Maritime sheep farming — A problem of growth

The failure of sheep and cattle to thrive in Maritime pastures during the late summer months has always been a mystery. Now, two NRC scientists at the Atlantic Regional Laboratory in Halifax may have an answer to the riddle.

Cumberland county, the sleeve of rolling pasture and woodland that connects the main Nova Scotian peninsula with New Brunswick, looks like good grazing land for sheep. Lambs put out to pasture in late May mature in the normal manner, gaining weight and growing at expected rates. By late July, however, when the grazing is still good, the weight gain suddenly begins to tail off, leading on occasion to weight losses and in extreme cases to death, seemingly from starvation. Scientists at Agriculture Canada's Nappan Experimental Farm in the area have examined all the usual causes of weight loss in domestic animals, known nutritional deficiencies, parasites, availability of feed, and so on, and found nothing. The condition, called "ill-thrift" by sheep farmers, or simply failure to thrive, occurs in other areas of the world as well, New Zealand and South Africa for example, and may be widespread in the Maritimes (the Nappan station is the only Canadian instance where it has been scientifically documented).

One of the most promising leads to the solution of the ill-thrift riddle comes from two scientists at the National Research Council's Atlantic Regional Laboratory in Halifax, Nova Scotia. If the future proves the hunch of organic chemist Alan Taylor and mycologist Don Brewer to be correct, then the lamb growth is being affected by fungal-produced antibiotics in the pasture grasses (fungi are plants without the green pigment chlorophyll — moulds, mildews and mushrooms are well-known examples).

The scientists first became interested in the problem when a fungus collected by Dr. Brewer from soil in the Nappan region was shown to produce significant quantities of chetomin, a chemical already identified as an antibiotic. "It was shortly thereafter, on reading that grasses take up chetomin from the soil, that we felt we might be onto something," explains Don Brewer. "Possibly, lambs ingesting the grass were either being poisoned directly by chetomin's toxic effects, or, more likely, the rumen (stomach) bacteria were being inhibited by the chemical. After all, the health and growth of ruminants like sheep and cattle are intimately related to the condition of these rumen microorganisms; they are vital to digestion, and bacteria-killing substances like chetomin could easily lead to the observed failure to thrive."

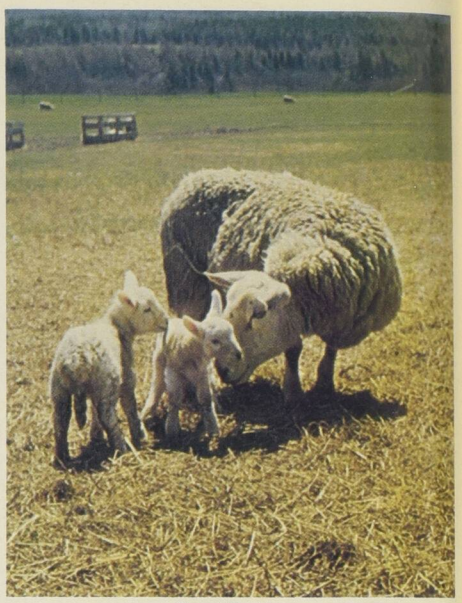
All very sound theoretically, and reasonable, but proving it has been another matter.

With help from Agriculture Canada scientists, Brewer and Taylor began a study involving two kinds of pasture land in the Nappan area, a forest-cleared upland where ill-thrift is normally more pronounced, and a reclaimed salt marsh in the lowlands where the condition is less severe. At regular intervals, they collected samples of fungi from the soil and vegetation as the lamb flocks grazed on the fields through the spring and summer.

"We began to see a pattern emerging as the data accumulated," says Dr. Brewer. "At the onset of ill-thrift in the lambs, there was a marked increase in fungal growth in the pastures, and this correlated with a decline in the numbers of viable bacteria found in the rumen of the animals." Further, the scientists found differences in the soil fungi from the two sites. Whereas the populations on the grasses were indistinguishable, the upland pasture contained species in the soil not found in the lowland area. Subsequent studies showed that the "potential" for producing antibiotics was greater in the upland fungi.

The reasonable inference was that, indeed, the fungi were interfering with normal bacterial growth in the animal rumen. Where the fungal capacity for producing antibiotics was greatest — in the upland pasture — the ill-thrift condition was most pronounced. Direct causality was still not demonstrated, however. Added to this, the differences in the living rumen bacteria between the two lamb flocks were not in evidence (the upland flock would be expected to have smaller populations of rumen bacteria); this may be due in part to the sensitivity of the counting method.

The problem with the experiments, according to Don Brewer, is the sheer complexity of the system under study. There are large numbers of fungal species to deal with (identification of certain species can sometimes take weeks), and the scientists only "see" those organisms that show up under their laboratory culturing conditions. The culprit organism might be missed simply because the conditions are not right for its growth. Then too, there are the possible pitfalls of spot sampling a field and extrapolating the results to cover the entire area.



Grant Crabtree

Though the conditions for raising sheep appear to be ideal in many parts of Nova Scotia and New Brunswick, results have generally fallen short of expectations. The problem may be in the grass itself.

Bien que de nombreuses régions de la Nouvelle-Écosse et du Nouveau-Brunswick semblent offrir des conditions idéales pour l'élevage des moutons, les résultats sont dans l'ensemble décevants. L'herbe en serait-elle responsable?

Even in a less-complicated system, the connection the scientists are seeking to establish would be a difficult job.

"The idea is that the effect of the fungi is indirect," explains Dr. Brewer, "and, as such, it is very difficult to prove. Fungal antibiotics inhibit the growth of rumen bacteria, which in turn reduce the animal's ability to digest their food."

To further study the problems, a more elaborate ARL-Agriculture Canada experiment is being set up that involves a survey of pastures treated in a variety of different ways. By ploughing and reseeding in one field, grazing heavily another, and so on, it is hoped that the kinds and numbers of fungi present in the areas will change. With distinctive fungal populations in the experimental plots, the scientists can survey for trends during the growing season with the hope of detecting an interrelationship between population type and ill-thrift. □

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