

ORIGINAL PAPER

S. Luna-Suárez · J.T. Frias-Hernández
V. Olalde-Portugal · L. Dendooven

Catclaw (*Mimosa buincifera*): a pest or a means to restore soil fertility in heavily eroded soil from the central highlands of Mexico?

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Abstract In the central highlands of Mexico, heavily eroded soils are often colonized by catclaw (*Mimosa buincifera*): an N₂-fixing shrub. An experiment was carried out to investigate how this shrub affected characteristics of the soil and its biological functioning. Soil was sampled from outside and under the canopy of catclaw at three sites characterized by different degrees of erosion and an increase in plant density. The soil microbial biomass C, total amounts of bacteria, fungi, actinomycetes and free-living N₂-fixing micro-organisms were measured, while production of CO₂ and dynamics of nitrate (NO₃⁻), nitrite (NO₂⁻) and ammonium (NH₄⁺) were monitored in an aerobic incubation at 22 ± 1 °C for 35 days. The C content was 1.6 times greater in the area with the largest density of plants and the least erosion (RECUP) compared with the site with the lowest density and greatest erosion (DEGR), while it was 1.2 times greater under the canopy of the catclaw than outside it (average of the three sites). The incorporation of N into the soil organic matter was greater under the canopy of the catclaw than outside it as the C:N ratio was on average 8.4 and 9.1, respectively. The microbial biomass C, as a percentage of soil organic matter, was 1.5 times greater in the RECUP than in the DEGR site. Greatest total number of colony-forming bacteria and

fungi (mean of organisms found under and outside the canopy) were found in the RECUP treatment and lowest in the DEGR treatment. Free-living N₂-fixing organisms and actinomycetes showed opposite trends. Greater total numbers of colony-forming bacteria, fungi, actinomycetes and free-living N₂-fixing organisms (mean of the three treatments) were found under the canopy of catclaw than outside of it. Production of CO₂ was 1.8 times greater in the RECUP than in the DEGR and 1.6 times greater under the canopy of catclaw than outside. Production of NO₃⁻ was 1.3 times greater in the RECUP than in the DEGR and 3.5 times greater under the canopy of catclaw than outside. There was no significant effect of location or canopy on NO₂⁻ and NH₄⁺ concentrations. It is concluded that the natural vegetation of catclaw increased microbial biomass and soil organic matter content under, but also outside its canopy, and preserved N better, releasing greater amounts of inorganic N upon mineralization. Catclaw can serve as a first colonizer of heavily eroded soil and be replaced by other vegetation, natural or crops, when fertility is restored.

Key words Catclaw · Carbon dioxide production · Inorganic N dynamics · Soil microbial population

S. Luna-Suárez · L. Dendooven (✉)
CINVESTAV, Departamento de Biotecnología y Bioingeniería,
Avenida Politécnico Nacional 2508, C.P. 07000 Mexico D.F.,
Mexico
e-mail: lucdendo@prodigy.net.mx
Tel.: +52-5-7477000
Fax: +52-5-7477002

J.T. Frias-Hernández
Instituto de Ciencias Agrícolas de la Universidad de
Guanajuato. Ex Hacienda el Copal, A.D. 311, 36500, Irapuato,
Guanajuato, Mexico

V. Olalde-Portugal
CINVESTAV-IPN, Uniclud Irapuato A.P. 629,
Departamento de Biotecnología y Bioquímica, Irapuato,
Guanajuato, Mexico

Introduction

Cutting trees for wood or agricultural purposes and extensive grazing by goats and cattle has diminished the natural vegetation in large parts of the central highlands of Mexico (3×10^6 ha⁻¹), increased erosion and in some areas has led to a complete loss of topsoil (J.T. Frias-Hernández, unpublished PhD. thesis, University of Guanajuato 1998). This has promoted run-off and affects the water regime in areas with intensive agriculture, e.g. Irapuato, heavily dependent on irrigation with water from aquifers. Catclaw (*Mimosa buincifera*), an N₂-fixing shrub, usually considered a pest, as it reduces grazing grounds (García and Frias-Hernández 1996), is