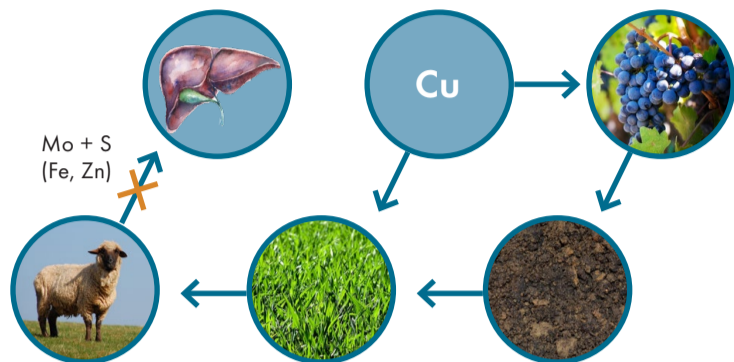


# Sheep in organic vineyards: landmarks for the risk of Chronic Copper Poisoning

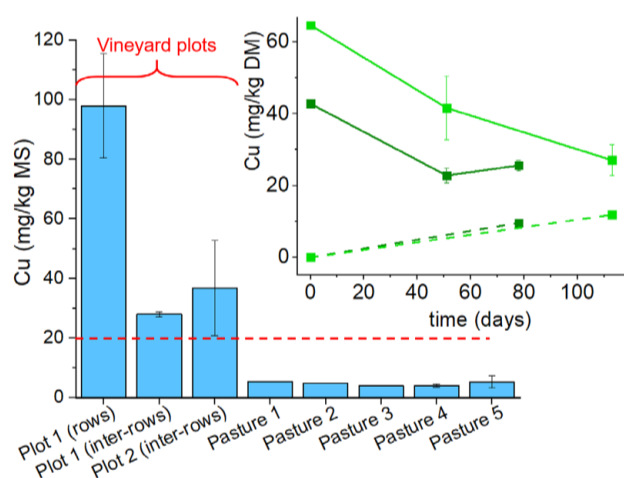


## Context & Objectives

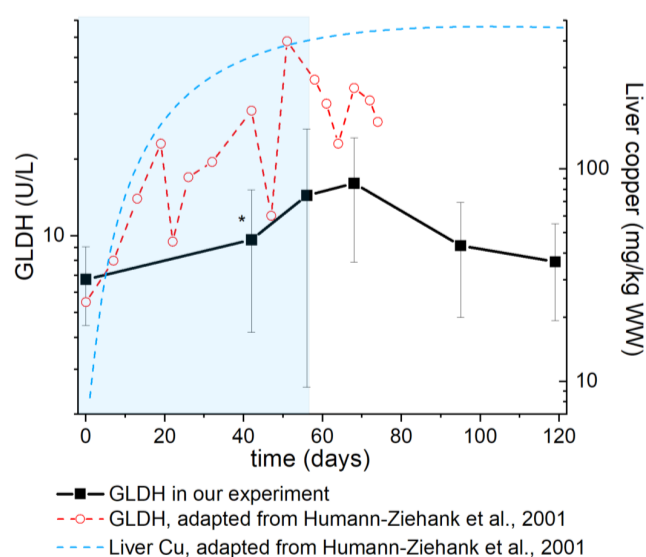
Many sheep breeders graze their animals in vineyards during winter to avoid forage expenses – an ancestral practice that is regaining popularity.

Still, copper found in the vineyard cover vegetation (because of drift during Cu-based fungicide application, or plant uptake from a contaminated soil) can induce Chronic Copper Poisoning (CCP) in sheep. CCP is linked to the progressive storage of high quantities of Cu in the liver of sheep, that may lead to a sudden crisis generally leading to rapid death of the animal.

**The aim of this study was to determine whether sheep grazing in organic vineyards during winter are at risk of undergoing Chronic Copper Poisoning (CCP).**



**Fig.1:** Cu concentrations in cover vegetation of vineyard (left) and pasture plots, at the time of sheep entrance. Error bars indicate standard deviation (n=3). Inset: evolution of Cu concentration in the cover vegetation of vineyards, initially mown (dashed lines) or left unmown (solid lines) after Cu treatments.



**Fig.3:** Changes in GLDH activity in the plasma of sheep, during and after their grazing in the vineyards (blue panel). Error bars indicate standard deviation (n=12). Asterisk shows significance (P<0,1) of the initial GLDH rise.

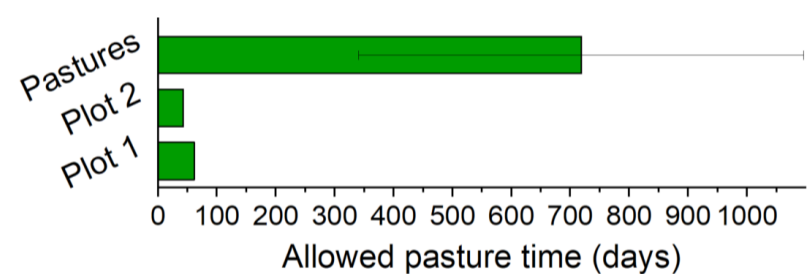
## Material & Methods

During winter 2018, 12 crossbred Merino x Mourerous female lambs aged 9 months (weight 25-30 kg) were allowed to graze during 56 days overall, in 2 organically managed vineyard plots in Drôme, France.

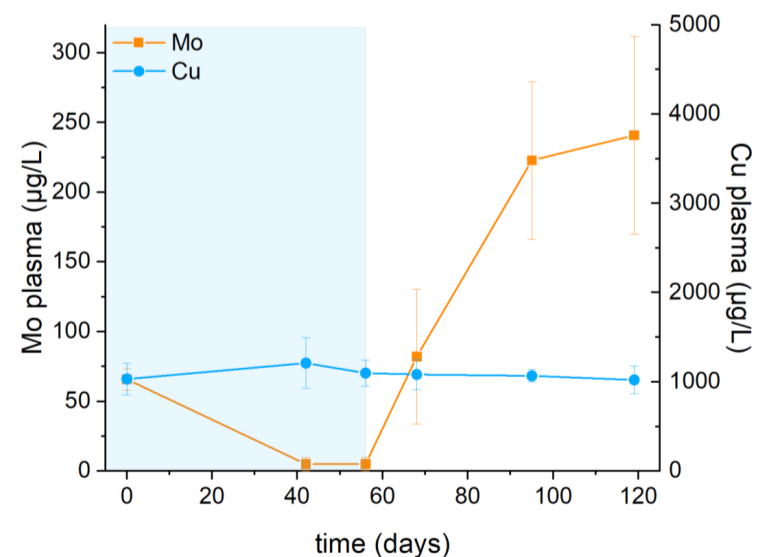
Vegetation samples were collected for analysis of Cu, Mo, S and Fe content. Plasma samples were collected for determination of GLDH, AST, γ-GT activities, and Cu and Mo concentrations.

## Conclusion & Perspectives

While large changes in plasma Mo content and slight GLDH activity rise suggest that some Cu is stored in the liver of sheep, our research overall shows that allowing sheep to graze in organic vineyards was reasonably safe in our conditions (relatively short grazing period, significant precipitation between Cu applications and sheep presence, mildly contaminated soil (10-35 mg Cu / kg DM), sheep breed). This somehow contradicts our data about cover vegetation, that suggest rapid occurrence of CCP risk. Further research should therefore focus on long-term and year-to-year accumulation effects, and/or monitor sheep placed in vineyards or orchards during the treatment period.



**Fig.2:** "Safe" pasture times calculated in vineyard (bottom) and pasture (top) plots; error bar corresponds to standard deviation (n=5). Allowed pasture time was calculated as number of days to reach 750 mg Cu / kg liver DM, on the basis of 30kg lambs, grazing 1.5 kg DM / day; Cu bioavailability to sheep was calculated by:  $A=5,7-1,3*[S]-2,785 \ln [Mo]+0,227 [Mo]*[S]$  with [Mo] in mg / kg DM, [S] in g / kg DM (Suttle, 2010)



**Fig.4:** Evolution of Cu and Mo plasma concentrations in sheep, during and after their grazing in the vineyards. Error bars indicate standard deviation (n=12)