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SHORT COMMUNICATION

IRON CONCENTRATIONS IN SOIL, PASTURE AND BLOOD PLASMA OF BEEF CATTLE REARED IN SUCKLING COWS SYSTEM

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ABSTRACT

The objective of this study was to compare concentrations of iron (Fe) in soil, pasture sward and blood plasma of extensive reared Aberdeen Angus bulls and heifers on a farm in the foothills of the Orlické Mountains. We sampled soil, pasture sward from pasture areas and blood from 22 bulls and 22 heifers in the period from birth to weaning at regular intervals (81, 151, 189 and 273 days of age). Concentrations of iron were analysed. Not significant relationships were noted between soil and pasture iron concentrations ($r = 0.32$), pasture and blood plasma iron concentration ($r = 0.39$). In this study, there were not found relationships between iron-soil, forage and blood concentration in beef cattle reared in suckling cows system.

Keywords: beef cattle, iron, soil, pasture, blood plasma

INTRODUCTION

Soil plays a significant role in cattle production and health because cattle obtain their nutrient needs from the feed and fodder, which in turn obtain nutrients from the soil. The role of soil and nutritional quality of plants with respect to the health and production of livestock is very important and varies from place to place **(Abdelrahman *et al.*, 1998)**. Plants are the basic and potential source of food for animals; ultimately the nutritional values of plants are of central importance in determining the plants and human health.

Herbs are an important source of delivering minerals to grazing livestock in extensive and low-input situations. At the same time mineral deficiencies can depress forage digestibility and herbage intake and ultimately decrease livestock production efficiency **(Khan *et al.*, 2007)**. The uptake of minerals and particularly trace minerals by plants can provide important information on environmental contamination and requirements of ruminants **(Yusuf *et al.*, 2003)**. Plants absorb minerals from soil as well as from surface deposits on parts of plants exposed to polluted areas **(Khan *et al.*, 2007)**. Information on mineral levels of forages are very important to identify what measures should be taken to improve the nutritional status of grazing livestock. Seasonal variation affects livestock seasonal production in different regions of the world by affecting forage dry matter accumulation **(Khan *et al.*, 2004)**.

Iron (Fe), being one of the essential elements required for the growth and development of both plants and animals, plays a vital role in a multitude of metabolic processes. The amount of Fe in soil varies significantly from area to area or even within a same area. It is found in soil in two different forms, i.e., divalent and trivalent. The divalent (Fe^{2+}) form is comparatively more soluble and more easily available to plants than the trivalent (Fe^{3+}) **(Petrova *et al.,* 2006)**. The availability and distribution of iron in soil is attributed to soil organic matter as chelates are often formed with soil organic matter **(Kooijman *et al.*, 2009)**.

Iron is indispensable for the normal activity of the nervous, vascular and immunological system **(Agarwal, 2001; Ekiz *et al.* 2005).** Because trace elements that constitute an important part of animal nutrition have unique roles in mammals, their deficiencies can adversely affect animal health **(Noaman *et al.*, 2011)**.

The objective of this study was to compare concentrations of iron in soil, pasture sward and blood plasma of extensive reared Aberdeen Angus bulls and heifers on a farm in the foothills of the Orlické Mountains (Czech Republic).

MATERIAL AND METHODS

The experiment was conducted on pasture areas in the foothills of the Orlické Mountains (Czech Republic). The elevation in this area is around 500 m a.s.l., and the total annual precipitation is an average 728 mm per year. Twenty-two grazing bull and heifers were selected for observation from birth to weaning. Sampling of soil, forage and blood plasma were provided at regular intervals (81, 151, 189 and 273 days of age of animals). The representative soil and forage samples were collected randomly. Composite forage samples weighing about 400 g were made from combined clippings from a sampling position. Soil samples were taken from below the clipped swards at 0 – 30 cm depths, using a soil sampler.

The soil samples were extracted in 2 $mol.L^{-1}$ HNO_3 **(Zbíral *et al.*, 2003)**. Forage samples were dried in an oven at 60ºC and decomposed in the microwave system Ethos 1 (Milestone, Italy) in the mixture of nitric acid and hydrogen peroxide. The content of Fe was determined on high resolution continuum source atomic absorption spectrometer ContrAA 700 (Analytik Jena, Germany) by using flame atomization. Blood plasma concentration of Fe was measured on an Konelab T20xt automatic analyser (Thermo Fisher Scientific, Finland) using common commercial sets (Biovendor-Laboratorní medicína, Czech Republic).

Statistical analysis of the obtained data was performed using the STATISTICA 8.0 programme. Single-factor analysis of variance was used for factor time. ANOVA was followed by post-hoc Fisher's LSD test for pair-wise comparisons, when appropriate. Evaluation of the interdependence between the soil, forage and animals minerals concentration was conducted using a correlation coefficient at the level of probability ($P < 0.05$).

RESULTS AND DISCUSSION

The mean soil Fe concentration varied during different sampling periods, probably due to a great diversity of the Fe-containing minerals in the soil. The mean values of soil Fe were higher than the critical level stated by **Rhue *and* Kidder (1983)**. But, winter season iron level in soil was not significantly different than summer season level. Forage Fe content decreased with the sampling season of forage plants from spring to summer season, corresponding to **Khan *et al*. (2009)**. Mean forage concentrations of this element (63.45 - 173.17 $mg.kg^{-1}$) were found to be higher compared with requirements (50 $mg.kg^{-1}$). Forage Fe values below 50 mg/kg DM point to upset balance between available Fe and the Fe requirement for the ruminants. Iron concentrations in blood plasma of bulls and heifers changed slightly during the survey. Significant decreasing ($p < 0.05$) was found at the end of experiment in both groups (from 31.65 to 18.03 $\mu mol.L^{-1}$ in bulls; from 30.02 to 22.99 $\mu mol.L^{-1}$ in heifers). The concentrations evaluated in this experiment were in physiological range according to **Noaman *et al.* (2012)**. In our study, not significant relationships was noted between soil and pasture Fe concentrations ($r = 0.32$), pasture and blood plasma Fe concentration ($r = 0.39$).

Table 1 Soil-forage-cattle blood plasma correlation of iron concentrations

Mineral		Soil-forage	Forage-blood plasma
Fe	correlation value	**0.32**	**0.39**
	P value	0.115	0.072

CONCLUSION

Evaluation of iron in the forage or other diet for ruminants has limited diagnostic value. It can be concluded, from the results of the present study, that cattle reared under extensive production system in foothills of the Orlické Mountains were not deficient in iron concentration. In this study, there were not found relationships between iron-soil, forage and blood concentration in beef cattle reared in suckling cows system.

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