EFFECTS OF FISH MANURE VERMICOMPOST ON A SOIL AFFECTED BY WILDFIRE

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1 INTRODUCTION

Sustainable growth of aquaculture industry requires profitability, economic development, and waste management. Aquaculture waste consists primarily of soluble metabolic products as well as solids present in the form of faeces and uneaten feed.

Vermicomposting is essentially organic composting through earthworms and an ecobiotechnological process that transforms energy rich and complex organic substances into a stabilized vermicomposts (Bentize et al. 2000). The use of earthworm in sludge management has been termed as 'vermistabilization'. Vermistablization represents a technology that is environmentally sound and relatively new technology that can be classified as an innovative and alternative technology (Surindra, 2009, Singh et al. 2010). Vermicompost made from fish manure or sludge from biofilter could provide an effective source of nutrient-rich organic matter. Instead of creating a disposal problem, composting these organic materials with a suitable carbon source creates a useful and potentially marketable product. It is commonly reported that composted organic residues release lower plant-available N and P than untreated biomasses due to higher organic matter stabilization and N losses during composting (e.g. Zucconi and de Bertoldi 1987; Golueke 1989; Eghball et al. 1997; Kithome et al. 1999). Considerable information is available about composting of biosolids, animal manures, and municipal solid wastes, but it is limited in the case of highly decomposable materials such as fish wastes (FW) (Jellum et al. 1995).Our main objectives were to: (1) assess the agronomic value of vermicomposted fish manure, and (2) determine whether aerobic incubations provide an adequate index of nutrient availability to estimate agronomically and environmentally acceptable rates of vermicompost application.

2 MATERIAL AND METHODS

2.1 Material

Burn soil was sampling from Pontevedra (Spain), a site which was completely burned by a wildfire in August 2006. Burn soil sample was collected from the top 30 cm. Fish manure sampling was carried from commercial turbot farm in O Grove (Pontevedra). Composting experiments are conducted at Ponteareas (Pontevedra) during 2008-2009.

Composting requires bulking agents in order to facilitate aeration and provide carbon sources for microorganisms. Selected waste mixtures – pine sawdust + fish manure (C1, compost 1), pine sawdust + fruit waste + fish manure

(C2, compost 2) were composted during four months. At the end of this process Eisenia andrei and Eisenia fetida, were added to C1 and C2 and the aerobic treated compost were vermicomposted for two month.

2.2 Methods

Laboratory incubations

Soil samples were collected under field-moist conditions, sieved to 2 mm, and thoroughly mixed with the vermicompost, which were previously ground to pass a 2-mm sieve. Vermicomposted fish manure were applied at a rate of 90 and 120 $Mg.ha^{-1}$. Samples of the mixtures were placed in 3kg plastic pots and incubated aerobically at 25ºC, 20% soil moisture (equivalent to the water content at 0.01 MPa) for 90 days. At each sampling date (0, 15, 30, 45, 60, 90 days), three replicates of control and amended soils were randomly selected for organic matter, inorganic N and P analysis. The net N mineralized was calculated according to Sims (1990):

$$N_m = (Na)_t - (Na)_{t=0} \; ; \; Na = (N_I)_{SL} - (N_I)_C \; ; \; N_I = N\text{-}NH^+_4 + N\text{-}NO^-_2 + N\text{-}NO^-_3$$

Nm=mineral nitrogen; Na= contributed nitrogen; N_I= inorganic nitrogen; SL= soil + vermicompost; C= control

Chemical analyses

Total organic carbon and nitrogen were determined by elemental analysis (Leco CN-2000). The NH^+_4 , $NO_3^-$and PO_4^{-3} were extracted using acidified calcium chloride solution (0.1 M), according to the method developed by Houba et al. (2000), and analyzing with a segmented-flow auto analyzer (Bran Luebbe-AA3). Statistical analyses were carried on the software SPSS.

3 RESULTS AND DISCUSSION

In the laboratory incubation assay with similar rates of vermicompost, values of Nm were >100 $mg.kg^{-1}$ in the case of C1 vermicompost (pine sawdust + fish manure). For C2 vermicompost (pine sawdust + fruit waste + fish manure) with 120$Mg.ha^{-1}$ rate, the Nm values were very low (<45 $mg.kg^{-1}$), and low (<53 $mg.kg^{-1}$) with 90$Mg.ha^{-1}$ rate (Figure 1), probably this low values were due to the fruit waste is a source of C that immobilise N.

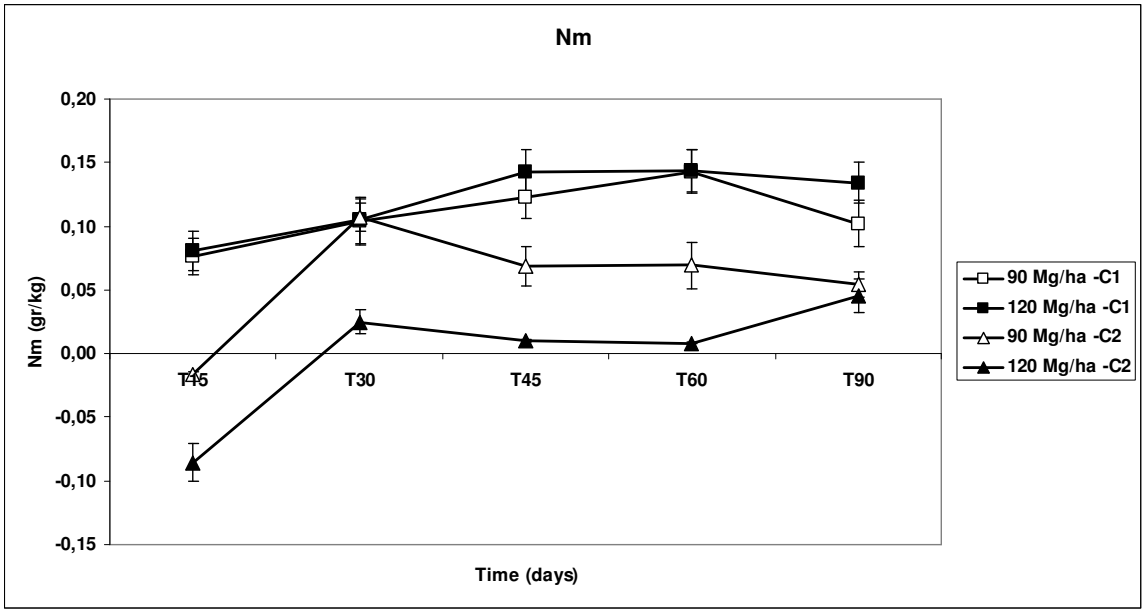

FIGURE1 **Net mineralized N ($g.kg^{-1}$). (C1-vermicompost 1– pine sawdust + fish manure; C2-vermicompost 2- pine sawdust + fruit waste + fish manure).**

NH_4^+-N was the predominant form of inorganic N at the incubation start (T0). Nitrification increased gradually and at the end of the incubation (T90), NO_3^--N represented the predominant form. Samples with 90 and 120$Mg.ha^{-1}$ rate of C2 vermicompost showed a slight N immobilization during the incubation period (Figure 2).

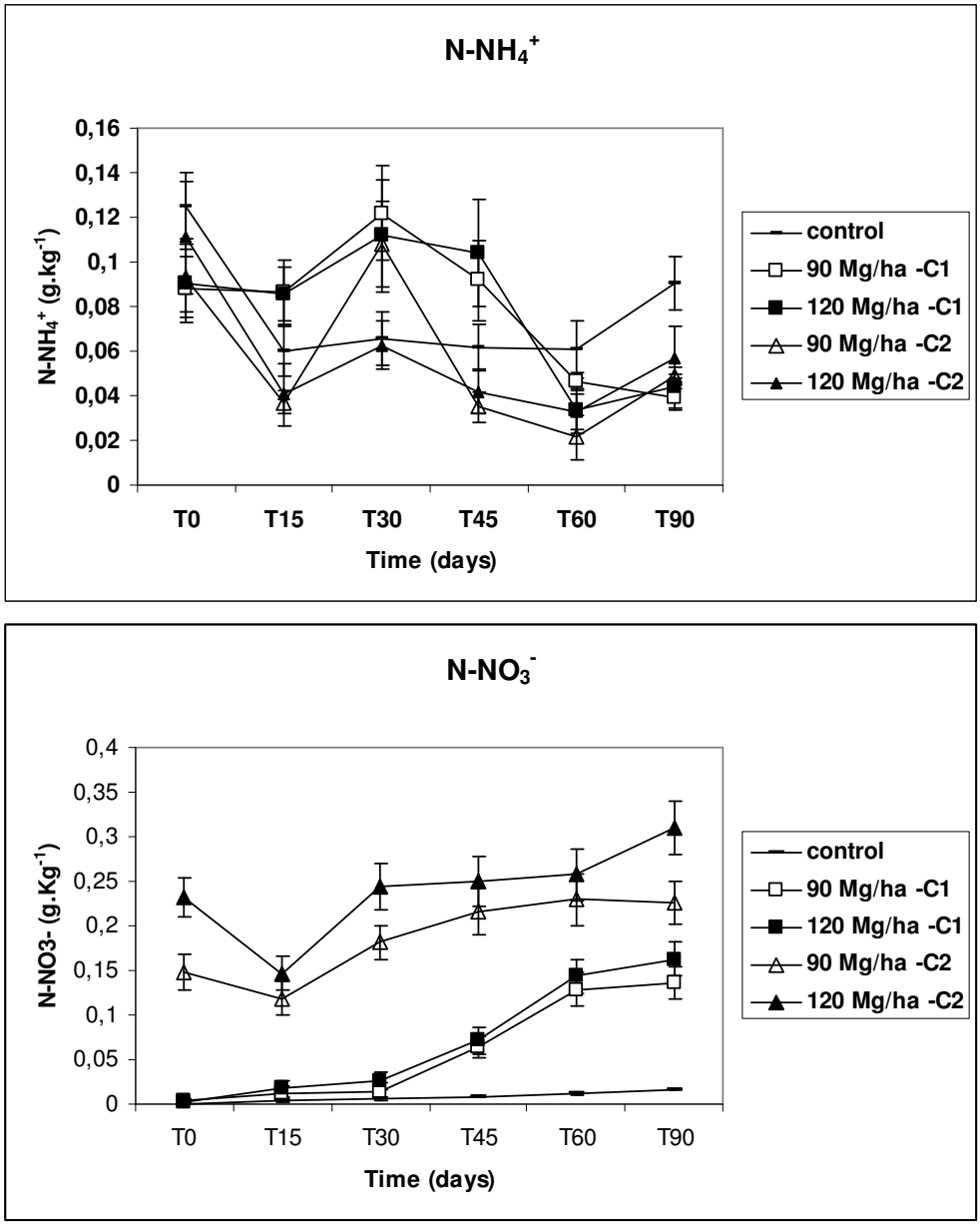

FIGURE2 **$N\text{-}NH_4^+$ and $N\text{-}NO_3^-$ content variation. (C1-vermicompost 1– pine sawdust + fish manure; C2-vermicompost 2- pine sawdust + fruit waste + fish manure).**

P added with the vermicompost was retained in the soil; the retention was high in the C1 treatment, coincided with a higher N min, probably indicating an increase in P consumption by the microorganisms (Figure 3).

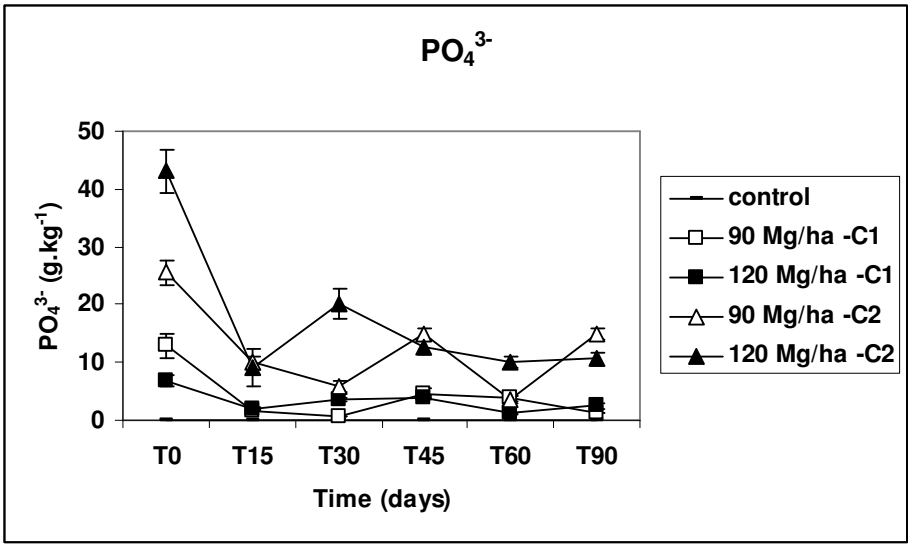

FIGURE3 **Bioavailable P content variation. (C1-vermicompost 1– pine sawdust + fish manure; C2-vermicompost 2- pine sawdust + fruit waste + fish manure).**

4 CONCLUSIONS

Fish manure vermicompost application increase the organic matter content and inorganic-N of burn soils. Rates of N mineralization depended on bulking agents. Net mineralized N was about twice as hight with C1 as with C2 vermicompost, at similar rates of application. Bioavailable P content was higher than control in all case.

The results suggest that fish manure vermicompost have a potential use as fertilizers in soils, which could reduce the direct risks of water pollution from the fish farming industry.

ACKNOWLEDGEMENTS

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