

Mineral metabolism and health status of dairy cattle fed adjusted mineral supplementation



Boubacar Telly DIALLO : PhD student, Animine, Inrae



September, 3th 2024



Goal: Measure and valorize the trace elements content in forages, using an innovative portable device (AniGun) in order to adjust mineral supplementation for dairy cows

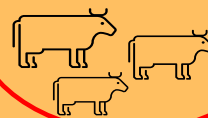
2022

Develop a portable mineral analyzer for rapid forage analysis

step 01



step 02



2022-2023

Test customized mineral supplementation in five dairy farms

3 partners



Supplier of Precision Minerals

François Cholat

Regional feed manufacturer

INRAE

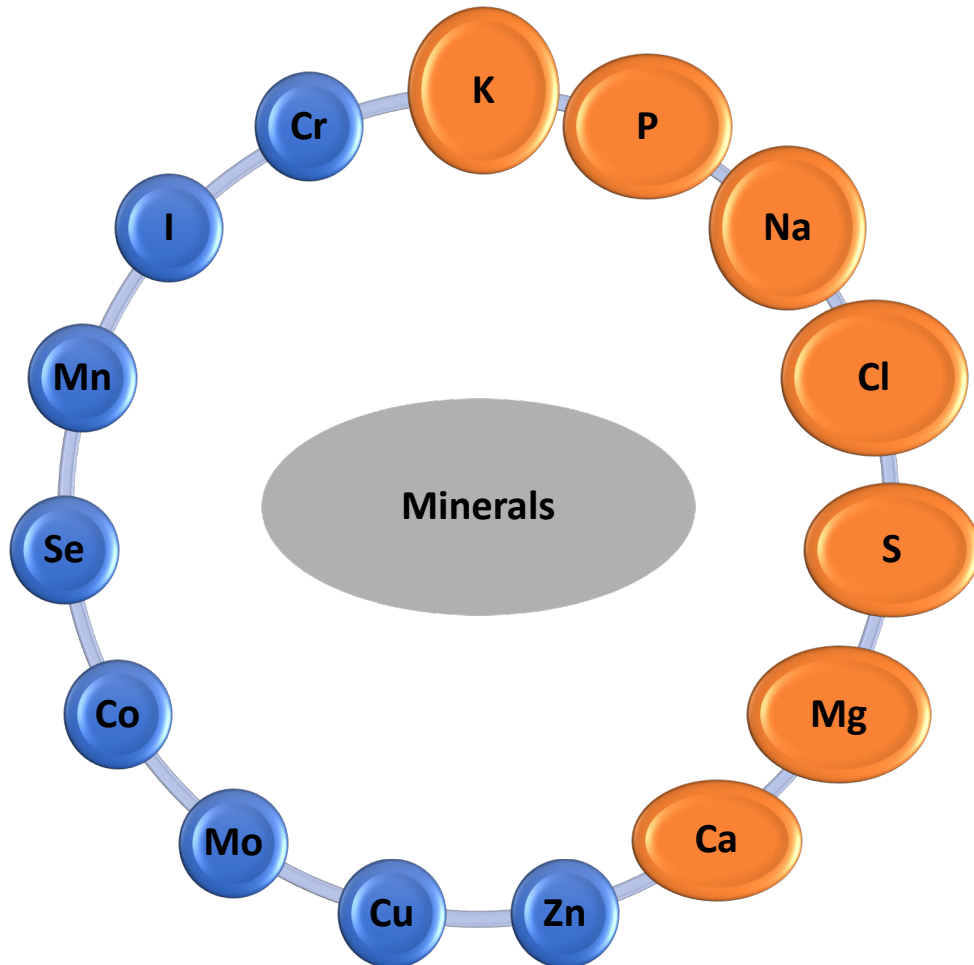
French National Institute of Agricultural Research

La Région
Auvergne-Rhône-Alpes



Context: minerals of interest for ruminants rearing

15 Minerals : 7 macro and 8 trace elements



interests

- Fertility and reproduction
- Role in antioxydant system
- Bone metabolism
- Milk production
- Immunity system
- Healthy
- Etc.

Mineral supplementation: consequences

not enough mineral

- Risk of deficiencies for animals
- Productions issues



too much mineral

- Excess in urine/soils or environment
- Overcosts for producers
- Toxicity for animals

Real need to adapt mineral supplementation



Aim

To test customized trace minerals
(Zn/Cu/Mn) supplementation for ruminants
using Animine products (Animix)

Material and Methods

 **Location:** Auvergne-Rhone-Alpes region, France



Farms: 5 farms, On average 80 dairy cows (Holstein and Montbeliard),
min=65, max=105 cows
basal diet (Grass, grass silage, haylage, hay, maize silage)



Experimental design: 2 periods → ANIMINE period compared to PREVIOUS period

PREVIOUS

February to July 2022

Commercial mineral
supplement with Zn,
Cu and Mn

VS

ANIMINE

February to July 2023

Animine products: Animix

- CoRouge: monovalent copper oxide
- HiZox: potentiated zinc oxide
- Mangrin: purified Manganese oxide

Minerals
supplementation
in diet

Customized trace mineral supplementation: explanations (average of 5 herds)

Mg/Kg	Basal diet	PREVIOUS (supplementation)	PREVIOUS (Total)	ANIMINE (supplementation)	ANIMINE (Total)	DIFFERENCE (supplementation) Animine vs Previous	NASEM (2021)
Zn	29	57	86	58	87	/	60
Cu	6	12	18	6	12	-50%	11
Mn	59	35	94	21	80	-33%	30
Sources		Chelates, sulfates & oxides		100% AniMix			

→ Animine Cu calculated considering level of antagonists: S= 1,7 g/kg DM; Mo= 0,83 mg/kg DM; Fe= 178 mg/kg DM, and the ratio Fe/Cu less than 50

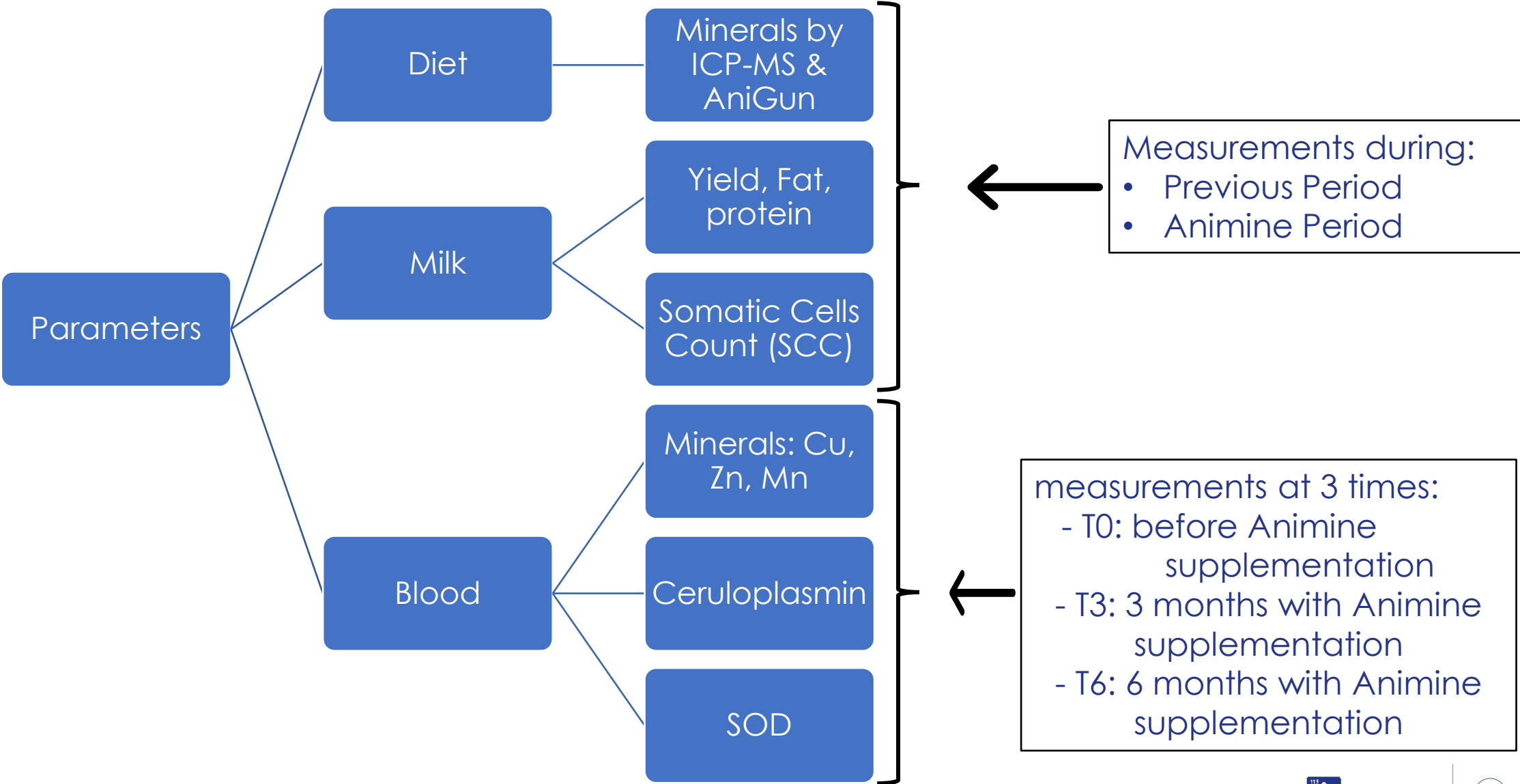
→ Animine Mn reduced but higher than NASEM due to pending debate on requirements and level of antagonist (Fe)

→ Animine Zn higher than NASEM due to Increased needs of high-producing cows (high Zn concentration in milk), and to avoid hoof and milk quality issues

Material and Methods



Measurements:





Results and discussions

Blood analysis: average of 5 herds

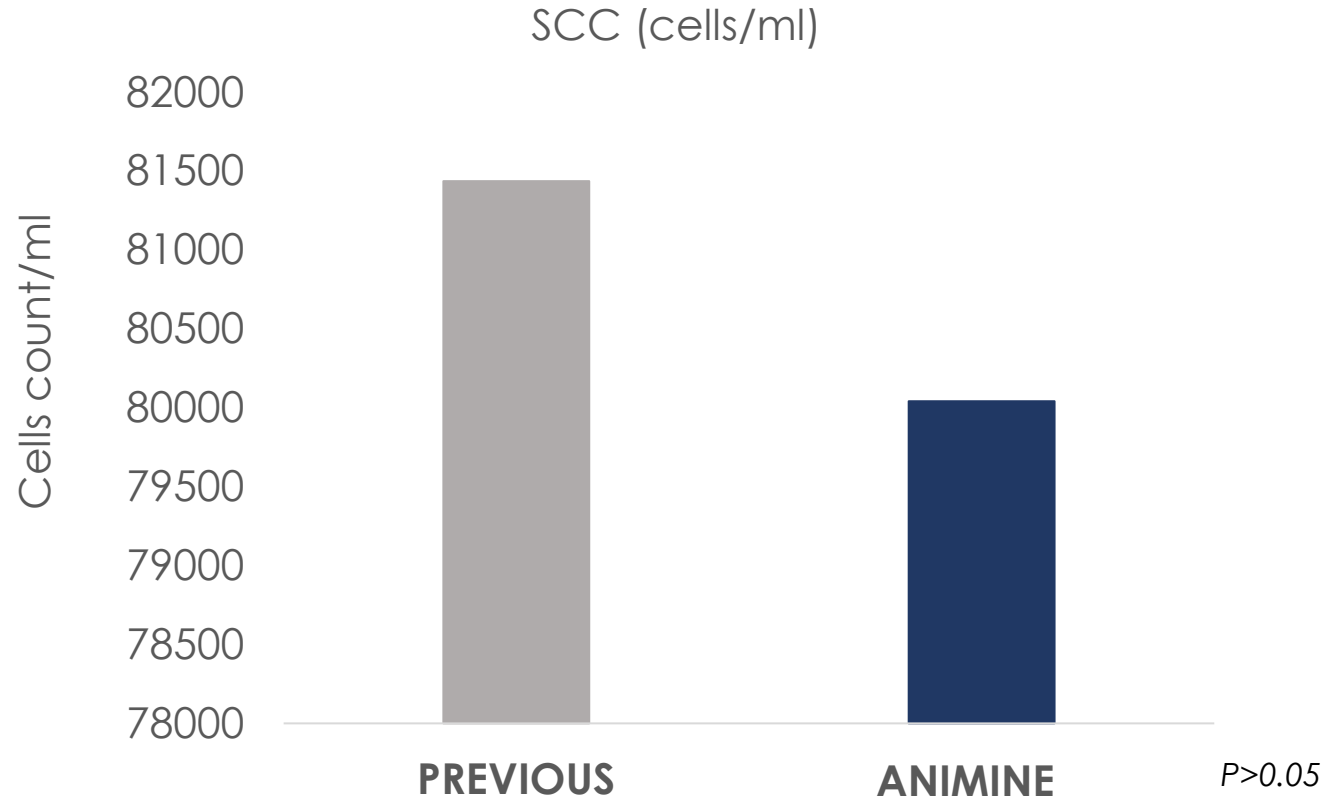
Parameters	T0	T3	T6	P-value	Standard values
Cu (μmol/L)	14.2	13.4	13.4	0.079	13-18
Zn (μmol/L)	15.2 ^a	16.5 ^b	18.4 ^c	<0.001	14-21
Mn (μg/L)	2.9 ^a	1.9 ^b	2.8 ^a	<0.001	2-6
SOD (U/gHb)	2029	1952	1875	0.135	1400-2500
Ceruloplasmin (mU/mL)	5708 ^b	4840 ^c	7628 ^a	<0.001	

U/gHb: units per gram of haemoglobin

- **Zinc** : blood Zn increased with time, indicating improved supply to animals
- **Copper** : not a significative change as for SOD too
- **Ceruloplasmin** : Higher level in T0 and T6 might be due to stress
 - Calving for T0 (*Hussein & al.,2011*)
 - Summer heat for T6
- **Manganese** : constant levels but decrease level in T3 due to an analytical procedure (goods results are obtained 2 to 3 hours after sampling)

Blood levels were barely even affected by supplementation decrease

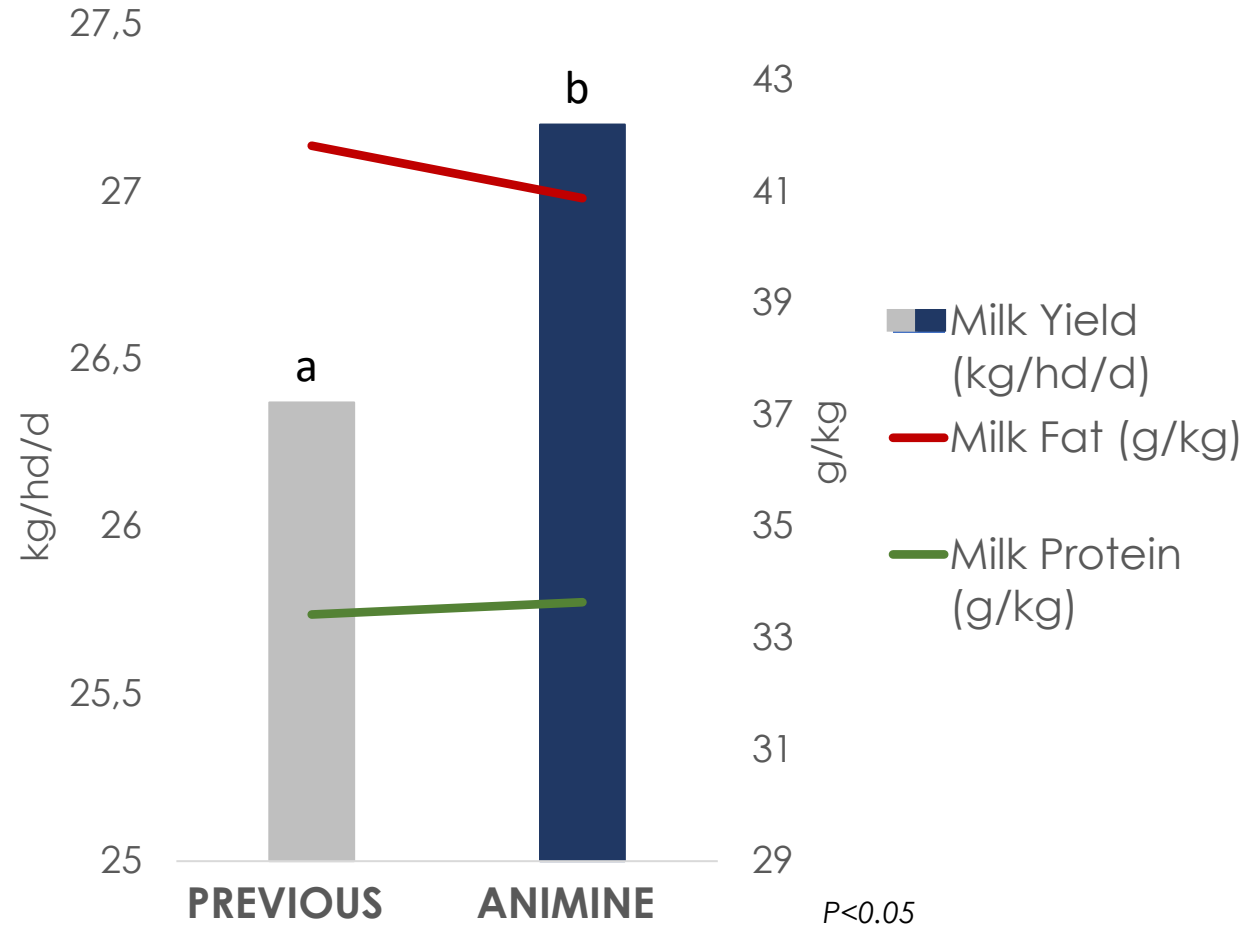
Somatic cell count (SCC): average of 5 herds



Somatic cells count (SCC) remained at excellent level
($\pm 80\,000$ cells/ml)

Values 5 times less than 400 000 cells/ml (Threshold max, European Union)

Milk production and composition: average of 5 herds



Milk yield increased by 0.8 kg/d/cow (+3 %) with a slight dilution effect on milk fat

Conclusions

A customised traces minerals supplementation in these five dairy farms using Animine products showed :

- Previously, an excess of copper supplementation
- Interpreted from blood values, an improved Zn status at same supplementation level, and maintained Cu and Mn status despite decreased supplementation levels
- Increased milk production
- good udder health with excellent somatic cells counts levels

Thank you for your attention

