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► To cite this version:

Alain Bermond, Michel Mench, Denis Baize, Sangdeog Augustin Kim. Analyses of soil copper contents on Chaponne of Carixien soil series of Burgundy in France. South Asian Research Journal of Biology and Applied Biosciences, 2021, 10.36346/sarjbab.2021.v03i02.003 . hal-03371719

HAL Id: hal-03371719

<https://hal.inrae.fr/hal-03371719v1>

Submitted on 8 Oct 2021

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Original Research Article

Analyses of Soil Copper Contents on Chaponne of *Carixien* Soil Series of Burgundy in France

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Article History

Received: 21.02.2021

Accepted: 02.03.2021

Published: 29.03.2021

Abstract: *Objectives:* This study was carried out for assessing total and available soil Cu in a *Carixien* soil series of a part of Burgundy, France. *Method:* Soil samples were collected from surface-ploughed layer in agricultural fields across the southern part of the Yonne district, Burgundy, France. The extraction time of soil Cu ranged from 5 minutes to 24 hours. *Findings:* The result on *Carixien* soil was Chaponne. And the trend of extraction on the *Carixien* soil was different from the results on *Domerien* soil. The pH value of the extracted solution increased for the Chaponne soil. For purpose of comparison it remained steady in the case of the Dubloc soil from the *Domerien* soil series, the copper (Cu) absorbance through the atomic absorption spectrophotometry and its content. The Cu concentration in the extracted solution increased up to the 24h-extraction (+ around 200 %) on the basis of 5 minutes. In the case of the Dubloc soil from the *Domerien* soil series, the Cu concentration in the soil extract only slightly increased during the 24h-extraction period (+ around 100%) on the basis of 5 minutes. *Novelty:* From these data it is considered that while *Domerien* soils have no 'hole' for Cu extraction, Chaponne soil has a 'hole' for Cu extraction.

Keywords: *Carixien* soil, copper, extraction, soil pH.

INTRODUCTION

A field case study was undertaken on a *Carixien* soil series across the southern part of the Yonne district, a part of Burgundy, France [1]. Thereafter, the relationships between soil weight, amount of an extracting reagent and extractable soil Cu from the soils in this *Carixien* soil series were assessed. And the absorbances of Cu element were determined by atomic absorption spectrophotometry [2]. The authors analysed soil Cu content during extraction. Here, we present results on total and extractable soil Cu in Chaponne, from the *Carixien* soil series, region of Burgundy in France.

MATERIALS AND METHODS

Soil samples (in triplicates) were collected on 0.3 m² area with a spade from the 0-0.25 m surface-ploughed layer in fields at a site belonging to the *Carixien* soil series, *i.e.* Chaponne, southern part of the Yonne district, region of Burgundy, France [1]. Soil samples were air-dried, 2 mm sieved and re-homogenised. This soil sample, labelled Chaponne, was used for determining soil properties and Cu contents. .

The method for extracting metals from the soil samples were reported by Lebourg [3] and Ghestem [4]. The time for soil extraction varied from 0 min, 5 min, 10 min, 20 min, 30 min, 1 hour, 5 hours, up to 24 hours. The chemical reagent for these extractions was 0.05 M EDTA (ethylene diamine tetraacetic acid) on the form of Na₂H₂EDTA. The soil

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sample was extracted in a polyethylene bottle (volume around 50 mL) with an agitator, then filtrated with a Millipore system (radius of membrane, $\varnothing = 0.45 \mu\text{m}$). Weighted aliquots (10 g dried soil) of soil samples and 30 mL of the EDTA solution were used. Experiments were made in triplicates for this report; soil sampling, soil analyses, crop analyses. These two experiments of soil sampling and crop analyses were performed. The Cu concentrations in the extracted soil solution were determined by air-acetylene flame atomic absorption spectrophotometry (AAS) (model: VARIAN SPECTRAA 250 PLUS), and its wave length was 324.8 μm . Background correction was not used for Cu analysis [5].

RESULTS AND DISCUSSION

The pH value of the extracted solution increased for the Chaponne soil. For purpose of comparison it remained steady in the case of the Dubloc soil from the Domerien soil series (Fig.1). The Cu concentration in the extracted solution increased up to the 24h-extraction (+ around 200 %, Fig. 2) on the basis of 5 minutes. In the case of the Dubloc soil from the Domerien soil series, the Cu concentration in the soil extract only slightly increased during the 24h-extraction period (+ around 100%) on the basis of 5 minutes.

Table 1 shows changes in the absorbance the EDTA-extractable soil Cu for Chaponne. From these two Figures, it is known that Chaponne soil has a ‘hole’ of Cu extraction while there was no ‘hole’ on Dubloc on Domerien soil [6]. Here ‘hole’ indicates the possibility for detachment, so it can show us the possible extraction of Cu in the case long extracting time. Pinta *et al.* [5] wrote that there are some factors which have affect to the changes of absorbance of Cu, for example, temperature, associated anion, interaction with other minerals.

From these data it is considered that while Domerien soils have no ‘hole’ for Cu extraction, Chaponne soil has a ‘hole’ for Cu extraction.

Table-1: Copper absorbance on atomic absorption spectrophotometry during soil extraction for Chaponne (Carixien) soil

extracting time (h : min : sec)	00:00	00:05	0:10:00	0:20:00	00:30:00	01:00:00	5:00:00	24:00:00
absorbance (x 0.001)		46	57	67	69	81	109	161
(on 10 nov 1998)		46	59	68	69	82	109	165
		46	59	68	73	81	109	160
		45	58	67	70	81	107	154
		45	58	65	72	81	109	162
		45	58	67	70	82	109	164
		45	58	68	70	80	108	161
		45	58	68	71	80	108	157
mean absorbance	0	45.3	58.1	67.2	70.5	81	108.5	160.5
standard deviation		# 0.5	# 0.6	# 1.0	# 1.4	# 0.7	# 0.7	# 3.5
Cu content (mg /kg soil)	0	1.2	1.5	1.8	1.8	2.1	3	4.5

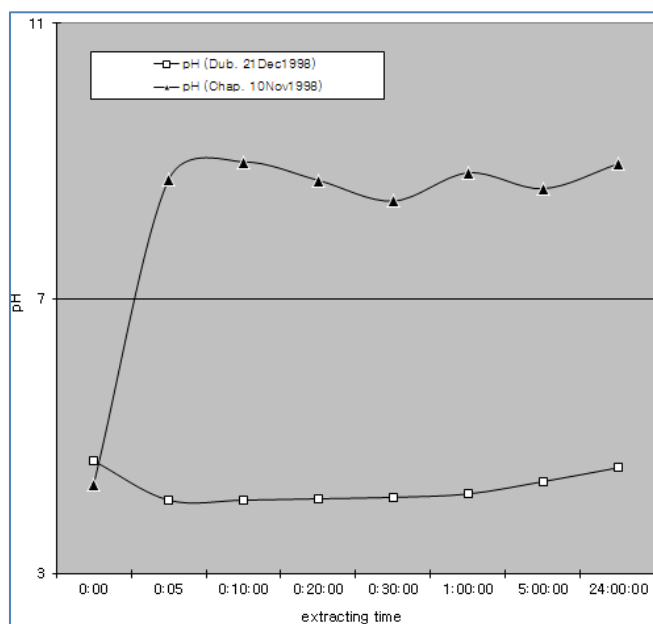


Fig-1: pH of Chaponne soil and Dubloc soil during extraction. Data of Dubloc soil was from Bermond *et al.* (2014)

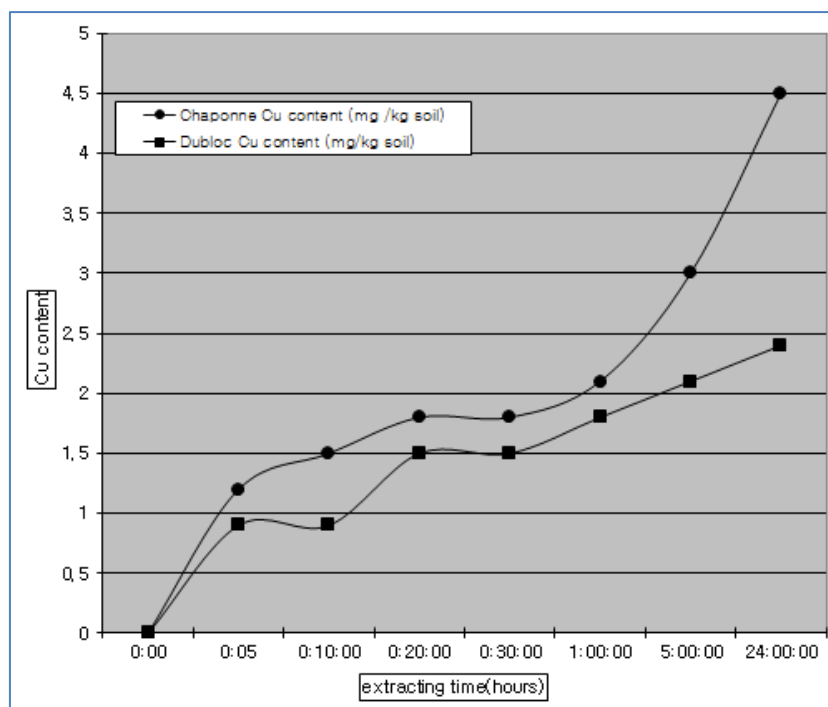


Fig-2: Comparaison of Cu content between Chaponne and Dublo. Data on Dubloc were taken from Bermond *et al.* (2014)

ACKNOWLEDGEMENTS

The corresponding author thanks Mr Ilsoo J. KIM and Mrs Bohwa KIM, Mr Yeonghag PARK and Mrs Hilye S. KIM, Pere Jean BLANC, Father Jeongsoo Barnabas KIM, Father Sangmin Thomas RO, Mrs Kisoon C. SONG and Mr Changyoo P. PARK, Madame Francine TENAILLON and Professor Nicolas TENAILLON, Professor Yong Kook KIM, Mr Ki Woo CHOI and Mr Jae Hong JO, Professeur C.J. DUCAUZE and Docteur Jean Claude FAVIER, Miss Og Za KIM and Mr Hwan Sik PARK, Professor Mitsuki OHSHIMA and Professor Ryosei KAYAMA and Professor Shigekata YOSHIDA, Professor Ik Suk YUN and Professor Tae Song KOH and Professor Jae In YUN, Father Andrés S. SHIN and members of *Ludovicus of Ordo Franciscanus Secularis* in Daejeon in Korea, Father JungEob Paul LEE and the members of Daejeon Nae-dong Catholic Church, the student of Department of Companion Animal and Animal Resources Science in Joongbu University, Korea Water Resources Corporation, Jieun Agatha and Kunjoo Daegon-Andrea and Jiah Anna and Rosa and Sohwa Threse and his wife Hyeonhi Regina PARK.

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Citation: Alain Bermond *et al* (2021) Analyses of Soil Copper Contents on Chaponne of *Carixien* Soil Series of Burgundy in France. *South Asian Res J Bio Appl Biosci*, 3(2), 28-30.