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TECHNICAL NOTE
Characterization of Some Resources in the Adama Assela Hawassa Region (Ethiopia), with Potential for Mineral Supplementation of Livestock, and Presentation of a New Mineral Salt

Silvio J. Martínez Sáez and Hamsasew Hankebo***

***Center for Animal Production Studies (CEDEPA), Faculty of Agricultural Sciences, Ignacio Agramonte Loynaz University of Camaguey, Cuba**

****Faculty of Natural Sciences, Science and Technology University of Adama, Ethiopia**

silvio.martinez@reduc.edu.cu

INTRODUCTION

Usually, pastures do not contain all the minerals required by animals (dairy cows, growing or breeding animals) to maintain an efficient production behavior. Recent findings have shown that their existence can improve the capacity of the immune system (Herd, 2011). The cost/benefit ratio in terms of mineral supplementation could me more than 3 (Gutiérrez, 2015). Therefore, the common international practice is to provide supplements based on mineral salts that contain macro and micro elements to achieve a more balanced diet. However, this practice is limited in the poor nations because the costs of commercial concentrated feeds cannot be afforded by many farmers.

In Ethiopia, sodium deficiency is more frequent so salt supplements must be supplied routinely. Other important minerals are phosphorus, calcium and copper (Kabaija and Little, 2012).

Furthermore, Adama-Hawasa is an agro-industrial region, and there are raw materials that could be used to formulate less expensive mineral supplements. A similar study was made a few years ago in Cuba (Martínez *et al*., 2004).

The purpose of this paper was to evaluate the different local resources near the towns of Adama, Assela and Hawasa, which may be useful as mineral supplements. Also important was recommending proper mixtures.

DEVELOPMENT

Samples of saline soil (more than 1 kg), at the local Hawasa market; limestone, sugar mill filter cake and bagasse ashes (Wonji-Shewa Sugar Factory), plaster (Tabor Ceramic Products S.C., Assela); diammonium sulphates (DAP) and dicalcium (DCP) (Adama market). The samples were air dried and crushed with mortar, and then they were sieved (1 mm).

Concentrations of Na, K and Ca were determined by flame photometry, using acetylene, and $SrCl_2$ as control of ionization and releasing agent. P and Fe were determined by UV-Vis spectrophotometry, and S was determined by turbidimetry.

All the samples were analyzed by triplicate, and the mean and variance coefficients were determined from every trio of values, as a precision measure. Accuracy was controlled using added standard recovery.

For all the sample treatment, analytical procedures and quality control of analyses, recommendations of the American Society for Testing and Materials (ASTM, 2014), were accomplished.

Calculations of mean and variation coefficient, as well as online programming for cost effectiveness of the mixture, were made using Solver MS Excel® (2007). Table 1 shows the contents of each element of the raw materials.

The saline soil was rich in Na and phosphorous in both diphosphates. Plaster may become a source of sulphur, whereas sugar mill filter cake has the highest copper concentration.

Table 2 shows a mixture proposition that only includes raw materials from Adama, Assela-Hawassa, whose composition meets the mineral requisites for grazing ruminants (McDowell and Arthington, 2005), assuming daily consumption of 50g, and prices during sample collection. According to material availability and price changes, other variants that meet the requisites could be proposed.

Conclusions

The mineral contents in the raw materials analyzed facilitate their use to produce mixtures that can be used as supplements for grazing animals. The cost of the mixtures recommended for use was less than half the costs in the local markets. Its production might become a source of jobs and income if a small company were set up for that purpose. Determination of mineral contents in other elements is recommended.

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Table 1. Mineral contents of the samples analyzed

Element	Saline soils	DAP	DCP	Plaster	Limestone	Sugar mill filter cake	Ashes
Na (%)	15.28	0.98	0.56	0.11	0.37	0.01	0.23
K (%)	0.86	0.12	0.03	0.01	0.07	0.66	0.51
Ca (%)	3.83	0.64	16.54	26.11	59.44	4.7	3.28

P (%)	0.33	35.4	22.14	0.03	0.01	0.37	0.25
S (%)	0.14	4.04	0.04	33.67	0.09	3.14	0.74
Fe (%)	0.26	0.17	0.1	0.01	0.13	0.05	0.13
Cu (ppm)	123	12	19	21	11	198	11

DAP - Diammonium phosphate DCP- dicalcium phosphate

The variation coefficient in all the cases was below 3%.

Table 2. Formulation for recommended mixture and chemical composition

Inclusion levels (%)		Composition	
Raw material		Elements	
Saline soil	57.25	Na (%)	8.90
DCP	24.75	K (%)	0.59
Plaster	4.49	Ca (%)	8.41
Limestone	0.56	P (%)	5.72
Sugar mill filter cake	12.93	S (%)	2.01
		Fe (%)	0.18
		Cu (ppm)	102