International Center for Tropical Agriculture
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Climate-smart soil protection and rehabilitation in India

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Outline

- Objectives of the CSS project
- CSS evaluation
  - Farm Typology
  - Climate Smartness Assessment (Kalkulator)
  - Biophysical assessment
  - Evaluation of Land Management Options (ELMO)
  - Attainable impact
- CSA prioritization framework
- Recommendations

Objective of the Climate Smart Soils Project

- **Assessment of climate smartness of ongoing and potentially suitable alternative agricultural soil conservation practices, including:**
  - **analysis of farm-level cost-benefit and tradeoffs**
  - **evaluation of the overall CSA impact and scope**
  - **adoption and scaling potentials**
- **Design of a CSA prioritization process**

> **"Agriculture has to be part of the solution to climate change."**
>
> ***Patrick Verkooijen, The World Bank, 2012***

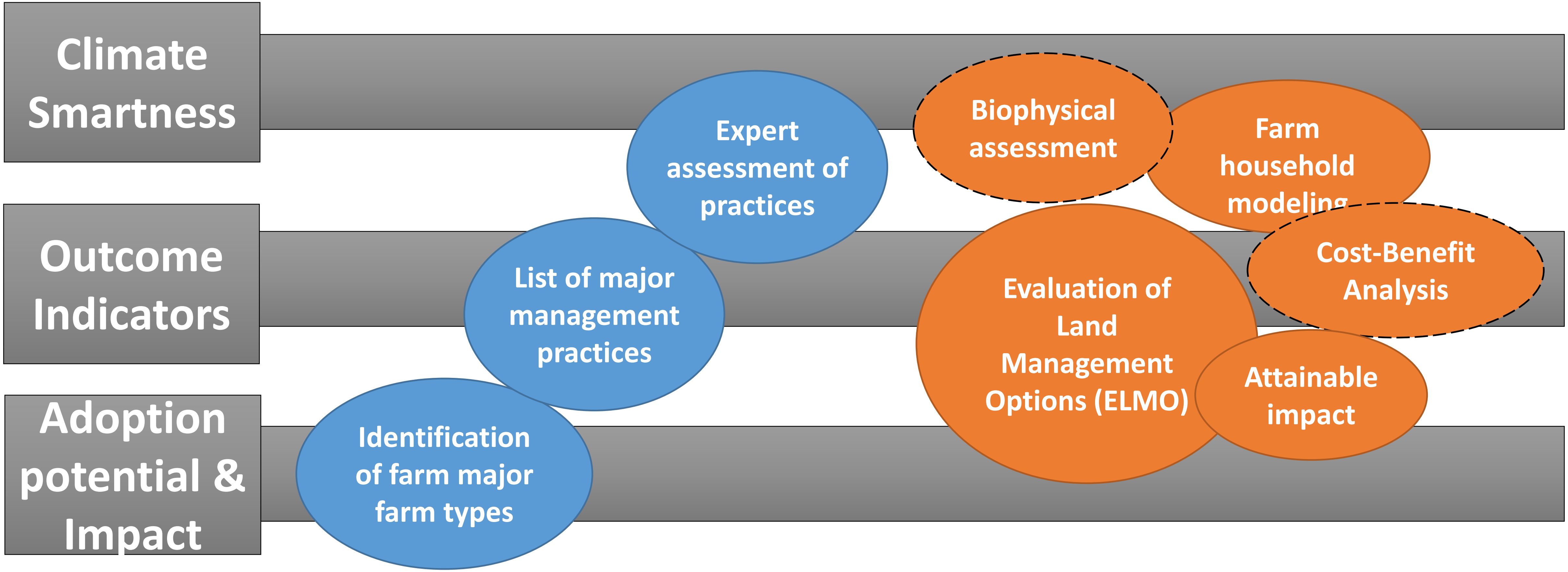
Climate smart agriculture

Triple-win goal – three pillars (FAO 2013):

1. Sustainably increasing agricultural productivity and incomes;
2. Adapting and building resilience to climate change;
3. Climate change mitigation: reducing greenhouse gases emissions, where possible.

"To ensure a food-secure future, farming must become climate resilient."

CIAT's approach to evaluate the climate smartness



CSA rapid assessment - methodology

Stakeholder workshops → Farming system types → **Case study farmer interviews**

Stakeholder workshops ↓ Soil technology shortlist

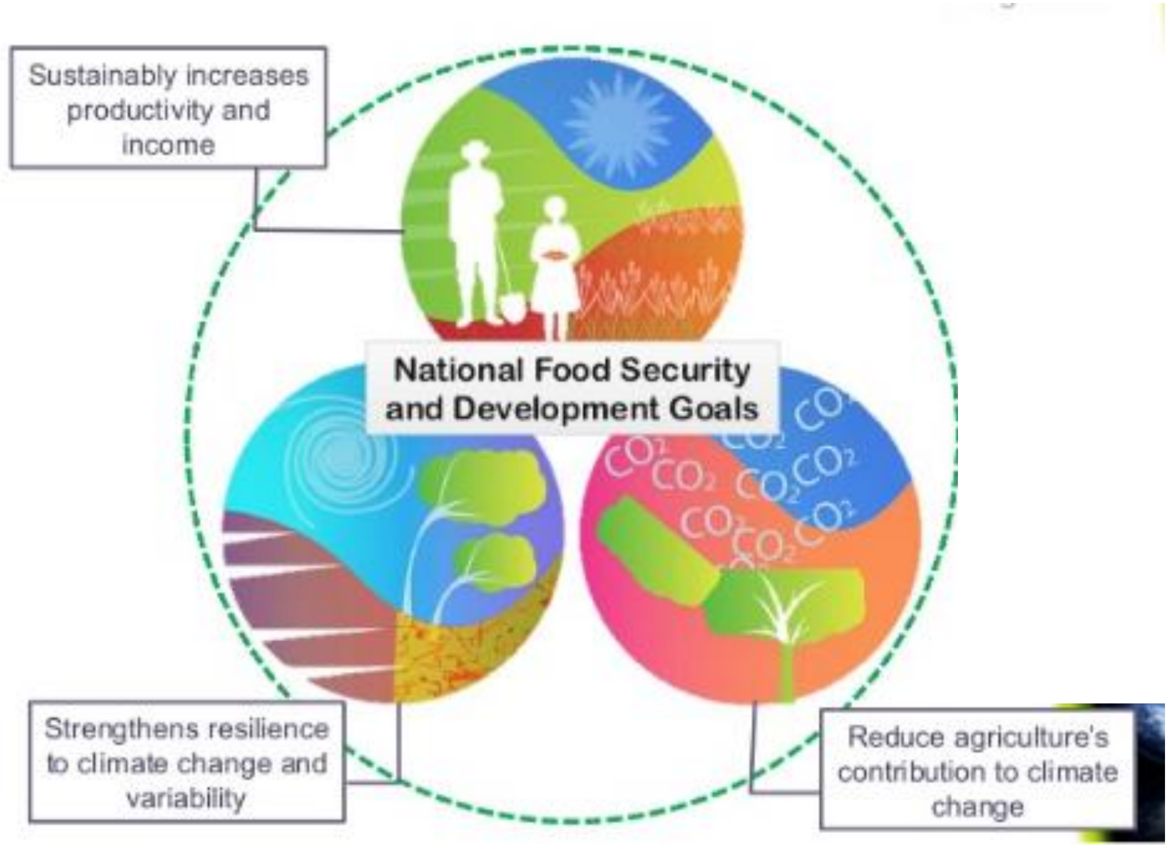
Case study farmer interviews ↓ Input data

Modelling CSA indicators for baselines and scenarios

Modelling of CSA indicators and trade-offs

Calories produced on farm/hectare

- Cash crops and meat not taken into account
- ‘Potential supply’ only



Soil nitrogen balances farm/hectare

- Simplified, non-holistic indicators

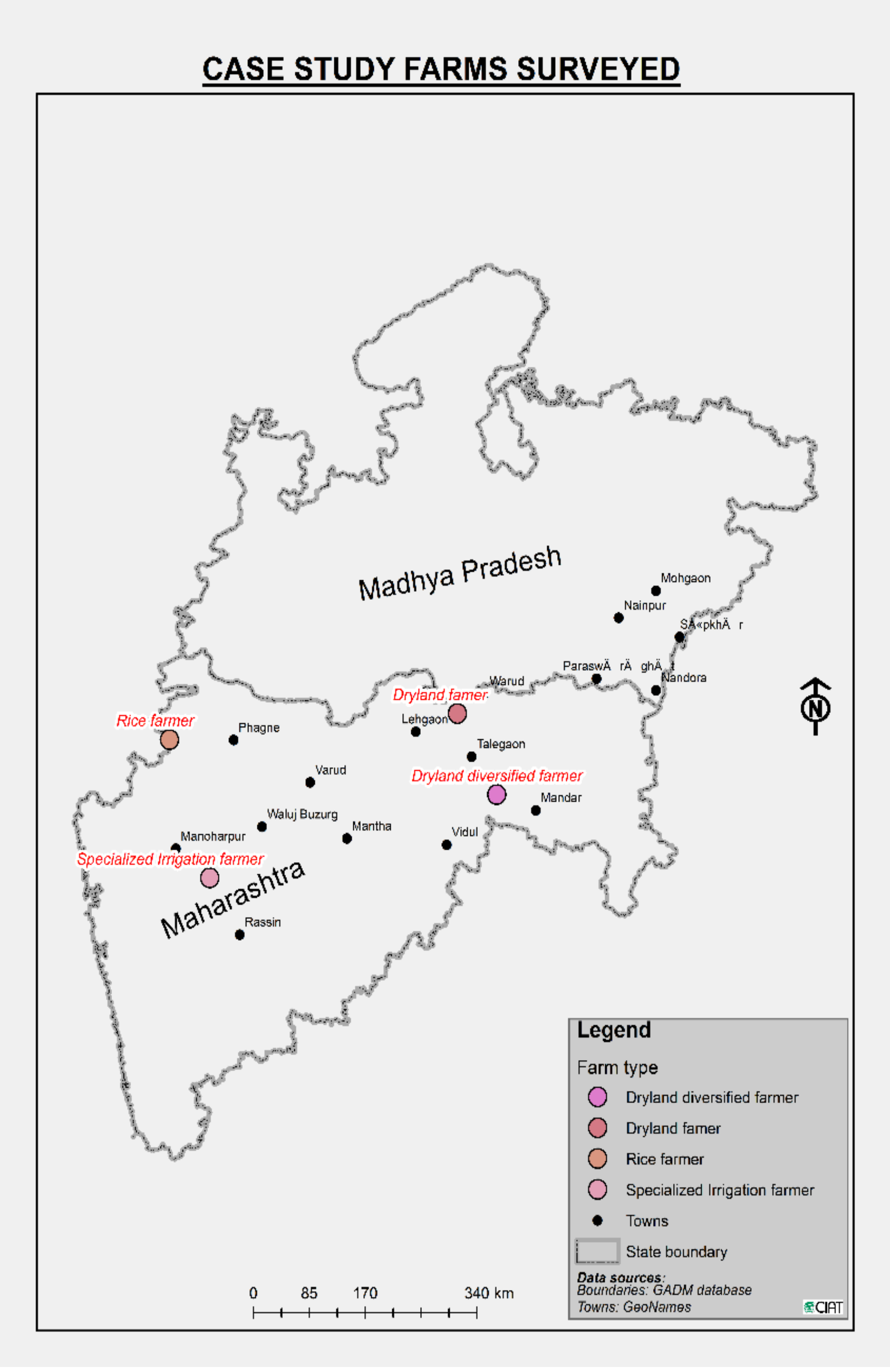
GHG emissions from agriculture per farm/hectare

- Soil C stock changes not included
- IPCC tier 1/2 overestimating for SSA

Farming system types

Factors: intensification, production orientation, commercialization, agro-ecological potential and resource endowment

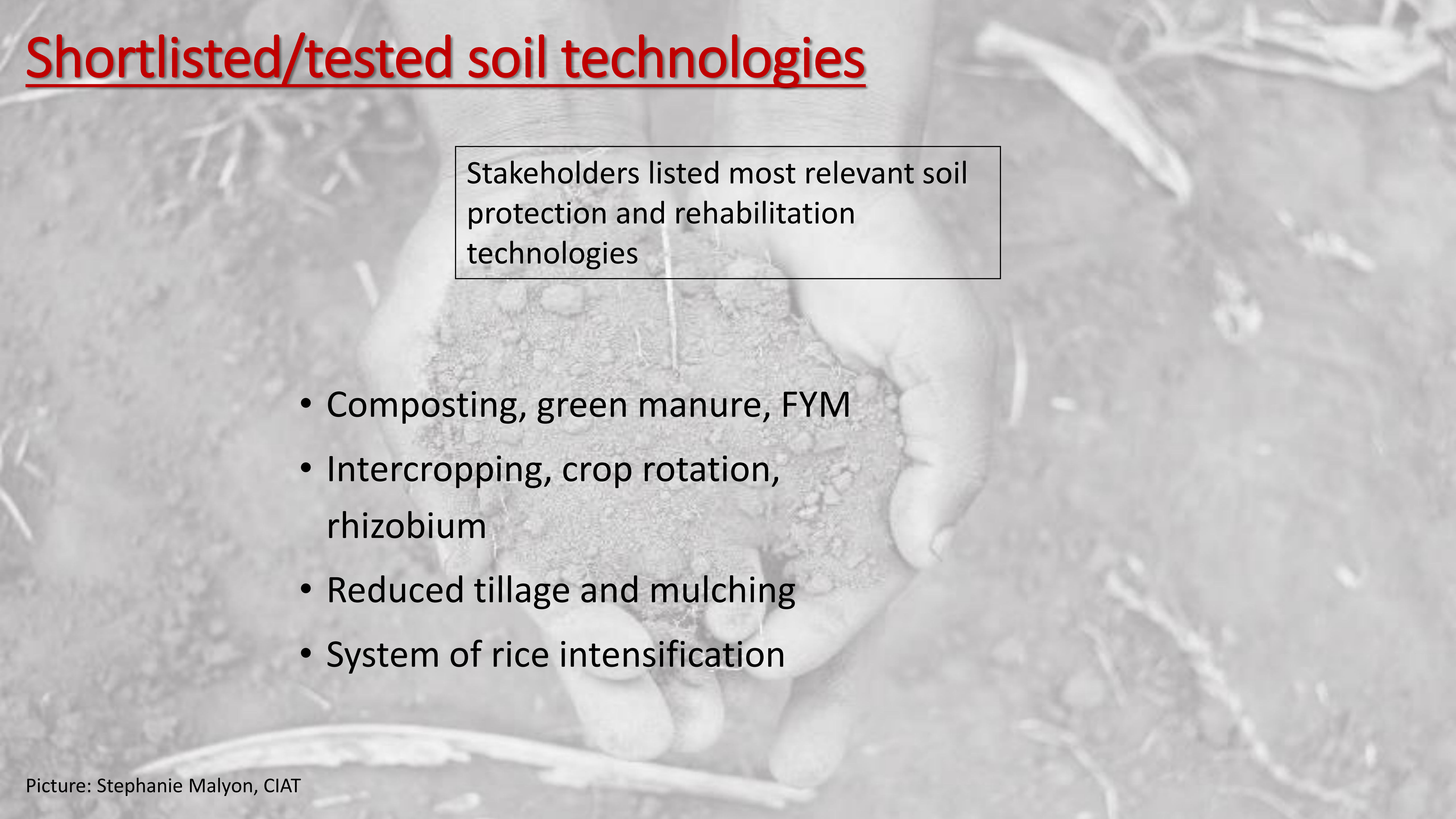
District	Dryland farmer	Dryland diversified farmer	Rice farmer	Specialized irrigation farmer
	----------------------------------	%	------------------------------	
Ahmednagar	23	5	7	65
Dhule	50	5	35	10
Jalna	60	35	0	5
Yavatmal	15	70	0	15
Amaravati	10	75	0	15
Overall project area	5	50	20	25



Shortlisted/tested soil technologies

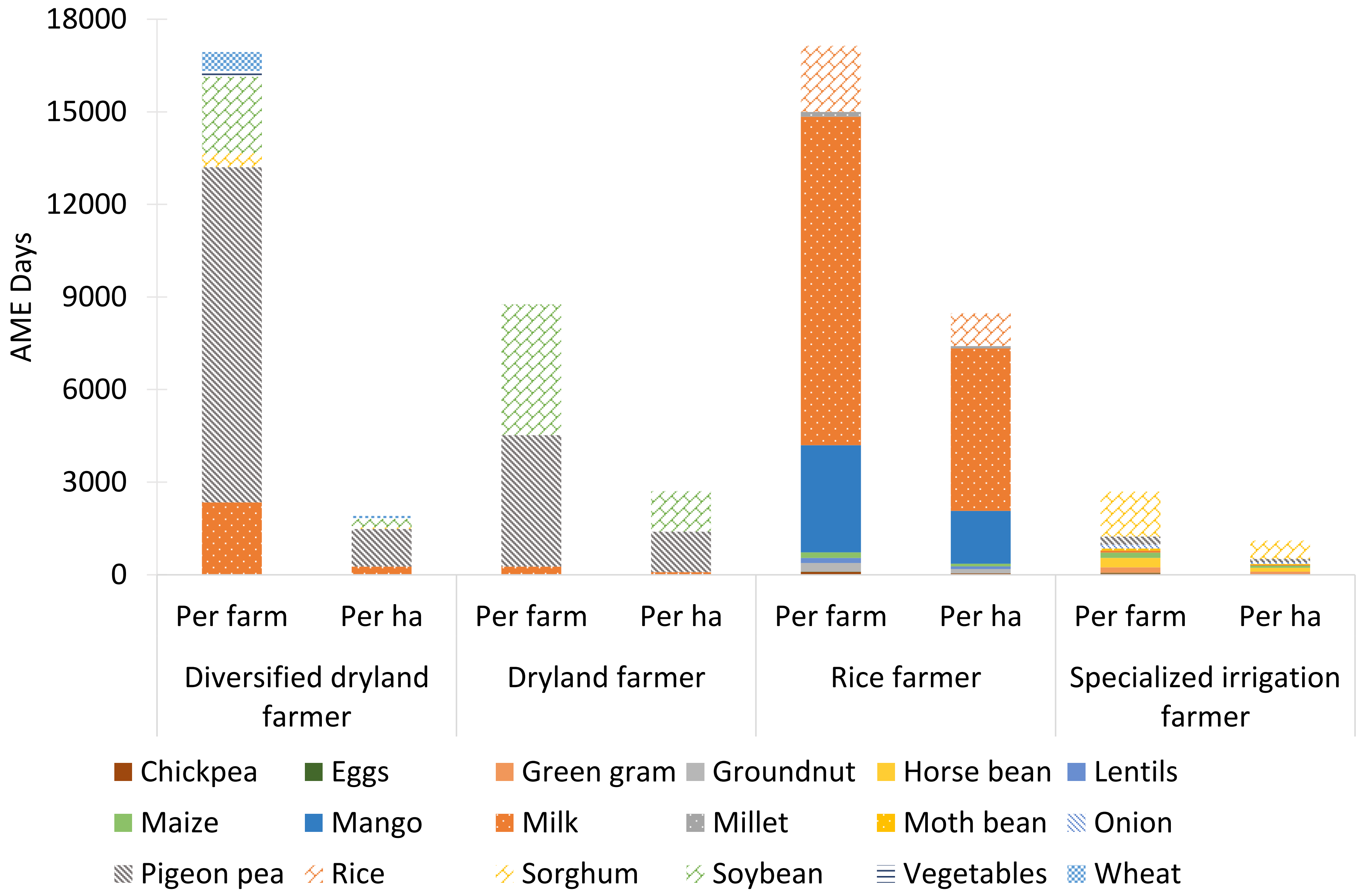
Stakeholders listed most relevant soil protection and rehabilitation technologies

- Composting, green manure, FYM
- Intercropping, crop rotation, rhizobium
- Reduced tillage and mulching
- System of rice intensification

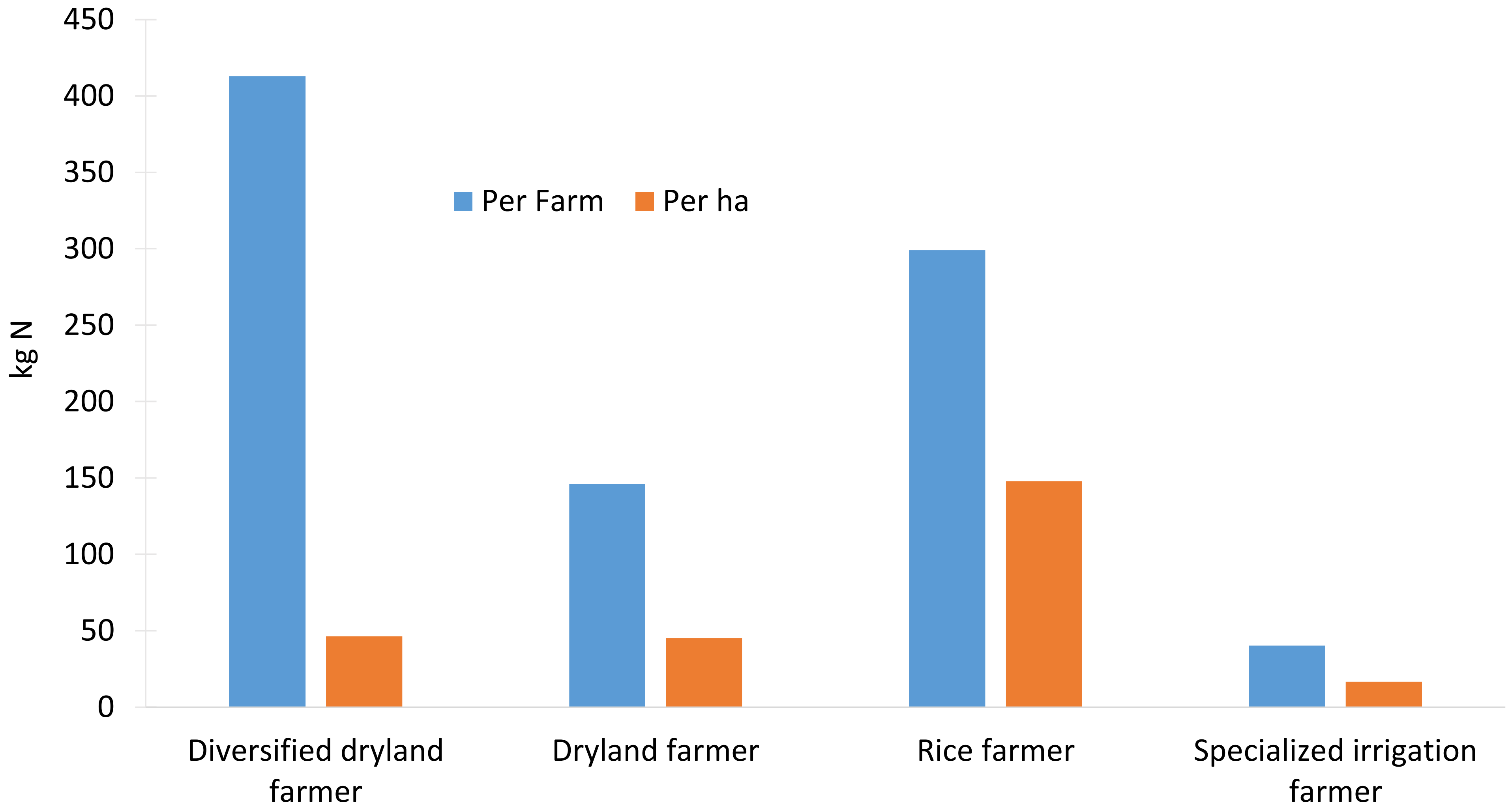


Picture: Stephanie Malyon, CIAT

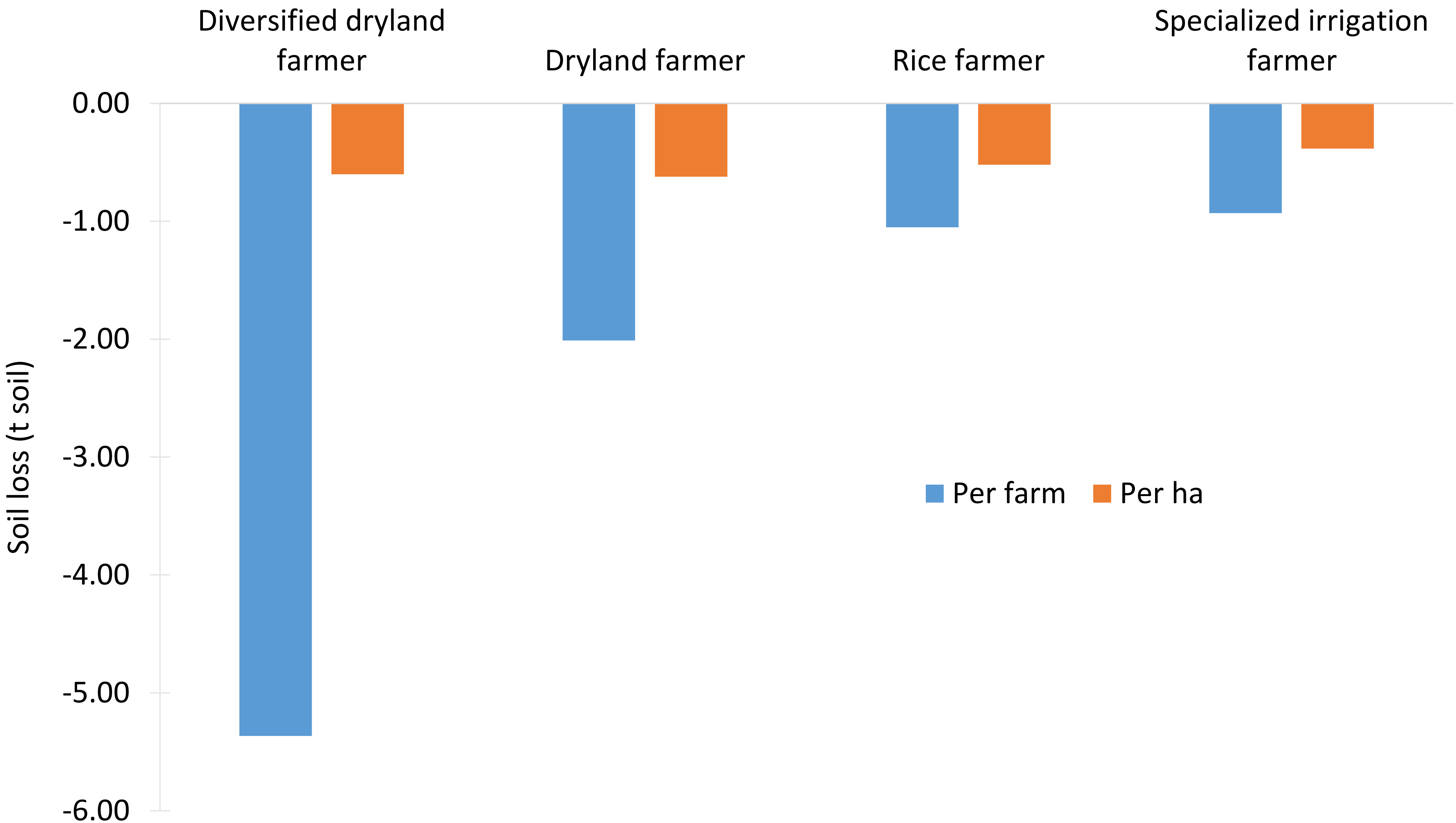
Calories produced on farm



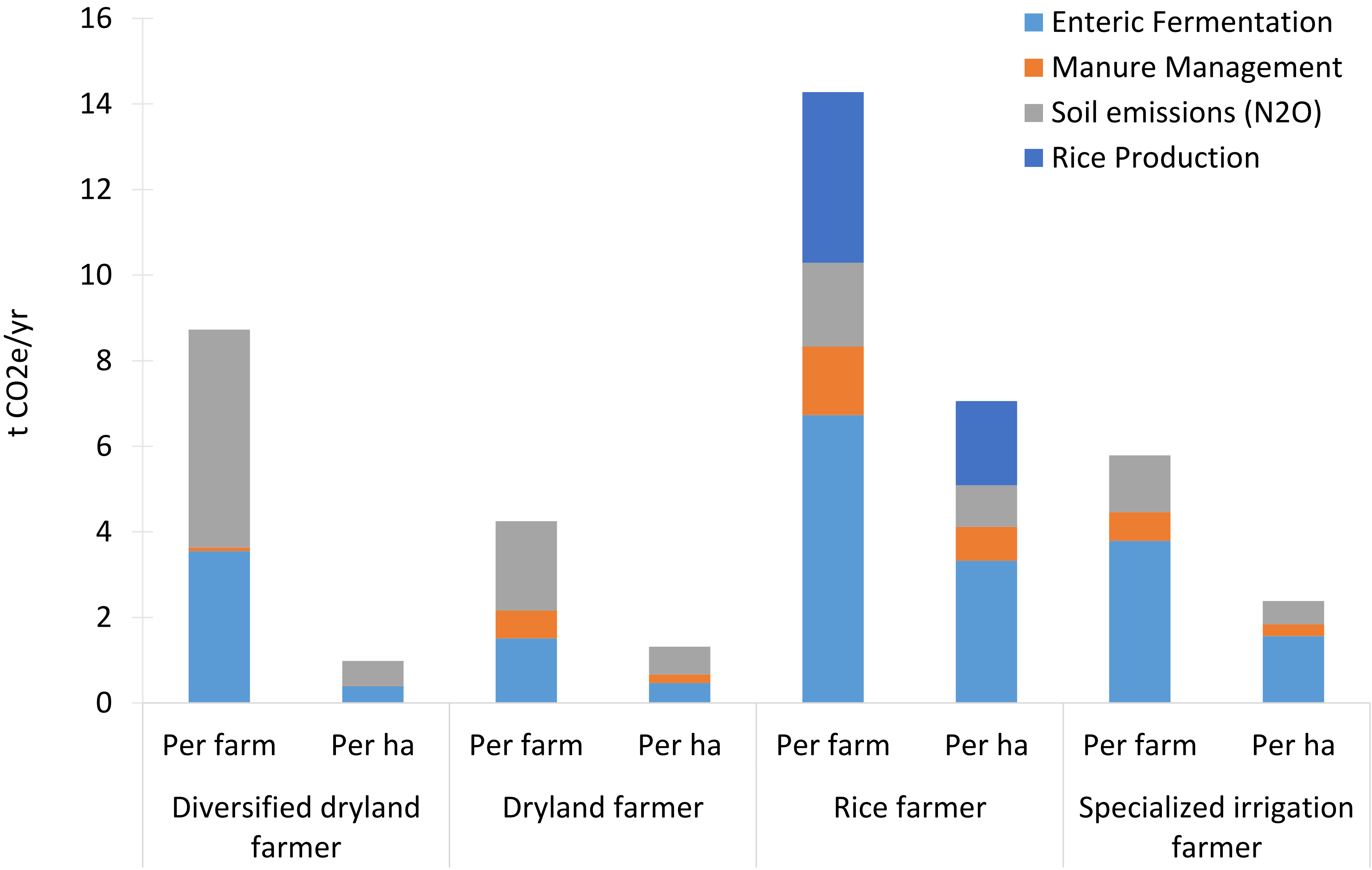
Nitrogen balance



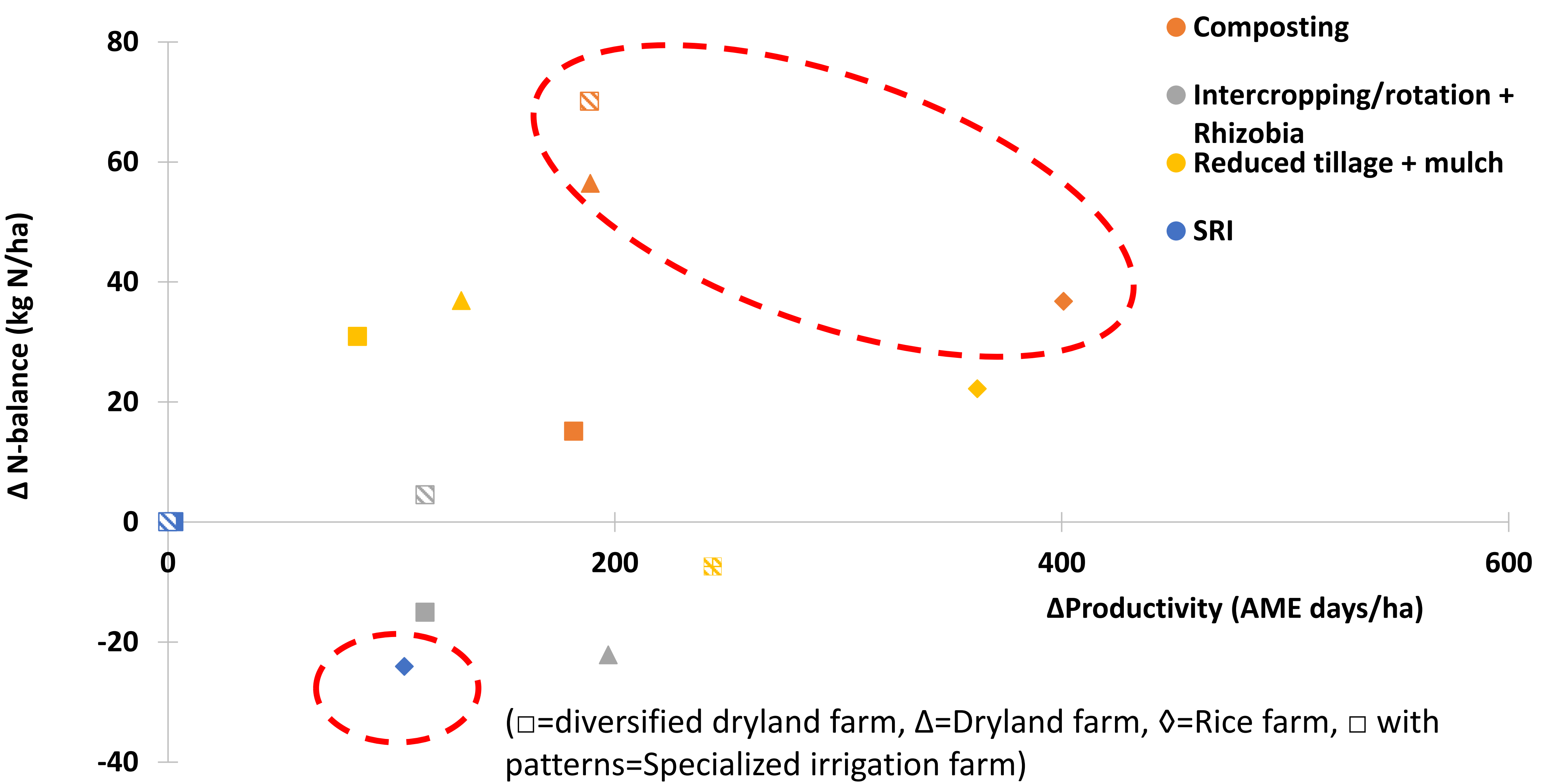
Soil erosion



Greenhouse gas emissions

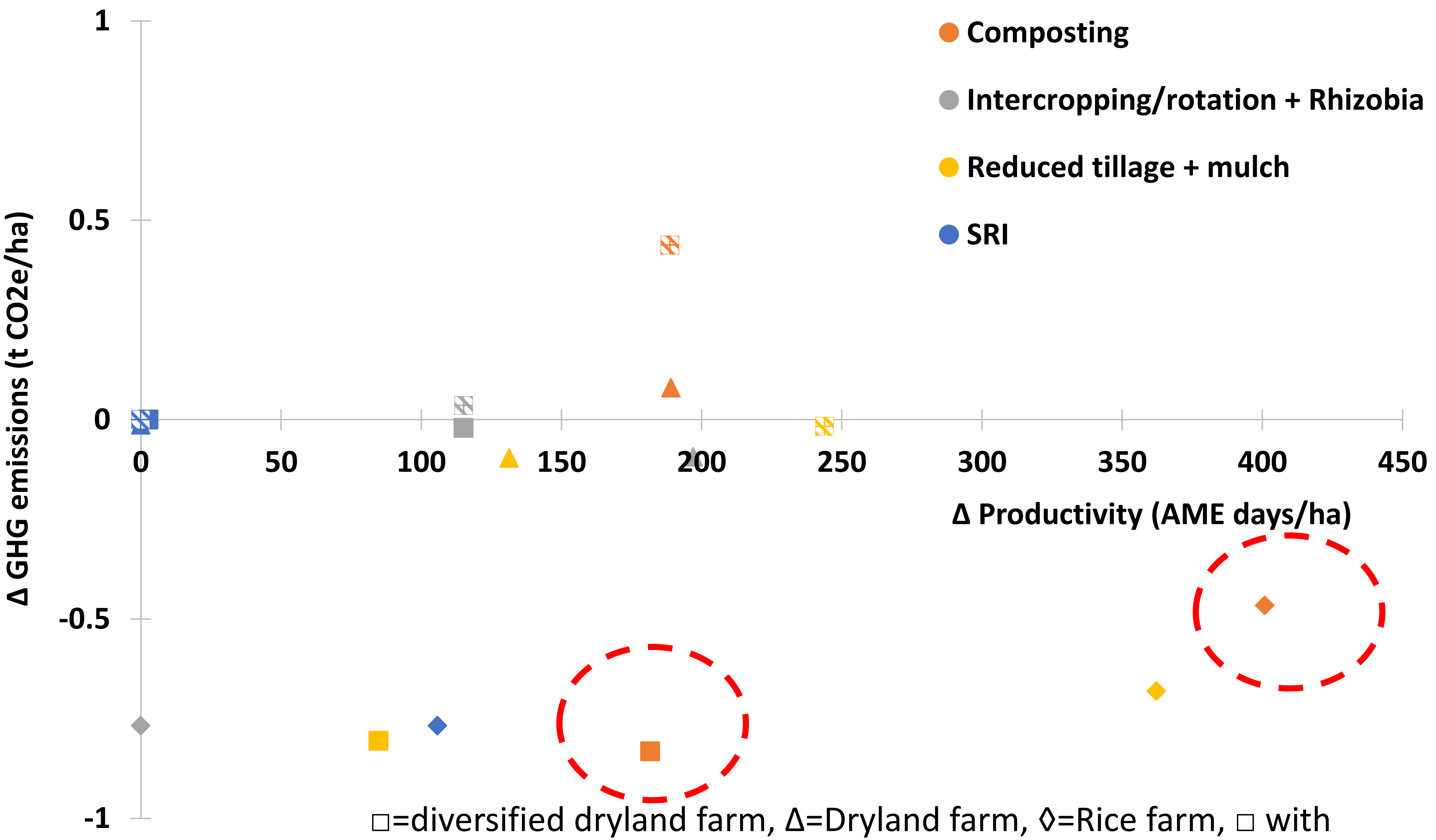


Trade-offs: Productivity vs. N balance



(□=diversified dryland farm, Δ=Dryland farm, ◊=Rice farm, □ with patterns=Specialized irrigation farm)

Trade-offs: Productivity vs. GHG emissions

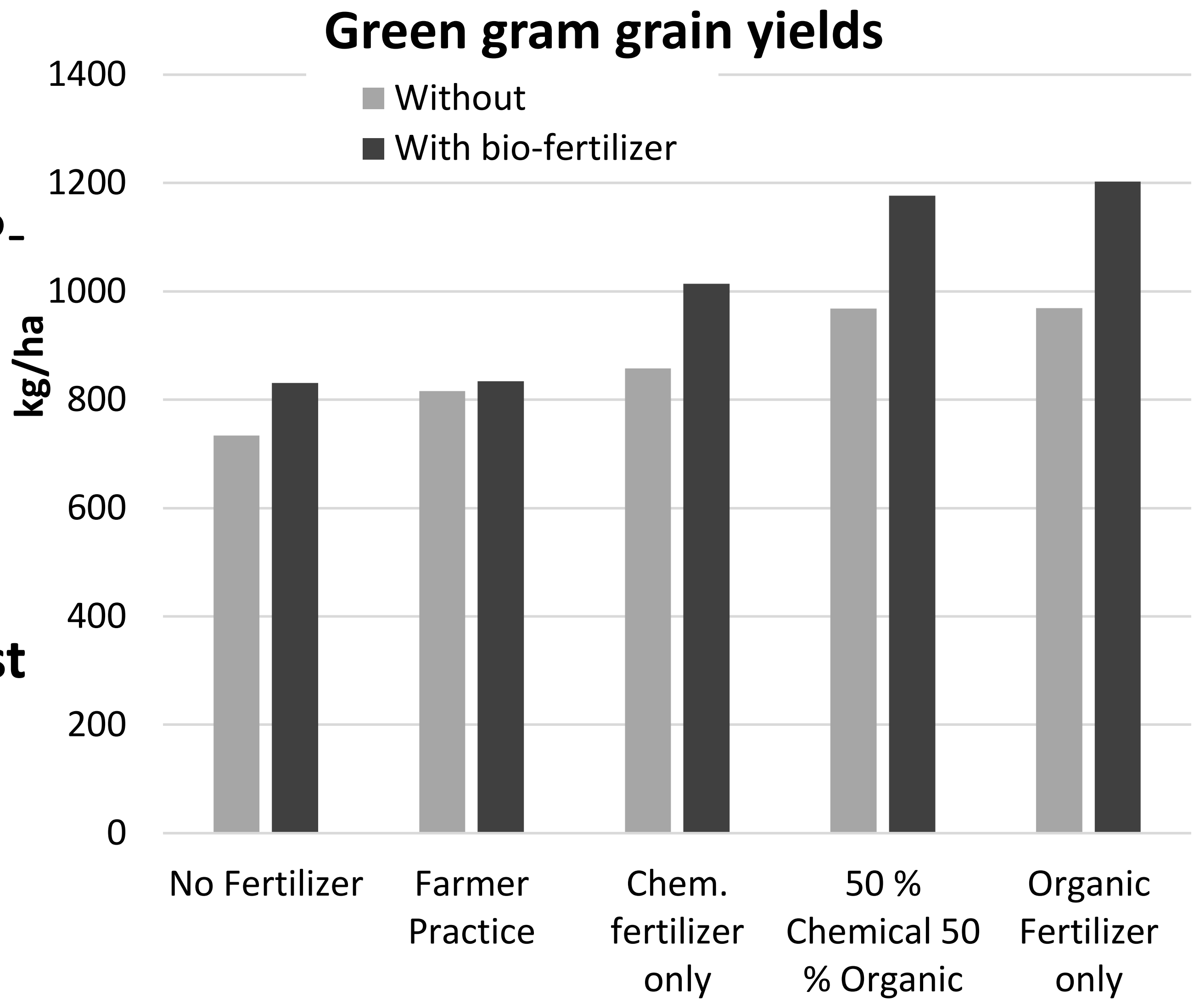


□=diversified dryland farm, Δ=Dryland farm, ◊=Rice farm, □ with patterns=Specialized irrigation farm

Biophysical monitoring and evaluation – green gram yields

Assessment of **agricultural performance** of *green gram* in response to various combinations of fertilizers and with or without seeds treated with rhizobia and P-solubilizing bacteria (= bio-fertilizer)

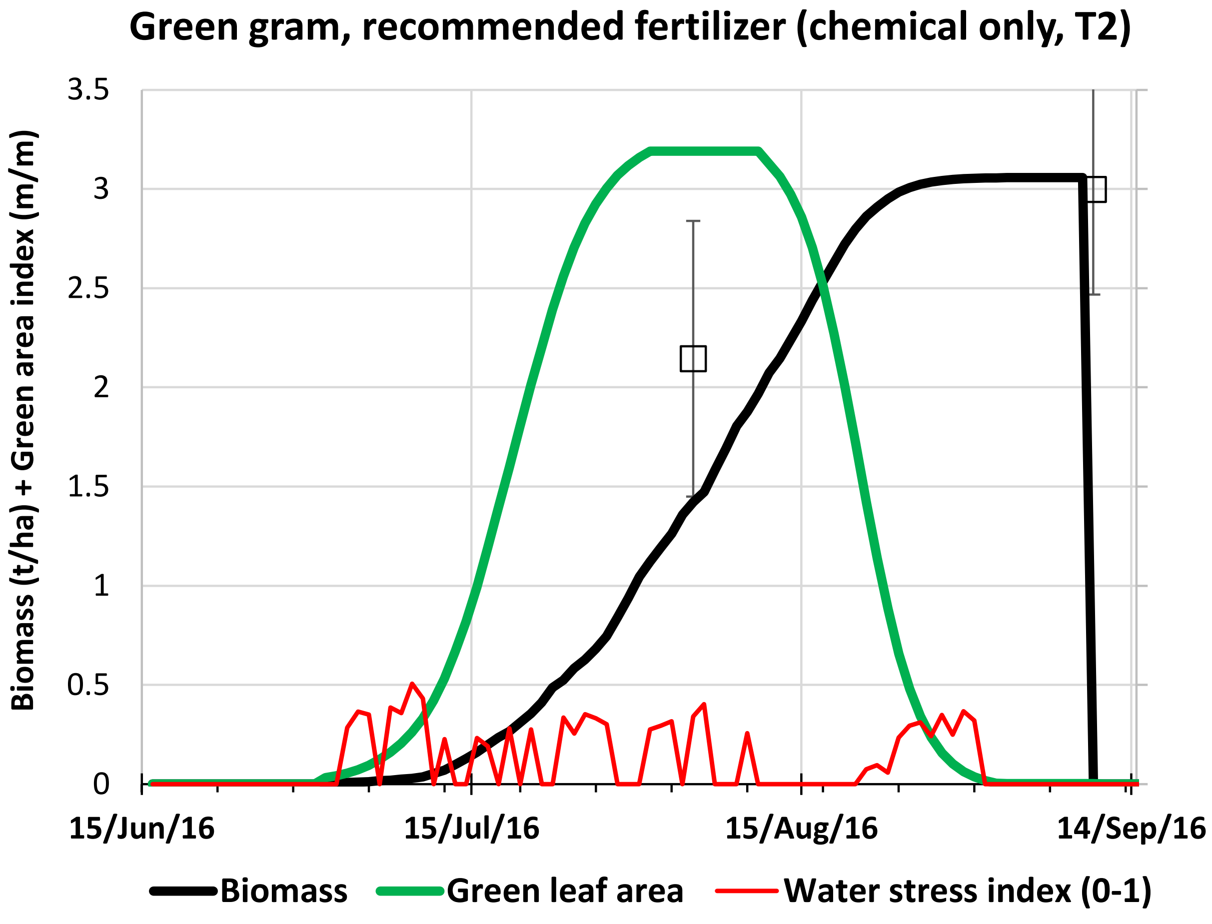
1. **Farmer practice**
   (9 kg P/ha as SSP)
2. **Chemical only**
   (25 kg N +18 kg P/ha as Urea+DAP)
3. **50 % chemical + 1.5 t/ha vermi-compost**
   25 kg N + 11 kg P/ha)
4. **3 t/ha vermi-compost**
   (25 kg N + 5 kg P/ha)
5. **No fertilizer added**

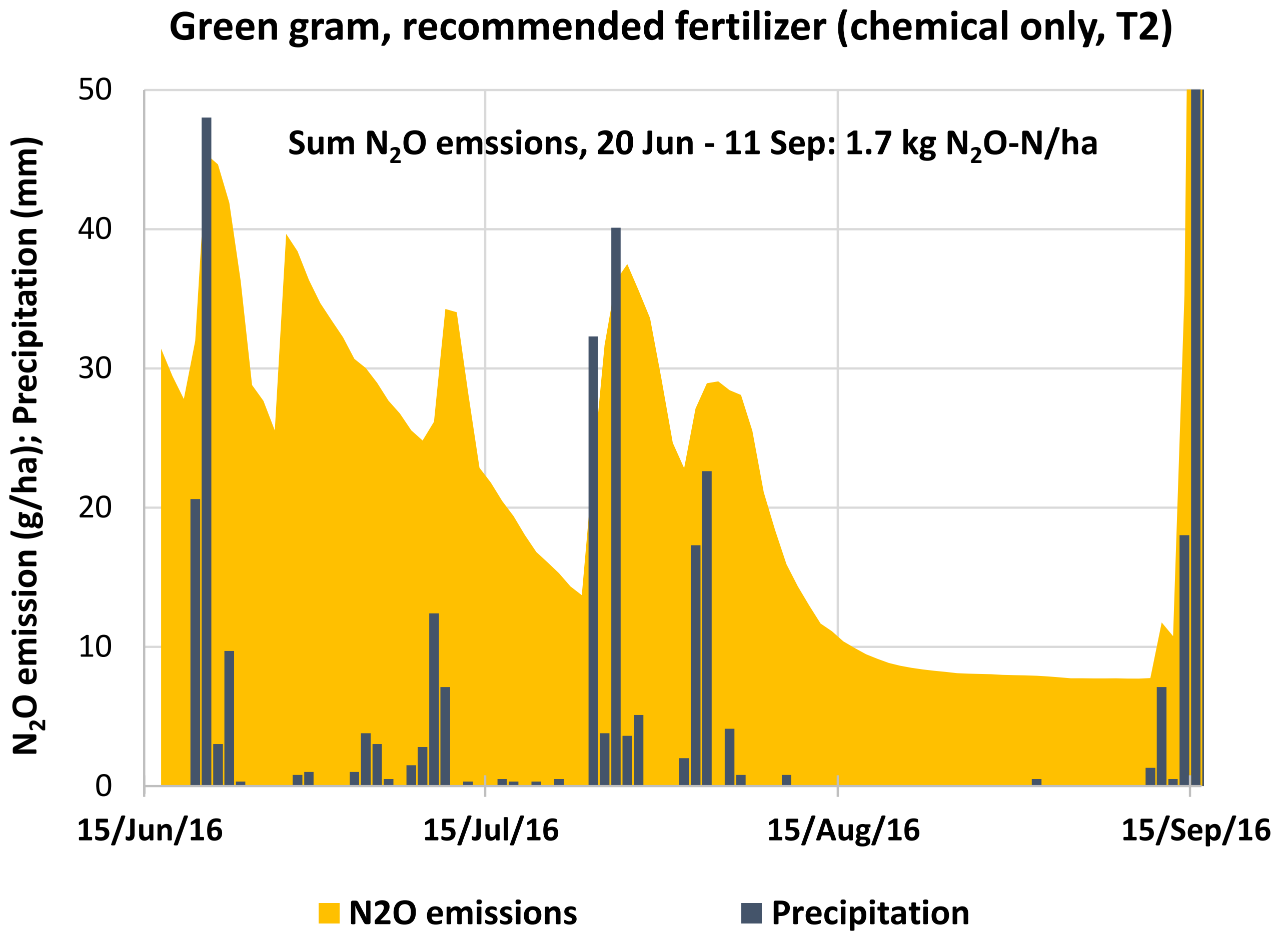


Source: WOTR & CIAT, unpublished

Biophysical monitoring and evaluation – N_2O emissions

Measurement and modeling of **nitrous oxide emissions**





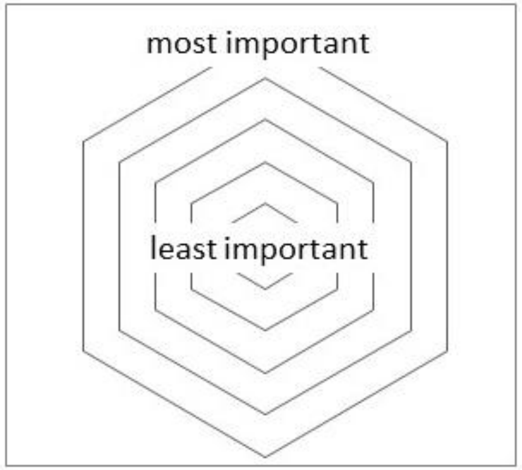
Evaluating Land Management Options (ELMO)

Participatory tool for assessing farmers' land management (LM) decisions, preferences & trade-offs

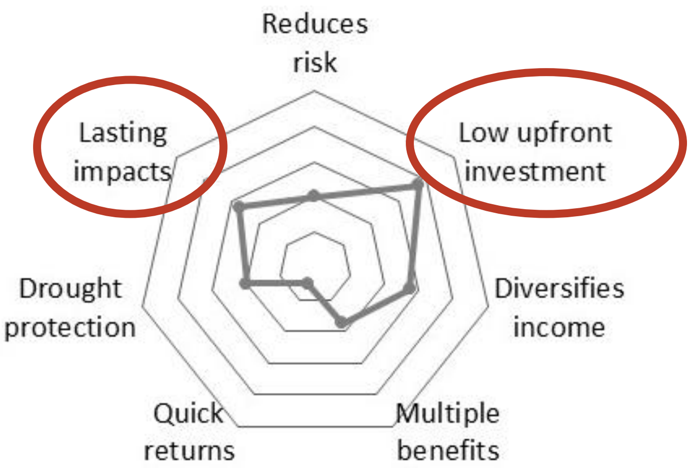
1. Identify techniques & attributes to be discussed
2. Record respondent characteristics
3. Define LM techniques & baseline
4. Rank & Score LM costs & input requirements
5. Rank & Score LM benefits & desired outcomes
6. Rank LM advantages & positive attributes
7. Rank LM disadvantages & negative attributes
8. Rank and weight LM alternatives overall

Individual discussions with farmers

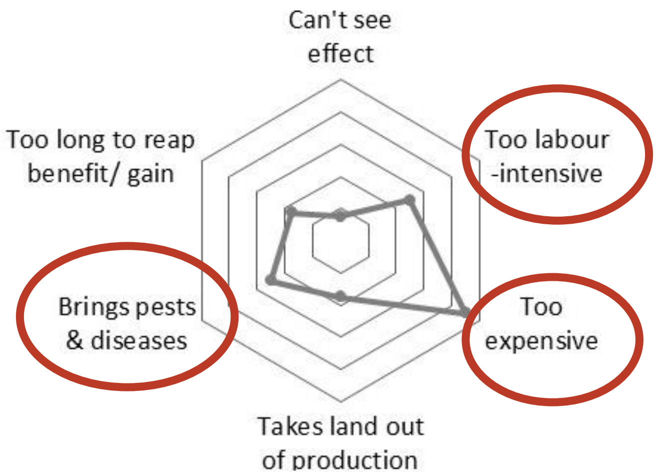
Relative importance of advantages & disadvantages of practices



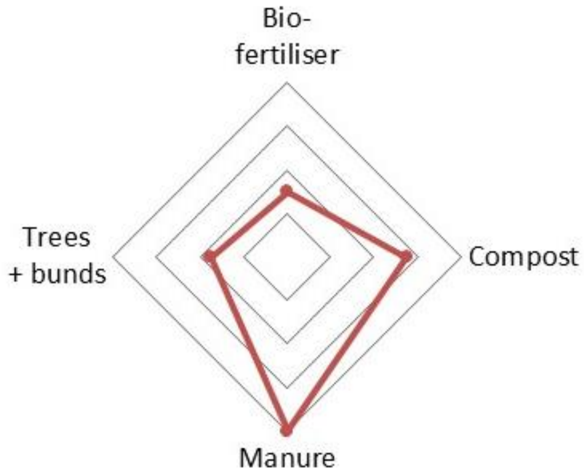
Advantages



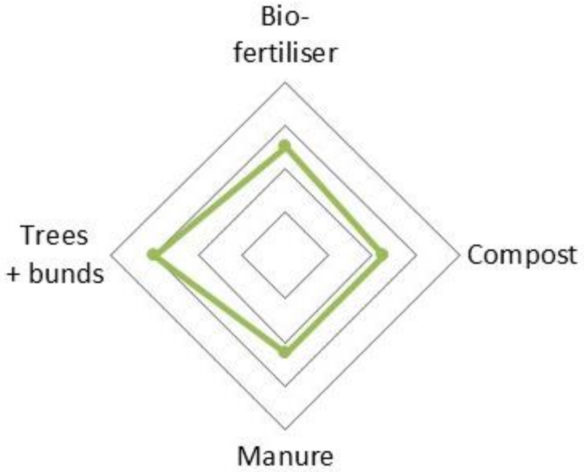
Disadvantages



Too labour-intensive

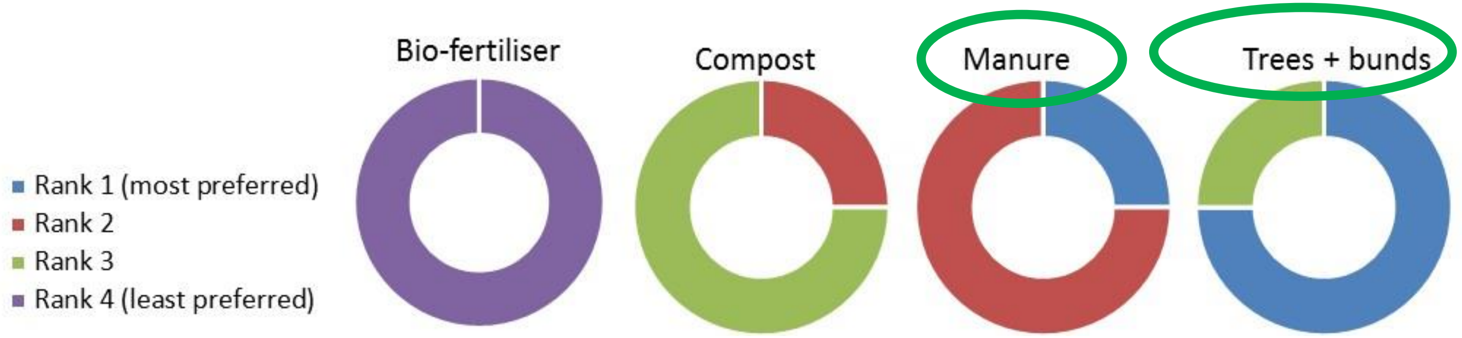


Too expensive

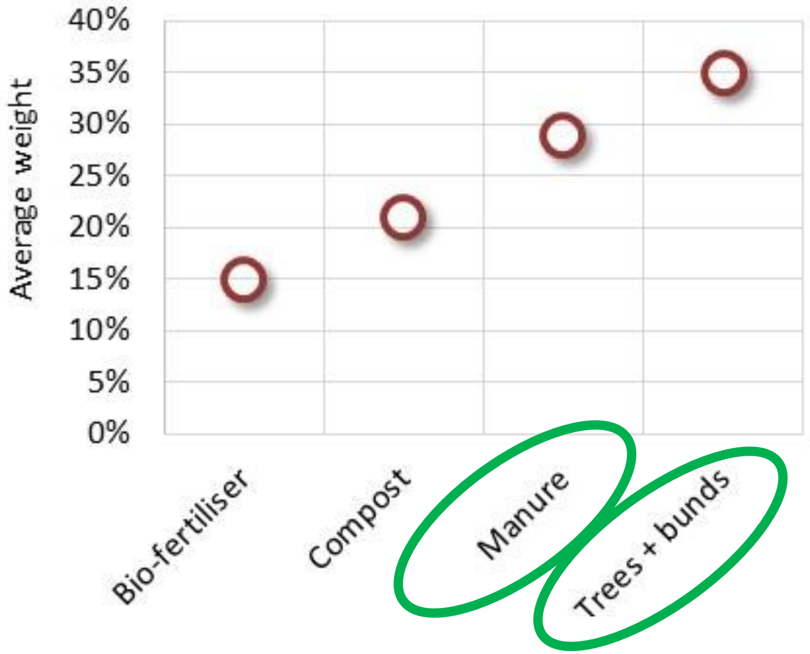


Shows average scoring by farmers

Overall preference of practices



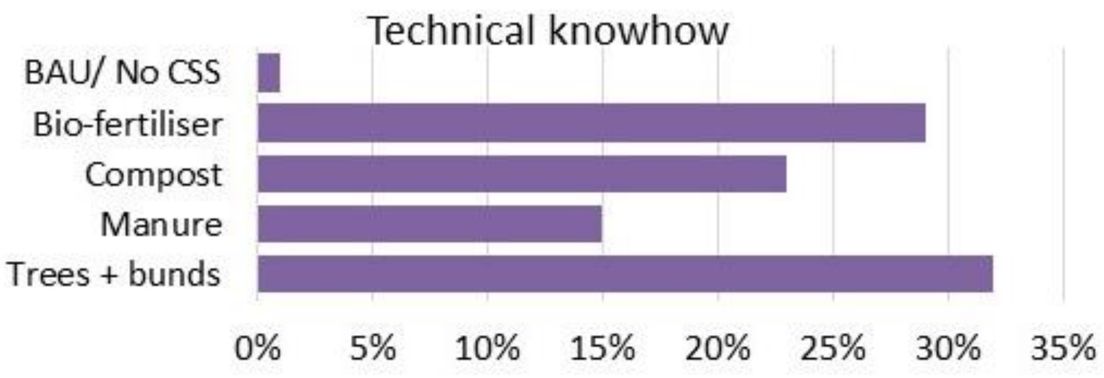
Shows percentage of respondents allocating different ranks to each land management practice.

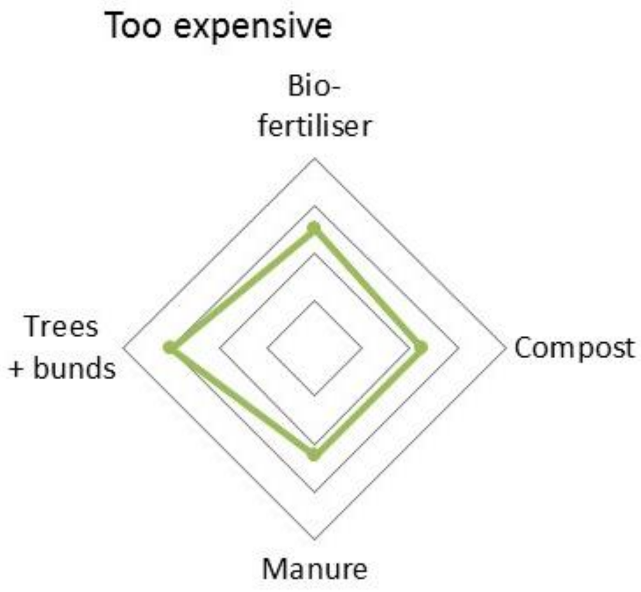


Shows average weight attributed according to overall preference relative to other land management practices. Note that total exceeds 100%, because interviews cover different combinations of land management practices.

Farmer’s general perceptions and preferences

- **Technical knowhow** poses a major barrier to uptake as many farmers do not have the knowledge that is required to implement practices successfully, and lack the means to access this information.
- **Relative expense** is one of the major concerns when choosing between different practices
- **Low upfront investment** needs is identified as an important advantage and sought-after characteristic.
- A critical concern is to **secure immediate benefits** in terms of higher crop yields, better food supplies and increased income





Calculating "attainable impact" across the five districts

1. Number of farm households of each farm type

~ rural population / HH-size * farm type %

%	Dryland diversified	Dryland	Rice	Specialized irrigation
Ahmadnagar	5	23	7	65
Dhule	5	50	35	10
Jalna	35	60	0	5
Yavatmal	70	15	0	15
Amaravati	75	10	0	15

RURAL HHs	Dryland diversified	Dryland	Rice	Specialized irrigation	Total
Ahmadnagar	37,201	171,124	52,081	483,612	744,019
Dhule	15,128	151,283	105,898	30,257	302,567
Jalna	111,047	190,367	-	15,864	317,278
Yavatmal	366,784	78,597	-	78,597	523,978
Amaravati	315,632	42,084	-	63,126	420,843
Total	845,793	633,455	157,980	671,456	2,308,685

2. Adoption rates (% of the HHs likely to adopt the specific intervention) per farm type

~ ELMO: "weight" of composting; others not deemed of interest

20% or

	Composting	Reduced tillage and mulch	Intercropping/rotation and rhizobia	SRI
Diversified dryland farmers	24	10	10	10
Dryland farmers	33	10	10	10
Rice farmers	19	10	10	10
Specialized irrigation farmers	24	10	10	10

Calculating “attainable impact” across the five districts

3. Number of adopting farms x estimated impact per farm

	Composting	I/R & Rhizobia	Reduced T&M	SRI
Diversified dryland farmers	373.48M	236.72M	174.42M	N/A
Dryland farmers	14.13M	14.73M	9.82M	N/A
Rice farmers	74.91M	N/A	67.69M	19.77M
Specialized irrigation farmers	52.91M	32.28M	68.36M	N/A

At 20% adoption rate:

> 1 billion total AME increase

Importance of expected adoption rates

	Composting	I/R & Rhizobia	Reduced T&M	SRI
Diversified dryland farmers	444.62M	118.36M	87.21M	N/A
Dryland farmers	23.55M	7.36M	4.91M	N/A
Rice farmers	71.34M	N/A	33.84M	9.88M
Specialized irrigation farmers	62.99M	16.14M	34.18M	N/A

At “ELMO informed” adoption rates:

< 1 billion total AME increase

Trade-offs with GHG emissions

AME

	Composting	I/R & Rhizobia	Reduced T&M	SRI
Diversified dryland farmers	444.62M	118.36M	87.21M	N/A
Dryland farmers	23.55M	7.36M	4.91M	N/A
Rice farmers	71.34M	N/A	33.84M	9.88M
Specialized irrigation farmers	62.99M	16.14M	34.18M	N/A

GHG emissions

	Composting	I/R & Rhizobia	Reduced T&M	SRI
Diversified dryland farmers	2.04M	0.02M	0.83M	N/A
Dryland farmers	0.01M	0.00M	0.00M	N/A
Rice farmers	0.08M	N/A	0.06M	0.07M
Specialized irrigation farmers	0.15M	0.00M	0.00M	N/A

Recommendations

- Multi-tools approach to evaluating the climate-smartness of interventions
- Impacts did not only vary by technology, but also farming system. Targeting is key, and rapid quantifications can help to prioritize
- Biophysical data and understanding farmers’ economic perceptions and preferences both valuable and complementary

What to prioritize?


Thank you!

CSA prioritization framework