

FEEDS AND FEEDING MANUAL

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Feeds and feeding manual by Elmer S. Savage & F. B. Morrison

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ELMER S. SAVAGE & F. B. MORRISON

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BY

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INTRODUCTION

"Feeds and Feeding Manual" first published in 1913, has apparently met a need in instruction in animal husbandry, due to the fact that it helped students to master important facts in live stock feeding by providing a convenient means of working out practical problems and rations. The manual was revised in 1915 and has since been twice reprinted. This edition has again been thoroly revised and certain improvements have been incorporated.

This manual has been prepared so that students in a course in *Feeds and Feeding* may make a systematic study of feeds and rations and may preserve the result of such study in convenient permanent form. The manual is designed especially for use with *Feeds and Feeding*, by W. A. Henry and F. B. Morrison, or with *Feeds and Feeding, Abridged*, by the same authors. The exercises have been made practical, based as far as possible on actual experience. The computations required have been chosen to teach something besides mere arithmetic. In the exercises which are here given the student will be required to make over and over again those computations which he will be forced to make in actual practice. He will thus become familiar with the methods of computing rations and with as many as possible of the feeds in common use in the United States.

The objects in mind in teaching an elementary course in *Feeds and Feeding*, as the authors see them, are three: (1) To teach the fundamental principles underlying the practice in feeding farm animals. (2) To teach as much as possible concerning the source, composition, and usefulness of the feeds commonly used in this country. (3) To teach the practice of feeding itself, so far as practice can be taught in the class room with occasional visits to the barns.

The teaching of the principles of nutrition which underlie the practice of feeding has been left to lecture and text-book. In this manual exercises have been outlined which will guide the student in his study of 50 common feeds. In addition, problems have been suggested covering rations for dairy and beef cattle, horses, sheep, and swine. In these problems the comparative usefulness of the common feeding standards is brought out, and the fact is impressed on the student that in order to formulate a ration intelligently, the nature, composition, usefulness and relative cost of a large variety of feeds must be known. A method of computing the relative value of the several feeds is clearly illustrated in the computation of the problems.

There have purposely been included in the manual more exercises and problems than can be worked out by most classes in the amount of time available. This has been done in order that each instructor may select the exercises and problems which are especially important in his own section. Additional blank pages are provided at the rear so that the instructor may assign special problems of local interest, if desired.

The authors wish to acknowledge the help of Professor W. A. Henry of the University of Wisconsin and of Professor H. H. Wing and Mr. T. A. Baker of Cornell University in the preparation of this manual.

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EXERCISE 1

DIGESTION COEFFICIENTS AND DIGESTIBLE NUTRIENTS

In order to feed livestock most economically and efficiently, one must understand thoroughly the chemical composition of the available feeds, the extent to which livestock can utilize each feed, and the actual feeding value of these feeds for the various classes of stock. Then, after finding the cost of the different feeds in any section of the country, an economical and efficient ration may readily be worked out, to suit the conditions in that particular district. Keeping in mind that the chief object of a course in *Feeds and Feeding* is to enable the student to feed farm animals more cheaply and efficiently, the exercises in this manual have been so arranged that first the composition, feeding value, and economy of different feeds are fully considered, and then the knowledge so gained is applied in working out practical rations for the different classes of animals.

The relative value of feeds depends not on their total chemical composition, but on the amount of nutrients which each feed actually furnishes. The most simple, and likewise the most common, method of measuring the usefulness of feeds is to determine the digestible nutrients in 100 lbs. of each feed. The method of finding the *coefficients of digestibility or digestion coefficients* of various feeds and of computing the *digestible nutrients* is fully explained in Part I of Chapter III of *Feeds and Feeding* or of *Feeds and Feeding, Abridged*.

After studying thoroughly this portion of whichever book is used as the text, work out the following problem. Put the summaries of your computations on page 8 in neat, logical form.

Problem.—During a 10-day digestion trial a cow consumed 96 lbs. of alfalfa hay, the average composition of which was 8.1 per ct. water, 8.8 per ct. ash, 14.6 per ct. crude protein, 28.9 per ct. fiber, 37.4 per ct. nitrogen-free extract, and 2.1 per ct. fat. During this time the cow voided in her feces or solid excrement 4.9 lbs. ash, 4.2 lbs. of crude protein, 15.2 lbs. of crude fiber, 1.16 lbs. of fat, and 35.7 lbs. of total dry matter. Find the coefficients of digestibility of the dry matter, crude protein, fiber, nitrogen-free extract, and fat.

Also compute the digestibility of the ash. This is not commonly given in tables of digestion coefficients, but can be computed from the data given in the problem.

FEED STUDIES

To aid in fixing in the mind the most important facts concerning the more common feeds, feed study blanks are provided for the systematic study of 50 feeds. Before filling out the feed study blanks for the two feeds given on the next page, read the following directions carefully, and be sure you understand them.

Source and definition.—Under "Source and definition" state briefly what the feed is.

Total composition.—Copy the total composition from Appendix Table I of the text book.

Coefficients of digestibility.—Copy the coefficients of digestibility from Appendix Table II of the text.

Digestible nutrients.—Compute the digestible nutrients for the first four feeds studied, using the total composition and the coefficients of digestibility you have already copied.

Enter in the proper spaces in the table the pounds of digestible fiber and of digestible nitrogen-free extract separately, and then add these numbers together to find the pounds of digestible carbohydrates. Enter this also in the table.

The coefficients of digestibility for the ash in feeds are not given in Appendix Table II. The digestible ash and the coefficient of digestibility for the ash can, however, be found as follows: First compute the digestible dry matter and the digestible nutrients, except the ash. Then subtract from the digestible dry matter the sum of the digestible protein, carbohydrates, and fat. (Do not multiply the fat by 2.25.) This will give the digestible ash. From this you can find the coefficient of digestibility for the ash.

The digestible nutrients should be computed to tenths of pounds. If in the computations the figure in hundredth's place is 5 or more, add 1 to the tenth's place; if less than 5, disregard it. Use this rule in general in dropping decimal places.

Total digestible nutrients.—Compute the total digestible nutrients in 100 lbs. and in 2,000 lbs. of each of the first four feeds studied, and enter the figures in the proper place on the feed study blank. The total digestible nutrients in any amount of a given feed equal the sum of the digestible crude protein, the digestible carbohydrates, and the digestible fat multiplied by 2.25. The formula for "total digestible nutrients," following the above definition, is: Total dig. nutr.=Dig. protein+dig. carbohydrates+(dig. fat \times 2.25).

Compute the total digestible nutrients in 2,000 lbs. to the nearest whole number, using the general rule just mentioned for dropping decimals.

Nutritive ratio.—Compute the nutritive ratio of the above feeds according to the definition and formula given in the text. Compute the second term of the ratio to one decimal place.

Price per ton.—Enter on page 7 and on the feed study blanks the local price of each feed. These prices will be furnished by the instructor, or may be ascertained from market reports, feed dealers, etc.

Weight of concentrates.—In the case of concentrates the bulkiness of the feed, as shown by the weight per quart, is important. Hence for concentrates copy the weight of 1 quart from Appendix Table VIII of *Feeds and Feeding* or from Appendix Table IX of *Feeds and Feeding, Abridged*. If possible determine the weights by actually weighing them.

Cost of 1 lb. total digestible nutrients.—Perhaps the most convenient way of determining which feeds are the most economical under the conditions in a particular district at any time is to compute the cost at which each of the available feeds furnishes 1 lb. of total digestible nutrients. As is pointed out further in Exercise 6 and in Chapter VIII of the text, this is a measure of the economy with which the various feeds furnish fuel or energy. The "Cost of 1 lb. total digestible nutrients" should therefore be worked out for each feed and entered on the feed study blank. Compute this cost to hundredths of a cent, using the price per ton for each feed.

Cost per lb. digestible crude protein.—Protein-rich feeds are commonly higher in price than those rich in carbohydrates in most districts of the country.

In balancing rations economically, it is therefore necessary to find out which feeds furnish digestible crude protein most cheaply. Therefore, compute for each feed, and enter in the feed study blank, the "Cost per lb. digestible crude protein."

Palatability, usefulness and limitations.—Under "Palatability, usefulness, and limitations for horses, dairy and beef cattle, sheep, and swine," state briefly, but as definitely as possible, the value of the particular feed for each class of stock. Before attempting to do this, consult the index of your text, and read carefully the paragraphs in the text on the value of the feed for each class of stock. Do not rely on your general knowledge of the feed, but be specific.

Timothy hay, \$. per ton. Use the figures in Appendix Table I, given under "Timothy, all analyses," and the figures in Appendix Table II which are the "Average of all trials." The value of timothy hay for horses, dairy cattle, beef cattle, and sheep is fully discussed in the text. It is not useful for swine. Would you grow much timothy on a livestock farm in your section?

Red clover hay, \$. per ton. Use the figures in Appendix Table I, given under "Clover, red, all analyses," and the "Average of all trials" in Appendix Table II. Red Clover exceeds any other legume in acreage in the United States. Discuss its value thoroughly.

