

# UNIVERSITY OF KENTUCKY

## COLLEGE OF AGRICULTURE

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### CIRCULAR No. 65.

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## Feeding Dairy Cows in Kentucky

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BY

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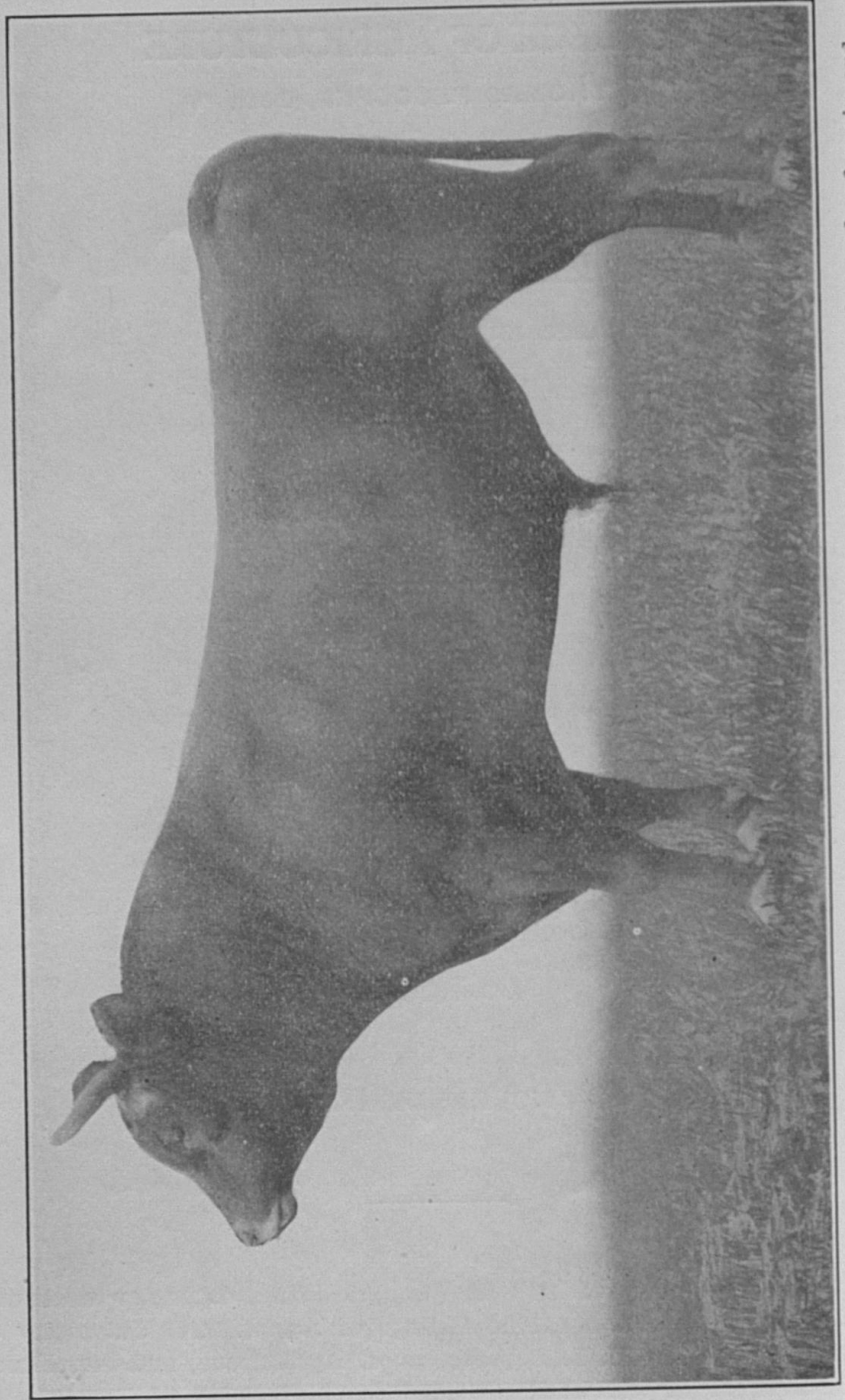


Fig. 1. Scotia's Golden Noble, 122613, herd sire at this Station. He is fed 12 pounds of grain and 10 pounds of hay, in winter, and pasture on good days. In summer he is pastured all day and fed, in addition, 6 pounds of grain a day.

## CIRCULAR NO. 65

### FEEDING DAIRY COWS IN KENTUCKY

By J. J. HOOPER

Dairymen have been accustomed to rely upon a small list of available feeds, consisting principally of wheat bran, corn meal, cotton seed meal and clover hay. Chief reliance has been placed in wheat bran, a feed that is almost unobtainable at present. Many of the standard feeds have been so adulterated with by-products as to materially change and lower their feeding value. Because of all these changes the dairyman is confronted with new and perplexing problems in feeding his dairy herd. This circular indicates the value of feeds that are now available. From the list of feeds that are now available experimental rations have been prepared at the Kentucky Experiment Station that have varied as widely in price as \$54 to \$65 per ton.

*Feeding Standards:* In seeking the best ration for a cow, the first thing to do is to consider her requirements. Her requirements vary according to the amount and richness of the milk she is producing and in regard to her live weight. Three gallons of milk contain 1.2 pounds of milk sugar, 0.9 pound of protein, 1.2 pounds of fat and 0.2 pound of ash material. A cow producing this quantity of milk, of average richness, must have the materials indicated for milk production, and also a liberal quantity of protein, carbohydrate and ash material to maintain her bodily functions and her normal temperature. Scientific men in various countries have considered the needs of the dairy cow, and have formulated feeding standards. One of these standards was presented by Professor T. L. Haecker, and in it he shows that the cow that weighs one thousand

Fig. 1. Scott's Golden Noble, 122613, herd sire at this Station. He is fed 12 pounds of grain and 10 pounds of hay in winter, and pasture on good days. In summer he is pastured all day and fed, in addition, 2 pounds of grain.

pounds, and that is producing three gallons of milk of rich quality, requires daily 2.21 pounds of protein, 14.1 pounds of digestible carbohydrates and 0.7 pounds of digestible fat. At this point it may be well to call attention to a constituent not enumerated in the standard, and that is the ash material. Many cows suffer for a lack of ash material of the proper kind. They need it for their milk and for the calf they carry in utero. Milk production is a serious drain upon the cow, and especially is this true with regard to ash material. Legume hays supply this material in excellent form. Salt also should be supplied in liberal quantities.

#### Value of Various Feeds

It is well to divide feeds into two groups: Concentrates include those feeds that contain abundant nourishment and a small proportion of fiber; corn meal, linseed meal and wheat bran are good illustrations. Roughages include corn fodder, silage, hay, etc. Also it is well to divide feeds into two other groups: Those that are relatively rich in protein and those that are rich in carbohydrates.

#### *Concentrates:*

Corn is a carbonaceous feed that should be fed in conjunction with some protein-rich hay or grain. Corn meal is heavy and should be mixed with some light, fluffy feed like wheat bran or brewers' or distillers' grains. The corn cob may be ground with the grain in order to lighten up the mixture.

Oats are an excellent feed, when rolled or ground. They are carbonaceous in character.

Barley is a carbonaceous grain that should be rolled. An excellent ration has been prepared at the Kentucky Experiment Station by mixing two parts of rolled barley, one part of ground oats and one part of velvet-bean feed.

Rye is not as palatable as some feeds, but can be used satisfactorily at intervals (off and on). It is carbonaceous and should be mixed with other feeds that are richer in protein.

Distillers' and brewers' grains are useful and supply approximately 22% of digestible protein. They are fluffy and

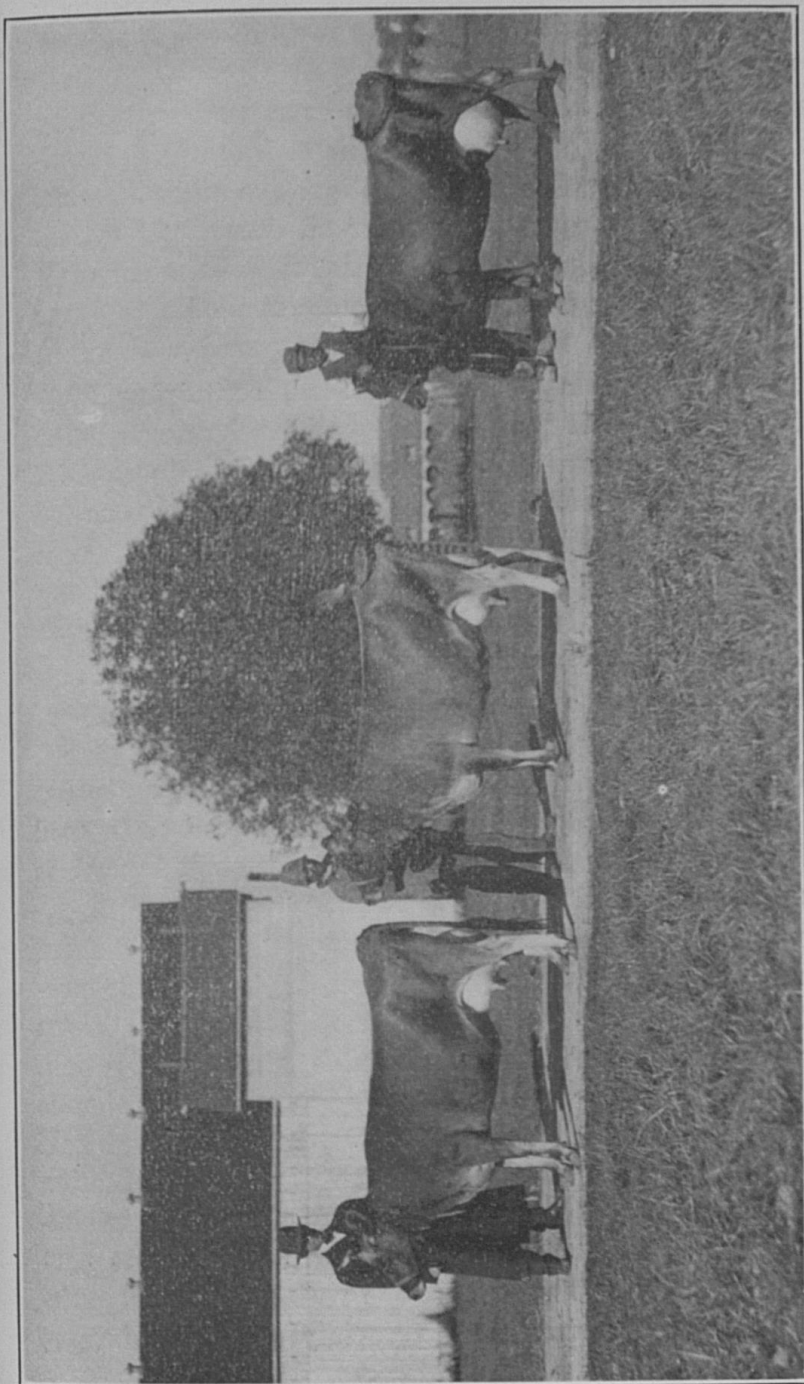


Fig. 2. The names and records of these three cows, reading from the left, are as follows: Hebron's Lady, 6,966 lbs. milk, 367 lbs. fat. Isabella's Golden Dollie, 7,367 lbs. milk, 391 lbs. fat, in a year. Eminent's Countess, 1,110 lbs. milk, 57 lbs. fat, in a month. All these are descendants of Dollie's Valentine and are members of the Experiment Station herd. When producing their heaviest flow of milk these cows are fed 8 to 12 pounds of grain, 10 pounds of hay and 30 pounds of silage daily. It is intended that they shall have 1 pound of grain for each  $3\frac{1}{2}$  pounds of milk that they produce.

light in texture and are useful for mixing with heavier grain. It is necessary to accustom many cows to these grains gradually as they do not like them at first.

Wheat bran is one of the best feeds ever used on a dairy farm. It is moderately rich in protein, containing approximately 12% of the digestible protein, is laxative and palatable. Also it is light and improves the texture of almost any ration. However, the dairyman must learn to do without much of it for a time, at least, because it is not now available in large quantities. Fortunately, rations may be prepared without it.

Cottonseed meal is a protein-rich feed, containing 37% of digestible protein, if it is of prime quality. However, most of the meal is now adulterated with cotton seed hulls and its protein content is often reduced to 20%. At the same time the hulls add crude fiber and some carbohydrates. This meal should be bought strictly on its analysis as shown by feed tag attached to every bag. It can be used to good advantage to add protein and variety to a ration.

Linseed meal is a most excellent feed, containing 31% of digestible protein. It is laxative and makes the hair glossy. Animals like it, and it is an excellent feed from every point of view. However, it is lower in protein than good cottonseed meal and usually costs more. Therefore cottonseed meal is usually employed instead of linseed meal.

Velvet-bean feed is new in Kentucky. It is made from the ground beans and pods and contains 18% of crude protein. The feed contains 60% of bean and 40% of pod. Cows learn to eat it readily, and it can be used in almost any ration. It is a heavy feed and should be mixed with something that is lighter in texture. A ration of half velvet-bean feed and half corn meal has been fed at the Kentucky Experiment Station for short periods, but such a ration lacks somewhat in palatability and variety. Mixed with two parts corn meal, one part bran and one part velvet-bean feed, the ration produced satisfactory results in comparison with a variety of other mixtures employed.

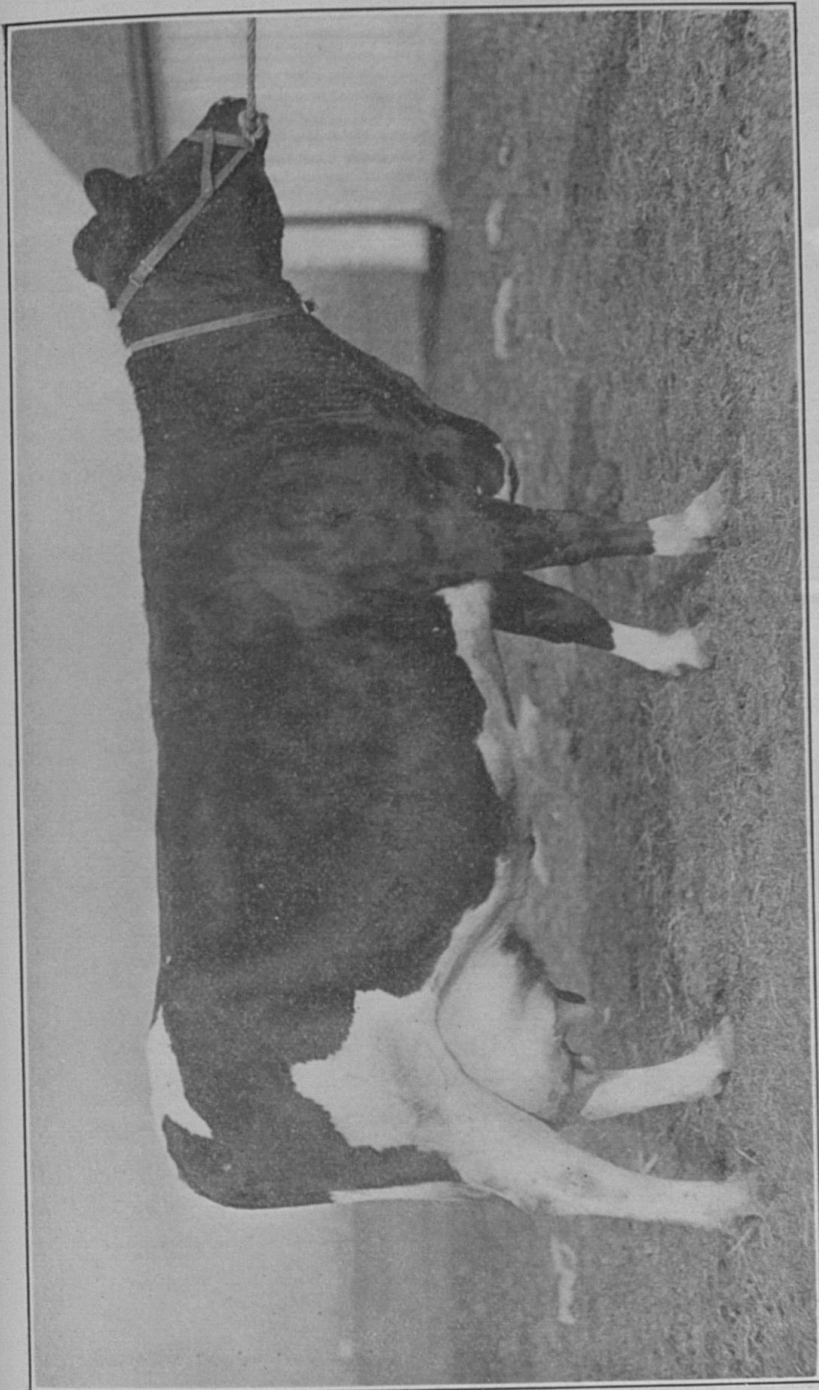


Fig. 3. Junior De Kol's Betsy, 105489. Record, 12,935 lbs. milk, 367 lbs. fat in a year; 2,102 lbs. milk, 76 lbs. fat in 31 days, and 12,720 lbs. milk, 392 lbs. fat in 7 months. Owned by the Kentucky Experiment Station. Unfortunately she is a dainty eater, consuming as a maximum 10 to 14 pounds of grain a day, even when giving as much as 65 pounds (8 gallons) of milk per day, at which time she should consume 18 pounds of grain daily. In winter she is fed, also, 15 pounds of hay and 30 pounds of silage.

Palm-kernel meal became available in Kentucky in 1917, owing to the fact that vast quantities of palm kernels were imported by the oil mills of the South. After they had been imported for a time the British Government prohibited their exportation from the Colonies in South Africa to any country except England. The oil mills expressed the palm oil, and sold the residue as palm-kernel meal. An analysis made at the Kentucky Experiment Station showed that the meal contains 18.75% protein, 2.4% fat, 16.53% fiber, 4.67% ash, 9.39% water and 48.26% nitrogen-free extract. Fed at this Experiment Station in place of part of the wheat bran in a ration it gave satisfaction. At first the cows disliked it, but finally accepted it as a part of their ration. The meal weighs a pound per quart, and is therefore rather light.

*Roughages:*

Corn stover is the most available roughage and it is useful, but not very nutritious. It should be fed freely to the cows and supplemented liberally with grain and hay. It is carbonaceous in character.

Sorghum fodder and millet hay are both carbonaceous feeds that can be utilized. They do not dry up cows, as so often reported. However, they are only moderate in nutriment and must be fed with grain and hay. Both lack protein and ash, like other feeds of similar composition. Neither is as hay to ripen too long in the field. The chief objection to soy bean hay (and legume hays in general), is that it is likely to be dusty.

Legume hays, including alfalfa, clover and the beans and peas, are most excellent, as they contain protein and ash, and are highly palatable. It has been found that the cows at the Experiment Station will actually consume 8½ pounds to every ten pounds of soy-bean hay supplied, leaving only the coarse stalks. Farmers have sometimes reported a greater percentage of refuse, but it must be due to leaving the soy-bean hay to ripen too long in the field.

The grain straws rank low in feeding value, altho serving a useful purpose for stock that is being wintered out of doors. And when hay is exceptionally high in price, as in 1917, the straws, moistened with molasses, may take the place of part of the hay.



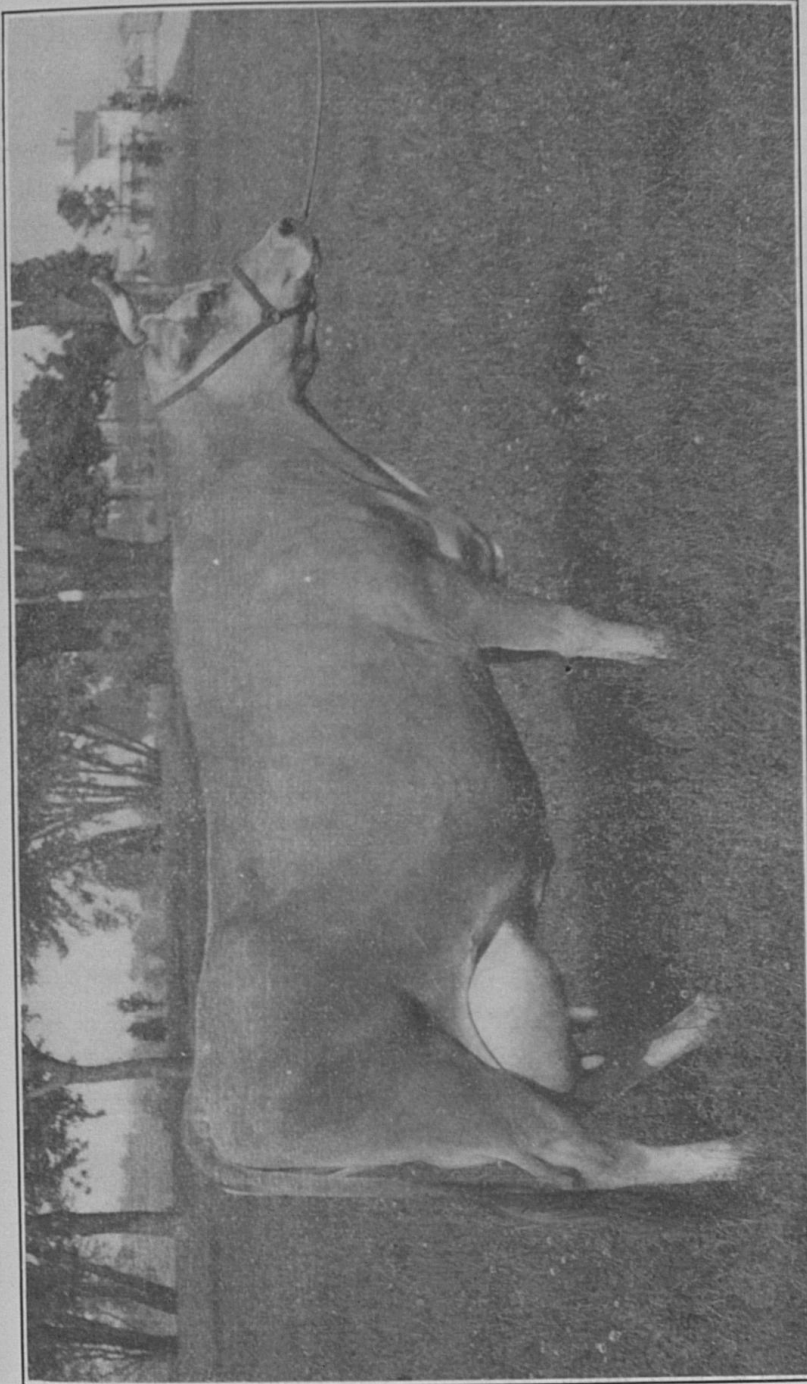


Fig. 4. Fairy Lad's Cocotte, 256,324, a Jersey cow owned at Allendale Farm. Fed according to rules explained in this circular, she produced, on official test, 9,754 pounds of milk and 666 pounds of butter in a year. Dam of one of the Jersey bulls in the herd of the Kentucky Agricultural Experiment Station.

Legume straws, such as result from threshing soy beans and cowpeas, contain considerable protein and are well liked by cattle. They should be saved and fed.

Corn silage is at once a nutritious and a palatable feed. The watery nature of the feed, termed succulence, stimulates the milk flow. When the rich grain is run into the silo the silage mass is most excellent. Three tons of good silage are equal to a ton of hay. It is a mistake to strip off the watery ears of corn and to place only the remaining stalks in the silo. The grain keeps well in the silo and adds to the feeding value of the silage. Sorghum yields more silage per acre, but it is not quite so rich.

Roots, such as mangels and sugar beets, are useful and can take the place of silage with small herds. But they cost more than silage.

#### Essentials of a Good Ration

In the preparation of a ration many points should be considered. The feeds should be home grown, because they are cheaper, and the growing of feeds rounds out the system of farm management. The cow rations of Kentucky should center around the corn plant and a legume hay. Every farm can produce both, and with these feeds available the farmer need buy little else for his cows. Corn is rich in carbohydrate material and the legume hay is rich in protein and ash.

It is well for the ration to contain a variety of feeds, as a cow likes a variety and will do best on it. A ration of corn meal and corn stover soon becomes monotonous and does not furnish all the nutriment needed. The addition of ground oats and velvet-bean feed would improve the ration and increase the milk flow.

The ration should be balanced in nutriment, containing the proper amounts of protein, carbohydrates and ash, and containing a succulent feed. A pound of grain should be supplied for each three and a half pounds of rich milk that the cow produces, and a pound of grain should be given for each four pounds of poor milk. A Jersey cow producing 28 pounds of milk would therefore receive eight pounds of grain daily.

In addition she should receive ten pounds of good hay and thirty pounds of silage.

In summer a good pasture may supply all the feed that is required. But the cow that is producing three gallons of milk will have to crop from 75 to 100 pounds of grass in a day. As most pastures do not supply so much grass during the entire season, it often pays to feed grain during the summer.

Sometimes hay approximates grain so closely in price that it becomes necessary to reduce the hay and feed more grain. This happened in the winter of 1917, when clover hay sold for \$35 to \$40 per ton. When clover hay sells at \$40 a ton a pound of nutriment in it costs  $4\frac{1}{3}$  cents a pound, and if corn meal is selling at \$60 a ton a pound of nutriment in it costs  $3\frac{3}{4}$  cents a pound. But if clover sells at \$35.50 and corn meal at \$60, a pound of nutriment costs the same in each, or  $3\frac{3}{4}$  cents a pound.

**Method of Preparing a Balanced Ration**

On pages 14 and 15 are presented two very useful tables that should be available to every dairyman, for with their use a suitable ration may be prepared for any dairy cow. The ration below has been prepared for a thousand-pound cow that is yielding three gallons of milk daily. A gallon of milk weighs 8.6 pounds.

**Ration For A Thousand-Pound Cow That Is Producing Three Gallons of 5% Milk Daily**

Consult Table on page 14.

	Digestible Nutrients Required		
	Protein Pounds	Carbohydrates Pounds	Fats Pounds
For maintenance .....	0.7	7.0	0.1
For three gallons of rich milk....	1.51	7.1	0.6
Total nutrients required.....	2.21	14.1	0.7

**Feeds Employed and Methods of Tabulating Nutrients**

Consult Table, page 15.

	Digestible Nutrients Supplied the Cow		
	Protein Pounds	Carbohydrates Pounds	Fats Pounds
4 pounds of corn meal.....	.312	2.672	.172
2 pounds wheat bran.....	.238	.840	.050
1 pound cottonseed meal.....	.376	.214	.096
15 pounds clover hay.....	1.065	5.670	.270
30 pounds corn silage.....	.360	4.260	.210
Total nutrients .....	2.351	13.656	.798

The ration that has been tabulated above supplies almost exactly the amount of nutriment that the cow requires, as indicated just above. The cow requires 2.21 pounds of digestible protein daily, and the ration supplies 2.351 pounds, which is sufficiently close for all practical purposes. Also the carbohydrates and fats are supplied in the right quantities.

To assist dairymen in preparing rations for dairy cows a list of grain mixtures is given below. These mixtures are balanced, as they contain a pound of protein for each four and seven-tenths pounds of carbohydrates and fats. It is anticipated that they will be fed in conjunction with good hay and silage, but they will fit in very well with the average roughages fed on Kentucky farms. Supply a pound of the grain mixtures for every three and half pounds of rich milk produced daily, and for every four pounds of poor milk.

GRAIN MIXTURES

- (1) 400 lbs. corn meal,  
200 lbs. wheat bran,  
100 lbs. cottonseed meal
- (2) 400 lbs. corn meal,  
100 lbs. wheat bran,  
100 lbs. distillers' or brewers' dried grains,  
50 lbs. cottonseed meal
- (3) 400 lbs. corn and cob meal,  
125 lbs. cottonseed meal
- (4) 600 lbs. corn meal,  
300 lbs. ground oats,  
150 lbs. cottonseed meal
- (5) 400 lbs. corn meal,  
200 lbs. wheat bran,  
200 lbs. velvet-bean feed,  
100 lbs. cottonseed meal
- (6) 400 lbs. corn meal,  
200 lbs. wheat bran,  
200 lbs. palm-kernel meal,  
100 lbs. cottonseed meal
- (7) 400 lbs. ground barley,  
200 lbs. velvet-bean feed,  
200 lbs. ground oats,  
100 lbs. cottonseed meal
- (8) 400 lbs. corn meal,  
200 lbs. wheat bran,  
150 lbs. peanut meal

The Agricultural College will assist any farmer prepare a satisfactory ration from the feeds that he has available.

## FEEDING STANDARD FOR MILK PRODUCTION

According to the Minnesota Station

Co-efficient for food of maintenance per hundred pounds of live weight and digestible nutrients required for the production of one pound of milk testing a given per cent. of butter fat.

For Maintenance	Protein .07 Lbs. Lbs.	Carbohydrates .7 Lbs. Lbs.	Fat .01 Lbs. (a) Lbs.
3.0%	.0469	.199	.017
3.0	.0469	.199	.017
3.1	.0474	.203	.017
3.2	.0478	.207	.018
3.3	.0482	.212	.018
3.4	.0487	.216	.018
3.5	.0492	.221	.019
3.6	.0501	.225	.019
3.7	.0511	.229	.020
3.8	.0520	.234	.020
3.9	.0530	.238	.020
4.0	.0530	.242	.021
4.1	.0546	.247	.021
4.2	.0553	.251	.021
4.3	.0558	.255	.022
4.4	.0565	.266	.022
4.5	.0572	.264	.023
4.6	.0579	.268	.023
4.7	.0584	.271	.023
4.8	.0591	.276	.024
4.9	.0597	.280	.024
5.0	.0604	.284	.024
5.1	.0611	.288	.025
5.2	.0618	.291	.025
5.3	.0625	.295	.025
5.4	.0632	.299	.026
5.5	.0639	.302	.026
5.6	.0644	.307	.026
5.7	.0651	.310	.027
5.8	.0656	.314	.027
5.9	.0663	.318	.027
6.0	.0668	.322	.028

- (a) Note that these amounts must be fed per 100 pounds weight of cow. For an 800 pound cow multiply these requirements by eight.
- (b) The nutrients given must be fed per pound of milk produced, per day. For 25.8 lbs. (3 gallons) of 5% milk multiply .0604 lbs. protein, .284 lbs. carbohydrates and .024 lbs. fat by 25.8.

## DIGESTIBLE NUTRIENTS IN ONE POUND OF FEEDING STUFFS

Concentrates	Protein	Carbohydrates	Fats
Barley .....	.084	.658	.016
Bean meal .....	.202	.423	.013
Brewers' dried grains.....	.200	.322	.060
Buckwheat .....	.081	.482	.024
Buckwheat bran .....	.059	.340	.020
Buckwheat middlings .....	.227	.375	.061
Corn .....	.078	.668	.043
Corn and cob meal.....	.044	.600	.029
Cottonseed meal .....	.376	.214	.096
Cowpea .....	.168	.549	.011
Distillers' dried grains.....	.228	.397	.116
Dry beet-pulp .....	.041	.649	.....
Emmer (speltz) .....	.100	.703	.020
Flaxseed .....	.206	.171	.290
Germ oil-meal .....	.158	.388	.108
Gluten meal .....	.297	.425	.061
Gluten feed .....	.213	.528	.029
Hominy feed .....	.068	.605	.074
Linseed meal .....	.302	.320	.069
Malt Sprouts .....	.203	.460	.014
Oats .....	.107	.503	.038
Red-dog flour .....	.162	.570	.034
Rye .....	.095	.694	.012
Rye bran .....	.112	.468	.018
Rye middlings .....	.110	.529	.026
Soy bean .....	.291	.233	.146
Wheat .....	.088	.675	.015
Wheat bran .....	.119	.420	.025
Wheat middlings .....	.169	.536	.041
Wheat shorts .....	.130	.457	.045
Roughage, Cured			
Alfalfa .....	.117	.409	.010
Alsike .....	.084	.397	.011
Barley straw .....	.009	.401	.006
Cowpea hay .....	.108	.386	.011
Corn stover .....	.014	.312	.007
Fodder corn .....	.037	.414	.015
Oat straw .....	.013	.395	.008
Oat hay .....	.047	.367	.017
Peas and oats.....	.076	.415	.015
Red top .....	.048	.469	.010
Prairie hay (upland).....	.030	.418	.014
Prairie hay (mixed).....	.029	.415	.012
Prairie hay (swale).....	.026	.419	.011
Red clover .....	.071	.378	.018
Sorghum fodder .....	.025	.443	.009
Timothy .....	.028	.424	.013
Wheat straw .....	.008	.352	.004
Silage			
Alfalfa .....	.110	.396	.012
Corn .....	.012	.142	.007
Corn cannery—refuse .....	.003	.119	.006
Pea cannery—refuse .....	.021	.131	.008
Sorghum .....	.006	.135	.002
Roots, Etc.			
Common beet .....	.012	.079	.011
Mangel .....	.010	.055	.002
Pumpkins .....	.001	.058	.002
Rutabaga .....	.010	.081	.002
Sugar beet .....	.013	.098	.001
Turnip .....	.009	.064	.001
Wet beet-pulp .....	.005	.077	.....

