International Conference on Negative CO_2 Emissions
22-24 May 2018, Chalmers University of Technology, Gothenburg

PREFERRED MODE OF PRESENTATION:

☐ Oral x Poster

PREFERRED SESSION:

☐ Modelling ☐ Policy ☐ Incentives ☐ BECCS
☐ Weathering ☐ Forest x Agriculture ☐ Soil/Biochar
☐ Air capture ☐ Other: ……...

MIXED FARMING SYSTEMS AS POTENTIAL CARBON SINKS

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ABSTRACT

Mixed farming systems have great potential to combine food production with environmental services, including climate change mitigation and biodiversity preservation. This study evaluated an integrated crop-livestock (ICL) production system from the point of view of its potential for carbon (C) sequestration.
The mixed crop-livestock production system (-16.4973591, -49.2954910) was situated in the Brazilian savanna (Cerrado) on a clay (53%) Rhodic Ferralsol. The partial C balance was assessed through the net ecosystem gas exchange of nitrous oxide (N_2O) and carbon dioxide (CO_2) using a TDL-TGA200 system by Campbell Sci (Logan, UT). The soil C stock was assessed to 1 m depth, however here we use data for the top 30 cm. Two adjacent areas, each around 7 ha, on the same soil type and with the same plant / land use rotation were monitored in parallel, one area being under crop phase, the other under pasture phase. The crop phase (22 months) under zero tillage included soybean (*Glycine max*), dryland rice (*Oryza sativa*) and sorghum (*Sorghum bicolor)* in consortium with palisade grass (*Urochloa brizantha* cv Marandú). The pasture phase (26 months) had palisade grass continuously.
During the evaluated period between September 1, 2013 and October 31, 2015, both the pasture and crop phase had net negative emission of CO_2 (-11.27 and -3.52 Mg C-CO_2 ha^{-1}, respectively). The N_2O emissions were positive for the crop phase (4.37 kg N-N_2O ha^{-1}) and negative for the pasture phase (-1.94 kg N-N_2O ha^{-1}). The total CO_2 equivalent emission of the pasture phase was -41.32 Mg CO_{2eq} ha^{-1} and of the crop production phase it was -10.78 Mg CO_{2eq} ha^{-1}. Thus, the total partial balance of the crop-pasture system would be -52.1 Mg CO_{2eq} ha^{-1} that corresponds to 14.21 Mg C ha^{-1} during the 4 years of the whole rotation of the crop-pasture system which corresponds to a yearly 3.55 Mg C ha^{-1} withdrawn from the atmosphere. This balance is partial because the contribution of methane (CH_4) emission or removal by the production system was not assessed. The C removed from the atmosphere through photosynthesis may be finally transferred into the soil, which is actually the main objective of C sequestration projects in agriculture. In the same study areas 0.57 Mg ha^{-1} $year^{-1}$ soil organic C accumulation was observed in the top 30 cm soil layer between 2010 and 2015. Part of the C captured was removed from the system by harvest and grazing. This study confirms that high biomass grower plants like pasture grasses in mixed farming systems or cover crops / green manure in grain production systems, combined with sustainable soil management practices, enhance C sequestration.

Acknowledgements to Embrapa (02.11.05.001; 01.11.01.002; 01.10.06.001.06.04), CNPq (562601/2010-4), FAPEG and Conv. CAPES-Embrapa.

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