

Changes in Mn availability and soil acidity in *Albic Retisol* limed with dolomite screenings of various sizes and doses: A long-term microfield experiment in the north-western Russia

Andrey Litvinovich^{1,2}, Anton Lavrishchev²,
Vladimir Bure^{1,3}, Vladimir Miladinović⁴, and Elmira Saljnikov^{4,5}

¹Agrophysical Research Institute, Grazhdanskiy pr., 14, Saint Petersburg, 195220, Russian Federation

²Saint Petersburg State Agrarian University, Peterburgskoye shosse, 2, Saint Petersburg, 196601, Russian Federation

³Saint Petersburg State University, Universitetskaya nab., 7–9, Saint Petersburg, 199034, Russian Federation

⁴Institute of Soil Science, Teodora Drajzera, 7, Belgrade, 11000, Serbia

⁵Mitscherlich Akademie für Bodenfruchtbarkeit (MITAK), GmbH, 14641, Paulinenaue, Prof.-Mitscherlich-Alle, 1, Germany

Address correspondence and requests for materials to Anton Lavrishchev, av.lavrishchev@yandex.ru

Abstract

Liming of acidic soils is associated with various processes in the soil, including the availability of nutrients for plants. The vector and extent of these changes depend, inter alia, on the type of lime material and the doses used. Particularly, excessive liming can trigger a deficiency of manganese for crops. A long-term microfield experiment (13 test years) was carried out on *Albic Retisols* reclaimed with the dolomite particles of various sizes as a by-product of stone processing quarries. Ten treatments including various sized dolomite particles and their combinations, as well as traditional limestone flour on the background of NPK fertilizer were studied for the changes in soil acidity indicators (exchangeable acidity, pH; hydrolytic acidity, Hy; total acidity, H_{tot}) and manganese availability. The amount of acidic components passing into the extract of 1N KCl was insufficient to reveal a dependency between the exchangeable acidity and the content of mobile manganese in the soil of most treatments limed with dolomite particles of various sizes. However, the relationship between the content of mobile Mn in soils and the value of hydrolytic acidity was proved by paired linear regressions. Regardless of the dose and size of dolomite particles added, the soil was highly and moderately supplied with plant available manganese during the entire study period.

Keywords: Retisol, dolomite screenings, manganese, hydrolytic acidity, dependency.

Introduction

Manganese (Mn) is an important micronutrient for plant growth and development in metabolic processes in a plant cell. Mn is one of the most abundant metals in soil and comprises about 0.1% of the Earth's crust (Emsley, 2003; Alloway, 2008). In *Albic Retisols* (IUSS, 2014), the concentration of mobile manganese ranges from 0.008 to 0.4 mmol (eq)/100 g of soil. Its amount depends on many factors, including total reserves of Mn in soil, soil acidity, concentration of exchangeable hydrogen, water and air regime of soil (Behera and Shukla, 2014; Rengel, 2015), as well as particle size distribution (Nebolsin and Nebolsina, 2010; Alejandro, Höller, Meier, and Peiter, 2020).

The mobility of manganese increases from soils with an alkaline reaction to neutral and further to acidic soils (Lukin, Avramenko, and Melentsova, 2006; Behera and

Citation: Litvinovich, A., Lavrishchev, A., Bure, V., Miladinović, V., and Saljnikov, E. 2023. Changes in Mn availability and soil acidity in *Albic Retisol* limed with dolomite screenings of various sizes and doses: A long-term microfield experiment in the north-western Russia. *Bio. Comm.* 68(3): 135–144. <https://doi.org/10.21638/spbu03.2023.301>

Authors' information: Andrey Litvinovich, Dr. of Sci. in Agricultural Sciences, Professor, orcid.org/0000-0002-4580-1974; Anton Lavrishchev, Dr. of Sci. in Agricultural Sciences, Associate Professor, orcid.org/0000-0003-3086-2608; Vladimir Bure, Dr. of Sci. in Technical Sciences, Professor, orcid.org/0000-0001-7018-4667; Vladimir Miladinović, orcid.org/0000-0001-7394-0173; Elmira Saljnikov, PhD, Principal Research Fellow, orcid.org/0000-0002-6497-2066

Manuscript Editor: Evgeny Abakumov, Department of Applied Ecology, Faculty of Biology, Saint Petersburg State University, Saint Petersburg, Russia

Received: February 12, 2023;

Revised: April 12, 2023;

Accepted: May 5, 2023.

Copyright: © 2023 Litvinovich et al. This is an open-access article distributed under the terms of the License Agreement with Saint Petersburg State University, which permits to the authors unrestricted distribution, and self-archiving free of charge.

Funding: No funding information provided.

Ethics statement: This paper does not contain any studies involving human participants or animals performed by any of the authors.

Competing interests: The authors have declared that no competing interests exist.