Some Aspects of the Feeding and Efficiency of Dairy Cows

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THE efficiency with which various kinds of livestock convert the gross energy of the feed they consume into energy in human feed varies greatly. Taking our livestock as a whole only a fraction of the energy is recovered in animal produce. Leitch and Godden for instance arrived at the conclusion, that in Great Britain under conditions of adequate feeding only 8·7 per cent. of the energy in the digestible nutrients consumed by all livestock would be recovered in the different types of animal produce. Measured on the basis of the efficiency with which they convert either digestible nutrients or nett energy into human food, dairy cows rank first among all livestock. Furthermore, the food of the dairy cow consists mainly of substances which are unsuitable for human consumption, while the food of, for instance the pig and particularly that of the fowl, come very near that of man. It can be said in general, that our livestock, including the dairy cow, are somewhat inefficient in the sense that they must consume large amounts of material before they begin to produce anything at all.

The low percentage of transformation, which even in the case of high producing dairy cows does not come to more than 30 per cent., and the fact that feeding stuffs total more than half the cost of milk production are the main limiting factors for the output of dairy produce, not only for the world household economy as a whole, but also for the individual dairy farmer's economy. It is of the greatest importance therefore, that we utilize the potentialities of our dairy cattle as efficiently as possible and feed them with food produced as cheap as possible, preferably such food which fit into our agricultural system in rotation with crops for human consumption.

The value of a dairy cow is determined by (1) her capacity to produce milk, (2) her capacity to breed regularly and to pass her good qualities on to her offspring and (3) the length of her useful life. High yields are apt to be reduced by ill health and a sound and strong constitution is therefore very essential. Good animals kept in good health will make better use of food resources than the poor and indifferent ones and therefore in order to obtain the best results good feeding must be combined with efficient breeding, selection, rearing and management.

No less than about half the total quantity of digestible energy consumed by an average good dairy cow is used for the maintenance of her body, heat production, &c. (In the resting condition all the metabolic processes continue to function and a certain amount of energy is therefore required) if for instance a cow is producing about 30 lb. of milk with 4 per cent. fat daily, just about

half of the digestible energy is required for maintenance and of the second half—the production ration—which is used for milk production only about $\frac{2}{3}$ will be recovered in milk. The other $\frac{1}{3}$, or $\frac{1}{6}$ of the total amount of food, is lost as energy required for the process of milk formation. It will therefore be seen in this example, that the energy loss for maintenance is 3 times as great as the energy loss for milk formation. In the case of low producing cows much less than half of the total amount of food digested is used for milk production. For a cow, for instance, producing 300 gallons of milk with 4 per cent. fat in a year only about 40 per cent. of the ration will be used for milk production, while 60 per cent. will be used for maintaining her body. This clearly stresses the economical importance in dairying of the maintenance ration which varies only according to body size, but is the same for low and high producing cows. An animal that eats no more than maintenance ration has obviously an efficiency of zero and the efficiency rises as production increases. For milk production we must aim at keeping cows with a low maintenance requirement and with a capacity to deal with large amounts of food for production. The maintenance ration must supply a certain minimum amount of energy represented in terms of digestible protein and total digestible nutrients in order to maintain the animal in constant weight and health. Furthermore the maintenance ration has to supply the animal with all the essential minerals and vitamins as it by no means follows, that because an animal is doing no work or producing no milk, that any of these aspects of its ration can be neglected for any length of time. The food for maintenance has therefore to be of a high order both in regard to quantity and quality and this holds good to an even greater extent in feeding for milk production. Animal digestion does not, of course, recognize any such division between the maintenance ration and the food for production, but deals with the total nutrients supplied. For the practical dairy farmer this division may not appear to have any importance, as he is feeding not only to keep his cows alive, but also to obtain an economical profit. The division, however, makes it possible for him to estimate as to how much of the total food fed of necessity is used for maintenance and therefore lost for production and thus enable him to calculate the expenditure involved in food before a certain production can be achieved.

The milk producing capacity of a cow is essentially inherited and for most high producers combined with a strong constitution. As a rule additional feeding beyond the inherited capacity of a cow will not influence the amount of milk to any appreciable degree. Any additional food given in an endeavour to increase the milk still further will be wasted, as all that the cow can do is to store the excess nutrients in the form of body fat. This is a very important point to keep in mind particularly when dealing with cows of low producing capacity, a fact which is often overlooked in this country. An experiment carried out at Polonnaruwa Livestock Farm with 10 low yielding Scindi cows proved this theory. From the date of calving these cows were fed very liberal amounts of concentrates in order to find out whether this would stimulate the milk yield to any considerable extent. The milk yields, however, were hardly affected by this heavy feeding, but the cows put on weight. On the other hand it is evident, that after allowing the cows

enough feed to cover their maintenance requirement, it would be poor business not to furnish the full production ration and thus meet the complete requirement of the cow for milk she is capable of yielding. The economic importance of increasing the output of milk per cow and her efficiency to transform feeding stuffs into milk, has led to several experiments investigating into the possibilities for reducing the maintenance requirement by artificial means, mainly by controlling the activity of the thyroid gland. The opinions as to the possibilities in this field are, however, very varied.

The nett energy for maintenance should primarily be produced by roughage,the value of which unlike those of concentrates are still not adequately known. Several authors have given formulae for estimating the digestibility of roughage from figures for protein and crude fibre with the aid of regression equations, but more precise methods are still needed as marked differences are found in the estimation of different roughage. Experience in various temperate zone countries shows, that relatively good milk yields can be obtained by feeding roughage alone ; however, if higher yields are to be reached, or if the production capacity of a good cow is to be fully utilized, the administration of protein rich concentrates is generally necessary. It is very common in those countries to see cows yielding even as much as 30 lb. of milk daily being fed solely on hay, grass, roots or silage, but as a rule it can be said that the feeding of roughage provides food not only for maintenance but also for good part of the milk produced. The application of new technical developments will undoubtedly enable the Livestock industry in those countries to rely still more on farm grown fodders and pastures and thereby help to reduce the cost of production and also make the dairy cow still more useful in their agricultural system.

In the tropics the contribution of roughage to rations for dairy cows seems to be entirely different from that of temperate countries, and even when considering the roughage fed the need for supplementary feeding of concentrates in the tropics is much greater than one actually would expect. The main reason for this seems to be the difficulty of providing the dairy cow in the tropics with an adequate supply of green fodder of high nutritive value. Most of the more advanced dairies in Ceylon adopt a system of " partial stallfeeding " where the cows are allowed a certain amount of grazing, while the bulk of the feed, composed of fodder-grass and concentrates, is fed in the stall, the most commonly fed grasses being Napier and Mauritius grass. The amounts of these grasses consumed by cows are, however, surprisingly low when compared with the roughage intake by dairy cows in temperate zones. Feeding trials carried out at Polonnaruwa Livestock Farm showed that the maximum amount of Napier grass (harvested when 4 ft. high during rainy season) a full grown Scindi cow in milk woud consume was just about 60 lb. daily. Similar, but more comprehensive experiments carried out in Jamaica had shown a daiy consumption of 51 lb. of Napier grass by 825 lb's cows and that this ration would furnish a cow of this weight giving 14 lb. of milk with only 2/5 of the energy and $\frac{1}{4}$ of the digestible crude protein, or not even enough to meet the maintenance requirement. This very low figure for consumption (cows in temperate countries consume freely

125—150 lb. of grass daily) and the low nutritive value make such grasses unsuitable for feeding high producing cows, unless they are cut at a very young stage, and they must of necessity create a need for heavy feeding of high protein concentrates. It should in this connection be kept in mind, that the process in ruminants, involving as it does, rather prolonged bacterial fermentation, is well adopted to make use of roughage, but is wasteful as regard big quantities of concentrates. The failure on the part of cows in the tropics to consume bigger quantities of these fodder grasses has not yet found its explanation. It might be that the nutrition of dairy cows is not merely a question of feeding the cow, but also a question of feeding properly the cellulose splitting bacteries in the rumen. While experience and research work have shown the types of food required for maintenance and increased production in milking cows, it is only now that evidence is beginning to accumulate on the part played by minor or trace elements and the microbiological activity in the alimentary tract.

We should in this country try to get away from the heavy feeding of concentrates necessitated by the feeding of coarse fodder grasses. The way to cheaper and more rational feeding of dairy cows in the tropics should be to turn from the feeding of coarse fodder grasses to finer leafy and more succulent fodders and pastures. Considerable attention should be devoted to better management of our grasslands in order to obtain improved quality and increased production. Appropriate measures in this direction would produce more effective results than any other means, as pastures and preferably mixed pastures with both legumes and grasses, without comparison are the cheapest source of food for dairy cows.

SUMMARY

About $\frac{2}{3}$ of the total quantity of digestible energy in the feed for milk production is " lost " for maintenance and milk formation. The loss for maintenance is 3 times that for milk formation.

Milk yields are proportional, not to the total ration, but to the amount of food eaten over and above the amount required for maintenance, hence the heavier yielder is the more economical producer.

The nutritive value of tropical fodder grasses is low when compared with that of temperate zone fodders. Dairy cows in the tropics are not able to consume enough of these grasses to meet even the maintenance requirement. Heavy feeding of concentrates is required if coarse fodder grasses are fed.

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