Martinet M., **Chapuis-Lardy L.**, Metay A., Douzet J.M., Rabenarivo M., Razafimbelo T., Toucet-Louri J., Rakotoarisoa J., Rabeharisoa L., 2007. Effect of agricultural practices on N_2O emissions from Malagasy soils. *In* International Symposium on Organic Matter Dynamics in Agro-Ecosystems., July 16-19, INRA-ESIP, Poitiers, France [poster]

Effect of agricultural practices on N_2O emissions from Malagasy soils

MARTINET M.[1], CHAPUIS-LARDY L.[2 *], METAY A.[1,2], DOUZET J.M.[3], RABENARIVO M.[2], RAZAFIMBELO T.[4], TOUCET-LOURI J.[5], RAKOTOARISOA J.[6], RABEHARISOA L.[4]

***corresponding author: lydie.lardy@ird.fr**

[1] ISTOM, 32 boulevard du Port, 95094 Cergy-Pontoise, Cedex 5, France
[2] UR SeqBio IRD, c/o LRI, Université d Antananarivo, BP 434, 101 Antananarivo, Madagascar
[3] CIRAD URP SCRiD c/o SRR FOFIFA B.P. 230 – Antsirabe, Madagascar
[4] LRI-SRA, Laboratoire des Radio-isotopes, Route d'Andraisoro, BP 3383, 101 Antananarivo, Madagascar
[5] UR SeqBio IRD, ENSAM, 2 place Viala, bât. 12, 34060 Montpellier Cedex 2, France
[6] FOFIFA URP SCRiD c/o FOFIFA B.P. 1690, Antananarivo, Madagascar

Abstract
Emissions of nitrous oxide (N_2O) are of concern because of the role of this gas in the greenhouse effect. The agricultural practices may affect the rate of N_2O emissions from soil. The work focuses on 2 contrasted practices in use in Malagasy Highlands, i.e. a direct seeding on cover crop residues (SD) and a hand ploughing without residue return to soil (HP). Regarding potential denitrification and *in situ* N_2O emissions, no difference was shown between both practices. Other measurements are currently in progress to confirm/invalidate this preliminary result.

Introduction
Land management can drastically affect biogeochemical processes and greenhouse gas emissions from soils by physically and chemically altering microbial habitats and functions. No-till systems adopted since 10 years in Madagascar are known to be agronomically efficient (Michellon *et al.*,2003). These systems also have an environmental benefit by sequestering C and then limiting CO_2 emissions to the atmosphere (Razafimbelo, 2005). Data are missing concerning their potential to emit nitrous oxide (N_2O). Denitrification plays an important role in the global nitrogen cycle and is a principal contributor of N_2O to the atmosphere. This study will document the N_2O emissions under field and laboratory conditions for Malagasy soils from no-till and conventional systems.

Material and methods
Samples were collected from the CIRAD-FOFIFA experimental design, established in 2002 on a ferrallitic soil at Antsirabe, Malagasy Highlands. Traditional cropping practices (hand ploughing, HP) were compared to direct planting on crop residue (DP). Three fertilisation levels were applied to the upland rice / soya and maize rotation: F0, no fertilisation; F1, organic manure fertilisation, F2, mineral plus organic fertilisation. The C & N soil contents were determined from CHN analysis. The soil denitrification potential was analysed with a method adapted from Lensi *et al* (1991). Preliminary *in situ* N_2O emissions were measured with the closed chamber technique at the beginning of the maize and soya culture.

Results and discussion
We obtained soil C/N decreasing with depth and ranging from 13.7 to 14.8 and from 13.8 to 15.0 for HP and DP respectively. No difference was observed between the different fertilisation treatments.
Potential denitrification results (figure 1) showed no difference between fertilisation treatments and agricultural practices. Values are rather low in comparison with literature (0.5 to 8.45 mg N-N_2O soil kg^{-1} d^{-1}, according to Hénault *et al.*, 2005). Regarding denitrification potential rates, we may assume that the denitrification potential of the lower layers was generally negligible compared to the upper horizons. The lower denitrification potential of the deeper horizons could partially be explained by their limited C availability.

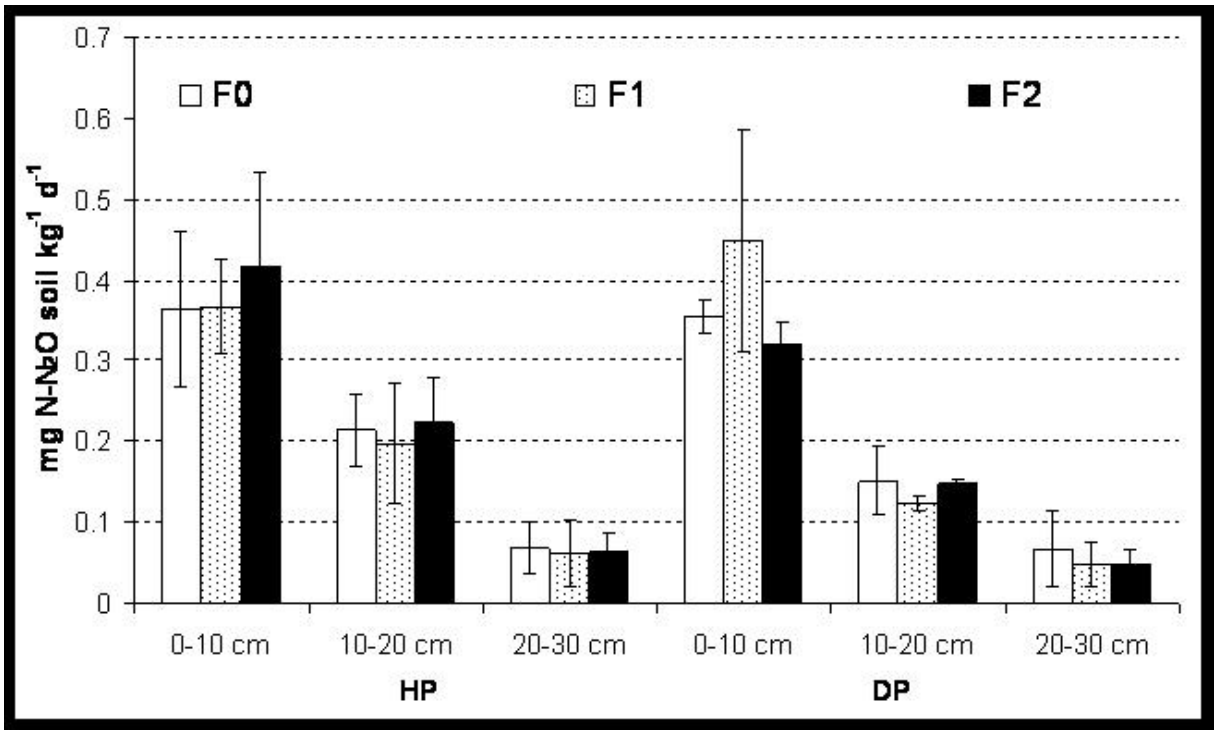

Figure 1: Potential denitrification (mg N-N_2O soil kg^{-1} d^{-1}) estimated from Malagasy soil layers (0-10 cm, 10-20 cm and 20-30 cm) under HP and DP treatments and different fertilisation conditions (F0: no fertilisation, F1: organic manure fertilisation, F2: organic + mineral fertilisation)

In situ N_2O fluxes were low (< 300 mg N-N_2O ha^{-1} d^{-1}) probably because the rainy season just started and no difference between fertilisation treatments and agricultural practices was noticed. N_2O emissions are generally larger in no-tillage systems due to a higher prevalence of anaerobic conditions, locally higher C availability and/or locally higher mineral content (e.g. Six *et al.*, 2002; Baggs *et al.*, 2003). However, Choudhary *et al.* (2002) measured similar emissions in no-till and conventional, tilled systems.

Conclusion

This preliminary study tends to show that the cultivation practices did not affect significantly the rate of *in situ* emissions as well as the potential emissions of N_2O from denitrification for this Malagasy ferralsol. Other measurements such as crop residues contents and more frequent *in situ* N_2O measurements are currently in progress to confirm/invalidate this hypothesis.

References

Choudhary M.A., Akramkhanov A., Saggar S., 2002. Agriculture, Ecosystems and Environnement 93, 33-43.

D'Haene K., Moreels E., De Neve S., Chaves Daguilar B., Boeckx P., Hofman G., Van Cleemput O., 2003, Biology and Fertility of Soils, 38, 358-366.

Hénault C., Bizouard F., Laville B., Gabrielle B., Nicoullaud B., Germon J.C., Cellier P., 2005. Global Change Biology, 11, 115-127

Lensi R., Lescure C., Clays-Josserand A., Gourbière F., 1991, Forest Ecology and Management, 44, 29-40.

Michellon R., Rakotondralambo P. Razanamparani C., Moussa N., Séguy L., 2003, International Congress on Conservartion Agriculture, Iguazu, Brazil, pp. 280-282.

Razafimbelo T., 2005, Montpellier University PhD thesis, 162 p.

Six J., Feller C., Denef K., Ogles N., Sa J.C.M., Albrecht A., 2002. Agronomie, 22, 755-775.

Baggs E.M., Stevenson M., Pihlatie M., Regar A., Cook H., Cadish G., 2003. Plant and Soil, 254, 361-370.