SEASONAL CHANGES OF MINERAL CONCENTRATIONS OF TROPICAL GRASSES IN MEXICO.

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ABSTRACT
Samples of tropical grasses were obtained during the wet and dry seasons of 1993 from four ranches of the state of Tamaulipas, Mexico. A total of 66 forage samples were obtained during both seasons. The concentrations of macrominerals during the wet and dry seasons, respectively, were Ca (0.44 vs. 0.41%), P (0.22 vs. 0.14%), Mg (0.14 vs. 0.11%), Na (0.06 vs. 0.13%), and K (1.8 vs. 0.9%). The concentrations of the trace minerals during the wet and dry seasons, respectively, were Zn (30.7 vs. 16.4 ppm), Fe (74.8 vs. 64.4 ppm), Mn (51.5 vs. 31.7 ppm), Cu (9.4 vs. 1.4 ppm), Co (0.08 vs. 0.04) and Mo (4.1 vs. 0.8 ppm). Phosphorus deficiency, especially during the dry season was most important for the macrominerals. Of the trace minerals, the Cu deficiency interactions with the relatively high concentration of Mo, especially during the dry season, was most important.

KEYWORDS
Minerals, Forage, Tropical Grasses, Season, Mineral Supplements.

INTRODUCTION

Forage is the sole source of minerals of most grazing ruminants in the tropical regions of Mexico. In many situations cattle are deficient in one or more essential minerals and supplementation may be required to satisfy their requirements for optimum productive performance. A mineral deficiency or imbalance in the diet may adversely affect fertility, weight gain, milk production and the health of grazing ruminants. Mineral deficiencies have been reported in almost all countries of Latin America. Several research reports (McDowell et al., 1993) have revealed that mineral supplementation of grazing cattle in tropical regions has resulted in increases of 20 to 100% in the conception rate and 10 to 25% increase in the growth rate, in addition to a significant decrease in the mortality rate. Tropical forages commonly have a lower mineral content during the dry season. However, mineral deficiencies are more prevalent during the wet season when forage quality is better and higher protein and energy intakes may allow grazing cattle to grow faster. Mineral concentrations in forages vary geographically depending on the type of soil and its mineral content and availability. The objective of this study was to determine the mineral concentrations in soils and tropical grasses of the Gulf coast of Mexico during the wet and dry seasons and to determine possible mineral deficiencies, excesses or imbalances that may affect the production of grazing cattle.

MATERIALS AND METHODS

Soil and forage samples were obtained during the wet (August) and dry (March) seasons of 1993 from four ranches in two counties (Aldama and Soto La Marina) of the state of Tamaulipas, Mexico. A total of 14 soil samples and 66 forage (33 in each season) samples were obtained. Grass species sampled were Coastcross-1 Bermuda (CC,*Cynodon sp*. hybrid), African Stargrass (SG, *Cynodon plectostachyus*), Santo Domingo (SD, *Cynodon dactylon* var. Santo Domingo), Guineagrass (GU, *Panicum maximum* L.), and Pangolagrass (PA, *Digitaria decumbens*). Procedures for sampling and analysis of forage samples are those described by Fick et al. (1979). Grass samples were dried in a forced air oven at 60° C and ground through a 1 mm screen in a Wiley Mill before analysis. Samples were also dried at 105° C to calculate dry matter content of samples (AOAC, 1990). In forages, concentrations of calcium (Ca), phosphorus (P), sodium (Na), potassium (K), magnesium (Mg), iron (Fe), copper (Cu), zinc (Zn), and manganese (Mn) were determined using a Perkin-Elmer Zeeman 5100 Atomic Absorption Spectrophotometer (Perkin-Elmer Corp., Norwalk, CT). Cobalt (Co) and molybdenum (Mo) in forage were determined using the same spectrophotometer with an adapted graphite furnace (Perkin-Elmer HGA-600). Phosphorus content of grasses was determined by a colorimetric procedure (Fick et al., 1979). Critical levels (CL) were defined in this study as the mineral concentrations in forages below the minimum requirements for beef cattle (NRC, 1984) or above the tolerable levels that cause toxicity or interference with the utilization of other minerals. The mineral concentrations in forages were statistically analyzed as a factorial design 5x2 (5 tropical grasses and 2 seasons).

RESULTS AND DISCUSSION

Mean macromineral concentrations of grasses from samples obtained during the wet and dry seasons (Figure 1), respectively, were: Ca, 0.44 and 0.41%; P, 0.22 and 0.14%; Mg, 0.14 and 0.11%; K, 1.8 and 0.91%; and Na, 0.06 and 0.13%. When these values are compared to the CL of deficiency of the macrominerals (Ca, 0.30%; P, 0.25%; Mg, 0.10%; K, 0.65%; y Na, 0.08%), the high K content of grasses during the wet season, and the low P concentrations in grasses, especially during the dry season, should be noted. Potassium concentration decreases with the advancing maturity of forages and can be reduced by leaching of mature standing forages in humid areas (NRC, 1984). On the other hand, high levels of K appear to interfere with magnesium metabolism and utilization by grazing cattle, which may be marginally deficient during the dry season. A P deficiency may affect primarily the growth, lactation and breeding of cattle. During the wet and dry seasons, the trace mineral concentrations of grass samples were, respectively: Cu, 9.4 and 1.4 ppm; Zn, 30.7 and 16.4 ppm; Mn, 51.5 and 31.7 ppm; Fe, 74.8 and 64.4 ppm (Figure 2); and Co, 0.08 and 0.04 ppm. These results, compared to the CL of deficiency of the trace minerals (Cu, 10 ppm; Zn, 30 ppm; Mn, 40 ppm; Fe, 50 ppm; and Co, 0.1 ppm), suggest deficiencies of Cu, Zn, Mn and Co, especially during the dry season. However, during the wet season, higher content of energy and protein in forage, may allow for more weight gains in cattle, increasing the need for mineral supplementation (McDowell et al., 1983). Molybdenum concentrations in grasses were higher than the CL of tolerance (3 ppm), during the wet season. A Mo content higher than the tolerable levels may aggravate an existing Cu deficiency. During the dry season, although Cu concentrations were lower, Mo content was at tolerable levels.

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Figure 1
Mean concentrations and critical levels (CL) of deficiency of macrominerals in tropical grasses during the wet and dry seasons (NRC, 1994).

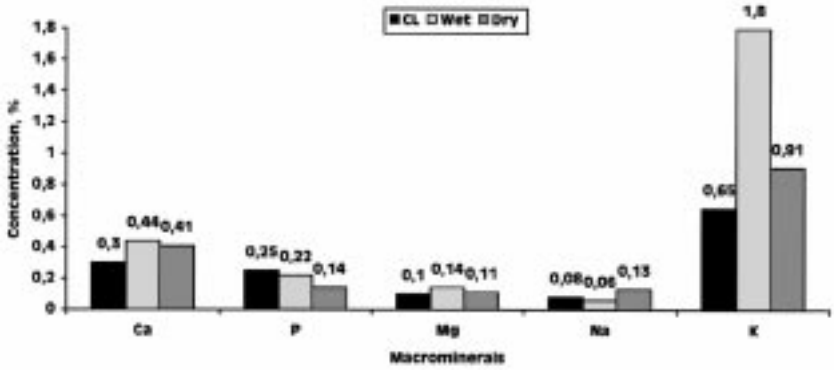
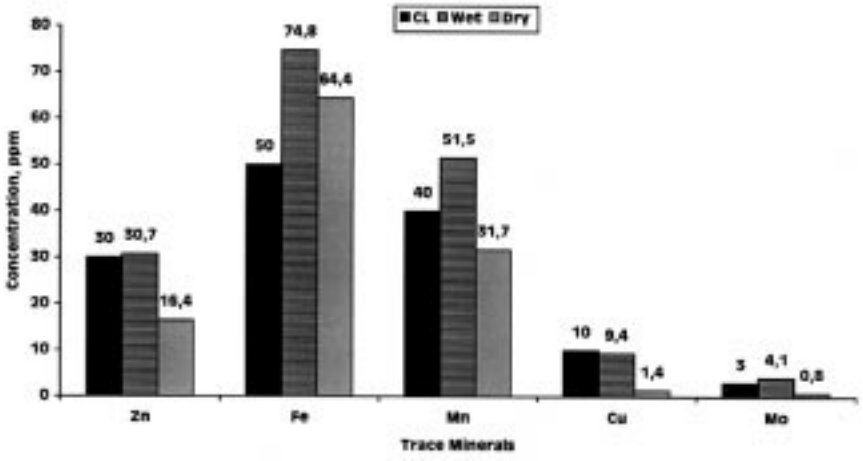


Figure 2
Mean concentrations and critical levels (CL) of deficiency of trace minerals in tropical grasses during the wet and dry seasons (NRC, 1994).



The soil sampling technique used for this study was that described by Bahia (1978). Soil samples (250 g) were collected with a stainless steel tube at a depth between 15 and 20 cm.). Mineral elements were extracted from the soil samples using the Mehlich extracting solution (0.025N H_2SO_4 and 0.05N HCL) of Rhue and Kidder (1983). Soil samples were analyzed for pH and mineral concentrations by procedures reported by Rhue and Kidder (1983). Macromineral elements analyzed in soil samples were calcium (Ca), potassium (K), sodium (Na) and magnesium (Mg).