Impact of nitrogen additions on greenhouse gases emissions at different stages of plant residue decomposition

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Abstract

Global warming is a real threat to the Earth's climate system, mainly owing to the rise in atmospheric greenhouse gases (GHGs) concentrations. Agricultural practices including tillage, over fertilization and residue burning are leading source of carbon dioxide (CO_2) which is the major GHG in the atmosphere. The impact of N addition at different stages of plant residue decomposition and residue type on CO_2 emissions and soil health parameters was evaluated. A laboratory incubation experiment was carried out in incubation jars along with two different quality residues i.e. wheat and rice residues (10 g residues kg^{-1} of soil) and one control without residues was also maintained. Nitrogen (132 mg kg^{-1} of soil) was added at two stages of residue decomposition i.e. (1) at the time of residue addition and (2) after 15 days of residue decomposition. Our results showed that with addition of crop residues (wheat and rice) there was significant increase in cumulative C-CO_2 as well as microbial biomass. Similarly, enzyme activities also enhanced with the addition of crop residues but there was significant decrease in chitinase activity with the addition of wheat residues. While, rice residues significantly enhanced all enzymes activity except acid phosphatase, where there was no significant change. Addition of N at different interval of decomposition has no significant impact on cumulative C-CO_2, while microbial biomass decreased in N addition at start and no significant impact by N addition in partially decomposed residues.

Keywords: Nitrogen; Crop residues, GHGs, Microbial biomass; Enzyme activities

1. Introduction

Global warming is the abnormally rapid rise in earth's normal surface temperature over the last century. Increased bioactive nitrogen (N) availability has a wide-ranging impact on terrestrial ecosystems as N enhancement leads to loss of biodiversity, soil acidification, and stimulation of plant growth. However, little is known about the interaction between the carbon and the nutrient cycles. and that increased feedback on nutrient availability on the global carbon cycle is still not known. The purpose of this study is to determine the impact of N addition on CO2 emissions and soil health parameters added in soil at different stages of plant residue decomposition. Furthermore, it is important to elucidate the impact of contrasting initial residue quality on GHGs emissions.

2. Material and methods

A two-factorial completely randomized design (CRD) was carried out having two residues types (wheat and rice), and N application at two stages of residues decomposition i.e. (1) at the time of residue addition and (2) after 15 days of residue decomposition for the present experiment. Cumulative C-CO_2 emissions, microbial biomass and extracellular enzyme activities were determined.

3. Results and discussion

The major results are given below with brief legend explanation.

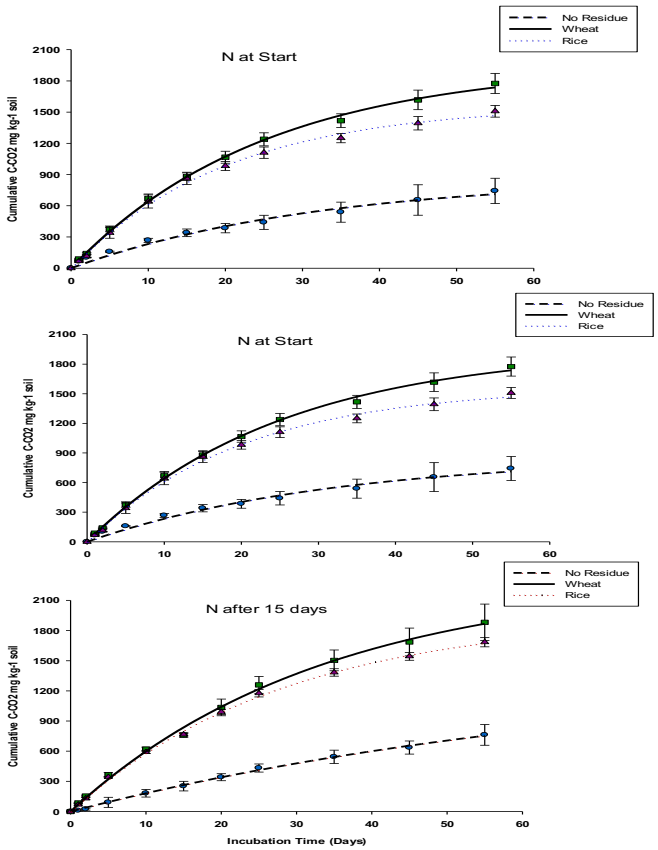

Fig. 1: C-CO_2 emission under temporal N addition with no residue, wheat and rice.

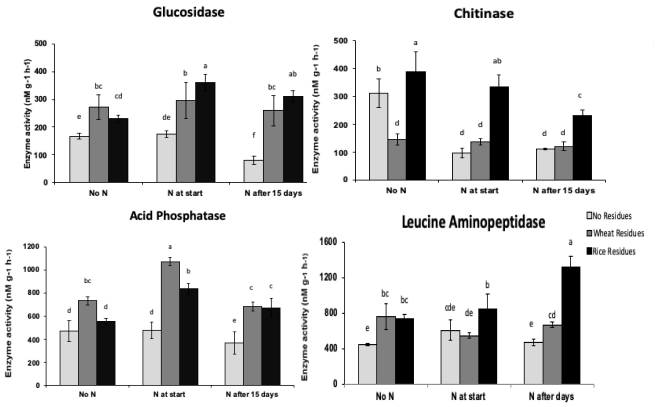

Fig. 2: Extracellular enzyme activities under temporal N addition with no residue, wheat and rice.