Kansas Memory

KANSAS HISTORICAL SOCIETY

Transactions of the Kansas State Board of Agriculture, 1909-1910

Section 11, Pages 301 - 330

This biennial report from the Kansas State Board of Agriculture includes information on farm animals, market classes and grades of meat, general agriculture, common forest trees, and poultry. County statistics include population, acreages, productions, live stock, and assessed valuation of property. State statistics and crop and livestock statistics are also included.

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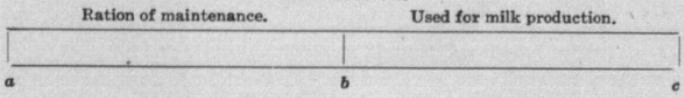
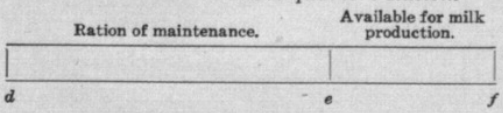
amounts to about 60 per cent of the ration that she is given. In the case of a heavier-producing animal, for example, one producing one pound to one and three-fourths pounds butter fat per day, this ration of maintenance amounts to about one-half the total feed of the animal. It should be clear that, after going to the expense of giving the animal the necessary amount to keep her alive, it is the poorest economy to refuse to furnish the other 40 or 50 per cent which she would utilize exclusively for milk production. On the average farm this is one of the most common mistakes made. The importance of liberal feeding for economical production can be easily understood from the following illustration:

COWS OF HIGH PRODUCTION CAPACITY LIABLE TO BE UNDERFED.

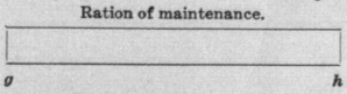
Full Ration.



Three-quarters Ration.



Half Ration.



The first illustrates the proper feeding of a heavy-producing cow, which is the one usually underfed. The line *a* to *c* represents the total capacity of the animal for food, or a full ration. The first half, from *a* to *b*, represents the amount of food required to maintain the animal's body, or the ration of maintenance. The second half, that portion from *b* to *c*, represents the proportion of the food used for the production of milk. In this case there is no fat being produced on the animal's body, and the cow is supposed to be of such dairy quality that all the feed she can eat in excess of that required for maintenance is used for milk production.

The line below represents what would happen if the feed of this animal is reduced one-fourth. The ration of maintenance remains practically the same as in the first case. The amount represented by the line *d* to *e* is the amount required to maintain the animal's body, which is the same as in the first case. However, the cut of one-fourth in the ration will be seen to come entirely on that available for milk production and reduces that amount one-half.

Suppose the ration of such a cow be still further reduced to one-half of the full ration, or that required for maintenance alone, as represented by the third line. In this case the cutting down of the ration one-half would remove all available feed for milk production. However, the animal would not cease producing milk at once. This is a point of great importance in feeding cows, and a lack of such knowledge leads to serious errors in feeding. The milk-producing function is so strong that the cow will continue to produce milk for some time, even when the feed is insufficient, utilizing the reserve material which has been accumulated in the body in the past. This always happens in the case of a heavy-milk-

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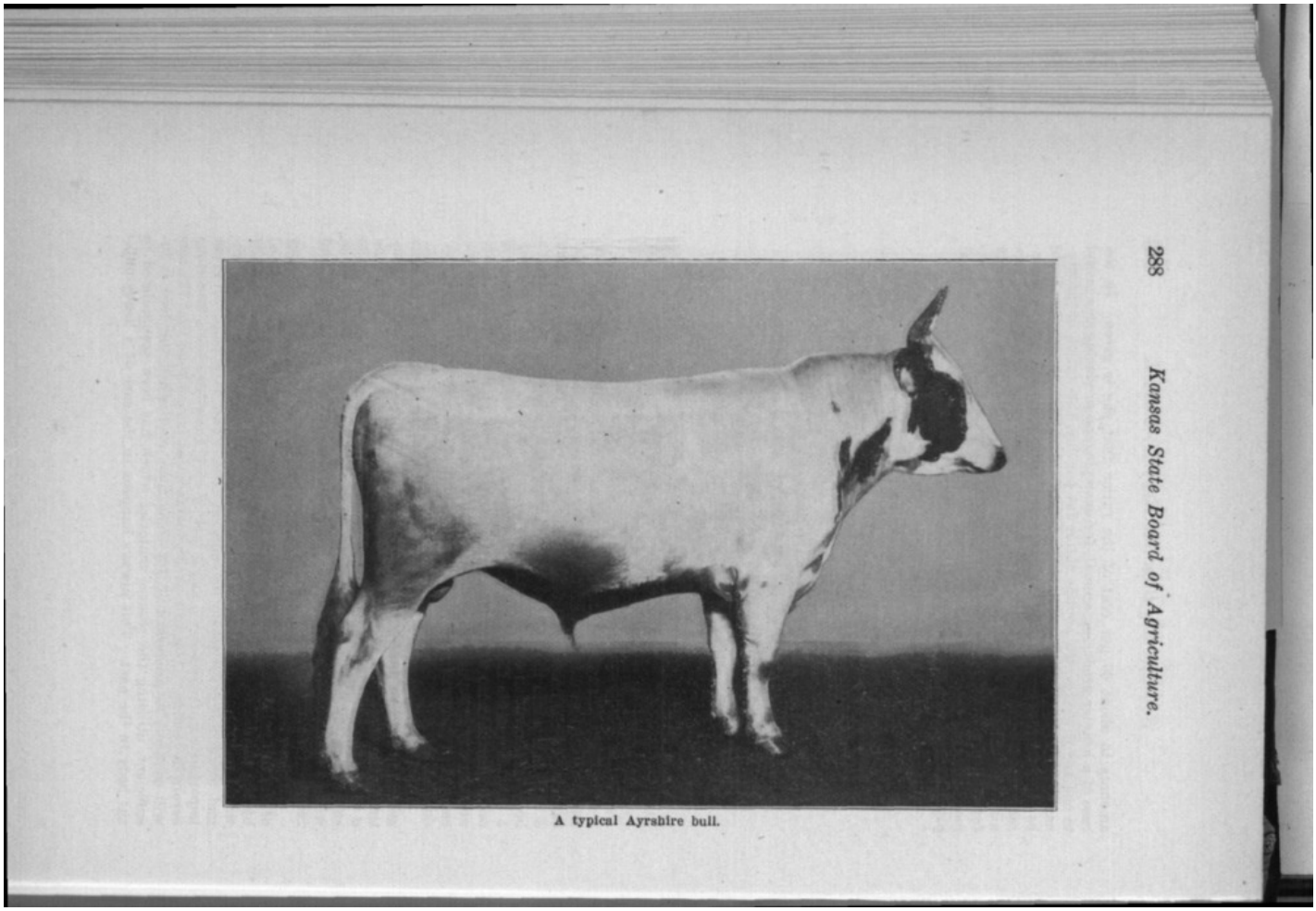

A typical Ayrshire bull.

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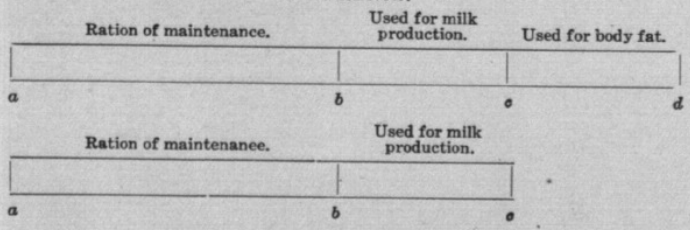
ing cow during the first few weeks after the birth of the calf. At this time it is not generally possible, and not desirable, on account of the condition of the animal, to give her a sufficient quantity of feed to supply the nutrients necessary to produce the milk, and even if the feed was offered the appetite is not usually strong enough to cause the necessary amount of feed to be taken to prevent this loss in weight. As a rule, all heavy-milking cows decline in weight for the first two or three weeks, and occasionally for ten weeks, after calving, which means that milk production has been in excess of the feed supplied for that purpose. The same thing happens in the case of the cow that is not fed a sufficient ration for the amount of milk she is producing. She may continue to produce considerable milk for a while by drawing on the reserve material of the body, but as soon as this is exhausted the production of milk must come down to the amount available for this purpose above the ration of maintenance. When the feed is in excess, the cow begins to store reserve material on her body. If the amount of milk produced by a cow varied directly with the feed, and she did not store up nutrients at one time and draw on reserve material at another, it would simplify the problem of feeding very much and result in more economical feeding at all times.

How to Avoid Overfeeding.—While the statement and illustration given apply to one class of dairy cows, there is another class to which it does not apply, and with which it would lead to a serious mistake in feeding from an economical standpoint. This group includes those of lower productive capacity, which are liable to be overfed, especially when they are in the herds of dairymen who realize the necessity of liberal feeding. The proper feeding of this group of animals can perhaps be made clearer by the following illustration:

COW OF LOWER PRODUCTIVE CAPACITY LIABLE TO BE OVERFED.

Full Ration.



The line *a* to *d* represents the amount of feed that an animal of this class will consume; *a* to *b* represents the ration of maintenance as before. In this case, however, the capacity for milk production is not equal to the capacity of the animal for utilizing feed in excess of that required to maintain the body. The amount which the animal is capable of utilizing for milk production is represented by that portion of the line *b* to *c*, while the animal's appetite is equal to the total line *a* to *d*. This gives a surplus, *c* to *d*, which is not utilized for milk production but which will be used for storing fat on the animal's body, and we will have the cow gaining in weight while she is producing milk. This gain in weight will be of no service as far as milk production is concerned, except that it is of some value as a reserve material to be drawn upon at some other time when feed is not supplied in sufficient amounts, but it is not economical nor desirable to fatten dairy animals with the expensive feeds which are fed dairy cows. That portion of the feed represented by the line *c* to *d*

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Jersey cow Jacoba Irene. Record, 69.8 pounds of milk in one day.

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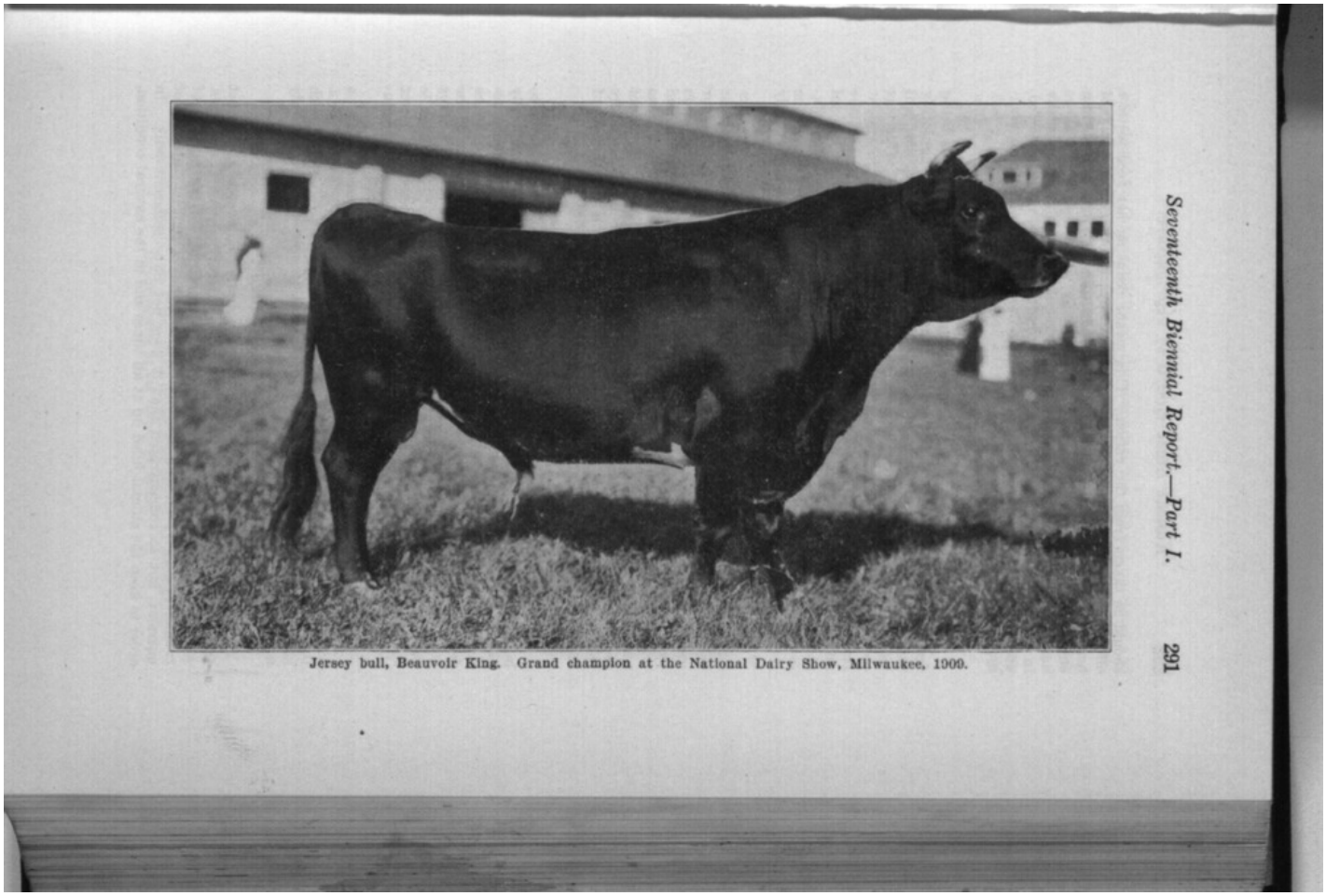

Jersey bull, Beauvoir King. Grand champion at the National Dairy Show, Milwaukee, 1909.

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should be taken from the ration. This means reducing her feed to take off the amount used for storing fat on the body; in other words, to feed her only what she will utilize for milk production. This means feeding enough to maintain a practically uniform body weight. In every large herd where the amount fed is not carefully regulated, we find errors made in both these classes. We find the heavy-producing cows being underfed, and we find the low-producing cows being overfed and allowed to accumulate fat.

Relation of Live Weight to Proper Feeding.

The live weight of a cow is a good index to whether the cow is being fed a proper amount or not, but good judgment must be used in regulating the ration by observing this condition. We must expect that a cow will lose weight in the first few weeks of her milking period, but after this period is past there is no reason why she need change much in weight for several months, and this is the period when the greater part of the milk production is secured. It will not mean, of course, that the animal should not be allowed to gain in weight during the latter end of the milking period, as this is necessary on account of the development of the fetus, and since it is natural for the animal to carry some fat on her body at calving time.

It does mean, however, that in order to feed a herd of cows economically it will not do to feed them all the same quantity of grain whether they are giving a gallon of milk a day or whether they are giving four gallons, and it means that when a cow in the middle part of her lactation period is putting on weight that she is being fed more than she needs and will give just as much milk if the feed is cut down somewhat. It also means that if a certain animal is losing weight that sufficient feed is not being given, and if the deficiency is not supplied it will not be long before the milk production will come down to correspond with the amount of feed available.

FEEDING AS INDIVIDUALS.

In connection with this subject of the amount to feed cows it needs to be pointed out that it is only possible to feed a bunch of cows economically when they are fed as individuals, and not as a herd. A too common practice, even in otherwise well-conducted herds, is for all animals to be fed the same amount of grain, regardless of the period of lactation or the quantity of milk individual cows are producing. Such feeding always lacks economy, as the high-producing cow does not get enough, and while she may milk very well for a short time she soon comes down to a lower level, while the lighter-producing cow usually gets too much and accumulates fat.

One of the difficult problems which confronts the practical feeder is how to adjust the quantity of feed to meet these individual requirements. It can be done fairly well, even in the large herds, by observing how much milk the cow is producing, and whether she is gaining or losing in body weight.

AMOUNT OF GRAIN AND ROUGHNESS TO FEED.

The cow being adapted by nature for consuming bulky feeds, does not feel satisfied unless she has sufficient bulk to the ration given at all times. An animal that is fed too much grain in proportion to the amount of roughness may seem hungry, while she really has a sufficient amount of nutrient, but so concentrated that it does not have sufficient bulk. In order to keep the animal filled up at all times and in the natural condition,

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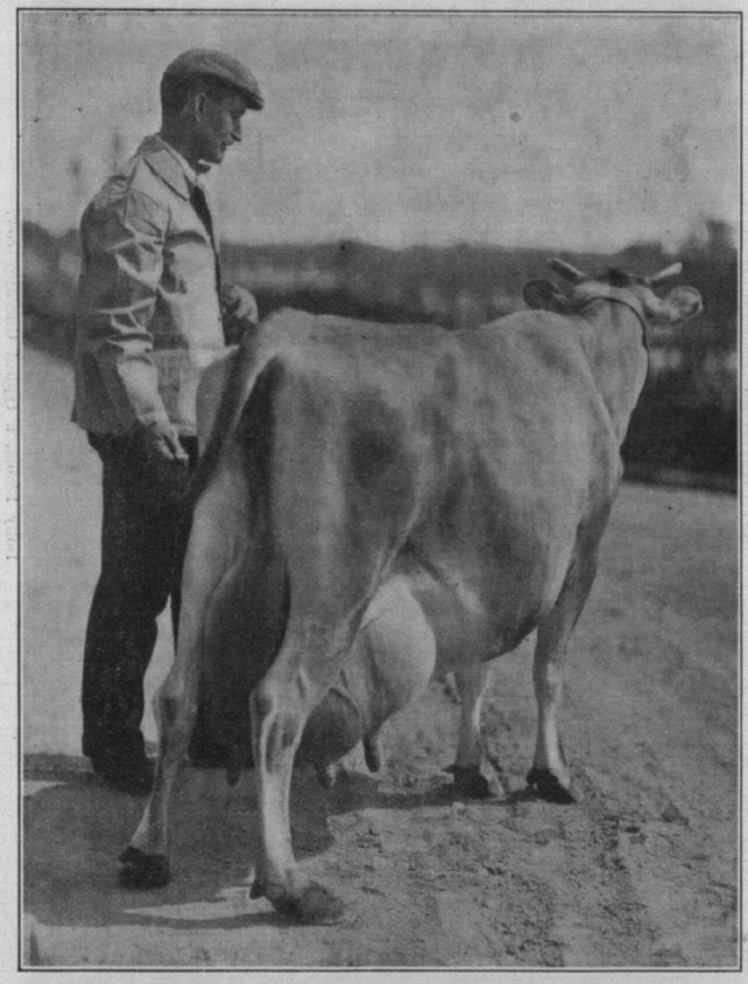
she should be fed practically all the roughness she will eat up clean, and the difference in ration given different animals should be not in the roughness fed, to any great extent, but in the amount of grain.

The following rules regarding the amount to feed cows cover the case fairly well:

1. Feed all the roughness they will eat up clean at all times.
2. Feed one pound of grain per day for each pound butter fat produced per week, or one pound of grain daily for each three pounds of milk.
3. Feed all the cows will take without gaining in weight.



Imported Jersey cow, Flying Fox's Golden Gem 162131, at seven years. Circumference of her udder, 76 inches.

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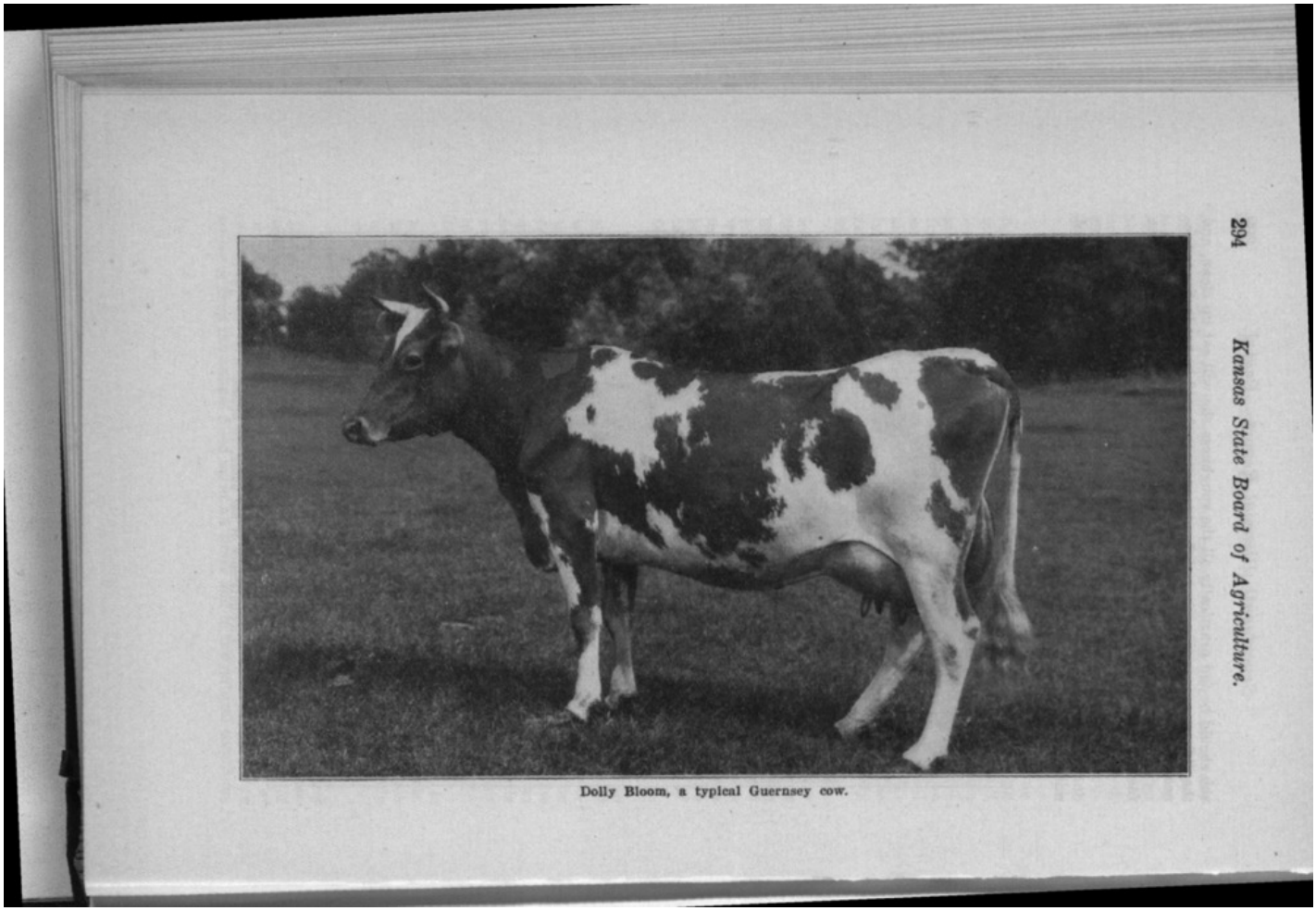

Dolly Bloom, a typical Guernsey cow.

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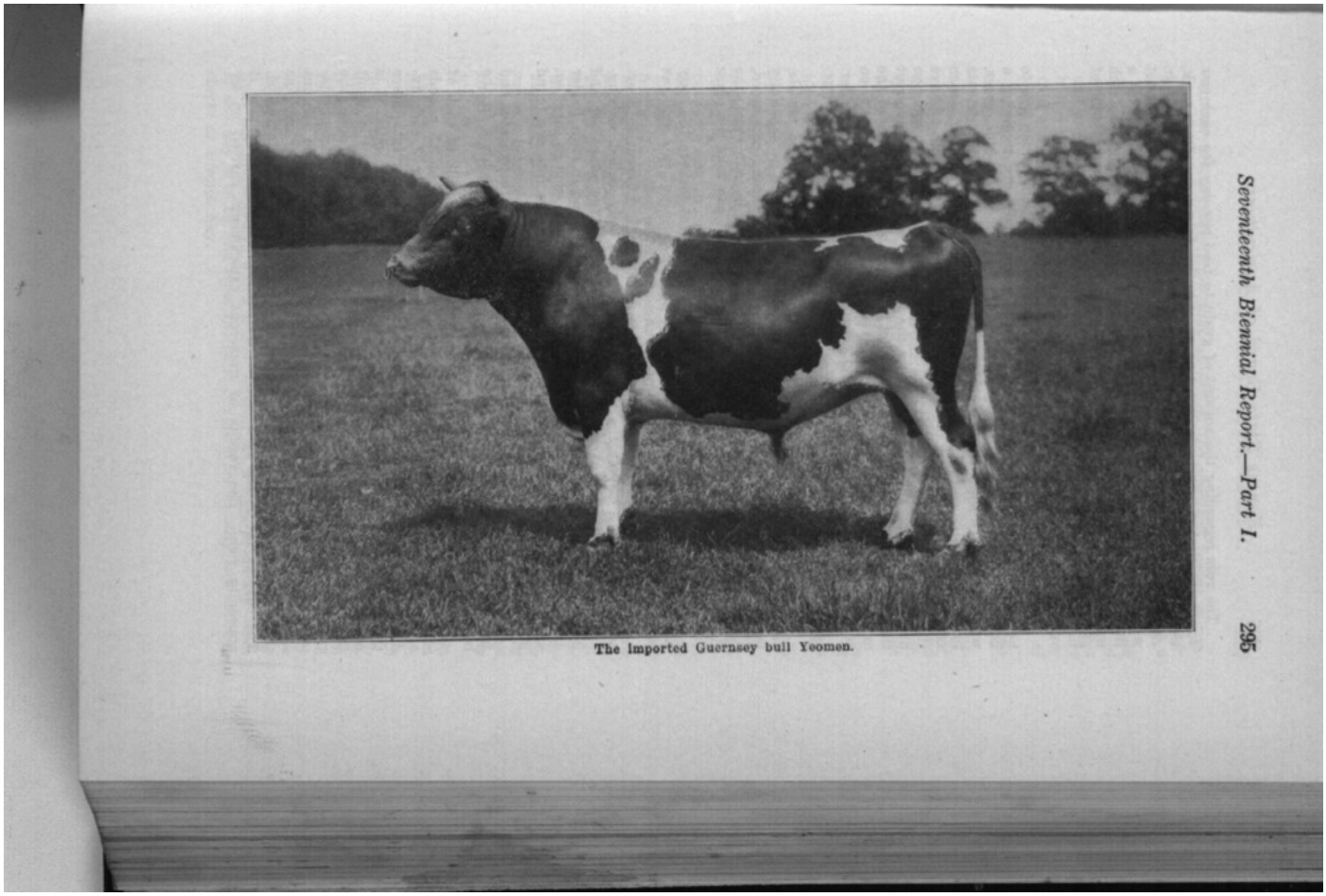

The Imported Guernsey bull Yeomen.

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The rule regarding the amount of grain to feed per day for each cow applies best when based upon the amount of butter fat produced per week, as this makes it applicable to any breed. The second part of the rule, in regard to feeding one pound of grain for three pounds of milk, would not work out in all cases, since in a heavy-milking Holstein cow this gives a little too large a quantity of grain, and with a Jersey giving very rich milk it is a little too low. It applies best to cows producing milk of about average composition.

REASON FOR FEEDING BALANCED RATIONS.

The second statement regarding the summer conditions which are to be maintained throughout the year is that the animals are receiving a balanced ration. The ordinary pasture grasses, especially blue grass, when in the growing state contain the proper proportion of nutrients to enable a dairy cow to produce the maximum amount of milk of which she is capable. The winter ration, on the other hand, is liable to have these nutrients out of proportion. This is one point wherein common practice falls far short of continuing the summer conditions throughout the winter. The feeding of a ration not properly balanced is one of the most common mistakes made on the average farm in the corn belt, on account of the usual abundance and cheapness of corn and corn fodder.

All good rations contain substances which serve two quite distinct purposes when taken into the body.

First.—Certain substances known as protein, which build up muscle, bone and hair. Protein is found in almost all food, but in especially large quantities in alfalfa, clover and cowpea hay, bran, cottonseed, linseed and gluten meals, also in nearly a pure form in lean meat, the white of an egg, and curd in milk. No other element can take the place of protein.

Second.—Another class of substances supplying heat to keep the body warm, fat to be stored in the tissues as body fat, or put into milk as butter fat, and energy to keep up the functions of the body.

This class is represented by two kinds of material, different in character but serving largely the same purpose in the body, called carbohydrates and fats. The carbohydrates are present in large quantities and in nearly all grains, such as corn, wheat and barley, and in corn fodder and timothy hay, in the form of starch. In other plants, such as sorghum and sugar beets, it is found in the form of sugars. The fats are found in varying quantities in all common grains.

All properly balanced rations must contain protein, carbohydrates and fat, and no amount of carbohydrates or fat can take the place in the body of protein.

A cow secreting milk must produce substances in the milk of each of these classes. In 100 pounds of average milk we find about 3.3 pounds of protein in form of casein (curd) and albumin, 5 pounds of carbohydrates in form of milk sugar, 4 pounds of fat in form of butter fat. Since these three kinds of solids must be present in order to form milk, it is necessary to furnish them in the feed in sufficient quantities and in about the right proportion, so there will be no loss. When this is done, the ration is properly balanced. If a cow be supplied with sufficient material in her feed to produce 30 pounds of milk per day, but on account of lacking protein produces but 15 pounds, it is useless to further increase the fat-producing material and expect the flow of milk to be increased. The surplus fat in the feed will not be put into the milk and make it unusually rich. The results of numerous experiments carried on by

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various investigators show that as far as the practical feeder is concerned the proportion of butter fat in cow's milk cannot be changed appreciably by the kind of feed given. The richness of a cow's milk is a natural characteristic.

Returns from liberal feeding and care in balancing the ration should be looked for in a larger yield and not in a richer milk. The quality of richness of milk is controlled by the selection of the individual animals and to a certain extent by the breed. The problem the feeder has before him constantly is how best to combine his feeds to furnish the necessary food elements in the right proportion and with the greatest degree of economy.

As an aid in properly balancing the rations, it is useful to divide our common feeds into two classes.

Class 1.—Including those feeds which contain a large amount of fat-producing material (carbohydrates and fat) but which are notably deficient in one of the essential substances required for producing milk and growth in young animals. In this class we have: Corn, corn fodder, corn silage, timothy hay, oat straw, wheat straw, millet hay, sorghum hay.

Class 2.—This class contains a much larger proportion of protein, the essential growth- and milk-producing elements, and smaller quantities of the fat-making materials. It includes: Clover hay, alfalfa hay, cowpea hay, bran, oats, cottonseed meal, gluten meal, linseed meal, soy beans.

A properly balanced ration will therefore include some of the feeds from each of these two lists.

Home-grown Balanced Rations.—One reason why the average farmer makes the mistake of feeding his cows rations that are not properly balanced is that it is easier, or he thinks it is, to grow feeds that are excessively rich in carbohydrates and lacking in protein, and comes about principally by the large amount of corn grown and used. Many Kansas farmers have corn fodder and timothy hay for roughness and practically nothing in the way of grain but corn. From such a ration of feeds it is impossible to make a ration that supplies the necessary nutrients for very heavy production of milk. It is possible to make a fairly good ration using these feeds for roughness, but it is only possible to do so by buying large quantities of mill feeds that are rich in protein. The thing for the farmer to do is to raise the feeds he requires on his own farm, as far as possible, and it is possible to produce practically all that is needed to make a balanced ration. The place to begin, in considering the feeding of an animal, always is with the roughness, since the character of the roughness determines to a large extent the kind of grain it is advisable to feed.

The cheapest source of protein is in leguminous hays, including clover, alfalfa and cowpeas. If an abundance of any one of these hays is on hand, the problem of making an economical balanced ration is very much simplified. The use of these hays makes it unnecessary to buy any large quantities of bran, oil meal or cottonseed meal for ordinary dairy cows, and makes it possible that the principal grain used be corn, which usually is our cheapest grain. Even cowpea hay or alfalfa hay alone, with corn for grain, makes a fairly good ration for an ordinary dairy cow, and such a ration could be substituted with good results for one of timothy hay and corn fodder. When hay is purchased, it is always best to purchase one of the kinds mentioned, as the price is about the same, or lower than that of timothy, which is far inferior as a milk-producing food. If any hay is to be sold from the farm it should be timothy hay and not clover or cowpea hay.

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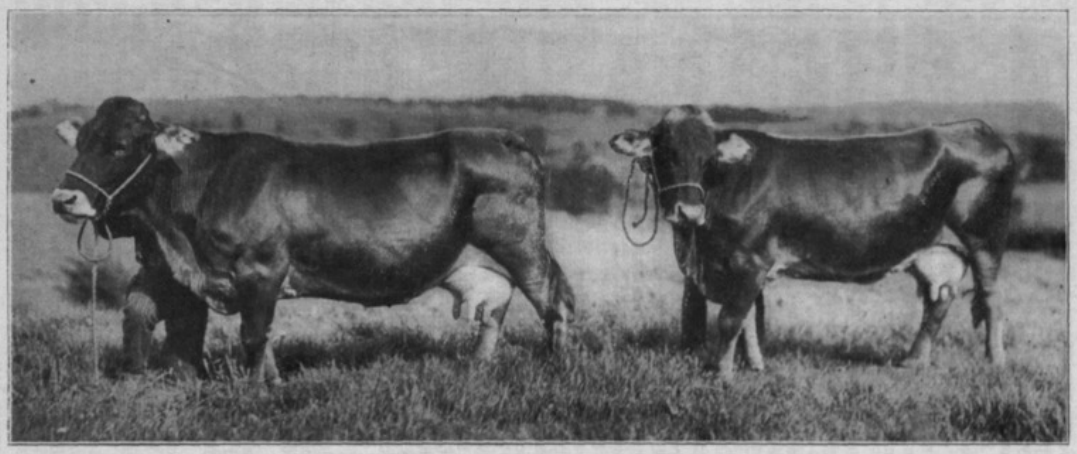

Finely typical Brown Swiss cows.

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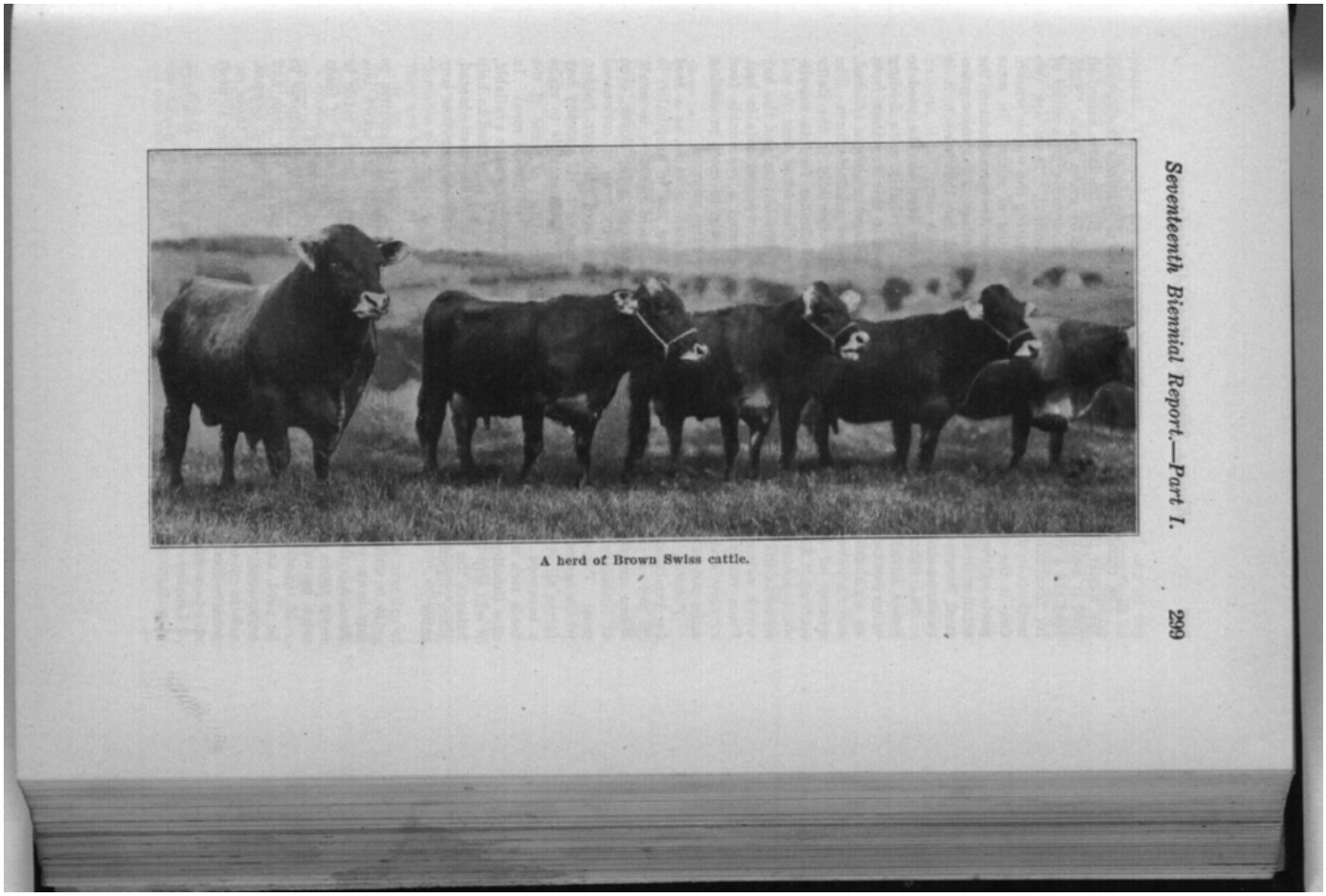

A herd of Brown Swiss cattle.

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SUCCULENT FEEDS.

The third summer condition which we desire to continue throughout the winter is that of a supply of succulent feed. By the term succulent feed is meant feed having that property possessed by green grass. Such feed has a value outside of the actual nutrients it contains, on account of its favorable effect upon the digestion of the animal. There are two methods in use for supplying this succulent feed during the winter season. One is the use of root crops and the other the use of silage. In some parts of the world the use of root crops is almost universal, and is the solution of the problem. In this state the use of silage is far more practical, however, than the use of root crops, and for that reason it is recommended exclusively for this purpose.

The Silo.—There is no way by which the corn crop can be used to better advantage than by putting it in the silo. Probably more feeding value can be secured from an acre of corn utilized in this way than from an equal amount used for any other purpose. Silage is always relished, and furnishes a part of the roughness in a cheap and palatable form. The number of silos in use is constantly increasing, especially in the dairy sections. Silage is also growing in favor as a summer feed to supplement pastures. In feeding silage it must not be expected that it will serve as the only roughness. Hay should be fed in addition, and the hay which naturally goes with corn silage is clover, cowpea or alfalfa hay. From thirty to forty-five pounds per day is counted a reasonable feed of corn silage. It can be fed successfully, not only to cows producing milk, but to young stock and, in fact, almost all farm animals.

Timothy Hay.—This hay is usually overestimated in value as a feed for producing milk. For this purpose it runs very low in proportion to its selling price. Another objection is that the yield per acre is small. When timothy hay is on hand it will pay to exchange it for clover, even at considerable expense for labor, or sell it and buy bran or cottonseed meal. Timothy hay can be largely or entirely replaced with corn fodder, which serves about the same purpose, at a far less cost. If timothy hay forms all or a large part of the roughness fed, it is impossible to make a balanced ration without using considerable quantities of some of the feeds rich in protein, such as bran, cottonseed meal or linseed meal. In case timothy or mixed hay and corn fodder is all the roughness available, it will pay by all means to purchase some one of these suggested to help balance the ration. For this purpose cottonseed meal is the best-adapted, since it generally supplies the protein which is lacking cheaper than any other.

BUYING CONCENTRATED FEEDS.

It is quite a problem with dairymen when and in what quantities to buy bran, cottonseed meal, gluten meal, or linseed meal, and which one furnishes them the most value for the money. No rule can be made to cover these cases. The whole subject of feeding and composition of feeds must be well understood in order to work to the best advantage.

If timothy, millet or sorghum hay or corn fodder is the roughness to be used, and corn the chief grain on hand, it will pay to buy bran and cottonseed meal, even if some of the corn has to be sold. When cowpea, alfalfa or clover hay is used extensively the necessity of using these expensive feeds is largely done away with and only small quantities at most will be needed.

Linseed meal, cottonseed meal and the best grades of gluten meal now manufactured are of about equal feeding value for cows, pound for —

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pound. This class contains the largest amount of protein of any of the common feeds, and for that reason is the most valuable. Gluten feeds as now sold rank about midway between this group and bran in feeding value. Bran and oats rank close together in feeding value, the oats probably being a little more valuable pound for pound. When oats are worth twenty-five cents per bushel, bran is worth about fourteen dollars per ton.

SOME SUITABLE RATIONS.

The following rations supply the necessary material to produce milk economically. If the cow will not give a good flow of milk in the early part of the milking period and when fed a liberal amount of one of these rations, it indicates she is not adapted by nature to be used as a dairy cow and should be disposed of. The amounts given are considered about right for the cow giving from twenty to twenty-five pounds of milk a day. For heavy-milking cows these rations would have to be increased, especially in the grain, and for light-milking cows the grain should be decreased. In making up these rations it is designed that the cow be given all the roughness she will eat and sufficient amount of grain to furnish the proper amount of digestible material. It is not designed that these rations should be sufficient or best-adapted for cows that are being fed for making records, where a very maximum production is desired regardless of expense:

SOME GOOD DAIRY RATIONS.

Clover hay..... 20 lbs. Corn..... 5 to 6 lbs. Bran or oats..... 3 to 5 lbs.	Alfalfa or cowpea hay..... 15 to 20 lbs. Corn..... 8 to 12 lbs.
Clover hay..... 20 lbs. Corn-and-cob meal..... 6 to 9 lbs. Gluten or cottonseed meal..... 2 lbs.	Corn silage..... 10 lbs. Clover hay..... 12 lbs. Corn..... 5 lbs. Bran..... 4 lbs.
Alfalfa or cowpea hay..... 10 lbs. Corn fodder..... 10 lbs. Corn..... 7 to 9 lbs. Bran..... 2 lbs.	Corn silage..... 20 lbs. Alfalfa or cowpea hay..... 15 lbs. Corn..... 8 to 10 lbs.

DISCUSSION.

E. HARRINGTON: Do you recommend a shady place for them in the pasture in the summer?

PROFESSOR ECKLES: This is a question, but I believe in having a comfortable shade for them. I note some people say they will eat better if they are kept out of the shade.

H. W. MCAFEE: Does n't it pay a farmer who is making a practice of dairying to feed grain the year round? I feed my cattle alfalfa morning and evening, and grain morning and evening. Then when they go out well filled up they don't have to stand and fight flies and eat. I believe it is economy. I averaged about seventy-four gallons of milk a day from thirty cows. I feed a good deal of oil meal the year round. I feed about four quarts of grain at a meal. In the summer I give them three quarts of bran and one of oil meal a day.

PROFESSOR ECKLES: I find we get more milk where we feed more grain. I think the idea is something like this: If you have an inferior milker, or an ordinary milker, it does n't pay to feed her any grain when she is on grass. She will give as much milk on pasture as she will on grain. But as you go up the scale it pays to feed her grain. No cow can possibly do her best on grass alone. She can't possibly eat and digest enough grass

One of the finest Dutch Belted cows in America.

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A prize-winning Dutch Belted cow and bull.

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to do her best. The better the cow the more you need grain. The cow that only gives a little milk won't give you much return if you do feed her grain. I would treat them as individuals while they are on grass.

A MEMBER: Do you increase the quality of the milk by feeding?

PROFESSOR ECKLES: That question has been discussed a great deal in recent years, and while there has been considerable new information brought out recently the fact remains good that for all practical purposes you cannot increase the amount of fat in a very considerable way. Under certain conditions it can be increased a little bit, but for all practical purposes you can't do it. Of course the quantity of milk responds very quickly and very strongly to the amount of feed, but the quality, very little.

J. T. TREDWAY: What per cent of oil meal is most profitable?

PROFESSOR ECKLES: We don't feed oil meal in very large quantities. Perhaps about two pounds a day. With clover and timothy hay and grain, I would make it two pounds of grain, four pounds of bran and two of oil meal.

R. B. WARD: I see that the things supplying the elements for milk and for the production of milk are cottonseed meal and alfalfa. Now, as a beef producer, should I feed my cattle cottonseed meal, grain and alfalfa?

PROFESSOR ECKLES: Yes; I would recommend it for both classes. The feeds that contain protein make fat and make milk too.

CHAS. E. SUTTON: There was brought up yesterday the question of silage tainting the milk.

PROFESSOR ECKLES: I visited the Tully farm, in Tully, N. Y., where they have 350 cows, fed silage, and their milk sells in New York for fifteen cents a quart, and that, it seems to me, should be sufficient answer. It is a fact that you can put silage taste in milk if you don't watch out. If you feed a cow silage two or three hours before milking you can taste it.

THOS. M. POTTER: On that silo question I think we overlook the real basis of the situation. When you come to the economic phase palatability is not the essential thing. There is a question of economy—the cost and expense—that becomes very prominent. I can readily see how Governor Hoard, of Wisconsin, and our friend Henry Wallace, take the position they have with reference to the silo. I can understand well why a man from New York state wants a silo. The reason they prefer a silo is it is not only furnishing a very palatable ration for their stock by preserving the green food for the winter, but when it comes to economical production it is all right for them. Where a ton of hay is worth from twelve to fifteen dollars you can well afford to expend in saving the foods, and palatability, and in amount that may be consumed of it, four or five dollars, if you can add to the palatability. When corn is worth fifteen cents a bushel you can't afford to spend five cents a bushel to have it ground that it may become more palatable, but when it is fifty cents a bushel it becomes another question. That is what you would have to meet in Kansas. Our Board, as you well know, once appointed a committee to investigate silos in this state. That committee's report was to the effect that they had nothing against the silo in and of itself, or that it did not produce good food for the animal. It is good. It takes the summer food and carries it into the winter; cans it for them, in other words, the same as our good housewives can the peaches and other fruits for us. With us we don't stop to think about the cost of labor, and so forth, our good wife expended in preparing that food for us. But when it comes to our ani-

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mals, that is the great question. Now when feeds—fodders of various kinds—are worth $2.50 a ton, you can't afford to expend in labor $6 to save one ton of those foods. That is the whole point of this thing. Here in the Central West our foodstuffs are very cheap. They are produced in such abundance we have found by experience that the labor expended on the silo in getting the food there, whether two miles or a half mile, is too great. The problem is the cost of getting it there and getting it into the silo; it is greater, from an economic standpoint, than we would save in preparing it for our stock. I have heard people complain of the tainting of the milk from this lovely alfalfa you have been talking about. There is not any of it flavored so badly but that a lover of good milk can get along, no matter what the animal is fed upon; indeed, whatever kinds of food the dairyman has. When our average fodder stuff gets to fifteen and twenty dollars a ton, as it in the East, we can afford to expend the extra energy in canning it. But until it does get to that we can't afford to do it.

Dutch Belted cow, Clytie 1059, and twin calves.

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A six-horse team of Percherons at the Kansas State Agricultural College.

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A COMPARISON OF CORN AND OATS FOR WORK HORSES.

From Ohio Agricultural Experiment Station Bulletin No. 195, by B. E. CARMICHAEL.

Problems connected with the feeding of work horses are doubtless of as wide interest as any problems in live-stock management. Practically all farmers, whatever particular branch of farming they may be engaged in, have occasion to feed work horses. Besides farmers, commercial firms of various classes keep horses in large numbers for work purposes, and they, too, have a deep interest in methods of feeding that will lessen the cost of maintaining work horses without decreasing their efficiency.

Whether feeds are high or low in price, it is well worth while for feeders to exercise great care in the selection of rations, so as to use the ones that are most efficient and economical. With the present exceedingly high market prices for all kinds of grain feeds, it is especially important that a judicious selection of feeds be made, for much waste may result if attention is not given to this phase of stable management.

Of all grain feeds used in this country none is in higher repute with horsemen than oats. Many horsemen believe oats to be the best single grain feed for horses, whether kept for draft or for road purposes. It has been stated time and again by practical horsemen and others that horses fed upon oats display more life, keep in condition and endure work, especially during hot weather, better than do horses which receive a grain ration made up largely or exclusively of corn. And this belief in the efficiency of oats as a grain feed for horses is so strong with some horsemen that they are willing to pay exorbitant prices for oats rather than feed corn.

A study of the chemical composition of corn and of oats fails to show any good reason for the exceedingly high favor in which oats are held, or for corn being considered so totally unfit for the use of horses, especially when at hard work. It has been claimed that oats contain a stimulating principle known as "avenine," which gives great spirit to horses. The existence of this stimulating principle has not been proved, and it is safe to say that its existence is very improbable. Even if it does exist, there is no evidence to indicate that it would have any special bearing upon the practical feeding of work horses.

On account of the widespread prejudice against corn and in favor of oats, an experiment, from which it is hoped that definite data may be secured in regard to this important subject, has been undertaken at this station. The plan of this work calls for a long-time experiment—not one of a few days' or weeks' duration, but one that will continue for a number of years.

The work was begun in the spring of 1907, and the results of the experiment up to the present time are so striking that it has been thought best to give them to the public at once, with the understanding that further work is being done along this line and that there is a possibility of different results being secured later.

PLAN OF EXPERIMENT.

The horses used in the first forty-eight weeks of this experiment were six mature grade Percheron geldings, belonging to the department of agronomy of this station and used for general farm and team work. The

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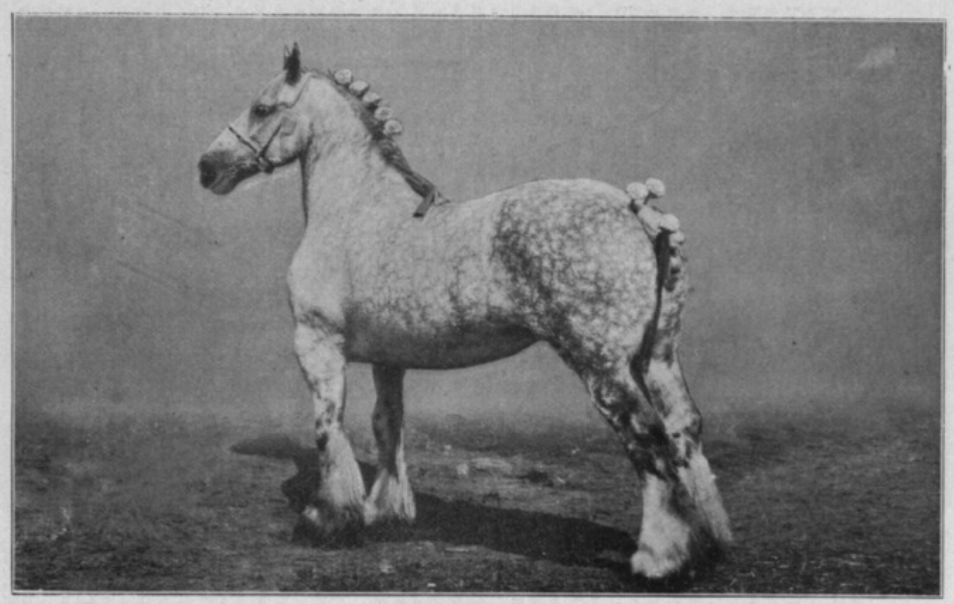
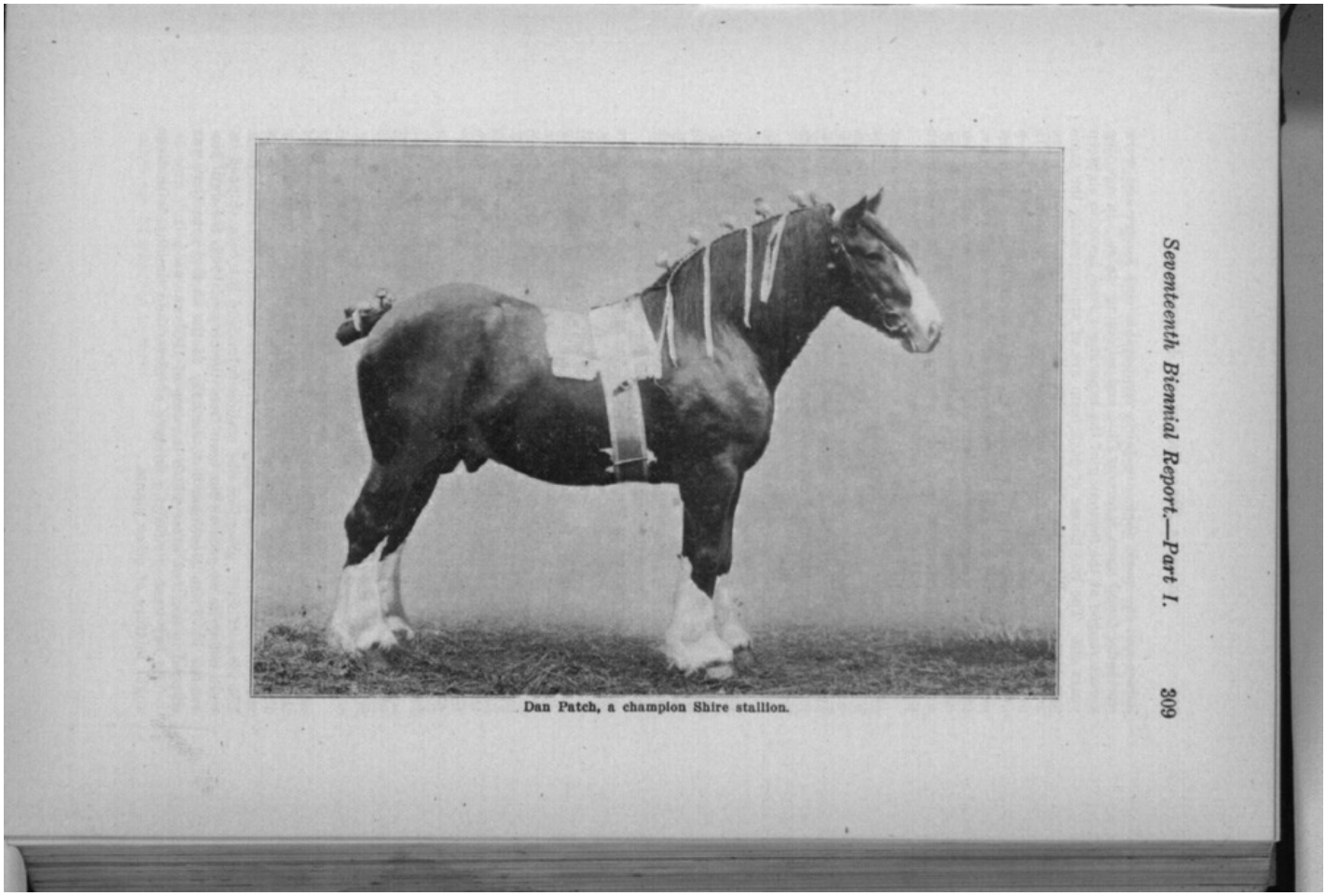


A champion Shire stallion.



Dan Patch, a champion Shire stallion.

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horses and the work, then, are fairly comparable with horses and work commonly found upon farms in Ohio and adjoining states. In age, the horses ranged at the beginning of the experiment from seven to eighteen years old. The two horses of each team are of approximately the same age, however. While there are some differences in the conformation, size and disposition of the various horses, they are a fairly uniform lot. In order to secure an accurate comparison of oats and corn one horse in each of the three teams is fed oats, while the other receives corn. With the exception of a very few days the two horses which comprised a team were, for forty-eight weeks, worked together; that is, it was very unusual for one horse of a team to work while the other horse was idle. This assures an equal amount of labor being performed by each horse in a given team and therefore permits a direct comparison of the two feeds.

The horse called Tom is by nature a very "easy keeper," and the cost of his maintenance is relatively low on this account. This fact should be borne in mind in making use of tables III and IV. At present the horses which received corn during the time covered by this bulletin are fed oats, and corn is fed to the horses which formerly received oats. In this way, it is hoped that individual differences in the horses may be overcome to some extent.

Until April 19, 1907, all six of the horses were fed practically alike on a grain ration made up chiefly of corn and oats. A small amount (one-half pound) of linseed-oil meal was fed for a while prior to April 19. On April 19 the change from a mixed grain ration to the separate grain rations was begun, and on April 25 the single grain rations of corn and oats respectively were in use. The initial three-days' weights (see table II) were taken May 16, 17 and 18, so that the experiment began after the horses had been on the single grain rations for three weeks.

The interruptions in the regular use of the single grain rations were very few. One horse, Bill, was sick for a few days at two different times, and some bran and oats were fed. There was no evidence to indicate that corn was responsible for this slight indisposition, the purpose of using other feeds being to induce the horse to eat. The continued use of corn alone afterwards caused no recurrence of the indisposition, and corn can in no sense be held responsible for the trouble. It has been assumed, therefore, for convenience in making the calculations, that this horse was fed the usual grain ration during these two very short periods, covering in the aggregate about ten days. Frank, Bill's team mate, was "off feed" for a short time in February, but, again, the exclusive use of oats cannot be considered the cause.

The effect of the two rations upon the health of the animals, upon their ability to stand hard work, especially in hot weather, and upon the live weight is being observed.

FEEDS USED.

The oats used were grown on the station farm, and, on account of the unfavorable season in which they were grown and harvested, were not of the very best quality. Samples that were tested weighed from 28½ to 31½ pounds per bushel. The corn was, for the chief part, grown on the station farm, but some was shipped in from the western part of the state. The crop of 1907, grown on the station farm, and the corn shipped in, were not quite as good as the corn from the crop of 1906, fed until November 1. From November 1 to January 24 the shelled corn that was shipped in was fed, after which the crop of 1907 was used.

The hay used is chiefly a mixture of clover and timothy, with some slight mixture of other plants.

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Table I gives the composition of oats, shelled corn and hay. The analyses presented in this table were made under the direction of Mr. J. W. Ames, chemist of this station.

TABLE I. Percentage composition of feeds.

	Moisture.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Fat.
Corn	11.673	1.390	9.630	1.830	71.220	4.257
Oats	10.235	3.410	12.500	10.901	59.424	3.530
Hay (mixed clover and timothy)	13.198	5.101	6.260	34.553	38.820	2.068

The plan was to feed as many pounds of ear corn to one horse in each team as is fed of oats to the other horse. When shelled corn was fed, the amount was adjusted so as to equal the amount of ear corn indicated above. In other words, for each pound of oats fed to the three horses which received this grain ration, a pound of ear corn or its equivalent in shelled corn (the ear corn of the crop of 1906 yielded, in August, 1907, 82.5 per cent shelled corn) was fed to the other three horses. At first thought this would seem to be too small an amount of corn to feed, but, as will be shown later, the results of the experiment indicate that the horses were equally well fed. Approximately the same amount of hay was fed to each of the horses with the exception of one (Tom), which would not eat as much as the others. Any hay that was refused was weighed and its weight deducted from the total amount fed. See table III for feed consumed by each horse.

WEIGHTS OF HORSES.

Weights of the horses were taken each week throughout the experiment. The weights were taken three days in succession at the beginning of the experiment, at the end of each four-week period, and at the close of the experiment. The purpose of the three-days weights is to overcome the daily fluctuations in weight which may occur from various causes. These weights are presented in table II. This table shows no very marked variations in weight. The variations that did occur cannot be said to be due to the feeds used, as some variations will occur even where the horses are fed alike.

Weights of the horses were taken near the close of each month previous to the beginning of the experiment. Prior to the time covered by the experiment all the horses were fed practically alike and the two horses that comprise a team were usually worked together. That some variations may occur even when the same feeds are used is shown. Fluctuations must be expected, and slight differences in weight cannot be attributed to the rations used, unless a uniform variation persists throughout a considerable number of weeks.

Beginning November 1, shelled corn was fed to the corn-fed horses until January 24. During this period the weights of the corn-fed horses seemed to be rather lower than normal. This might possibly be due to the fact that the shelled corn was of hardly as good quality as the ear corn, or it may be that the shelled corn was not so thoroughly masticated and digested as the ear corn, since the horses might eat it faster than the ear corn could be eaten. There is nothing to indicate that the use of corn during hot weather produced any undesirable effects. The variations that occurred in weights were so slight that no special significance can be attached to them.

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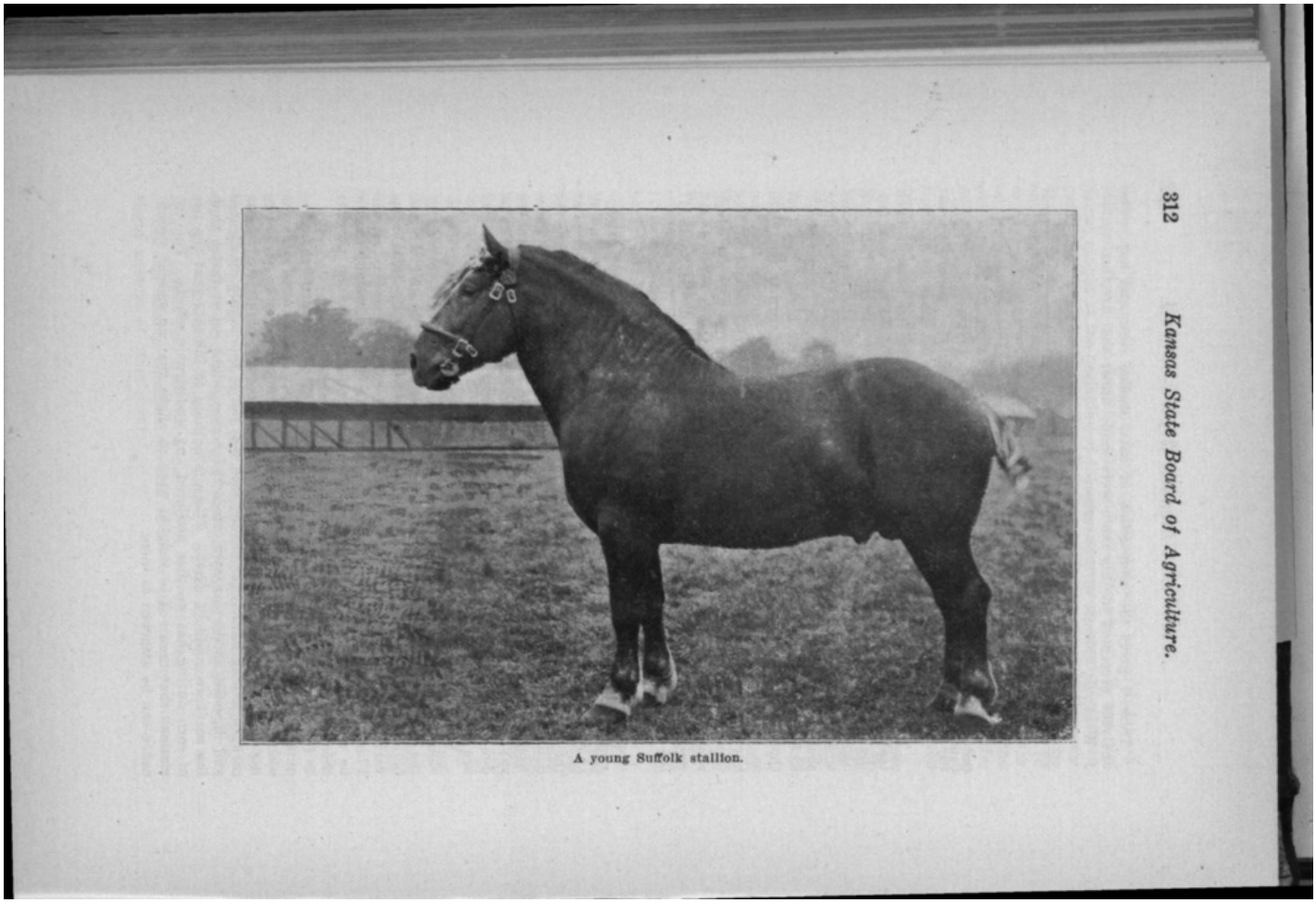
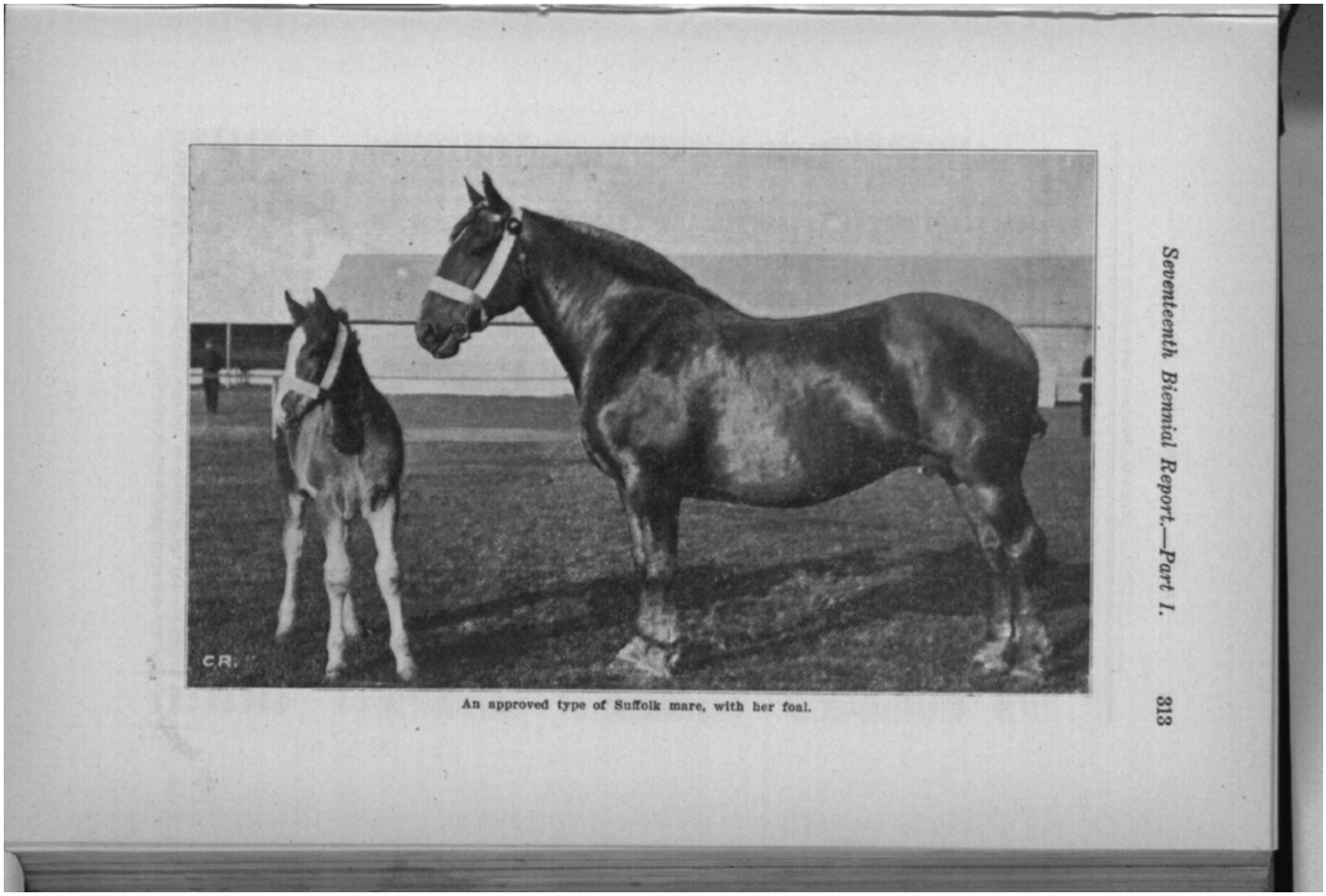


A young Suffolk stallion.



An approved type of Suffolk mare, with her foal.

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TABLE II. Weights of horses.

DATE.	Weight in pounds.					
	JOE, fed corn.	JAKE, fed oats.	BILL, fed corn.	FRANK, fed oats.	TOM, fed corn.	DICK, fed oats.
May 16, 17, 18	1,555	1,453	1,493	1,470	1,527	1,349
" 24	1,570	1,446	1,468	1,430	1,510	1,330
" 31	1,570	1,452	1,500	1,450	1,520	1,340
Jun. 7	1,544	1,460	1,492	1,422	1,512	1,336
" 13, 14, 15	1,573	1,443	1,484	1,427	1,543	1,358
" 20	1,570	1,436	1,494	1,458	1,540	1,370
" 28	1,542	1,422	1,494	1,450	1,540	1,354
Jul. 5	1,550	1,420	1,474	1,450	1,550	1,370
" 11, 12, 13	1,535	1,423	1,484	1,480	1,540	1,369
" 19	1,480	1,420	1,474	1,474	1,542	1,370
" 26	1,522	1,410	1,460	1,460	1,550	1,390
Aug. 2	1,540	1,400	1,470	1,470	1,542	1,390
" 8, 9, 10	1,523	1,398	1,467	1,487	1,545	1,379
" 16	1,510	1,400	1,448	1,460	1,530	1,370
" 23	1,520	1,380	1,460	1,470	1,520	1,380
" 30	1,510	1,370	1,450	1,450	1,500	1,354
Sept. 5, 6, 7	1,503	1,363	1,451	1,451	1,497	1,355
" 13	1,510	1,364	1,470	1,456	1,520	1,360
" 20	1,524	1,400	1,470	1,430	1,540	1,380
" 27	1,518	1,380	1,450	1,450	1,520	1,360
Oct. 4, 5, 6	1,519	1,388	1,463	1,457	1,536	1,370
" 11	1,510	1,390	1,500	1,500	1,555	1,400
" 18	1,514	1,386	1,472	1,488	1,536	1,374
" 25	1,524	1,410	1,464	1,458	1,560	1,380
" 31, Nov. 1, 2	1,534	1,413	1,489	1,495	1,568	1,413
Nov. 8	1,510	1,400	1,486	1,500	1,568	1,442
" 15	1,526	1,432	1,494	1,510	1,580	1,440
" 22	1,524	1,420	1,492	1,490	1,570	1,418
" 28, 29, 30	1,515	1,420	1,500	1,520	1,565	1,429
Dec. 6	1,520	1,430	1,510	1,526	1,546	1,400
" 13	1,544	1,466	1,532	1,542	1,590	1,468
" 20	1,576	1,480	1,500	1,520	1,586	1,460
" 26, 27, 28	1,580	1,475	1,513	1,573	1,598	1,473
Jan. 3	1,586	1,492	1,500	1,550	1,600	1,452
" 10	1,580	1,480	1,530	1,580	1,600	1,452
" 17	1,586	1,494	1,530	1,590	1,600	1,440
" 23, 24, 25	1,577	1,491	1,540	1,592	1,609	1,467
" 31	1,588	1,490	1,560	1,610	1,616	1,480
Feb. 8	1,610	1,522	1,526	1,600	1,630	1,504
" 14	1,626	1,512	1,540	1,582	1,640	1,510
" 20, 21, 22	1,622	1,483	1,551	1,603	1,609	1,452
" 28	1,620	1,500	1,546	1,580	1,610	1,500
Mar. 6	1,630	1,520	1,568	1,586	1,612	1,480
" 13	1,630	1,530	1,570	1,584	1,636	1,504
" 19, 20, 21	1,574	1,493	1,551	1,551	1,624	1,453
" 27	1,540	1,460	1,500	1,500	1,582	1,410
Apr. 3	1,550	1,460	1,504	1,490	1,580	1,410
" 10	1,560	1,454	1,506	1,460	1,570	1,406
" 16, 17, 18	1,535	1,438	1,486	1,473	1,545	1,389

SPIRIT AND ENDURANCE.

No difference due to the feeds used could be observed in the spirit and endurance of the horses. There are some differences in the various animals in respect to temperament, but this factor seems to be more largely dependent upon natural tendencies than upon the effect of any special kind of feed. It would, of course, be folly to say that a well-fed horse will not exhibit more spirit and endurance than will a horse that is fed such scant rations that it is improperly nourished. But this experiment has as yet yielded no evidence to indicate that the use of either corn or oats induces either sluggishness or activity.

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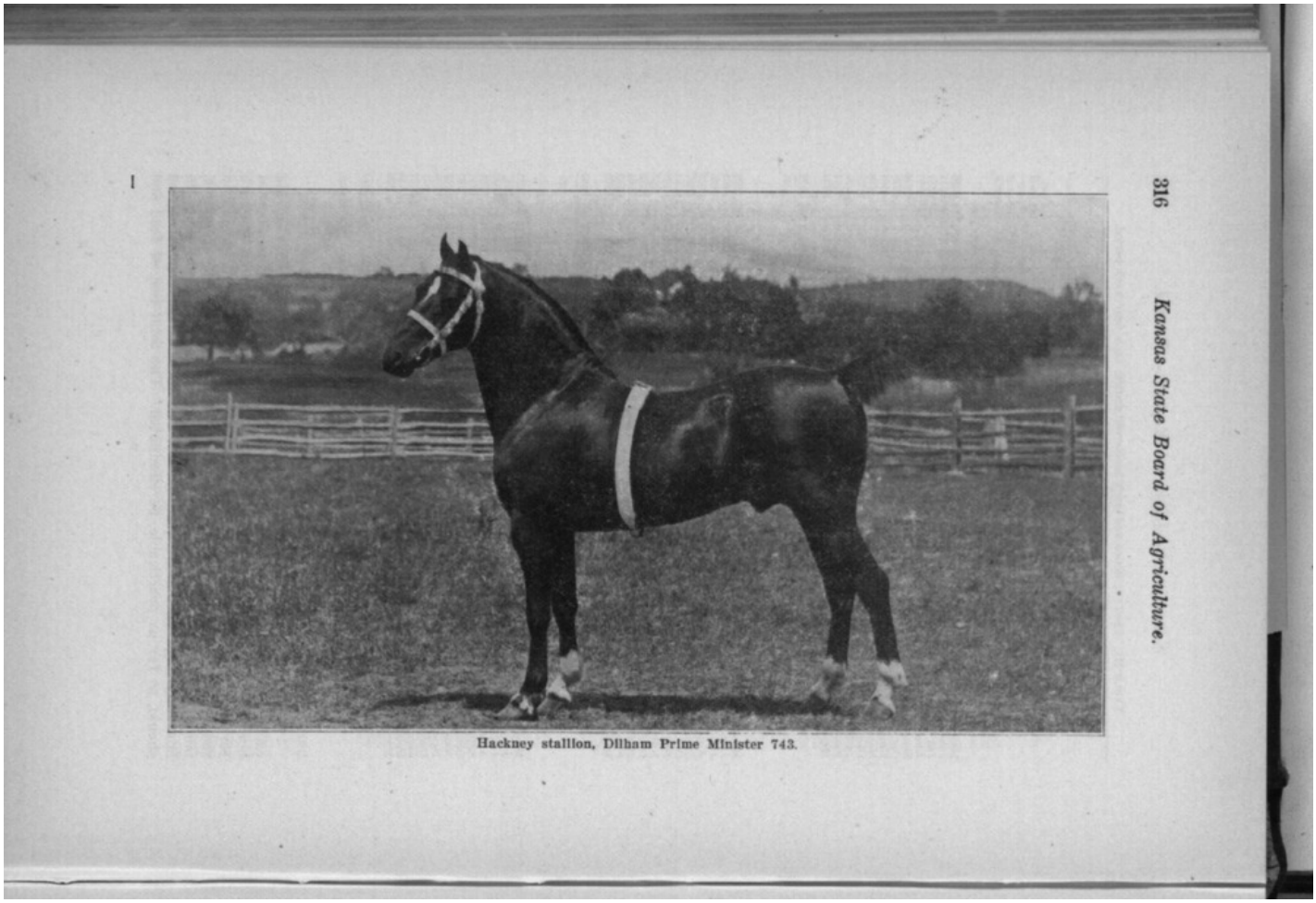
TABLE III. Feed consumed and work performed during each four-week period.

PERIOD.	JOE.					JAKE.				
	Feed consumed, pounds		Cost of feed.*	Hours work.	Cost of feed per hour of work.*	Feed consumed, pounds.		Cost of feed.	Hours work.	Cost of feed per hour of work.*
	Hay.	Corn.				Hay.	Oats.			
May 17 to Jun. 13..	504.00	485	$4 87	186.0	$0.0262	504.0	486	$6 57	186.0	$0.0353
Jun. 14 to Jul. 11..	459.50	472	4 61	201.5	.0229	459.5	472	6 26	201.5	.0311
Jul. 12 to Aug. 8..	497.00	476	4 79	184.0	.0260	497.0	476	6 45	184.0	.0351
Aug. 9 to Sep. 5..	500.00	472	4 78	216.5	.0221	504.0	472	6 44	216.5	.0297
Sep. 6 to Oct. 3..	504.00	460	4 72	155.0	.0305	504.0	460	6 33	155.0	.0408
Oct. 4 to Oct. 31..	504.00	432	4 56	160.5	.0284	504.0	432	6 07	160.5	.0378
Nov. 1 to Nov. 28..	504.00	394	4 33	122.5	.0353	504.0	394	5 71	122.5	.0466
Nov. 29 to Dec. 26..	504.00	348	4 06	12.5	.3248	504.0	348	5 28	12.5	.4224
Dec. 27 to Jan. 23..	504.00	338	4 00	7.5	.5333	504.0	338	5 18	7.5	.6907
Jan. 24 to Feb. 20..	502.25	336	3 99	0.0	.....	499.0	336	5 15	0.0	.....
Feb. 21 to Mar. 19..	499.00	307	3 80	21.0	.1810	495.5	307	4 86	21.0	.2314
Mar. 20 to Apr. 16..	498.50	417	4 45	220.0	.0202	483.5	417	5 84	220.0	.0265
Totals.....	5,980.25	4,937	$52 96†	1,487.0	$0.0356	5,962.5	4,938	$70 14†	1,487.0	$0.0472
	BILL.					FRANK.				
May 17 to Jun. 13..	504.00	487	$4 88	212.5	$0.0230	484.0	487	$6 50	212.5	$0.0306
Jun. 14 to Jul. 11..	459.50	470	4 60	154.5	.0298	447.5	470	6 20	154.5	.0401
Jul. 12 to Aug. 8..	497.00	469	4 75	132.5	.0358	493.0	474	6 42	132.5	.0485
Aug. 9 to Sep. 5..	501.00	464	4 73	145.0	.0326	464.5	464	6 21	145.0	.0428
Sep. 6 to Oct. 3..	504.00	458	4 71	161.0	.0293	477.0	458	6 20	161.0	.0385
Oct. 4 to Oct. 31..	504.00	414	4 45	104.5	.0426	502.0	414	5 89	104.5	.0564
Nov. 1 to Nov. 28..	504.00	408	4 42	141.5	.0312	489.0	408	5 78	141.5	.0408
Nov. 29 to Dec. 26..	504.00	362	4 15	38.5	.1078	453.0	362	5 21	38.5	.1353
Dec. 27 to Jan. 23..	504.00	352	4 09	25.0	.1636	504.0	352	5 32	25.0	.2128
Jan. 24 to Feb. 20..	502.50	350	4 07	35.0	.1163	448.0	336	4 94	26.5	.1864
Feb. 21 to Mar. 19..	504.00	333	3 97	64.5	.0616	425.0	317	4 67	62.0	.0753
Mar. 20 to Apr. 16..	518.50	417	4 53	216.0	.0210	460.5	379	5 40	216.0	.0250
Totals.....	6,006.50	4,984	$53 35‡	1,430.5	$0.0373	5,647.5	4,921	$68 74‡	1,419.5	$0.0484
	TOM.					DICK.				
May 17 to Jun. 13..	323.50	478	$4 11	196.0	$0.0210	504.0	478	$6 50	196.0	$0.0332
Jun. 14 to Jul. 11..	376.00	470	4 27	197.0	.0217	459.5	470	6 24	197.0	.0317
Jul. 12 to Aug. 8..	389.00	476	4 36	179.0	.0244	497.0	476	6 45	179.0	.0360
Aug. 9 to Sep. 5..	319.50	470	4 04	226.0	.0179	504.0	472	6 44	226.0	.0285
Sep. 6 to Oct. 3..	340.00	460	4 07	180.5	.0225	504.0	460	6 33	180.5	.0351
Oct. 4 to Oct. 31..	414.00	408	4 06	87.5	.0464	498.0	409	5 83	82.5	.0707
Nov. 1 to Nov. 28..	358.00	402	3 80	121.5	.0313	504.0	402	5 78	121.5	.0476
Nov. 29 to Dec. 26..	327.00	408	3 71	115.5	.0321	499.0	408	5 82	115.5	.0504
Dec. 27 to Jan. 23..	325.00	386	3 57	88.5	.0403	493.0	394	5 67	88.5	.0641
Jan. 24 to Feb. 20..	326.00	362	3 43	64.0	.0536	481.0	364	5 34	72.5	.0737
Feb. 21 to Mar. 19..	309.50	327	3 16	72.0	.0439	441.0	315	4 72	64.0	.0738
Mar. 20 to Apr. 16..	336.75	417	3 80	188.0	.0202	461.0	388	5 48	183.0	.0299
Totals.....	4,144 25	5,064	$46 38‡	1,715.5	$0.0270	5,845.5	5,036	$70 60‡	1,706.0	$0.0414

* Corn, 40 cents per bushel; oats, 30 cents per bushel; hay, $8 per ton. †=plus. ‡=minus.

AMOUNT AND COST OF FEED.

Table III shows the amount of feed consumed by each horse during each four-week period of the experiment, together with the number of hours' work done, total cost of feed and cost of feed per hour of work for each of these twelve periods. The cost of feed per hour of work in those periods during which little or no work was done is, of course, much higher than the average. This suggests an important point in horse feeding: periods of partial or total idleness are expensive and should, so far as practicable, be eliminated. The total cost of feed and



Hackney stallion, Dilham Prime Minister 743.