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Use High Producing Cows, Top Quality Forages

Increasing Dairy Returns

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The principal function of a dairy cow is to convert feed into milk and money. Her efficiency in this conversion largely determines the success of dairy farm operations.

Efficiency is defined as the output per unit of input. Economic efficiency (dollar return per dollar cost) can be easily determined for given prices when pounds of milk produced per pound of feed is known. Efficiency factors, as determined from research studies, describe the effect of: 1) genetic potential of the herd and, 2) quality of the ration.

Function of a dairy cow is to convert feed into milk income.

Genetic Potential of the Dairy Herd

Genetic potential is the inherited ability of a cow, or herd of cows, to produce more milk when other management factors are similar. The genetic potential of a herd is improved through 1) use of dairy herd improvement records on each cow as a basis for culling, breeding and feeding, and 2) breeding to sires that produce superior offspring. The importance of superior genetic potential in converting feed to milk is shown in Table 1.

The important points are:

1. Genetically Superior Cows Produce More Milk per Pound of Feed. There is a direct relationship between the amount of milk produced and feed consumed (dry matter). Figure 1 shows an increase in lb milk per lb of feed from 1.16 at 10,000 lb milk per cow to 1.88 at 24,300 lb milk per cow. This is an increase in feed efficiency of 62%.

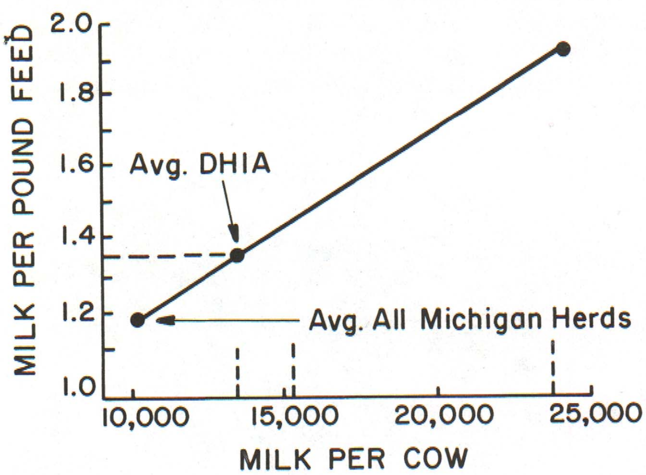
Feed efficiency increased at approximately .05 lb more milk per lb of feed for each 1,000 lb increase in genetic potential; or at a rate of 4.22% per 1,000 lb increase in production.

TABLE 1. Performance of cows fed a free-choice mixed-ration with 40% chopped alfalfa hay and 60% concentrate.

	Milk production		
	High	Medium	Low
Milk (lb/308 days	24,241	15,310	10,054
Milk/cow/day (average)	78.7	49.7	32.6
Fat (%)	2.9	3.0	3.2
Fat (lb/308 days)	706	455	320
Dry matter intake (% BW)	3.13	2.45	2.24
Body weight (lb)	1,434	1,446	1,391
Change in body wt (lb)	+ 106	+ 74	+ 130
lb milk/lb feed	1.88	1.49	1.16

Source: California data.

Figure 1. Genetic Effect.



Source: California data

SYSTEMS → ANALYSIS
DAIRY

2. **Maintenance Costs are Proportionately Less for High Producing Cows Than for Low Producers.** The increase in feed efficiency is primarily due to the lower proportion of feed (energy) required to maintain body weight of the high producing cow. Thus, a higher proportion of energy is available for milk production, as shown in Table 2. The energy consumed per lb of milk was similar at all levels of production after deducting the energy required for maintenance. The high cost of maintaining low producing cows is a major burden confronting dairymen under adverse economic conditions.

TABLE 2. Energy expenditure for maintenance of body weight relative to total energy intake.

	MILK PRODUCTION		
	High	Medium	Low
Dry matter intake (lb)	44.9	35.4	31.2
ENE intake (Mcal)	32.8	25.9	22.7
Maintenance ENE required	-10.9	-10.9	-10.9
ENE available for milk	21.9	15.0	10.8
Milk/day (avg lb)	78.7	49.7	32.6
ENE available/lb milk	.28	.30	.36
Maintenance (% of intake)	33	42	48

Calculated from California data.

3. **High Producers Convert More Feed to Milk.** High producing cows consume more feed (dry matter) per 100 lb of body (Table 1). Dry matter intake per 100 lb body weight increases with milk production at a rate of approximately .02 lb per 100 lb body weight per lb of milk produced (see Figure 2). The energy required for maintenance is proportional to body weight (approximately 0.75 lb total digestible nutrients (TDN) per 100 lb body weight). Milk production increases the energy requirement approximately 0.3 lb TDN per lb of milk produced. Cows with high milk production potential consume proportionately more energy per 100 lb body weight when provided an adequate diet than required for body maintenance. This extra energy is then available for milk production (or fattening, if energy intake exceeds the milk production potential).

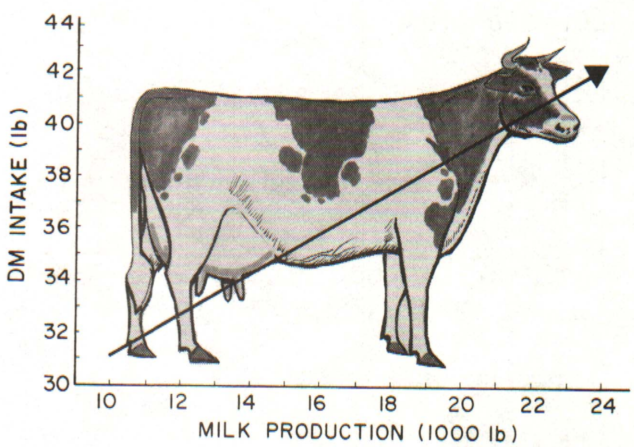
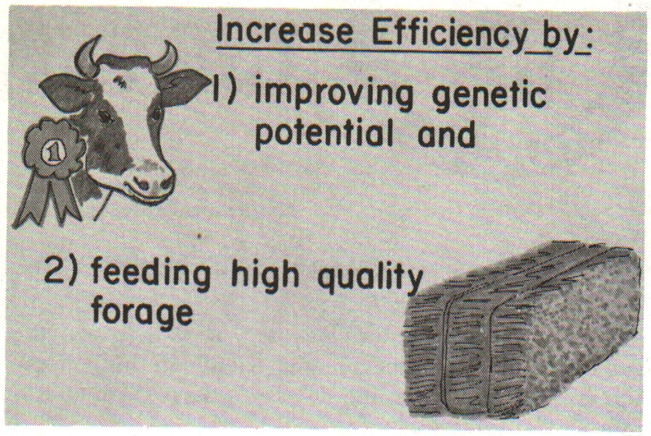


Figure 2. High production cows have higher dry matter intakes.



4. **High Producers Generate More Income per Unit of Feed Cost.** In terms of milk priced at $8.50 per cwt and feed priced at $4.80 per cwt (40% alfalfa, 60% concentrate) the income and net return per 100 lb feed for cows at three levels of production are shown in Table 3.

TABLE 3. Effect of genetic potential on milk income and return per 100 lb feed.

Milk/lactation (lb)	24,241	15,310	10,054
Milk/100 lb feed (lb)	188	149	116
Milk income/100 lb feed($)	16.00	12.66	9.86
Net return/100 lb feed ($)	11.20	7.86	5.06
Milk income/$1.00 feed cost ($)	3.33	2.63	2.00

5. **High Producers Reduce Feed Costs per 100 lb Milk.** The impact of genetic potential on feed cost per 100 lb of milk produced is illustrated in Table 4. The difference is largely in maintenance cost, since it takes three cows producing 33 lb milk per day to produce

TABLE 4. Impact of production level on feed cost per 100 lb milk.

Milk per 305 day	24,241	15,310	10,054
Milk value/day ($8.00/3.5%), $	5.93	3.78	2.56
Feed cost (cows), $	2.36	1.82	1.63
Return above feed cost, $	3.95	2,22	1,19
Feed cost/100 lb milk			
milk cow only, $	3.00	3.66	5.00
dry cow + heifers, $	.80	1.28	1.94
Total feed cost/100 lb milk, $	3.80	4.94	6.94

Based on California data (hay $50/T; Concentrate $120/T).

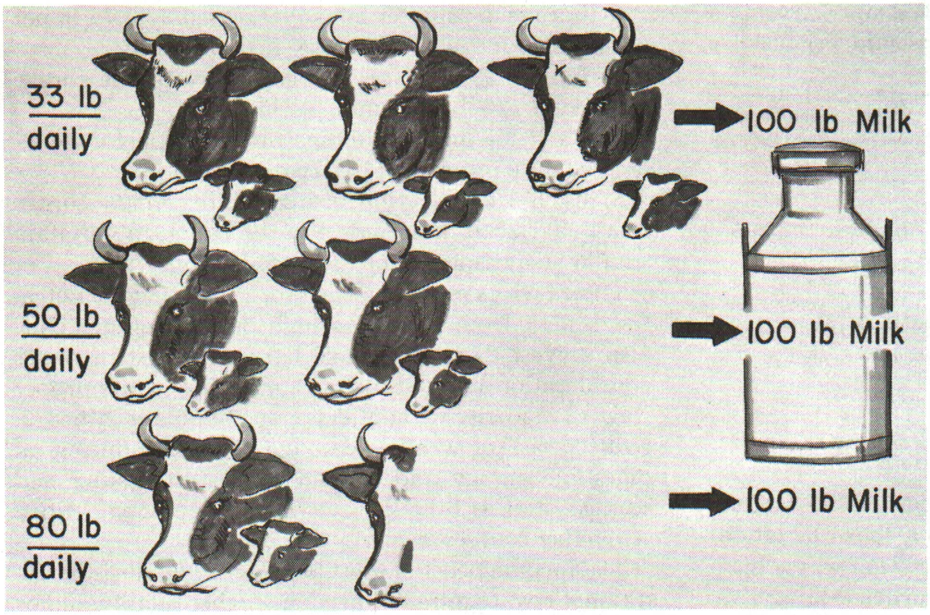


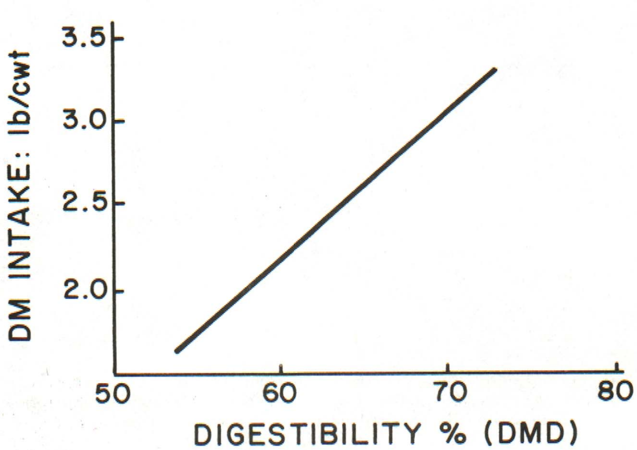
Figure 3. High producers reduce feed costs per 100 lb milk.

100 lb of milk, or two cows at 50 lb milk per day, or only 1.25 cows at 80 lb milk per day. The cost per 100 lb milk is further increased when replacement heifers and dry cows are included since they are normally retained at the same ratio per 100 lb milk as lactating cows (See Figure 3).

Effects of Ration Quality on Feed Efficiency

Cows of given genetic potential convert feed to milk in proportion to the energy consumed beyond maintenance requirements. Efficient conversion of feed to milk depends on adequate energy intake. Dry matter intake and energy intake per 100 lb body weight are proportional to the digestibility of the ration dry matter as illustrated in Figure 4.

Figure 4. Relationship of digestibility and dry matter intake.



Dry matter intake per 100 lb body weight increases at a rate of about .075 lb per 100 lb body weight per 1% increase in digestibility of the ration dry matter from about 50 to 67% digestibility. Between 68 and 73% digestibility, the rate of increase is reduced. When digestibility exceeds about 73%, dry matter intake is reduced. This relationship and the point of maximum intake is further modified by physical and chemical characteristics of the ration, the balance of nutrients and the animal requirement.

High Quality Forages Improve Feed Intake and Production. Forages are a major source of feed for cattle. Harvesting forages at different stages of maturity effects feed intake and milk production. This is shown in Table 5.

TABLE 5. Impact of date of harvest and maturity of mixed legume-grass hay on feed intake and milk production.

	HARVEST DATE & MATURITY		
Maturity of species in mix	**May 25**	**June 9**	**June 24**
Alfalfa	Early bud	1/10 bloom	¾ bloom
Clover	Bud	Full bloom	Past full bloom
Timothy	Vegetative	Just past bloom	Full head
Digestibility, %	71.1	65.6	60.6
Protein, %	18.5	13.3	12.2
Cow Performance:			
Milk, daily 4% fat corrected milk (FCM), lb	40.4	37.1	32.8
Body weight change/day, lb	1.4	0.9	0.6
Feed intake, (lb/DM):			
Forage	34.2	30.8	26.3
Concentrate (20% protein)	8.4	8.6	8.1
Total	42.6	39.4	34.4

Adapted from S. L. Spahr, et al., J. Dairy Sci. 44:503.

TABLE 6. Effects of harvesting date and maturity on value of milk produced and hay consumed per 305-day lactation.

Date cut	Milk produced	Hay consumed	Milk value	Increased milk value per ton hay DM over June 24 value
	lb	tons	$	$
May 25	12,322	5.2	1047	40.16
June 9	11,315	4.7	962	23.82
June 24	10,004	4.2	850	Base

Based on Spahr, et al., J. Dairy Sci. 44:503. Milk at $8.50/cwt.

Efficiency factors based on the above data indicate:

1. Harvesting forage 15 days earlier (June 9 vs. June 24) increased milk production by 1,300 lb per lactation. A further increase of 1,000 lb per lactation was achieved by harvesting another 15 days earlier (May 25 vs. June 9), when a similar amount of grain was fed.

2. For each 15-days forage was harvested before June 24, milk income was increased by $100 per lactation (milk at $8.50/cwt).

3. Harvesting June 9 instead of June 24 increased milk income by $24 per ton of forage DM consumed. Harvesting May 25 increased milk income an additional $16. Thus, harvesting May 25 instead of June 24 increased milk income $40 per ton of forage consumed over a lactation (Table 6).

4. Forage digestibility was increased by 0.35% for each day it was harvested before June 24.

5. Forage dry matter intake increased by 0.75 lb per head daily for each 1% increase in digestibility.

6. Each 1% increase in digestibility of the forage resulted in 220 lb more milk per lactation.

7. Each 1% increase in digestibility of the forage increased milk income by $18.76 per lactation.

8. Each 1% reduction in digestibility of the forage required 1.25 lb more grain in the ration to maintain similar energy intake and milk production.

These factors provide a basis for estimating the potential benefit from providing high quality forage. They also suggest that any forage harvesting system under consideration must allow: 1) harvesting at the proper stage of maturity without delay due to poor weather; 2) reduced risk of weather damage; 3) minimum loss of digestible energy and protein during harvesting and storage; and 4) function at a cost that is competitive with other sources of energy and protein.

The income benefits must be weighed against the additional cost required to produce higher quality and/or the cost of substituting larger quantities of concentrate in the diet for lower quality forage.

SUMMARY

The opportunities to improve feed efficiency by improving genetic potential and forage quality are substantial. Under adverse economic conditions such as exist when milk prices are depressed and concentrates are expensive, not taking advantage of opportunities can be serious.

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