SHORT-TERM MICROBIAL RESPONSE AFTER LABORATORY HEATING AND GROUND MULCHING ADITION

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INTRODUCTIÓN:

Several studies have evidenced marked soil organic carbon reduction after moderate and high intensity fire, which limit the total recovery of microbial biomass during years. Post-fire managements focus on protect soil against erosion-risk can include organic amendment as mulching, logging litter, seeding application, etc. This kind of post-fire management to protect soil can influence soil microbial response as well, since these practices could be modifying post-fire condition to start microbial recolonisation.

In this preliminary study the main **objective** was to compare microbial response after soil laboratory heating to simulate a medium-high intensity fire with and without the influence of ground mix of alfalfa:straw, trying to isolate the possible nutritional influence of mulching application on microbial response

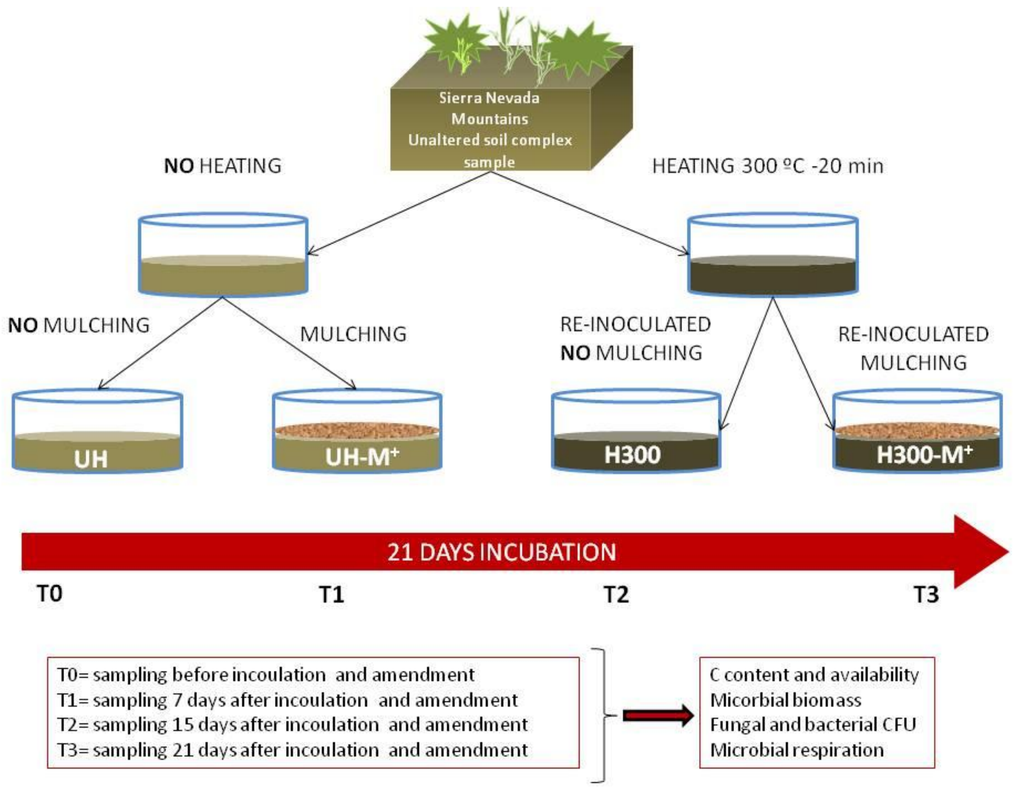

Figure 1. Experimental design explanation. UH= Unaltered-control; UH-M+= Unaltered-control amended with ground mulching; H300= heated at 300 ºC 20 min; H300-M+= heated at 300 ºC 20 min. amended with ground mulching. CFU= Colony Forming Units

MATERIAL AND METHODS:

Experimental design

Soil was heated at 300 ºC during 20 minutes in a muffle furnace (H300) to simulate a medium-high intensity fire. After heating, soil samples were inoculated with unaltered fresh soil (1%), rewetted at 55-65% of water holding capacity and incubated during 3 weeks. At the same time, unheated soil samples were incubated under the same conditions as control (UH). In addition, trying to partially alleviate soil organic matter fire-induced alterations effects on microbial colonization, we include an organic amendment treatment (M+). So, part of heated and unheated samples were amended with a mix of ground alfalfa:straw (1:1) (2mg g-1 fresh soil) and soil samples were collected 7, 15 and 21 days after inoculation (Fig. 1).

Soil analyses

Soil organic carbon content and availability was monitored during the whole study. Total soil microbial abundance was estimated by **microbial biomass** C by Fumigation-Extraction method . Viable and cultivable **fungi** and **bacteria** abundance were estimated by plate count method, using Rose Bengal Chloramphenicol (0.1 g l^{-1}) Agar and Triptic Soy Agar (TSA) , respectively. Microbial activity was estimated measuring soil **basal respiration** by static incubation-titrimetric determination using NaOH trap.

RESULTS AND DISCUSSION

Heating process reduces total organic carbon content. Heated and amended samples showed slight higher values of total organic carbon than the heated and unamended ones after one week of incubation. This marked decrease could be related to high intensity burning reached during heating process that could reduce markedly carbon content and availability.

After soil heating no surviving microorganisms was checked in heated samples. H300 treatment hardly showed some recovery during the experiment. Ground mulching appears to stimulate microbial biomass in both, heated and unheated samples, although microbial stimulation in heated samples was not enough to reach the unaltered values in 3 weeks since several years can be required to recover the original microbial biomass after fire.

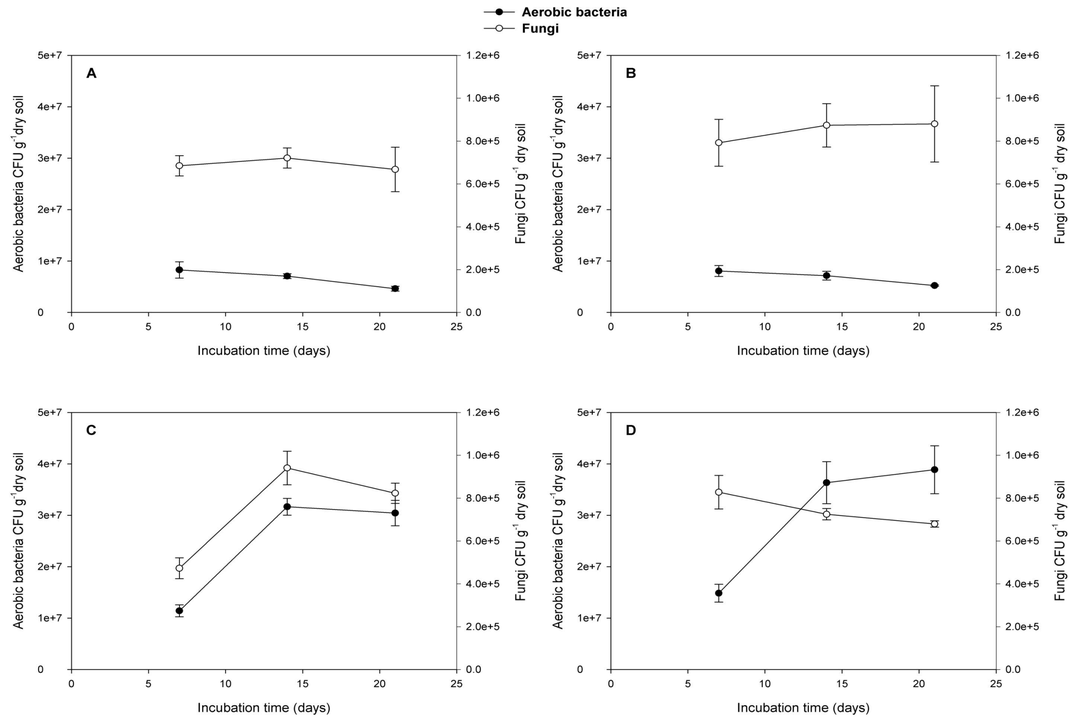

Figure 2. Viable and cultivable fungi and bacteria quantified 7, 15 and 21 days after inoculation. A) Unaltered-control; B) Unaltered-control amended with ground mulching; C) heated at 300 ºC 20 min; D) heated at 300 ºC 20 min. amended with ground mulching. Mean values ± standard error.

Heated samples showed higher abundance of viable and cultivable bacteria compared to the unheated ones, showing a marked increasing with incubation time. Mulching addition did not show marked differences in unheated samples, while appears to stimulate slightly bacterial proliferation in heated samples.

Fungal abundance decreased markedly due to heating process during the first week of incubation, increasing until reach the unheated samples values at the end of the experiment. Ground mulching addition stimulate fungal proliferation in both, heated and unheated treatments (Fig. 2, 3).

Heating treatment causes a marked decrease in microbial respiration. Mulching treatment induce an increment in soil microbial respiration in both, heated and unheated samples, although heated samples amended with mulching did not reach the respiration rate values of unaltered samples (Fig. 4).

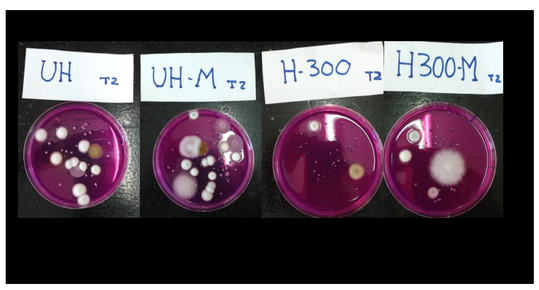

Figure 3. Fungal colonies growing in Rose Bengal Chloramphenicol Agar 15 days after inoculation with fresh soil. UH= Unaltered-control; UH-M+= Unaltered-control amended with ground mulching; H300= heated at 300 ºC 20 min; H300-M+= heated at 300 ºC 20 min. amended with ground mulching.

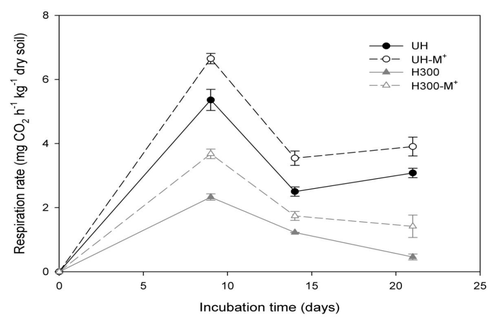

Figure 4. Microbial respiration rate measured 7, 15 and 21 days after inoculation with fresh soil. UH= Unaltered-control; UH-M+= Unaltered-control amended with ground mulching; H300= heated at 300 ºC 20 min; H300-M+= heated at 300 ºC 20 min. amended with ground mulching. Mean values ± standard error.