ISSN: 2694-166X
Scientific Journal
Biology & Life Sciences
DOI: 10.33552/SJBLS.2023.02.000546
Iris Publishers

Short Communication

Forms of Iron in Soils of The P.G.I. Montilla-Moriles (Córdoba, Spain): Incidence of Iron Chlorosis

Alvarez-Romero M* and JL González

Department of Agricultural Chemistry, Soil Science and Microbiology, Faculty of Science, University of Cordoba, Spain

***Corresponding author:** Alvarez-Romero M, Department of Agricultural Chemistry, Soil Science and Microbiology, Faculty of Science, University of Cordoba, 14071 Cordoba, Spain.

Received Date: December 10, 2022

Published Date: February 07, 2023

Introduction

The study of iron chlorosis appearance in vineyards has been widely studied due to the negative effects it produces on the crop. This is especially true in basic soils with a high carbonate content. In these cases, the appearance of iron deficiency in plants is quite normal [1].

The P.G.I. Montilla Moriles is located in the southwest of Spain. The representative soils of the study area are Regosols, Vertisols, and Luvisols [2], which are distinguished by high active limestone contents and, as a result, pH values. In this context, it favors the presence of this deficiency in iron. These soils are developed on calcareous materials that are more or less weathered and consolidated.

This work aims to determine what type of soil meets the conditions to cause iron chlorosis in the grapevine variety *V. vinífera* L. cv. Pedro Ximénez grafted on V. chasselas x V. berlandieri.

Materials and Methods

According to its geographical distribution, four profiles were sampled for each soil type using an 8-cm-diameter auger; Regosols (R-1, R-2, R-3, R-4), Vertisols (V-1, V-2, V-3, V-4); and Luvisols (L-1, L-2, L-3, L-4). Samples were taken from five control sections of 25 cm, from the surface to a depth of 1.25 m since the highest percentage of vine roots are located above this depth (20–80 cm) [3]. The soil samples were air-dried before being broken down with a roller and passed through a sieve with a mesh size of 2 mm to separate coarse and fine-earth fractions. Fine-earth fractions were used for the chemical analysis. The average value of three replicates per sample was used for all analytical assays. On each soil sample, the following determinations were performed: Soil pH in H_2O was measured in saturated paste; texture was determined by the Bouyoucos method; soil carbonate content in a Bernard calcimeter by reaction with HCl; soil organic matter was determined by $K_2Cr_2O_7$ oxidation; CEC; Fe-total and Fe-AEDT [4]; and Fe-oxalate, extracted with ammonium oxalate [5]. Soils were classified according to the World Reference Base [6]. Finally, using the Statgraphics plus Software Version 5.1 statistical package [7]. A cluster analysis performed taking into account the average values of the four profiles sampled for each soil type for the five control sections considered.

Results and Discussion

Figure 1 shows the dendrogram performed on the average values of the four profiles sampled for each soil type for the five control sections considered (1: 0-25; 2: 25-50; 3: 50-75; 4: 75-100; 5: 100-125 cm). Regosols sections RE1 RE2 RE3 RE4 RE5; Vertisols sections VE1, VE2, VE3, VE4, VE5 and Luvisols sections LU1 LU2 LU3 LU4 LU5, for the ten variables considered pH(H_2O); % Sand; % Silt; % Clay, % Carbonates; % Organic Matter; CEC; Fe-total and Fe-AEDT; and Fe-oxalate.

As can be seen, there are two groups, Regosols on the one hand and Vertisols and Luvisols, more evolved soils, on the other. This difference is based on the fact that the Regosols present, in general, the lowest values for all the determined variables except for sand and silt. For Vertisols and Luvisols, except in the three deepest

control sections, the opposite of Regosols occurs. This may be due to the more limestone nature of the deeper control sections in the case of Luvisols. On the other hand, regardless of the type of soil, a greater similarity is observed between the superficial layers of the soil Figure 1.

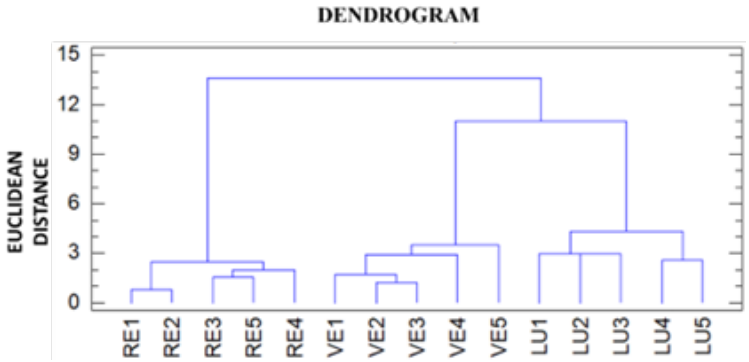

Figure 1: Schematic representation of a typical electrochemical cell. R -> Reference electrode, W -> Working electrode, C → Counter electrode, V -> voltmeter A -> amper**emeter**

Likewise, a series of indices were tested to try to predict the influence of these soils on the possibility of chlorosis of the Pedro Ximénez vineyards in the P.G.I. Montilla-Moriles. Of all of them, the one that seems to best fit the chlorosing characteristics of these soils is the Fe-oxalate/limestone ratio.

In this sense, Regosols present values from $9x10^{-3}$ to $1.5x10^{-2}$ but are always lower than the other two types of soils, whose values range from 0.4 to 0.9 for Vertisols and from 0.2 to 2.0 for Luvisols. Finally, it should be noted that in Luvisols there is a notable decrease in this index with depth, corresponding to the disappearance of illuviation horizons and the appearance of horizons with more carbonate contents.

Considering the dendrogram obtained and the values of the indices studied, regosols seem to be the most propitious to promote iron chlorosis in vineyards, although the variety Pedro Ximénez grafted on V. chasselas x V. berlandieri seems insensitive to the appearance of this deficiency.

Acknowledgment

None.

Conflict of Interest

The authors declare no conflict of interest.

References

1. Reyes JM, del Campillo MC, Torrent J (2006) Soil Properties Influencing Iron Chlorosis in Grapevines Grown in the Montilla-Moriles Area, Southern Spain, Communications in Soil Science and Plant Analysis 37(11-12): 1723-1729.
2. Sillero CP (1985) Distribución de micronutrientes en distintos tipos de suelos vitícolas del marco Montilla-Moriles. Tesis de Licenciatura. Universidad de Córdoba.
3. Jiménez-Ballesta R, Bravo S, Amorós JA (2022) Soil and Leaf Mineral Element Contents in Mediterranean Vineyards: Bioaccumulation and Potential Soil Pollution. Water Air Soil Pollut 233: 20.
4. MAPA (1994) Métodos oficiales de análisis de suelos y agua. Madrid, Spain.
5. Schwertmann U (1964) Differenzierung der Eisenoxide des Bodens durch Extraktion mit Ammoniumoxalat-Lösung. Z Pflanzenernähr. Bodenkd 105: 194-202.
6. FAO-WR (2015) Base Referencial Mundial del Recurso Suelo. Organización de la Naciones Unidas para la Alimentación y la Agricultura (FAO). Roma, Italy, p 218.
7. Emmanuel de Jesús Ramírez-Rivera, Marco Antonio Camacho-Escobar, Juan Carlos García-López, Virginia Reyes-Borques, Mabel Rodríguez-Delatorre (2012) Sensory analysis of Creole turkey meat with flash profile method. Open Journal of Animal Sciences 2(1)
8. Statistical Graphics Corporation (1994) Statgraphics plus Software Version 5.1. Warrenton, VA, USA.