FAIR CLIMATE NETWORK

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EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work

Estimating & Calculating Emission Reductions in Low Carbon Farming

Rakesh

LCF Expert, FCN Tech Team

Bagepalli, 19 April 2011

Validation & Verification

- Initial Validation proves to the scientific community that our Methodology is valid and credible
- Verification (during and after implementation) shows, with irrefutable MoV, that we have followed the proven Methodology
- There are existing CDM and VCS Methodologies. They are valuable pointers, but cannot be directly applied because:
  - Eligibility of rain fed agriculture and management practices
  - Tropical semi-arid agriculture hardly considered
  - Focus on individual components (E.g. manure management)
- This presentation will show the steps needed for Validation & Verification of Emission Reductions from LCF

LCF Processes

- ✓ Participating Farmers identified
- ✓ Demographic and Landholding Data recorded
- ✓ Discrete Plots delineated
- ✓ Baseline Carbon Stock (Trees) recorded
- ✓ Land Tenure established & Title obtained

- Implementable & Manageable SA Practices chosen
- Participating Farmers oriented/trained
- Reference Plots set up
- Farmer Diaries maintained at each Discrete Plot
- Emission Reductions calculated

How do we Calculate Emission Reductions?

- Sample Surveys conducted and AEZ Scenario developed by LCF Expert
- All crop(s)-wise SA Practices listed at each NGO area of operation
- Manageable and Implementable SA Practices chosen from above
- 3 Reference Plots set up for each chosen SA Practice at each NGO
  - Farmer Diaries maintained with meticulous authenticity
  - Soil Sampling carried out
  - Gas Sampling conducted
- Farmer Diaries maintained on all selected Discrete Plots
- After harvest, all Farmer Diary information entered into Excel Sheets
- Data fed into DNDC Model and Emission Reductions calculated

Scenario Development

- Questionnaires administered in order to identify:
  - Major Soil Types in NGO area of operation
  - Major Mono Crops and Multiple Crops
  - Organic Manure application – Farm Yard Manure, Composting, etc.
  - Inorganic Fertizer applicaton
  - Cultivation Practices
- Soil & Manure Sampling conducted
- Current SA Practices studied
- DNDC Model Calibrated with AEZ information (specialised software programme to calculate GHG Emissions in agriculture)

Reference Plots
Mainstream Practices

- 3 “Progressive” Farmers using HEIDA practices identified for each crop(s) that Participating Farmers will grow under LC F.
  (E.g. 3 Crop(s) x 3 plots = 9 Mainstream Reference Plots)
- General average of farm inputs for chosen crops, as estimated when developing Scenario, meticulously practiced on these Mainstream Reference Plots
  (E.g. tilling, land preparation, seed, organic manures, inorganic fertilizers, pesticides, irrigation, and all other HEIDA crop management parameters)
- Farm outputs, soil carbon and emission levels continually measured on Mainstream Reference Plots for 3 cropping seasons
- Measurements fed into DNDC Model to calibrate the software and recognise the particular Crop(s)/AEZ Scenario
- Elicited data provides Baseline information for emission levels of crops in that AEZ

Reference Plots
SA Practices

- Participant NGOs realistically list their crop(s)-wise SA Practices, choosing the most implementable and manageable – i.e. with least number of combinations and permutations
- 3 Lead Farmers identified to meticulously implement, record and measure each of the chosen SA Practices on particular Discrete Plots
  (E.g. 2 SA Practices x 3 crop(s) x 3 plots = 18 SA Reference Plots)
- All practices in the SA (package of) Practices fully and meticulously implemented on these SA Reference Plots
- Farm outputs, soil carbon and emission levels continually measured on these SA Reference Plots for 3 cropping seasons
- Measurements fed into DNDC Model to calibrate the software and recognise the particular SA Practice in that AEZ
- Elicited data provides emission levels of SA Practices in the AEZ

Farmer Diary

Land ID		Year	
Calculated area		Season	

1. Crop Details

Crop	Variety	Seeds (kg)	Sowing Date	SA Practice Code

2. Tillage

Date	Method

3. Inter-cultivation (Deweeding)

Date	Method

4. Chemical Fertilizers

Date	Type	kg

5. Manuring (FYM, Compost, Jeevamrutha, etc.)

Date	Type	kg

6. **Chemical Pesticides, Herbicides, etc.**

Date	Type	kg

7. **Biological Pest Control**

Date	Type	kg

8. **Harvesting**

Date	Crop	kg

Additional Information for Paddy

Chemical Fertilizers Applied to Nursery

Date	Type	kg

Manure Applied to Nursery

Date	Type	kg

Transplantation date	

9. Water Regime

From (Date)	To (Date)	Drained or flooded

Week (after transplantation)	Drained or flooded
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	

SA Practices and ER Estimates * at AF and SEDS

Crops	SA Practices	Estimates of ER t CO_{2-e}/acre/crop
Groundnut and Red Gram (rain fed)	✓Reducing nitrogenous fertilizer ✓Reducing pesticides ✓Manure management (Composting, Jeevamrutha, green manure – biomass management) ✓Biomass tree planting ✓Biological pest management	**1.5 – 4.5**
Paddy (bore well)	✓SRI and water management ✓Nitrogenous fertilizer reduction ✓Manure management ✓Reducing pesticides ✓Biological pest management ✓Biomass tree planting	**2.5 – 5.5**

* Aim at 3 tCO_{2-e} in order to earn Rs 1,000 per acre

SA Practices and ER Estimates * at BEST and SACRED

Crops	SA Practices	Estimates of ER t CO_2/acre/crop
Ragi (rain fed)	✓Reducing nitrogenous fertilizer ✓Reducing pesticides ✓Manure management ✓Biomass tree planting ✓Biological pest management	**1.5 – 4.5**
Mulberry (bore well)	✓Reducing nitrogenous fertilizer ✓Reducing pesticides ✓Manure management ✓Biomass tree planting ✓Biological pest management	**2.5 – 6.0**
Paddy (bore well)	✓System of rice intensification ✓Altered water regime ✓Precision fertilization: Reducing N fertilizer ✓Manure management ✓Biomass tree planting	**2.0 – 5.0**

* Aim at 3 tCO_{2-e} in order to earn Rs 1,000 per acre

SA Practices and ER Estimates * at PWDS

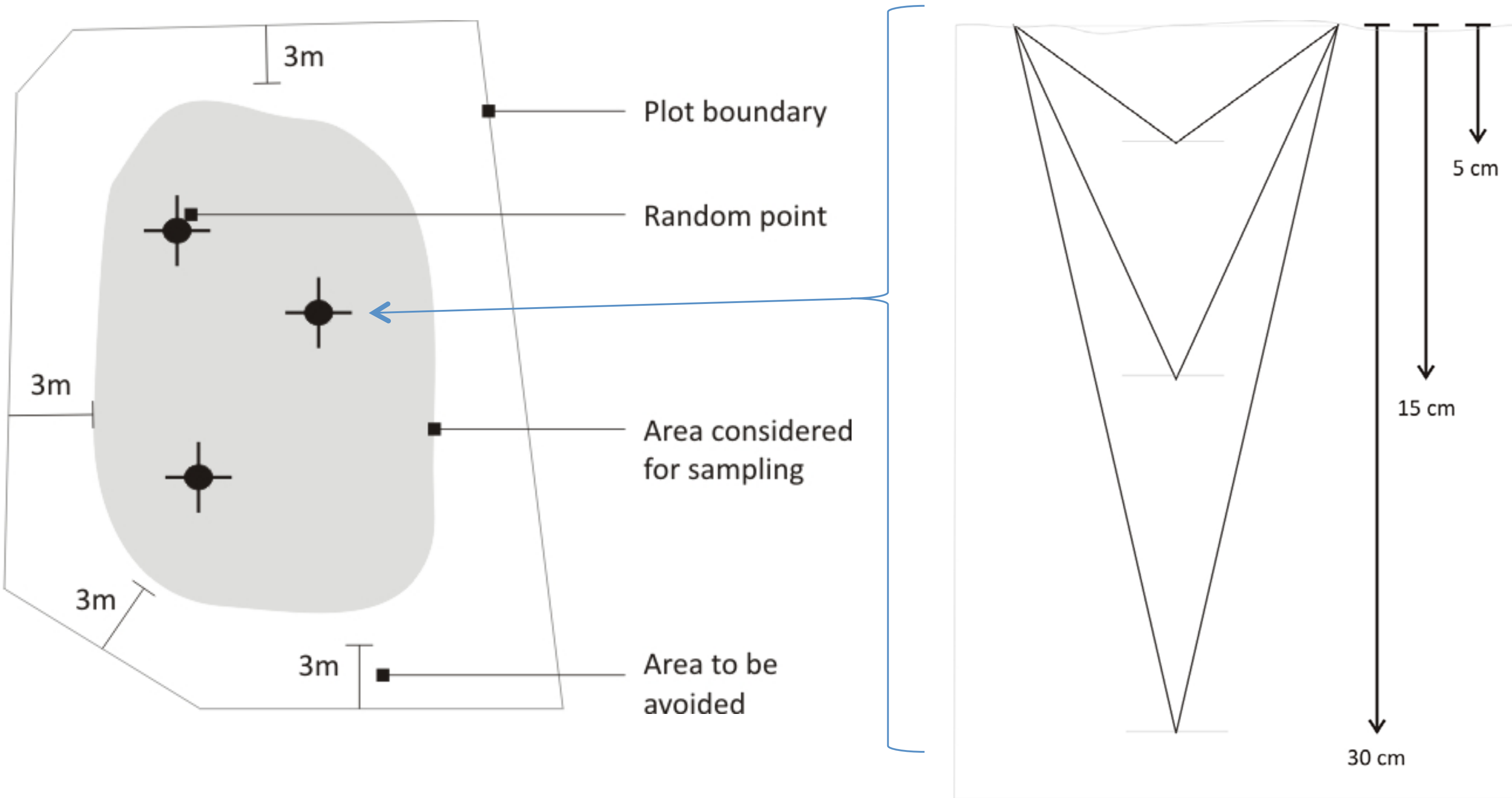
Crops	SA Practices	Estimates of ER t CO_2/acre/crop
Paddy (river/canal)	✓System of rice intensification ✓Altered water regime ✓Precision fertilization: Reducing N fertilizer ✓Manure management ✓Biomass tree planting	**3.5 – 7.0**
Banana (river/canal)	✓Precision fertilization: Reducing N fertilizer ✓Manure management ✓Biomass tree planting	**2.5 – 8.0**

* Aim at 3 tCO_{2-e} in order to earn Rs 1,000 per acre

Soil Sampling

- 3 random points selected at each Reference Plot
  (avoid points close to bund and other disturbances)
- Soil Samples drawn from three depths at each point – 5 cm, 15 cm & 30 cm
- Samples analyzed in a laboratory for organic carbon, macro and micro nutrients
- Data fed into the DNDC Model and used in scenario development

Sample point determination and depth of sampling



Sampling points should avoid: bunds, manure pit vicinity, littered area, tree shade, ploughed land or other disturbances

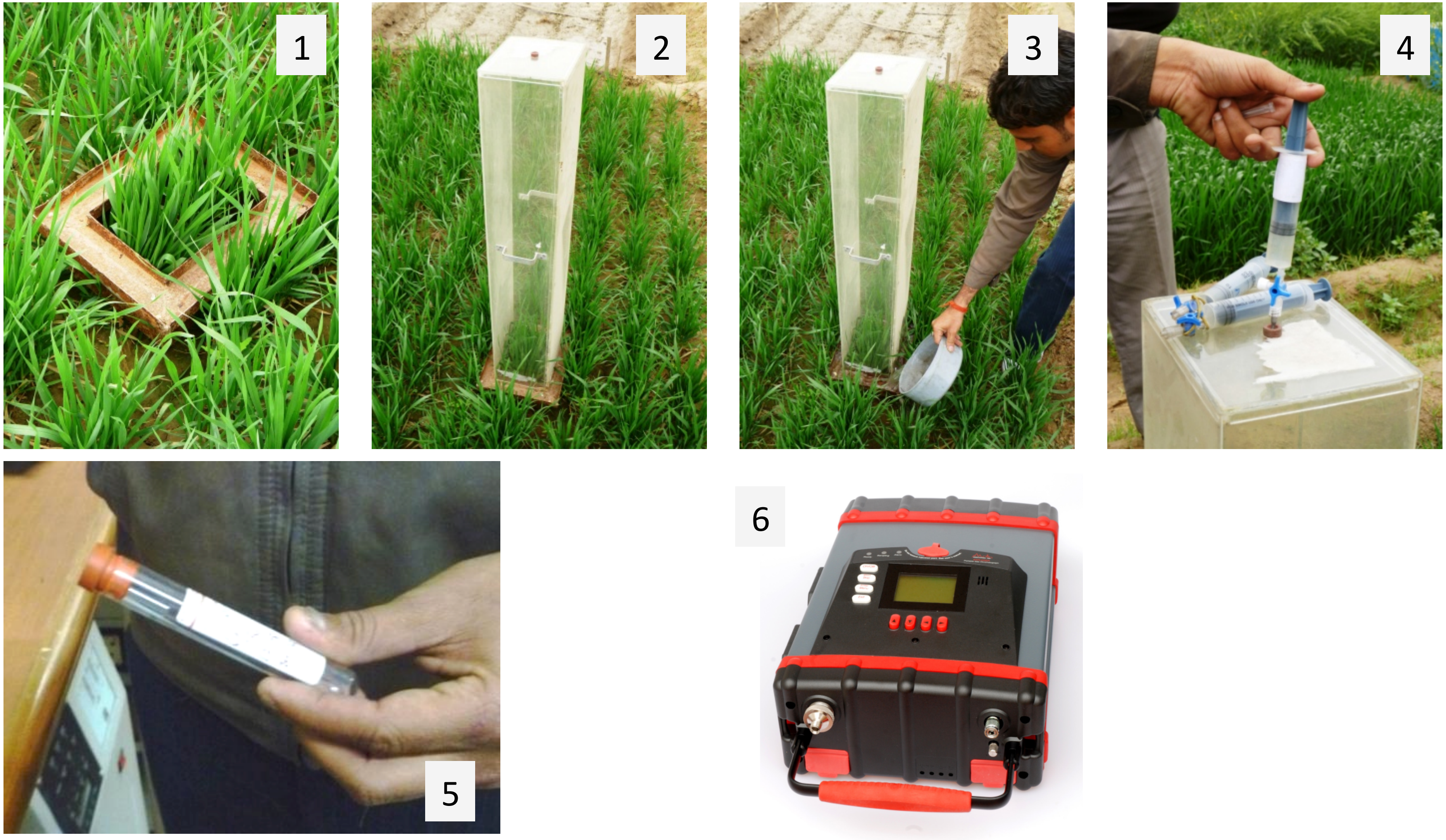
Soil Augers

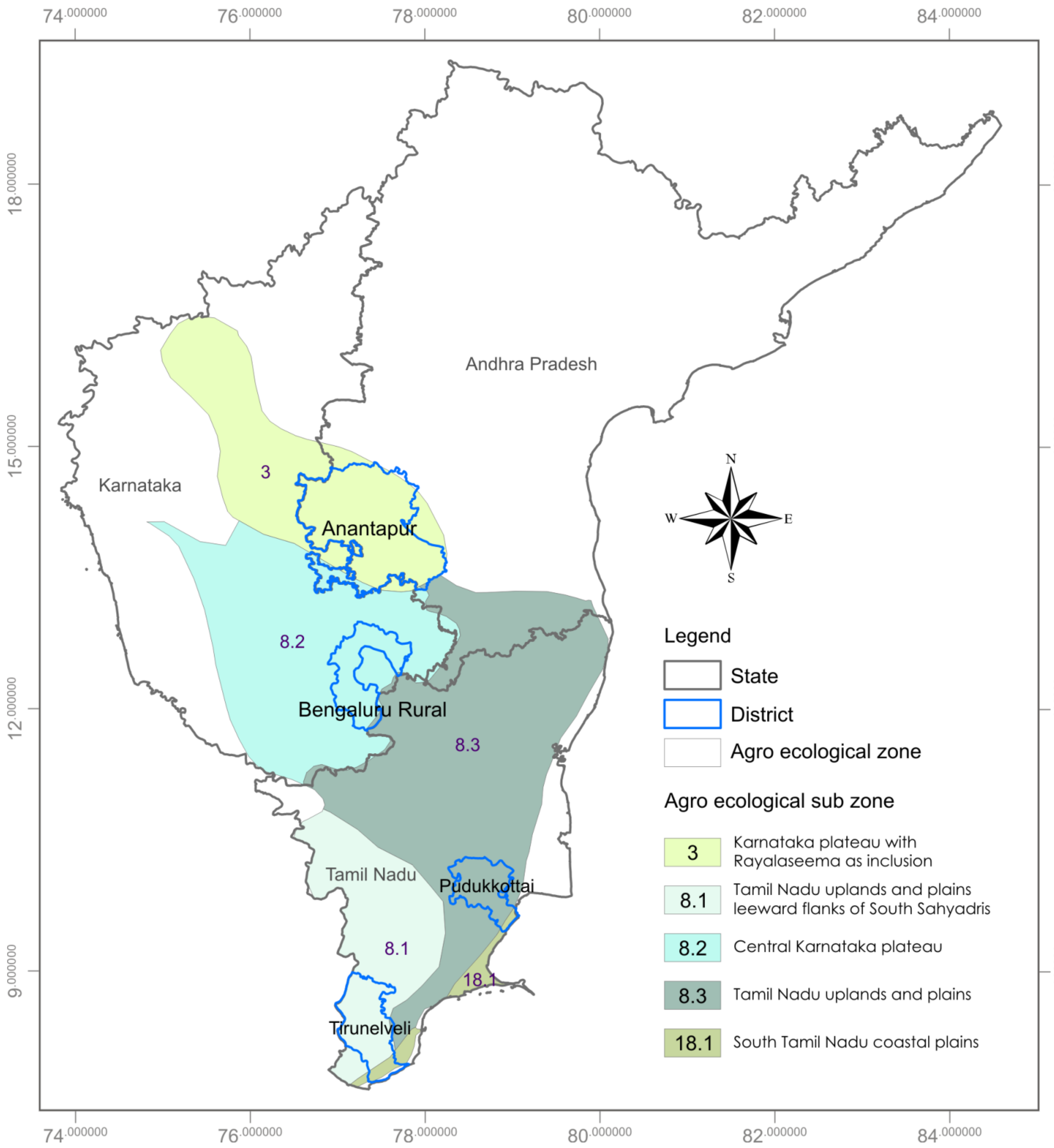
- Specialized **Sand Augers** used for accuracy
- Tme taken to manually digging pits reduced
- Ease of use as compared to digging with pickaxe

Gas Sampling

- Portable Gas Analyzers placed at each Participant NGO (approx cost: US$ 20,000 each)
- Perspex Boxes placed at each Reference Plot for 1 hour (between 10 am and 12 noon) on a fixed day every week, throughout the 5-6 month crop season
- Gas samples drawn with syringes, transferred to Vaccutainer, and transported to the Gas Analyzer within 24 hours
- A Staff member at each NGO trained by LCF Expert

Steps involved in Gas Sampling





AEZ 3: hot arid climate; deep loamy and clayey mixed red and black soils; low to medium available water capacity; length of growing period 60-90 days

AEZ 8.1: hot dry semi-arid climate; moderately deep to deep, loamy to clayey, mixed red and black soils; medium available water capacity; length of growing period 90-120 days

AEZ 8.2: hot moist semi-arid climate; medium to deep red loamy soils; low available water capacity; length of growing period 120-150 days

AEZ 8.3: hot moist semi-arid climate; deep red loamy soils; low available water capacity; length of growing period 120-150 days

AEZ 18.1: hot dry semi-arid climate; deep, loamy to clayey, alkaline coastal and deltaic alluvium-derived soils; medium available water capacity; length of growing period 90-120 days

- De Nitrification De Composition (DNDC) is a process oriented crop Model
- Highly specialised Software developed by New Hampshire University in 1992 and continually updated
- Represents Carbon and Nitrogen Biogeochemistry for Agricultural Ecosystems
- Gas emission simulated
  - Nitrous oxide (N2O)
  - Methane (CH4)
- Simulates crop growth, soil processes, soil carbon fluxes and nitrogen leaching
- Most extensively tested and studied Model in agriculture
- Has been calibrated for North Indian Agricultural Ecological Zones (AEZ)
  (can directly be used in the Rice and Wheat belts without Reference Plot monitoring)
- Limited or no studies from South India
  (our FCN-LCF Pilot Project will calibrate the Model for the whole of Tamil Nadu, half of Karnataka, and one district in AP)

Thank you!