

Theme 3

Impacts of soil nutrient management on the environment and climate change



Bovine manure mineralization and organic matter quality on ultra high density grazing (PUAD) in the Colombian Tropic

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INTRODUCTION

Area for production of beef and dairy cattle has increased in Colombia, generating changes in agricultural land use to livestock systems. High volumes of manure produced are potential source of water and soil contamination, generating compaction and contributing greenhouse gas emissions. Alternatives such as transformation and controlled decomposition of manure by addition of microorganisms are alternatives to mitigate these processes. Decomposition rate of cattle manure by addition a commercial mixture of mineralizing microorganisms of organic matter and Organic Carbon (OC) contribution to soil was compared.

METHODOLOGY

Manure was collected from the PUAD system at Hacienda La Cascada-Vereda Carrizales, Norcasia-Caldas, Colombia under tropical conditions (Figure 1); 18 wooden frames of 1*1*0.05m located in 3 different lots were used; 12-kg fresh manure were deposited by frame (Figure 2). A mixture of commercial organisms (5% v/v) previously activated for 48 hours and subsequently 9 frames were inoculated. Humidity, OC and pH were determined in manure and soil; mineralization rate and OC distribution on fine and coarse fraction of manure were also determined. Samples were taken fortnightly by 6 months.

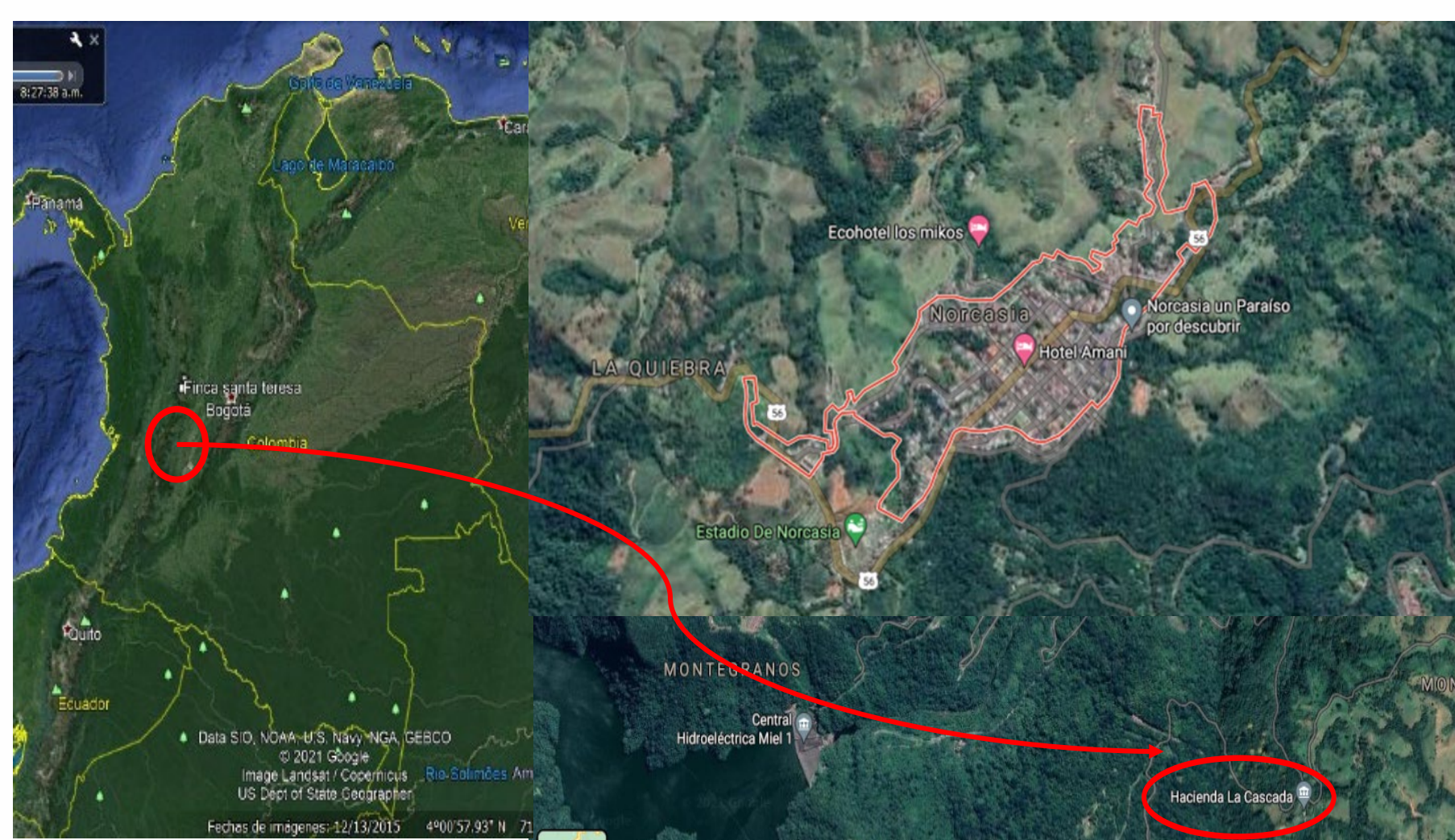


Fig.1: Geographical location of Farm La Cascada-Vereda Carrizales, Norcasia-Caldas, Colombia. Source: Google Maps, September 2019.

<https://www.google.com/maps/place/Norcasia,+Caldas/@5.5760675,-74.8930207,2062m/data=!3m1!1e3!4m5!3m4!1s0x8e412bcd2af22475:0xcfb2027787dccc018m2!3d5.576269!4d-74.8>



Fig.2 : Distribution of inoculated manure and without inoculation in squares, in a random way, 15% slope.

RESULTS

12 Kg of fresh manure, 2.2-3.0 Kg dry matter equivalent used by wooden; mineralization rate indicates that in 30 days 65.1% of the non-inoculated manure and 70.3% of the inoculated manure were transformed; later 6 months, 97.74% no inoculated and 98.15% in inoculated manure was the mineralization rate, statistical values was similar (Figure 3). Correlation between mineralization of manure and its acidification was evidenced, decreased pH 7.48 to 5.50 for non-inoculated manure and 5.72 for inoculated manure 150 days after, as shown in figure 4.

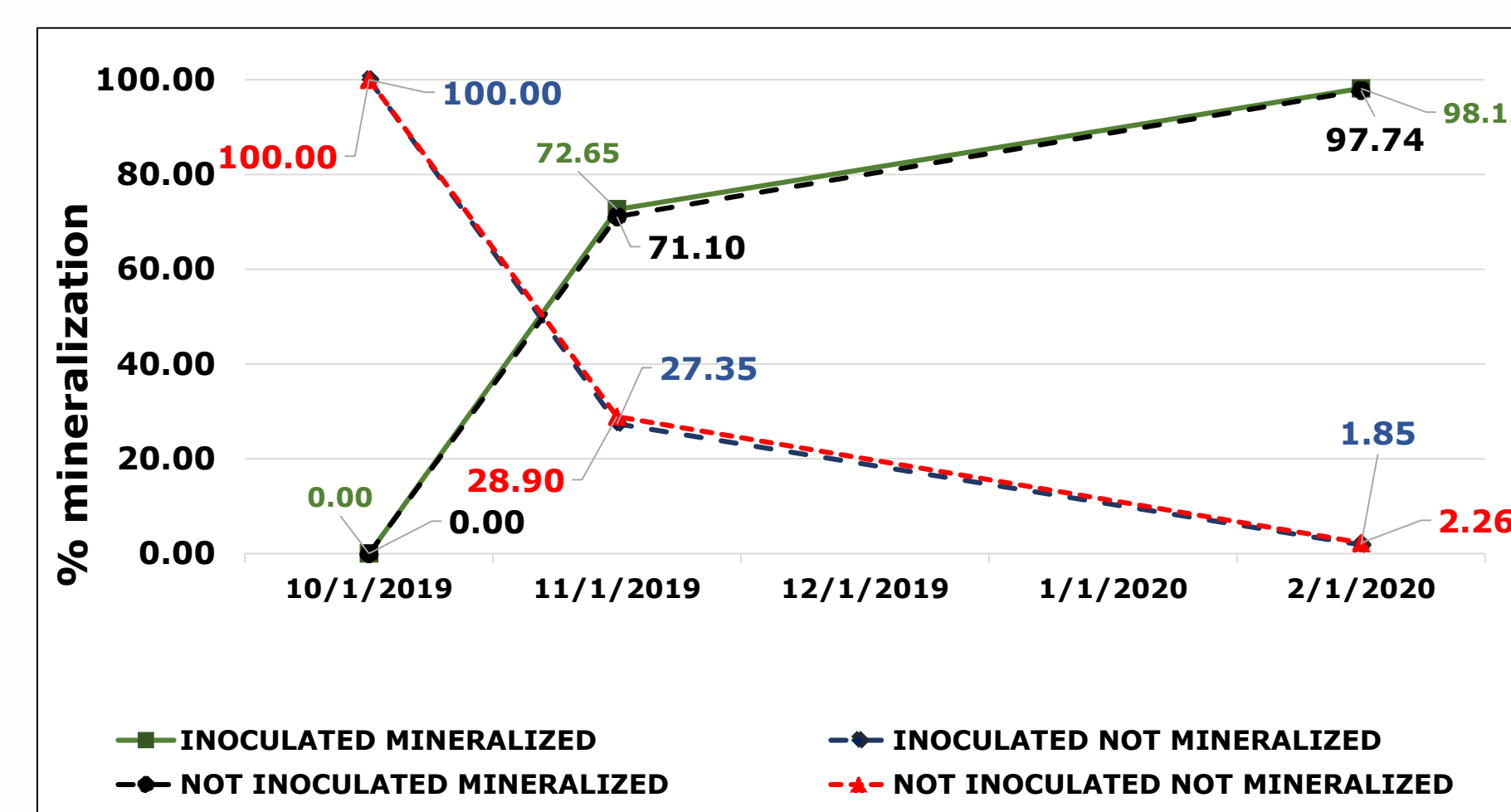


Fig.3. Mineralization rate of inoculated and non-inoculated manure and its relationship with untransformed manure during 60 days after start.

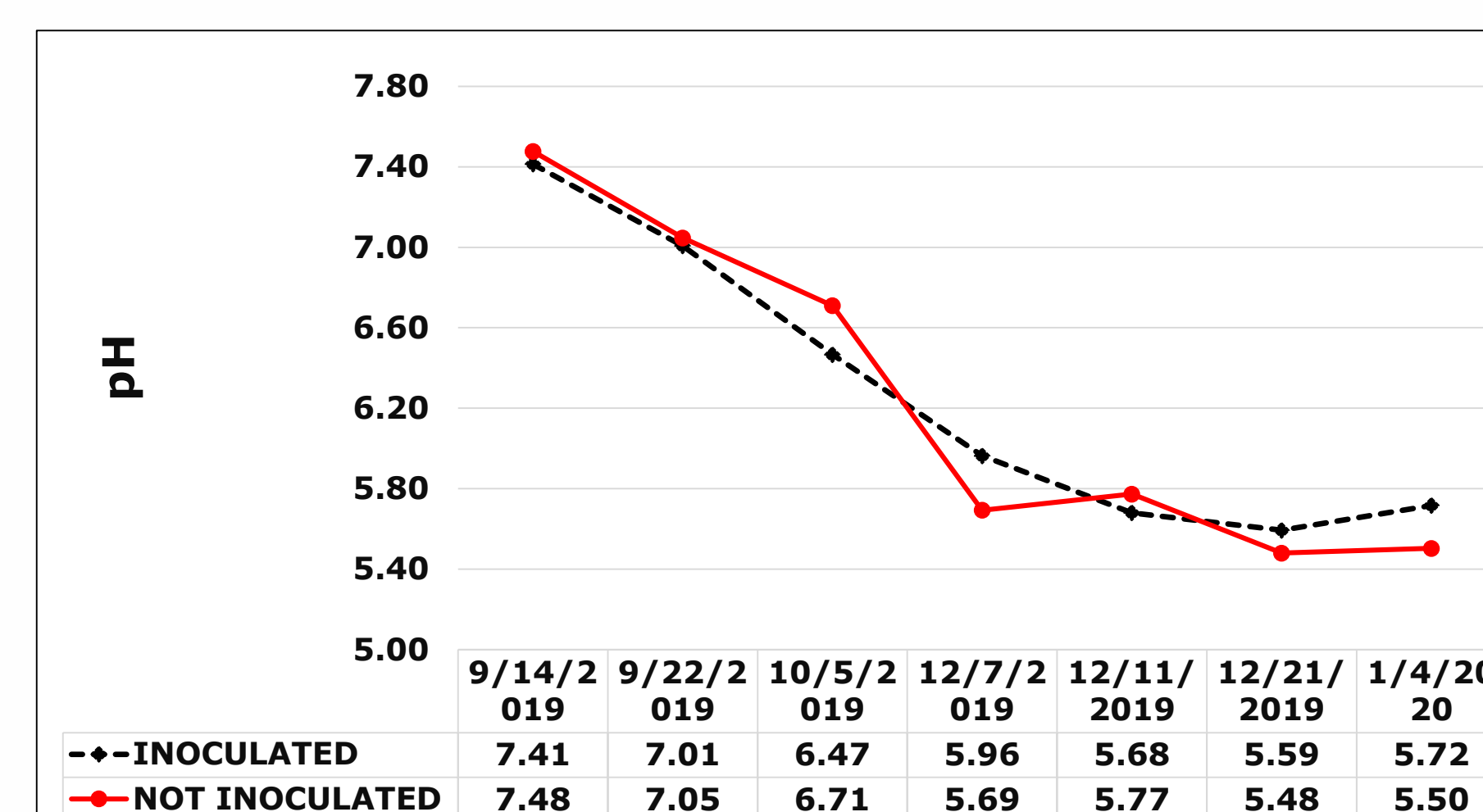


Fig.4. pH variation in inoculated and non-inoculated manure during mineralization and transformation process.

After 30 days, OC contents in manure decreased 23.45% to 17.68% in non-inoculated manure and 19.69% to 12.65% in inoculated manure; 150 days later, OC decreased to 8.06% in non-inoculated manure and 6.22% in inoculated manure (Figure 5).

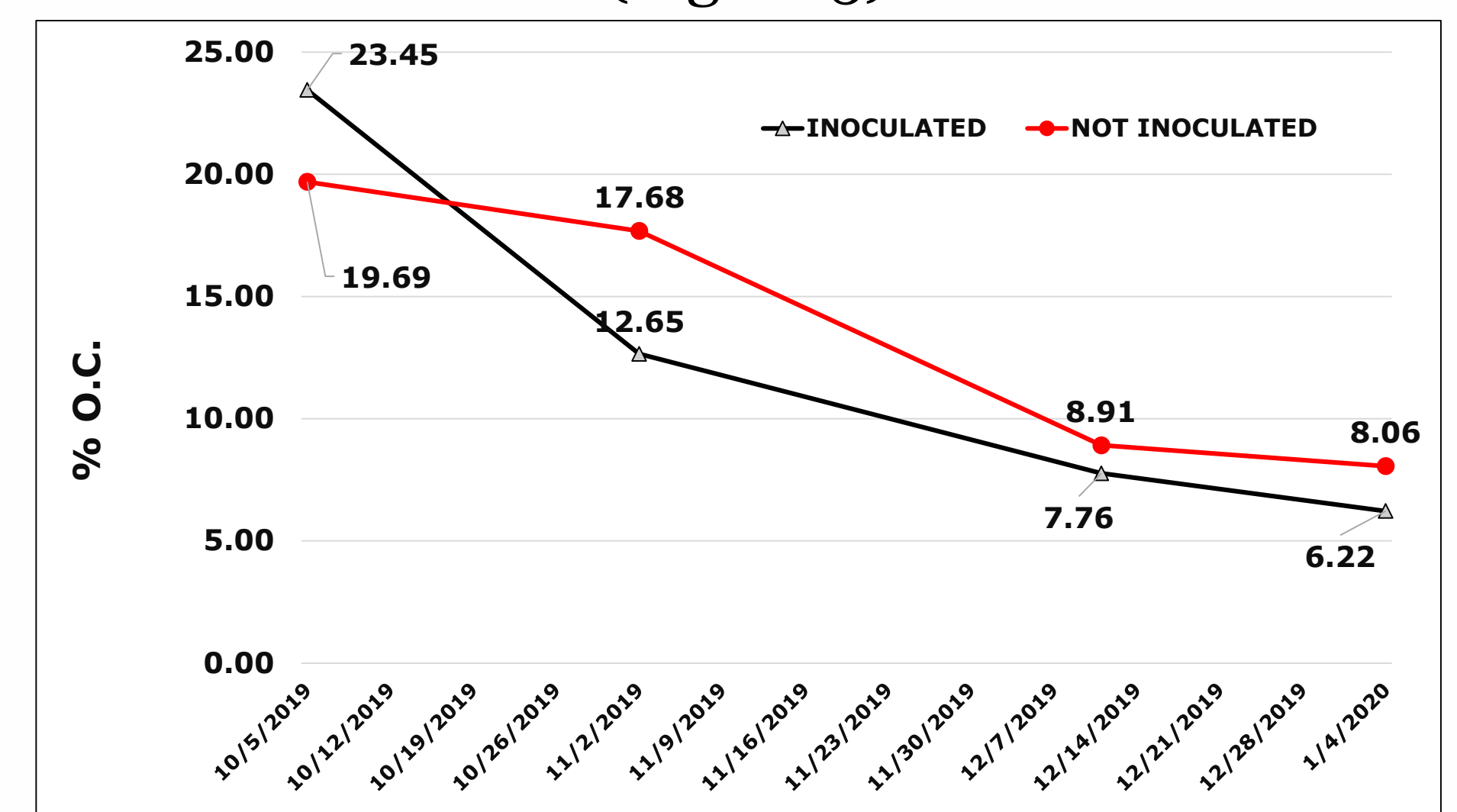


Fig.5. Organic Carbon changes in mineralization process of inoculated and non-inoculated manure.

CONCLUSIONS

Although inoculation with microorganisms increases initial mineralization processes, no significant differences or changes were found in the final content of OC transformed. This could indicate that the initial rates of manure mineralization are due to initial action of organisms that takes their energy by breaking down the rapidly degrading materials in manure, although if there are significant changes in acidity degree of materials through of time, which can generate changes in behavior of some soil properties, as has been reported (Aarons, O'Connor and Gourley, 2004).

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