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J. W. Sanborn

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Narrow versus Wide Nutritive Rations for Horses.

J. W. SANBORN.

In the third annual report of this Station (1892) the result of feeding wide and narrow nutritive rations to horses was given. This trial was favorable to the narrow nutritive ration. This ration was made up of clover, oats and wheat, while the wide ration was made up of timothy and corn. The trial ran through the summer, when the influence of what has been termed heating food, like corn, might be less effective than in the winter season. Many believe that the more varieties of food given the better the result, as the palatableness of food, it is claimed, has a reflex influence on the appetite and digestive system. The weight to be attached to such reasoning is uncertain. The influence of season on the ration to be fed is less doubtful.

The trial was repeated the past year, beginning on October 21st and continuing to December 13th, when the rations were reversed in order to ascertain the influence of the individual factor. The doctrine that a very narrow nutritive ration, or a ration containing a pound of protein to something like five pounds of carbohydrates, is better than a ration made up of one pound of protein to six or more pounds of carbohydrates, comes from German students of animal nutrition, and has taken a very

deep hold on the American mind. It has appeared to the writer that a ration that contains nitrogen enough for the formation of the protoplasm of blood, and the usual wear of muscle, is all that is needed for work animals, animals that have already built up the muscular frame. An examination of the wastes of the body shows that during labor their muscular tissue is broken down very little, and that the nitrogen needed per day to supply this waste is very much less than is claimed by German physiologists. As it is now conceded that carbohydrates may be the source of force, it does not clearly appear that the carbohydrates may not be as effective for a work horse as the protein foods, for it has been shown by Rubner that the burning of a pound of protein does not give out more heat than the burning of a pound of carbohydrates, and as the amount of heat derived is a measure of its energy or ability to do work, it would seem that carbohydrates for the amount of protein given should be as valuable as the protein. The claim that protein has a direct relation to the nervous energy of the animal is not a demonstration, even though proven, that it will enable the animal to accomplish more labor. In short, the energy supplied by food seems to me the measure of utility to work after a certain minimum amount of protein had been supplied. That minimum amount is supplied by all the foods that a feeder by hap-hazard methods of feeding may give, if the skill to provide foods palatable enough to secure the consumption of an adequate ration is used.

In the following experiment the lot receiving the narrower nutritive ration were given timothy, clover and oats, while that receiving the wide nutritive ration received timothy and corn:

TABLE I.

WEIGHT OF FEED, OCTOBER 21 TO DECEMBER 13.

Set 1—Wide Ration.		Set 2—Narrow Ration.	
Timothy	1590	Timothy	575
Corn	900	Clover	1015
		Oats	900
Total fed	2490		
Waste	44.5	Total fed	2490
		Waste	37
Total eaten	2445.5		
		Total eaten	2453

Food reversed to lots:

TABLE II.

WEIGHT OF FEED, DECEMBER 13 TO FEBRUARY 21.

Set 2—Wide Ration.		Set 1—Narrow Ration.	
Timothy	2100	Timothy	700
Corn	1251	Clover	1400
		Oats	1251
Total fed	3351		
Waste	141	Total fed	3351
		Waste	27.25
Total eaten	3210		
		Total eaten	3323.75

Table I shows the amount of feed from October 21 to December 13. It will be noticed that the total amount eaten by each lot was almost identical. After reversal of food the amount eaten varied slightly in favor of the lot receiving the narrow ration. Being mixed food, the appetite was a little better. The difference, however, was not a material one, although it should give a difference in gain or loss of about one

pound for five or six pounds variation in the amount eaten. Set 1, then, in the second table, should have maintained weight to the extent of at least about eighteen to twenty pounds better than it did compared with the other lot, on account of this excess food eaten.

Tables III and IV show the gain or loss in the weight of the lots.

TABLE III.

WEIGHTS OF HORSES, OCTOBER 21 TO DECEMBER 13.

RATIONS.	October 21	October 30	November 6	November 13	November 27	December 4	Average, Dec. 11, 12 and 13	Gain or Loss
Narrow ration	2583	2550	2555	2520	2572	2582	2543	—40
Wide ration	2301	2330	2310	2290	2335	2335	2335	34

TABLE IV.

WEIGHTS OF HORSES, DECEMBER 18 TO FEBRUARY 21.

RATIONS	December 18	December 25	January 1	January 8	January 15	January 22	January 29	February 5	February 12	Average, Feb 19, 20 and 21	Gain or Loss	Gain or Loss, Oct. 21 to Feb. 12
Narrow ration.	2320	2350	2350	2337	2340	2365	2325	2370	2340	2285	—35	—75
Wide ration	2535	2535	2535	2517	2530	2540	2505	2520	2505	2437	—98	—64

Table III, representing the amount eaten by the two lots, shows that when eating equivalent amounts, those on the wide ration, or corn ration, did much the better, making a difference of seventy-four pounds in a period of fifty-three days, or nearly one and a half pounds a day per pair.

Table IV shows that the lot on the wide or corn ration lost sixty-three pounds the most, but they ate 113.75 pounds less,

which would account, as stated, for something like eighteen or twenty pounds of this loss. After this deduction, it will be seen that the lot receiving the wide ration still did the poorer. These figures show that Set 1, while on the narrow ration, did the poorer, and that Set 1, while on the wide ration, did the poorer. It is a question, then, in part of the individual horses. When the gain and loss of both periods are taken into account, it seems that the lot on the wide ration, as revealed in the last column of Table IV, lost eleven pounds less than that on the narrow ration, while eating over 100 pounds less food, leaving the results favorable to the corn ration as against the oats ration.

It is an interesting, and, I believe, valuable experiment, as it shows that corn and timothy are superior to clover, timothy and oats, although the popular estimation of the value of these foods leans strongly to the latter ration. Oats have been given a high position in the opinion of horsemen, but oats are not as digestible as corn.

The following table of the digestibility of oats, made up from American digestive trials, shows the actual amount of food digested in each ration, and the ratio to each other of the materials digested.

TABLE V.

AMOUNT DIGESTIBLE, NARROW RATION.

Feed.	Protein	Carbo-hydrates	Fibre	Fat	Total	Nutritive Ratio
Oats, 2151 pounds	213.13	1097.01	54.81	106.19	1472.14	1:6.6
Timothy, 1275 pounds	32.48	437.12	211.83	12.52	693.95	1:20.9
Clover, 2415 pounds	142.9	590.88	299.08	22.94	1055.80	1:6.6
Total	389.51	2125.01	565.72	141.65	3221.89	1:7.8

TABLE VI.

AMOUNT DIGESTIBLE, WIDE RATION.

Feed	Protein	Carbohydrates	Fibre	Fat	Total	Nutritive Ratio
Corn, 2151 pounds	132.62	1472.2	23.76	96.18	1724.76	1:13.1
Timothy, 2690 pounds	68.54	922.26	446.91	26.48	1464.19	1:20.9
Total	201.16	2394.46	470.67	122.66	3188.95	1:15.2

Tables 5 and 6 show that the ration of the corn-fed lot was an extremely wide one, namely, 1:15.2, far out of the region that would be regarded as at all admissible by the German notion of a proper nutritive ratio. Yet on a few pounds less consumption of total digestible material slightly greater gain was made. The difference, however, was so small as to show, so far as similar experiments can show, that the value of food depends upon the amount of digestible materials fed. It further shows that in this experiment the lot fed on corn did as well or better than the oat-fed lot, though on one-half the protein that the oat-fed lot received.

The experiment, then, corroborates the belief that above a certain minimum amount of protein required the value of food depends upon the digestible materials contained. In this case it is equivalent to the assertion that the value depends upon the heat units contained.

In estimating the above nutritive ratio the fat was multiplied by 2½ in order to increase it to its equivalent in starch of heat units furnished per pound. As a pound of protein and pound of carbohydrates are the equivalent of each other in the heat units furnished in combustion and as the total amount of digestible matters the fat being multiplied by 2½ and the total digestibility increased by this amount were the same in each ration, we arrive at the conclusion that fat being multiplied by 2½ and added, the total digestible matters in a food thus found are the approximate measure of their value.

SUMMARY.

1. Horses receiving corn and timothy did as well as horses fed on oats, clover and timothy.

2. The experiment seems to show that the value of food depends upon the heat units it may furnish in combustion.

3. A wide nutritive ration up to 1:15.2 was equivalent to a nutritive ration of 1:7.8.

4. A small amount of protein, amounting in the above experiment to eighty-two one hundredths lbs. per day per horse, was as adequate for the horses as double the amount, thus showing that a very small amount of protein per day is sufficient for a working horse.