NUTRITION AND ANIMAL HEALTH IN NEW ZEALAND

A Consideration of the Role of Pasture in the Causation or Spread of Disease.

by

Dr. I. J. Cunningham, Animal Research Station,
Department of Agriculture, Wallaceville.

A discussion of the relation of nutrition to animal health in New Zealand becomes essentially a discussion of the adequacy of pasture as a food for stock, for in New Zealand we rely almost entirely on pasture in its various forms to provide nutriment for our domestic animals. I propose, therefore, to deal with the subject in a very general way and to attempt to indicate special features of pasture farming which constitute danger to the health of stock.

Before doing this it is of interest to consider the evidence of the general adequacy of stock nutrition in New Zealand. Even a superficial examination leads at once to the broad conclusion that our farming methods are, in the main, satisfactory for the health and the production of our stock. For example, certain areas support, and do well, as many as six to ten sheep per acre or one cow per acre; in all, an area of thirty-one million acres, just over one-half of which is improved, carries thirty-one million sheep, four and a half million cattle, as well as pigs and horses.

This population remains fairly steady and an approximation of the annual stock increases by breeding can, therefore, be obtained by examining the figures for the annual slaughtering at meat works. These figures vary slightly from year to year but in 1940 approximately one million pigs, one million calves, 600,000 cattle, 4½ million sheep, and ten million lambs were slaughtered.

In 1940, wool production ranked fourth in the world whilst sheep population was seventh. Fleece weight was, therefore, high though the comparison should be made with due regard to differences in breed of sheep and quality of the wool.

Dairy cow production of an average of 490 gallons of milk and 220 pounds of fat per annum compares favourably with Great Britain, 490 gallons of milk and 186 pounds of fat; United States of America, 412 gallons of milk and 157 pounds of fat; but unfavourably with Denmark, 720 gallons of milk and 274 pounds of fat.

Other evidence concerning production might be brought forward but what I have quoted is sufficient to give a broad picture.

Concerning the incidence of disease I have been unable to find suitable data on which to make comparisons between this and other countries except in respect to culling or losses amongst dairy cows. A comparison of dairy cow wastage is possible between Ward's figures for New Zealand and those issued in 1934 by the British Economic Council's Advisory Committee on Animal Diseases. Ward's figures for the last three years have been summarised and in this form they refer to a total of approximately 470,000 cows. The Economic Advisory Council summarised three individual surveys and the total number of cows dealt with was approximately 80,000. After excluding sale for dairying purposes, the annual wastage in New Zealand was 15.2 per cent.; in Great Britain 17.9 per cent. In New Zealand the proportion of cows which died or were culled because of disease was 8.2 per cent. of the total; in Great Britain 12.7 per cent. While many of these diseases may have been of other than nutritive origin

it is possible that the nutritive state of the animal may have contributed to its susceptibility. Loss due to those diseases most likely caused by faulty nutrition (here I include acetonaemia, grass staggers, milk fever, bloat, etc.), was 1.4 per cent. in New Zealand; 2.3 per cent. in Great Britain. These figures should not be taken as indicating anything but a very general comparison of dairy cow wastage in the two countries; they demonstrate, however, that in New Zealand the wastage is at least not abnormally high when compared with Great Britain.

The evidence presented, very briefly and sketchily, suggests that our total stock population, its production, its reproduction and the incidence of disease, are in the main fairly satisfactory. In so far then as these criteria can be taken to indicate adequate nutrition, the nutrition of our stock must also be fairly satisfactory. I do not suggest that we adopt a complacent attitude towards the position but I do suggest that there is no evidence that pasture per se, is inimical to the health of stock.

Although pasture under ideal conditions may be nutritious fodder there are several features of pastoral farming which lead, directly or indirectly, to impairment of health or production and in some cases to actual disease, and it is with these features that I propose to deal.

1. Uneven Supply:

As you know, the chief factors governing pasture growth are soil temperature and soil moisture. At temperatures below approximately 50°F. little growth occurs and after prolonged drought, grasses and clovers dry up and growth ceases. Thus winter cold and summer or autumn drought may very materially reduce pasture production. The food supply to the grazing animal is, on consequence, diminished.

To illustrate these points I shall make brief reference to a publication of Elliot and Lynch. These workers have shown that, over a period of eight years at Marton, the average production during the three winter months, June, July, August, was 15 per cent. of the total annual production; spring, summer and autumn average production was 39, 25 and 21 per cent. respectively. Whereas spring production was always high, the range for eight years being 34-52 per cent. of the total annual production, summer and autumn production varied respectively from 9 to 32 per cent. and from 12 to 36 per cent. of the total, the years of low production being dry years. The adverse effects of low winter temperatures and summer and autumn drought on pasture production were thus clearly demonstrated as also were the beneficial effects of spring and summer warmth and rains. Not only does quantity of available food vary but even more important is the variation in quality. Rapidly growing young grass is richly supplied with protein, minerals and carbohydrates in a highly digestible form. It is also well endowed with carotene. Pasture at a mature stage of growth contains less protein, less mineral matter and less carotene and the carbohydrate and other constituents are very much less digestible. The feeding value of pasture may thus alter tremendously with stage of growth. It becomes low as ensilage or hay which are virtually the only forms in which it is now saved to tide over the periods when production of pasture by growth is at its slowest.

The grazing animal then is exposed to violent fluctuations in the quality, and in most cases also the quantity, of its food supply. In the winter, for example, growing grass is sparse and supplementary feeds when provided are of low nutritive quality; in the spring growing grass is abundant and of high succulence, high digestibility and high nutritive properties. The changeover between these rations

is made more dramatic by the practice of conserving spring growth for the use of cows after parturition.

It is a recognised fact in good animal husbandry that the plane of nutrition should be maintained at a moderately even level and particularly that sudden changes in the nature of the diet should be avoided. Departure from both of these precepts is inevitable under grazing conditions.

It is not easy to assess the extent to which the variations in quality and quantity just referred to are responsible for clinically recognisable disease.

There is, amongst dairy cows, a high incidence of disease during spring, the milk fever, grass staggers, and acetonaemia group being particularly rampant at that time. Though the etiology of these diseases is by no means fully understood, it is recognised that they occur most frequently in the recently calved animal. Their association with spring flush of growth in New Zealand may, therefore, be due merely to the coincidence that it is arranged for cows to calve at that time. The possibility that diet is a contributory factor cannot, however, be entirely dismissed. Some, at least, of our veterinarians attribute a proportion of these diseases to sparse and innutritious winter feeding.

The association of facial eczema epizootics with flush autumn growth following dry hot weather is more definite though the position is less clear in respect to sporadic cases.

Failure of the supply of grazing for ewes approaching lambing is believed to be responsible for the occurrence of pregnancy toxaemia - a ketosis which affects chiefly those ewes bearing two or more foetuses. The failure may be due to overstocking, to a late spring, or even to accidental loss of pasture through flooding and silting over of fields.

Another "unevenness" which may lead to disease is unevenness in growth of components of a pasture sward. For example, the high content of clovers which sometimes develops in pastures during the latter part of spring is held to be responsible for the incidence of bloat in dairy cattle.

2. Specific Deficiencies of Pasture:

A feature of pastoral farming is the complete dependence of the stock of any farm on the grass crop of that farm. The diet is not supplemented by fodder grown in other different areas, so that stock kept on a tract of land deficient in an essential mineral, develop symptoms of deficiency of that mineral.

The best illustration of this circumstance in New Zealand is bushsickness, due, we now know, to deficiency of cobalt in the pasture. The elucidation of this problem has been followed by elaboration of practicable means of control.

A deficiency of iodine has been demonstrated in certain areas of New Zealand notably in parts of Southland, Otago, Canterbury, Westland, and Hawke's Bay. Occasional outbreaks of goitre in newly-born lambs have been recorded, for example, that at Wanaka in 1930.

Phosphorus deficiency has been recorded in New Zealand amongst dairy cows, the condition being known locally as Waihi disease. This name was given to the disease because of its high incidence round Waihi in the Taranaki Province. The disease was said to be cured by phosphate licks. It is not now seen; probably the free use of superphosphate and pasture improvement are responsible for its disappearance.

Various bone abnormalities of sheep, including osteoporosis and rickets, have been observed. The conditions leading to their occurrence are not yet fully understood.

3. Toxic Weeds:

Another specific hazard to which grazing animals are exposed is the consumption of toxic weeds or trees growing amongst the pasture. This hazard is, of course, almost non-existent in high-grade pastures but may be high in unimproved or rough country.

It is unnecessary to go into detail in this section and I shall simply mention the nervous condition induced by tutu in cattle, the liver damage caused in cattle by ragwort, and the lethal effects of Ngaio on cattle and sheep.

4. Fungi Parasitic on Pasture:

Fungi sometimes constitute a danger to grazing stock or to stock fed on pasture saved in the form of hay or ensilage.

The genus Claviceps is the most outstanding example of this danger. Claviceps purpurea parasitises many grasses and, when sufficient sclerotia are formed, these become a grave menace to the health of stock. Cases of lameness and peripheral gangrene have been seen in cows fed ryegrass hay containing ergot sclerotia; lameness and loss of limbs in cattle on infected fescue grass is probably due to the ingestion of ergot sclerotia though this is not settled beyond doubt. It is of interest that sheep fed ergot sclerotia do not become affected in the limbs although ulceration of the tongue and parts of the alimentary tract occur.

The ingestion of sclerotia of Claviceps paspali which grows on paspalum in suitable seasons, produces nervous in-co-ordination in cattle.

5. Intoxications of Unknown Origin:

Certain diseases as yet not fully understood occur in stock which are grazed on pasture at a particular stage of growth or pasture growing on a particular area. These diseases include facial eczema, some of the photo-sensitivity diseases, enzootic icterus of sheep, ryegrass staggers of sheep, and scouring of cattle on peat pastures in the Waikato district.

The circumstances under which pastures become liable to cause facial eczema are sufficiently well-known to render it unnecessary for me to undertake any detailed description. Many lines of enquiry point to the same conclusion, namely, that pastures with a history of exposure to high temperature and dryness followed by warm rain and rapid growth, are specially liable to be dangerous. Up to the present time no pasture toxin has been isolated.

Photosensitisation, as distinct from facial eczema, is known in New Zealand and the condition which occurs in sheep in the MacKenzie Country of the South Island is perhaps the best example. The etiology of this disease is unknown and its classification as a pasture intoxication is adopted, provisionally, on analogy with other photosensitivity diseases such as hypericism. In such diseases sensitisation to light is brought about by absorption into the blood stream of a pigment which occurs in the herbage.

Enzootic icterus is a disease of sheep with a very acute course. It occurs repeatedly on the same area and sheep brought in from healthy areas show symptoms a year or more after coming on to the affected farms. The disease is

not contagious and the symptoms, in fact, coincide closely with those of copper poisoning. No abnormally high source of copper can, however, be demonstrated, and the etiology of the disease is at present quite unknown. The outstanding feature of this disease is its occurrence in stock kept on certain more or less well defined areas of land, most of which are in the King Country or the lower Waikato districts.

Ryegrass staggers of sheep occurs in both Islands, in the late summer or early autumn. The disease is characterised by the development of generalised tonic muscular spasm after a short period of exercise. In most outbreaks the pasture is dried up, but one outbreak has been observed on an abundant growth of green ryegrass sown three months before while others have occurred on aftermath of hay. Information on etiology is meagre. In one experimental case, the only one for which grass was available, a recovered animal developed symptoms after being fed dried grass cut from a field during an outbreak. This suggests that the causative agent might be some abnormality in the pasture.

Chronic scouring in cattle on some of the peat country in the Waikato is in many respects similar to a condition which occurs on "teart" pastures of Somerset. In both instances treatment with copper sulphate appears to be curative. Teart pastures are high in molybdenum and British workers have shown that molybdenum administered by mouth to cattle causes scouring. The molybdenum status of the Waikato peat pastures is not yet known.

6. Parasitic and Bacterial Hazards:

An important hazard to which the grazing animal is exposed is the possibility of ingestion of internal parasites and of the infection of certain bacterial diseases.

You will recall that the stomach and intestinal strongyles exist as adults in the alimentary tract of the host. Females lay eggs which pass out in the faeces and which subsequently develop to an infective larval stage. These third stage or infective larvae become adults only after ingestion by the host animal. It is apparent, therefore, that spread of parasitic infestation depends on:-

1. The excretion of parasite eggs in the faeces of already infected animals.

2. The development of these eggs to the infective larval stage.

3. The ingestion of infective larvae.

The heavy concentrations of stock on highly nutritive pasture is obviously a prime factor in increasing the potential spread.

Certain other features of pastoral farming may also favour spread of parasitic infestations - for example, variations in climate and the type of herbage.

During dry periods as fodder becomes more scarce, animals feed closer to the ground and cover a greater area to obtain their daily food requirements - they thus become exposed to the possibility of ingesting a greater number of larvae. When dry periods become drought development of strongyle eggs to the larval stage may be temporarily suspended. After rain the humid conditions favour mass hatching of the eggs and very heavy infestations can occur.

Drought may also favour infestation by another parasite - the liver fluke. Under drought conditions sheep wander into creek beds or into swamps in search of water and

succulent fodder; it is in these damp areas that the cercaria of the liver fluke are found, provided, of course, an appropriate intermediate host snail is present. Fluke disease and black disease may subsequently occur.

Type of herbage is known to influence migration of strongyle larvae. Short green grass pastures and short clover pasture favour accessibility of larvae to the sheep since the larvae can reach the tips without being diverted along lower leaves which are not eaten.

Bacterial Diseases:

Just as parasitic infestation is spread through ingestion of infectious material so also is the infection of many bacterial diseases transmitted.

In New Zealand the more important diseases of which infection is sometimes or always transmitted by ingestion of the causative organism with infected fodder are:-

Tuberculosis	Black disease
Johne's disease	Blackleg
Contagious abortion	Entero-toxaemia
Anthrax	

In Johne's disease and contagious abortion the danger of spread from one grazing animal to another is particularly well illustrated. The infective agent of Johne's disease is excreted in the faeces in large numbers. The bacillus will live in the soil for long periods and will remain a danger to healthy cattle grazing on infected areas.

The organism which causes contagious abortion is discharged on to the ground with infected foetal membranes and other discharges. It is not so resistant as the bacillus of Johne's disease but will live up to a period of about three months under suitable conditions and during that period is infective.

These two diseases, therefore, exemplify the point I wish to make, namely, that when nutrition is obtained by grazing there is a definite hazard of spread of certain bacterial diseases.

I have attempted to show that whereas the nutrition provided for our domestic stock, drawn largely from pastures as grazing or saved as hay or ensilage, is in the main satisfactory for the health of stock, yet disease may occur in grazing animals through certain defects inherent in the grazing system. To recapitulate, these defects are:-

1. Unevenness of fodder supply.
2. Specific deficiencies, mainly mineral, of certain areas.
3. The presence of toxic weeds in pasture.
4. Parasitism of grasses by toxic fungi.
5. Enzootic intoxications of unknown origin,
6. The fact that grazing favours the spread of some parasitic and bacterial diseases.

Proper management can contribute materially to the avoidance of some of these disease risks; the avoidance of others must await determination of the etiology of the diseases.

Under the present system the heavy spring and summer growth is utilised to provide for lactation of dairy cows

and for the extra food necessary in rearing lambs. Shortage of winter food is provided against by conserving surplus spring and summer pasture as ensilage and hay. These practices fit in with a normal cycle of seasons though trouble might still be experienced in abnormal seasons. Some reflection is merited on the question of whether fodder is conserved in the best possible manner. At the stage at which grass is made into hay or ensilage it is of low nutritive value. These foods are employed for dairy stock during the dry season or when production is low. Nevertheless it is during this period that the foetus is making its greatest growth and it is during this period also that the cow must restore the losses it has suffered during lactation. Better fodder at this time would undoubtedly improve the ability of the animal to enter on an exacting lactation. If even a portion of the ration were of grass dried in the young stage of growth the ration would be substantially improved. The economics of this procedure at least deserve study.

Again, the provision of pastures capable of production during the present lean seasons might be attended with useful results. In this connection the conservation of the so-called winter grass or even of swards of different species deserves consideration. These questions, of course, come properly into the sphere of others and I am certain that their importance is fully realised.

The eradication of toxic weeds on intensively managed land is a relatively simple matter but the problem is more complex on rough country. An example of one successful technique, however, is the use of sheep to control ragwort.

Management for control of parasites is perhaps less simple but the principle of preserving less infected pastures for susceptible animals combined with the intelligent use of drenching will go a long way to achieving control.

Control of bacterial diseases may be achieved by the identification and the removal of infected animals or by protective vaccination of healthy animals. The choice of method depends on the nature of the disease. The first method is practised to a small extent with tuberculosis and Johne's disease and the second is even now under consideration for contagious abortion.

To conclude, it can be stated that the diseases due to faulty nutrition in New Zealand arise mainly because of certain defects inherent in a system whereby the supply of nutrition is dependent on the supply of pasture. The extent of such diseases is not unduly high and could be reduced by enlightened measures for their avoidance.