PASTURE IMPROVEMENT WITH RELATIONSHIP TO ANIMAL DISEASE

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At a recent conference of the New Zealand Veterinary Association Dr J. Melville, then of the Grasslands Division, Department of Scientific and Industrial Research, Palmerston North, spoke on pasture improvement and its relationship to animal health and production. Dr Melville rightly stated that as no surveys had been carried out, there was no positive evidence that pasture improvement had led to an increase in disease in farm animals grazing these pastures.

I have no survey data on the incidence of disease before and after pasture improvement. However, it is frequently stated by farmers and veterinarians that pasture improvement, using the term in its broadest sense, almost inevitably leads to an increase in stock problems. As there is such a dearth of recorded information on this subject, I shall briefly discuss those stock problems whose apparent increase in incidence may be directly or indirectly associated with pasture improvement and then discuss in more detail our recent investigations into the part played by selenium in animal nutrition in New Zealand.

Nutritional and/or Metabolic Diseases

Several important diseases of livestock, although occasionally seen on unimproved farms, are far more prevalent on the highly improved farm. In some cases the disease entity appears to be directly related to the improved pasture; for example, bloat, and in other cases indirectly; for example, facial eczema. In some instances predisposing animal factors play a part; for example, parturition and milk fever.

Certain pasture types are in certain localities associated with specific problems. Thus, in the North Island on the typical highly improved perennial ryegrass and white clover pastures one can expect cases of milk fever, grass staggers, ketosis, bloat, facial eczema, ryegrass staggers, and autumn flush hogget ill-thrift. On the clover-dominant swards of the recently brought-in pumice lands in the centre of the North Island one can expect, in addition to the metabolic diseases, bloat and unthriftiness in cattle and white muscle disease and unthriftiness in sheep. On the subterranean clover pastures of Hawke's Bay enzootic icterus or chronic

copper poisoning may occur. On *Phalaris tuberosa* dominant swards one may encounter outbreaks of phalaris staggers in sheep.

Additional less important disease entities include ergot poisoning and paspalum staggers resulting from the ingestion of the ergot on the seed heads of ryegrass and paspalum. Certified white clover contains relatively large amounts of cyanogenetic glucosides which can act as goitrogens. Rachitogenic substances have been demonstrated in some improved grasses. Short-rotation ryegrass has been incriminated on one occasion as a cause of nitrate poisoning.

Copper and cobalt deficiency diseases are not generally associated with any particular pasture type, although it has been postulated that these diseases may be accentuated by pasture improvement. Injudicious application of molybdenum to enhance clover growth can, if applied to soils low or borderline in copper, lead to a copper deficiency syndrome. Heavy liming of acid soils may reduce the uptake of cobalt by pasture plants.

Microbiological Diseases

Wherever stock are run closely together one can anticipate a greater chance of spread of any infectious disease. Examples of this are salmonellosis, leptospirosis, and foot-rot.

The well-fed, fast-growing young animal is more susceptible to certain infectious diseases, in particular enterotoxaemia in lambs and blackleg in calves. Further, high milk producing cows are said to be more susceptible to streptococcal mastitis than are low producing ones.

Parasitic Diseases

As with the microbiological diseases, heavy stocking rates will greatly enhance the possibility of animals becoming infected with internal parasites.

In spite of the apparent increase of stock troubles after pasture improvement, the farmer almost invariably is assured of an increased income as a result of the increased carrying capacity. Further, the majority of the disease entities can be largely controlled by judicious managemental and therapeutic procedures.

As far as I am able to ascertain the only disease entity that can be controlled by pasture improvement is the autumn flush type of hogget ill-thrift. At Manutuke this entity can be prevented by grazing hoggets during the danger period on pure stands of white clover.

Selenium and Animal Health

Selenium until two or three years ago was of importance in animal health only because of its poisonous properties. Recent work in the U.S.A. and elsewhere, however, has shown that this

element is capable of preventing many of the disease entities previously thought to be due to a vitamin E deficiency. These diseases include necrotic liver degeneration in the rat and mouse, exudative diathesis in the chick, hepatosis dietetica in the pig, and white muscle disease in lambs and calves. However, selenium does not prevent testicular degeneration and embryonic degeneration in rodents, muscular dystrophy in rabbits, and encephalomalacia in chicks, all of which are preventable by vitamin E.

In New Zealand we have several disease conditions of sheep which are prevented or controlled by minute amounts of selenium. These are:

1. Congenital and delayed forms of white muscle disease in lambs. (Selenium may also control white muscle disease in hoggets folded on brassica crops, but this requires experimental verification.)
2. Barrenness in ewes associated with (1) .
3. Some forms of unthriftiness in lambs, hoggets, and adult sheep.

The detailed results of our observations carried out in the 1958-59 lambing season have been submitted for publication in the N.Z. ***Veterinary Journal,*** and brief accounts have already appeared in New Zealand farming journals. I now propose to describe the more interesting features of last season's investigations and include preliminary results from the current season's work.

White Muscle Disease in Lambs

This entity is commonly seen in certain seasons in widely scattered areas of the South Island of New Zealand and also in the Rotorua-Taupo area of the North Island. It is seen from September to January in lambs from birth up to 3 or 4 months of age. Outbreaks are commonly associated with certain managemental procedures.

In the South Island the disease characteristically occurs on country classified as stony silt loams, particularly where the pastures were previously unimproved or largely "run out". In the North Island it has appeared on Taupo ash soils. After ploughing, seeding with improved pasture strains, and liberal application of phosphatic fertilisers this country now produces. lush autumn and spring growth of legume dominant herbage. It is usual for white muscle disease to appear only after these paddocks have been down for three or more years; white muscle disease may then occur yearly for several years and then disappear. Its disappearance in some cases appears to be associated with an increase in the proportion of ryegrass to clover in the sward.

In some seasons white muscle disease is seen chiefly in the congenital form; in other seasons the disease appears to develop after

the lamb is born. On some properties both the congenital and delayed forms of white muscle disease occur in the same mob in the same season. Where a few cases of the delayed form of white muscle disease are seen at pasture, driving may precipitate a severe outbreak.

Investigations carried out by Wallaceville workers over the past two lambing seasons have shown:

1. That the congenital form of white muscle disease can be prevented by oral dosage of the ewe before mating with 5 mg of selenium (as sodium selenate) and at monthly intervals during pregnancy, and
2. That the delayed form of white muscle disease appears to be prevented by giving the lamb one oral dose of 2 mg of selenium at docking.

Barren Ewes

In some areas and in some seasons a large proportion of barren ewes (dry dry) are encountered on properties experiencing outbreaks of white muscle disease, particularly the congenital variety. During the last lambing season 15 trials have been carried out on such properties. Half the ewes in the trial flocks were drenched with 5 mg of selenium at monthly intervals from six weeks before tupping to late pregnancy.

On the three trial farms in the Rotorua-Taupo area initial results indicate that the lambing percentage in the selenium dosed ewes is from 20 to 40 per cent higher than in the controls. The barren control ewes came on heat at regular intervals but apparently did not hold. On the property where there was a 40 per cent difference there were only odd lamb losses from congenital white muscle disease. Early figures from the South Island trials indicate that most farms have enjoyed a good lambing percentage in both selenium dosed and control ewes.

Unthriftiness in Sheep

On some properties experiencing either form of white muscle disease a severe form of unthriftiness in lambs may in some seasons be apparent in lambs 4 to 6 weeks of age. On other properties there may be no apparent associated unthriftiness.

One of the worst affected areas experiencing pre-weaning lamb unthriftiness is the newly brought in clover dominant pumice country in the centre of the North Island. Trials carried out in this area last season in unthrifty weaned lambs showed that selenium immediately and dramatically controlled the mortality and the unthriftiness. Initial observations carried out this year suggest that selenium will also control the pre-weaning unthriftiness.

Last season, in addition to the trials in the Rotorua-Taupo area,

trials were carried out on unthrifty weaned lambs on 22 properties in the southern half of the North Island where white muscle disease had not been recognised. On 15 of the properties there was a statistically significant growth response to selenium. Preliminary trials indicate that selenium will not prevent or control the autumn flush type of ill-thrift.

The most satisfactory weight response to selenium has been obtained on the sandy, stony, and pumice soil types.

Wool Growth

In our investigations it was essential to find out whether the selenium we were giving to the sheep had any detrimental effect on wool quality and quantity. Our preliminary observations indicate that selenium administration has no adverse effect on wool quality; furthermore, on most trial properties there has been a significant increase in wool production both in ewes and lambs receiving selenium as compared to the controls.

Selenium and Cattle Diseases in N.Z.

White muscle disease in cattle is apparently very rare in this country. As far as I can ascertain it does not occur in calves on properties that experience the disease in lambs. However, on many properties experiencing unthriftiness in sheep on the pumice soils 'there is often a similar problem in 6 to 15-month-old and sometimes also in older cattle. Initial observations indicate that some of this unthriftiness is responsive to selenium.

Conclusions

Although direct experimental evidence is lacking, a number of stock diseases appear to be associated with pasture improvement. It is too early to postulate the exact cause of these disease entities. We have not yet carried out sufficient analyses to indicate whether or not there are deficient levels of selenium in the soils, pastures, and animal tissues from affected properties.

From the results of a Dominion-wide survey based on controlled animal trials and shortly to be undertaken, we hope to delineate those areas in terms of soil type and/or other environmental factors where selenium administration is likely to benefit unthrifty stock. Meanwhile our main aims are directed towards finding methods of selenium administration that are safe, effective, and practicable.

DISCUSSION

Q. (Mr David Sinclair, Manutuke): What is the depressant effect of selenium on worm egg count due to?

A. Selenium does not destroy worms or eggs; in other words, it is not anthelmintic. The depressive effect is directly related to better growing conditions of the sbeep.

Q. (Mr Cooper, Gisborne): Is the level of selenium-uptake seasonal and what are the effects of fertilisers?

A. We do not know as yet whether the uptake is seasonal. It might be tied up with fertiliser use, especially of superphosphate. However, we have no experimental evidence available.

Q. (Mr Pemberton, Geraldine): What is the cheapest and most effective method of detecting mineral deficiencies?

A. Contact the local branch of the Department of Agriculture to take pasture and liver samples for selenium, copper and cobalt analysis if warranted. A dosing trial could possibly be conducted.

Q. (Mr Lammerink, Winchmore Irrigation Research Station): Is the high incidence of worm eggs in the cobalt treated sheep of the trial reported by you (1,900 eggs per gramme compared with 670 eggs per gramme for the control sheep) accidental? If not, is this "response" in egg count a direct result from cobalt, or is it caused by the reduced resistance of the cobalt treated sheep?

A. Some overseas evidence points to a direct effect of cobalt on egg count. In other words, egg production may be increased by cobalt.