

Farm-level Scenario Assessment of Trade-offs between Greenhouse Gas Emissions & Gross Margin of Predominant Production Systems in Nigeria

T.B. Ayinde¹; C.F. Nicholson²; B. Ahmed³; A. Ayantunde⁴; M. Akinola³; O. Yusuf³

¹Samaru College of Agriculture, Ahmadu Bello University, Zaria, Nigeria

²Radboud University, Netherlands & Cornell University, U.S.A.

³Department of Agricultural Economics, Ahmadu Bello University, Zaria, Nigeria

⁴International Livestock Research Institute, Ouagadougou, Burkina Faso



Abstract

This study analyses the trade-offs between welfare (measured by income) and greenhouse gas (GHG) emissions using a farm-level optimization model that incorporates the predominant cereal (sorghum), legumes (groundnut, soybeans), livestock (cattle, goats and sheep) and trees (locust-bean, camel's foot) representative of production systems at two contrasting sites in northern Nigeria. The optimization model maximizes value of total farm production subject to constraints on GHG reductions of 10%, 25% and the maximum allowable reductions of 26 and 30%. Substantive reductions in livestock and legume production would be required to achieve the maximum possible reductions from current emissions and would reduce household income by 22 and 44 %, respectively.

Introduction

There are few empirical studies on trade-offs between farm-level GHG emissions and welfare (Paul et al., 2017) or on the potential productivity improvements required to avert trade-offs (Tittonell, Gérard, & Erenstein, 2015). A key question is whether changes in smallholder farm-level production activities can reduce GHG emissions without negatively affecting household income. This research addresses this question for smallholder farms using crop-tree-livestock systems in northern Nigeria. The objective of this study is to assess tradeoffs in reducing Greenhouse Gas emission and income in smallholder farms of Northern Nigeria.



Fig. 1 Farmer Focus Groups

Methods

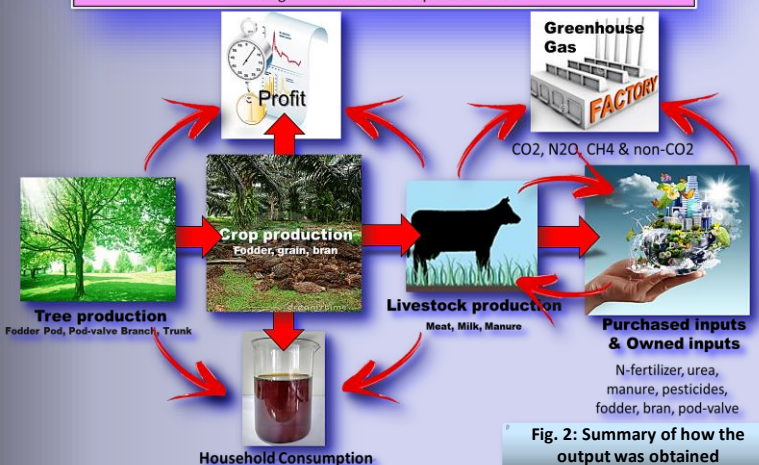
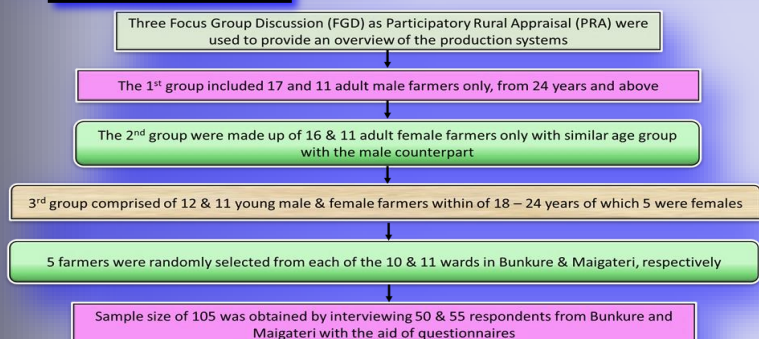


Fig. 2: Summary of how the output was obtained

Results

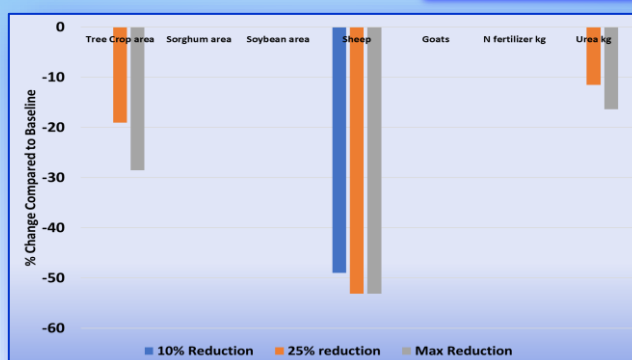


Fig. 3: Percentage changes in selected outputs & inputs compared to baseline for required GHG emission, Bunkure LGA

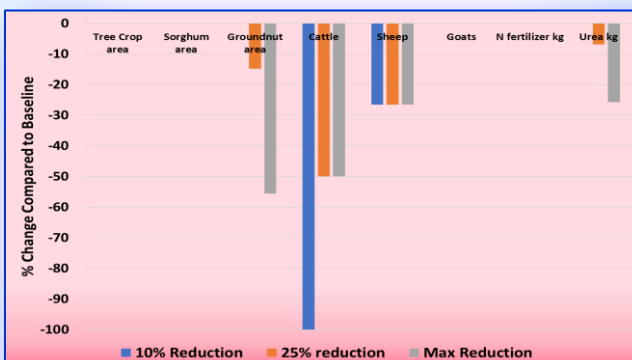


Fig. 4: Percentage changes in selected outputs & inputs compared to baseline for required GHG emission, Maigateri LGA

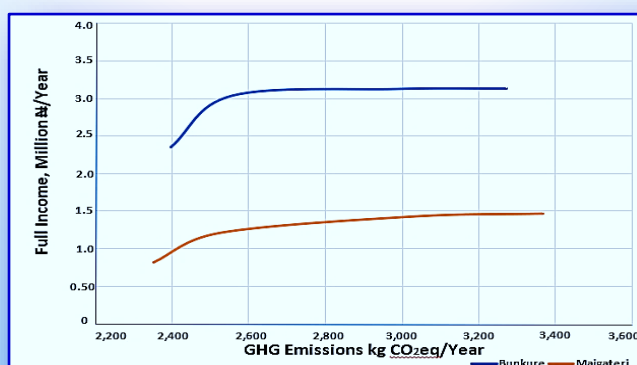


Fig. 5: Trade-offs curve between full income and GHG emission of the Current Plan

Conclusion

There were no win-win opportunities of increased income and reduced GHG emissions using current production technologies, which further suggests the need for further research on productivity-enhancing-technologies that could enhance income and reduce emissions in this production context.

References

- Paul, B. K., Frelat, R., Birnholz, C., Ebong, C., Gahigi, A., Groot, J. C. J., ... Wijk, M. T. Van. (2017). Agricultural intensification scenarios, household food availability and greenhouse gas emissions in Rwanda: Ex-ante impacts and trade-offs. *Agricultural Systems*.
- Tittonell, P., Gérard, B., and Erenstein, O. (2015). Tradeoffs around crop residue biomass in smallholder crop-livestock systems - What's next? *Agricultural Systems*, 134, 119-128.