Promising business cases for rice smallholders combining income increase and climate smart interventions

Rice loss reduction pilots

Intervention analysis in rice harvest, threshing (and winnowing)

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Olam

CONSORTIUM FOR INNOVATION IN POST-HARVEST LOSS & FOOD WASTE REDUCTION

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security

CCAFS

Background

Company : Olam

Region case study (pilot) Nigeria: 700 farmers, 800 ha

Rice Farmers Olam: 66.000 (> 50% in Nigeria)

Product : Rice

Topic: food loss reduction, increase farmer profit, decrease greenhous gas emissions

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Rice loss reduction pilot Nigeria

Goal: analyse the impact on food loss and farmer profit and greenhouse gas emissions

1. when switching from manually to mechanised rice harvesting
2. when switching from manually to mechanised rice threshing

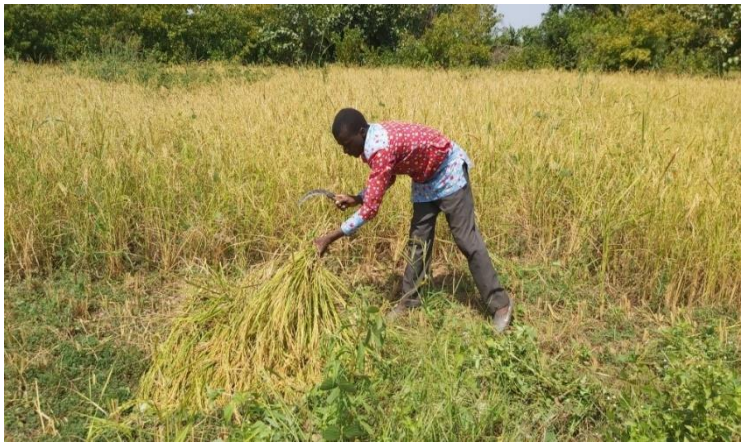
Pilot set up: Harvest

- 5 farmers were selected
- each farmer marked 6 pieces of land of 24m^2: 3 for manual harvesting and 3 for mechanised harvesting with a reaper
- weighing (using digital scale) of:
    - harvested material (plant material + paddy) (before drying)
    - paddy left on soil in harvested piece of land
    - harvested material (plant material + paddy) (after drying)
    - mechanically threshed paddy
- moisture content measurement of paddy before and after drying

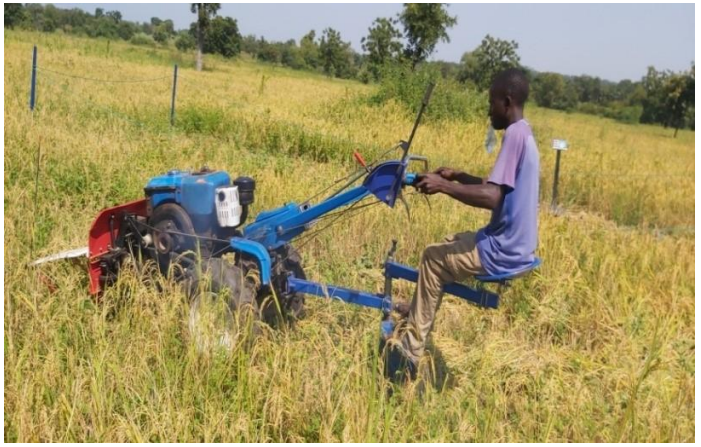
Pilot set up: Threshing (and winnowing)

- same 5 farmers were selected
- each farmer marked 6 pieces of land of 24m^2 for manual harvesting
- 3 harvested volumes were manually threshed as usual and the other 3 were mechanically threshed
- weighing (using digital scale) of:
    - harvested material (plant material + paddy) (after drying)
    - mechanically threshed paddy
- winnowing was included (integrated in mechanised threshing) and assumed to have no significant loss (according to Olam experts)

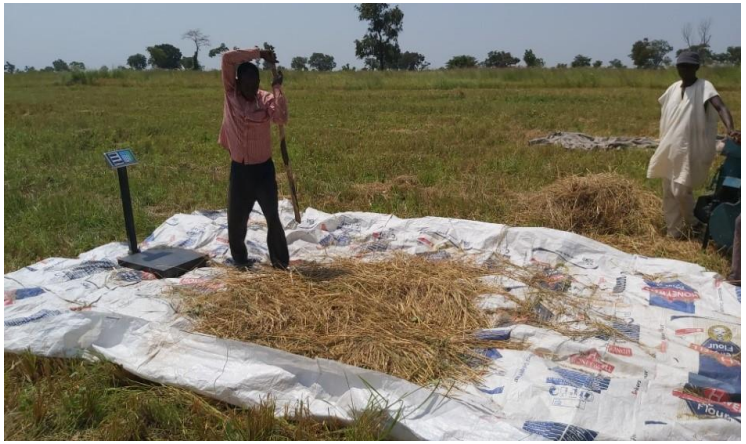
Pictures from the field pilot



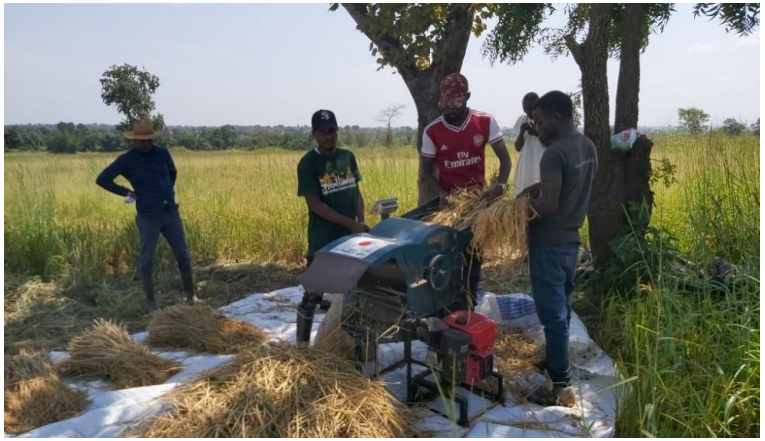
Manual harvesting with sickle



Mechanized harvesting with reaper



Manual threshing



Mechanized threshing

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Results (reduction food loss)

Harvest pilot:

- *manual harvesting*: 9.6% loss of available paddy on land
- *mechanized harvesting*: 0.9% loss of available paddy

The main reason for the huge difference in loss is the fact that the reaper takes everything from the land, whereas with manual threshing some material is not taken from the land. The lost paddy on the soil is less relevant

Threshing pilot:

- *manual threshing*: 31.1% of the weight of the dried input plant material (incl. paddy) was threshed as paddy
- *mechanized threshing*: 33.1%

Threshing losses cannot be directly derived from these data. Work-around:

- *mechanized threshing*: 3% loss (assumed, based on literature)
- *manual threshing*: 9% loss (estimated on the differences in yield).

The difference in loss for the 2 threshing scenarios can be calculated and equals 185 kg per ha.

Results (profit & GHGe reduction) mechanised harvesting

- Farmer has 1.92 ha average (pilot 2019)
- Average farm price is 169 Naira/kg = 0.37 USD/kg (Dec. 2020)

Results per harvest of switching to **mechanised harvesting**:

Harvest impact	Harvesting loss reduction*	Profit increase**	GHGe's reduction
Per ha	299 kg	110 USD	1044 kg
Per farmer	**574 kg**	**211 USD**	**2005 kg**
Olam (66.000 farmers)	**37.867 ton**	**13.912 KUSD**	**132.316 ton**
SRP (700.000 farmers)	401.625 ton	147.553 KUSD	1.403.350 ton

*= of paddy, directly after harvest, before drying
**= after mechanized threshing

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Results (profit & GHGe reduction) mechanised threshing

Results per harvest of switching to **mechanised threshing**:

Threshing impact	Loss reduction (weight)	Profit increase	GHGe reduction
Per ha	180 kg	66 USD	734 kg
Per farmer	**346 kg**	**127 USD**	**1.410 kg**
Olam (66.000 farmers)	**22.852 ton**	**8.396 KUSD**	**93.031 ton**
SRP (700.000 farmers)	242.370 ton	89.045 KUSD	986.690 ton

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Results (profit & GHGe reduction) mechanised harvesting and mechanised threshing

Results per harvest of switching to **mechanised harvesting and mechanised threshing"**

Harvest impact	Loss reduction (weight)	Profit increase	GHGe's reduction
Per ha	479 kg	176 USD	1.773
Per farmer	**920 kg**	**338 USD**	**3.404**
Olam (66.000 farmers)	**60.720 ton**	**22.308 KUSD**	**224.695 ton**
SRP (700.000 farmers)	643.995 ton	236.598 KUSD	2.383.125 ton

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Results ACE-calculator Rice

ACE calculator RICE — Agro Chain greenhouse gases Emissions Calculator, Version December 2020 — Jan Broeze, Wageningen Food & Biobased Research

Case study title:	Rice. Scenario: manual harvesting, manual threshing		
RESULT: FOOD LOSS (lost edible part)	26.9%	moisture & residues loss	37.95%
RESULT: GHG EMISSIONS	7.908 kg CO2-EQ. per kg sold on market	chain yield (kg purchased/kg crop)	0.454
FLW associated GHG emissions	2.108 kg CO2-EQ. per kg sold on market		

ACE calculator RICE — Agro Chain greenhouse gases Emissions Calculator, Version December 2020 — Jan Broeze, Wageningen Food & Biobased Research

Case study title:	Rice. Scenario: mechanical harvesting, manual threshing		
RESULT: FOOD LOSS (lost edible part)	19.8%	moisture & residues loss	37.95%
RESULT: GHG EMISSIONS	7.231 kg CO2-EQ. per kg sold on market	chain yield (kg purchased/kg crop)	0.497
FLW associated GHG emissions	1.314 kg CO2-EQ. per kg sold on market		

ACE calculator RICE — Agro Chain greenhouse gases Emissions Calculator, Version December 2020 — Jan Broeze, Wageningen Food & Biobased Research

Case study title:	Rice. Scenario: manual harvesting, mechanical threshing		
RESULT: FOOD LOSS (lost edible part)	22.1%	moisture & residues loss	37.95%
RESULT: GHG EMISSIONS	7.443 kg CO2-EQ. per kg sold on market	chain yield (kg purchased/kg crop)	0.483
FLW associated GHG emissions	1.555 kg CO2-EQ. per kg sold on market		

ACE calculator RICE — Agro Chain greenhouse gases Emissions Calculator, Version December 2020 — Jan Broeze, Wageningen Food & Biobased Research

Case study title:	Rice. Scenario: mechanical harvesting, mechanical threshing		
RESULT: FOOD LOSS (lost edible part)	14.6%	moisture & residues loss	37.95%
RESULT: GHG EMISSIONS	6.808 kg CO2-EQ. per kg sold on market	chain yield (kg purchased/kg crop)	0.530
FLW associated GHG emissions	0.846 kg CO2-EQ. per kg sold on market		

data from source/default value | user-given value | value in calculations

SELECT REGION AND SPECIFIC DATA SETS FOR GHG EMISSION FACTORS AND FLW FLW FACTORS			
Geographical region	SubSaharanAfrica		
Specific country (optional, incomplete list	Nigeria		
Country-averg. GHG emiss. factor of elec	0.573		0.573 kg CO2-eq./kWh
CROP PRODUCTION DATA			
CROP GHG EMISSION FACTOR: data sour	Thai Rice (derived from dedicated study)		
Crop GHG emission factor:	3.490		3.490 kg CO2eq per kg paddy rice
Crop dry matter content:	22.0%		22.0%
HARVESTING AND ON-FIELD OPERATIONS			
HARVESTING	machine reaping (data obtained from measurements in Nigeria, 2020)		
Losses:	0.9%		0.9%
FIELD DRYING	stacking/piling/drying in the field		
Losses:	2.4%		2.4%
Dried crop dry matter content:	18.0%		18.0%
HAULING COLLECTION TRANSPORT	(losses included in harvest losses)		
Losses:	0.0%		0.0%
THRESHING	mechanical threshing (data obtained from measurements in Nigeria, 2020)		
Losses:	3.0%		3.0%
WINNOWING	(Winnowing: data are already included in threshing; if not, fill in values manually in the white cell below)		
Losses:	0.0%		0.0%
STORAGE AT FARM	(On-farm storage: data are already included in threshing; if not, fill in values manually in the white cell below)		
Losses:	0.0%		0.0%
(ON-FARM) TRANSPORT			
Transport distance		0	km

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Conclusions Calculator, case Nigeria

Summary scenario's calculator

	Baseline scenario	**Improved scenarios**		
	1. Manual harvesting and manual threshing	2. Mechanized harvesting, manual threshing	3. Manual harvesting and mechanized threshing	**4. Mechanized harvesting & mechanized threshing**
Food Loss	**26,9 %**	19,8 %	22,1 %	**14,6 %**
GHG Emissions kg CO2eq per kg sold on market	**7,908**	7,231	7,443	**6,808**
FLW associated GHG Emissions kg CO2eq per kg sold on market	**2,108**	1,314	1,555	**0,846**
Chain yield (kg purchased/kg crop)	**0,454**	0,497	0,483	**0,530**

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Major conclusions based on 4 rice scenarios shown via the calculator

- ✓ As explained previously, scenario 4 - mechanized harvesting and mechanized threshing - is the most favourable scenario
- ✓ Scenario 4 versus the baseline scenario 1 – no mechanization -, has:
  - 46 % less losses
  - 14 % less GHG Emissions kg CO2eq per kg sold on market
  - 60 % less FLW associated GHG Emissions kg CO2eq per kg sold on market
  - 17 % more chain yield (kg purchased/kg crop)

Remarks

- Business case will be elaborated later, when information on labor costs and manhours for harvest etc. are known
- All results and pilot information will be published in a scientific article

Thank you

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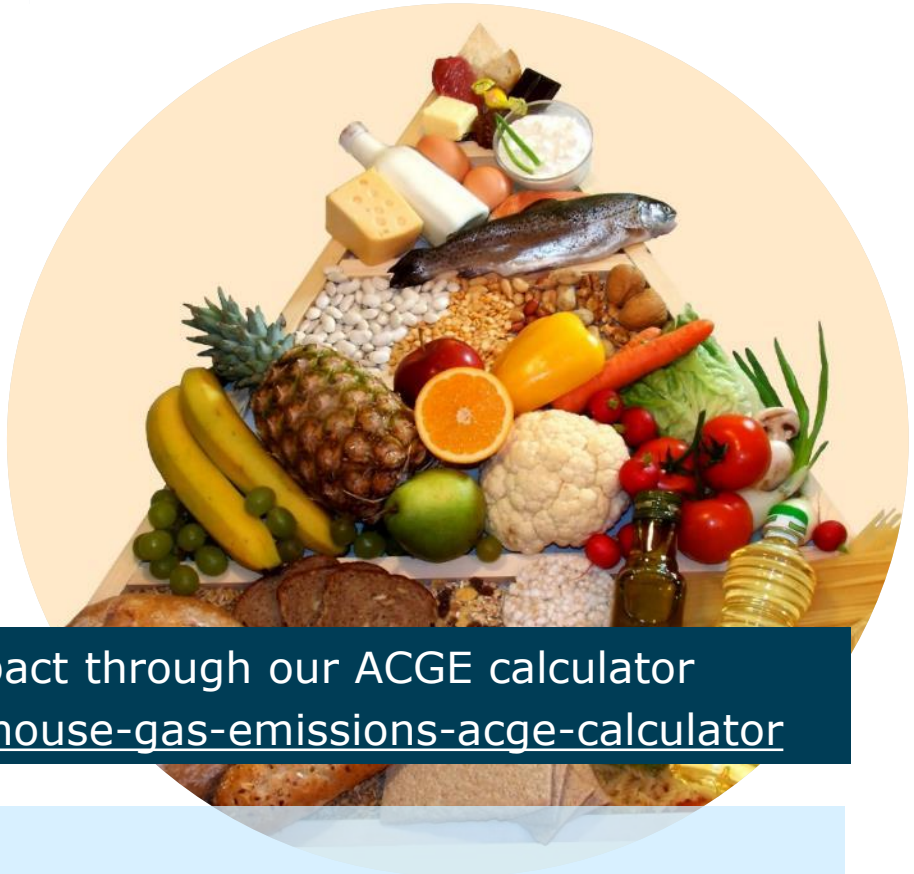

Estimate your food products' climate impact through our ACGE calculator
https://ccafs.cgiar.org/agro-chain-greenhouse-gas-emissions-acge-calculator

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