tribute funds for the benefit of the public, which the individual would not do. He contended that it would be cheaper for the State to pay such loss than to run the risk from infected stock.

Another member argued that, in the case of a man having diseased stock through imperfect, badly-ventilated stables, the owner of such stock, and not the State, should bear the loss.

The questions of the laws of breeding and feeding were also fully discussed. The writer took the ground that old theories of breeding will not bear investigation, and that variation is the hope of the breeder. While some were opposed to this new view of the question, the majority were inclined to accept this interpretation.

Prof. Burnett, of Nebraska Station, gave an account of the feeding experiments in his State, whereby alfalfa hay and corn silage, with some meal, had enabled the feeders to lessen very materially the cost of beef and milk production. He favored the use of liberal amounts of protein and a careful study of "balanced rations." Others were of the opinion that palatability was of more importance than formulas in the practical feeding of live stock.

Our own judgment is that the "balanced-ration" theory has been overworked, and that it is more important to balance a ration with good sense than with any stated number of pounds of protein or any other nutrient. A balanced ration was never intended to be slavishly followed, but is given as a guide to the feeder.

One other breezy discussion took place at the close of the meeting, when one of the farmer Representatives in the State Legislature read a motion asking the Association to bring to the attention of Senators and Congressmen the need of securing an extension of the markets for farm products, by maximum and minimum tariffs, or otherwise. He claimed that the American farmer needed better and more extended markets for his produce, and that the man on the farm deserved some consideration at the hands of the tariff reformers. Manufacturers had held farmers by the throat long enough, and they (farmers) demanded some relief. A member jumped up at once after the resolution had been read, and said he was a "stand-patter," and advised farmers to have nothing to do with "tariff tinkerers." He claimed that protection was necessary in order to obtain funds to meet the expenses of government, and that home markerts were of more value to farmers than any foreign markets. When the motion was put, on a standing vote, the secretary declared a tie. A motion "to lay the resolution on the table" was finally carried. We were surprised to hear the Michigan farmers complain of their markets. We had supposed that they had one of the best markets in the world. Many Canadian farmers have looked with longing eyes towards the market in American cities, but it would seem to be another case of "Far-away hills looking green," and of "Distance lending enchantment to the view."

A hasty look about the Michigan Agricultural College convinced us that a wonderful growth has taken place during the fifteen years or more since we last visited the institution. The new agricultural building will be, when completed, one of the very best among the fine buildings devoted to a study of agriculture by the various States of the Union. Michigan seems to be going the other States one better. In live stock, the College seems to be strong. The appearance of the animals and stables reflect much credit upon Prof. R. S. Shaw, a former Canadian, and Prof. Anderson, of the Dairy Department, as well as upon their assistants. The large farm, of 700 acres, supplies plenty of food for the large stock, and seems to be well managed. President Snyder is to be congratulated on the large attendance of students (some 1,400, fifty per cent. of whom are taking agriculture), and upon the excellent work which this, the oldest of American agricultural colleges, appears to be doing. H. H. D.

Supplementary Cattle Feeds.

The subject of cattle feeds, with particular reference to the several classes of mill by-products, was discussed in a very acceptable address by Prof. Harcourt, of the Ontario Agricultural College, before the Western Ontario Dairymen's Convention, at Brantford. While, as Prof. Harcourt said, the practice of some experienced feeders leaves little to be desired, they having probably learned much from their forefathers, besides their own long experience, supplemented by the natural instinct of the feeder, yet there are many farmers who have not been bequeathed any valuable experience, and, further, there are on the market to-day many new feeds about which very little is known. Hence, there are many reasons why we should examine into the question of the composition of cattle foods.

FUNCTIONS OF FOOD CONSTITUENTS.

The parts of foods which furnish the materials for body tissue, for milk-making, and for heat and energy production, are: (1) Protein, (2) fat, (3) carbohydrates, (4) ash material.

Protein, so far as foods are concerned, is made up of two classes of substances—albuminoids (proteids) and amides. The amides are found in immature plants, and are not so valuable as the higher proteid materials. The albuminoids, which occur in grain, roots, and other forms of vegetable foods, are similar in composition to those found in milk, blood, and flesh. They are commonly called the "flesh-formers," as they are the only materials in the food which the animal can construct into flesh. They are also the source of such materials as hair, wool, hoof, horn, etc. Further, by the combustion of the albuminoids in the body, heat and mechanical force are developed, and, under some circumstances, they are split up with the formation of fat, but fat and carbohydrates, especially the latter, are the cheapest materials for this purpose.

The fats found in food are similar in composition to such substances as lard, tallow, etc., which are the common fats formed in the animal body. The fat may be either burnt in the animal system to furnish heat and energy, or deposited on the body as fat. As a heat and force producer, fat has a greater value than any other ingredient of the food.

The carbohydrates of the food are chiefly starch, sugars and celluloses, and form the largest part of vegetable foods. The latter substances form the stiff framework of the stems of plants and the hulls of seeds, and are only partially digested. These carbohydrate bodies are not permanently stored in the animal body, but serve, when burnt in the system, for the production of heat and mechanical work. They are also capable, when consumed in excess of immediate requirements, of conversion into fat.

The ash materials present in the food are the same as those found in the animal body; all that is accomplished by the animal is to select from the digested ash constituents those of which it is in want.

COMPOSITION OF FOODS.

The feeding value of a food is largely determined by two factors: (1) Its composition, (2) its digestibility. The first of these deals with richness of the food in protein, fat, carbohydrates and ash materials. The second determines the extent to which these various constituents become available in the body. A knowledge of the composition of a food is important, if it is to be used intelligently. Those foods which contain the largest amounts of the protein and fat, and the smaller percentage of crude fibre, are the most valuable. The following table gives the percentage amount of the various food constituents present in a number of the most common foods:

COMPOSITION OF CATTLE FOODS.

	Water.	Crude Protein.	Fat.	Soluble Carbohydrates.	Crude Fibre.	Ash.
Wheat	10.5	11.9	2.1	71.9	1.8	1.5
Oats	11.0	11.8	5.0	59.7	9.5	3.0
Barley	10.9	12.4	1.8	69.9	2.7	1.8
Corn	10.6	10.3	5.0	70.4	2.2	1.5
Peas	14.0	22.5	1.6	53.7	5.4	2.8
Timothy Hay	13.2	5.9	2.5	45.0	29.0	4.4
Clover Hay	15.3	12.3	3.3	38.1	24.8	6.2
Alfalfa Hay	8.4	14.3	2.2	42.7	25.0	7.4
Oat Straw	9.2	4.0	2.3	42.4	57.0	5.1
Corn Silage	79.1	1.7	0.8	11.1	6.0	1.4
Mangels	90.9	1.4	0.2	5.5	0.9	1.1
Turnips	90.5	1.1	0.2	6.2	1.2	0.8
Wheat Middlings	10.1	15.5	3.9	62.5	4.3	3.7
Wheat Bran	10.4	15.0	3.8	57.0	8.7	5.1
Cotton-seed Meal	5.9	44.2	13.6	24.6	4.8	6.9
Linseed Meal	9.1	30.4	7.1	36.9	10.6	5.9
Gluten Meal	7.1	38.8	3.4	47.6	2.0	1.1
Gluten Feed	8.6	25.0	4.6	54.8	5.9	1.1
Brewers' Grains	6.6	14.6	6.6	58.1	12.8	1.3
Oat Hulls	8.1	2.2	0.9	53.9	28.1	6.8
Dried Beet Pulp	2.9	8.5	1.1	65.9	15.2	6.4

The valuable forage plants of this country belong mostly to two families—the grasses and the legumes. June grass, red-top, timothy, and the cereal grain plants, are types of the former; and the clovers, alfalfa and peas of the latter. The most essential difference between the members of the two families of plants, when considered as feeding stuffs, is in the larger proportion of the protein in the legumes. For this reason they are very justly regarded as the better foods for growing stock and for general use on dairy farms.

EFFECT OF MATURITY ON COMPOSITION.

The composition of all dried fodders and roots, foods that are fed in an immature state, is liable to considerable variation. We find that the composition depends largely on the stage of maturity at which they are cut, and also upon the character of the manuring. In general, it may be said that, as a plant matures, the proportion of water, protein and ash matter decreases, while the proportion of carbohydrates, especially of fibrous material, increases. As this latter substance is largely indigestible, fodder crops deteriorate towards maturity. Young grass is much richer in albuminoids, and contains a smaller proportion of indigestible fibre than older grass, and is, consequently, more nourishing. The same comparison may be made between young clover and that which is allowed to mature for hay. It follows that fodder crops should be cut for hay before they reach maturity, and experimental work and general experience has fully demonstrated that these crops should be cut immediately full-bloom is reached. Alfalfa is an exception to this, because it very rapidly becomes fibrous, and should be cut in the early blossoming stage to obtain the best results.

Regarding the root crops, it has been found that, while fodder crops deteriorate towards maturity, because of the conversion of soluble forms of carbohydrates into the insoluble and indigestible fibre, roots crops, such as mangels and potatoes, improve, owing to the carbohydrates produced in this case being sugar and starch, both of which are of great feeding value.

The root crops do not contain a very large amount of the valuable food constituents, but, when fed along with the dried fodders, they probably have a food value much greater than their composition indicates. This is due to the increased succulency which they impart to the ration. The same applies to silage.

THE PURPOSE OF CONCENTRATED FEEDS.

The place of grain in a ration is to increase the proportion of protein and other digestible materials; or, in other words, to make the ration more concentrated. It is generally agreed that cows of 1,000 pounds weight need, approximately, 16 pounds of total nutrients daily. Animals that are thin in flesh, especially when fresh in milk, can consume two or three pounds more to advantage. Of these 16 pounds, approximately 2.5 pounds of protein is necessary, in order to enable the cow to produce large and continuous yields of milk. If a cow is fed all hay, she cannot eat enough of the food to obtain the amount of the nutrients mentioned. Thus, suppose a cow should be fed all she can consume of any palatable, dry, coarse fodder, such as good hay, she would have at her disposal the following digestible nutrients, approximately: Protein, 1.4 lbs.; fat, 0.4 lbs.; carbohydrates, 12.4; total, 14.2. It is clear that such a ration lacks in protein, as well as in total digestible matter. In order to overcome these deficiencies, recourse is had to the concentrated feeds, rich in protein, and sufficient is added to increase the protein to the desired amount. It is, of course, evident that the cereal grains, as corn, oats, wheat, etc., are not sufficiently rich in protein to very materially increase its proportion in the diet, though they increase the total amount of protein consumed per head. But these foods are rich in nitrogen-free-extract or carbohydrates that are easily digested, and are very useful when fed along with the coarser foods, which contain much fibre.

IMPORTANCE OF PROTEIN.

Pea meal, linseed meal, gluten feed, wheat bran and middlings are foods rich in protein, and are, therefore, most valuable components for a ration intended for dairy cows. On the other hand, it is evident that oat hulls, dried beet pulp, corn bran, and such low-grade materials cannot build up the protein side of the ration. They are also entirely unfit to be used as substitutes for linseed meal, gluten meal, gluten feed, and such nitrogenous materials.

What has been said serves to draw attention to the point, that, when purchasing foods, the percentage of protein they contain is of prime importance. The home-grown crops, especially the grasses and cereal grains, are more likely to be deficient in this than in any other constituent, but when clover or alfalfa hay are used as the coarse foods, the use of concentrates especially rich in protein is not so necessary.

WHAT TO BUY.

The shortage of coarse foods and grains the last few years has been the means of causing many feeders of live stock, particularly dairymen, to consider the advisability of purchasing certain of these mill by-products, for which, heretofore, they have had little or no use. Dairymen, too, are recognizing the fact that, in order to secure the best results from their cows, they must feed a ration richer in protein than can, as a rule, be compounded from the grains, hay and straw raised on the farm. The by-products best adapted to enrich the diet in protein are the residues from the manufacture of some specific product from the seed or grain, as, for example, oil from cottonseed and flaxseed, starch and sugar from corn, beer from barley, and flour from wheat, rye and buckwheat. All these by-products, which include cottonseed meal, linseed meal, dried brewers' grains, gluten meal, gluten feeds, and the various kinds of bran, middlings, etc., are very much richer in protein than the original seeds or grains, because the substance extracted from them consists of fat, in the case of the first two, and of starch or products rich in starch in the case of the others, thus proportionately increasing the protein in the residues. For this reason, all of these by-products have been found to serve an excellent purpose in the building up of rations. They are generally palatable and healthful, and, if judiciously used, do not con-