The Status of Selected Minerals in Soil, Forage and Beef Cattle Tissues in a Semi-arid Region of Zimbabwe

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ABSTRACT

Five districts in the Matabeleland region, an arid western area of Zimbabwe, were investigated for the status of Ca, P, Na, Cu and Zn in soil, forage and cattle during the wet and dry seasons over a period of one year. The cattle came from the natural grazing lands and were not supplemented at the time of sampling. Some deficiencies in soil Zn and P were found in the districts of Lupane and Bulilima-mangwe, respectively. Dry season soil Ca, Cu and P concentrations were significantly higher (p<0.05) than rainy season values owing to leaching in all five districts. Most forage samples had mineral concentrations below the critical levels known to be adequate for animal requirements. Forage levels of Ca, Na, Cu and Zn significantly increased (p<0.05) with advancing maturity, while P significantly decreased (p<0.05) in almost all the districts. Marked deficiencies of minerals were found in cattle tissues and these levels followed the seasonal trend seen in the forage. These results indicate that cattle in Matebeleland are deficient in P, Ca, Cu and Zn and that grazing areas in the region cannot provide adequate levels of the five minerals studied.

Keywords: cattle, deficiencies, forage, minerals, seasonal-variation, soil

Abbreviations: EDTA, ethylenediaminetetraacetic acid

INTRODUCTION

Mineral imbalances (deficiencies and excesses) in soils and forage have long been held responsible for low production and reproductive problems, especially among grazing ruminants in developing countries (McDowell et al., 1983). Variation in mineral content of soil gives rise to variable mineral status of herbage in tropical pastures (McDowell, 1992). Consequently, grazing ruminants in the tropics are sometimes exposed to severe deficiencies or excessive intake of some minerals (Kumagai et al., 1990; Fujihara et al., 1995).

In Zimbabwe, ruminant livestock production depends largely on the use of natural pastures (veld) throughout the year. Only rarely, however, can tropical forage completely satisfy all mineral requirements (McDowell et al., 1983). There are no
records of general deficiencies of minerals in Zimbabwean rangelands apart from work done by Mpofu and colleagues (1995) in Chimamhura and Sanyati districts in the north and north-west of the country, respectively. A few station-based trials were reported by Bembridge (1965) and Ward (1968). There is a need for information on areas in Zimbabwe in which problems of mineral nutrition exist before recommendations for specially formulated mineral supplements can be made. The use of mineral supplements without regard to local conditions can cause mineral imbalances and is therefore likely to impede rather than promote improvement in livestock production (Mtimuni et al., 1983).

According to McDowell and colleagues (1983), the mineral elements most likely to be lacking under tropical grazing conditions are Ca, P, Co, Cu, I, Se and Zn. In Zimbabwe, studies by Bembridge (1965), Ward (1968) and Mpofu and colleagues (1995) indicated Ca, P, Na and Cu as the most limiting elements. Some workers investigating maize-based systems in communal areas around the country have reported widespread and significant deficiencies of Cu and Zn (Tagwira, 1993; Mukurumbira et al., 1998).

Matebeleland is the driest region of the country which is suitable for cattle ranching. Feed companies in the region base formulations of their mineral mixes on textbook recommendations, which may not necessarily be applicable to southern Zimbabwe. The objectives of this survey were therefore to detect specific mineral deficiencies and toxicities in Matebeleland, to determine the effect of season on the levels of Ca, P, Na, Cu and Zn in soil, forage and cattle tissues, and to determine correlations between levels of the five minerals in soil, forage and animal tissues.

MATERIALS AND METHODS

Location

The study was conducted in Matebeleland region, which covers the south-western part of Zimbabwe. It lies between 25°15’ E and 31° E longitudes, and between 17°15’ S and 22°15’ S latitudes. All the districts in this region fall under Natural Regions IV and V (a Zimbabwean agroecological classification based on potential for agricultural production). These regions experience fairly low to extremely low rainfall (less than 650 mm per annum) and are thus suitable for semi-extensive to extensive farming based on utilization of veld for cattle ranching with little or no cropping. The Matebeleland region is divided into two provinces, north and south of Bulawayo. The mineral nutrition survey concentrated on two districts in Matebeleland North (Umgua and Lupane) and three districts in Matebeleland South (Bulilima-mangwe, Umzingwane and Matobo).