Assessment of hair analysis to determinate the Copper, zinc and selenium status in charolais cattle

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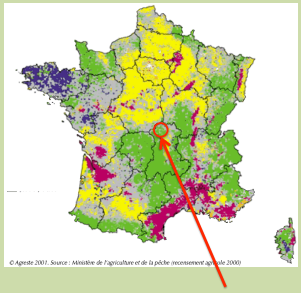
Introduction

Trace elements deficiencies in cattle are responsible for lower performances and health problems especially for cow-calves farms. There are many methods to estimate the nutritional status for trace elements. The dosage of trace elements in the hair is cheap and increasingly available to farmers especially in organic farms. However, bibliographic data are contradictory. The aim of this work is to determine if the content of copper (Cu), zinc (Zn), and selenium (Se) in hair can be used to assess nutritional status in cattle.

Material and methods

In 30 farms of a French grassland area, 10 more than 2 years old cows in apparent good health were randomly selected, excluding cows within the last month of pregnancy and the first 15 days of lactation. All cows are Charolais breed with only white hair.
Minerals level in hair is a long-term evaluation, whereas blood measurements are short-term evaluation (Zn), the samples were performed at the end of winter after 4 months (december to march) with the same diet, including the same mineral supplies.



Hair sample

- Hair was cut at the top of the head of each cow (according to the recommendations of the laboratory) with a pair of surgical scissors.
- The 10 individual 1 g hair samples were mixed for each farm.
- Cu, Zn and Se assays were carried out by inductively coupled plasma atomic emission spectroscopy

Blood sample

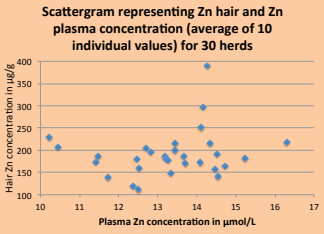
- Blood was sampled from the external jugular vein in lithium heparin tube.
- Se status was assessed by erythrocyte glutathione peroxidase (eGSH-Px) activity, Cu and Zn plasma levels were analyzed by flame atomic absorption spectrophotometry.

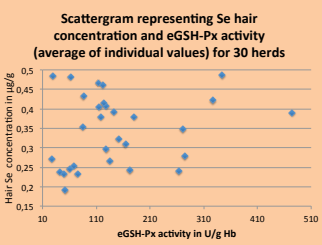
Conclusion

Without any link between hair and blood values, the analysis of minerals in pooled hair does not allow to identify a deficiency in cattle. Hair analysis allows the detection of toxic products but should not be used to assess the animal mineral supply.

Reference: Enjalbert F. Lebreton P. & Salat O., 2006. Effects of copper,zinc and selenium status on performance and health in commercial dairy and beef herds *J. Anim. Physiol. Anim. Nutr.*, 90, 459

Results and discussion





* Hair / plasma correlation

Pooled hair and average plasma values were very poorly correlated (r = -0.04, 0.13, 0.18 and *P* values = 0.85, 0.48, 0.33 for Cu, Zn and Se, respectively, Spearman's correlation).

* Concordance of plasma herd status with hair evaluation

The herd's status was classified according to the lower terciles of plasma concentration (Enjalbert et al. 2006)

	Deficient	Marginal	Adequate
Plasma Cu (µmol/L)	< 8	8 - 11	> 11
Plasma Zn (µmol/L)	< 12	12 - 14	> 14
eGSH-Px activity (U/gHb)	< 75	75 - 150	> 150

Table 1 : herd's status depending upon the lower terciles of plasma concentration

	Cu	Zn	Se
Deficient	-	183 ± 30 [a] (7)	0.31 ± 0,11[a] (11)
Marginal	8.4 ± 2.4 [a] (13)	199 ± 41 [a] (16)	0.37 ± 0,08[a] (11)
Adequate	8.3 ± 2.4 [a] (17)	185 ± 30 [a] (7)	0.36 ± 0,08[a] (8)

Table 2 : Means ± SD for hair values in mg/kg (number of farms) - means with the same letter in a column are not significantly different, p<0.05 (analysis of variance)

- **Variation of Zn hair values according to environment**

restraining system	Zn
wood	133 ± 22 (4)
galvanized steel tube	201 ± 50 (26)

Table 3 : Means ± SD for zinc hair contents in mg/kg (number of farm)


galvanized steel restraining system

Despite hairs washing in laboratory, Zn hair values depend on the environmental Zn level; they are higher in farms with galvanized steel tube. Means were significantly different (p<0.001).


Wood restraining system

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