Dairy Nutrition for the Pasture–based Cow

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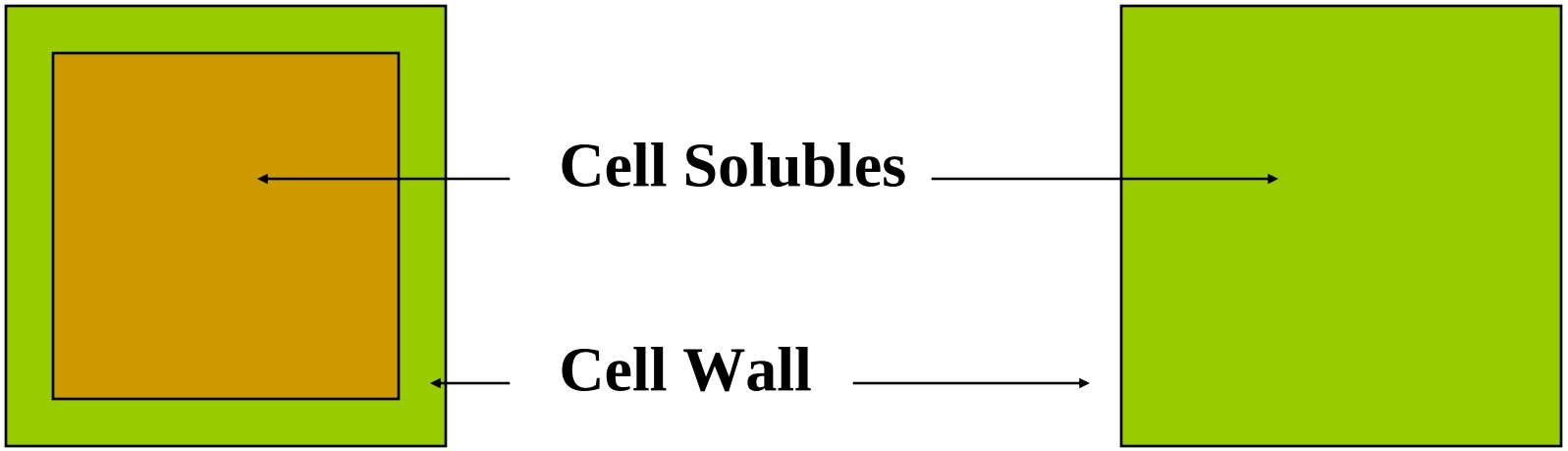
Characteristics of Pasture

- **18 - 34% Protein**
  - **High soluble protein**
- **0.66 - 0.80 Net Energy**
- **30 – 55% NDF**
- **Low non-fiber carbohydrates**
  - **12-24%**

Table 1. Average nutrient composition for cool season grass pasture and legumes over a grazing season.[a]

	Predominantly Grass (Cool season)		Grass with Legumes	
Nutrient	Spring	Summer	Spring	Summer
Crude Protein (CP), % DM	21-25	18-22	22-26	20-24
RUP[b], % of CP	20-25	25-30	20-25	25-30
Sol. P[c], % of CP	35-40	25-30	30-35	25-30
ADF[d], % DM	24-28	28-34	21-25	25-30
NDF[e], % DM	40-45	48-55	30-36	35-45
Hemicellulose, % DM	17-21	21-25	12-16	15-19
Cellulose, % DM	16-20	21-26	16-20	18-23
NE, Mcal/lb	0.72-0.78	0.66-0.72	0.74-0.80	0.70-0.74
Non-fiber carbohydrate (NFC), %DM	15-20	12-15	18-24	15-20
Fat, % DM	3-4	3-4	3-4	3-4
Ash, %DM	7-9	7-9	8-9	7-9
Ca, % DM	0.50-0.75	0.50-0.75	1.1-1.3	1.1-1.3
P, % DM	0.30-0.35	0.30-0.35	0.30-0.35	0.30-0.35
Mg, % DM	0.15-0.20	0.15-0.20	0.18-0.24	0.18-0.24
K, % DM	2.0-3.5	2.0-3.5	2.5-3.5	2.5-3.5
S, % DM	0.16-0.22	0.16-0.22	0.18-0.26	0.18-0.26

Cell Wall & Quality



Cell Wall - 45%
Protein - 25+%
NE_L - 0.68
Quality - HIGH

Cell Wall - 65%
Protein - 14%
NE_L - 0.50
Quality - LOW

A cow can consume 1.2% of BW as cell wall (NDF)

Availability of Components

COMPONENT	DIGESTIBILITY
Soluble Carbohydrate	100
Starch	90+
Protein	90+
Pectin	98
Cellulose	Variable
Hemicellulose	Variable
Lignin	Indigestible

Characteristics cont.

- **As quality decreases, good quality forage will be selected if abundant choice**

	DM	CP	NDF	ADF
Pasture	22.9	18.8	42.7	28.7
Masticate	14.1	20.8	38.1	25.9

Reis & Combs, J..Dairy Sci. 83:2888-2898 (2000)

Pasture Intake

Biting rate (BR)
X
Grazing Time
X
Intake/bite
=

Pasture Intake

Factors Affecting Grazing

- **Animal factors**
  - **Size**
  - **Production**
  - **Genetic merit**
- **Pasture factors**
  - **Height**
  - **Density**

Effect of supplementation on grazing

- **Grazing time**
  - **Concentrate consistently decreases GT**
    - **Arriaga-Jordan & Holmes**
      - **Barley 2.2 lb/d GT 467 min**
      - **Barley 13.2 lb/d GT 424 min**
      - **Difference of 43 minutes in GT**
    - **Bargo et al.**
      - **Corn 1.8 lb/d GT 609 min**
      - **Corn 18.9 lb/d GT 534 min**
      - **Difference of 75 minutes in GT**

Effect of supplementation on grazing

- **Grazing time**
  - **Average of studies in Table 2**
    - **Average supplementation 9 lb/day (range 1.8-19.1 lb/d)**
    - **Grazing time reduced by 34 minutes**
    - **Biting rate and bite size not affected**
  - **1 lb decrease in DMI = 2 lb decrease in milk**

Substitution Rate

- lb pasture intake substituted per lb concentrate intake
- Research trials Table 3
  - Range of 0.14 to 0.65

Type of supplement – Forage

- **Mayne and Wright (1998)**
  - **Grass silage supplementation**
    - **Substitution rate of 0.84 to 1.02 lb/lb grass silage**
    - **Is it prudent to feed hay to cows on adequate pasture?**
  - **Concentrate supplementation**
    - **Substitution rate of 0.11 to 0.50 lb/lb of concentrate.**

Type of supplement – Starch or Fibrous

- **Table 4 lists several studies evaluating DMI, milk production and composition**
- **Starch sources:**
  - **Corn, cassava, barley or combination of barley/wheat/corn**
- **Fiber sources:**
  - **Oatfeed, beet pulp either alone or combined with soy hulls or citrus pulp**

Type of supplement – Starch or Fibrous

- **Inconsistent effects of S vs F**
  - **Delahoy et al. (2003)**
    - **Conc. Fed at 1 lb / 4 lb milk produced**
    - **Conditions forced mechanical harvest and bringing to cows during part of the trial**
    - **Forage quality was an issue**

	----------DMI. Lb/d----------			Milk
Concentrate type	Level	Pasture	Total	lb/d
Corn	**18.0**	**26.6**	**44.7**	**60.7**
Beet pulp / soy hull	**18.0**	**26.4**	**44.4**	**60.3**

Type of supplement – Starch or Fibrous

- **Sayers (1999)**

Concentrate type	DMI. Lb/d Level	DMI. Lb/d Pasture	DMI. Lb/d Total	Milk lb/d
S (barley/wheat/corn)	11.0	27.7[a]	38.7[a]	68.6[a]
F (beet/citrus pulp)	11.0	29.5[b]	40.5[b]	68.0[a]
S (barley/wheat/corn)	22.0	9.5[c]	42.9[c]	76.1[b]
F (beet/citrus pulp)	22.0	10.9[d]	46.0[d]	77.4[b]

[a,b,c,d]Means with different superscripts differ (P < 0.05)

Starch Content & Degradation Rates

Feed	Starch Content		Starch Degradation	
	% DM	Range	Rate %/ Hour	Rapidly Degr. %
Corn	76	72-78	6	21
Barley	64	60-74	9	66
Oats	58	52-69	15	97
Wheat	70	67-77	24	78
Milo	71	68-78	3	4

Level of supplementation

- **Table 2 supplementation range of 1.8 to 19.1 lb/day**
  - **Pasture DMI decreased by 13%**
- **Table 5**
  - **Average all studies and supplementation increases milk production about 9.7 lb/d, or 22% compared with pasture only**
  - **Does not take into account pasture DMI**

Level of Supplementation

Grain DMI	0.0	11.0	22.0
Pasture DMI	30.6[a]	27.9[a]	21.6[b]
Total DMI	30.6[c]	38.9[b]	43.6[a]
Milk, lb/d	48.0[c]	59.0[b]	66.9[a]
FCM, lb/d	48.2	51.0	51.5
Fat %	3.89[a]	3.50[b]	3.08[c]
Protein %	2.85[c]	2.95[b]	3.05[a]
Milk/DMI	1.60	1.54	1.54

Reis & Combs, J..Dairy Sci. 83:2888-2898 (2000)

Rumen Undegradable Protein Supplementation

Dairy Forage Research Center

- **26 cows, 21-109 DIM**
- **Roasted SB & HM Ear Corn, 17.6-18.7 lb/day**
- **61-63 lb milk/day**
- **NOT SIGNIFICANT**

Penn State

- **24 cows, 68 DIM**
- **NOT SIGNIFICANT**
- **Corn, barley, CG meal & animal protein blend, 19.6 lb/day**
- **75-78 lb milk/day**
- **NOT SIGNIFICANT**

Rumen Undegradable Protein Supplementation

Argentina

- **34 cows, 13-36 DIM**
- **Pelleted Sunflower or Fishmeal, 11.0 lb/day**
- **49-53 lb FCM milk/day**
- **Significant at $P < 0.08$**

Argentina

- **18 cows, 1st eight weeks of lactation**
- **Soybean Meal or Bloodmeal, 14.5 lb/day**
- **55-64 lb milk/day**
- **SIGNIFICANT at $P < 0.02$**

Fat supplementation on pasture

- **Inconsistent research results**
- **3 studies showed a positive effect (full fat rapeseed, hydrogenated fish fat and hydrogenated oil)**
- **3 studies showed no effect (Ca salts and soybean oil)**

Conclusions

- **Feeding the grazing cow**
  - **Forage Quality**
  - **Forage Intake**
  - **Compliment With Grain**
    - **Energy**
    - **Protein ??**
    - **Vitamins & Minerals**

Conclusions

- **Feeding the grazing cow**
  - **Substitution rate**
    - **0.14 to 0.65 lb pasture / lb supplementation**
      - **Can be used to maintain pasture wedge**
    - **Higher levels will require ingredient adjustments**
  - **Ingredients in supplement**
    - **60 to 70% corn**
      - **Other cereal grains can be used, consider starch degradation rates**
    - **30-40% fibrous type feeds**
      - **Soy hulls most economical in Missouri**

Conclusions

- **Feeding the grazing cow**
  - **Level of supplementation**
    - **8-15 lb/cow/day**
    - **Higher levels will require ingredient adjustments**
  - **Rumen undegradable protein**
    - **Research inconclusive**
  - **Added fat**
    - **Limited research in a grazing situation**
    - **2.25 X the energy compared to CHO and protein**
    - **Include, add slowly to the ration**

K.I.S.S.

It’s not just about grass,
it’s all about forage quality and INTAKE, INTAKE, INTAKE!!!!!