THE DAIRY.

Energy Value of Feeds Expressed in Therms.

EDITOR "THE FARMER'S ADVOCATE":

The casual reader is fairly well acquainted now with the word "calorie" or unit of energy. In these days of so-called health-squads among various sets of individuals, and when the general public is devoting more attention than ever to obtaining the utmost food value at low cost, a further glimpse into the problem of energy values will be of interest.

In a general way it is understood that a man at light work needs about 2,500 calories per day, most people eat considerably more: a fairly good meal supplies from 800 to 1,200 calories. Naturally, each food consumed supplies its own measure of energy: for instance, a teaspoon of sugar gives about 20, while two boiled eggs supply 180 calories. It is also worth noting that a lunch of about ten ounces of bread and a pint of skim milk will furnish 925 calories at a cost of roughly five or six cents; whereas an ordinary restaurant meal of soup, beef, potatoes, turnips, bread, butter and coffee will furnish only 940 calories, and will cost at least five times as much as the homely bread and milk.

Turning from this fascinating human side to a consideration of the dairy cow, the super-valuable economist of the farm, and her needs, it is recalled that feeding standards, based on a study of the digestible nutrients, that is, the protein, carbohydrates and fat, that are contained in feeding stuffs, have been available for the computation of dairy rations for over fifty years. The wise dairyman by their use, is able to derive the very best results from suitable combinations of the various feeds at his command, so as to obtain the maximum production of milk and fat. Sometimes the intelligent re-arrangement of a ration has resulted in a saving of five cents per cow per day for feed, and a gain of twenty per cent. profit.

A somewhat new expression is now finding its way into dairy literature, the word "therm" being employed to describe one thousand calories of net energy in feed. It has been introduced by Dr. H. P. Armsby of State College, Pennsylvania, who suggests it to include the combined value of carbohydrates and fat as used in the older type of feeding standards.

The word seems a happy choice; we are familiar with thermometers and thermos bottles. We know that "better" coal, containing more heat energy, quickly raises the mercury in the heat measurer when consumed in a stove. As all food may be rationally considered as the fuel of the body, the feeding problem is to make the best possible use of the fuel or energy value in the available feeds. Value is largely determined by the amount of energy it is possible to get out of feed and convert into other forms of energy, such as heat, work, meat, milk, etc. Much energy is lost in this conversion: with roughage, about forty per cent.; with concentrates, between ten and thirty per cent., by ruminants.

The gross energy contained in ordinary feeds varies considerably. Certain proportions of this gross energy are lost in the various processes in the animal body, the remainder is the valuable net energy values. It is only this net energy, the quantity supplied in excess of the animal's requirement for actual maintenance, which assists in beef or milk production.

Dr. Armsby classes nutrients under two heads: those going to form nitrogenous substances, and those used for heat, fat production and energy. The amount of digestible albuminoids is the measure for one, and the total heat value of the nutrients is used for the other. Thus we have just two terms, digestible protein and energy value. Here, then, is the new introduction, the word "therm" as a convenient name for representing one thousand calories or units of this net energy value.

It is just as well to have this perfectly clear, for the word therm is not to be found in every dictionary, and for some curious reason or other it is disguised by some writers under the expression "thermic unit."

It seems to be a simplified means of dealing with feed stuffs generally; for the values of carbohydrates and fat, which are frequently loaded with a rather bewildering array of figures (the carbohydrates being again sometimes sub-divided into percentages of fibre and nitrogen free extract) can by this new proposal be expressed briefly and calculated as therms.

The second important point which our dairymen will do well to notice is that as the result of abundance of experimental work a change has been made in the standard for rations, so that now only five tenths of a pound of protein is given as the maintenance requirement for a 1,000-lb. cow in place of the old figure or seven-tenths. In addition to that half pound of digestible true protein the maintenance requirement is expressed as six therms of net energy.

From the many excellent tables in bulletins published by the Pennsylvania State College it is easy to compute dairy rations from any feeds available by the dairyman, having due regard to the primary rules of the art of feeding, as well as the scientific necessity of balancing rations.

Supposing a cow is giving 20 pounds of milk testing 4.5 per cent. of fat, it is readily found that the requirements are 1.04 lbs. true protein, and 5.8 therms net energy. The total requirements therefore for maintenance and milk stand at 1.54 lbs. true protein and 11.8 therms net energy.

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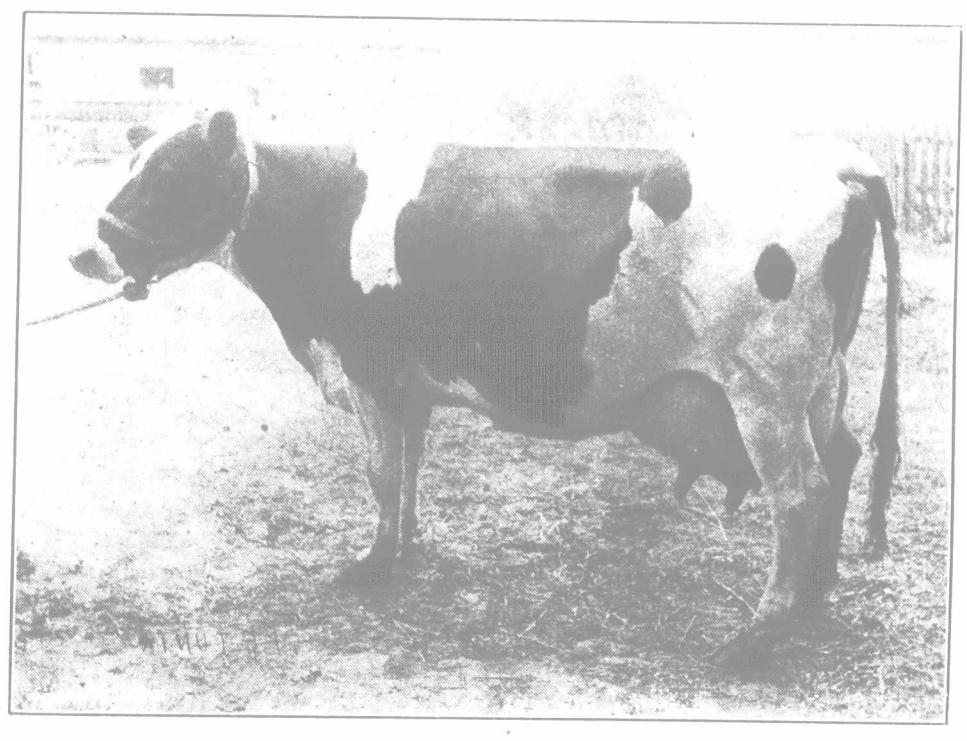
The Value of Pasteurized Whey.

Certain lines of farming are more profitable than others, owing to the fact that they furnish a by-product which has a certain value. Dairying is a well marked example. The by-products of butter-and-cheese-making have considerable value for feeding stock, particularly young animals. Skim-milk is recognized as an excellent feed for calves, pigs and poultry. Whey and buttermilk, while not so valuable as skim-milk, will reduce the cost of producing pork if fed judiciously. However, many feeders look upon whey as being unfit for animal consumption and do not consider it of sufficient use to draw it from the factory. Possibly because of the way whey and whey tanks are looked after at quite a large percentage of the factories, the product has little value. On the other hand stockmen have found that if it is properly pasteurized, pigs and calves do fairly well on it at a considerable saving in grain. Unpasteurized whey is not as good feed, nor is it as safe to feed as pasteurized whey, and yet although it costs only a trifle to pasteurize it at the factory only nine and one-half per cent. of the cheese factories in Eastern Ontario, and about fifty per cent. in Western Ontario pasteurized the whey in 1916.



Royalton Petunia 2nd 19366.
Seven-day record: Milk, 545.3 lbs.; butter, 25.17 lbs.

In the making of cheese the casein, albumen, and a large percentage of the fat in milk enters into the composition of cheese, thus leaving a small amount of ash and fat and a considerable quantity of milk-sugar in the by-product. The average composition of whey is 93.4 per cent. water, .7 per cent. ash, .8 per cent. protein, 4.8 per cent. carbohydrates—which are largely sugar—and .3 per cent. fat. This is only 3 per cent. less dry matter than is found in roots, which are considered so valuable for feeding stock. Patrons of cheese factories who have once used pasteurized whey recognize its value and would be loth to return to the day when sour, ill-smelling whey was returned to them in the cans which were to carry the milk to the factory the next morning. Theoretically and in practice, whey has a feed value, especially when it is fed sweet.

There are a number of reasons why whey should be pasteurized before it leaves the factory; for instance, there is a certain amount of fat left in it and this has a tendency to float on the top of the whey in the tank when it is not pasteurized. Consequently, there is an uneven distribution of this feed constituent to the farmers. Milk products constitute an excellent place for germ life to grow and produce putrefactive flavors. These reproduce very readily in sour whey, and become lodged in the crevices of milk cans, and unless extra care is taken it is impossible to remove them when washing the can. Consequently they start bad flavors in the milk, which sometimes develop considerably before the milk reaches the factory. When the whey becomes very sour the sugar which it contains is changed into lactic acid. T is reduces its feed value, and the acid affects the tin of the can. These evils are overcome by pasteurization. It is inconsistent for cheesemakers to ask their patrons to adopt improved methods of caring for milk so long as they permit them to put sour, foul-smelling whey into their cans. With the proper system of pasteurization many of the evils mentioned are overcome, and experiments have proven that there is practically the same percentage of fat returned to the farmer with the whey as is found in the whey when it comes off the curd. This is not the case under the system in vogue in practically ninety per cent. of the factories in Eastern Ontario. The disease known as tuberculosis is finding its way into many herds, and it is possible that the germs of this dread disease may be carried through the medium of whey and infect animals to which it may be fed. These germs are destroyed by the application of heat at 155 to 160 degrees, or the temperature which is recommended for pasteurizing whey. From this standpoint, together with the extra ease with which the cans can be cleaned when the whey is returned sweet, are sufficient arguments to warrant patrons of every cheese factory demanding that the whey be pasteurized.

The feed value of whey should also be considered. Regarding whey for calves, information in "Feeds and Feeding", by Henry, is to the effect that whey which is acid and often loaded with germs deranges digestion and is unsuited for calf feeding, but where it is pasteurized and can be obtained sweet and undiluted, whey may give fair results when fed under the strictest rules as to quantity, regularity of feeding and cleanliness of the vessels employed. In an experiment recorded, calves fed whey gained from one to one-and-one-third pounds per day, while skim-milk-fed calves made two pounds gain. At the Kansas Station, calves were changed from skim-milk to whey when from three to five weeks old, and from 10 to 14 pounds of whey were fed daily together with alfalfa hay and ground oats. These calves were thrifty and healthy but not quite so fat as those getting skim-milk. The protein part of the milk goes into the cheese, consequently whey should be supplemented with feeds rich in this nutrient. Feeds which are high in protein, such as bran and linseed meal, should be combined with it. Whey is more generally fed to hogs than to calves, and results show that it has considerable value. The experiments carried on in different parts of the country go to show that whey is worth about half as much as skim-milk for pig feeding. No set amount can be given, as the value depends largely on the price of other feeds, and age of animals. For instance, when feeding corn and barley meal it was found that a thousand pounds of whey are equal to a hundred pounds of cornmeal for fattening swine. In another experiment 744.5 pounds of sweet whey was equal to 100 pounds of mixed meal. Figuring meal worth $2.40 per cwt. at the present time, this would give whey a value of practically 32 cents per hundred pounds, and yet some dairymen claim that it has no value.

Taking the amount of milk delivered to the factories in Eastern Ontario and dividing it by the number of patrons, it is found that on an average a patron delivers to a factory about 33,000 pounds of milk per factory season. Considering that for each 100 pounds of milk there are in the neighborhood of 90 pounds of whey, this would be worth about $94 to each patron for feeding hogs. Of course, with grain only half the price, whey would have only half the value.

When whey is run off the vat it has a temperature around 97 or 98 degrees, and pasteurization should begin then in order to prevent the development of acid and to take advantage of the temperature. By means of steam from the boiler the whey in the tank should be heated to 155 degrees. This temperature arrests the growth of bacteria and if the tank is properly constructed and has a tight cover, the whey will be warm and sweet when it goes into the patrons' cans the following morning. Care should be taken not to raise the temperature above 160 degrees as there is danger of precipitating the albumen and causing the whey to be slimy. The whey tanks should be cleaned out and scalded every day in order that no bacteria be left to act as a culture. At some factories a man is engaged by the season to measure out the whey to each patron and then thoroughly clean the tank, after which live steam is injected to destroy any germs which might be lurking in the corners or crevices of the tank. Unless the pasteurizing can be done properly and the tanks thoroughly cleaned every day, the results will be disappointing. This work cannot be done for nothing, and as the patrons reap the full benefit they should pay all expenses. It takes a little extra fuel to heat the whey to the temperature mentioned, but at the present price of fuel and labor it is doubtful if it would amount to much more than one-half cent per hundred pounds. True, it may require a little larger boiler than the one in use, and extra piping and a pump will be necessary, but considering everything the expense is a mere trifle as compared with the advantages of having the whey always delivered sweet. In the very near future every cheese factory should be equipped to pasteurize the whey; in fact, the patrons should demand it.