

Extension Bulletin 215.

November, 1917

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# Oregon Agricultural College

EXTENSION SERVICE

O. D. Center, Director

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## BALANCING RATIONS FOR DAIRY COWS

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Oregon Agricultural College and  
United States Department of Agriculture cooperating

Revision of College Bulletin 182, Ex. II, No. 29

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# BALANCING RATIONS FOR DAIRY COWS

Feed is the largest item of expense in connection with the production of milk. Successful dairying is consequently dependent to a large extent upon the judgment of the feeder in selecting and combining feeds for his cows.

The problem of the feeder is to provide most economically the materials necessary to enable the cow best to accomplish her work. These materials are the digestible protein, carbo-hydrates, and fats which are contained in the foods and which are grouped under the general term of nutrients. These nutrients are used by the animal body as follows. The protein is used, mainly, in the upkeep of the body and is the source of the casein and albumen in the milk. The carbo-hydrates supply the body with heat and energy and are the source of the fats and sugar in the milk. The fats in the food serve the same general purpose as do the carbo-hydrates but are listed separately because of their greater value, one pound of fat being equal to about two and one-fourth pounds of carbo-hydrates.

When the nutrients in a ration are in such proportion as to meet all these food requirements of the animal, the ration is in proper proportion and is known as a balanced ration.

In order to be able to balance a ration properly one must spend some time in studying the subject and in becoming familiar with the composition of the various feed stuffs.

A list of some of the more important and common feeds, together with the amount of dry matter and nutrients contained therein, is given in Table I.

TABLE I. DIGESTIBLE NUTRIENTS IN FEEDING STUFFS\*

Feeding Stuff	Total dry matter in 100 lbs.	Amount in 100 pounds			Total
		Crude protein	Carbo-hydrates	Fat	
<b>CONCENTRATES—</b>					
Corn, dent	89.5	7.5	68.7	4.6	85.7
Hominy Feed	89.9	7.0	61.2	7.3	84.6
Gluten Feed	91.3	21.6	51.9	3.2	80.7
Gluten Meal	90.9	30.2	43.9	4.4	84.0
Wheat	89.8	9.2	67.5	1.5	80.1
Wheat Bran	89.9	12.5	41.6	3.0	60.9
Wheat Middlings	89.3	15.7	52.8	4.3	78.2
Wheat Shorts	89.5	13.4	46.2	4.3	69.3
Rye	90.6	9.9	68.4	1.2	81.0
Rye Bran	88.6	12.2	56.6	2.8	75.1
Barley	90.7	9.0	66.8	1.6	79.4
Oats	90.8	9.7	52.1	3.8	70.4
Buckwheat	87.9	8.1	49.7	2.5	63.4
Buckwheat Middlings	88.0	24.6	38.3	6.1	76.6
Emmer (Speltz)	91.3	9.5	63.2	1.7	76.5
Kaffir Corn	88.2	9.0	65.8	2.3	80.0
Milo Maize	89.3	8.7	66.2	2.2	79.9
Sorghum Grain	87.3	7.5	66.2	2.6	79.5
Dried Beet Pulp	91.8	4.6	65.2	0.8	71.6
Molasses Beet Pulp	92.4	5.9	68.0	0.6	75.3
Canada Peas	90.8	19.0	55.8	0.6	76.2
Cocoanut Meal	90.4	18.8	42.0	8.1	79.0
Soy Bean Meal	88.2	38.1	33.9	5.0	83.2
Linseed Meal O. P.	90.9	30.2	32.6	6.7	77.9
Cottonseed Meal	92.5	37.0	21.8	8.6	78.2
Beet Molasses	74.7	1.1	59.4	0.0	60.5
<b>ROUGHAGE—</b>					
Corn Fodder	81.7	3.0	47.3	1.5	53.7
Corn Stover	81.0	2.1	42.4	0.7	46.1
Timothy Hay	88.4	3.0	42.8	1.2	48.5
Orchard Grass Hay	88.4	4.7	41.1	1.6	49.4
Oat Hay	88.0	4.5	38.1	1.7	46.4
Wheat Hay	91.9	4.0	48.5	0.8	54.3
Sudan Hay	90.0	2.7	45.4	0.7	49.7
Millet Hay	85.7	5.0	46.0	1.8	55.0
Red Clover	87.1	7.6	39.3	1.8	50.9
Alsike Clover	87.7	7.9	36.9	1.1	47.3
Sweet Clover	91.4	10.9	38.2	0.7	50.7
Alfalfa	91.4	10.6	39.0	0.9	51.6
Common Vetch	92.9	11.6	42.8	1.6	58.0
Oats and Vetch	84.3	6.9	37.0	1.4	47.9
Oats and Peas	83.4	8.3	37.1	1.5	48.8
Oat Straw	88.5	1.0	42.6	0.9	45.6
Wheat Straw	91.6	0.7	35.1	0.5	36.9
<b>SUCCULENCE—</b>					
Corn Silage	26.3	1.1	15.0	0.7	17.7
Clover Silage	27.8	1.3	9.5	0.5	11.9
Alfalfa Silage	24.6	1.2	7.8	0.6	10.4
Sorghum Silage	22.8	0.6	11.6	0.5	13.2
Oat Silage	28.3	1.5	13.8	0.9	17.3
Carrots	11.7	0.9	8.6	0.2	9.9
Sugar Beets	16.4	1.2	12.6	0.1	14.0
Mangels	9.4	0.8	6.4	0.1	7.4
Turnips	9.5	1.0	6.0	0.2	7.4
Artichokes	20.5	1.0	14.6	0.1	15.8
Potatoes	21.2	1.1	15.8	0.1	17.1
Pumpkins	8.3	1.1	4.5	0.5	6.7
Kale	11.3	1.9	4.7	0.3	7.3
Cabbage	8.9	1.9	5.6	0.2	7.9
Rape	16.7	2.6	10.0	0.3	12.3
Apple Pomace	23.3	1.2	15.6	0.8	18.6

\*From "Feeds and Feeding, Abridged" by Henry & Morrison.

The first step in balancing a ration for a dairy cow is to ascertain her requirements in food or nutrients. These requirements are: first, maintenance or upkeep of the body; and, second, materials for the making of milk. The amount of food required is dependent upon the weight of the animal and the amount and richness of the milk. Tables II and III supply us with this important information.

TABLE II. NUTRIENTS REQUIRED DAILY BY COWS OF DIFFERENT WEIGHTS FOR BODY MAINTENANCE

Weight of cow.	Nutrients Required.		
	Crude protein.	Carbo-hydrates.	Fat.
lbs.	lbs.	lbs.	lbs.
800	.56	5.60	.08
900	.63	6.30	.09
1000	.70	7.00	.10
1100	.77	7.70	.11
1200	.84	8.40	.12

TABLE III. NUTRIENTS REQUIRED FOR THE PRODUCTION OF ONE POUND OF MILK CONTAINING A GIVEN PERCENT-AGE OF BUTTER FAT

Fat in milk percent	Nutrients Required		
	Crude protein.	Carbo-hydrates.	Fat.
lbs.	lbs.	lbs.	lbs.
3.0	.047	.20	.017
3.5	.049	.22	.019
4.0	.054	.24	.021
4.5	.057	.26	.023
5.0	.060	.28	.024
5.5	.064	.30	.026
6.0	.067	.32	.028

As an illustration as to how to proceed we will assume that we have a cow weighing approximately 1000 pounds and giving 25 pounds of 4% milk daily. In Table II we find the maintenance requirements of the cow and in Table III we find the nutrients required to produce one pound of 4% milk, which, multiplied by 25, gives the necessary nutrients for the production of 25 pounds of milk. From these facts the total daily requirements of the cow are computed, as presented in Table IV.

TABLE IV. DAILY FOOD REQUIREMENTS OF A 1000-POUND COW GIVING 25 POUNDS OF 4% MILK

	Crude protein.	Carbo-hydrates.	Fat.
For maintenance .....	.70	7.0	.10
To produce 25 lbs. 4% milk .....	1.35	6.0	.53
Total nutrients required .....	2.05	13.0	.63

The next step is to make a selection of feed stuffs that will meet these requirements. The ration should contain a considerable amount of roughage; first, because the cow requires a bulky ration, and second, nutrients can usually be grown cheaper in this form than any other. For these reasons it is the common practice to give the cow all the hay or other coarse fodder she will clean up. It is also desirable, and necessary for best results, that some succulent feed be included in the ration, such as silage, roots, or kale.

By referring to Table I we may make such selections of roughage, succulent foods, and grains or concentrates as shown in Table V.

TABLE V. BALANCED RATIONS FOR A 1000-POUND COW GIVING 25 POUNDS OF FOUR-PERCENT MILK

A			
	Crude protein.	Carbo-hydrates.	Fat.
12 lbs. clover hay .....	.91	4.72	.22
25 lbs. corn silage .....	.28	3.75	.18
5 lbs. barley .....	.45	3.34	.08
2 lbs. oats .....	.19	1.04	.08
1 lb. oil meal O. P. ....	.30	.33	.07
	2.13	13.18	.63
B			
15 lbs. oats and vetch hay .....	.04	5.55	.21
40 lbs. mangels .....	.32	2.56	.04
5 lbs. M. beet pulp .....	.30	3.40	.03
3 lbs. wheat bran .....	.38	1.25	.09
1 lb. cocoanut meal .....	.19	.42	.08
	2.23	13.18	.46
C			
15 lbs. oat hay .....	.68	5.72	.26
30 lbs. kale .....	.57	1.41	.09
30 lbs. carrots .....	.27	2.58	.06
3 lbs. corn meal .....	.23	2.06	.09
3 lbs. oats .....	.29	1.56	.11
	2.04	13.33	.61

These rations are given to illustrate the method used in building up a ration rather than to present one that is ideal. Many others equally good can be formulated and, possibly, cheaper foods substituted for some of those used.

It will be noticed that the nutrients provided in these sample rations do not correspond exactly with the animal's requirements. Foods vary considerably in composition and rations built up by this method can only be close approximations.

The amount of milk a cow can give is limited to the protein content of the ration and, as a surplus of this nutrient can be used for other purposes in the animal body, it is the practice of most careful feeders to supply protein somewhat in excess of actual requirements.

In making a grain ration for a herd it is well to compute the requirements for a cow giving an average amount of milk. This same mixture can then be fed to cows giving greater or lesser amounts in the proportion of one pound of grain to each four pounds of milk given by the cow.