Exploring Mitigation Strategies from Cropland-based Agriculture: Some Empirical Evidences from India

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Cropland-based agriculture (CLA) emits 34% of the total non-energy emission from Indian agriculture; 23% of total non-CO2 emission and contributes 64% of the national gross value added as of 2013-14 (Economic Survey, 2018). It accounts for 24% of the India’s total methane emission and 95% of the total nitrous oxide emission from agricultural sector.

Introduction

Objectives

1. To analyze the driving factors behind non-CO2 GHG emission trend.
2. To identify possible mitigation options.

Findings

Decomposition Methodology:
Step 1: Constructed a modified Kaya identity keeping in mind the possible driving forces behind non-CO2 GHG emission from India’s cropland-based agriculture.
Step 2: Applied the additive formulation of Logarithmic Mean Divisia Index (Ang and Liu, 2001) to decompose the identity.

Possible mitigation strategies

Optimizing fertilizer use
• Inhibit emission
• Increase marginal productivity of fertilizer
• Reduce fertilizer intensity

Popularizing land-intensive agriculture
• Inhibit emission
• Helps in economizing agricultural resource use.

Shift in paddy-water regime
• Transition from rain-fed to irrigated (irrigated single and multiple aeration) will help to reduce methane emission

Conclusion: This study suggests policies targeting intensive agriculture, changes in water management regimes and improvements in N-fertilizer use which may help in reducing non-CO2 emission from India’s cropland-based agriculture.

References

Data sources
• Ministry of Agriculture & Farmers Welfare, Govt. of India. Ministry of Chemicals & Fertilizers, Govt. of India, Ministry of Commerce & Industry, Office of the Economic Adviser, Govt. of India. Ministry of Statistics and Programme Implementation, Govt. of India.

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CH4 emission = \sum_i (EF_i \times A_i) where EF_i = emission factor for i; A_i = annual harvested area of rice under i; different paddy-water management regime.

N2O emission = [(EF_F \times EF_p \times EF_s) \times EF_F]/4428)
where EF_F = annual amount of synthetic N fertilizer applied to soil; FR = flooded rice; EF_p = emission factor

N\% share of different paddy harvest area

Methane emission (in Mt)

Nitrous Oxide emission (Mt)

Decomposition results:
Factors Pulling up emissions:
Rising Fertilizer intensity
Affluence
Population growth

Factors Pulling down emissions:
Falling Productivity of fertilizer used,
Falling Share of agricultural GDP to total GDP,
Falling Land use per unit of output
Decreasing Non-CO2 GHG emission intensity

Over the study period, the effects of the pull-up factors outweigh those of the pull-down factors resulting in a rising non-CO2 GHG emission