DIAGNOSING NUTRITIONAL PROGRAMS WITH RECORDS

Michael F. Hutjens
Extension Dairy Specialist
University of Illinois
Urbana, IL 61801

INTRODUCTION

Dairy nutritionist, educators, and veterinarians are asked to evaluate feeding practices on a daily basis; sometimes you are asked and other times you see problems. Several diagnostic techniques and approaches are discussed below. The challenge is to ask and "see" the right questions and "hear" the answers correctly. A question which has unique application is "are we talking (communicating) with our cows?"

FACTORS NOT RELATED TO NUTRITION

Feeding is the first targeted problem or concern when milk production declines or profitability drops. DHI records can quickly eliminate or confirm other factors that should be corrected before making major feeding changes (Hutjens, 1991).

1. Evaluate milk production changes in the DHI herd average over the last two to three years for cyclic trends and changes (milk yield, components, cow numbers, calving pattern, and average cow age).

2. Review the average age of the herd and its impact on milk yield.

3. Summarize somatic cell counts (SCC) by age and days in milk. Milk yield will shift 1.5 pounds if SCC double or reduce in half (from 300,000 to 150,000 for example).

4. Consider the reproductive status by age and lactation number to determine if calving interval is excessively long (over 13 months) which results in too many days in milk at lower milk yield levels. DHI records can be used to determine if cows are not bred soon enough (days to first service), are not conceiving (services per conception) are not seen in heat (days between services average 19 to 23), and/or are losing calves (days between services average over 25 days).

5. Culling pattern (percent of cows annually below 30 percent) and reason (percent voluntary culled such as for low milk yield or dairy purposes is less than 50 percent compared to the percent involuntary culled for death, reproduction, mastitis, metabolic disorders, and foot/leg problems) can have dramatic effects on milk production.

6. Measure genetic trends in the replacement heifers (superior to milking cows) and milking cows (young cows should be higher than older cows) to assess if genetic improvement is a limitation.

USING MILK PRODUCTION CURVES

Evaluation of milk production curves will allow you to find weak links or production caps (Hutjens, 1993). Table 1 provides Holstein data for first, second, and third and over lactation cows (table 2 contains data on the other dairy breeds). Six points on the lactation curve are provided for each group of cows.

- 0 to 50 days (reflects dry cow program, transition diet, and metabolic disorders).

- 50 to 100 days (reflects fresh cow ration, dry mater intake, and body condition status).

- 100 to 200 days (reflects dry matter intake, body condition status, and nutrient intake).

Table 1. Milk production profiles for Holstein cows (Hutjens, 1993).

Milk Yield	Lactation (No.)	Summit Milk (lb)	<50	50-100	101-200	201-300	>300
			----------lb milk/day----------				
23000	1	75	64	72	69	61	53
(3.56/3.15)	2	97	86	90	79	62	49
(142)	3	104	89	95	85	65	51
21000	1	69	59	66	63	54	47
(3.57/3.17)	2	89	80	83	72	56	44
(522)	3	96	81	88	77	59	46
19000	1	64	56	61	57	49	43
(3.60/3.19)	2	82	73	76	66	51	39
(1145)	3	88	76	80	70	53	40
17000	1	59	52	56	52	44	38
(3.62/3.21)	2	75	67	68	59	45	37
(1423)	3	80	70	73	64	48	36
15000	1	54	49	50	46	40	34
(3.64/3.23)	2	67	62	61	53	42	32
(1004)	3	73	65	66	56	43	33
13000	1	48	44	45	41	35	31
(3.62/3.25)	2	60	57	55	47	37	29
(438)	3	65	60	60	51	39	30

Number in parenthesis are milk fat test, milk protein test, and number of herds.

Table 2. Production profiles for Ayrshires, Brown Swiss, Guernsey, and Jersey breeds. (Hutjens, 1993)

Breed Production (lb)	Lactation (No.)	Summit Milk	<50	50-100	100-200	200-300	>300
			lb/day				
Ayrshire							
13000	1	48.5	42.9	43.8	40.3	34.7	30.7
(20)	2	58.5	55.3	50.0	46.2	31.4	25.3
(3.90/3.39)	3	64.1	57.0	56.0	51.0	35.9	29.1
14800	1	54.6	51.3	54.3	46.7	37.9	32.0
(14)	2	67.2	66.3	61.7	51.2	36.9	24.5
(3.86/3.39)	3	74.0	70.7	68.4	56.0	41.3	29.1
16600	1	60.6	55.7	54.0	55.1	40.4	31.6
(5)	2	75.6	73.2	64.0	52.9	41.5	29.2
(3.56/3.40)	3	80.1	68.3	71.5	56.7	45.3	36.8
Brown Swiss							
13100	1	44.8	39.4	41.4	39.2	33.7	30.9
(40)	2	59.1	56.0	52.8	44.4	35.3	31.3
(4.02/3.60)	3	64.5	59.1	58.2	49.9	39.0	31.2
14900	1	49.3	44.3	47.5	44.6	38.1	35.7
(39)	2	64.3	60.5	62.3	52.6	42.5	37.1
(3.96/3.58)	3	70.7	63.9	67.9	57.8	46.5	36.2
16800	1	53.4	47.1	51.2	46.9	42.8	39.8
(20)	2	70.1	65.0	62.8	57.9	44.9	40.2
(4.06/3.58)	3	78.4	78.2	72.5	64.8	48.8	42.5
18400	1	59.1	47.9	61.2	52.2	47.0	43.0
(8)	2	75.5	63.9	66.8	63.4	50.3	48.5
(400/3.59)	3	84.7	73.1	77.3	72.9	52.8	42.1
Guernsey							
12700	1	48.4	43.3	44.7	40.7	33.7	28.7
(38)	2	57.9	51.9	50.0	47.1	35.0	25.6
(4.55/3.34)	3	61.0	52.5	54.5	47.2	35.4	28.7
14605	1	54.3	45.3	51.4	46.7	39.3	33.7
(19)	2	63.9	59.1	59.8	51.7	39.3	31.8
(4.48/3.53)	3	68.9	59.8	62.6	53.8	40.7	29.9
16900	1	58.0	60.8	54.2	52.4	39.9	40.4
(2)	2	71.7	75.0	70.2	52.4	46.9	42.9
(4.43/3.34)	3	73.3	63.7	69.1	55.8	45.1	45.7
Jersey							
12800	1	44.4	39.8	41.1	38.5	33.3	29.7
(63)	2	54.5	51.3	49.4	44.9	34.1	30.5
(4.63/3.77)	3	58.8	51.8	53.1	46.4	37.2	30.0
14800	1	50.0	44.8	48.7	44.9	39.8	35.8
(20)	2	62.2	57.3	57.3	52.8	43.7	29.9
(4.59/3.70)	3	65.0	58.9	60.0	54.6	43.3	34.3
16500	1	53.7	52.3	54.0	48.4	45.2	43.4
(4)	2	67.8	65.3	59.0	55.5	45.5	43.7
(4.55/3.65)	3	72.4	72.2	68.5	59.8	45.2	39.6

Value in parenthesis are herd numbers, percent milk fat, and percent milk protein in the group means.

- 200 to 300 days (reflects late lactation nutrient intake, priority use of nutrients, and persistency problems).

- Over 300 days (reflect profitability of problem breeding cows and persistency problems).

Cows should peak in the second phase (50 to 100 days in milk). Be careful interpreting data if cow numbers are small in a group (one good or bad cow can shift the group average significantly). Also, watch days in milk in a subgroup because it can shift the expected milk yield average. For example, if cows in 0 to 50 days were fresh only 10 days on the average compared to 45 days, the value would be low. A similar case could be made for cows in the group over 300 days in milk averaged 385 days compared to 310 days for example.

MILK COMPONENT ANALYSIS

Monitoring milk fat and milk protein tests provide valuable tools to evaluate feeding problems. Normal breed values are listed in Table 3 (Palmquist, 1995). The following situations can be evaluated.

1. High milk fat test
   a. Low milk yield
   b. High fiber diet (over 21% ADF)
   c. Excessive weight loss (over 2 lb per day)
   d. Feeding added fat (over 1 lb)

2. Low milk fat test
   a. Acidosis (milk fat depression)
      - Excessive grain intake (less than 2 lb milk/lb grain)
      - Shortage of functional forage (less than 5 lb)
      - Excessive fermentable carbohydrate (over 40%)
      - Fine feed particle size (pellets or fine grind)
      - Low in acid detergent fiber (**ADF**; under 19%)
      - Wet rations (over 50% moisture)
      - Slug feeding of grain (over 5 lb dry matter (**DM**) per meal)
   b. Thin cows (body score < 2)
   c. Shortage of energy intake
   d. Low dry matter intake

3. Low milk protein test
   a. Shortage of fermentable carbohydrate (< 35% non-fiber carbohydrate)
   b. Shortage of protein
      - Soluble (30-32% total protein)
      - Degradable (60-64% total protein)
      - Undegradable (36-40% total protein)
      - Shortage of amino acids (lysine with corn-based diets and methionine with legume based diets)
   c. Feeding added fat (over 1.5 lb of supplemental fat)

Table 3. 1993 National DHI milk fat and milk protein relationships (Palmquist,1995)

Breed	Milk fat (%)	Milk protein (%)	Ratio (protein:fat)
Ayrshire	3.93	3.38	.86
Brown Swiss	4.02	3.56	.89
Guernsey	4.54	3.55	.78
Holstein	3.64	3.20	.88
Jersey	4.73	3.78	.80
Milking Shorthorn	3.56	3.31	.93

4. High milk protein test
    a. Milk fat depression
        - Cows below 2.5% milk fat
        - Cows with fat test .4 point below milk protein
    b. Low milk yield

Review fat and protein test by lactation number, level of milk, and days in milk. First lactation cows, high milk yielding cows, and cows fresh less than 100 days may show major milk component shifts.

REVIEWING DRY MATTER INTAKE

High milk production drives high DM intake (indicated by BST and 3X studies). These cows must be allowed and encouraged to achieve higher feed intake. In early lactation, DM intake can be 18 percent below NRC, 1989 levels (Table 4). Each additional pound of DM consumed can support 2.0 to 2.4 pounds more milk. The following guides can optimize DM intake (Hutjens, 1994).

- Forage quality should exceed .60 Mcal of net energy per pound of DM.
- Dry cows should not be restricted in DM intake.
- Lead feeding to close up dry cows can maintain rumen fill and function, adjust rumen microbes for higher grain diets, and increase DM intake.
- Major ration changes should be avoided at parturition.
- NDF and ADF should be balanced for maximum intake and digestibility at 28-33 and 19-20 percent, respectively.
- Feed delivery systems should encourage cows to eat balanced meals (2 to 3 times per day).
- Slug feeding of concentrates (over five pounds of DM per meal) should be avoided.
- Feed additives such as buffers, yeast, or niacin can improve DM intake.

EVALUATING BODY WEIGHT LOSS

High producing cows will lose body weight in early lactation. Milk nutrient needs exceed nutrients provided in the DM consumed. Peak DM intake lags milk yield peak by 4 to 6 weeks. Energetically one pound of mobilized body fat can support seven pounds of milk energy (NRC, 1989). Dairy cows should not need to mobilize more than two pounds of weight per day with cows returning to positive weight balance by 10 to 12 weeks postpartum (Hutjens, 1994). USDA researchers (Tyrrell and Moe, 1975) reported cows are more efficient replacing lost body weight when cows are lactating. To replace one pound of body weight, an additional 2.5 pounds of shelled corn (DM) equivalent is required above maintenance and milk yield needs. The following strategies will allow optimizing body weight losses (Hutjens, 1994).

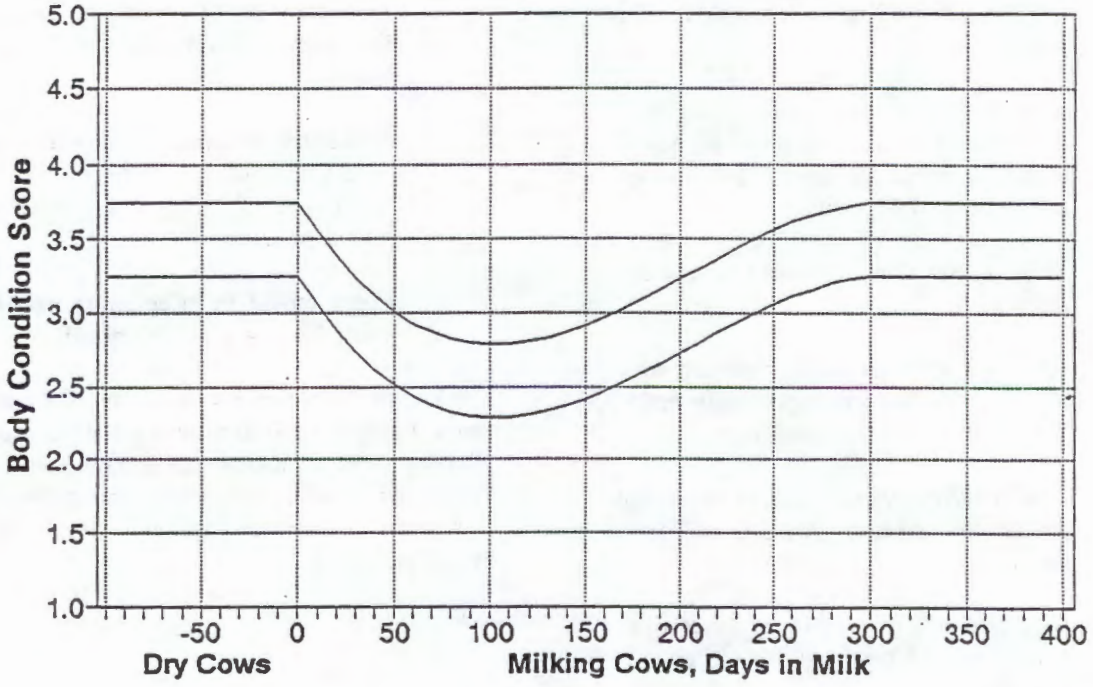
- Dry matter intake in early lactation should be maximized.
- One to 1 1/2 pounds of unprotected fat plus one pound of protected fat can be fed if weight loss is excessive.
- Body condition score (**BCS**) should be monitored monthly. Avoid drops of one full point within a month with no cows below 2.
- Additional undegraded protein is needed to utilize mobilized body reserves (one half pound of undegraded protein per pound of fat).
- Cows should be in optimum BCS with a code 3.5 to 4 prior to dry off.

Figure 1 illustrates a desirable BCS curve for cows during the lactation and gestation cycle. Plotting cows at calving, one month postpartum (pre-breed check), at breeding, and at dry off time is minimal to evaluate changes (monthly BCS would be ideal).

Table 4. Dry matter intake guidelines (NRC, 1989)

Milk Yield (lb. 4% FCM)	Body Weight (lb.)			
	880	1100	1320	1540
	lb D.M. intake/day			
44	32	35	38	40
66	39	41	46	49
88	48	51	53	55
110	NA	59	62	63
132	NA	NA	71	72

Figure 1. Desirable body condition score for cows during the lactation and gestation cycle (Oetzel, 1994).



EVALUATING METABOLIC DISORDERS

Current and accurate metabolic disorder profiles are a must for the dairy consultant. If the herd experiences a change or a pattern shift, feeding guidelines for the far off dry cow, close up dry cow, and fresh cow transition diets should be evaluated. Guidelines for metabolic disorders are listed below (Hutjens, 1993).

•Milk fever	<6%
•Ketosis (clinical)	<3%
•Hypocalcemia (<8 mg % total blood calcium)	<15%
•Displaced abomasum	<3%
•Retained placenta	<8%

Developing a computerized format for on farm use with graphic or summary capabilities can be valuable for monthly evaluation.

MONITORING HEIFER GROWTH CHARTS

If first lactation cows are not large and well grown, milk production potential will not be captured. For each pound of body weight below 1250 pounds at calving (from 950 to 1250 pounds), first lactation cows produced six pounds less milk (Fischer and Hutjens, 1994). For example, a heifer calving at 1150 pounds (excluding calf, fluids, and membrane weight) would produce 600 pounds less milk in the first lactation (100 pounds below the target weight times 6). Dairy managers must monitor all ages of heifers to avoid growth slumps (less than 1.6 pounds of gain per day after weaning). In an Illinois heifer monitoring program (Fischer and Hutjens, 1994), the four major reasons why heifers did not achieve optimum growth included a lack of dietary protein, housing that resulted in large groups of heifers with wide ranges in age, poor parasite control programs, and use of pasture (lack of available forage in the summer).

CONCLUSIONS

Five records are needed to evaluate nutritional programs for clientele in the field.

1. Milk production records (milk yield, components, and SCC)
2. Dry matter intake
3. Body condition scores
4. Metabolic disorder profiles
5. Heifer growth charts

Methods or programs can be used that are user friendly and economical. These tools will allow professionals to maximize their time and improve profits to their clientele.

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