**GREENHOUSE GAS EMISSIONS FROM RICE, PEANUT AND MILLET FARMS IN PENINSULAR INDIA: EFFECTS OF WATER AND NITROGEN MANAGEMENT**

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**BACKGROUND**

At Environmental Defense Fund, low-carbon farming (LCF) is an integral component of our international climate work and we recognize that any intervention to mitigate agricultural greenhouse gas emissions should meet farmers’ interest and food security needs.

Climate change is already imperiling the livelihoods of small-scale farmers around the globe by exacerbating droughts, heat waves, floods and other extreme weather events, as well as creating an influx of new pests and diseases. Worldwide, 500 million smallholder farms produce about 80% of the food consumed in Asia and sub-Saharan Africa, and provide livelihoods for more than 2 billion people.1 In and semi-arid regions – home to more than 40% percent of the world’s population, including 650 million of the poorest, most food-insecure people – dryland agriculture is particularly vulnerable to drought.2 Densely populated low-lying coastal areas, where significant agricultural production also takes place, are already experiencing rising sea levels that worsen floods and saline intrusion (i.e., seawater contamination of soils and ground water supplies). Unless business-as-usual GHG emission intensities trends are altered, additional warming will devastate these vulnerable agricultural communities, further exacerbating the immense challenges of poverty alleviation, food and water security, and energy access already being faced by developing countries.

**OBJECTIVES**

GHG emissions reduction measurement for methodology development

As part of our Low carbon farming project, five GHG measurement laboratories have been set up across three states in peninsular (south) India. These laboratories and associated representative farms represent different agro-ecological sub-zones (AEZ) within the dry-land agriculture belt for which no reliable datasets on GHG emission have been available. The low carbon farming project activities also include collection of extensive surveys for determining baseline economic, demographic and farming practices; research on determining alternative “sustainable” package of farming practices which increase/maintain yield and economic benefit while decreasing GHG emissions; and monitoring, self-reporting and third party verifications. In the near future, we will use the GHG data to calibrate a biogeochemical model to extrapolate emission reductions over large jurisdictions and develop carbon offset methodologies.

**METHODOLOGY**

Nitrous oxide and methane concentration measurement

Field sampling at 3 replicate plots for both baseline (BP) and alternative practices (AP) for growing rice, millet and groundnut using customized GRACEnet protocol.2 The GHG emission rates quantified less than 12 hours after sample collection using ThermoFisher Trace GC 6000 (Nashik, India) with <3% RSD.3

**RESULTS**

Fig. 1 Seasonal N2O emissions: Rice (Anantapur, Andhra Pradesh, AEZ 3.0)

Fig. 2 Seasonal N2O emissions: Millet (Bangalore, Karnataka, AEZ 8.2)

Fig. 3 Annual N2O emissions 2012-2013: Groundnut

**CONCLUSIONS**

- Dryland N2O emission is triggered by rain (upland crops) & N input and draining (rice).

- For peninsular India, low-carbon rice cultivation practices (which combine water and N management) offer very large emission reduction potential (2-5 metric tons CO2e per hectare per season) with most of the reduction due to N2O emission reduction.

- Smaller reductions (0.15-0.5 metric tons CO2e per hectare per season) from peanut & millet cultivation.

Table 1. Groundnut (AEZ 3, 8, South India)

Table 2. Groundnut: Input farming cost

**POLICY IMPLICATIONS**

Climate mitigation will need to meet the development and food security needs of developing nations and there is an urgent need for strategies that provide a “triple win” of: 1) enhance farmers’ economic development; 2) make agriculture resilient to the impacts of climate change and increase yield thereby increasing food security; 3) mitigate agriculture’s GHG emissions to avoid dangerous climate change.

Our results demonstrate that “Agricultural triple win” is possible. Our alternate packages maintain/increase yields (seed, above & belowground data gathered but not shown), reduce GHG emissions (Fig 1-3) and increase farmer’s profit (Table 2).

**REFERENCES**

1. IFAD Viewpoint (2011) Smallholders can feed the world.


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