

Cu dynamics in *Quercus rubra* L. agroforestry systems after sewage sludge inputs

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INTRODUCTION

The use of sewage sludge as fertilizer in silvopastoral systems increased pasture production and tree growth. However, sewage sludge contains a relatively higher concentration of heavy metals (mainly Zn and Cu) than that normally found in soils which is regulated in Spain by the R.D. 1310/1990 and by the European Directive 86/278/EEC

OBJECTIVE: to evaluate the effects of different dose of sewage sludge (100, 200 and 400 kg total N ha⁻¹) compared to control treatment (no fertilization) on the total and available Cu concentration in soil and the Cu levels of pasture in a silvopastoral system under *Quercus rubra* L.

MATERIALS AND METHODS

LOCALIZATION



EXPERIMENT DESIGN

- Randomized block (4 treatments and 3 replicates)
- 15 experimental units (144m²) with 25 *Quercus rubra* L.
- Sowing with *Dactylis glomerata* L., *Lolium perenne* L. and *Trifolium repens* L.

TREATMENTS

- (1) No fertilization (ON)
- (2) 100 kg N ha⁻¹ of anaerobic sludge (100N) in 2002 and 2003
- (3) 200 kg N ha⁻¹ of anaerobic sludge (200N) in 2002 and 2003
- (4) 400 kg N ha⁻¹ of anaerobic sludge (400N) in 2002 and 2003

SAMPLE COLLECTION: soil samples in March 2003 and in January 2004, 2005, 2006, 2007, 2008, 2009 and 2010 and pasture samples in June 2002, in July and December 2003, in June, July and December 2004, in May, July and December 2005 and 2006, in April, May and December 2007 and in May and December 2008 and 2009

ANALYSIS IN THE LABORATORY: soil total and available Cu and pasture Cu concentration

STATISTICAL ANALYSIS: ANOVA and LSD

RESULTS

Soil total and available Cu ↑ in 2010 than in 2003. Soil total Cu < 50 mg kg⁻¹ (R.D.1310/1990)

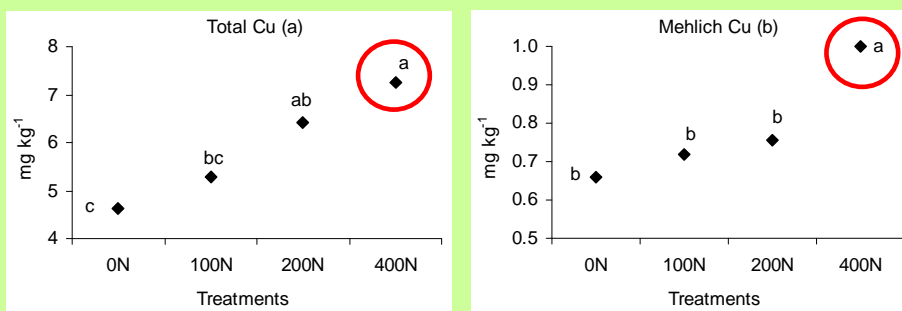


Figure 1. Mean soil total and available Cu to the period 2003-2010

In general, 400 N ↑ total and available Cu than the other treatments

400N ↑ concentration of Cu in pasture than the other treatments

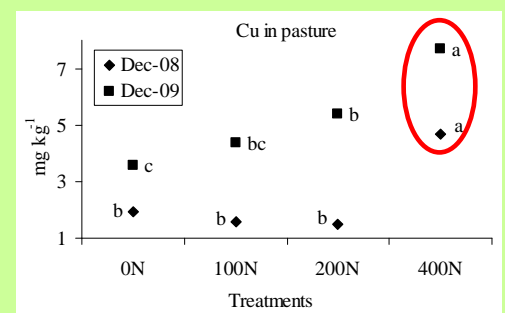


Figure 2. Concentrations of Cu in pasture

CONCLUSIONS: the fertilization with sewage sludge increased the concentration of Cu in the soil and plants, mainly when high doses of sewage sludge were applied (400 kg total N ha⁻¹), but never exceeded the maximums set by Spanish regulations and did not cause harmful effects on plants and animals. Therefore, the use of high quality sewage sludge as fertilizer may improve the productivity of the herbaceous and tree components of silvopastoral systems without creating environmental hazards