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## SUMMARY OF DOCTORAL THESIS

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### **Title: STUDIES ON THE MINERAL STATUS OF FEED RESOURCES AND DAIRY COWS IN MOROGORO, TANZANIA**

(タンザニア、モロゴロ地域における乳牛の無機物栄養に関する研究)

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Minerals are vital to animal health and productivity whereby deficiency can depress feed digestibility and intake; and affect livestock production efficiency. Little is known about the effect of season changes in levels of minerals present in the forages and ruminant tissues in the tropics. Therefore, the study was conducted aiming at increasing knowledge on effect of season on mineral status of feedstuffs and dairy cattle, in Turiani, Morogoro, Tanzania.

The effect of season on mineral concentration and nutritive value were examined in twelve feed resources. Results showed that (1) mineral concentrations highly varied ( $P < 0.05$ ) while season changes influenced the (2) nutritive value contents in feed resources. In all seasons, feed resources had enough concentrations of Ca, Mg and S to meet dairy cattle requirements. Phosphorus levels were marginal in MPTs and concentrates while were deficient in grasses and CL in dry season. All feed resources had low Cu and Zn levels but in MPTs and concentrates, concentrations were at the marginal levels. With Exception of concentrates, all feed resources had low Se concentration to meet dairy cattle requirement. Low potential mineral intake by the cow weighing 450 kg BW, producing 10 kg milk per day and consuming 12.15 kg DM were estimated for Cu, Zn and Se. Among studied feed resources, MPTs had high CP levels followed by concentrates while grasses had the lowest. In both seasons, the potential degradability values were high in grasses while high rate of feed degradability were observed in concentrates. Moderate improved ( $P < 0.05$ ) *in vitro* ruminal fermentation upon addition of PEG were also observed.

Also, influence of season on the status of minerals in dairy cows was studied (3). About 129 blood samples from crossbred dairy cows were studied for their mineral status. Results showed that plasma concentrations of P, Cu Zn and Fe varied ( $P < 0.05$ ) between seasons while concentrations of Ca, Mg, S in plasma; and Se in whole blood did not vary ( $P > 0.05$ ) with seasons. The mineral concentrations of Cu in plasma and Se

in whole blood were low for optimal animal performance. High variation ( $P < 0.001$ ) in plasma Fe were observed with values below critical level recorded in rainy season.

As alternative feed resources, browse species (4) were evaluated for their mineral concentrations and (5) nutritive values at the end of rain season. Results showed that mineral concentrations in browse species were affected ( $P < 0.05$ ) by the levels of these minerals in the soils. Browse leaves had high concentrations of Ca, Mg, S, Zn and Mn. With exception of *L. camara*, all leaves had Se concentration enough to meet ruminants' requirement. The estimated potential intake of Ca, Mg and S by a cow weighing 450 kg BW, producing 10 kg milk per day and consuming 12.15 kg DM; and goat weighing 50 kg and consuming 4 % BW, were sufficient for Ca, Mg, S; moderate for Zn, Mn, Se; and low for P and Cu. All leaves had high CP content and moderate fibre contents. The potential gas production values among browse leaves were high in *C. Africana*. *Balanites aegyptiaca* had high rate of gas production. Highest increase in 24 h gas production, OMD and ME upon PEG treatment were observed in *C. africana*, *A. tortilis* and *A. nilotica*.

From the present study, the following conclusions were drawn: (a) Forages were deficient in P, Cu, Zn and Se in all seasons. Thus supplementation regime should include P, Cu, Zn and Se for optimal animal performance. (b) Concentrates, MPTs and browse leaves appeared to be good protein supplements to ruminants fed poor quality forages. However, suitability of MPTs and browse leaves to supplement protein to the animal will depend on the levels of phenolics contents. (c) Dairy cows appeared to suffer more Cu, Zn and Se deficiency during both wet and dry season. This is probably contributed by deficiency of these minerals in forages. (d) Browse leaves observed to be deficient in P and Cu, levels which might be contributed by their low concentration in soils. High Se concentrations in browses signify their alternative use in ruminant production.

The following recommendations are suggested; (i) supplementation of deficient minerals (P, Cu, Zn and Se) is recommended. (ii) Conduction of mineral supplementation studies to determine requirement for different classes of dairy animals and economic benefits of all minerals, particularly trace minerals, which were observed to be severely deficient. (iii) *In vivo* studies to determine nutritive value of feed resources in terms of palatability, intake, digestion and effect on production performance of the animals.