

Animal health

Can geochemists help?

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Collecting cattle blood samples in north-east Zimbabwe

Though energy and protein deficiencies are accepted as the most limiting factors to grazing livestock production in tropical areas, mineral deficiencies, excesses or imbalances in soils and forages can also have serious effects.

Worst in the tropics

The mineral-related problems appear to be particularly severe in developing countries in the tropics. For grazing livestock, deficiencies of cobalt, copper, iodine, iron, manganese, selenium and zinc together with excesses of copper, fluorine, manganese and molybdenum have been recognised. As farming systems progress in developing countries, and farmers are encouraged to increase productivity from grazing livestock, the correction of mineral deficiencies or imbalances in forage will become more pressing.

Mineral status mapping

Apart from goitre, resulting from iodine deficiency and dental mottling and skeletal deformities associated with excess fluoride, few mineral-related problems have diagnostically specific clinical symptoms. Diagnosis is further complicated by the fact that many of the symptoms caused by mineral imbalances, such as subnormal growth and reproduction, may also result from

energy and protein deficiencies or the effects of parasites. Diagnosis of sub-clinical cases must rely on chemical and biological screening. However, testing large numbers of animals for evidence of mineral deficiency without first identifying geographical target areas is an expensive and laborious process.

Areas with mineral-deficiency or toxicity problems in grazing livestock have generally been identified by mapping soil, forage, animal tissue or fluid compositions. Unfortunately, these techniques may be unsuitable for mapping large areas owing to localised variations in soil chemistry, forage plant species and forage maturity.

Previous studies in temperate regions have demonstrated that drainage-sediment geochemical mapping can be used to delineate areas where cattle may be at risk to mineral problems. The BGS is investigating the feasibility of using such data for animal mineral-status mapping in developing countries in collaboration with veterinary organisations including the Centre for Tropical Veterinary Medicine, the University of Edinburgh; the Veterinary Faculty, University of Santa Cruz, Bolivia; the Zimbabwe Veterinary Research Laboratory and the University Department of Preclinical Veterinary Studies, Zimbabwe.

Veterinary reviews

The mineral status of grazing ruminants, soils and forages was reviewed for sectors of Bolivia, Kenya, Sierra Leone, Sumatra, Swaziland and Zimbabwe in order to investigate whether a consistent relationship could be detected between mineral levels in drainage-sediment geochemical samples and in free-grazing ruminants. The elements copper, cobalt,

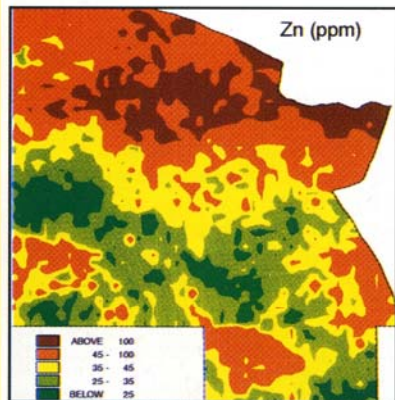
manganese and zinc are appearing as useful indicators and it is tentatively concluded that deficiencies in unsupplemented grazing ruminants might occur in areas where mineral concentrations in drainage sediments are below 15 parts per million copper and cobalt, and 35 parts per million zinc.

In north-east Zimbabwe, a rigorous experiment has been designed to test the correlation between trace-element concentrations in drainage sediments and cattle mineral status in an area having a wide range of zinc, copper, cobalt and manganese, which reflects variations in the chemical composition of the underlying rocks. Zinc is the principal element of interest because its concentration in cattle blood serum is generally accepted as a reliable indicator of zinc status and because blood is easy to collect.

Soil, forage and cattle-blood samples were collected in order to complete the links along the pathway from rocks, through soil and forage, to cattle. Provisional results for the first set of samples collected in 1993 are promising: cattle are being resampled in 1994 in order to confirm the initial results.

Benefits for vets and farmers

Geochemical maps cannot provide a definitive indication of areas with potential deficiency problems. They can, however, be used to outline those areas where further specific veterinary investigations and correction, through supplementation, are required in the interests of higher productivity. Milk from cattle is a major source of protein in areas such as north-east Zimbabwe, so household food security would increase with improvements in cattle productivity.



Zinc drainage sediment geochemical map for north-east Zimbabwe where cattle mineral status is being investigated