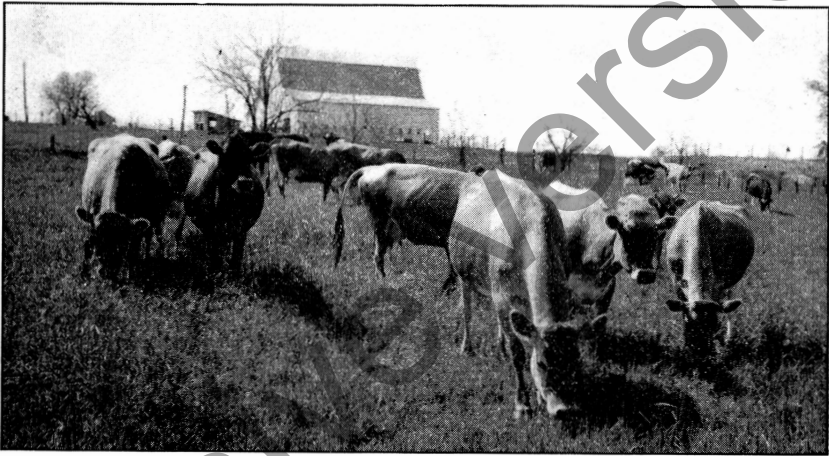


Rations for Dairy Cows

M. J. REGAN AND W. H. CLONINGER



Home grown roughages, when fed with the proper balanced grain supplement, will produce milk and butterfat with greatest economy.

The average annual production for Missouri dairy cows, 160 pounds of butterfat, can be raised to approximately 300 pounds through proper feeding.

Cows in Missouri dairy herd improvement associations producing only 160 pounds butterfat per year return on the average \$26 annually for labor, veterinary services, and other expenses, after paying for feed. Cows producing 300 pounds of butterfat per year return an average of \$102 per cow above the cost of feed to cover labor, other costs, and a reasonable profit.

In addition to providing regular and profitable employment the year around, milk cows provide a more profitable market for grain and roughages than is ordinarily found through cash sales of the crop.

This is particularly true of farm-grown roughages harvested in an unmarketable condition.

Since good dairy cows provide one of the best markets for farm-grown roughages, the roughages grown on your particular farm should provide the basis of your milk producing ration. This roughage may be classified on the basis of the protein content, as in the table on pages 6 and 7. Select the group of roughages which most nearly approximate those available on your farm. Printed underneath each roughage, is a grain mixture which will provide feed constituents required for milk production in such proportion that, with the roughage, an efficient and economical milk producing ration results.

FEEDING STANDARDS FOR DAIRY COWS

The following feeding standards have been prepared to serve as approximate guides in the computations of balanced rations for the practical feeding of dairy cows. Both minimum and more liberal recommendations are given for cows of different weights and production. The range between minimum and liberal recommendations is dependent upon the availability and comparative feed cost of protein and total digestible nutrients. The following example illustrates the method of determining from these standards, the recommended amounts of digestible protein and total digestible nutrients required daily, by a 900 pound cow, producing 30 pounds of 5% milk.

Digestible Protein Required:	lbs.
For Maintenance	0.593
For Milk Production, 30 lbs. milk x 0.056 (protein per lb. of 5% milk)	1.680
Total	2.273
Total Digestible Nutrients:	
For Maintenance	7.230
For Milk Production, 30 lbs. milk x .373 (Nutrients per lb. of 5% milk)	11.190
Total	18.420

Therefore, in order to maintain her body weight and produce 30 pounds of 5% milk this cow should have daily, in her roughage and grain feed, approximately 2.27 pounds of digestible protein and 18.42 pounds of total digestible nutrients. *If the minimum allowance figures are used this cow must have not less than 1.93 pounds of digestible protein and 16.97 pounds of total digestible nutrients.*

When the requirements have been estimated the table giving the amount of nutrients in 100 pounds of common feeds, contained in this Circular, may be used in determining a roughage and grain ration that will supply the required nutrients for maintenance and milk production.

TABLE OF FEEDING STANDARDS*

	Digestible Protein		Total Digestible Nutrients	
	Minimum allowance advised	Recommended for good cows under usual conditions	Minimum allowance advised	Recommended for good cows under usual conditions
		Lbs.	Lbs.	Lbs.
(a) For maintenance (per head daily)				
700-lb. cow	0.440	0.476	5.13	5.81
750-lb. cow	0.467	0.506	5.45	6.18
800-lb. cow	0.494	0.536	5.77	6.53
850-lb. cow	0.521	0.564	6.08	6.88
900-lb. cow	0.547	0.593	6.38	7.23
950-lb. cow	0.574	0.621	6.69	7.58
1000-lb. cow	0.600	0.650	7.00	7.93
1050-lb. cow	0.626	0.678	7.30	8.27
1100-lb. cow	0.652	0.706	7.60	8.61
1150-lb. cow	0.677	0.734	7.90	8.95
1200-lb. cow	0.703	0.762	8.20	9.29
1250-lb. cow	0.730	0.790	8.51	9.64
1300-lb. cow	0.754	0.817	8.80	9.97
1350-lb. cow	0.779	0.844	9.09	10.29
1400-lb. cow	0.805	0.872	9.39	10.63
1450-lb. cow	0.829	0.898	9.67	10.96
1500-lb. cow	0.854	0.925	9.96	11.28
(b) For Milk Production per pound of Milk (to be added to allowance for maintenance)				
For 2.5% milk	0.034	0.040	.238	.251
For 3.0% milk	0.036	0.043	.261	.276
For 3.5% milk	0.038	0.046	.284	.300
For 4.0% milk	0.041	0.049	.307	.324
For 4.5% milk	0.044	0.052	.330	.349
For 5.0% milk	0.046	0.056	.353	.373
For 5.5% milk	0.049	0.059	.376	.397
For 6.0% milk	0.052	0.062	.399	.422
For 6.5% milk	0.054	0.065	.422	.446
For 7.0% milk	0.057	0.068	.445	.470

*Based on Missouri Agricultural Experiment Station Bulletin 281, "Feeding Dairy Cattle," by A. C. Ragsdale; and "Feeds and Feeding," 20th Edition, by F. B. Morrison.

FACTORS AND CONSTANTS FOR EVALUATING FEEDS

In order to select economical rations for dairy cows it is frequently necessary to determine which of the available feeds, that are otherwise satisfactory, provide nutrients at least expense. The following general table will help in arriving at the comparative values.

Feed	Constants		Total digestible nutrient factors (on net energy basis for certain feeds)
	For Corn	For Cottonseed Meal	
<i>Concentrates</i>			Per Cent
Barley, common, not including Pacific Coast states	0.899	0.083	97.6
Beet pulp, dried	0.941	-0.053	89.1
Blood meal, or dried blood.....	-1.146	2.246	94.2
Brewers grain, dried	0.323	0.525	81.0
Brewers grain, wet	0.104	0.110	20.6
Buttermilk	0.031	0.088	11.3
Corn, dent, Grade No. 2	1.000	0.000	100.0
Corn ears (corn and cob meal).....	0.964	-0.024	94.2
Corn gluten feed	0.443	0.557	96.0
Corn gluten meal	0.060	1.028	101.5
Cottonseed meal 43% protein grade, all analyses	0.012	0.995	93.7
Cottonseed meal, 41% protein grade, all analyses	0.019	0.962	91.3
Cottonseed feed, below 36% protein.....	0.140	0.730	81.8
Distillers' corn grains, dried	0.572	0.520	105.5
Fish meal	-0.516	1.458	83.9
Hominy feed	1.048	0.010	105.7
Linseed meal, old process, all analyses....	0.197	0.832	97.0
Linseed meal, 37% protein or over.....	0.097	0.935	96.5
Malt sprouts	0.270	0.524	75.7
Molasses, cane	0.836	-0.143	70.2
Oats, not including Pacific Coast states	0.786	0.109	88.7
Peanut oil meal, old process, all analyses	0.015	1.080	101.9
Rye grain	0.888	0.114	99.4
Skimmed milk, centrifugal	0.017	0.096	10.7
Skimmed milk, dried	0.206	0.902	104.3
Soybean seed	0.248	0.885	106.9
Soybean oil meal, hydraulic or expeller process, all analyses	0.027	1.069	102.0
Tankage, 60% protein grade	-0.647	1.738	96.8
Wheat, recent analyses	0.909	0.138	103.7
Wheat bran, all analyses	0.646	0.243	87.1
Wheat standard middlings, all analyses	0.729	0.263	97.3
<i>Dry Roughages</i>			
Alfalfa hay, all analyses	0.299	0.241	52.4
Clover hay, red, all analyses	0.436	0.111	54.0

Feed	Constants		Total digestible nutrient factors (on net energy basis for certain feeds)
	For Corn	For Cottonseed Meal	
Clover and timothy hay, all analyses.....	0.454	0.034	48.5
Corn fodder, medium in water	0.437	0.011	44.8
Corn stover, medium in water	0.303	—0.001	30.1
Cottonseed hulls	0.449	—0.068	38.6
Cowpea hay	0.223	0.314	51.5
Kafir fodder, dry, including grain	0.397	0.051	44.4
Kafir stover, medium in water.....	0.339	—0.020	32.0
Lespedeza hay, annual	0.369	0.187	54.3
Oat Straw	0.333	—0.042	29.4
Sorghum fodder, sweet, dry	0.416	0.018	43.3
Soybean hay, all analyses	0.237	0.268	48.6
Sudan grass hay	0.388	0.044	42.9
Timothy hay, all analyses	0.453	—0.009	44.4
Wheat straw	0.128	—0.003	12.5
<i>Green Roughages, Silages and Roots</i>			
Alfalfa, green	0.088	0.079	16.1
Corn fodder, dent, all analyses	0.190	—0.004	18.6
Mangels, roots	0.081	0.012	9.2
Sudan grass	0.188	0.002	19.0
Alfalfa, high in water	0.109	0.032	13.9
Corn, dent, well-matured, well-eared.....	0.197	0.003	20.0
Corn, dent, well-matured, few ears	0.158	—0.001	15.8
Corn, dent, immature, before dough stage	0.143	0.000	14.3
Sorghum, grain varieties	0.175	—0.004	17.1

In using this table, to arrive at the value of a given feed, (1) multiply the constant for that feed given in corn column, by the price of corn; (2) multiply the constant for the feed given in the cottonseed meal column by the price of cottonseed meal; (3) add the results (except when a minus (—) sign precedes any constant, in that case subtract) to obtain the dollar and cent value of the feed.

Example:—To find the value of oats when corn is selling at \$1.00 per hundred and cottonseed meal at \$1.50 per hundred. In the Table of Constants, the constant for oats under the Column head “Corn” is .786 and the constant under the column head “Cottonseed Meal” is .109. Therefore, .786 (constant for oats under corn column) x \$1.00 (price of corn) = \$0.786 and .109 (constant for oats under cottonseed meal column) x \$1.50 (price of cottonseed meal) = \$0.164. Then \$0.786 + \$0.164 = \$0.95, the value of oats per 100 pounds.

LET YOUR ROUGHAGE BE YOUR GUIDE

	Non-Legume	Mixed	Legume	Pasture
With this kind of roughage → feed ↓ This mixture of grain →	Corn silage, corn stover, oat hay, cane, timothy, soybean straw, sudan, or other non-legumes.	Corn silage, stover, cane, timothy, or other non-legumes, with alfalfa, clovers, soybeans or cowpeas.	Cowpeas, soybeans, alfalfa or clover.	Sweet clover, Korean, sudan, barley, wheat, rye bluegrass or other permanent pasture.
	Ground corn 400 Wheat bran 300 Cottonseed meal 300 Steamed bone meal 20 Salt 15	Ground corn 600 Wheat bran 250 Cottonseed meal 150 Steamed bone meal 15 Salt 15	Ground corn 600 Ground oats 200 Wheat bran 200 Steamed bone meal 10 Salt 15	Ground corn 700 Wheat bran 200 Cottonseed meal 100 Steamed bone meal 15 Salt 15
Approximate protein content	Crude20.0 Digestible16.5	Crude16.0 Digestible12.5	Crude11.0 Digestible 8.5	Crude14.5 Digestible11.5
Amount to feed	Feed Jersey or Guernsey cows 1 lb. of grain for each 3-4 pounds of milk produced. Feed Holsteins, Brown Swiss or Shorthorns 1 lb. of grain for each 4-5 pounds of milk produced.			Jersey or Guernsey 1 lb. feed to each 4-5 lbs. of milk produced. Holstein or Shorthorn 1 lb. feed to each 5-6 lbs. of milk produced.
Substitutes for corn	Corn and cob meal, barley, hominy feed, pound for pound. Up to 50% of the corn may be replaced by an equal weight of ground wheat or sorghum grains.			
for bran	Oats, alfalfa meal, or wheat middlings, pound for pound.			
for cottonseed meal	Linseed oil meal, gluten meal, soybean oil meal, crushed soybeans, pound for pound.			

When comparing carbohydrate feeds and when protein rich feeds cost no more than low protein feeds, the factor given in the third column should be used for determining the relative value of feeds instead of the constants in the first two columns. To illustrate, using barley, the factor in the third column is 97.6, which means that barley is worth 97.6 as much as a source of total digestible nutrients as No. 2 Dent corn. Assuming corn is worth \$2.00 per hundred, multiply 97.6 by \$2.00 and we find that the value of barley as a source of total digestible nutrients is \$1.95 in comparison with corn at the price stated.

Other considerations may determine the desirability of selecting certain feeds. This table and method will give, for any price condition, on the basis of nutrients, what one can afford to pay for a given feed.

FEEDING THE DRY COW

The amount of milk that a cow will produce during her lactation depends greatly upon her condition at freshening time. A cow should rest from 6 to 8 weeks previous to her calving period. Proper feeding during this dry period is just as important as is proper feeding during the lactation period. She should be provided with good pasture or fed hay and silage at approximately the same rate as to milking cows.

The same grain ration recommended for the milking herd or the dry cow grain mixture suggested in this Circular may be fed in such amounts as required to get or keep cows in good condition until about one week before calving. The amount of grain fed will vary from 2 to 8 pounds per day depending on the condition of the cow.

About one week before calving one-half, or more, of the grain mixture should be replaced with bran. Beginning about the third day following calving the grain ration can be changed back gradually to the regular grain mix. The amount of grain fed may then be increased slowly until the cow is on full feed. Avoid heavy feeding during this period.

A suggested dry cow ration

Ground corn	800 pounds	Soybean meal	75 pounds
Ground oats	600 pounds	Bone meal	25 pounds
Wheat bran	400 pounds	Salt	25 pounds
Cottonseed meal	75 pounds		

Linseed meal may be substituted for a portion of the cottonseed meal and the soybean meal when available at similar prices.

APPROVED PRACTICES AND GENERAL FACTS

For the most profitable results, all grain should be ground.

Feed all the roughage the cow will clean up. This approximates 2 to 2½ pounds of hay daily for each 100 pounds of live weight or 1 to 1½ pounds of hay and 3 pounds of silage daily for each 100 pounds of live weight.

More or less silage, hay or other dried roughages may be used as circumstances make desirable by substituting 3 pounds of silage for 1 pound of hay, or vice versa. As a matter of fact either silage or hay can make up the sole roughage, although better results may be expected when both are used except when on pasture.

In feeding of either grain or roughage, each cow should be considered individually since cows differ in their ability to convert feed into milk. Regulate the amount of feed so that total profits are greatest. The live weight or physical condition of a cow is a good indication of whether she is receiving enough, too much, or too little feed.

Milk cows require 100 to 300 pounds of water daily. When their consumption of water is lowered, milk production suffers first. In cold weather either heat the water enough to remove the chill or pump just enough to supply the immediate needs of the herd. Don't force the cows to stand exposed to the winter winds while drinking. Build a windbreak.

In Missouri, dairying has proven most profitable and satisfactory where the owner has provided each cow with:

1½ tons good legume hay.

½ acre small grain, legume or sudan pasture in addition to native pasture.

3 to 4 tons of silage (in herds of 10 or more cows) in addition to a sufficient amount of a suitable grain mixture.

Plenty of good water (heated slightly in cold weather).

Summer shade and conveniently located pastures.

A monthly production record as a guide for economical feeding.

TABLE GIVING NUTRIENTS IN 100 LBS. OF COMMON FEED

Feeds	Crude Protein Lbs.	Digestible Protein Lbs.	Total Digestible Nutrients Lbs.	Fiber Lbs.
<i>Concentrates:</i>				
Ground corn (No. 2)	9.4	7.1	80.6	2.2
Corn and cob meal	8.2	6.0	75.9	8.2
Hominy feed	11.0	7.8	85.2	4.8
Ground barley	11.8	9.9	78.7	5.7
Ground wheat	13.1	11.3	83.6	3.0
Ground oats	12.0	9.4	71.5	10.6
Wheat bran	15.8	13.1	70.2	9.5
Rice bran	12.8	8.8	67.7	13.0
Wheat middlings, standard (shorts)	17.1	14.4	78.4	6.8
Corn bran	9.8	5.7	74.4	9.8
Corn germ meal	19.8	14.5	79.5	8.9
Corn gluten feed	26.4	22.7	77.4	7.1
Corn gluten meal	42.9	30.5	81.8	2.5
Distillers' dried grains (corn)....	30.6	22.3	85.0	10.8
Brewers' dried grains	25.6	20.7	65.3	14.8
Cottonseed (ground)	23.0	17.0	91.0	16.9
Cottonseed meal (43%)	43.2	35.0	75.5	10.6
Cottonseed meal (41%)	41.8	33.9	73.5	9.9
Linseed meal (op)	35.2	30.6	78.2	8.0
Soybean seed (crushed)	36.9	33.8	86.2	4.5
Soybean oil meal	44.3	37.7	82.2	5.6
Peanut meal (from shelled nuts)	42.7	38.0	82.1	8.9
<i>Dried Roughages:</i>				
Alfalfa hay or meal	14.7	10.6	50.3	29.0
Red clover hay	11.8	7.0	51.9	27.3
Soybean hay	14.8	11.1	50.6	28.4
Cowpea hay	18.6	12.6	49.4	23.3
Peas and oats	12.2	8.9	52.2	27.3
Clover and timothy	8.6	4.4	48.9	30.1
Timothy hay	6.2	2.9	46.9	30.1
Sudan grass	8.8	4.3	48.5	27.9
Orchard grass	7.7	4.6	49.6	30.5
Oat hay	8.3	4.5	46.3	28.4
Prairie hay	7.7	2.6	49.2	30.3
Corn stover	5.9	2.2	52.2	30.8
Corn fodder	6.7	3.5	54.6	21.7
Kafir stover	5.1	1.7	47.7	27.4
Kafir fodder	8.9	4.6	54.1	26.8
Sorghum fodder	6.4	3.6	52.7	25.8
Soybean straw	4.0	.9	39.6	41.4
Oat straw	4.0	0.9	44.1	36.1
Wheat straw	3.8	0.8	35.7	35.7
Cottonseed hulls	3.9	0.8	43.7	46.6
<i>Silage, Roots, Beet Pulp and Molasses:</i>				
Brewers' grain (wet)	5.7	4.6	16.6	3.6
Distiller's grain (wet)	4.4	2.9	17.2	2.5
Corn silage	2.1	1.1	17.7	6.3
Corn stover silage	1.5	0.8	13.6	7.7
Kafir silage	1.9	1.0	17.3	8.7
Corn and soybean silage.....	2.5	1.5	19.5	7.2
Mangels	1.4	1.0	7.3	0.8

TABLE GIVING NUTRIENTS IN 100 LBS. OF COMMON FEED—*Continued*

Feeds	Crude Protein Lbs.	Digestible Protein Lbs.	Total Digestible Nutrients Lbs.	Fiber Lbs.
Rutabagas (swedes)	1.3	1.0	9.3	1.4
Dried beet pulp	9.0	4.8	71.8	18.8
Molasses beet pulp	9.9	6.1	74.3	15.9
Molasses, cane or blackstrap.....	1.3	0.4	67.8	—
Mung beans	3.1	1.9	13.5	9.8
<i>Fresh Green Roughages:</i>				
Bluegrass (before heading)	5.6	4.4	17.7	5.3
Bluegrass (all analyses)	4.2	2.4	18.6	8.7
Alfalfa	4.6	3.4	14.7	7.0
Red clover	4.0	2.6	15.4	6.8
Soybeans	4.1	3.2	15.1	6.7
Cowpeas	3.0	2.3	10.9	3.8
Sweet clover	3.9	3.0	14.0	6.4
Lespedeza	6.7	5.0	20.9	10.7
Peas and oats	3.1	2.3	10.7	4.3
Sudan grass	2.0	1.4	17.7	9.8
Corn fodder	2.0	1.2	16.3	5.6
Kafir fodder	2.4	1.3	15.5	6.6
Sorghum fodder	1.5	0.8	17.3	7.0

HOW TO FIGURE A RATION

In most cases in Missouri, cows have access to a good amount of carbohydrate and energy feeds. Protein feeds are generally more expensive; therefore it is necessary to balance for protein. When a ration made up of home-grown feeds is balanced for protein it is approximately in balance for carbohydrate and energy.

To balance a ration for protein it is necessary to make the following calculations:

(1) Multiply the pounds of each individual feed in the ration by the figure (percentage protein) for that particular feed as given in the above table in the column headed "digestible protein." This gives the total pounds of digestible protein in the specified amount of each ingredient in the ration.

(2) Add these amounts to find the total digestible protein in the ration.

(3) Add up the total pounds of feed in the ration.

(4) Divide the total pounds of digestible protein by the total

pounds of feed and multiply this result by 100 to get the percentage of protein.

Example: To figure a ration of 16.5% total digestible protein to be used with non-legume roughage:

400 lb. corn x 6.0 (digestible protein in corn and cob meal)	= 24 lbs. protein
300 lb. bran x 13.1 (digestible protein in wheat bran)	= 39.3 lbs. protein
300 lb. cottonseed meal x 33.9 (digestible pro- tein in 41% cottonseed meal)	= 101.7 lbs. protein
1,000 lbs. feed	165.0 lbs. total digestible protein
165 (total protein) ÷ 1,000 (total lbs. feed) = .165 x 100 = 16.5%	
	digestible protein

If the percentage of digestible protein is too high or too low it may be adjusted to the desired amount by adjusting the amount of high protein feed, adjusting the amount of carbohydrate feeds, or adjusting the amount of both high protein and carbohydrate feeds.

Use the same method given above to balance the carbohydrate and energy requirements in the ration, using the figures in the column headed "total digestible nutrients."

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DEPARTMENT OF AGRICULTURE COOPERATING

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