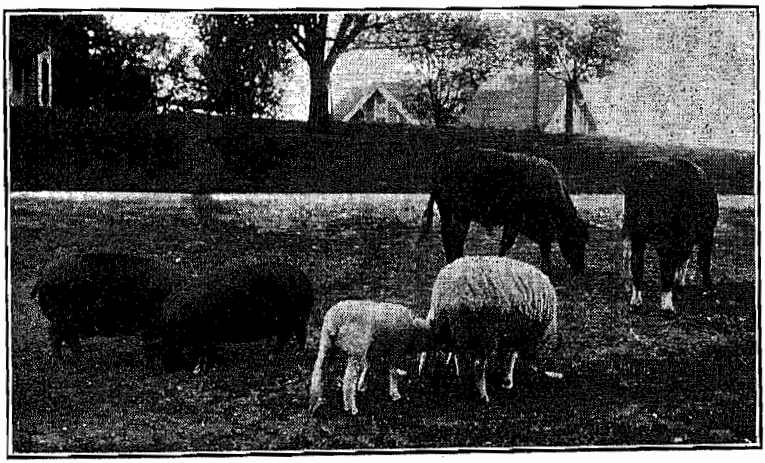
Agricultural Experiment Station
OF THE
University of Tennessee

BULLETIN No. 116 DECEMBER, 1916

HOW TO FEED LIVE STOCK SUCCESSFULLY

BY
C. A. WILLSON



Live Stock Make Farm and Farmer Richer

This publication is printed jointly by the Experiment Station and the Division of Extension of the University of Tennessee.

KNOXVILLE, TENNESSEE

The Agricultural Experiment Station

OF THE UNIVERSITY OF TENNESSEE

BROWN AYRES, President

EXPERIMENT STATION COMMITTEE

BROWN AYRES
SAMUEL N. WARREN
J. E. HITE
I. B. TIGRETT
H. CLAY EVANS

STATION OFFICERS

H. A. MORGAN, Director, Zoologist and Entomologist
S. M. BAIN, Botanist
C. A. MOOERS, Chemist and Agronomist
W. G. SHAW, Veterinarian
C. A. WILLSON, Animal Husbandman
MAURICE MULVANIA, Bacteriologist
W. H. MACINTIRE, Soil Chemist
G. M. BENTLEY, Associate Entomologist
S. H. ESSARY, Assistant Botanist and Mycologist
J. F. VOORHEES, Consulting Meteorologist
L. G. WILLIS, Assistant Chemist
H. R. WATTS, Assistant Entomologist
O. M. WATSON, Horticulturist
W. A. HOLDING, Assistant Chemist
W. A. CAMPBELL, Farm Foreman
S. M. SPANGLER, Assistant in Plot Work
S. A. ROBERT, Supt. West Tenn. Exp. Station, Jackson
J. E. CONVERSE, Assistant in Cooperative Experiments, Crossville
W. N. RUDD, Assistant in Cooperative Experiments, McMinnville
C. M. HUME, Assistant in Cooperative Experiments, Murfreesboro
ROY H. MILTON, Supt. Tobacco Exp. Sta., Clarksville
O. A. CAMPBELL, Assistant in Plot Work, Jackson
F. H. BROOME, Librarian and Secretary
MISS RUBY FRANKLIN, Assistant Librarian
MISS EFFIE N. KLOSS, Stenographer

The Experiment Station building, containing the offices and laboratories, and the plant house, are located on the University campus, 15 minutes' walk from the Custom House in Knoxville. The experiment farm, the barns, stables, dairy building, etc., are located one mile west of the University on the Kingston Pike. The fruit farm is adjacent to the Industrial School, and is easily reached by the Lonsdale car line. Farmers are cordially invited to visit the buildings and experimental grounds.

Bulletins of this Station will be sent, upon application, free of charge, to any farmer in the State.

HOW TO FEED LIVE STOCK SUCCESSFULLY

By
C. A. Willson

IT is not possible to lay down any set of rules by which one may become a successful feeder, for the successful feeding of farm animals is like any other business, in that the personal factor is the thing of greatest importance. There is no statement that is more true with regard to feeding than that it is "the eye of the master that fattens the cattle." The personal factor is too often disregarded in the feeding of farm animals. Good feeders are like poets, in that they are "more often born than made." More depends upon the man who does the feeding than upon the feeds used and the directions for feeding them. It not infequently happens that men who know nothing about feeding standards, balanced rations, or the composition of feeding stuffs make more successful feeders than do men who have learned all the facts about feeds and feeding standards.

TRAITS OF A SUCCESSFUL FEEDER

It is pertinent to inquire, then, who are, or who may become successful feeders of live stock. The feeding of live stock is more of an art than a science. To know all the rules and the science of feeding is of valuable assistance to the man who wishes to learn how to feed farm animals, but, like painting, one must learn the art through practice. The man who will be the successful feeder is the man who loves the work and the animals that he works with. There must be a bond of sympathy between the feeder and the animals that he cares for. No man can be a successful feeder whose animals are in constant fear of him or who is not liberal with his animals and does not love to see them eat. The man who can feed the most animals in the shortest length of time is not the most desirable feeder, but rather the man who has the greatest personal knowledge of all the animals at each feeding time. It is more important that a man observe each animal at each feeding time than that he perform the operation with dispatch. The man who feeds and runs away may not feed some of the animals the next day. Know the health and appetite of every animal. Be gentle. It is said that

"the breath of some men is poisonous to their animals"; animals do not do well in their presence. There can be no success in feeding where the animals fed fear their master.

Some men excuse themselves for the condition of their animals by saying that they were unfortunate in the selection of the breed to begin with. There is an altogether too prevalent idea that there are differences among breeds as to the economy and rate of gains. There are warm advocates for all the breeds, and which one of the breeds will make the most economical gains depends upon the person who is doing the talking. As a matter of fact, there is little if any difference between breeds in the economy of gains, from point of view of feeds consumed per pound gain, if the animals considered are of like condition and stage of maturity. No one has proved that any one breed will put on gains with less feed than will any other. For example, many feeding experiments have been conducted at various experiment stations with the purpose of determining which of the breeds of hogs will produce the most economical gains. There seems to be no unanimity among the various trials that have been made, and the general conclusion has been that there is a greater difference among the animals of each of the breeds than there is among the breeds. A Jersey steer will make as economical gains from the standpoint of the amount of feed per pound of gain as an Angus steer. This does not mean, however, that one should use the Jersey for the production of beef, for no greater mistake can be made. While the feed consumed per pound gain may be practically the same, the price received for the pound of gain will be much less in the case of the Jersey. The Jersey will not have thick flesh along the back, but will store fat as caul and kidney fat, which sells at as low price as tallow. There will not be less than 2½ cents a pound difference in favor of the Angus, which means that a 1000-pound Angus steer would sell for $25.00 more than the Jersey steer. The same difference in values exists between scrubs and high grades.

One cannot afford to grow and finish for the market other than the highest grades.

The reason follows.

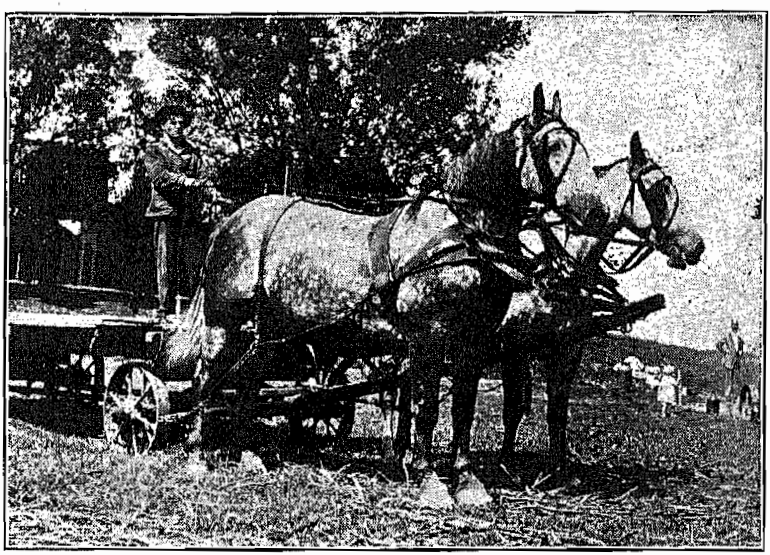
FEED ANIMALS OF THE RIGHT TYPE

The economic difference, then, between animals for successful feeding purposes is rather one of type than of breed. The type that will make the best use of feeds for the production of meat is the type that will put on the most meat in the regions of the most valuable cuts. The Jersey heifer may develop into the best type for the production of milk and butter, but would not be at all suited for the production of beef, owing to the small amount of porterhouse and prime-of-rib that she would make. She can digest food equally as well as the Angus heifer, but when not producing milk will put the fat resulting from digested food into other regions than those of the valuable cuts.

PRINCIPLES AND PRACTICE OF ANIMAL FEEDING

There are several principles that may be considered in the feeding of farm animals:

1.—**Always have a variety of feeding stuffs in the ration.** This is one of the fundamental principles in feeding, for if the feeder will but observe this one thing alone, being careful to keep within the limitations of the various feeding stuffs, he cannot help feeding somewhere near a balanced ration. A variety of feeding stuffs always gives better results than any one feed fed alone. For example, corn and wheat have about the same nutritive ratio, and when fed alone make an equally unbalanced ration, which will not be corrected in any way



Work Horses Will Do Well if Their Feed Is Adapted to the Amount of Work They Have to Do

through the combination of the two feeds; yet the combination may give much better results than either fed alone. If we define the limitation of soy beans, cowpeas, cottonseed meal, linseed meal, and gluten meal as 4 pounds per head per day for cattle, and as 1 pound per head per day for hogs, then we can hardly make a mistake in combining them with other grains produced on the farm for cattle and hogs. The greater the number of feeds incorporated into the ration the better will be the results.

2.—**Do not make sudden changes in the rations.** The beef steer may easily consume 16 pounds of grain per day if brought up to a full feed gradually, but if given that amount of grain before becoming

accustomed to large quantities it would suffer disastrous results. If the horse is fed on Sunday and on rainy days the same amount of feed as when performing heavy labor there has been made, in effect, a sudden increase in the ration, with, oftentimes, the result that the horse is sick during the forepart of the week and for the days following a rainy spell. If growing shotes are kept in a small pen during all of the winter months and then suddenly obtain access to a field of green wheat in the spring, they gorge themselves with a feed that would ordinarily be the very best for them but in this case does them a great deal of harm because they have not been accustomed to it. Salt is sometimes kept from the hogs until they have such a craving for it that they cannot resist the temptation to take more than they need, with the result that the salt poisons them. Salt is needed by hogs in the daily ration equally as much as by other animals, yet if a sudden increase in the amount of salt is given it may result disastrously. Eggs are very rich in the elements of salt, and if salt is kept from laying hens for a long period of time they may consume more of it than would be good for them, if they gain sudden access to it or a sudden increase in the amount of it is given them in the ration. All changes in feed rations should be made gradually.

If one has two kinds of roughage feed on hand, and neither one alone will last the cattle through the winter, but the two together will, it is usually better practice so to combine them in the daily feed that each last the winter through. Variety will be given the ration in that way, and much better results will be obtained than if one of the feeds is used for part of the winter and the other for the remainder. The same principle will apply to the feeding of grains. It is not good practice to feed one kind of grain one week and another kind the next week.

3.—Do not feed animals that are extremely tired until they have time to become somewhat rested, because much of the blood has been diverted away from the digestive tract. Food given to animals under such conditions often causes colic. Wait for at least an hour, until the animal can become rested somewhat, before giving the regular feed.

4.—Water horses before giving them the grain ration, because of the small capacity of their stomachs. The stomach of the horse holds only 17 to 19 quarts; hence water given immediately after the grain ration is very apt to wash a portion of the contents of the stomach out before the stomach digestion has been completed.

5.—Do not disturb or unnecessarily exercise dairy animals or animals on full feed. It requires from 30 to 40 per cent more feed to maintain an animal while standing on its feet than while lying down. A good feeder will not disturb his animals more than he can help, and will not set the dog on them, for wasted energy means wasted feed. Large feeders of lambs in the North say that they would rather give a visitor a five dollar bill than to show him through their feeding plant, because lambs quickly notice strangers, and where hundreds of

lambs rise to their feet more than five dollars worth of feed will be wasted. Holland dairymen milk their cows in the field instead of driving them to the farmyards. They get more milk through conserving the energies of their cows. Quietness and gentleness should be the rule in the feeding and handling of all farm animals.

6.—**Convert all cheap feed on the farm into some animal product.** Thousands of dollars worth of feed on Tennessee farms goes to waste every year. It has been estimated that more than $14,000,000 worth of corn stover goes to waste every year in this State. Every ton of straw, every ton of corn stover, every ton of cheap hay produced on Tennessee farms should pass through live stock, or should be used for bedding. Live stock farmers make more money than other farmers because they receive added returns through the use of low-grade feeds that otherwise would be wasted. Every ton of oat straw is worth $10, every ton of barley straw is worth $9, every ton of wheat straw is worth $6, and every ton of well-cured corn stover is worth from $8 to $10, for feeding purposes. Every foot of waste land on the farm should be grazed. Waste lands that are grazed grow more grass than lands that are not grazed, and when pastured are made to bring in additional returns to the farm.

7.—**Do not underfeed farm animals.** All feed is wasted when given to an immature animal that does not make some growth. The pig that goes to sleep at night without having made some gain during the day has wasted the feed that was given it. Withholding feed in order to save it is wasting it. Farm animals should always be given all the feed that they will consume with a relish. It is only the character of the feed that should be changed. Cattle that are being wintered over may be given cheaper feed than grain, such as well-cured corn stover, straws, etc., but they should be given all that they will consume with a relish. Hogs may be given cheaper rations than full feeds of grain, such as green forage crops, but they should be given all that they will consume by being provided with luxuriant forage crops. Horses may be wintered on cheaper feeds than full rations of hay. They should, however, be provided with all the clean, bright, cheap straw and stovers that they care to eat. It does not pay to withhold feed from farm animals.

8.—**Do not overfeed farm animals.** Occasionally there are feeders who overfeed, although it does not often occur. The best rule is to feed only as much as the animals will clean up thoroughly before the next feed. Palatability is one of the principal factors in the feeding of farm animals. There is a greater secretion of digestive juices when a food is palatable to the animal, and hence a more thorough digestion. If animals on full feed do not clean up their feed from one feed to the next the feed boxes should be cleaned out, and fresh clean feed put in, in a little lessened amounts.

9.—**Do not give animals moldy feed.** Much of the food value has been lost through the growth of the molds and fungi, and further than that it is very dangerous to live stock, especially horses. If grains become moldy they may be with some degree of safety fed to hogs if they are cooked and then mixed in equal proportions with the other grains.

10.—**Do not incur too much expense in feeding.** The feed must pay for the expense before it can begin to give returns on the investment. Multiplicity of operations in the feeding of farm animals means added expense. Cattle should not be fed singly in stalls where they can be fed in groups. Feeds should not be cut, shredded, or ground when they would give practically as good results without such preparation. Live stock should not be fed three times per day when twice will do just as well. Corn broken from the stalk with the husk on and later ground with cob, husk, and all will give as good results for cattle as corn that has had the extra operation and cost added to it of removing the husk. Corn broken in pieces with a hatchet in the feed bunks of the finishing cattle will be more profitable where hogs follow the cattle than corn that has had the extra expense added to it of grinding. Hogs, except when on full feed during the last three weeks of the finishing period, make more profitable gains when fed ear corn than when fed ground corn. It is a common saying that "a sheep that cannot grind its own feed is not worth having." It is doubtful whether it will pay to shred corn stover unless the corn can be husked more cheaply or the manure handled more economically. It will not pay to grind good, bright alfalfa hay, soy bean hay, or cowpea hay for cattle, horses or sheep. There is a tendency to add too much to the cost of feeding stuffs through extra manipulations of the feed.

11.—**Do not feed condimental stock food to healthy animals.** If any of the animals are sick consult a veterinarian. Average results with condimental stock foods show that where there are added gains with stock foods, the extra expense incurred more than offsets the added gains.

12.—**Mix feed on the farm whenever possible.** Commercial mixed feeds are often mixed for the purpose of obtaining a high price for such low-valued feeds as corn bran, rice hulls, rice straw, low-grade alfalfa, cottonseed hulls, buckwheat hulls, oat hulls, and screenings. The farmer can mix these with such feeds as corn, low-grade wheat, feeding molasses, and cottonseed meal and secure a mixed feed at a low cost.

13.—**The solid manure is a perfect indicator of the health of the animal.** When the manure passing from the animal is hard it indicates that either the animal is feverish, or the feed is too constipating. If the manure is too soft it indicates the food is too laxative, or too stimulating to the bowels, or that the animal has been overfed. Any

of these conditions is the first warning the feeder will have that the animal is off tone. The wise feeder will heed the warning, seek the cause, and correct it. At the very first indication of looseness of the bowels of animals that are on full feed, lighten up on the feed. Do not wait until the animals refuse entirely to eat. If the manure is too hard give a good dose of raw linseed oil or of epsom salts. If the trouble is due to the ration, correct the ration.

14.—**Feed farm animals where the manure may be recovered.** Wherever practical, feed on land that may later be plowed. The greater part of the manure of pigs fed in pig sties or manure thrown in open, wet, muddy barnyards is lost. It is possible to save of the fertility of the feeds fed, 22.5 cents worth for each bushel of wheat; 11.3 cents for each bushel of oats; 19.9 cents for each bushel of corn; 18.7 cents for each bushel of barley; $8.19 for each ton of clover hay; $4.49 for each ton of meadow hay; and $26.57 for each ton of cottonseed meal. Plan to save every particle of the manure. The fertilizing elements in it are more valuable than the same elements contained in commercial fertilizer. You would not leave a ton of fertilizer standing out in the rain.

WHAT CONSTITUTES A FULL FEED

Failure to get the best returns sometimes results from a lack of knowledge of the general limitations with regard to the amounts of feed that should be given under various conditions.

Horses.—A general rule as to amounts of grain for horses is, to feed ½ pound of grain per hundredweight per day for horses doing moderate work; 1 pound per hundredweight per day for horses doing medium work; and 1½ pounds per hundredweight per day for horses doing heavy work.

Beef Cattle.—Ordinarily a full feed of grain for beef cattle, where silage is fed, should be from 12 to 14 pounds per head per day at the end of the finishing period. Best results are obtained with cottonseed meal when not more than from 6 to 7 pounds are fed per head per day at the end of the finishing period. But little grain should be given during the first one-third of the finishing period.

Dairy Cows.—The rule for feeding grain to dairy cows is to feed during the winter 1 pound of grain for every 3 to 3½ pounds of milk produced. For example if the cow gives 30 pounds of milk per day she should be fed from 8½ to 10 pounds of grain. If grain is fed to cows while on pasture it should be fed in one-half the amounts recommended for winter feeding. Every added pound of grain that will produce three pounds of milk is profitable.

Hogs.—A full feed for hogs during the finishing period is from 3 to 3½ per cent of the live weight per day. A hog weighing 200 pounds

will consume, then, from 6 to 7 pounds of grain per day. Hogs on pasture, before the latter part of the finishing period is reached, should not be fed larger amounts than 2¾ per cent of their live weight per day when the pasture is good. If given a full feed they will not make the best use of the cheaper forage crops, and the gains produced will be more expensive.

The greater the amount of milk fed per day to hogs, the less value per hundredweight may one obtain for it. One should not feed to hogs more than from 3 to 4 pounds of milk for every pound of grain fed. Even less than that proportion will give a higher value per hundredweight for the milk.

Sheep.—One pound of grain per head per day is liberal feeding for sheep. During the latter part of the finishing period sheep sometimes consume from 2 to 3 pounds per head per day.

Calves.—A good rule for the feeding of milk to calves is, to feed daily 10 pounds of milk for the first 100 pounds live weight, 5 pounds for the second 100 pounds live weight, and 2½ pounds for the third 100 pounds live weight. A 200-pound calf, for example, should be fed daily 15 pounds of milk, and a 300-pound calf should be fed 17½ pounds. A quart of milk weighs approximately two pounds.

COMPARATIVE VALUES OF FEEDS

In order to compare feeds, one must use such terms as "protein", "carbohydrates", and "fat". These are materials occurring in all feed stuffs, but in different amounts. "Protein" may be defined as the "muscle-forming" compounds of feeds. One of the common proteins is the white of egg, sometimes called "egg albumen". "Carbohydrates" and "fat" may be defined as the "fat-forming" compounds of feeds. These also are used for the production of heat and energy. Starch and sugar are the most common carbohydrates. Linseed oil is a fat obtained directly from flaxseed; soy bean oil from soy beans; and rapeseed oil from rapeseed. The amounts of these compounds in feeds that animals can make use of, or digest, is spoken of as "digestible protein", "digestible carbohydrates", and "digestible fat". By the term "ration" is meant the total amount of feed an animal will eat in a day, and not the amount that is given for any particular meal. It is a collective term meaning "all the feed given".

No hard and fast rules can be laid down for determining the values of feed stuffs, or their relative values, owing to the large number of factors that enter into calculations. A few general rules may be given that will be of some assistance in approximating such values. A feed may also be compared with other feeds.

Milk.—There are two rules for approximating the value of skim-milk for fattening hogs:

1. To find the value of 100 pounds of skimmilk multiply the market price of live hogs in cents per pound by 6 when the skimmilk is fed in combination with corn, barley, or wheat.

2. When fed along with corn, 100 pounds of skimmilk is worth one-half the price of corn per bushel. These values are in terms of corn saved.

Buttermilk and skimmilk have the same value for hog-feeding purposes where no water has been added to the milk.

Whey.—For pig-feeding purposes whey is worth about one-half as much as skimmilk.

Corn.—When corn is properly balanced with other feeds 1 bushel will produce 12 pounds of gain with hogs; when not balanced with other feeds, the rule is that 1 bushel will produce 10 pounds of gain.

Corn, wheat, and barley, when properly balanced with other feeds, are worth practically the same per pound for feeding purposes.

Kafir corn, sorghum, etc.—These feeds are practically of the same composition as corn, but not quite so palatable. Feeding trials show that it takes from 6 to 7 pounds of these to equal 5 pounds of corn.

Oats.—This feed is generally overrated. One hundred pounds of oats contains but 2.2 pounds more of digestible protein, or "muscle-former" than 100 pounds of corn, and contains 15.6 pounds less of carbohydrates, or "fat-former". One quart of whole corn contains twice as much digestible material as one quart of whole oats. On the pound basis oats are really worth a little less than shelled corn.

Wheat bran.—Only a little more than one-half of bran is digestible, or can be used by the animal. It has only 4.7 pounds more digestible protein, or "muscle former", in 100 pounds than corn and has 26.9 pounds less of carbohydrates, or "fat-former". It is low in lime, which is the principal ash of bones. Its chief value in the ration is as a diluent. Ground alfalfa hay, soy bean hay, or cowpea hay is equally valuable for the same purpose. When cottonseed meal sells at from $30.00 to $35.00 per ton, bran is not worth, as a source of protein, or "muscle-former", more than $20.00 to $23.00 per ton.

Corn bran is not palatable and is worth about four-fifths as much as wheat bran for feeding purposes.

Wheat shorts.—This wheat by-product contains a little more protein and a little more carbohydrates than wheat bran. It is worth from $1.00 to $2.00 more per ton than wheat bran.

Cottonseed meal.—There is three times as much digestible protein in cottonseed meal, and as much digestible carbohydrates and fat combined as in bran. As a food to balance a corn ration, it is worth twice as

much as wheat bran. One pound of cottonseed meal will balance as much corn as three pounds of bran.

Sometimes the analysis of the cottonseed meal offered for sale is given in terms of nitrogen, or of ammonia, on the tag, or is quoted by letter in those terms, when the probable purchaser desires most of all to know the protein content. One may readily transform these factors into terms of protein by using the following factors:

When the analysis is given in terms of nitrogen, multiply by 6.25. For example, if the analysis is given as 7 per cent nitrogen, then the pounds of protein in 100 pounds of the cottonseed meal would be 6.25x7, which equals 43.75; and this would mean that it was a very choice grade of meal.

When the analysis is given in terms of ammonia, multiply by 5.15. For example, if the analysis is given as 8 per cent ammonia, the pounds of protein in 100 pounds of the cottonseed meal would be 5.15x8, which equals 41.20; and this would mean that it is a good grade of meal. If the analysis is given as 6.85 per cent ammonia it would be a low-grade meal, for the protein contained would be 35 pounds in every 100 pounds of the cottonseed meal.

Linseed meal.—This by-product has a little less protein than cottonseed meal, but on account of its soothing effects on the bowels when fed with other feeds it is considered to be equal to cottonseed meal.

Soy beans.—There is no other feed that can be grown on the farm that is the equal of soy bean grain in protein content. It has 31 pounds of digestible protein in every 100 pounds, and is very high in fat content. It may be used in the ration, pound for pound, in place of cottonseed meal or linseed meal. It should never be fed in large quantities in the ration on account of its high protein and fat content.

Soy bean cake, and soy bean meal made from cake.—Mills for the extraction of oil from soy beans are being established throughout the South and soy bean cake will soon be a common feed stuff on the market. It has a slightly greater feeding value for dairy cows than cottonseed meal. In analysis it is slightly higher in protein than cottonseed meal, and has practically the same amounts of carbohydrates and fat.

Alfalfa hay, soy bean hay, and cowpea hay.—These hays, when well cured, are practically equal in feeding value, and are worth about the same as bran ton for ton. They are rich in lime, which is the principal ash of bones and this ash is largely lacking in bran. When fed very liberally they are sometimes too laxative. The remedy in such cases is to lessen the amount in the ration by substituting for awhile in the ration a little timothy or other grass hay.

Tankage.—This is a packing-house by-product that is especially adapted for balancing the corn ration for hogs. It is rich in protein,

or "muscle-former", and ash material and is especially palatable to hogs. It is worth 1½ times as much per ton as linseed meal or cottonseed meal and 2 to 3 times as much as bran.

Potatoes, apples, root crops, pumpkins, etc.—Succulent, watery feeds like these usually require from 3 to 4 pounds to equal 1 pound of corn. Such feeds should never make up more than one-half the ration. When not supplemented with grain a ration made up entirely of such feeds is too bulky to make gains or produce milk and is no more than a maintenance ration.

Corn silage.—The average cost of producing silage is about $3.00 per ton, and hence it is usually figured in at that amount when cost factors are considered in arriving at conclusions in experimental results. Experiments have shown that from $6.00 to $9.00 may be obtained for every ton of silage fed to finishing steers. Even more than that may be obtained for silage fed to high-producing dairy animals. In experiments at the Tennessee Experiment Station a value of $7.65 per ton was obtained for silage fed to finishing steers that received a medium amount of cottonseed meal for the grain ration. Soy beans, cowpeas, or alfalfa should never be made into silage, when they can be made into hay, for nothing will be added to their palatability or feeding value.

Straws.—Every ton of well-cured and well-preserved straw on Tennessee farms has a feeding value of $6.00 to $9.00 per ton. The relative values of the various straws rank as follows: Oat straw, barley straw, wheat straw, and rye straw.

Corn stover.—Good corn stover, well cured in the shock, has a feeding value equal to cottonseed hulls. Some experiments show that it is decidedly superior to cottonseed hulls. One ton of well-cured corn stover is worth three-fourths of a ton of timothy for horses and cattle. The stover is best if put into the shock and tied tight, close to the top. When the ear is well glazed, and after husking, it should be stored in stacks. Corn stalks left standing in the field subject to the effects of the weather very soon lose practically all their feeding value.

Cottonseed hulls.—The digestible content of cottonseed hulls, or the amount the animal can make use of, is less than that of oat straw, and they, therefore, are not so valuable. They also are of less value for feed than well-cured corn stover.

BALANCED AND STANDARD RATIONS

The term "balanced ration" is used so carelessly that many persons understand it to mean a sort of standard ration for each class of animals that will do for all ages and conditions of animals in that class. A ration is properly "balanced" for any animal when it supplies all the food elements in the proper proportion for that particular animal.

One can readily see, then, that as the demands of the animal body change, so must the ration change.

The young, rapidly growing animal needs a much larger proportion of protein, or "muscle-former", in the ration than that same animal after it becomes mature and protein is less needed for the building of muscle.

The dairy cow that is producing large amounts of milk, which is rich in protein material, needs much more protein in the ration than the cow that is being fattened. Laying hens must be supplied protein in the ration for the eggs, which are rich in that material.

The brood sow that is secreting large amounts of protein, lime, and phosphorous in the milk to be used by the rapidly growing pigs must be supplied those elements in liberal quantities, or they will draw from her own muscles and bones in order to keep her milk to a constant quality, with the result that the sow soon breaks down. If lime is not supplied in the ration of the laying hen she must necessarily produce shells without lime, which will be soft-shelled eggs. If the growing pig is fed only corn, which is very low in ash and protein, it will fatten, but will grow but slightly, for there is little material present for the making of bones and muscle. Salt is another material that is necessary to the ration. It tends to correct digestive disorders, for it contains elements that are necessary constituents of some of the digestive juices. It is just as necessary for poultry and hogs as for other classes of animals.

In order to make plain the discussion relating to the balancing of rations, the following explanations of terms are given:

Dry matter is the total material in the ration or feed that would be left if the feed were oven-dried so as to expel all the water. All hay and grains contain some water. The amount varies according to the degree of thoroughness with which the feed is air-dried. Usually hays and grains that are well cured contain from 9 to 12 pounds of water in every 100 pounds. Silage contains from 70 to 80 pounds of water in every 100 pounds. Hay and grains, then, contain from 80 to 91 pounds of "dry matter" and silage from 20 to 30 pounds of "dry matter" in every 100 pounds.

Digestible protein in the ration is the protein available to animals that exists in varying proportions in the various feed stuffs; it is present in all plants, and is the material that is necessary to the animals for the building up of muscle and bone tissue. If it is not present in sufficient quantities in the ration or feed, of the young, growing animal, then that animal may not be able to make a normal growth. The white of egg is largely protein, or "muscle-former". The casein of cheese is protein. Soy beans, cowpeas, alfalfa hay, cottonseed meal and clover hay are examples of feeds that are rich in protein. The milch cow must receive a sufficient amount of it before she will reach her maximum supply of milk, because milk is rich in protein;

the growing animal must have it to attain its maximum rate of growth; and the hardworking animal must have it to repair the muscular tissue that is worn out in the production of work.

Digestible carbohydrates is such material as starch, sugar, and digestible crude fiber tissue that the animal can make use of. It is stored in the animal body in the liver, and is also transformed into fat. It is the material used in the animal body for the production of work. As stored carbohydrates in the liver or as carbohydrates that have been transformed into fat, it represents stored energy that may be used at any time for the production of work. Some of the feeds that are rich in carbohydrates, or "fat-formers", are corn, wheat, barley, rye, sorghum seed, and potatoes.

Digestible fat is, as the name implies, the oils found in feeds that the animal can make use of. It serves exactly the same function in the animal body as carbohydrates. It is also a "fat-former" or "energy-producer". One pound of fat in feeds is as valuable to the animal for the production of work as 2¼ pounds of carbohydrates, for it contains 2¼ times as much stored energy. A few feeds that are rich in oils, or fats, are soy beans, peanuts, acorns, and nuts. The maximum amount of digestible fat that should be contained in any ration for 1000 pounds live weight is 1 pound. More than that might cause digestive disturbances.

Total digestible nutrients is the sum of the digestible protein, the digestible carbohydrates, and the digestible fat x 2¼.

Ash is the material that is left after burning. There are several elements found in the ash, the principal ones of which that are useful to the animal being calcium, or lime, and phosphorus. Over 80 per cent of the ash of bones is made up of these two elements. They, then, are very essential in the ration of the young, growing animal. Feeds that are rich in the elements calcium and phosphorus are all of the legume hays, such as soy bean hay, alfalfa hay, red clover hay, cowpea hay, and crimson clover hay. Bran is rich in ash, but its ash is low in calcium.

Nutritive ratio is the relation that exists between the digestible protein on the one hand and the digestible carbohydrates and digestible fat on the other, after the fat has been multiplied by 2¼. For example, the digestible nutrient content of corn is protein 7.5 pounds in 100, carbohydrates 67.8, and fat 4.6 pounds.

The nutritive ratio, then, is $\frac{67.8+2\frac{1}{4}\times 4.6}{7.5}=\frac{10.4}{1}$

or 1: 10.4; that is, the nutritive ratio of corn is 67.8 plus 2¼ times 4.6 divided by 7.5, which equals 10.4; or the ratio of the protein to the combined carbohydrates and fat is as 1 to 10.4. This relation between

the protein and the combined carbohydrates and fat has been found to be too wide for nearly all classes of animals, and therefore corn should practically always be combined with some other kind or kinds of feed, so as to add to the protein content and thus produce the best results. A ration is considered wide when the nutritive ratio is as 1 : 8 or greater; medium when the ration is as 1 : 5 to 7; and narrow when the ratio is as 1 : 4 or less.

Digestible nutrients—Protein, carbohydrates, fat, and ash are "nutrients". The amounts of these that the animal can digest are collectively called digestible nutrients.

HOW TO BALANCE A RATION

Scientists have determined just how much dry matter, ash, protein, carbohydrates, and fat will without waste, exactly meet the requirements of each kind of animals for each age and condition. The amounts required for any class and age of animals are called a "feeding standard" for that particular class and age. A ration ordinarily is said to be "balanced" when it exactly contains the food elements as given by the "feeding standard" for the particular class and age of animals to which it is to be fed. The "standard ration", for example, for 1000 pounds live weight of fattening pigs weighing 200 pounds each is—

Dry matter	Digestible crude protein	Total digestible nutrients	Nutritive ratio
Lbs.	Lbs.	Lbs.	1 :
25.5-28.1	3.0-3.4	22.77-25.0	6.5-7.3

This standard ration means that experimenters have found that 1000 pounds live weight of 200-pound hogs will need the amounts of the various materials as given above in order to make the best and the most economical gains.

If one knows the amount of dry matter in a day's ration, the amount of protein, and the total amount of digestible nutrients that an animal should have, and also the amounts of these in feed stuffs, it is easy enough to calculate how nearly any given day's ration supplies the proper amounts that the animal should have according to the standard for that particular animal. (Table II in the Appendix gives the amounts of digestible nutrients in the various American feed stuffs and Table III gives the standard rations for various classes and ages of farm animals). If the "total digestible nutrients" in the ration is high and the total amount of "digestible protein" is low, then some feed rich in protein should be substituted in the ration for some of the feed that is evidently high in carbohydrates and fat and low in protein. The amount that must be substituted in order to make the ration balance can only be determined by trial until the ration is made to balance according to the standard.

Suppose that we try making a balanced ration for a hog weighing 150 to 200 pounds on full feed that is being fattened for the market.

The standard ration for 1000 pounds of live weight of such hogs is—

Dry matter	Digestible crude protein	Total digestible nutrients	Nutritive ratio
Lbs.	Lbs.	Lbs.	1:
29.0-32.0	3.5-3.9	25.8-28.5	6.2-7.0

A 200-pound hog would require one-fifth of the above standard for 1000 pounds live weight, or the standard for a 200-pound hog would be—

Dry matter	Digestible crude protein	Total digestible nutrients	Nutritive ratio
Lbs.	Lbs.	Lbs.	1:
5.8-6.4	.70-.78	5.1-5.7	6.2-7.0

The dry-matter factor is useful as a guide to show approximately how much feed the animal will consume in a day's ration. The rules given on pages 57-8 will also be found useful in determining how much grain will be required in the ration for a day's feed. Corn has about 89.5 pounds dry matter in every 100 pounds. We may estimate, then, that a full feed of corn for a 150- to 200-pound hog would be from 6¼ to 7 pounds. As a matter of fact, corn is too often used as the exclusive feed for this weight of hogs. Suppose that we determine how near a straight corn ration would be to the standard requirements for this sized hog:

	Dry matter	Digestible crude protein	Total digestible nutrients	Nutritive ratio
	Lbs.	Lbs.	Lbs.	1:
6½ lbs. corn ----	5.8	.49	5.57	10.4

We note that the ration is entirely too low in the amount of protein that is required according to the standard. This is indicated in another way; namely, in the nutritive ratio, which is entirely too wide. The standard ration for a 150- to 200-pound hog is 1: 6.5. When the dry-matter factor is correct a wide nutritive ratio indicates either that the protein is too low or that the total digestible nutrient factor is too high on account of the digestible carbohydrates and digestible fat being too high. By trial we find that if we substitute in the above ration 1¼ pounds of soy beans for 1½ pounds of corn we shall have a ration that will balance according to the standard requirements, and which will therefore be according to the daily needs of the hog. The ration balanced is, then, as follows:

	Dry matter	Digestible crude protein	Total digestible nutrients	Nutritive ratio
	Lbs.	Lbs.	Lbs.	1:
5 lbs. corn ------	4.4	.38	4.14	
1¼ lbs. soy beans	1.2	.38	1.07	
	5.6	.76	5.21	6.2

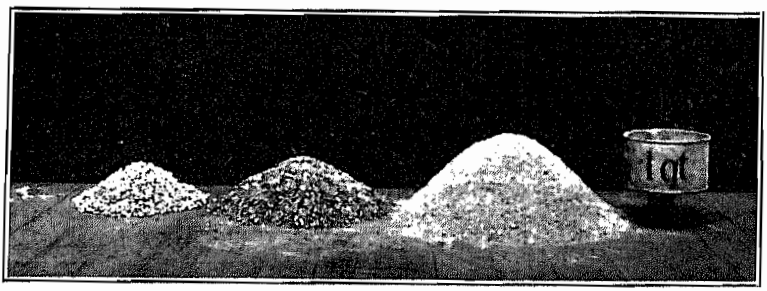
The following rations would prove equally as well balanced and equally as efficient for the same weight of hogs:

1. 4½ pounds corn and 2 pounds cowpeas.
2. 6 pounds corn and ½ pound tankage.
3. 4 pounds corn and 2½ pounds wheat shorts.
4. 2 pounds corn, 2 pounds barley, and 4 quarts skimmilk.
5. 2 pounds corn, 2 pounds barley, 2 pounds wheat and ¼ pound tankage.

The last ration is the best of all on account the larger number of feeds entering into it. In considering rations of equal balance, one may generally consider that ration will be most economical to use that can be purchased the cheapest. What feeds to use, then, will depend upon the price of the ration in each case after it is balanced.

FEEDING HORSES

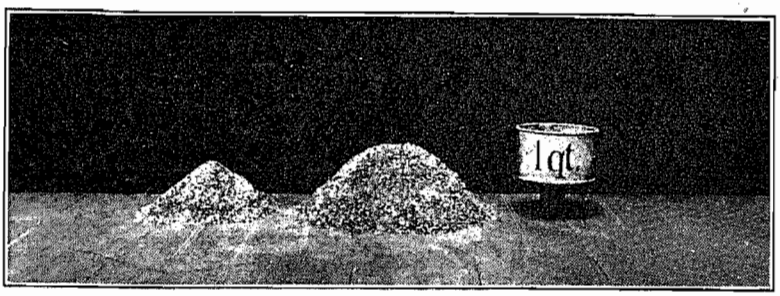
The feeds that ordinarily are considered most adaptable for horses are oats, wheat bran, and timothy hay, although such feeds as clover hay, alfalfa hay, and corn are commonly used. The reason why oats and bran have gained such a good reputation for horses is that they have been the safest to feed. A quart of shelled corn contains twice as much food material as a quart of whole oats and five times as much as a quart of bran. Changing from either one or both oats and bran, to corn, measure for measure, always means a great change in the ration. Such sudden changes are oftentimes attended with bad results,



One Quart Shelled Corn | Two Quarts Whole Oats | Five Quarts Bran

Each Lot of Feed Here Shown Has Practically the Same Feeding Value as the Others

and hence we often hear it said that corn is "more heating" than oats, or oats and bran, or it is condemned because the horses get sick in making the change. The corn is not to blame, but rather the feeder, who did not know that corn is a very much more concentrated feed and that half a quart of corn would replace in the ration a quart of

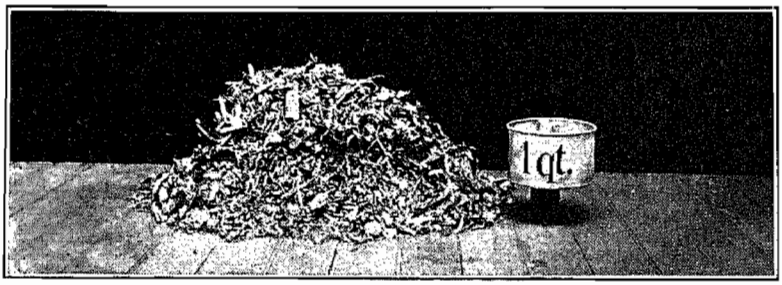


One Quart of a Mixture of Six Parts Corn and One Part Cottonseed Meal. Three Quarts of a Mixture of Seven Parts Ground Oats and Two Parts Bran.

Either of These Amounts Will Be as Effective in Feeding the Horse as the Other

oats, and that one quart of corn would replace five quarts of bran. Corn is an especially valuable food for horses when fed intelligently.

Other feeds that may be used for horses are any of the straws that are bright and clean, bright, well-cured corn stover, silage, millet hay when it does not make up more than one-half the roughage ration, well-cured soy bean hay for not more than one-half the roughage



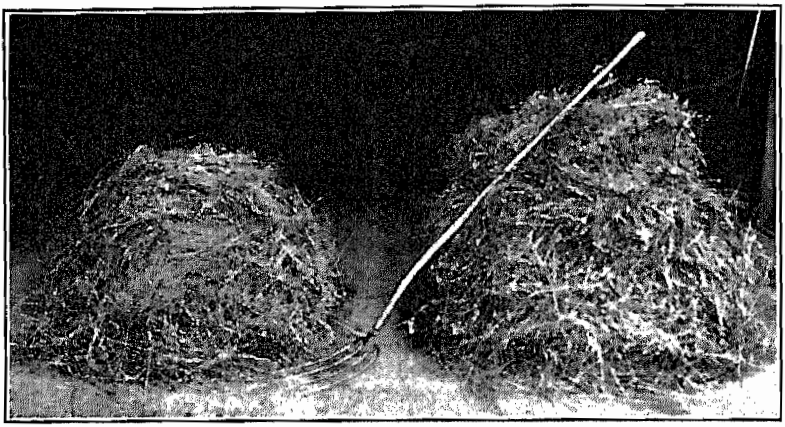
Six Pounds of a Grain Mixture Made Up of Six Parts Ground Corn and One Part Cottonseed Meal. This is Diluted with Five Pounds of Silage

Here Is a Single Meal for a Horse

ration, cowpea hay for not more than one-half the roughage ration, sorghum hay for not more than one-half the roughage ration, cottonseed meal with a limit of 2 pounds per head per day, and barley. A combination of several of these feeds would be much better than any two of them. Such feeds as bright

corn stover and bright, clean straws could well be used in the horse's ration to help cheapen it. Cottonseed meal within the limitations given, is one of the very best feeds for horses. One pound of cottonseed meal will replace in the ration from 2 to 3 pounds of wheat bran and 1 quart of cottonseed meal will replace in the ration from 8 to 10 quarts of bran. One quart of a mixture of ground feed consisting of 6 parts ground corn and 1 part cottonseed meal (parts by weight) would be equally as effective as 3 quarts of a mixture of ground feed consisting of 7 parts of ground oats and 2 parts of wheat bran.

Silage is an excellent feed for horses. Care should always be taken, however, that no moldy silage is fed. Ordinarily it should not



Fourteen Pounds Hay Twenty-two Pounds Hay

The Work Horse Should Be Fed the Smaller Amount Each Day He Is at Work. He Will Eat the Larger Amount on Sunday or on a Rainy Day if the Manger Is Kept Full. To Keep the Work Horse Well He Must Be Fed Less on Days He Does Not Work.

be fed in greater amounts than 5 pounds at a feeding. It may be fed at the same time as the grain ration, as a diluent for the grain ration. There is no better method of feeding the grain ration than to mix it thoroughly with about 5 pounds of silage at each feed.

Do not feed moldy, musty, and dusty feeds to horses, for this class of animals is very susceptible to the poisons in these feeds. Moldy silage and moldy hay should always be discarded.

Feeds that are heavy and concentrated in character, like corn and cottonseed meal, may be diluted with cut hay, silage, or cottonseed hulls.

The feeding of the work horse demands much consideration, for work is the ultimate use of the horse. The efficiency of the horse for the production of work depends in a large measure upon how he is fed and cared for. The amount of feed given should be according

to the amount of work done. (See page 57). If the work ceases for a day, on account of rainy weather or Sunday, the feed should be lessened for the time. Most of the severe digestive disturbances of horses occur during the first three days of the week following the heavy feeding of Sunday without the production of work, or for the two or three days following rainy weather. To give the horse the same ration when idle as when at heavy work amounts in effect to an increase in the ration and violates one of the principal rules of feeding. (See page 53). It is exceedingly harmful to a horse that has been putting in long hours at heavy labor during the week to stand at a manger all day Sunday or on a rainy day and consume hay throughout the entire day.

The ration for a horse that is at heavy labor should be richer in protein feed than for a horse that is doing light work, since the muscles are worn more rapidly and the worn tissue must be replaced with protein. Feeding standards say that the ration for the horse at heavy labor should have a nutritive ratio of 1: 7 or 8, while for horses that are idle it may be 1: 9 or 10. While carbohydrates, or "fat-formers", are the principal food elements needed for the production of work, protein is needed to repair wear. A machine cannot be used without some wear. For that reason clover hay when bright and clean is better for horses at heavy labor than timothy hay. If it is not bright and clean, use timothy hay. For rations for horses see page 104.

During the seasons of the year when the horse is not at heavy labor, the roughage part of the ration may be made up principally of bright, well-cured corn stover and clean, well-cured straws. Ten pounds per day of good corn silage added to such a ration would materially increase its efficiency.

The brood mare should be given work, up to the time of foaling, where there is a good, firm footing, in order that she will be certain to have sufficient exercise. The rest for the brood mare should come during the three to six weeks after foaling instead of before. The ration of the brood mare should have more protein in it than the ration of the work horse, for in addition to the repair of worn muscle tissue in the production of light work, she must have protein for the production of a foal whose body compounds are largely protein. For that purpose such feeds as bright clover hay, alfalfa hay, soy bean hay, and cowpea hay should be given the brood mare. They should be continued after foaling also, for they are well suited for the production of milk.

It is best that the brood mare be worked until nearly the hour for foaling. In order that the bowels may be in good, laxative condition, they should be cooled out through the use of bran mashes just before and immediately after foaling. The brood mare should be fed lightly of grain for four or five days after foaling. Bran mashes are the only feeds that need to be given during that time.

Always plan to be present at the time of foaling, for oftentimes

a little assistance to the mare at foaling, or so simple a thing as the removal of the thin membrane of the "foal blanket" from the foal's nose at the time of birth may be the means of saving what has been looked for with eagerness for nearly a year. The navel cord should be ligated with heavy white thread or catgut, to prevent bleeding from foal, and then severed. It is considered good practice to paint the navel immediately with tincture of iodine in order to prevent infection that will cause navel ill.

A very good grain mixture for the mare while suckling the foal would be—

Corn 2 parts.
Barley 2 parts.
Oats 2 parts.
Cottonseed meal 2 parts.
Bran 2 parts.

As soon as the foal will take grain, it should be fed, in a separate box from the mare, a grain mixture of equal parts of whole corn, barley, and oats. Keep bright, clean soy bean hay or clover hay before the colt. Do not allow it to follow the mare when she is put to work, after the four-weeks rest that will be given her. The colt is much better off if kept during the day in a dark stall, where the flies will not bother it and where it will not be worried with following the mother about. During the first few days that the mare is taken from the foal to work, it is best, where at all possible, to bring the mare to the barn during the middle of each half day and allow the foal to suckle. Where that cannot be done, the mare should be milked out enough to relieve the tension of the udder during the middle of each half day. If the mare is very warm when brought in from work she should be allowed to cool off before the colt is permitted to suckle.

Feed the colt well, for the mature weight of the horse is as much determined by the manner of feeding the colt during the first year as it is upon breeding. Horsemen have the rule that "the colt will reach more than one-half its mature weight during the first twelve months of its life." If a large weight is not reached during the first year a large mature weight will not be reached. Starving the colt during the first year will lower the final mature weight. Good, bright legume hays, such as clover, alfalfa, soy bean, and cowpea, should be given for the first two years of the colt's life, for these hays are rich in lime, which is the principal ash element that is used in the making of bones. They are also rich in protein, which is needed for the production of muscle.

FEEDING BEEF CATTLE

The aim of every farmer who is not directly interested in dairying should be to keep enough beef cattle to consume and turn into money all cheap roughages, such as straws, corn stover, cheap hays, and the

grazing on waste-land areas. Cattle on Tennessee farms could be grown to the age of two years with a small expenditure of grain and at a much lower cost of production per pound than would be received for them. They could be sold at that age as feeders to corn-belt farmers who have cheaper feeds for finishing of cattle. Tennessee, and the South generally, should be a great feeder-cattle producing section on account of the abundance of cheap feeds.

Every farm in the State, where the farmer does not wish to specialize in dairying, should have a few beef cattle; and where the farmer wishes to keep only a few they should be milked. It is easily possible to build up small herds of beef cows in which the total production in milk per cow will exceed 4,000 pounds per year. The butter production from the cows would exceed 200 pounds per year without heavy feeding. The steers and heifers from such cows would be highly profitable, for a large amount of the feeds that they consume would otherwise be wasted. The butter fat would be too valuable to be given the calves by allowing them to suckle their dams. Experiments have shown that one cannot tell the difference between steers that have been allowed to suckle their dams and those that have been pail-fed at the same time that they are put in the feed-lot to be finished for the market.

Calves should not run with their dams more than 24 to 36 hours after birth. Take the calf away from the cow at night and put the cow where she cannot hear the calf. In the morning feed the calf from the bucket warm, fresh milk obtained from its mother. Pour only a small amount of the milk into a light bucket, then moisten the fingers with the milk and offer the calf the two middle fingers and force the calf's nose into the milk, and as the calf begins to drink, gradually remove the fingers. Two fingers must be placed in the calf's mouth in order that a channel may be formed for the passage of the milk between the fingers. If but one finger is offered, the calf will so wrap the tongue around the finger that no milk can be drawn into its mouth. Do not overfeed the calf. (For a rule for feeding milk to calves see page 58). Feed the calf from three to five times daily for the first few days, and later feed twice daily. As soon as the calf will take a little grain in the bottom of the bucket when licking it out this should be given. Drop into the bottom of the bucket a little grain of the following mixture: 3 parts whole corn, 3 parts whole oats, and 2 parts bran (parts always to be taken by weight). The calf will like whole grains better, and, besides, the grains need not be ground for calves of this age, for they thoroughly masticate their feed. Also calves receiving whole grains are said to be less subject to scours. The calf should always be given its feed in a stanchion, for it can be given its allowance of grain without interference from other calves. It should be left in the stanchion until the mouth is thoroughly dry;then there will be no desire to suckle the other calves ears and teats, which is a common source of scours infection. The

calf should be well fed until a year old. Cottonseed meal should not be fed to the calf until it is past ten months of age, at which time it will be taking a considerable amount of rough feeds, such as hay, which counteract the poison of meal. Even then it should not be fed in greater amounts per head per day than one pound.

During the second year the beef animal may be fed cheap feeds, such as straws, corn stover, and a little silage. Experiments at the Tennessee Experiment Station with the stocker cattle show that they should be so fed during the winter that they will make small gain in weight, in which case they would make considerable growth. Corn stover or straw, or a ration composed of the two with 1 to 2 pounds of cottonseed meal per head daily, makes a satisfactory ration for wintering stocker steers that are to be grazed during the following summer and finished for the block the next winter. Steers of that age should not be so fed that they make large gains, for two reasons: first, they cannot make use of the cheap feeds of the farm, such as corn stover and the straws; and secondly, the larger the winter gain, generally the smaller will be the summer gain. Experiments at the Tennessee Experiment Station, show, however, that where there is a loss in weight during the winter the total weight for the year of such steers is not as great as where they are so fed that they make a small gain during the winter. The experiments conducted thus far seem to indicate that the ideal to strive for is so to winter the stocker steers that they make a gain of from 50 to 80 pounds each during the winter.

There are several methods that may be successfully used in the wintering of stocker steers. A few good rations are as follows:

Ration 1:
Silage 15 lbs.
Straw 8 lbs.
Corn stover 8 lbs.
Cottonseed meal ½ lb.

Ration 2:
Silage 15 lbs.
Low-grade hay 10 lbs.

Ration 3:
Straw 10 lbs.
Cottonseed hulls 10 lbs.
Cottonseed meal 2 lbs.

Ration 4:
Corn stover cured in the shock, and then stacked when well-cured 20 lbs.
Cottonseed meal 2 lbs.

One of the best methods of wintering the stocker steer is to utilize winter-growing crops. During most of Tennessee winters, year-and-a-half-old cattle can pasture the greater part of the winter on such crops as wheat, rye, barley, crimson clover, and winter oats. Many successful feeders are wintering cattle on these crops during favorable weather and supplementing them with corn stover, straws, low-grade hays, and about one pound of cottonseed meal per head per day.

Another practice in feeding stocker steers in the State that has proved very successful is to winter the steers on a fairly good winter ration, and continue the ration while the steers are on grass, marketing

them during June with a fair amount of finish. When intended for market at that particular time of the year, they should receive during the winter a liberal ration of silage, with such cheap feeds as corn stover, straws, and a fair grain ration of 4 pounds of broken ear corn and 3 pounds of cottonseed meal. The grain ration should not be given until the latter part of the winter period. Hay should be given during the transition period from winter feeding to grass on account of the watery condition of the grass at this time, which makes the grass very laxative, and also because that grass has but a small amount of dry matter and therefore has a low food value.

The method of finishing cattle during the winter months depends upon several factors, the principal ones of which are the cost of feeds and the quality of steers to be finished. In the South corn is usually much higher in price than in the corn-belt states and the quality of the steers is usually lower. As a result, entirely different methods of finishing steers have been worked out. The quality of steers will oftentimes not pay for a high finish. When corn is high, cheaper feeds must be substituted. When steers are poor to fair in quality, less finish should be put on.

Corn may be used in the ration of the fattening steer when not too high priced. When used, the best practice seems to be to use cottonseed meal during the first 30 days, at the rate of 3 pounds per head per day, and then introduce corn into the ration during the second 30 days and third 30 days, with cottonseed meal reaching 4 pounds per head per day, and with corn beginning at 2 pounds per head per day and gradually increasing to 8 pounds. The roughage part of the ration should be made up of silage, oat straw, and barley straw. Bright, clean straws and well-cured shock-corn stover in such a system of feeding will give nearly as good results as hay.

Another method of finishing steers is that of using cottonseed meal or velvet bean meal as the sole grain ration. This has grown to be a common practice with Southern cattle feeders, and is being adopted by some Northern feeders. Experiments at the Tennessee Experiment Station indicate that the largest gain can be put on when cottonseed meal with silage or hulls is used, in the proportion of 5 to 7 pounds per head per day. The average daily gains where steers were fed in amounts increasing from 3 to 5 pounds of cottonseed meal per head per day was 1.52 pounds; where steers were fed in amounts increasing from 5 to 7 pounds the daily gain was 1.75 pounds; and where they were fed in amounts increasing from 7 to 9 pounds the daily gain was 1.72 pounds. Care should always be taken in getting steers on a full feed of cottonseed meal. Ten to fifteen days should be taken, with slight increase each day, to get the steers on a feed of 5 pounds per head per day. Where silage is fed, the cottonseed meal should be well mixed with the silage at the time of feeding. If velvet bean meal is used as the sole concentrate it may be fed in

amounts of about 10 pounds per head per day at the latter end of the finishing period.

The "fill" that is obtained on cattle when they are put into the feed lot during the fore part of the winter feeding period may be obtained largely with straws, stovers, and silage. In order to obtain the greatest advantage through the use of these cheap feeds the feeding of grain should not begin until the cattle have been on dry feed for twenty days.

Silage and cottonseed meal make it possible for the Tennessee farmer to compete in the raising of cattle and the finishing of steers with the corn-belt farmer. One of the best feeds that may be grown for cattle is corn silage. A 100-ton silo can be built for a money outlay of from $80.00 to $120.00. (Write for bulletin on silo). Experiments at the Tennessee Station with silage and cottonseed hulls as the roughage part of the ration, for finishing steers, proved that silage was more efficient than hulls. The average gain for the time on experiment of steers receiving silage and cottonseed meal was 154.9 pounds; hulls and cottonseed meal 144.1 pounds; and a combination silage, hulls and cottonseed meal 171.7 pounds. Whenever silage is fed, some dry feed should be fed along with it for best returns. Bright, clean straws are equally as efficient for that purpose as cottonseed hulls. Allowing that the manure offset the labor, and that the steers were fed on a $1.50 margin and sold for $7.00 per hundredweight, silage was worth, in Tennessee experiments, $7.65 per ton. With hulls figured at $8.00 per ton, silage at $3.00 per ton, and cottonseed meal at $25.00 per ton, the average profit on steers receiving hulls was $7.28 and on steers receiving silage, $11.28.

FEEDING DAIRY CATTLE

The products from dairy cattle are much more valuable than those from beef cattle, and hence more expensive feeds may be used. More hays and more grains may be used in the ration of the dairy cow. The cheaper roughages may be used for wintering the dry cows and yearlings. Silage should always be provided for the dairy animals, for larger yields of milk may be obtained through the use of this feed than any other kind.

The amounts of feed that should be given the dairy cow will vary with the kind. (For rule for feeding grain to the dairy cow, see page 57). While silage is an excellent feed, it should never make up the entire roughage ration. Ordinarily 30 pounds of silage per head per day should be considered a full feed for a 1000-pound dairy cow. The remainder of the roughage ration should consist for the most part of some legume hay, such as clover, alfalfa, soy bean, or cowpea. About 10 to 15 pounds of hay per day should be given. If more rough feed is needed, such feeds as bright, clean straws or well-cured shock-corn stover will prove appetizing and profitable. It never pays to feed less than a full feed to any kind of animals,

although the character of the ration may be adapted to the best practice for the kind to be fed.

The cheapest source of protein, where the protein feeds must be purchased, is cottonseed meal. An excellent grain ration for the dairy cow is 3 parts crushed corn-cob-and-shuck meal and 2 parts cottonseed meal. This ration may be given in the proportion of 1 pound for every 3 to 3½ pounds of milk until the amount of cottonseed meal reaches 4 pounds per head per day. If, according to this rule, more grain should be given, then some other kind of grain than cottonseed meal should be added to the ration. In that case barley, oats, or bran may be used. Another very good grain mixture is 4 parts crushed corn-cob-and-shuck meal, 2 parts cottonseed meal, and 2 parts cowpeas. In this ration 1 part soy beans may be substituted for the 2 parts cowpeas. For other grain rations, see page 104, or calculate a balanced ration according to methods outlined on pages 64 and 65.

The feeding of the dairy calf should be essentially the same as that recommended for the beef calf. (See pages 58 and 71).

If one desires to have a good, strong, vigorous dairy cow, it is best to develop a good, strong, vigorous dairy heifer. It does not pay to underfeed the dairy heifer. Do not turn the heifer on the stalk fields and allow her to shift for herself. Protection against storms and cold winds should be provided by means of good shed and barns, with well-battened sides, and good, bright, clean roughages, such as oat and barley straws, and well-cured shock-corn stover, with about 5 pounds of good hay and 1 to 2 pounds of cottonseed meal, should be given to the yearling heifers during the winter months. Ten to fifteen pounds of silage per head per day, or winter cover crops, may also be given in addition to the roughages just outlined.

The dairy heifer should be well developed until the time of dropping the first calf. Jersey heifers should be bred to drop calves at 24 months of age, Holsteins at 26 to 28 months of age. Jersey heifers may breed at 5 months of age. Hence aged and young bulls should not be allowed to run with the Jersey heifers that are 5 months of age or older.

Under general dairy-farm conditions the cows should freshen in the fall months. Dairy products of both milk and butter sell at better prices in winter than in summer. Dairy cows that freshen in the fall produce more milk and butter for the entire year than cows that freshen in the spring. Labor is more plentiful and cheaper in the winter months than in the summer months. There are more good reasons for having cows freshen in the fall than in the spring.

Do not allow the bull to run with the herd. Otherwise calves will arrive at all seasons of the year, and the lactation periods will be less than a year, which is not the most economical practice, for the freshening dates should be twelve months apart in order to give the maximum returns from the herd. It is better not to engage in the dairy business than to allow bulls to run with the herd.

FEEDING HOGS

The systems of feeding hogs in vogue today are inherited from the practices of our fathers, who used grain entirely for hogs. Corn and other grain were used exclusively because they were very cheap and were very profitably fed to hogs when cheap. With the prevailing high prices of grain, cheaper feeds for the hog must now be found.

An exclusive grain ration is not natural to the hog any more than it is to other kinds of farm animals. In the wild state hogs utilized such foods as roots, herbs, and succulent forage plants. Grain was eaten only when in season. Hogs will consume forage crops as

Throughout the Periods of Growth and Fattening Hogs Should Be Given Green Feed. Here the Hogs Are Shown Grazing on Oats.

well as will other farm animals if they are given an opportunity to do so. It is not true that grain forages are not good for hogs. Of course, green wheat or any other green feed will kill hogs just like it will any other kind of farm animals if they are kept in a dry lot throughout the winter and then are given unlimited access to an abundant supply of such feed. The fact that hogs will consume green feed enough to make them sick is evidence enough that they should be given it throughout the periods of growth and fattening. Green feeds are as essential for hogs as for other classes of animals, and if they are given a liberal supply of succulent forage crops they will make more profitable gains than almost any other kind of farm live stock. A straight corn ration is no more natural a feed for hogs than for any other class of farm animals.

One of the most common and mistaken opinions with regard to hogs is that they are the most unclean of farm animals. Hogs will keep their pens and yards cleaner than any other class of farm animals if they are given room enough to do so. There is no other class of farm animals that will set off one portion to sleep in, and another portion to feed in. The fact that hogs will wallow in mud is not an evidence that they are unsanitary; they do it rather as a sanitary measure. They do not by choice wallow in the unsanitary mud of the farmyards. If they could choose their place for wallowing in the mud they would select pools along the edges of streams that are practically free from the filth that is so common in the farmyard. Hogs wallow in the mud as a protection against lice and they lie in the edges of streams by choice when they can do so in order to keep cool. There are no sweat pores in the skin of the hog that will enable it to become cool through evaporation of moisture thrown out through the skin.

Streams of water are usually much cleaner than filthy wallow holes in barnyards. In hog cholera survey work conducted in 1914 by the U. S. Department of Agriculture, in 16 counties scattered throughout the United States, it was found that only 1.61 per cent of the outbreaks of hog cholera were traceable to contaminated streams; 23.1 per cent were traceable to exchanging labor and visiting infected premises; 17.27 per cent to birds; 8.42 per cent to exposure to sick hogs and adjoining farms; 9.57 per cent to dogs; and 4.58 per cent to other sources.

The best returns from hogs will always be obtained through feeding them a balanced ration. Since young hogs have a greater rate of growth than any other class of farm animals they need a greater supply of ash material. A little pig will multiply its birth weight by 10 in from 6 to 8 weeks. It takes from a year to a year and a half for colts and calves to multiply their birth weight by 10, and it takes a man from 10 to 12 years to multiply his birth weight by 10. The milk of the brood sow must necessarily be very rich in ash in order to meet the demands of Nature in supplying ash material to the young suckling pigs. Nature compels the sow to keep up a standard product of food for the young pigs. Therefore if ash is not supplied in the ration of the sow, with which she may supply ash in the milk that she secretes, she must supply the ash from the least used parts of her own body. Is it any wonder, then, when the sow is asked to supply milk rich in ash from a food low in ash, like corn, that she finally so weakens some of those parts that they break and we have on hand a "broken-down" sow? A straight corn ration is the most unbalanced ration imaginable for the sow that is suckling a large litter of pigs.

The remedy for a sow that has "broken down" is first to remove the cause. Wean the pigs; for there is little chance for a sow's recovery so long as she is required to produce milk, which is continually adding to the trouble through additional removal of the ash material

from her body, and so long as the little pigs worry the mother, which is already painfully sick. If tankage is obtainable it should be put into milk and given to the sow in quantities of ¼ pound per day. In three or four days it may be increased to ½ pound. This particular feed is rich in lime and phosphorus, which are the elements most needed to repair broken parts of the sow. The pigs must be carefully fed by hand on cow's milk. A couple of teaspoonfuls of tankage added to the ration of milk three times daily would also be good for the pigs.

Mineral matter (ash) may also be supplied to brood sows, growing pigs, and fattening hogs by the feeding of charcoal, wood ashes, air-slaked lime, ground bone, and salt. It is considered excellent practice to make a small pit 2 feet deep and 18 inches wide and rake the cobs from the feeding yard of the fattening hogs into it after first starting a fire in the bottom of the pit. After the fire is well started the pile should be covered with earth, with just enough opening at the top to keep the fire from smothering entirely. When the whole mass of cobs is on fire, the fire should be smothered entirely or the earth pulled away and wet down thoroughly. The hogs will greatly appreciate the cobs and will make better gains as a result of feeding on them. A very good mixture to keep before hogs as a condition powder, or to supply mineral water is the following:

Wood ashes 10 lbs.	Air-slaked lime 3 lbs.
Salt 2 lbs.	Copperas 1 lb.
Sulphur 1 lb.	Charcoal 3 lbs.

When hogs have worms, a very good mixture to keep before them is the following:

Glauber's salts 3 parts.	Sulphur 1 part.
Copperas 3 parts.	Salt 3 parts.
Sal Soda 3 parts.	Bran 3 parts.

Charcoal 6 parts.

Parts are always to be taken by weight. The above mixtures should be carefully mixed, on a good floor and then placed in boxes so that the hogs may have constant access to them. Where hogs are not accustomed to them they should be used in small quantities for the first few days, until the abnormal appetite of the hogs for them is satisfied. Where they are intended for pregnant brood sows the cooperas should be left out of each of the mixtures, as it is said to be harmful to sows in this condition.

If corn is used for the brood sow it should always be balanced with protein feeds. Likewise, better results are always obtained with corn for the fattening hogs when it is balanced with protein feeds. During the first thirty-six hours after farrowing, the brood sow

should be given no grain except a little bran mash in 2 quarts of milk at a feed. Water should, of course, be kept before her. More litters are perhaps ruined through overfeeding of the brood sow during the first thirty-six hours after farrowing than in any other way. The sow is feverish. Feed makes her more feverish. She is sluggish. Full feeding makes her more sluggish; and she is not careful with the pigs or heedful to their cries when lain upon. She should be fed very lightly during the first week. After that a very good practice is to feed all that the sow will clean up, with good appetite, of a mixture of grains, as in the following rations:

Ration 1:
Corn 4 parts.
Barley 2 parts.
Oats 2 parts.
Soy beans 2 parts or cowpeas 4 parts.

Ration 2:
Corn 3 parts.
Barley 3 parts.
Oats 3 parts.
Soy beans 2 parts or cowpeas 4 parts.

Ration 3:
Corn 1 part.
Skimmilk or buttermilk 3 parts.

Ration 4:
Corn 6 parts.
Barley 3 parts.
Tankage 1 part.

The sow and pigs would do best if given, in addition to the above, all the green feed that they would eat, such as alfalfa, clover and soy bean forages in season, and winter cover crops, such as barley and crimson clover, wheat, rye, and oats in season.

The fattening hog being finished on corn should always receive some protein supplement to the ration. Any one of the following supplements may be given to 150- to 250-pound hogs in the amounts recommended. No more than one should be given at a time in this amount, along with corn:

Cottonseed meal ½ to 1 pound per head per day.
Tankage ¼ to ½ pound per head per day.
Soy beans ½ to 1 pound per head per day.
Cowpeas 1 to 1½ pounds per head per day.
Skimmilk or buttermilk 3 to 4 quarts per head per day.

Cottonseed meal may be used for the last three weeks in balancing the corn ration fed to hogs intended for market, with no danger of poisoning. Where cottonseed meal is to be used in the ration for a period longer than three weeks, copperas should be fed with it to neutralize its detrimental effects. A solution of copperas should be made up in the proportion of 4 pounds of copperas to 50 gallons of water. A quart of this solution should be fed for every pound of cottonseed meal.

Hogs should be grown and finished on forage crops whenever possible. Forage alone is but little more than a maintenance ration, but when supplemented with grain will produce pork more cheaply than any other feed. Forage crops also have the advantage of allowing for the retention of the greatest amount of fertilizing constituents of the feeds fed on the lands. (See Table IV, also Table V, in the Appendix). It is a good general rule for feeding grain to hogs on forage crops, to feed to the growing shotes 2½ per cent of their live weight per day. If the forage is abundant the grain ration may consist almost entirely of corn, although the addition of ½ pound of soy beans or ½ pound of cowpeas will prove profitable. Tankage may be used at the rate of ¼ pound daily. During the finishing period they should of course be given a full feed of corn, supplemented with protein feeds, as outlined above.

The number of hogs that should be put on each acre will depend upon the nature of the forage. Ordinarily ten to twelve 100- to 150-pound shotes per acre are enough. Forage crops for hogs should not be pastured too closely. Forage crops that are best suited to hogs for summer pastures are alfalfa, red clover, soy beans, Lespedeza clover, blue grass, a mixture of rape, oats and clover, and sorghum if pasturing is begun when 6 inches high. Forage crops best suited for winter forage are crimson clover, barley, wheat, rye, and winter oats. Combinations of these crops may easily be made, so that there will be a continuous succession of succulent forages for the hogs.

FEEDING SHEEP

Sheep are the most profitable animals that may be kept on the farm; yet it does not follow that there should be large flocks of sheep on Tennessee farms, because when kept in large numbers they are not nearly so profitable. Small flocks of sheep should be kept on every farm. A few sheep on the farm would consume feed that would otherwise go to waste. A few sheep, say an average-sized flock of ten ewes, would represent almost clear profit on the average Tennessee farm. A small flock could be put on the wheat in winter without damage to it; could be put on barley and crimson clover in the spring, or on blue grass; could be turned into the cornfield to eat weeds that the cultivator had missed, and to eat grass along the fence around the cornfield; could be turned on the wheat stubble after the wheat was taken off; could be turned on the soy bean field or in the cowpea field; and, in fact, could be turned into many places on the farm to gather feed that would otherwise be wasted.

Where small flocks are kept, the fleece of wool would more than pay for the cost of keep of the ewe and lamb for the entire year. Each lamb, if dropped in January, should be marketed in May or June at a weight of 90 pounds, and sell at from 8 to 11 cents per pound. In other words, every ewe on the farm should bring in a clear profit

of from $7.00 to $8.00, when one lamb is produced, and more than that when two lambs are produced. A small flock of ten ewes should bring in a profit to the farm of from $70 to $100.

When the lambs are marketed the ewes should be put on short pasture for a few days until the milk flow ceases. Give the flock special attention at this time, for often the best ewes in the flock are ruined for lack of attention to the udder. After the lambs have been removed for twelve hours, drive the flock into a small pen and examine the udders. Milk out enough to relieve the tension from the udders that are much distended. The operation should be repeated again in another twelve hours. Usually further attention will not be needed. It is the very best ewes, giving the most milk, that give trouble.

The ewe flock should be kept on rather poor pasture until the first of August, when they may be turned on extra good pasture, such as a good meadow field that has been reserved for them until this time. Any pasture that is especially good at this time may be used for the ewe flock. The practice of keeping ewes on poor pasture for the period intervening between lamb-weaning time and the breeding season, and then putting them on very good pasture, is known as "flushing". It may likewise be accomplished by giving the ewes grain during the mating season. Experiments on the flushing of ewes show that they will come into season earlier, and all at nearly the same time, and that a larger number of twins will be produced. The theory of flushing is that the increase of laxative, cooling food will cause a sudden stimulation in health of the ewe, that the cells of the body will be suddenly multiplied, and that the reproductive cells will become more active. If the flock has been kept on good pasture it is not easy to flush them.

The ram should be so cared for as to be in the very best condition at the breeding season. He should be kept separate from the flock, on the very best of pasture, during the summer months. In order to have good, strong lambs, the ram should be in good, strong, vigorous condition at the breeding season. It is exceedingly good practice to exchange rams with a neighbor four weeks after the beginning of the breeding season. For one reason or another, rams sometimes become impotent, and the exchange of rams with a neighbor insures a crop of lambs for both flocks.

The ewes for the production of early lambs may be mountain or common ewes, but the ram should be a purebred ram of one of the black-faced breeds. Southdown, Shropshire, Hampshire, Suffolk, or Oxford rams should be used for the production of early lambs. Black-faced lambs have gained such a reputation on the market that the trademark of a black face helps to sell the lamb. Dorset Horned lambs also sell well on the market.

If the ewes are in good condition at the beginning of the winter season they will need no grain. If they are not in good condition they should be given ¼ to ½ pound of cottonseed meal. Unless the weather

is very unfavorable, they may pasture for most of the winter on cover crops. In fact, cover crops of some kind should be provided for the ewe flock.

If the breeding season has been successful most of the lambs will come during the second and third weeks of January, and not be scattered over a long period of time. Special attention should be given the flock at this time, for the loss of a lamb means the loss of profit from a ewe for the year. The flock should be visited several times a day in order that the ewes that are lambing may be cared for. An ideal shelter for the flock at this time would be a shed tightly closed on three sides and with one side open to the south. If the ewe does not make any progress toward the delivery of a lamb after an hour and a half of labor, an investigation should be made and some assistance given. It is best to keep the ewes on a well-drained blue-grass lot during the lambing season. The grain fields are likely to be too wet. After a ewe lambs, she may be put into the grain field.

If the pasture is abundant the ewes will need no grain. Where convenient, the lambs should be provided with a "creep",* where they may be fed a grain ration composed of equal parts of shelled corn and oats.

FEEDING POULTRY

The poultry of the farm suffer more neglect in the matter of feeding than any other of the farm live stock. The eggs they produce are richer in protein than any other live stock product. If protein is not supplied in the ration of the laying hen she cannot be expected to lay, for she must have plant protein in order to make animal protein. Such feeds as corn, barley, and oats are low in protein and should be balanced with such feeds as soy beans, cottonseed meal, cowpeas, milk, and meat scrap. A very good grain mixture for laying hens on Tennessee farms that may be made almost entirely from home-grown feeds is—

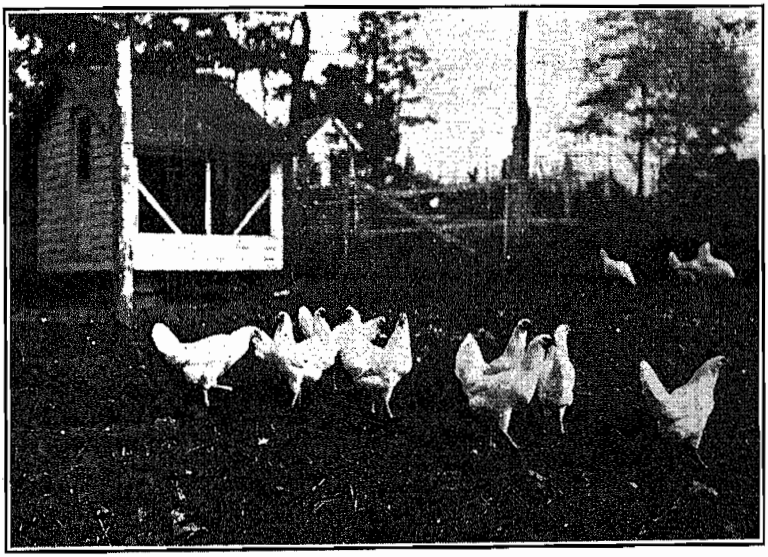
Corn 6 parts.
Barley 6 parts.
Wheat 4 parts.
Oats 4 parts.
Soy beans 2 parts.
Cottonseed meal 2 parts.

Skimmilk should be given in addition to the above mixture, at the rate of 2 pounds of skimmilk for every pound of the mixture. It would

*A lamb creep is a small pen with vertical openings wide enough to admit of the entrance of the lambs but not the mother ewes. When they are made in the corner of the field, covered troughs should be used so as to keep the feed troughs dry. The more rapid gains will more than pay for the feed given them. Put into the troughs only as much as they will clean up from one feed to another.

be well for a third of the above mixture to be ground and fed in the morning, in the form of a mash. A little of the whole grain could also be fed in the morning, in the litter, in order to provide exercise for the hen during the day, and the remainder of the ration fed in the late afternoon. Such a mixture of grains would be equally as efficient as commercial poultry foods and would cost much less, for it could be compounded on the farm. Not so many grains in the ration are necessary but are advisable because better results are always had where there is plenty of variety of feed stuffs in the ration.

Meat meal may be used in the above ration where it can be easily obtained, but where skimmilk is plentiful it is not necessary. Ground green bone is also highly beneficial where it can be obtained.



Don't Neglect the Hens. They Need Good Feed and Will Respond to It With a Cash Income for the Farmer. This Bulletin Tells What Tennessee Farmers Can Feed With Profit.

Care must be taken to provide plenty of material for the making of shells. If there are soft-shelled eggs, it is an indication that enough lime is not being supplied in the ration. Crushed lime rock is equally as beneficial as broken oyster shell.

The little chicks will need finer feed than the mature fowls. Food should not be given them for at least 24 hours after hatching. Some poultrymen do not feed chicks until 72 hours after hatching.

There is possibly a little less mortality when dry foods are given to the young chicks. The following mixture makes a fairly well-balanced ration for the young chicks:

Equal parts of—

Rolled or pin-head oats.
Cracked wheat.
Cracked barley.
Cracked buckwheat.
Cracked kafir corn.
Millet seed.

In a short time wheat may be given whole. Screenings are good for half-grown chicks, and the oats may be simply hulled and the corn more coarsely cracked.

Cottage cheese or clabbered milk is excellent for the growing chicks. They are much less subject to diarrhea when receiving it.

A very good bread for chicks is made by baking a dough made of the following ingredients:

Bran 2 quarts
Coarse corn meal 2 quarts
Wheat middlings 1 quart
Beef scrap 1 handful
Finely broken limestone 1 handful

Rub together dry with from 2 to 4 eggs. Those eggs that have been found infertile at the end of the first week may be used. Mix with barley enough skimmilk to moisten, and rub the whole into a crumbly mass. Put into a 3-inch-deep pan, press down hard, and bake in a slow oven from 3 to 6 hours. When finished there should be no stickiness or doughiness.

Salt is a necessity for fowls. Eggs are rich in salt elements and salt is necessary for the best health of the fowl. Fowls regularly accustomed to salt are not likely to eat an injurious quantity when it is accidentally left within their reach. A little salt should be given every day in the ration of the fowls.

APPENDIX

Tables for Men Who Feed Live Stock

On the pages that follow will be found information that can be used by any Tennessee feeder of live stock. For the information in the long tables the writer is indebted to Henry and Morrison, "Feeds and Feeding."

Use the facts that these tables give you to make your feeding easier and more profitable.

Money can be made from live stock properly fed and cared for. Let the pages of this bulletin help you.

TABLE I—*Average percentage composition of American feeding stuffs*

FEEDING STUFF	Water	Ash	Crude protein	Carbohydrates		Fat
				Fiber	N-free extract	
CONCENTRATES AND THEIR BY-PRODUCTS	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Corn and its products						
Dent corn	10.5	1.5	10.1	2.0	70.9	5.0
Flint corn	12.2	1.5	10.4	1.5	69.4	5.0
Sweet corn, mature	9.3	1.8	11.5	2.3	67.2	7.9
Corn meal or chop	11.3	1.3	9.3	2.3	72.0	3.8
Corn cob	10.0	1.5	2.0	31.8	54.3	0.4
Corn-and-cob meal	10.4	1.5	8.5	7.9	67.6	4.1
Hominy feed, high grade	10.1	2.6	10.6	4.4	64.3	8.0
Gluten feed, high grade	8.7	2.1	25.4	7.1	52.9	3.8
Gluten meal, high grade	9.1	1.1	35.5	2.1	47.5	4.7
German oil meal, high grade	8.9	2.7	22.6	9.0	46.0	10.8
Corn bran	10.0	2.4	9.7	9.8	62.4	5.7
Wheat and its products						
Wheat, all analyses	10.2	1.9	12.4	2.2	71.2	2.1
Winter wheat	10.9	1.8	11.7	2.0	71.6	2.0
Standard wheat middlings (shorts)	10.5	4.4	17.4	6.0	56.8	4.9
Wheat bran, all analyses	10.1	6.3	16.0	9.5	53.7	4.4
Wheat feed (shorts and bran)	10.1	5.2	16.8	7.6	55.7	4.6
Wheat screenings	10.2	3.9	13.3	7.4	61.1	4.1
Rye and its products						
Rye	9.4	2.0	11.8	1.8	73.2	1.8
Rye middlings	11.4	3.7	15.7	4.6	61.2	3.4
Rye bran	11.4	3.5	15.3	4.0	62.7	3.1
Rye feeds (shorts and bran)	11.5	3.8	15.3	4.7	61.5	3.2
Oats and oat products						
Oats	9.2	3.5	12.4	10.9	59.6	4.4
Oat meal	7.9	2.0	16.0	1.5	66.1	6.5
Oat feed, low grade	10.2	4.0	9.6	18.5	53.8	3.9
Oat hulls	6.8	6.0	4.0	29.2	52.3	1.7
Barley, its products, and emmer						
Barley	9.3	2.7	11.5	4.6	69.8	2.1
Brewers' grains, dried	7.5	3.5	26.5	14.6	41.0	6.9
Brewers' grains, wet	75.9	1.0	5.7	3.6	12.1	1.7
Rice and its products						
Rough rice	9.6	4.9	7.6	9.3	66.7	1.9
Rice polish	10.0	4.8	11.9	1.9	62.3	9.1
Rice bran, high grade	10.1	9.7	12.1	12.4	44.3	11.4
Rice meal	9.5	9.1	11.8	9.3	48.7	11.6
Rice hulls	9.3	16.9	3.3	35.4	34.0	1.1
Buckwheat and its products						
Buckwheat	12.1	2.1	10.8	10.3	62.2	2.5
Buckwheat middlings	12.0	4.8	28.3	4.8	42.7	7.4
Buckwheat bran, high grade	11.2	4.2	22.3	7.1	49.4	5.8

TABLE I—*Continued*

FEEDING STUFF	Water	Ash	Crude protein	Carbohydrates		Fat
				Fiber	N-free extract	
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Buckwheat feed, good grade	11.8	4.4	19.3	17.9	41.4	5.2
Buckwheat hulls	10.3	2.1	4.4	43.7	38.5	1.0
The Sorghums						
Kafir grain	11.8	1.7	11.1	2.3	70.1	3.0
Kafir-head chops	12.5	2.8	9.7	6.4	65.9	2.7
Milo grain	10.7	2.8	10.7	2.4	70.5	2.9
Milo head chops	10.3	3.1	10.10	5.9	68.1	2.6
Feterita grain	10.8	1.5	11.5	1.2	71.7	3.3
Kaoliang grain	9.9	1.9	10.5	1.5	71.9	4.3
Sorghum grain	12.7	1.9	9.2	2.0	70.8	3.4
Broom-corn seed	11.8	2.9	10.2	8.2	63.5	3.4
Cottonseed and its products						
Cottonseed	9.4	4.6	19.5	22.6	24.9	19.0
Cottonseed meal, choice	7.5	6.2	44.1	8.1	25.0	9.1
Cottonseed meal, prime	7.8	6.6	39.8	10.1	27.4	8.3
Cottonseed meal, good	7.9	6.4	37.6	11.5	28.4	8.2
Cold-pressed cottonseed cake	7.9	4.2	26.1	24.0	30.1	7.7
Cottonseed hulls	9.7	2.7	4.6	43.8	37.3	1.9
Cottonseed-hull bran	8.4	2.5	3.4	34.8	49.7	1.2
Flaxseed and its products						
Linseed meal, new process	9.6	5.6	36.9	8.7	36.3	2.9
Legume seeds and products						
Bean, navy, cull	12.8	3.3	22.1	3.7	56.7	1.4
Cowpea	11.6	3.4	23.6	4.1	55.8	1.5
Horse bean	12.6	3.8	26.2	7.1	49.4	0.9
Pea, field	9.2	3.4	22.9	5.6	57.8	1.1
Peanut, with hull	6.5	4.1	20.4	16.4	16.4	36.2
Peanut cake, from hulled nuts	10.7	4.9	47.6	5.1	23.7	8.0
Peanut cake, hulls included	5.6	4.5	28.4	23.4	27.0	11.1
Peanut hulls	9.1	5.5	7.3	56.6	18.9	2.6
Soy bean	9.9	5.3	36.5	4.3	26.5	17.5
Soy bean meal, fat extracted	11.8	5.4	41.4	5.3	28.7	7.4
Velvet bean, seed and pod	12.3	4.0	17.1	14.3	47.7	4.6
Velvet bean, seed	11.7	2.6	20.8	7.5	51.0	6.4
Rapeseed cake	10.0	7.9	31.2	11.3	30.0	9.6
Sunflower seed, without hulls	4.5	3.8	27.7	6.3	16.3	41.4
Milk and its products						
Cow's milk	86.4	0.7	3.5	-----	5.0	4.4
Skim milk, centrifugal	90.1	0.7	3.8	-----	5.2	0.2
Skim milk, dried	8.3	25.1	36.6	-----	25.8	4.2
Buttermilk	90.6	0.7	3.6	-----	5.0	0.1
Whey	93.4	0.7	0.8	-----	4.8	0.3
Mare's milk	90.6	0.4	2.0	-----	5.9	1.1
Ewe's milk	80.8	0.9	6.5	-----	4.9	6.9

TABLE I—*Continued*

FEEDING STUFF	Water	Ash	Crude protein	Carbohydrates		Fat
				Fiber	N-free extract	
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Sow's milk	81.0	1.0	5.9	-----	5.4	6.7
Slaughterhouse by-products						
Dried blood	9.7	3.3	82.3	-----	3.8	0.9
Fish meal, high in fat	10.8	29.2	48.4	-----	-----	11.6
Fresh bone	30.4	21.1	19.7	-----	3.8	25.0
Meat-and-bone meal, 30-40% ash	6.0	36.8	39.8	2.1	4.1	11.2
Pork cracklings	5.0	2.3	56.4	-----	4.1	32.2
Tankage, 55-60% protein	7.5	13.6	58.1	4.9	2.9	13.0
Miscellaneous concentrates						
Acorn, kernel and shell	27.9	1.1	3.4	17.8	45.4	4.4
Beet pulp, dried	8.2	3.5	8.9	18.9	56.6	0.9
Beet pulp, molasses	7.6	5.6	9.5	15.9	60.7	0.7
Chess, or cheat, seed	7.7	4.1	10.5	7.2	68.8	1.9
Distillers' grains, dried, from corn	6.6	2.6	30.7	11.6	36.3	12.2
Distillers' grains, dried, from rye	7.2	3.9	23.1	10.9	47.1	7.8
Molasses, beet	25.3	5.2	3.5	-----	66.0	-----
Molasses, cane, or blackstrap	25.8	6.4	3.1	-----	64.7	-----
Starch feed, dry	9.3	1.8	15.4	7.2	59.4	6.9
Starch refuse	10.3	1.6	6.3	7.3	73.1	1.4
DRIED ROUGHAGE						
Cured corn, sorghum forage, etc.						
Corn fodder (ears, if any remaining) very dry, from barn or in arid districts	9.0	6.5	7.8	27.2	47.3	2.2
Corn fodder, medium in water	18.3	5.0	6.7	22.0	45.8	2.2
Sweet corn fodder	12.3	9.0	9.2	26.4	41.3	1.8
Corn stover (ears removed), very dry	9.4	5.8	5.9	30.7	46.6	1.6
Corn stover, medium, in water	19.0	5.5	5.7	27.7	40.9	1.2
Corn husks	24.7	2.5	2.9	24.9	44.2	0.8
Corn stalks	17.7	5.2	4.8	27.8	43.1	1.4
Kafir fodder, dry	9.0	9.4	8.9	26.8	43.1	2.8
Kafir stover, dry	16.3	8.3	5.1	27.4	41.2	1.7
Milo fodder, dry	11.1	9.9	12.0	18.4	44.1	4.5
Sorghum fodder, dry	9.7	7.8	7.4	26.1	45.9	3.1
Sorghum bagasse, dried	11.3	2.9	3.4	30.5	50.5	1.4
Broom-corn fodder	9.4	5.7	3.9	36.8	42.4	1.8
Sugar-cane bagasse	10.2	5.6	3.3	34.6	39.2	7.1
Hay from the grasses, etc.						
Bent grass, Canada or blue joint	6.7	6.8	7.6	34.7	41.8	2.4
Bermuda grass	9.7	7.6	7.1	25.6	48.2	1.8
Bluegrass, Canada	10.7	5.8	6.6	28.2	46.4	2.3
Bluegrass, Kentucky, all analyses	13.2	6.6	8.3	28.3	40.7	2.9
Brome grass, smooth	8.5	7.7	9.9	31.3	40.2	2.4

TABLE I—*Continued*

FEEDING STUFF	Water	Ash	Crude protein	Carbohydrates		Fat
				Fiber	N-free extract	
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Bluestem grasses	6.9	5.5	4.9	34.2	46.7	1.8
Carpet grass	7.9	10.2	7.0	31.8	40.9	2.2
Chess, or cheat	8.4	7.9	7.2	28.0	46.2	2.3
Crab grass	9.5	8.5	8.0	28.7	42.9	2.4
Crowfoot grass	9.5	7.9	8.6	27.4	44.4	2.2
Fescue, meadow	11.7	7.0	6.8	30.4	42.1	2.0
Fowl meadow grass	11.1	7.2	9.8	28.8	40.4	2.7
Foxtails, miscellaneous	6.8	10.1	9.3	28.6	42.6	2.6
Johnson Grass	10.1	7.5	6.6	30.2	43.5	2.1
Millet, barnyard	13.5	8.2	8.3	27.6	40.8	1.6
Millet, common or Hungarian	14.3	6.3	8.3	24.0	44.3	2.8
Millet, German	8.7	6.9	8.0	27.3	46.5	2.6
Mixed grasses	12.8	5.6	7.6	28.8	42.7	2.5
Mixed grasses, rowen	13.6	6.5	12.3	24.2	40.1	3.3
Oat grass, tall, or meadow oat grass	11.8	6.1	8.0	29.4	42.1	2.6
Old witch grass	7.1	10.1	10.6	24.3	45.7	2.2
Orchard grass	11.6	6.9	7.9	30.3	40.4	2.9
Prairie hay, western	6.5	7.7	8.0	30.5	44.7	2.6
Quack, or couch grass	5.9	7.3	7.3	36.5	40.1	2.0
Red top, all analyses	9.8	6.8	7.4	28.7	45.0	2.3
Rye grass, perennial	12.0	8.1	9.2	24.2	43.4	3.1
Sedges, eastern	9.3	7.4	6.1	29.2	46.3	1.7
Sweet vernal grass	9.3	9.3	12.4	21.7	42.7	4.6
Timothy, all analyses	11.6	4.9	6.2	29.9	45.0	2.5
Wheat grass, common	7.3	6.9	6.5	27.4	49.4	2.5
Wild oat	7.9	6.4	8.0	30.1	44.8	2.8
Wild barley, or foxtail	7.5	8.8	7.0	27.4	47.3	2.0
Hay from the smaller cereals						
Barley hay, common	7.4	6.4	7.0	29.7	47.3	2.2
Oat hay	12.0	6.8	8.4	28.3	41.7	2.8
Rye hay, all analyses	8.1	5.1	6.7	37.5	40.5	2.1
Wheat hay	8.1	6.4	6.2	24.7	52.6	2.0
Hay from the legumes						
Alfalfa, all analyses	8.6	8.6	14.9	28.3	37.3	2.3
Alfalfa, first cutting	8.5	8.8	13.9	30.9	36.2	1.7
Alfalfa, second cutting	7.3	9.0	14.7	31.9	35.4	1.7
Alfalfa, third cutting	8.9	9.5	14.6	28.4	36.8	1.8
Alfalfa, fourth cutting	16.0	7.8	15.9	24.6	34.0	1.7
Alfalfa meal	8.8	9.0	14.3	30.1	35.8	2.0
Bean, whole plant	12.6	3.5	22.5	4.4	55.2	1.8
Beggarweed	9.1	8.4	15.4	27.5	37.3	2.3
Clover, alsike, all analyses	12.3	8.3	12.8	25.7	38.4	2.5
Clover, bur	7.0	10.8	19.2	23.0	37.0	3.0
Clover, crimson, or scarlet	10.6	8.8	14.1	27.3	36.9	2.3

TABLE I—*Continued*

FEEDING STUFF	Water	Ash	Crude protein	Carbohydrates		Fat
				Fiber	N-free extract	
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Clover, mammoth red	18.7	6.2	10.8	27.0	34.2	3.1
Clover, red, all analyses	12.9	7.1	12.8	25.5	38.7	3.1
Clover, sweet, white	8.6	7.2	14.5	27.4	40.1	2.2
Clover, white	8.1	8.0	16.2	23.2	41.6	2.9
Clover meal	8.5	7.2	13.7	25.9	42.4	2.3
Clover, rowen	14.8	7.3	16.5	20.4	37.3	3.7
Cowpea, all analyses	9.7	11.9	19.3	22.5	34.0	2.6
Kudzu vine	7.1	6.8	16.7	25.0	41.2	3.2
Lespedeza, or Japan clover	11.8	5.8	12.1	25.9	41.6	2.8
Pea, field	11.1	7.9	15.1	24.5	37.9	3.5
Peanut vine, without peanuts	21.5	8.7	9.1	20.2	36.8	3.7
Soy bean hay	8.6	8.6	16.0	24.9	39.1	2.8
Trefoil, yellow, or black medic	11.2	10.9	16.9	14.8	43.2	3.0
Velvet bean	7.2	7.4	16.4	27.5	38.4	3.1
Vetch, common	7.1	8.2	17.3	26.2	38.7	2.5
Vetch, hairy	12.3	8.6	19.9	24.8	31.6	2.8
Hay, mixed legumes and grasses						
Clover and timothy	12.2	6.1	8.6	29.9	40.8	2.4
Straw and chaff from cereals						
Barley straw	14.2	5.7	3.5	36.0	39.1	1.5
Buckwheat straw	9.9	5.5	5.2	43.0	35.1	1.3
Oat straw	11.5	5.4	3.6	36.3	40.8	2.4
Oat chaff	8.2	11.5	5.9	25.7	46.3	2.4
Rice straw	7.5	14.5	3.9	33.5	39.2	1.4
Rye straw	7.1	3.2	3.0	38.9	46.6	1.2
Wheat straw	8.4	5.2	3.1	37.4	44.4	1.5
Wheat chaff	14.4	7.2	4.2	28.0	44.8	1.4
Legume straws						
Bean stover	10.5	7.2	7.3	30.8	42.9	1.3
Cowpea stover	8.5	5.4	6.8	44.5	33.6	1.2
Soy bean stover	11.9	6.8	5.6	36.8	37.2	1.7
Miscellaneous dry roughages						
Sweet potato vines	11.3	9.2	12.5	20.2	43.5	3.3
FRESH GREEN ROUGHAGE						
Corn and the sorghums						
Corn fodder, all anlayses	78.1	1.2	1.9	5.2	13.0	0.6
Sweet corn fodder, ears removed	78.5	1.3	1.6	5.6	12.6	0.4
Corn stover, green (ears removed)	77.3	1.4	1.3	6.0	13.6	0.4
Kafir fodder, all analyses	76.4	1.9	2.4	6.6	12.0	0.7
Sweet sorghum fodder	75.1	1.4	1.5	7.0	14.0	1.0
Sugar cane	78.3	1.4	0.9	6.2	12.2	1.0
Fresh green grass						
Bermuda grass	66.8	2.3	3.0	8.0	18.9	1.0
Bluegrass, Canada	66.8	2.6	3.0	10.3	16.1	1.2

TABLE I—*Continued*

FEEDING STUFF	Water	Ash	Crude protein	Carbohydrates		Fat
				Fiber	N-free extract	
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Bluegrass, Kentucky, all analyses	68.4	2.8	4.1	8.7	14.8	1.2
Chess, or cheat	60.4	1.8	3.2	13.0	20.5	1.1
Crab grass	69.1	4.3	2.7	9.1	13.8	1.0
Fescue, meadow	69.5	2.4	3.0	10.1	14.0	1.0
Johnson grass	70.9	2.0	2.5	9.3	14.4	0.9
Meadow foxtail	70.4	2.7	3.6	8.0	14.1	1.2
Millet, barnyard	78.7	1.6	1.7	6.7	10.7	0.6
Millet, common, or Hungarian	72.4	2.1	2.9	8.4	13.3	0.9
Oat grass, tall, or meadow oat grass	69.7	2.0	2.6	10.5	14.3	0.9
Orchard grass	70.8	2.5	2.9	9.8	12.9	1.1
Quack grass	75.0	2.5	3.8	7.0	10.5	1.2
Red top	60.7	2.7	3.1	12.2	20.2	1.1
Rye grass, perennial	73.4	2.4	3.0	6.7	13.2	1.3
Sweet vernal grass	68.8	2.0	2.6	9.7	15.9	1.0
Timothy, all analyses	62.5	2.2	3.1	11.7	19.3	1.2
Wild barley, or foxtail	64.3	3.5	4.9	11.8	14.1	1.4
Green fodder, the smaller cereals						
Barley fodder	76.8	2.1	3.3	6.0	11.0	0.8
Oat fodder	73.9	2.1	3.2	7.8	11.9	1.1
Rye fodder	78.7	1.7	2.6	7.3	9.0	0.7
Wheat fodder, all analyses	72.6	2.7	3.6	7.5	12.8	0.8
Green legumes						
Alfalfa, all analyses	74.7	2.4	4.5	7.0	10.4	1.0
Clover, alsike	75.7	2.2	3.5	5.9	9.3	0.6
Clover, bur	79.2	2.3	5.1	3.9	7.8	1.7
Clover, crimson	82.6	1.7	3.0	4.7	7.4	0.6
Clover, mammoth red	74.9	2.3	4.0	7.3	11.0	0.5
Clover, red, all analyses	73.8	2.1	4.1	7.3	11.7	1.0
Clover, sweet	75.6	2.1	4.4	7.0	10.2	0.7
Clover, white	78.2	2.7	4.6	4.2	9.5	0.8
Cowpeas	83.7	2.0	3.0	3.8	7.0	0.5
Peas, field, Canada	83.4	1.6	3.6	4.0	6.9	0.5
Kudzu vine	69.4	2.2	5.5	8.3	13.6	1.0
Lespedza, or Japan clover	63.4	3.5	6.7	10.7	14.7	1.0
Soy beans, all analyses	76.4	2.4	4.1	6.3	9.8	1.0
Soy beans, in bloom	79.2	2.3	3.9	5.8	8.2	0.6
Soy beans, in seed	75.8	2.4	4.0	6.4	10.4	1.0
Velvet bean	82.1	2.0	3.5	5.1	6.6	0.7
Vetch, common	79.6	2.1	3.8	5.5	8.5	0.5
Vetch, hairy	81.8	2.2	4.2	5.0	6.3	0.5
Mixed legumes and grasses						
Clover and mixed grasses	72.7	1.6	3.0	8.5	13.3	0.9
Cowpeas and corn	80.0	1.8	2.1	5.3	10.4	0.4
Soy beans and corn	76.2	1.7	2.7	5.4	13.2	0.8

TABLE I—*Continued*

FEEDING STUFF	Water	Ash	Crude protein	Carbohydrates		Fat
				Fiber	N-free extract	
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Vetch and barley	80.0	1.2	2.8	6.5	9.0	0.5
Vetch and wheat	77.3	1.6	3.3	7.1	10.1	0.6
Roots, tubers, etc.						
Artichoke	79.5	1.7	2.0	0.8	15.9	0.1
Beet, sugar	83.6	1.1	1.6	1.0	12.6	0.1
Carrot	88.3	1.2	1.2	1.1	8.0	0.2
Cassava	67.4	1.0	1.1	1.4	28.8	0.3
Chufa	79.5	0.4	0.7	2.2	10.5	6.6
Mangel	90.6	1.0	1.4	0.8	6.1	0.1
Potato	78.8	1.1	2.2	0.4	17.4	0.1
Rutabaga	89.1	1.0	1.2	1.4	7.0	0.3
Sweet potato	68.8	1.1	1.8	1.3	26.4	0.6
Turnip	90.5	0.9	1.4	1.1	5.9	0.2
Miscellaneous green forages						
Apple	81.8	0.4	0.5	1.3	15.6	0.4
Apple pomace	76.7	1.0	1.6	4.6	14.5	1.6
Cabbage	91.1	0.8	2.2	0.9	4.7	0.3
Pumpkin, field	91.7	0.9	1.4	1.3	4.2	0.5
Rape	83.3	2.2	2.9	2.6	8.4	0.6
Sugar beet leaves	88.4	1.8	1.9	1.1	6.5	0.3
Turnip tops	85.0	3.0	2.8	1.5	7.3	0.4
SILAGE						
From corn, the sorghums, etc.						
Corn, well matured, recent analyses	73.7	1.7	2.1	6.3	15.4	0.8
Corn, immature	79.0	1.4	1.9	5.8	11.3	0.6
Corn, from frosted corn	74.7	1.8	2.2	6.1	14.4	0.8
Corn, from field-cured stover	80.4	1.4	1.4	6.3	9.8	0.7
Sorghum, sweet	77.2	1.6	1.5	6.9	11.9	0.9
Sugar-cane tops	76.6	1.9	1.3	8.0	11.8	0.4
Miscellaneous silage						
Alfalfa	75.4	2.9	3.5	8.2	8.6	1.4
Apple pomace	79.4	1.0	1.6	4.5	12.2	1.3
Clover	72.2	2.5	3.7	9.0	11.5	1.1
Corn and clover	71.4	2.2	3.3	7.7	14.5	0.9
Corn and soy bean	75.3	2.0	2.5	6.7	12.5	1.0
Cowpea	78.0	2.2	3.2	6.3	9.4	0.9
Pea-cannery refuse	76.8	1.3	2.8	6.5	11.3	1.3
Soy bean	72.9	3.5	3.9	8.1	10.3	1.3
Wet brewers' grains	70.2	1.2	6.4	4.5	15.6	2.1

TABLE II—*Average digestible nutrients and fertilizing constituents in American feeding stuffs*

The total digestible nutrients given in the fifth column is the sum of the digestible crude protein, the digestible carbohydrates, and the digestible fat x 2.25.

*The asterisk after certain feeds indicates that the calculation of their digestible nutrients is based on available knowledge of other but similar feeds.

FEEDING STUFF	Total dry matter in 100 lbs.	Digestible nutrients in 100 lbs.				Nutritive ratio	Fertilizing constituents in 1000 lbs.		
		Crude protein	Carbohydrates	Fat	Total		Nitrogen	Phosphoric acid	Potash
CONCENTRATES	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	1:	Lbs.	Lbs.	Lbs.
Corn and its products									
Dent corn	89.5	7.5	67.8	4.6	85.7	10.4	16.2	6.9	4.0
Flint corn	87.8	7.7	66.1	4.6	84.2	9.9	16.6	6.8	3.9
Sweet corn*	90.7	8.5	64.5	7.3	89.4	9.5	18.4	----	----
Corn cob	90.0	0.4	47.3	0.2	48.1	119.2	3.2	0.7	6.6
Corn-and-cob meal	89.6	6.1	63.7	3.7	78.1	11.8	13.8	5.8	6.3
Hominy feed, high grade	89.9	7.0	61.2	7.3	84.6	11.1	17.0	12.4	9.5
Gluten feed, high grade	91.3	21.6	51.9	3.2	80.7	2.7	40.6	6.2	2.3
Gluten meal, high grade	90.9	30.2	43.9	4.4	84.0	1.8	56.8	5.5	1.2
German oil, high grade	91.1	16.5	42.6	10.4	82.5	4.0	36.2	13.2	2.5
Corn bran	90.0	5.8	56.9	4.6	73.1	11.6	15.5	6.2	5.4
Wheat and its products									
Wheat, all analyses	89.8	9.2	67.5	1.5	80.1	7.7	19.8	8.6	5.3
Flour wheat, middlings	89.3	15.7	52.8	4.3	78.2	4.0	28.5	----	----
Standard wheat middlings (shorts)	89.6	13.4	46.2	4.3	69.3	4.2	27.7	21.1	11.8
Wheat bran, all analyses	89.9	12.5	41.6	3.0	60.9	3.9	25.6	29.5	16.2
Wheat feed (shorts and bran)	89.9	12.9	45.1	4.0	67.0	4.2	26.9	21.9	8.8
Wheat screenings	89.8	9.6	47.3	3.6	65.0	5.8	21.3	7.4	7.6
Rye and its products									
Rye	90.6	9.9	68.4	1.2	81.0	7.2	18.9	7.3	5.7
Rye middlings*	88.6	12.6	55.5	3.1	75.1	5.0	25.1	5.6	4.9
Rye bran	88.6	12.2	56.6	2.8	75.1	5.2	24.5	15.4	9.6
Rye feed (shorts and bran)	88.5	12.2	55.8	2.9	74.5	5.1	24.5	5.6	4.6
Oats and oat products									
Oats	90.8	9.7	52.1	3.8	70.4	6.3	19.8	8.1	5.6
Oat meal*	92.1	12.8	56.9	6.0	83.2	5.5	25.6	----	----
Oat hulls	93.2	2.0	45.2	1.3	50.1	24.1	6.4	2.1	5.8
Barley, products, and emmer									
Barley	90.7	9.0	66.8	1.6	79.4	7.8	18.4	8.5	7.4
Barley screenings*	88.6	8.3	47.7	2.5	61.6	6.4	18.4	----	----
Malt*	94.2	15.8	62.7	3.2	85.7	4.4	28.8	9.5	4.5
Malt sprouts	92.4	20.3	47.4	1.3	70.6	2.5	42.2	16.5	18.3
Brewers' grains, dried	92.5	21.5	30.5	6.1	65.7	2.1	42.4	9.9	0.9
Brewers' grains, wet*	24.1	4.6	8.7	1.5	16.7	2.6	9.1	2.4	0.3

TABLE II—*Continued*

FEEDING STUFF	Total dry matter in 100 lbs.	Digestible nutrients in 100 lbs.				Nutritive ratio	Fertilizing constituents in 1000 lbs.		
		Crude protein	Carbohydrates	Fat	Total		Nitrogen	Phosphoric acid	Potash
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	1:	Lbs.	Lbs.	Lbs.
Rice and its products									
Rough rice	90.4	4.7	64.6	1.7	73.1	14.6	12.2	4.9	2.6
Rice polish	90.0	8.0	57.2	7.5	82.1	9.3	19.0	30.8	11.7
Rice bran, high grade	89.9	7.9	38.1	8.8	65.8	7.3	19.4	22.2	12.0
Rice hulls	90.7	0.3	12.3	0.7	14.2	46.3	5.3	0.9	2.2
Buckwheat and its products									
Buckwheat	87.9	8.1	49.7	2.5	63.4	6.8	17.3	10.0	7.0
Buckwheat middlings	88.0	24.6	38.3	6.1	76.6	2.1	45.3	23.4	11.8
Buckwheat bran, high grade	88.8	10.5	30.4	3.2	48.1	3.6	35.7	16.5	10.0
Buckwheat hulls*	89.7	0.4	13.9	0.7	15.9	38.8	7.0	5.7	8.6
The sorghums, etc.									
Kafir grain	88.2	9.0	65.8	2.3	80.0	7.9	17.8	5.7	3.1
Kafir-head chops	87.5	6.1	56.6	2.0	66.7	9.9	15.5	----	----
Kaoliang grain	90.1	8.5	67.0	3.3	82.9	8.8	16.8	----	----
Sorghum grain*	87.3	7.5	66.2	2.6	79.5	9.6	14.7	8.2	3.3
Broom-corn seed*	88.2	8.3	62.9	2.6	77.0	8.3	16.3	----	----
Barnyard millet seed*	89.8	7.6	57.0	3.4	72.2	8.5	17.1	----	----
Cottonseed and its products									
Cottonseed	90.6	13.3	29.6	16.5	80.0	5.0	31.2	15.0	15.0
Cottonseed meal, choice	92.5	37.0	21.8	8.6	78.2	1.1	70.6	26.7	18.1
Cottonseed meal, prime	92.2	33.4	24.3	7.9	75.5	1.3	63.7	26.6	18.0
Cottonseed meal, good*	92.1	31.6	25.6	7.8	74.8	1.4	60.2	26.6	18.0
Cold-pressed cottonseed cake	92.1	21.1	33.2	7.4	70.9	2.4	41.8	----	----
Cottonseed hulls	90.3	0.3	33.3	1.5	37.0	122.3	7.4	3.6	12.8
Cottonseed-hull bran*	91.6	0.2	33.3	0.9	35.5	176.5	5.4	----	----
Flaxseed and its products									
Linseed meal, old process	90.9	30.2	32.6	6.7	77.9	1.6	54.2	17.0	12.7
Linseed meal, new process	90.4	31.7	37.9	2.8	75.9	1.4	59.0	17.7	13.0
Legume seeds, their products									
Bean, navy, cull*	87.2	18.3	54.3	0.8	74.4	3.1	35.4	----	----
Cowpea	88.4	19.4	54.5	1.1	76.4	2.9	37.8	10.1	14.9
Horse bean	87.4	22.8	49.1	0.7	73.5	2.2	41.9	12.4	13.4
Pea, field	90.8	19.0	55.8	0.6	76.2	3.0	36.6	8.4	10.1
Peanut, with hull*	93.5	18.4	15.3	32.6	107.1	4.8	32.6	7.6	6.4
Peanut waste*	96.0	22.0	22.9	30.1	112.6	4.1	39.0	----	----
Peanut cake, from hulled nuts	89.3	42.8	20.4	7.2	79.4	0.9	76.2	11.6	10.0
Peanut cake, hulls included	94.4	20.2	16.0	10.0	58.7	1.9	45.4	----	----
Peanut hulls*	90.9	0.4	33.0	2.1	38.1	94.2	11.7	1.4	7.4
Soy bean	90.1	30.7	22.8	14.4	85.9	1.8	58.4	13.7	24.7
Soy bean meal, fat extracted	88.2	38.1	33.9	5.0	83.2	1.2	66.2	----	----
Velvet bean, seed and pod*	87.7	14.9	51.7	3.8	75.2	4.0	27.4	----	----
Oil-bearing seeds and their products									
Rapeseed cake	90.0	25.3	23.7	7.6	66.1	1.6	49.9	20.3	13.2

TABLE II—*Continued*

FEEDING STUFF	Total dry matter in 100 lbs.	Digestible nutrients in 100 lbs.				Nutritive ratio	Fertilizing constituents in 1000 lbs.		
		Crude protein	Carbohydrates	Fat	Total		Nitrogen	Phosphoric acid	Potash
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	1:	Lbs.	Lbs.	Lbs.
Sunflower seed, without hulls*	95.5	23.3	17.0	33.9	116.6	4.0	44.3	----	----
Milk and its products									
Cow's milk	13.6	3.3	4.9	4.3	17.9	4.4	5.6	1.9	1.7
Skim milk, centrifugal	9.9	3.6	5.1	0.2	9.1	1.5	6.1	2.2	1.7
Buttermilk*	9.4	3.4	4.9	0.1	8.4	1.5	5.8	1.7	1.6
Whey*	6.6	0.8	4.7	0.3	6.2	6.8	1.6	1.2	2.6
Slaughterhouse by-products									
Dried blood	90.3	69.1	----	0.9	71.1	0.03	131.5	4.9	1.2
Meat-and-bone meal, 30-40% ash*	94.0	37.0	----	11.0	61.8	0.7	63.7	----	----
Pork cracklings*	95.0	52.4	----	32.6	125.8	1.4	90.2	6.1	----
Tankage, 55-60% protein	92.5	54.0	----	12.7	82.6	0.5	93.0	----	----
Tankage, below 45% protein	93.5	37.6	----	16.7	75.2	1.0	64.6	135.7	----
Miscellaneous concentrates									
Acorn, kernel and shell*	72.1	2.3	36.2	3.8	47.1	19.5	5.4	----	----
Beet pulp dried	91.8	4.6	65.2	0.8	71.6	14.6	14.2	2.4	3.8
Beet pulp, molasses	92.4	5.9	68.0	0.6	75.3	11.8	15.2	1.5	18.1
Chess, or cheat, seed*	92.3	6.2	60.6	1.5	70.2	10.3	16.8	----	----
Distillers' grains, dried, from corn	93.4	22.4	40.4	11.6	88.9	3.0	49.1	6.8	1.7
Distillers' grains, dried, from rye	92.8	13.6	38.0	6.6	66.4	3.9	37.0	8.3	2.4
Molasses, beet*	74.7	1.1	59.4	----	60.5	54.0	5.6	0.5	56.3
Molasses, cane or blackstrap	74.2	1.0	58.2	----	59.2	58.2	5.0	2.4	31.6
DRIED ROUGHAGE									
Cured corn, sorghum forage, etc.									
Corn fodder (ears, if any remaining), very dry, from barn or in arid districts	91.0	3.5	51.7	1.5	58.6	15.7	12.5	3.7	9.9
Corn fodder, medium in water	81.7	3.0	47.3	1.5	53.7	16.9	10.7	3.3	8.9
Sweet corn fodder	87.7	5.9	47.6	1.3	56.4	8.6	14.7	4.0	11.8
Corn stover (ears removed), very dry	90.6	2.2	47.8	1.0	52.2	22.7	9.4	4.5	12.9
Corn stover, medium in water	81.0	2.1	42.4	0.7	46.1	21.0	9.1	4.0	11.5
Corn leaves	76.6	3.2	40.1	1.1	45.8	13.3	11.4	----	----
Corn husks	75.3	0.6	47.3	0.3	48.6	80.0	4.6	2.3	10.2
Corn tops	82.1	3.1	45.5	1.1	51.1	15.5	9.0	----	----
Kafir fodder, dry	91.0	4.1	45.0	1.7	52.9	11.9	14.2	----	----
Kafir stover, dry	83.7	1.7	43.1	1.3	47.7	27.1	8.2	----	----
Milo fodder, dry	88.9	1.9	36.3	2.8	44.5	22.4	19.2	----	----
Sorghum fodder, dry	90.3	2.8	44.8	2.0	52.1	17.6	11.8	----	----
Sorghum bagasse, dried	88.7	0.5	52.3	0.6	54.2	107.4	5.4	----	----
Sugar-cane bagasse*	89.8	0.5	47.6	3.3	55.5	110.0	5.3	----	----

TABLE II—*Continued*

FEEDING STUFF	Total dry matter in 100 lbs.	Digestible nutrients in 100 lbs.				Nutritive ratio	Fertilizing constituents in 1000 lbs.		
		Crude protein	Carbohydrates	Fat	Total		Nitrogen	Phosphoric acid	Potash
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	1:	Lbs.	Lbs.	Lbs.
Hay from the grasses, etc.									
Bermuda grass	90.3	3.7	37.9	0.8	43.4	10.7	11.4	4.0	20.0
Bluegrass, Kentucky, all analyses	86.8	4.7	43.5	1.5	51.6	10.0	13.3	5.3	21.0
Brome grass, smooth	91.5	5.0	44.2	0.9	51.2	9.2	15.8	4.2	21.5
Chess, or cheat	91.6	3.0	35.5	0.7	40.1	12.4	11.5	6.6	17.8
Crab grass	90.5	3.5	40.0	1.0	45.7	12.1	12.8	9.0	30.9
Fescue, meadow	88.3	3.5	45.2	1.1	51.2	13.6	10.9	4.6	17.2
Fowl meadow grass*	88.9	6.1	43.0	1.4	52.3	7.5	15.7	----	----
Foxtails, miscellaneous	93.2	5.6	48.0	1.7	57.4	9.2	14.9	----	----
Johnson grass	89.9	2.9	45.0	1.0	50.1	16.3	10.6	4.2	11.3
Millet, barnyard	86.5	5.1	40.5	0.8	47.4	8.3	13.3	5.5	25.3
Millet, German*	91.3	4.8	49.7	1.7	58.3	11.1	12.8	3.5	14.4
Millet, pearl, or cat-tail	87.2	4.2	43.8	0.8	49.8	10.9	10.7	----	----
Mixed grasses	87.2	4.3	44.3	1.2	51.3	10.9	12.2	3.8	16.4
Mixed grasses, rowen	86.4	7.0	39.9	1.6	50.5	6.2	19.7	3.3	16.6
Oat grass, tall or meadow oat grass	88.2	3.4	38.4	1.2	44.5	12.1	12.8	3.1	16.4
Orchard grass	88.4	4.7	41.1	1.6	49.4	9.5	12.6	4.0	19.4
Quack grass	94.1	4.2	49.7	1.1	56.4	12.4	11.7	----	----
Red top, all analyses	90.2	4.6	45.9	1.2	53.2	10.6	11.8	4.4	18.8
Rye grass, perennial*	88.0	4.4	39.0	1.6	47.0	9.7	14.7	----	----
Sedges, eastern*	90.7	2.7	41.8	0.6	45.9	16.0	9.8	2.0	9.3
Timothy, all analyses	88.4	3.0	42.8	1.2	48.5	15.2	9.9	3.1	13.6
Timothy, nearly ripe	87.5	2.2	40.7	1.1	45.4	19.6	8.3	----	----
Timothy rowen*	84.9	8.2	35.8	2.1	48.7	4.9	23.0	----	----
Hay from the smaller cereals									
Barley hay, common	92.6	4.6	48.2	0.9	54.8	10.9	11.2	----	----
Oat hay	88.0	4.5	38.1	1.7	46.4	9.3	13.4	8.0	32.7
Rye hay, all analyses*	91.9	2.9	41.1	1.1	46.5	15.0	10.7	5.0	17.0
Wheat hay*	91.9	4.0	48.5	0.8	54.3	12.6	9.9	----	----
Hay from the legumes									
Alfalfa, all analyses	91.4	10.6	39.0	0.9	51.6	3.9	23.8	5.4	22.8
Alfalfa, first cutting	91.5	9.3	39.0	0.6	49.7	4.3	22.2	5.4	22.3
Alfalfa, second cutting	92.7	11.2	40.2	0.7	53.0	3.7	23.5	5.4	22.6
Alfalfa, third cutting	91.1	10.2	37.1	0.8	49.1	3.8	23.4	5.3	22.2
Alfalfa, fourth cutting*	84.0	11.1	33.6	0.7	46.3	3.2	25.4	4.9	20.5
Alfalfa meal*	91.2	10.2	38.7	0.8	50.7	4.0	22.9	5.4	22.8
Clover, alsike, all analyses	87.7	7.9	36.9	1.1	47.3	5.0	20.5	7.0	17.4
Clover, bur	93.0	15.6	42.8	0.2	58.8	2.8	30.7	----	----
Clover, crimson, or scarlet	89.4	9.7	36.8	1.0	48.7	4.0	22.6	6.1	22.4
Clover, mammoth, red*	81.3	6.4	37.2	1.8	47.6	6.4	17.3	6.3	8.7
Clover, red, all analyses	87.1	7.6	39.3	1.8	50.9	5.7	20.5	3.9	16.3
Clover, sweet, white	91.4	10.9	38.2	0.7	50.7	3.7	23.2	6.6	12.6

TABLE II—*Continued*

FEEDING STUFF	Total dry matter in 100 lbs.	Digestible nutrients in 100 lbs.				Nutritive ratio	Fertilizing constituents in 1000 lbs.		
		Crude protein	Carbohydrates	Fat	Total		Nitrogen	Phosphoric acid	Potash
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	1:	Lbs.	Lbs.	Lbs.
Clover, white	91.9	11.8	43.3	1.5	58.5	4.0	25.9	5.2	20.0
Clover meal*	91.5	8.1	42.0	1.3	53.0	5.5	21.9	4.0	17.2
Clover rowen	85.2	10.7	33.1	2.2	48.8	3.6	26.4	----	----
Cowpea, all analyses	90.3	13.1	33.7	1.0	49.0	2.7	30.9	9.6	41.3
Kudzu vine*	92.9	11.4	39.8	1.2	53.9	3.7	26.7	----	----
Lespedeza, or Japan clover*	88.2	8.6	41.1	1.1	52.2	5.1	19.4	10.3	20.7
Pea, field, Canada	88.9	12.2	40.1	1.5	56.6	3.6	24.2	6.7	12.4
Peanut vine, without nuts	78.5	6.6	37.0	3.0	50.4	6.6	14.6	2.2	13.9
Soy bean hay	91.4	11.7	39.2	1.2	53.6	3.6	25.6	6.8	23.3
Velvet bean*	92.8	12.0	40.3	1.4	55.5	3.6	26.2	5.5	26.5
Vetch, hairy	87.7	15.7	37.1	1.9	57.1	2.6	31.8	10.3	26.2
Hay from the mixed legumes and grasses									
Clover and timothy	87.8	4.0	39.7	1.1	46.2	10.6	13.8	4.7	19.0
Cowpeas and millet*	90.3	9.3	34.7	0.9	46.0	3.9	21.9	----	----
Peas and oats	83.4	8.3	37.1	1.5	48.8	4.9	18.2	6.6	16.4
Vetch and wheat	85.0	10.7	41.1	1.3	54.7	4.1	23.2	----	----
Straw and chaff from cereals									
Barley straw	85.8	0.9	40.2	0.6	42.5	46.2	5.6	1.8	12.0
Buckwheat straw*	90.1	4.2	26.3	1.2	33.2	6.9	8.3	1.3	11.3
Millet straw*	85.8	1.0	41.7	0.6	44.1	43.1	5.8	1.8	17.3
Oat straw	88.5	1.0	42.6	0.9	45.6	44.6	5.8	2.1	15.0
Oat chaff	91.8	2.2	34.3	1.2	39.2	16.8	9.4	1.3	4.5
Rice straw	92.5	0.9	37.8	0.3	39.4	42.8	6.2	1.4	15.4
Rye straw	92.9	0.7	39.6	0.4	41.2	57.9	4.8	2.8	7.9
Wheat straw	91.6	0.7	35.1	0.5	36.9	51.7	5.0	1.3	7.4
Wheat chaff	85.6	1.1	25.7	0.6	28.2	24.6	6.7	4.0	8.4
Legume straws									
Bean*	89.5	3.6	42.4	0.7	47.6	12.2	11.7	4.2	13.6
Cowpea stover*	91.5	3.8	39.1	0.7	44.1	12.0	10.9	----	----
Soy bean stover	88.1	2.8	38.5	1.0	43.5	14.5	9.0	1.2	8.9
Miscellaneous dry roughages									
Sweet potato vines*	88.7	6.0	37.1	1.6	46.7	6.8	20.0	5.4	16.4
FRESH GREEN ROUGHAGES									
Corn, the sorghums, etc.									
Corn fodder, all analyses*	21.9	1.0	12.8	0.4	14.7	13.7	3.0	1.1	3.7
Sweet corn fodder, ears removed*	21.5	1.0	13.1	0.3	14.8	13.8	2.6	----	----
Corn husks*	36.5	1.0	22.7	0.3	24.4	23.4	2.9	0.6	5.5
Kafir fodder, all analyses*	28.6	1.1	12.4	0.4	14.4	12.1	3.8	1.6	5.1
Sweet sorghum fodder	24.9	0.7	14.1	0.6	16.2	22.1	2.4	1.1	4.1
Broom-corn fodder*	22.9	0.9	12.1	0.3	13.7	14.2	3.2	1.7	7.0
Sugar cane*	21.7	0.4	12.3	0.6	14.1	34.2	1.4	----	----

TABLE II—*Continued*

FEEDING STUFF	Total dry matter in 100 lbs.	Digestible nutrients in 100 lbs.				Nutritive ratio	Fertilizing constituents in 1000 lbs.		
		Crude protein	Carbohydrates	Fat	Total		Nitrogen	Phosphoric acid	Potash
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	1:	Lbs.	Lbs.	Lbs.
Fresh green grass									
Bermuda grass*	33.2	1.4	17.0	0.5	19.5	12.9	4.8	1.5	7.4
Bluegrass, Kentucky, all analyses	31.6	2.3	14.8	0.6	18.5	7.0	6.6	1.9	7.1
Brome grass, smooth*	33.0	2.9	15.0	0.2	18.3	5.3	6.7	2.0	8.6
Chess, or cheat*	39.6	1.5	20.8	0.6	23.7	14.8	5.1	2.9	10.8
Crab grass*	30.9	1.3	14.2	0.5	16.6	11.8	4.3	2.2	10.8
Fescue, meadow*	30.5	1.6	15.0	0.5	17.7	10.1	4.8	1.8	7.0
Johnson grass*	29.1	1.2	14.7	0.5	17.0	13.2	4.0	----	----
Meadow foxtail*	29.6	2.1	13.9	0.6	17.4	7.3	5.8	----	----
Millet, pearl, or cat-tail*	18.7	1.1	10.4	0.2	11.9	9.8	2.9	1.9	10.3
Mixed grasses, immature	29.7	3.6	14.5	0.9	20.1	4.6	8.2	2.1	7.9
Mixed grasses, at haying stage	30.8	1.7	15.2	0.6	18.3	9.8	4.8	2.5	6.4
Oat grass, tall, or meadow oat grass*	30.3	1.1	13.3	0.4	15.3	12.9	4.2	1.8	8.4
Orchard grass	29.2	1.7	13.0	0.6	16.1	8.5	4.6	2.1	9.5
Quack grass*	30.6	2.2	11.3	0.7	15.1	5.9	6.1	----	----
Red top	39.3	1.9	20.0	0.6	23.3	11.3	5.0	2.3	8.4
Rowen, mixed	28.2	3.3	14.0	0.9	19.3	4.8	7.5	2.0	7.5
Rye grass, perennial*	26.6	1.7	12.5	0.7	15.8	8.3	4.8	2.2	9.2
Sedges, western*	38.5	2.4	20.3	0.5	23.8	8.9	6.1	----	----
Sweet vernal grass*	31.2	1.5	16.1	0.5	18.7	11.5	4.2	2.0	6.4
Timothy, all analyses	37.5	1.5	19.3	0.6	22.2	13.8	5.0	1.8	6.7
Green fodder from the smaller cereals									
Barley fodder	23.2	2.3	11.5	0.4	14.7	5.4	5.3	1.3	6.8
Oat fodder	26.1	2.3	11.8	0.8	15.9	5.9	5.1	1.8	7.7
Rye fodder	21.3	2.1	12.2	0.5	15.4	6.3	4.2	1.5	4.9
Wheat fodder, all analyses*	27.4	2.8	15.1	0.6	19.3	5.9	5.8	1.9	7.2
Green legumes									
Alfalfa, all analyses	25.3	3.3	10.4	0.4	14.6	3.4	7.2	1.5	6.7
Clover, alsike*	24.3	2.7	11.8	0.4	15.4	4.7	6.6	1.8	9.2
Clover, bur*	20.8	3.4	8.2	1.1	14.1	3.1	8.2	----	----
Clover, crimson	17.4	2.3	8.1	0.4	11.3	3.9	4.8	2.0	4.1
Clover, mammoth, red*	25.1	2.7	12.4	0.3	15.8	4.9	6.4	----	----
Clover, red, all analyses	26.2	2.7	13.0	0.6	17.1	5.3	6.6	1.3	5.6
Clover, red, rowen	34.4	3.3	15.4	0.8	20.5	5.2	8.5	2.0	9.5
Clover, sweet*	24.4	3.3	10.3	0.3	14.3	3.3	7.0	1.3	5.0
Clover, white*	21.8	3.1	9.6	0.5	13.8	3.5	7.4	1.8	8.1
Cowpeas	16.3	2.3	8.0	0.3	11.0	3.8	4.8	1.4	6.2
Kudzu vine*	30.6	4.2	13.9	0.5	19.2	3.6	8.8	----	----
Lespedeza, or Japan clover*	36.6	4.5	17.1	0.6	23.0	4.1	10.7	----	----
Peas, field, Canada	16.6	2.9	7.1	0.3	10.7	2.7	5.8	1.1	2.8
Soy beans, all analyses	23.6	3.2	10.2	0.5	14.5	3.5	6.6	1.8	5.7

TABLE II—*Continued*

FEEDING STUFF	Total dry matter in 100 lbs.	Digestible nutrients in 100 lbs.				Nutritive ratio	Fertilizing constituents in 1000 lbs.		
		Crude protein	Carbohydrates	Fat	Total		Nitrogen	Phosphoric acid	Potash
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	1:	Lbs.	Lbs.	Lbs.
Velvet bean*	17.9	2.7	7.2	0.4	10.8	3.0	5.6	1.3	4.5
Vetch, hairy	18.1	3.5	8.1	0.4	12.5	2.6	6.7	1.4	5.1
Mixed legumes and grasses									
Clover and mixed grasses*	27.3	2.2	14.1	0.6	17.7	7.0	4.8	----	----
Cowpeas and oats*	21.8	3.3	9.1	0.6	13.8	3.2	7.2	----	----
Cowpeas and sorghums*	18.7	0.7	10.0	0.3	11.4	15.3	2.4	----	----
Soy beans and corn*	23.8	1.7	13.6	0.6	16.7	8.8	4.3	1.1	4.0
Vetch and wheat	22.7	2.4	12.2	0.3	15.3	5.4	5.3	----	----
Roots and tubers									
Artichokes*	20.5	1.0	14.6	0.1	15.8	14.8	3.2	1.4	4.9
Beet, sugar	16.4	1.2	12.6	0.1	14.0	10.7	2.6	0.8	3.2
Carrot	11.7	0.9	8.6	0.2	9.9	10.0	1.9	1.1	2.7
Chufa*	20.5	0.4	10.2	3.3	18.0	44.0	1.1	----	----
Mangel	9.4	0.8	6.4	0.1	7.4	8.2	2.2	0.4	2.2
Potato	21.2	1.1	15.8	0.1	17.1	14.5	3.5	1.2	5.3
Sweet potato*	31.2	0.9	24.2	0.3	25.8	27.7	2.9	0.9	5.1
Turnip	9.5	1.0	6.0	0.2	7.4	6.4	2.2	1.3	2.9
Miscellaneous green forages									
Apple*	18.2	0.4	15.6	0.2	16.4	40.0	0.8	0.3	1.6
Apple pomace*	23.3	1.2	15.6	0.8	18.6	14.5	2.6	0.6	1.5
Cabbage	8.9	1.9	5.6	0.2	7.9	3.2	3.5	0.7	2.9
Cactus, prickly pear	16.5	0.4	8.9	0.2	9.7	23.2	1.3	0.7	4.3
Pumpkin, field	8.3	1.1	4.5	0.5	6.7	5.1	2.2	0.9	3.2
Rape	16.7	2.6	10.0	0.3	13.3	4.1	4.6	1.1	3.9
Sugar beet leaves*	11.6	1.2	6.3	0.1	7.7	5.4	3.0	1.2	5.5
Turnip tops*	15.0	1.8	7.3	0.1	9.3	4.2	4.5	1.5	5.2
SILAGE									
From corn, the sorghums, etc.									
Corn, well matured, recent analyses	26.3	1.1	15.0	0.7	17.7	15.1	3.4	1.6	4.4
Corn, immature	21.0	1.0	11.4	0.4	13.3	12.3	3.0	1.2	3.5
Corn, from frosted corn*	25.3	1.2	13.7	0.6	16.3	12.6	3.5	1.5	4.3
Corn, from field-cured stover*	19.6	0.5	9.9	0.4	11.3	21.6	2.2	----	----
Kafir	30.8	0.8	15.3	0.6	17.5	20.9	2.9	----	----
Sorghum	22.8	0.6	11.6	0.5	13.3	21.2	2.4	1.5	1.9
Miscellaneous silage									
Alfalfa*	24.6	1.2	7.8	0.6	10.4	7.7	5.6	----	----
Apple pomace*	20.6	0.9	15.0	0.6	17.3	18.2	2.6	0.8	2.2
Clover	27.8	1.3	9.5	0.5	11.9	8.2	5.9	----	----
Corn and soy bean	24.7	1.6	13.8	0.8	17.2	9.8	4.0	1.6	4.5
Cowpea	22.0	1.8	10.1	0.6	13.3	6.4	5.1	1.8	3.8
Pea-cannery refuse*	23.2	1.6	11.6	0.8	15.0	8.4	4.5	----	----
Sorghum and cowpea*	32.3	0.9	16.6	0.6	18.9	20.0	3.8	----	----
Wet brewers' grains*	29.8	5.2	11.1	1.9	20.6	3.0	10.2	----	----

TABLE III—*Modified Wolff-Lehmann feeding standards for farm animals*

	Digestible crude protein	Total digestible nutrients
	Lbs.	Lbs.
1. Dairy cows		
For maintenance of 1000-lb. cow	0.700	7.925
To allowance for maintenance add:		
For each lb. of 3.5 per ct. milk	0.049-0.061	0.316
For each lb. of 4.0 per ct. milk	0.054-0.065	0.346
For each lb. of 4.5 per ct. milk	0.057-0.069	0.376
For each lb. of 5.0 per ct. milk	0.060-0.073	0.402
For each lb. of 5.5 per ct. milk	0.064-0.077	0.428

The amount of dry matter to be fed daily per 1,000 lbs. live weight to dairy cows may range from 15.0 lbs. or even less with dry cows to 30.0 lbs. with cows yielding 2.0 lbs. of butter fat per head daily. Cows producing 1.0 lb. of fat per head daily should receive about 21.0 to 25.0 lbs. of dry matter daily per 1,000 lbs. live weight. The nutritive ratio may readily be found by computation; for example, a 1,200-lb. cow yielding daily 30.0 lbs. of 3.5 per ct. milk will require for maintenance and production 2.31 to 2.67 lbs. digestible crude protein and 18.99 lbs. total digestible nutrients. The nutritive ratio should hence not be wider than 1:6.1 to 1:7.2.

LIVE WEIGHT	Actual, per head daily			Per 1000 lbs. live weight			Nutritive ratio
	Dry matter	Digestible crude protein	Total digestible nutrients	Dry matter	Digestible crude protein	Total digestible nutrients	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	1:
2. Growing, fattening steers							
100 lbs.	1.41	0.32	1.66	14.1	3.2	16.6	4.2
200 lbs.	4.81	0.67	3.48	24.0	3.4	17.4	4.1
300 lbs.	8.00	0.80	5.36	26.7	2.7	17.9	5.6
400 lbs.	9.72	0.87	6.32	24.3	2.2	15.8	6.2
500 lbs.	11.95	1.04	7.88	23.9	2.1	15.8	6.5
600 lbs.	13.94	1.22	9.25	23.2	2.0	15.4	6.7
800 lbs.	17.13	1.61	11.43	21.4	2.0	14.3	6.2
1000 lbs.	19.66	1.80	13.51	19.7	1.8	13.5	6.5
1200 lbs.	20.76	1.84	14.71	17.3	1.5	12.3	7.2

ANIMAL	Per day per 1000 lbs. live weight			Nutritive ratio
	Dry matter	Digestible crude protein	Total digestible nutrients	
	Lbs.	Lbs.	Lbs.	1:
3 Fattening 2-yr-old steers on full feed				
First 50-60 days	22.0-25.0	2.0-2.3	18.0-20.0	7.0-7.8
Second 50-60 days	21.0-24.0	1.9-2.3	17.0-19.5	7.0-7.8
Third 50-60 days	18.0-22.0	1.8-2.1	16.0-18.5	7.0-7.8
4. Ox at rest in stall	13.0-21.0	0.6-0.8	8.4-10.4	10.0-16.0
5. Wintering beef cows in calf	14.0-25.0	0.7-0.9	9.0-12.0	10.0-15.0
6. Horses				
Idle	13.0-8.0	0.8-1.0	7.0-9.0	8.0-9.0
At light work	15.0-22.0	1.1-1.4	10.0-13.1	8.0-8.5
At medium work	16.0-24.0	1.4-1.7	12.8-15.6	7.8-8.3
At heavy work	18.0-26.0	2.0-2.2	15.9-19.5	7.0-8.0
7. Brood mares suckling foals, but not at work	15.0-22.0	1.2-1.5	9.0-12.0	6.5-7.5
8. Growing colts, over 6 months	18.0-22.0	1.6-1.8	11.0-13.0	6.0-7.0
9. Fattening lambs				
Weight 50-70 lbs.	27.0-30.0	3.1-3.3	19.0-22.0	5.0-6.0
Weight 70-90 lbs.	28.0-31.0	2.5-2.8	20.0-23.0	6.7-7.2
Weight 90-110 lbs.	27.0-31.0	2.3-2.5	19.0-23.0	7.0-8.0
10. Sheep, maintaining mature				
Coarse wool	18.0-23.0	1.1-1.3	11.0-13.0	8.0-9.1
Fine wool	20.0-26.0	1.4-1.6	12.0-14.0	7.5-8.5
11. Breeding ewes, with lambs	23.0-27.0	2.6-2.9	18.0-20.0	5.6-6.5
12. Growing, fattening pigs				
Weight 30-50 lbs.	46.2-51.0	7.8-8.5	41.0-45.4	4.0-4.5
Weight 50-100 lbs.	37.0-40.8	5.5-6.0	32.9-36.4	5.0-5.6
Weight 100-150 lbs.	32.4-35.8	4.4-4.9	28.8-31.9	5.5-6.2
Weight 150-200 lbs.	29.0-32.0	3.5-3.9	25.8-28.5	6.2-7.0
Weight 200-250 lbs.	25.5-28.1	3.0-3.4	22.7-25.0	6.5-7.3
Weight 250-300 lbs.	24.4-24.8	2.6-2.9	20.0-22.0	6.7-7.5
13. Brood sows, with pigs	20.0-24.0	2.4-2.7	18.0-21.0	6.0-7.0

	Digestible nutrients per day for each 100 lbs. live wt.					
	Total dry matter	Ash	Protein	Carbo-hydrates	Fat	Nutri-tive ratio
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	1:
14. Poultry. Hens in full laying*	5.50	.30	1.00	3.75	.35	1.46

*Jordan's Feeding of Farm Animals.

TABLE IV—*Manurial value of farm products*

FEED	Amount fertilizing materials per ton*			Value fertilizing materials per ton†			Total value per ton
	Nitrogen	Phosphoric acid	Potash	Nitrogen	Phosphoric acid	Potash	
	Lbs.	Lbs.	Lbs.				
Meadow hay	20.4	8.2	26.4	$4.08	$ .41	$1.32	$5.81
Clover hay	40.1	11.2	36.6	8.03	.56	1.83	10.42
Alfalfa hay	52.2	12.2	35.8	10.44	.61	1.79	12.84
Soy bean hay	47.6	8.0	26.4	9.52	.40	1.32	11.24
Cowpea hay	28.6	10.4	29.4	5.72	.52	1.47	7.71
Wheat bran	49.2	54.6	28.6	9.83	2.73	1.43	13.99
Cottonseed meal	135.7	56.2	29.2	27.00	2.81	1.46	31.27
Wheat	37.5	15.8	10.6	7.50	.79	.53	8.82
Oats	36.4	12.4	8.8	7.28	.62	.44	8.34
Barley	39.7	15.4	9.0	7.93	.77	.45	9.15
Milk	10.2	3.4	3.0	2.04	.17	.15	2.36
Cheese	90.6	23.0	5.0	18.12	1.15	.25	19.52
Butter	5.7	.7	1.2	1.14	.03	.06	1.23
Live cattle	53.2	37.2	3.4	10.64	1.86	.17	12.67

*Data from Henry's "Feeds and Feeding."
†Based on the following prices: Nitrogen 20c, phosphoric acid 5c, and potash 5c.

TABLE V—*Fertility in farm produce removed annually per acre**

CROP YIELD PER ACRE	Market value	Fertilizing materials removed			Total retail value of fertility removed per acre	Manurial value of $10 worth†
		Nitrogen	Phosph'ric acid	Potash		
		Lbs.	Lbs.	Lbs.		
70 bu. corn	$ .70 per bu.	70	12	13	$15.25	$3.06
60 bu. oats	.45 per bu.	40	7	10	8.85	3.23
25 bu. wheat	1.00 per bu.	36	6	7	7.85	3.84
25 bu. soy beans	2.00 per bu.	80	13	24	17.85	3.57
1000 lbs. cottonseed	.25 per bu.	63	11	19	14.10	9.65
2 tons timothy hay	18.00 per ton	48	6	47	12.25	3.40
2 tons clover hay	15.00 per ton	80	10	60	19.50	6.49
4 tons alfalfa hay	20.00 per ton	200	18	96	45.65	5.70
2 tons cowpea hay	15.00 per ton	87	9	65	21.10	7.03
200 bu. potatoes	.50 per bu.	42	9	60	11.85	1.19

*Composition based upon data from Hopkins' "Soil Fertility and Permanent Agriculture," p. 154.
†Based on same prices as in Table IV.

TABLE VI—*Weights and measures of feeding stuffs*

FEEDING STUFF	One quart weighs	One pound measures
Protein feeds	**Lbs.**	**Qts.**
Cottonseed meal	1.5	0.7
N. P. linseed meal	0.9	1.1
O. P. linseed meal	1.1	0.9
Gluten meal	1.7	0.6
Gluten feed	1.3	0.8
Germ oil meal	1.4	0.7
Distillers' dried grains	0.5-0.7	2.0-1.4
Malt sprouts	0.6	1.7
Brewers' dried grains	0.6	1.7
Wheat middlings (flour)	1.2	0.8
Wheat middlings (standard)	0.8	1.3
Wheat mixed feed	0.6	1.7
Wheat bran	0.5	2.0
H-O dairy feed	0.7	1.4
Oat middlings	1.5	0.7
Rye feed	1.3	0.8
Starchy feeds		
Whole oats	1.0	1.0
Ground oats	0.7	1.4
Whole wheat	1.9	0.5
Ground wheat	1.7	0.6
Whole barley	1.5	0.7
Barley meal	1.1	0.9
Whole rye	1.7	0.6
Rye meal	1.5	0.7
Whole corn	1.7	0.6
Corn meal	1.5	0.7
Corn-and-cob meal	1.4	0.7
Corn bran	0.5	2.0
Hominy meal	1.1	0.9
Corn and oat feed (Victor)	0.7	1.4
Quaker dairy feed	1.0	1.0
Oat feed	0.8	1.3

*Mass. Exp. Sta. Bul. 112.

TABLE VII—*Feeding rations recommended**

For Beef and Dairy Cattle

Lbs. Ration No. 1
35 Silage
2 Cotton-seed meal
7 Ground ear corn, or 6 lbs. barley
10 Cowpea hay, or alfalfa, or soy-bean hay

Ration No. 2
40 Silage
10 Oat and vetch hay, or wheat and vetch hay
5 Cotton-seed meal

Ration No. 3
30 Silage
3 Cotton-seed meal
6 Ground ear corn, or 5 lbs. barley
7½ Red-top hay
7½ Cowpea hay

Ration No. 4
35 Silage
15 Cowpea hay, or alfalfa, or soy-bean hay
8 Ground ear corn, or 7 lbs. barley

Lbs. Ration No. 5
16 Cotton-seed hulls
5 Cotton-seed meal
8 Ground ear corn, or 7 lbs. barley

Ration No. 6
30 Silage
5 Soy-bean meal, or cotton-seed meal
6 Ground ear corn, or 5 lbs. barley
10 Corn stover, or soy-bean straw

Ration No. 7
30 Silage
10 Soy-bean straw, or corn stover
4 Cotton-seed meal
3 Dried brewers' grains

Ration No. 8
15 Soy-bean straw, or corn stover
4 Cotton-seed meal
3 Dried brewers' grains

Ration No. 9
20 Clover hay
8 Ground ear corn
2 Cotton-seed meal

For Beef Cattle—90 to 100 Days' Feeding Period

Ration No. 1
50 Silage, entire period
3 Cotton-seed meal, 1st 30 days
4 Cotton-seed meal, 2nd 30 days
5 Cotton-seed meal, balance of period

Ration No. 2
40 Silage, entire period
5 Cotton-seed meal, 45 or 50 days
6 Cottonseed meal, balance of period

Ration No. 3
35 Silage, entire period
6 Cotton-seed hulls, entire period
4 Cotton-seed meal, 1st 30 days
5 Cotton-seed meal, 2nd 30 days
6 Cotton-seed meal, balance of period

Ration No. 4
25 Cotton-seed hulls, entire period
5 Cotton-seed meal, 1st 30 days
6 Cotton-seed meal, 2nd 30 days
7 Cotton-seed meal, balance of period

For Horses and Mules

Lbs. Ration No. 1
4 Oats
2 Cotton-seed meal
10 Ground ear corn
12 Mixed hay

Ration No. 2
2 Cotton-seed meal
4 Wheat bran, or middlings
12 Oat hay

Ration No. 3
6 Corn
6 Wheat bran, or middlings
2 Cotton-seed meal
12 Timothy, or red-top hay

Lbs. Ration No. 4
10 Oats
2 Cotton-seed meal
6 Alfalfa, cowpea, or soy-bean hay
8 Timothy, or red-top hay

Ration No. 5
8 Corn
4 Oats
12 Japan clover, alfalfa, cowpea, or soy-bean hay

Ration No. 6
12 Corn
1.5 Cotton-seed meal
12 Japan clover, alfalfa, cowpea or soy-bean hay

*Tenn. State Dept. Agr., Bul. 2.

INDEX

On Other Farm Topics

Some of these publications will be of use to you in your work

Write to the Agricultural Experiment Station, University of Tennessee, Knoxville, for any of the following bulletins:

Regular Bulletins

X2. Pot culture of lettuce.
75. Selection for disease-resistant clover.
78. The soils of Tennessee.
81. Tick eradication.
83. Comparison and improvement of dairy herds in Tennessee.
84. Sheep and lambs in Tennessee.
86. Experiments with soils, fertilizers and farm crops.
87. The relation of the Weather Service to the farmers of Tennessee.
88. Insuring the peach crop.
90. Fertility experiments in a rotation of cowpeas and wheat. Part I.
91. Relation of temperature and rainfall to crop systems and production.
92. Experiments with fertilizers and field crops on important soil types of Middle Tennessee.
93. Tobacco insects of Tennessee. Tobacco culture in Montgomery County.
94. The cattle tick as affected by climate.
96. Fertility experiments in a rotation of cowpeas and wheat. Parts II and III.
97. Liming for Tennessee soils
101. The rational improvement of Cumberland Plateau soils.
102. The rational improvement of Highland Rim soils.
103. The influence of ammonium carbonate upon the determination of humus (Technical).
104. Feeding beef cattle.
105. The Tennessee wooden-hoop silo.
107. The non-existence of magnesium carbonate in humid soils.
108. Summer-pruning the peach.
109. Fertility and crop experiments at the West Tennessee Station.
110. A survey of sheep and lamb production in 1914.
112. The small grains in Tennessee.
113. North American fever tick.
114. Relation of steer feeding to farm economics.
116. Factors influencing the lime and magnesia requirements of soils (Technical).

Press Bulletins

20. Cattle tick extermination.
25. Cattle ticks frozen.
27. Rates and dates of seeding.
33. A select list of varieties of farm crops.
34. Lespedeza, or Japan clover.
38. "Cornstalk disease."
41. Sweet potato rots in Tennessee.
43. Bulletins available for distribution.

Write to the Division of Extension, College of Agriculture, University of Tennessee, Knoxville, for any of the following publications:

2. Kitchen Rules for the Home.
3. Cereals and Breads.
4. Eggs and Meats.
5. What to Do When Cleaning House.
7. Feeding Cottonseed Meal to Work Horses.
8. Suggestions for Farm Buttermaking.
9. Crimson Clover.
10. Rural Organization.
11. Farm Gardens.
12. How to Choose Woolens.
13. Directory of Tennessee Breeders of Registered Live Stock.
14. Good Light Bread.
15 Beef Cattle Profits.
16. Cheap Feed for Steers.
17. How to Feed Cottonseed Meal to Hogs.
18. Use the Winter Growing Season by Planting Legumes.
20. Getting a Stand of Alfalfa in Tennessee and Maintaining It.
21. Legumes and Truck Crops.
22. What to Do to Keep Well.
23. Use Meat in Many Ways.

If there is any other subject upon which you would like to have information, a letter addressed to the Agricultural Experiment Station or to the Division of Extension, University of Tennessee, Knoxville, will be answered promptly by the man or the woman who knows about the subject in which you are interested.