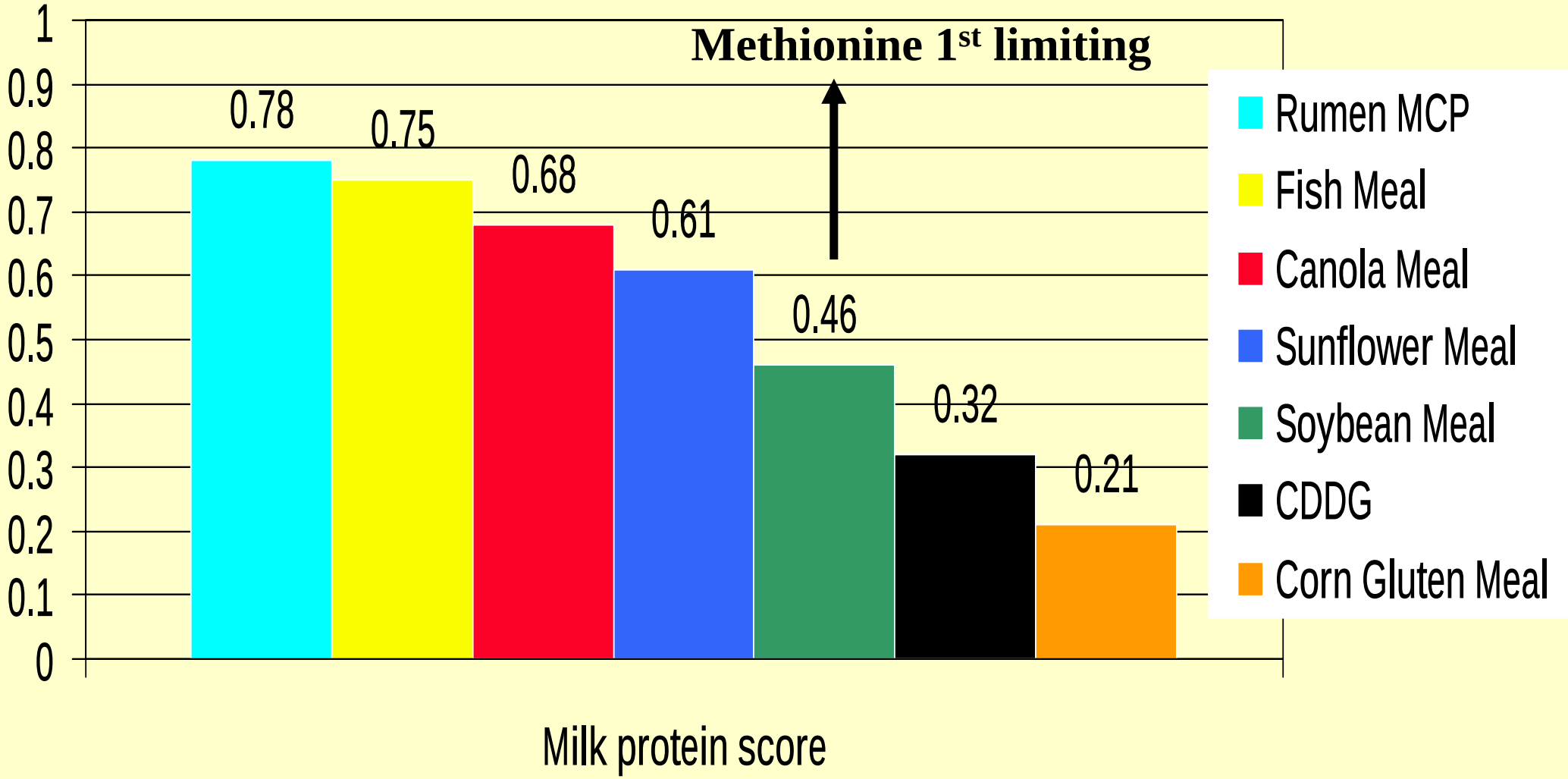
# Nutrient Composition Variation

| DM basis | SBM exp. | CNM mech. | SFM *solv.* |
|---|---|---|---|
| CP, % Avg. | 46.3 | 37.8 | 28.4 |
| StDev | 3.2 | 1.1 | 5.0 |
| n | 546 | 230 | 48 |
| Fat, % Avg. | 8.1 | 5.4 | 1.4 |
| StDev | 3.2 | 5.5 | 2.3 |
| n | 473 | 71 | 36 |
| NDF, % Avg. | 21.7 | 29.8 | 40.3 |
| StDev | 8 | 6.6 | 6.6 |
| n | 70 | 81 | 16 |

**NRC-01**

# Relative Amino Acid Quality of CP Supplements

## Milk protein score (Schingeothe, SDSU, 1991)



# Lactation response to high-RUP canola meal

## Rode, Ag Canada, Lethbridge, Alberta

| Item | 0 | 33 | 67 | 100 |
|---|---|---|---|---|
| CSM solv. (% of DM) | 15% | 10% | 5% | 0% |
| AB Gold[a] (% of DM) | 0% | 5% | 10% | 15% |
| DMI, lb./d | 41 | 42 | 44 | 45 |
| Milk, lb/d | 64 | 66 | 65 | 70 |

**[a]2.1% fat & 55%-70% RUP product**

# Lactation response to high-RUP canola meal

## Rode, Ag Canada, Lethbridge, Alberta

| Item | 0 | 33 | 67 | 100 |
|---|---|---|---|---|
| Milk fat, % | 3.3 | 3.4 | 3.5 | 3.3 |
| lb/d | 2.0 | 2.2 | 2.3 | 2.1 |
| Milk CP, % | 2.8 | 3.1 | 3.2 | 2.9 |
| lb/d | 1.8 | 2.0 | 2.1 | 1.9 |

# Solvent Sunflower Meal vs. Soybean Meal

## Schingoethe et al., 1977, JDS

| Item | SBM | SFM |
|---|---|---|
| SBM solv. (% of DM) | 8% | -- |
| SFM solv.[a] (% of DM) | -- | 12% |
| DMI, lb./d | 39 | 39 |
| Milk, lb/d | 47 | 47 |

[a]2.0% fat

# Single-sample nutrient composition of local products

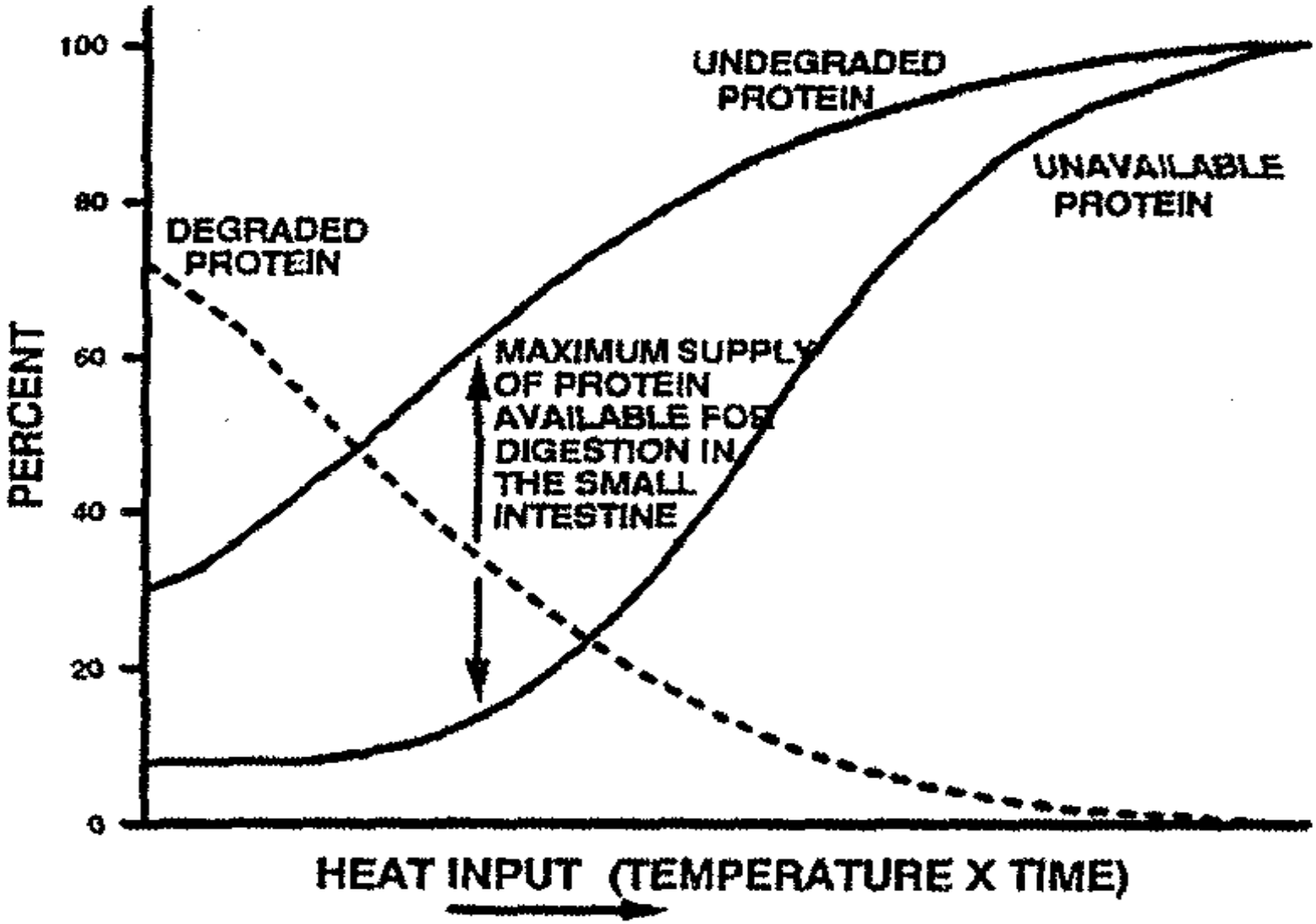
| DM basis | Canola Meal 03/10/06 MARS | Sunflower Meal 05/01/06 CTL |
|---|---|---|
| CP, % | 36.9 | 25.2 |
| RUP, % of CP | ? | ? |
| Fat, % | 14.1 | 23.5 |
| TDN[a], % | 94 | 88 |
| NDF, % | 16.5 | 31.5 |
| P, % | 1.02 | 0.80 |

[a]Calculated using NRC-01 summative equations

# Two-sample nutrient composition of local SFM product

| DM basis | Sunflower Meal 05/01/06 CTL | Sunflower Meal 09/01/06 MARS |
|---|---|---|
| CP, % | 25.2 | 23.6 |
| RUP, % of CP | ? | ? |
| Fat, % | 23.5 | 19.0 |
| TDN[a], % | 88 | 85 |
| NDF, % | 31.5 | 30.6 |
| P, % | 0.80 | 0.79 |

[a]Calculated using NRC-01 summative equations




**Source: Van Soest text book**

# Saturated vs. Unsaturated

- Myristic C14:0
- Palmitic C16:0
- Stearic C18:0

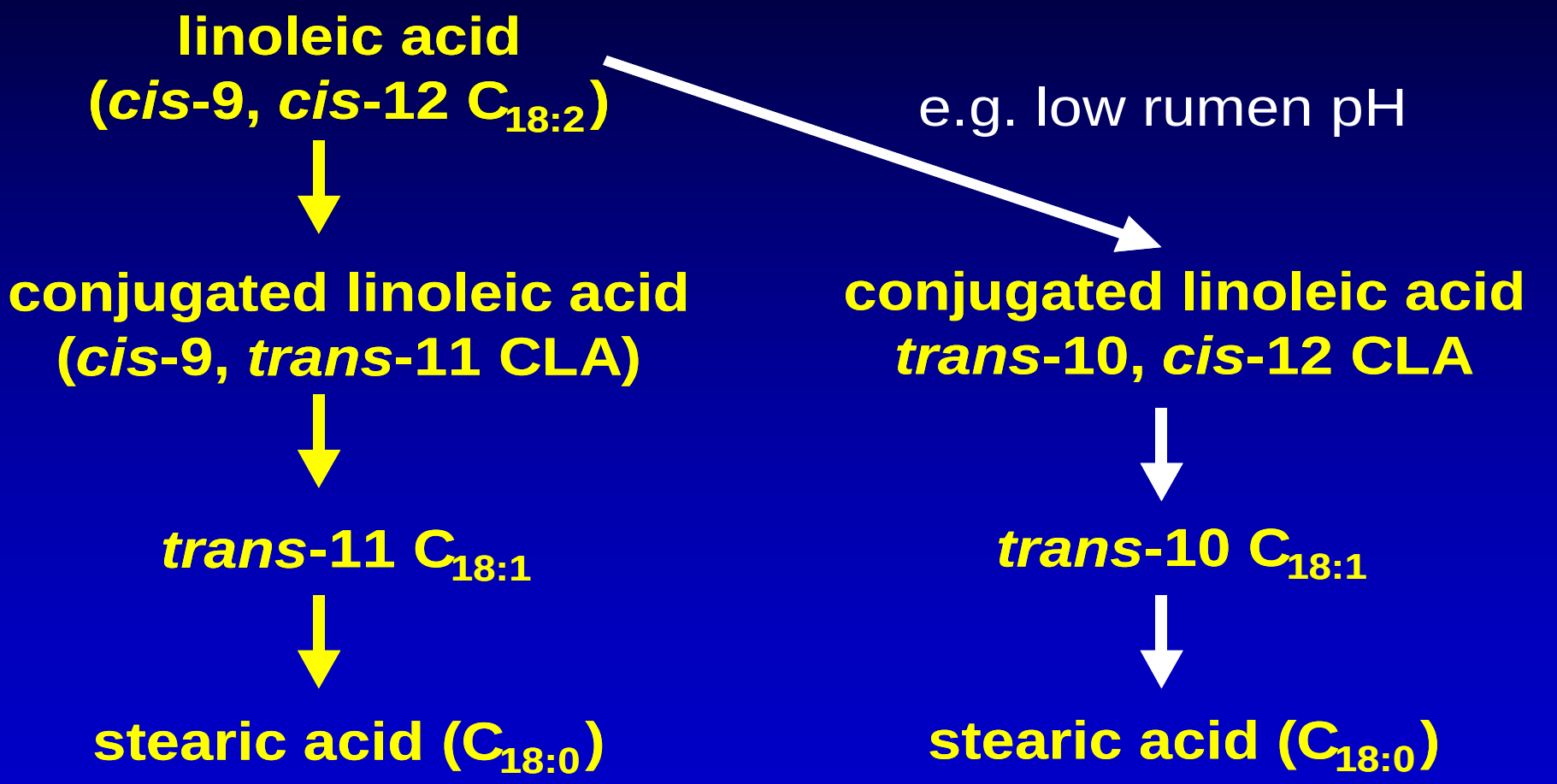
- Palmitoleic C16:1
- Oleic C18:1
- Linoleic C18:2
- Linolenic C18:3
- Eicosapentaenoic acid C20:5

Source: Tom Overton, Cornell Univ.

# Fatty Acid Composition

| | 16:0 | 18:0 | 18:1 | 18:2 |
|---|---|---|---|---|
| | % of Fat | | | |
| Soybeans | 11 | 4 | 24 | 54 |
| Cottonseed | 25 | 3 | 17 | 54 |
| Canola | 5 | 2 | 56 | 24 |
| Sunflower | 7 | 5 | 29 | 58 |
| Tallow | 24 | 24 | 42 | 5 |

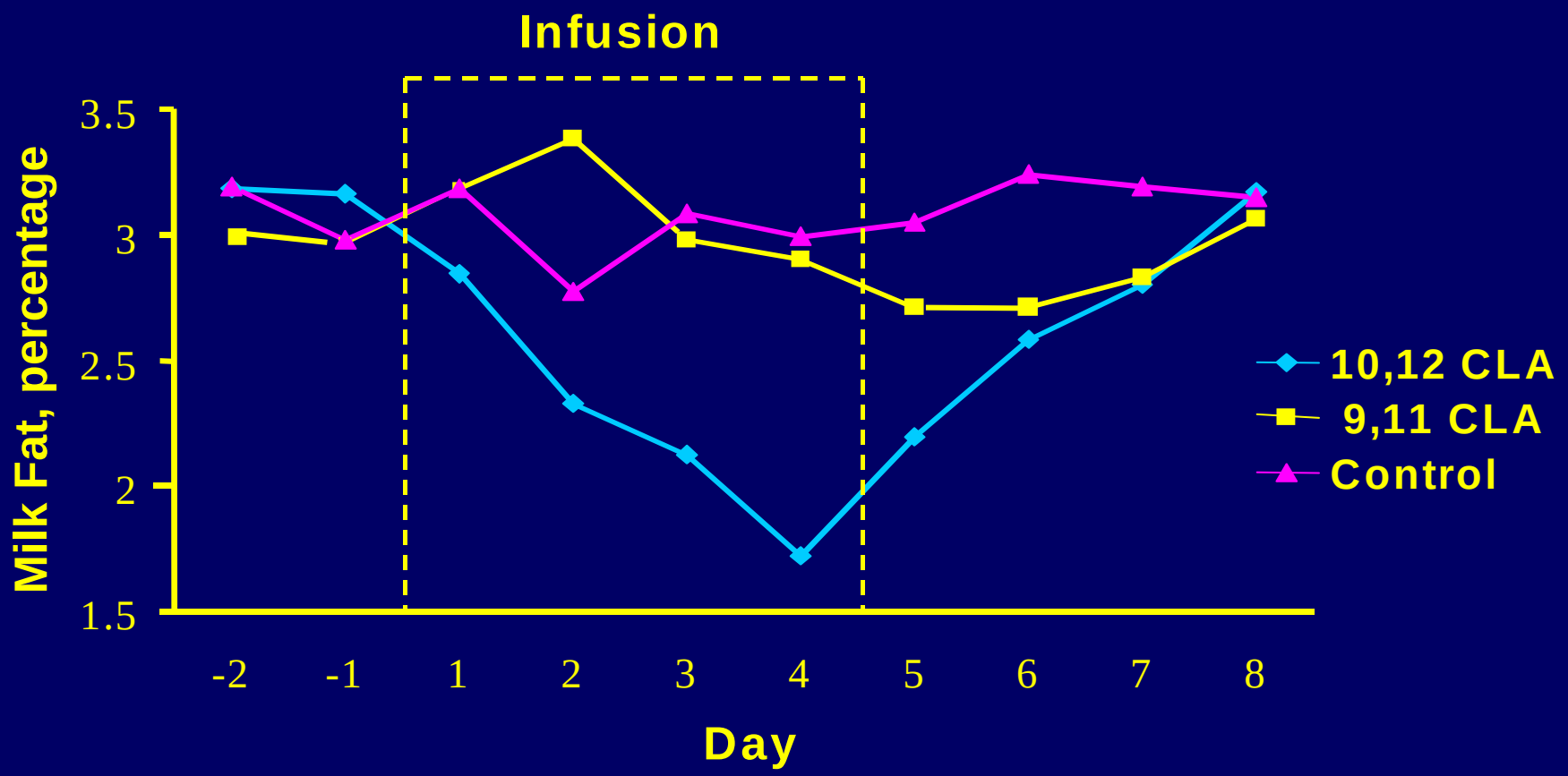
# Rumen Biohydrogenation




Griinari and Bauman, 1999

Source: Tom Overton, Cornell Univ.

# Effects of CLA isomers on milk fat %




Source: Tom Overton, Cornell Univ.

Baumgard et al., 2000

# Vegetable fats & milk fat test depression

- Fat content may be higher than book values
  - i.e. DDG/DWG
- Fat usually high in C18:2
  - Canola high in C18:1 instead
- Fat often in free-oil form
  - i.e. ground, extruded, or expeller meals
- Other sources of vegetable fat often in modern diets
  - i.e. basal corn/CS, WCS, FFSB, etc.
- Low ruminal pH common in modern dairy cows
  - i.e. high DMI, high starch intake, high ruminal degradability

# Suggested oil meal upper feeding limits to prevent milkfat test depression

| Fat Content of Oil Meal (DM basis) | lb. as fed/cow/day |
|---|---|
| 5% | 11.0 |
| 10% | 5.5 |
| 15% | 4.0 |
| 20% | 3.0 |
| 25% | 2.5 |
| 30% | 2.0 |

# Breakeven Values

## UW Feedval4; September, 2006

| Ingredient[a,b] | $ per ton (as fed basis) |
|---|---|
| CNM mech., local<br>03/10/06 MARS analysis | $211 |
| SFM mech., local<br>Average of CTL& MARS analysis | $185 |

**[a]Relative to $182 per ton SBM-48 solv.**

**[b]Assumed 40% RUP (% of CP)**

# Feeding Glycerol to Transition Cows[1,2]

## DeFrain et al., JDS, 2004

| | 2 lb./hd/d Cornstarch | 1 lb./hd/d Cst 1 lb./hd/d Glyc | 2 lb./hd/d Glycerol |
|---|---|---|---|
| DMI, pre., lb/d | 28[a] | 24[b] | 25[b] |
| DMI, post, lb/d | 39 | 39 | 35 |
| ECM[3], lb/d | 85[a] | 77[b] | 77[b] |

**[1]Treatment topdresses hand mixed into upper 1/3rd of TMR from 14d prepartum thru 21d postpartum**

**[2]Bio-diesel product comprised of 80% glycerol, 12% salt, 7% water, & 1.3% methanol**

**[3]Measured over 1st 70 DIM**

# Glycerol in Oral Drenches

Goff and Horst, 2001, JDS abstr.

- Glycerol reported to be an acceptable substitute for propylene glycol in oral drenches
- Usually drenched 1x at 10 to 12 oz. per cow per day

# Feeding Glycerol to Late Lactation Cows

Linke et al., JDS abstr., 2006

| | Control | 1 lb./hd/d Glycerol | 2 lb./hd/d Glycerol |
|---|---|---|---|
| DMI, lb/d | 42 | 40 | 41 |
| FCM, lb/d | 61 | 62 | 64 |
| lb FCM / lb DMI | 1.46[b] | 1.59[a] | 1.60[a] |

# Glycerol/Glycerin from on-farm bio-diesel production

- Lower purity than feeding trials cited
- May contain 20% to 25% methanol
  - Methanol converted to methane by rumen microbes in functional ruminants (Pol & Demeyer, 1988, JA&EM)
- Lye (sodium hydroxide) left in the product is a ruminal alkalizing agent (raises pH)