but that more intelligent care is necessary in feeding and management, and if these things are properly attended to, there need be no serious trouble in the hog. It requires but a few illustrations to show that the hog, as now bred and managed, is the farthest removed from a state of nature of any of our domesticated animals."

No doubt our freedom from disease in Canada has been largely caused by the feeding of foods rich in protein, and the small quantities of corn grown in our country. It is not necessary to feed such a high ration as that given to the hogs fed for lean in the above experiment; but every farmer should feed largely those foods which are rich in protein substances, a table of which is given on this page, and sloppy foods should be avoided as much as possible.

Fodder Rations for Stock.

Having described the influences which affect the composition and digestibility of foods, we give herewith a table showing the average and the variations, the former being in the centre of the column and the latter immediately below.

This table is much more worth to the farmer than its value for figuring out fodder rations. For example, if a farmer has a food which in a ration would give too much fat, he may, by consulting the market reports, profitably exchange it for a food containing less fat and more protein. Again, if he wishes to obtain rich manure, he can obtain foods which are rich in ash, as well as protein—such as bran and oil-cake, and by obtaining an analysis of the ash, he may restore the fertility of his farm if it is worn out in any special constituent of plant food, say phosphoric acid.

A "nutritive ratio" is simply the relation which exists between the nitrogenous and non-nitrogenous portion of a given food or ration, and is expressed thus: 1 : 6, meaning that the food or ration contains six times as much digestible carbo-hydrates as digestible protein, or a proportion of one to six. But as all the non-nitrogenous portion of the food does not belong to the carbo-hydrate group, the fat is converted into its carbo-hydrate equivalent by multiplying by 2.5 (more accurately 2.44). But this factor is not very accurate, for it merely assumes that the fat has 2½ times more heating power than the carbo-hydrates.

Various attempts have been made to establish relative money values to the three nutrients, protein, fat, and carbo-hydrates, just in the same manner as a fertilizer is valued by the percentages of nitrogen, phosphoric acid, and potash which it contains; but the establishing of such standards is attended with almost insuperable difficulties. In the first place, the food nutrients cannot be obtained separately, as is done with the constituents which make up the fertilizer, and, secondly, the market price differs from the scientific value. Another obstacle for our conditions is that the calculations have been made from the market prices in Germany, which may vary materially from those in Canada. The German investigators, basing their calculations upon market prices, have established 5 : 5 : 1 as the relative values for protein, fat and carbo-hydrates respectively; and in working out the money values in the subjoined table, we simply called these figures cents, which also gives the average market prices per 100 lbs. for some of the foods, notably hay, oats, oil-cake, and roots.

These are the money values from a practical standpoint: Scientifically, however, protein, considering all the functions which it performs, is more valuable than fat, and yet fatty foods in our markets appear to bring as high a price as those rich in protein, and then also the manurial value of protein foods is considerable, while fat has no value as a manure. The relation in the American standard is 4.5 : 3.84 : 0.95 respectively for the protein, fat, and carbo-hydrates, which figures usually also come close to the market prices. This relation is scientifically more accurate than the German standard, but we do not know whether or not it has been based on market prices.

In Germany the concentrated foods, especially the by-products, must have a guaranteed analysis, and they are reduced to units of feeding value. For example, suppose the relative value to be 5 : 5 : 1 respectively for the protein, fat, and carbo-hydrates, and the analysis of, say, oil-cake to be 29.5 percent of crude protein, 10 percent of crude fat, and 39.5 percent of carbo-hydrates. In these calculations, the crude, not the digestible, portions of the nutrients are taken as the basis, for it would be impossible to guarantee the digestibility, the variations being so great. In order to obtain the number of feeding units in the above oil-cake, we proceed as follows: $29.5 \times 5 + 10 \times 5 + 39.5 \times 1 = 237$ units. Now if the market price of oilcake is $2.00 per 100 lbs., therefore 237 units will cost $2.00, or one unit will cost $200 \div 237 = \$0.0084$. This is the money value of one feeding unit, but as there are in the protein $29.5 \times 5 = 147.5$ units, the value of the protein will be $147.5 \times .0084 = \$1.24$; in the same manner, the value of the fat will be $10 \times 5 \times .0084 = \$0.43$, and the carbohydrates $39.5 \times 1 \times .0084 = \$0.33$; total, $2.00.

TABLE SHOWING THE COMPOSITION AND DIGESTIBILITY OF FEEDING STUFFS:

	Total Dry Matter.	Crude Protein (Albuminoids).	Crude Fat.	Nitrogen-Free Extract.	Crude Fibre.	Ash.	Digestible. Protein.	Digestible. Carbohydrates	Digestible. Fat.	Nutritive Ratio.	Relative Values.
	%	%	%	%	%	%	%	%	%		$
Timothy	**86.5** 85.7 87.5	**6.2** 4.9–8.4	**1.7** 1.1–2.0	**45.8** 43.3–48.1	**28.9** 25.3–32.8	**3.9**	**3.5** 1 9–6	**45.5** 39–52	**0.76** .09–1.3	1 :13.5	0.66
Red Clover	**84** 78.5–87.1	**13.4** 7.6–18.3	**3 2** 1.4–5.1	**36.4** 15.2–48.1	**25 4** 18.8–48.1	**5.6**	**8.0** 3.2–13.4	**37.0** 20.6–56.7	**1.88** 0 46–3.84	1 : 5.2	0.86
Wheat Straw	**85 7** 74.0 91.9	**3.1** 1.4–5.6	**1.2** 0.6–2 0	**37.5** 26.7–44.4	**40 0** 28.9–52.6	**3.9**	**.8**	**35.6**	**0.4**	1 :45.8	0.41
Oat Straw	**85.7** 78.7–89.7	**4 0** 1.3–7.0	**2.0** 1.0–5.1	**35.6** 24.9–48.9	**39.7** 30.0–50.2	**4.4**	**1.4** 1.0–3.5	**40.** 27–48.6	**0.7** 0.14–2.6	1 :29.9	0.50
Pea Straw	**85.7** 82.6–88 1	**7.3** 4.8–10.1	**2.0** 1.5–3.3	**32 3** 22.8–39.8	**39.2** 33.6–51.8	**4.9**	**4.4** 2.8–6.1	**40.9** 33.2 50.1	**0.9** 0.6–1.6	1 : 9.8	0.67
Wheat	**85.7** 81.3–90.0	**13.2** 8.2–24.1	**1.6** 0.7–2.7	**66.2** 60.2–75.3	**3.0** 0.7–8.3	**1.7**	**11.7**	**64.3**	**1.2**	1 : 5 8	1.28
Oats	**86.3** 83.6–92.4	**12.0** 6.3–18.5	**6.0** 4 4–7.3	**56.6** 48.–71.8	**9.0** 4.1–16.1	**2.7**	**10 4** 5.0–17.3	**45.9** 37–59.8	**4.6** 3.1–6.2	1 : 4.5	1.20
Peas	**86.8** 77.9 91.1	**22.4** 18.6–27.1	**3.0** 0.6–5.3	**52.6** 41.9–59.6	**6 4** 1.9 9.2	**2.4**	**19.7** 15.6–24.7	**55.7** 41.2 63 6	**1.7** 0 2–3.6	1 : 2.6	1.62
Barley	**86.2** 79.1 91.7	**11.2** 6.2–18.3	**2.1** 1.0–3.2	**65.5** 56.1–74 7	**5.2** 2 2–10 8	**2.2**	**8.0**	**58.9**	**1.7**	1 : 7.9	1.07
Maize	**87.3** 77.6 91.8	**10.6** 5.8–15.1	**6.5** 1.5–9.2	**65.7** 52.4–72 7	**2.8** 1.3–8 5	**1 7**	**9.0** 4.86–13.3	**62 6** 49.1–71,1	**4 9** 1.1–7.2	1 : 8.3	1.32
Bran	**87.0** 83.5–92.4	**14.5** 10.1 27.0	**3 5** 1.7–6.6	**53.6** 28.5 61.5	**9.4** 4.1–34.6	**6.0**	**12.7** 8.3–25.2	**44.6** 23.3–58.7	**2.8** 0.54–5.3	1 : 4	1.12
Middlings	**87.1** 86.0–88,5	**14 6** 12.6 15.2	**3.0** 2.6–3 3	**63 8** 61.6 64.9	**3 1** 1,4–4.8	**2.6**	.....	.....	.....	.....	.....
Oil Cake	**87.8** 81.1–92.9	**29 5** 20.6 37.8	**10.0** 6.0–18.2	**29.8** 19.7–41.3	**9.7** 5.1–16.8	**8.8**	**25.6** 16.5–35	**29.6** 19.4–39.7	**9.1** 5.2–17.1	1 : 1.2	2.03
Mangels	**12 0** 7.4–24.6	**1 1** 0.55–2.6	**0 1** 0.05–0.6	**9.1** 5.2–13.8	**0.9** 0.6–4.5	**0.8**	**1 1** 0.55–2.6	**10** 5.8–18.3	**0 1** 0.05–0.6	1 : 9.3	0.16
Carrots	**14.1** 10.1–20.8	**1.3** 0.5–2.4	**0.25** 0.2–0.8	**9 6** 5.9–15.5	**1 9** 0.7–3.4	**1.0**	**1 3** 0.5–2.4	**11.5** 6.6–18.9	**0.25** 0.2–0.8	1 : 9.3	0.35
Turnips	**8 5** 7.1–13.9	**1 0** 0.6–1.8	**0.15** 0.1–0.2	**5 8** 3.7–10.9	**.97** 0.3–1.0	**0.8**	**1.0** 0.6–1.8	**6.7** 4.0–11.1	**0.15** 0.1–0.2	1 : 7	0.12
Potatoes	**25.0**	**2.1**	**0.2**	**20.7**	**1 1**	**0.9**	**2 1**	**21.8**	**0.2**	1 :10.6	0.33

How to Calculate Feeding Rations.

Suppose a farmer has hay (2 parts timothy and 3 parts clover), oat straw, peas and mangels, all of average composition and digestibility, as found in the accompanying tables:

The small table is based upon numerous feeding experiments with ruminants, and gives the amounts of the digestible nutrients required for the various animals and purposes mentioned:

If the farmer desires to feed these foods say to a cow giving milk and weighing 1,000 lbs., let him select any ration at random, say the following: 10 lbs. hay (4 lbs. timothy and 6 of clover); 8 lbs. straw; 4 lbs. peas; and 25 lbs. of mangels. By consulting the tables he will find that this ration will give him 1.6 lbs. of protein, .29 lbs. of fat, and 10.8 lbs. of carbo-hydrates, or a nutritive ration of about 1 : 10.

But as the table demands 2.5 lbs. of protein, .4 lbs. of fat, and 12.5 lbs. of carbohydrates, being a nutritive ratio of 1 : 5.4, it will be seen that the ration selected by the farmer contains insufficient nutrients, and too wide a nutritive ratio; and as the total dry substance is about the same amount required by the table, it is evident that some of the coarse fodders, with a wide nutritive ratio, will have to be exchanged for more concentrated ones having a narrow ratio.

Exchange 4 lbs. straw for 4 of peas, and ration will contain 24.8 lbs. dry matter, having 2.5 lbs. protein, .32 of fat 12.5 of carbohydrates.

Rations per 1000 lbs Live Weight for	Total Organic Substance.	Albuminoids.	Carbohydrates.	Fat.	Nutritive Ratio.
	lbs	lbs.	lbs.	lbs.	as 1
Milch Cows	24	2.5	12.5	0.4	: 5.4
Fattening Steers, 1st Period	27	2.5	15.	0.5	: 6.5
" " 2nd Period.	26	3 0	14 8	0.7	: 5.5
" " 3rd Period.	25	2.7	14.8	0.6	: 6.0
Fattening Sheep, 1st Period.	26	3.0	15.2	0.5	: 5.5
" " 2nd Period.	25	3.5	14.4	0.6	: 4.5
Fattening Swine, 1st Period	36	5.0	27.5		: 5.5
" " 2nd Period.	31	4.0	24.0		: 6.0
" " 3rd Period.	23.5	2.7	17.5		: 6.5
Sheep, coarse wooled	20	1.2	10.3	0.2	: 9
Sheep, fine wooled	22.5	1.5	11.4	0.25	: 8
Horses moderately worked	22.5	1.8	11.2	0.6	: 7
Horses heavily worked	25.5	2.8	13.4	0.8	: 5.5
GROWING CATTLE.					
Ages—Months. Live Weight.					
2– 3 150	22	4.0	13.8	2.0	: 4.7
3– 6 300	23.4	3 2	13.5	1.0	: 5.0
6–12 500	24	2.5	13 5	0 6	: 6 0
12–18 700	24	2.0	13 0	0.4	: 7
18–24 850	24	1.6	12.0	0.4	: 8