A Grain Feeding Guide for Dairy Cattle in Hawaii

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Cooperative Extension Service
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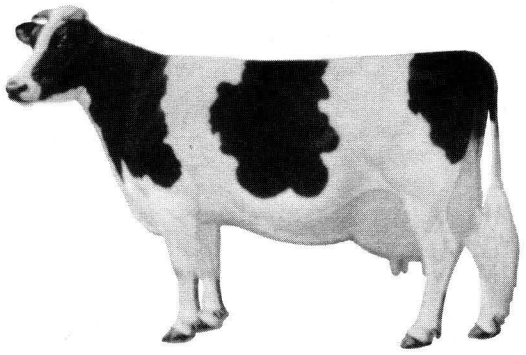

The cost of feeding dairy cows amounts to approximately one-half of the total cost of producing milk. This is by far the greatest single expense to the dairyman. For dairy cattle to produce economically, at a high level, they must receive a well-balanced ration. Roughages alone are inadequate to meet the nutritional needs of high-producing animals. Concentrates are needed to supplement the roughages.

Dairy cattle should be fed individually whenever possible. Their body weight, milk and butterfat production are the major factors determining the amount and kind of feed they should receive. Since it is difficult to feed cows individually under dry-lot conditions, they should be separated into groups of comparable production or strings and fed accordingly. This avoids the usual tendency of overfeeding low producers and underfeeding high producers.

This circular has been written to provide grain feeding guides for dairy cattle. Consideration is given to the amount and quality of roughage consumed by the animals in relation to their maintenance requirements and the amount of milk and butterfat being produced.

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Why Dairy Cattle Are Fed

Maintenance

Dairy animals are fed for five reasons. The first is maintenance. A certain amount of nutrients is necessary to maintain the animal's body. This amount is needed whether the animal is in production or not. If animals are underfed, they utilize the nutrients needed for maintenance at the expense of milk production.

Milk Production

The second and most important reason for feeding dairy animals is milk and butterfat production. Animals produce milk up to their genetic ability only if adequately fed. A common reason for low production is a condition known as "hollow belly," a result of inadequate feeding. Potentially high-producing animals must be fed very carefully if they are to reach and maintain a high level of production. The amount of nutrients required for milk production depends on both the quantity of milk produced and the amount of butterfat in the milk. The higher the butterfat content, the greater the nutrient need for production. For this reason, the tables presented in this publication consider the percent butterfat content of the milk as well as the amount of milk being produced.

Pregnancy

During pregnancy, animals require some additional nutrients. This need is greatest during the last two or three months of the gestation period. Animals carrying a calf should be fed an additional amount of feed during this period to insure continued milk production and the proper development of the unborn calf.

Additional Allowances for Growth

First and second calf heifers, particularly those which have freshened for the first time at a young age, require more nutrients during their first and second lactations. These animals should be fed more than would be fed a mature cow producing at the same level, because they need the added nutrients to grow and further develop throughout their first and second lactations.

Conditioning

In some cases, dairy animals are fed to improve their body condition. For example, pregnant dry cows may need some additional nutrients in order to be in top physical condition when they freshen. Condition is also a major factor in the price received for cull animals that go to slaughter. In both cases, animals may have to be fed more than is needed for maintenance alone, but not nearly the amount that a high-producing animal would require.

How Much Roughages and Concentrates to Feed

Maintenance, milk production, pregnancy, additional allowances for growth and condition are the reasons why dairy animals are fed. The amount of feed, both roughage and concentrate, needed to satisfy these nutritive requirements depend upon a number of factors.

First of all, it is usually economical to make maximum use of roughage feeds. In other words, feed the maximum amount of roughage that the animals will consume; then feed concentrates to provide the additional nutrient required. The amount of roughage that an animal will consume is largely determined by its body size and the quality of the forage. Animals of equal size, regardless of the amount of milk produced, will eat about the same amount of roughage. As for the amount of concentrate required, the high-producing cow needs more than the low producer. For very high-producing cows, the amount of roughage fed might have to be lower than that fed lower producing cows. This may be necessary to make sure the animal has sufficient concentrate to meet the additional energy demands of high production.

The quality of the roughage determines the amount of roughage and concentrates that a dairy animal requires. Top-quality roughage has more nutrients, and animals will consume more of this than low-quality material.

The following example shows the amounts of concentrates needed for three cows producing at the same level of production and butterfat test. Different amounts of concentrates are needed because of the variation in roughage intake.

	Milk production	Hay equivalent intake[1]	Grain required
	lbs. daily	lb./100 lbs. body wt.	
Cow No. 1	40	1.5	20
Cow No. 2	40	2.0	15
Cow No. 3	40	2.5	9

[1] See page 5 for definition of hay equivalent intake.

Other Factors to Consider in Feeding Dairy Cattle

Stage of Lactation

The greatest nutrient requirement for dairy animals occurs just after calving. During this period of lactation, the animal utilizes some stored fat to maintain a high level of milk production. How well the animal is fed determines whether she will continue a high level of production. As animals come into production following calving, they should be challenge-fed. This means that the animals should be fed slightly in excess of their requirements to enable them to increase their production according to their genetic ability. If an animal responds to an added 2-pound increment of feed, then feed her another 2-pound increment. In other words, lead her in the feeding program until she no longer responds with extra production for extra feed.

Condition of Cow

Dairy animals that have been in production for a while should show an angular form, carry no surplus flesh, but show evidence of liberal feeding by a vigorous physical condition.

Each animal responds differently to the feeding program. Because of differences in the genetic make-up, some cows produce more milk when given additional feed, while others become fat. Those that produce more milk are the ones that should be given additional feed as long as they continue to increase production. Animals that have a tendency to get fat can be fed less without lowering their production. Those that are thin should be fed more to get them in good working condition. The condition of the cows, therefore, indicates the level at which to feed.

Review of Feed Requirements

The amount to feed a cow depends on:

1. Size of the cow (maintenance).
2. The production level and butterfat content of the milk.
3. Age of animal (growth requirements).
4. Stage of pregnancy.
5. Condition of animal.

The amount of concentrate and roughage to feed depends on:

1. Availability of roughage and concentrates.
2. Relative cost of roughage and concentrate items.
3. Quality of roughage, which determines the consumption level.

How to Compute the Amount of Grain to Feed

The amount of hay or hay equivalent an animal consumes daily influences the amount and level of protein of the concentrate needed. To determine the amount of concentrate, it is necessary to first compute the hay equivalent intake (HEI). Hay equivalent intake is the equivalent of 1 pound of average quality hay consumed daily per 100 pounds of body weight of the animal. Hay equivalent factors for various feeds are shown in Table 1. Multiplying by these factors adjusts the roughages to a hay equivalent basis.

Table 1. Hay Equivalent Factors for Various Feeds

Feeds	Factor
Hay (all forms)	
Alfalfa	1.0
Pineapple	1.0
Grass	1.0
Succulent roughage	
Green chop (grass)	.25
Pineapple silage	.22
Corn, silage or green chop 30% D.M.*	.33
" " " " " 25% D.M.	.28
" " " " " 20% D.M.	.22
" " " " " 17% D.M.	.19
" " " " " 15% D.M.	.17
Other feeds	
Wet brewers grain	.40
Pineapple bran	1.25
Molasses (under 10% of total ration)	1.50
Molasses (10% to 20% of total ration)	1.10

*D.M. is dry matter.

The hay equivalent intake must be determined for each herd before the grain feeding tables in this publication can be used effectively. To do this, weigh each type of roughage that is fed and divide the total pounds by the number of animals being fed. This gives the average daily consumption per head for each type of feed other than the concentrates. Then, using the factors given in Table 1, calculate the total hay equivalence of the roughages fed. Every time the roughage feeding program is changed, the hay equivalent of the roughages should be recalculated. Using these hay equivalence figures and the average body weight of the animals in the herd, you can now calculate the hay equivalent intake of each animal.

Example of Calculating Hay Equivalent Intake

A dairyman is feeding the following average amounts of roughage daily:

Pineapple hay	11 pounds
Pineapple silage	34 pounds
Molasses	5 pounds

Refer to Table 1 and find the total hay equivalent intake of these roughages:

Pineapple hay (1 × 11)	= 11.0
Pineapple silage (.22 × 34)	= 7.5
Molasses (1.5 × 5)	= 7.5
Total hay equivalent intake	= 26.0

What is the hay equivalent intake of the average cow in this herd? The hay equivalent intake is the pounds of hay equivalent per 100 pounds of body weight. The average body weight of the cows is 1,300 pounds. Therefore:

$$\text{HEI} = \frac{\text{Total hay equivalent intake}}{\text{Body weight}} \times 100$$

$$\text{HEI} = \frac{26.0}{1300} \times 100 = 2.00$$

Thus the hay equivalent intake for this group of animals is 2.00.

Table 6 gives the amount of grain which these animals, producing at their level of production and butterfat test, should receive.

How to Determine Amounts of Grain to Feed

The grain feeding guide tables (Tables 2 to 9) show the amounts of grain to feed at different levels of production and butterfat test for animals with varying hay equivalent intakes. The amounts shown serve as guides in feeding concentrates to dairy cows. These guides, plus good "cow sense," provide an efficient feeding program that allows for maximum production. Each individual cow should be fed according to her ability to consume roughages and concentrates as well as her physical condition.

Individual cattle or groups of cattle should be fed the amount of grain listed in the table corresponding to the level of milk production and butterfat test of the individual cows. The suggested crude protein content of the grain mixture, depending upon the type of roughage being fed is shown in each table. The grain ration should contain appromixately 72 percent total digestible nutrients (T.D.N.).

The price received for milk and the cost of roughage and concentrate items influence the feeding program for dairy cattle. Major changes in the price of these items would influence the recommended amounts of grain to feed. If roughages should become inexpensive relative to the price of grain, dairymen should utilize the maximum amount of roughages and feed the amounts of grain shown in the high hay equivalent intake tables.

When feeding according to milk production, it is practical to make changes in the amounts of grain fed at least once a month. This should be done following each monthly test period.

When More Frequent Changes in the Amounts of Grain Fed Are Necessary:

1. When a change takes place in the quantity or quality of the roughage consumed.
2. When the flesh, appetite, or health of a cow, or cows, requires an immediate change.
3. During the time following calving when animals are increasing in production.

When More Concentrates Than Recommended in the Tables Are Required:

1. Any cow, milking or dry, in thin condition can benefit from extra feed.
2. For animals that are just coming into production, increase the amount fed by 2-pound increments as long as the animal responds to the extra feed by an increase in production.
3. First-calf heifers should receive from 10 to 20 percent more than indicated. This additional amount depends upon the animal's growth and development. Second-calf heifers should receive from 5 to 10 percent more.

When Less Concentrates Than Recommended in the Tables Are Adequate:

1. Cows getting too fat.
2. Cows that are being dried off that are unusually persistent.
3. Temporary periods when a cow has mastitis or other sickness.

Figure 1.
An example of an over-conditioned cow. Less grain could be fed to this cow without much change in her production level.

Figure 2.
An example of a cow in good working condition. She is receiving ample feed for maintenance and production.

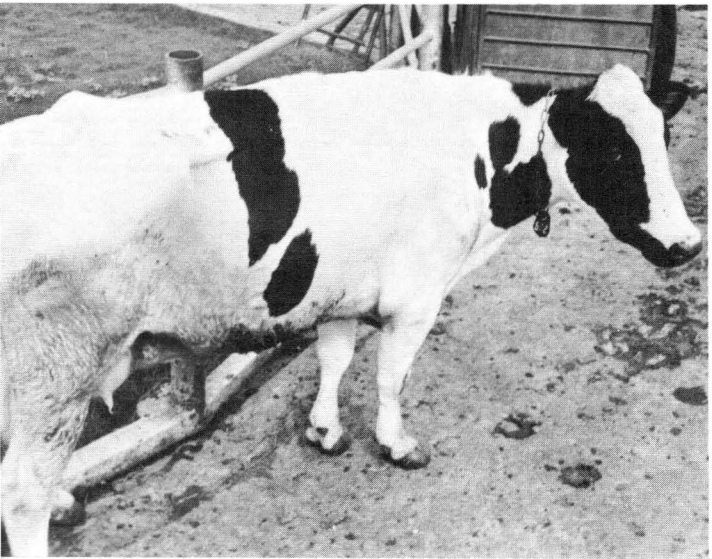

Figure 3.
An example of an under-conditioned cow. Additional feed would probably result in improved body condition and production.

Table 2. Complete Grain Feeding Guide for Animals Consuming Less Than One Hay Equivalent[1]

Milk production	Butterfat Test			Required crude protein content of grain mixture when feeding[2]		
	3.0%	3.5%	4.0%	No legume	¼ legume	½ legume
lbs. daily	lbs. grain to feed daily			%	%	%
5	8	8	8	16.5	13.0	9.0
10	10	10	10			
15	12	12	13			
20	14	15	15			
25	16	17	18	16.5	15.0	12.5
30	18	19	20			
35	21	22	23			
40	23	24	25			
45	25	26	27	16.5	15.5	14.0
50	27	28	30			
55	29	31	32			
60	31	33	35			
65	34	35	37	16.5	16.0	15.0
70	36	38	40			
75	38	40	42			
80	40	42	44			
85	42	44	47	16.5	16.0	15.0
90	44	47	49			
95	46	49	52			
100	49	51	54			

1. See pages 5-6 for instructions on calculating hay equivalent intake.

2 If no legume roughage is being fed, use the first column to determine the crude protein content of the grain mixture. If legumes make up ¼ or ½ of the hay equivalent intake, use the second and third columns, respectively.

Table 3. Complete Grain Feeding Guide for Animals Consuming 1.0 to 1.2 Hay Equivalents[1]

Milk production	Butterfat Test			Required crude protein content of grain mixture when feeding[2]		
	3.0%	3.5%	4.0%	No legume	¼ legume	½ legume
lbs. daily	lbs. grain to feed daily			%	%	%
5	7	7	7	19.0	14.5	8.5
10	9	9	9			
15	11	11	12			
20	13	14	14			
25	15	16	17	18.0	16.0	13.0
30	18	18	19			
35	20	21	22			
40	22	23	24			
45	24	25	26	17.5	16.5	14.0
50	26	28	29			
55	28	30	31			
60	30	32	34			
65	33	34	36	17.0	16.5	15.0
70	35	37	39			
75	37	39	41			
80	39	41	44			
85	41	44	46	17.0	16.5	15.0
90	43	46	48			
95	46	48	51			
100	48	50	53			

[1] See pages 5-6 for instructions on calculating hay equivalent intake.

[2] If no legume roughage is being fed, use the first column to determine the crude protein content of the grain mixture. If legumes make up ¼ or ½ of the hay equivalent intake, use the second and third columns, respectively.

Table 4. Complete Grain Feeding Guide for Animals Consuming 1.3 to 1.5 Hay Equivalents[1]

Milk production	Butterfat Test			Required crude protein content of grain mixture when feeding[2]		
	3.0%	3.5%	4.0%	No legume	¼ legume	½ legume
lbs. daily	lbs. grain to feed daily			%	%	%
5	4	4	4	23.0	16.5	8.0
10	6	6	7			
15	8	9	9			
20	11	11	12			
25	13	13	14	19.5	16.5	13.0
30	15	16	16			
35	17	18	19			
40	19	20	21			
45	22	23	24	18.5	16.5	14.0
50	24	25	26			
55	26	27	29			
60	28	29	31			
65	30	32	34	18.0	16.5	15.0
70	32	34	36			
75	34	36	38			
80	36	39	41			
85	38	41	43	18.0	16.5	15.0
90	41	43	46			
95	43	46	48			
100	45	48	51			

[1] See pages 5-6 for instructions on calculating hay equivalent intake.

[2] If no legume roughage is being fed, use the first column to determine the crude protein content of the grain mixture. If legumes make up ¼ or ½ of the hay equivalent intake, use the second and third columns, respectively.

Table 5. Complete Grain Feeding Guide for Animals Consuming 1.6 to 1.8 Hay Equivalents[1]

Milk production	Butterfat Test			Required crude protein content of grain mixture when feeding[2]		
	3.0%	3.5%	4.0%	No legume	¼ legume	½ legume
lbs. daily	lbs. grain to feed daily			%	%	%
5	2	2	2	35.0	23.5	8.5
10	4	4	4			
15	6	6	7			
20	8	8	9			
25	10	11	11	23.0	18.5	13.0
30	12	13	14			
35	14	15	16			
40	16	18	19			
45	19	20	21	20.5	18.0	15.0
50	21	22	24			
55	23	24	26			
60	25	27	28			
65	27	29	31	19.5	17.5	15.5
70	29	31	33			
75	32	34	36			
80	34	36	38			
85	36	38	41	19.0	17.5	15.5
90	38	41	43			
95	40	43	46			
100	42	45	48			

[1] See pages 5-6 for instructions on calculating hay equivalent intake.

[2] If no legume roughage is being fed, use the first column to determine the crude protein content of the grain mixture. If legumes make up ¼ or ½ of the hay equivalent intake, use the second and third columns, respectively.

Table 6. Complete Grain Feeding Guide for Animals Consuming 1.9 to 2.1 Hay Equivalents[1]

Milk production	Butterfat Test 3.0%	3.5%	4.0%	Required crude protein content of grain mixture when feeding[2] No legume	¼ legume	½ legume
lbs. daily	lbs. grain to feed daily			%	%	%
5	2	2	2	44.0[3]	44.0	10.0
10	3	3	3			
15	3	3	4			
20	5	6	6			
25	7	8	9	28.0	22.0	14.0
30	9	10	11			
35	12	13	14			
40	14	15	16			
45	16	17	18	23.0	19.5	15.0
50	18	19	21			
55	20	22	23			
60	22	24	26			
65	24	26	28	21.0	18.5	16.0
70	27	29	31			
75	29	31	33			
80	31	33	35			
85	33	36	38	20.0	18.0	16.0
90	35	38	40			
95	37	40	43			
100	40	42	45			

[1] See pages 5-6 for instructions on calculating hay equivalent intake.

[2] If no legume roughage is being fed, use the first column to determine the crude protein content of the grain mixture. If legumes make up ¼ or ½ of the hay equivalent intake, use the second and third columns, respectively.

[3] Where 44% appears under protein content of grain, feed soybean oil meal or other oil meals.

Table 7. Complete Grain Feeding Guide for Animals Consuming 2.2 to 2.4 Hay Equivalents[1]

Milk production	Butterfat Test 3.0%	3.5%	4.0%	Required crude protein content of grain mixture when feeding[2] No legume	¼ legume	½ legume
lbs. daily	lbs. grain to feed daily			%	%	%
5	2	2	2	44.0[3]	44.0	11.0
10	2	2	2		Feed ½	Feed ½
15	3	3	3		of the	of the
20	4	4	4		amount	amount
					shown	shown
25	4	5	6	37.0	28.0	14.5
30	7	8	8			
35	9	10	11			
40	11	12	13			
45	13	14	16	26.0	21.5	16.0
50	15	17	18			
55	17	19	20			
60	20	21	23			
65	22	24	25	23.0	20.0	16.0
70	24	26	28			
75	26	28	30			
80	28	30	33			
85	30	33	35	21.0	19.0	16.0
90	32	35	38			
95	35	37	40			
100	37	40	42			

[1] See pages 5-6 for instructions on calculating hay equivalent intake.

[2] If no legume roughage is being fed, use the first column to determine the crude protein content of the grain mixture. If legumes make up ¼ or ½ of the hay equivalent intake, use the second and third columns, respectively.

[3] Where 44% appears under protein content of grain, feed soybean oil meal or other oil meals.

Table 8. Complete Grain Feeding Guide for Animals Consuming 2.5 to 2.7 Hay Equivalents[1]

Milk production	Butterfat Test			Required crude protein content of grain mixture when feeding[2]		
	3.0%	3.5%	4.0%	No legume	¼ legume	½ legume
lbs. daily	lbs. grain to feed daily			%	%	%
5	2	2	2	44.0[3]	44.0	No grain
10	2	2	2		Feed ½	feeding
15	3	3	3		of amount	required
20	4	4	4		shown in table	
25	4	5	5	44.0	44.0	16.5
30	5	5	6			
35	6	7	8			
40	8	9	10			
45	10	12	13	30.0	24.5	16.5
50	12	14	15			
55	15	16	18			
60	17	18	20			
65	19	21	23	25.0	21.5	16.5
70	21	23	25			
75	23	25	27			
80	25	28	30			
85	28	30	32	23.0	20.0	16.5
90	30	32	35			
95	32	34	37			
100	34	37	40			

1 See pages 5-6 for instructions on calculating hay equivalent intake.

2 If no legume roughage is being fed, use the first column to determine the crude protein content of the grain mixture. If legumes make up ¼ or ½ of the hay equivalent intake, use the second and third columns, respectively.

3 Where 44% appears under protein content of grain, feed soybean oil meal or other oil meals.

Table 9. Complete Grain Feeding Guide for Animals Consuming More Than 2.7 Hay Equivalent[1]

Milk production	Butterfat Test			Required crude protein content of grain mixture when feeding[2]		
	3.0%	3.5%	4.0%	No legume	¼ legume	½ legume
lbs. daily	lbs. grain to feed daily			%	%	%
5	2	2	2	44.0[3]	44.0 Feed ½ of amount shown in table	No grain feeding required
10	2	2	2			
15	3	3	3			
20	4	4	4			
25	4	4	4	44.0	44.0	18.5
30	5	5	5			
35	6	6	6			
40	6	8	9			
45	8	10	11	34.0	26.5	17.5
50	10	12	14			
55	12	14	16			
60	14	17	18			
65	16	19	21	27.0	22.5	17.0
70	19	21	23			
75	21	24	26			
80	23	26	28			
85	25	28	31	24.0	20.5	17.0
90	27	31	33			
95	29	33	36			
100	32	35	38			

[1] See pages 5-6 for instructions on calculating hay equivalent intake.

[2] If no legume roughage is being fed, use the first column to determine the crude protein content of the grain mixture. If legumes make up ¼ or ½ of the hay equivalent intake, use the second and third columns, respectively.

[3] Where 44% appears under protein content of grain, feed soybean oil meal or other oil meals.

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