

Investigation of Iron Levels in Locally Prepared Livestock Feeds in Uganda

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Abstract

Due to lack of regulations and certifications in Uganda for iron levels in animal feeds, there is great variability in iron levels in feeds from different suppliers. This may lead to under or over dosages of iron in animal feeds which may result in reduced farm productivity. In this study, locally produced animal feeds namely broiler starter, dairy meal and sow and weaner from six different suppliers namely Biyinzika, Mutima, Impala, Kuku, Nuvita, and Ugachic were investigated for their iron levels. The iron levels were determined using the European Commission method for Iron and atomic absorption spectroscopy. Results indicate a substantial variation in iron levels recorded for the different suppliers ranging from 70 to 630 mg/kg. This was linked to insufficient knowledge and expertise in feed formulations and the lack of local regulatory standards for iron in animal feeds in Uganda. However, the results obtained in this study are within the limits set by international standards agencies and comparable to other studies.

Material and Methods

The method for determination and quantification of Iron content for the different livestock feeds followed the European commission method for Iron based on dry ashing followed by acidic digestion of the feed stuff samples and then atomic absorption spectrophotometric (AAS) measurement. One kilogram weight of each of the selected livestock feed samples packed in Low density polyethylene (LDPE) bags were bought from Mutima Feeds limited, Ugachick Feeds limited, Impala Feeds limited, Kuku Feeds limited, Nuvita Feeds limited and Biyinzika Feed Suppliers limited, all located in Kampala central business district. The samples were subjected to oven-drying at temperatures of 105°C for 24 hrs and later placed in a desiccator for cooling to prevent them from attracting moisture and then crushed using a sample grinder to convert them into powders. Approximately 4.0 g of a powdered feed sample was weighed into a dry and clean porcelain crucible and then

placed into an electric furnace set at temperatures of 550°C which was slowly increased to 600°C and maintained for 8 hours. On removing the porcelain crucibles from the furnace, the powdered feed samples had turned into ash and placed in a desiccator for cooling. The carbon free ash residues were dissolved in 10 ml of 3 M hydrochloric acid and then diluted to a definite volume of 100 ml before being introduced in the atomic absorption spectrophotometer for Iron determination. The Spectrophotometer used was a 6300 shimadzu, made in Japan, with Flame atomiser, graphite furnace atomiser, mercury vapour unit. It's a GFA-EX7i model, serial number A30534200187LP, and catalog number 206-52100-34. The instrumental conditions for the AAS (Atomic absorption Spectrophotometer, model: Shimadzu 6300 with a programmable auto sampler, desktop computer and printer data tape) were set at wavelength 248.3 nm, Lamp current value 2.0 mA, Slit width 0.7 mm and air/acetylene flow ratio 3.5/1.5. Prior to sample determination, the AAS was subjected to a calibration with analytical standards (1000 µg/ml Fe³⁺- plasma HIQU, density – 1.032 g/ml at 20°C, manufactured by Chem-Lab NV, Industriezone "De Arend"2, B-8210 Zedelgem, Belgium) of known concentration of Iron whose concentrations ranged from 0.2-4 ppm prepared from pure stock solution of 1000 µg/mL prepared serially and diluted with 1% nitric acid. These were used to obtain a calibration curve for iron with a linear regression coefficient (R²) value of 0.9993. The samples were then aspirated into the AAS and the relative concentrations of iron in the samples were determined. The relative concentration of iron in each feed sample were determined as shown in Eqn.. $Fe (mg/kg) = (C_m \times D_f \times V_d) / W_t$, Fe - Iron concentration in mg/kg C_m - Concentration of Iron as read by the AAS D_f - Dilution factor V_d - Volume to which the sample has been diluted after ashing W_t - Original weight of sample in grams.

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