Greenhouse Gas Emission Mitigation And Agriculture, Trade-off Or Win-win Situation: Bioeconomic Farm Modelling In The Sudanian Area Of Burkina Faso

AUTHOR

Tiertou Edwige SOME, PhD student

Email: someedwige09@yahoo.fr

Dr. Bruno Barbier

bbarbier@cirad.fr

AFFILIATION

WASCAL
West African Science Service Center on Climate Change and Adapted Land Use

BACKGROUND & OBJECTIVES

BACKGROUND:

Climate changes talks regularly underline that developing countries' agriculture could play a stronger role in GHGs mitigation strategies and benefit from the Kyoto Protocol program of subsidies. Scientists explain that agriculture can contribute to carbon mitigation by storing more carbon in the soil through greener cropping systems.

The clean development mechanism (CDM) proposed in the Kyoto protocol is one particular policy instrument that can incite farmers to mitigate the GHG balance towards more sequestration and less emission

OBJECTIVES (O): Assessment whether mitigation strategies imply a trade-off between environmental and economic objectives or a win-win situation.

O1: Impact of perennial crops in farmers' utility

O2: Impact of emission limitation in Farmers' utility

ACTIVITIES

Study area: Village of "Bala" located in the "Satiri" rural commune, located in the "Haut-***Bassins"*** region in the Sudanian zone

Main crops activities: cotton, maize, sorghum and small areas of peanut, bean, rice, and perennial such as eucalyptus, cashew-nut and Jatropha, subdivided by traditional crops, intensive crops, and high intensive crops.

Method: Multi-period linear programming model.

Data source: IPCC (2007): emissions of GHGs per crop and carbon sequestration from agroforestry. **Primary data:** crops yields, costs and the inputs collected during a field work in which 45 small farmers.

Farmers' objectives: Maximisation of their utility. The net present value (NPV) of the annual net cash income (NCI) obtained after subtracting of revenues, all current expenses as food consumption and production costs, is used as proxy of the utility. The planning horizon for simulation is 25 years in order to take into account the life cycle or perennial crops.

More the NPV is higher, more the utility is improved, and then farmers' welfare is improved.

They must make decisions about what commodities to produce in which quantity, subject to constraints as the food consumption, resources constraint (land, labour, and treasury) and minimum income.

The treasury is composed by the farmers' own cash and the credit bounded by cotton area. The total farm expenses must not exceed the available treasury.

The household must satisfy the food need by consuming a part of its production or by purchased grains.

Risk is taken into account in the model, because of variability due to many factors (Hazell et al., 2015).

Emission constraint is added to the scenario of emission limitation. Sequestration function is added to perennial crops scenario, to generate the carbon balance.

ACKNOWLEDGEMENTS

For their indispensable contributions to advancing the research processes, I am thankful to:

- Prof. Joachim von Braun, Centre for development research, Bonn (Germany)
- Prof. Ahmadou Aly Mbaye, University of Cheikh Anta Diop, Dakar (Senegal)
- Bruno Barbier, Unité Mixte de Recherche, gestion l'eau, acteurs et Usages,

Centre de coopération International en Recherche Agronomique pour le Développement (UMR-GEAU, CIRAD)

RESULTS

I. BASELINE:

Crops activities: High income crops with high GHG emission: Intensive maize, cotton, rice and traditional sorghum

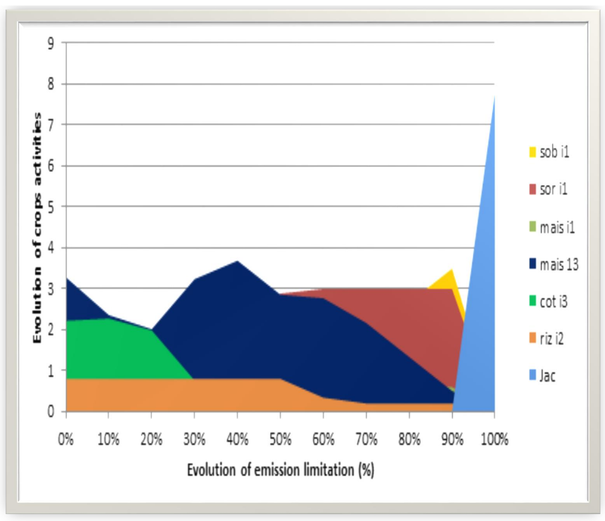
Annual seasonal NCI: Dry 528,500 CFA normal; Normal 848,350 CFA; humid 496,200 CFA with risk 948,160 CFA.

NPV 8,065,300 CFA

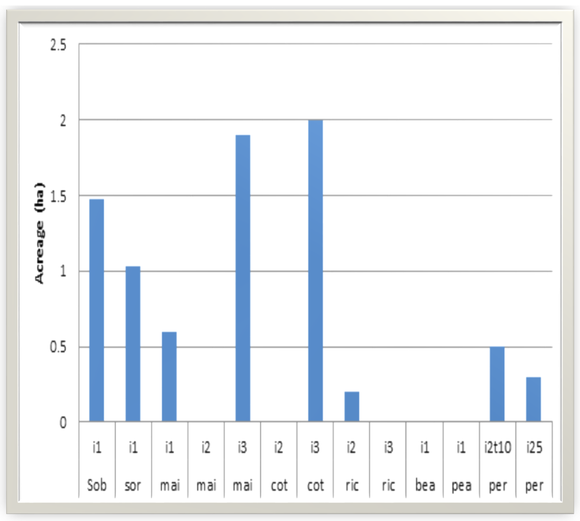
II. Scenario of mitigation strategies

A. CROPS ACTIVITIES

Crops activities in emissions limitation



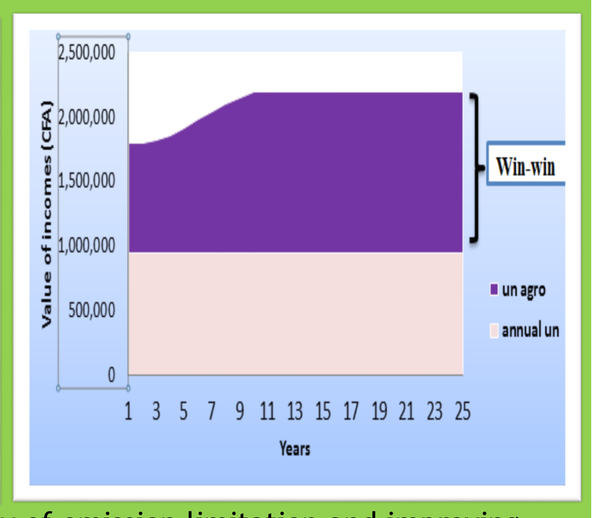
Crops activities with perennial crop scenario



Emission limitation: More emissions are limited, more pollutant crops are replace bye less pollutant

Perennial crops: intensive crops are produced associated to perennials crops.

B. Impact on farmers' utility



Farmers, utility is decreasing in the strategy of emission limitation and improving with the association of perennial crops.

Emission limitation strategy involves trade-off while perennial crops improve farmers' utility.

Perennial crops lead also an individual carbon balance of 6.118 TCO2eq.

LESSONS-LEARNED & RECOMMENDATIONS

Small farmers must integrate perennial crops in their cropping system while limiting emissions will get worse their life conditions. To reduce emissions in annual crops system, subsidies are needed to compensate the income lost. The country can apply to CDM program to get compensation.

REFERENCES

- Hess U., Hazell P. and Kuhn S. (2015), Innovations and Emerging Trends in Agricultural Insurance, ResearchGate
- Porter M. E. and van der Linde C. (1995), Toward a New Conception of the environment-competitiveness relationship, Journal of Economic Perspectives, 9, 97-118
- Babcock B. A., Dumortier J. and Rosas F. (2011), Greenhouse Gas and Nitrogen Fertilizer Scenarios for U.S. Agriculture and Global Biofuels, Working Paper 11-WP 524
- Barnum H. N. and Squire L. (1978), an econometric application of the theory of the farm-household
- Beach, R. H., DeAngelo, B. J., Steven R., Li, C., Salas, W., and DelGrosso, S. J. (2006), Mitigation Potential and Costs for Global Agricultural Greenhouse Gas Emissions, International Association of Agricultural Economists Conference, Gold Coast, Australia
- Bostick, W.M., Bado, V.B., Bationo, A., Soler, C.T., Hoogenboom, G., Jones, J.W. (2007), Soil carbon dynamics and crop residue yields of cropping systems in the Northern Guinea Savannah of Burkina Faso. Soil Tillage Res. 93, 138–151