Role of microorganisms during aging of vermicompost: effects of decaying enzyme activity

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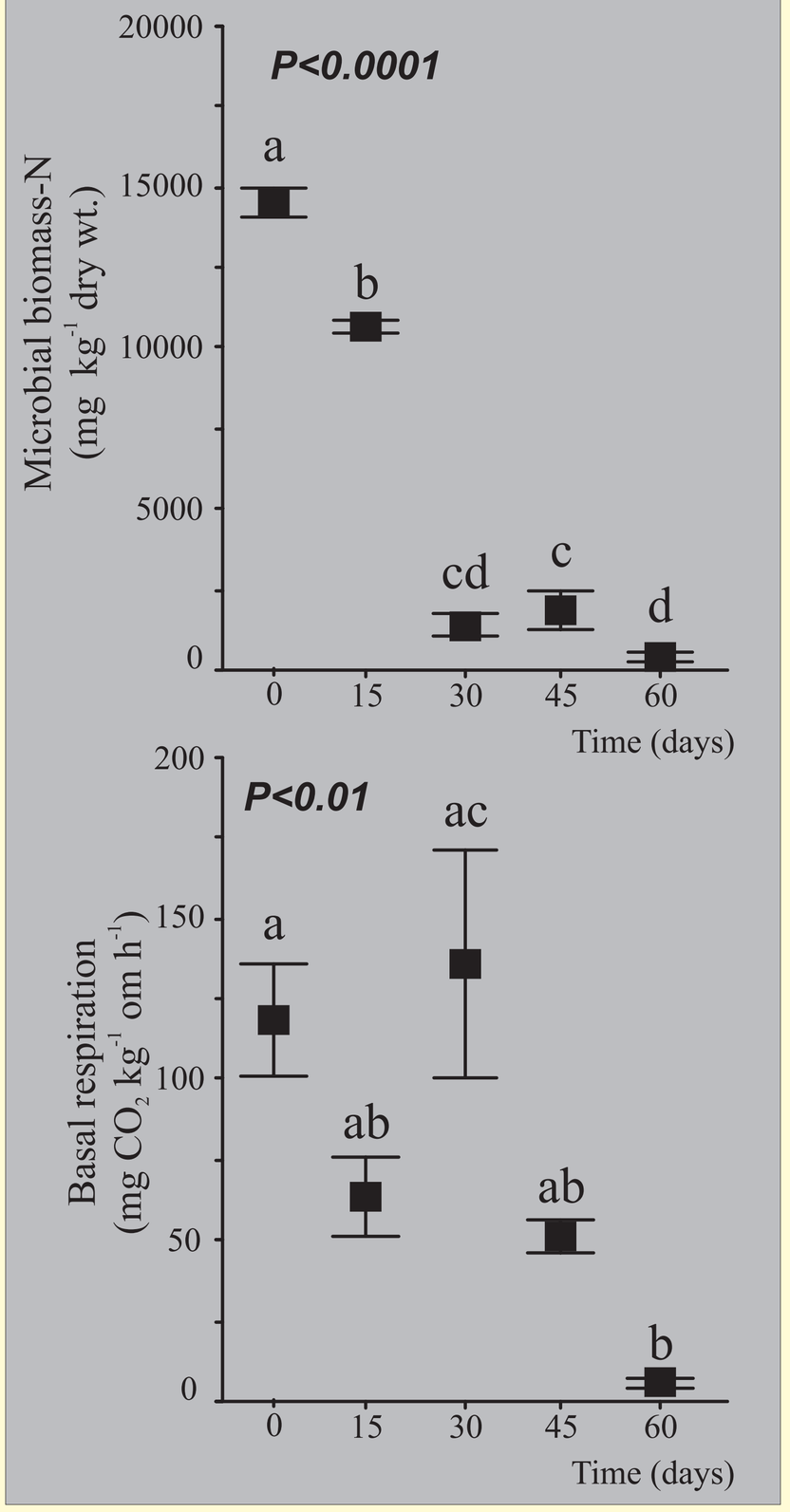
RATIONALE

Vermicomposting is the biooxidation and stabilization of organic matter involving the joint action of earthworms and microorganisms, thereby turning wastes into a valuable soil amendment called vermicompost. Studies have focused on the changes in the type of substrates available before and after vermicomposting, but little is known on how these changes take place, especially those changes related with maturation of vermicompost. In the present study, the effects of vermicompost aging especially patterns of changes in microbial biomass and enzyme activities were investigated because these parameters can control the quality of the resulting vermicompost. To do this we analyzed the pig slurry once earthworms have initially processed it (fresh vermicompost).

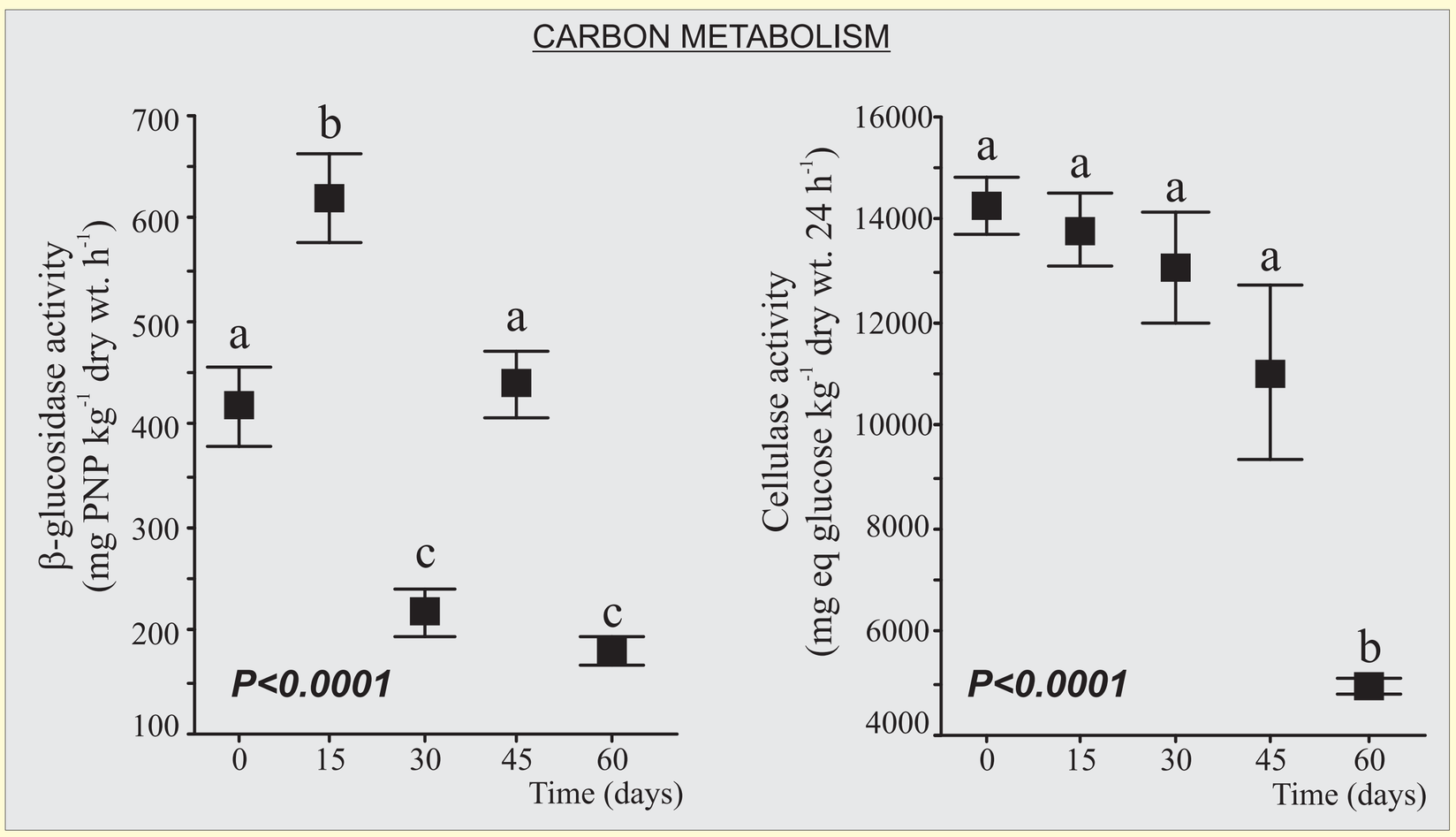
Material and methods

We incubated 16 week-old vermicompost (fresh vermicompost) and sampled it after 15, 30, 45 and 60 days analyzing microbial biomass and activity (assessed as microbial biomass-N and basal respiration respectively), and four enzymatic activities (β-glucosidase, cellulase, protease, alkaline phosphatase). Data were analyzed with a repeated measures ANOVA (value of **P** in the figures; different letters indicate differences at $p<0.05$, Tukey HSD test)

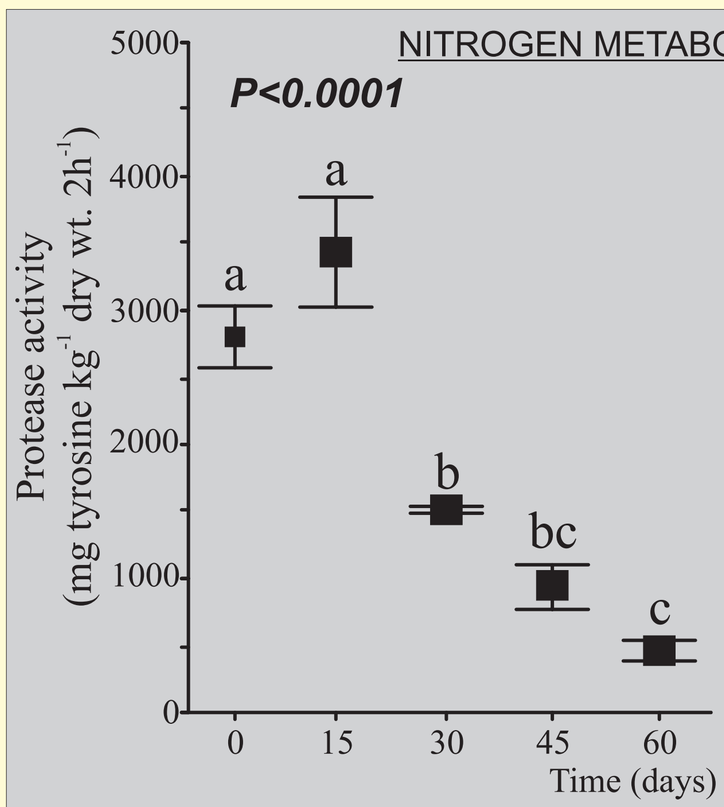
MICROBIAL BIOMASS AND ACTIVITY



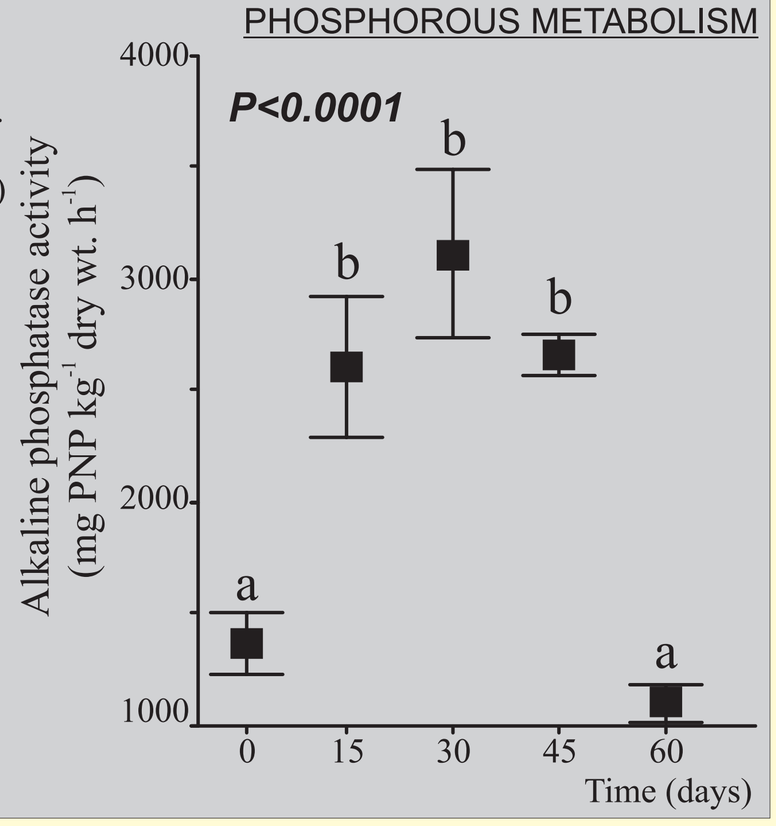
CARBON METABOLISM



NITROGEN METABOLISM



PHOSPHOROUS METABOLISM



Aging of vermicompost resulted in decreases of microbial biomass and activity. Three of the four enzymes analyzed also showed decrease.

CONCLUSIONS

High and significant correlations between microbial biomass and β-glucosidase ($r = 0.62$, $P<0.001$), cellulase ($r = 0.56$, $P<0.01$) and protease ($r = 0.82$, $P<0.001$) were found. Results suggest that there may be two steps involved in the aging dynamics of vermicompost with regards to extracellular enzyme activity; the first step was characterized by a decrease in microbial populations, which resulted in a reduction in the synthesis of new enzymes. The second step was the degradation of the pool of remaining enzymes. This dynamic does not seem to be affected by earthworms because similar decaying patterns of microbial biomass and activity were found in substrate where earthworms were present.