Mechanization helps Nigerian rice farmers to increase income and reduce climate impact

Axmann H., Soethoudt H., Castelein B., Kok M., Broeze J.

Background

Nigeria is Africa's largest producer of rice. Rice plays a pivotal role for Nigeria's food security. Nevertheless, the country still depends heavily on rice importations. Production methods are traditional with a low-level of mechanization and high inefficiencies. It was measured that as much as ~35% of the harvested rice is lost from harvest at smallholder rice farms till the gates of the collection centres. Losses represent a climate threat. Food loss and waste reduction has been identified as the most impactful solution to reduce the excess of greenhouse gases in our atmosphere. Worldwide rice accounts for as much as ~ 10% of the food loss and waste induced Greenhouse Gas emissions (GHGe) and it therefore is a hotspot product. Harvesting and threshing are detected as stages in the supply chain with the highest losses. In this study we assessed whether the introduction of mechanization is an impactful intervention for loss- and GHGe reduction.

Figure 1. Drivers for food loss reduction

Objective

The goal of this study is to analyse the impact of switching to mechanization on food loss, farmer profit, GHGe, and labour hours. Results should lead to research-informed knowledge, guiding the industry and the relevant stakeholders to effectively scale transitions pathways for profitable and climate smart food loss reduction interventions in smallholder rice systems.

Approach

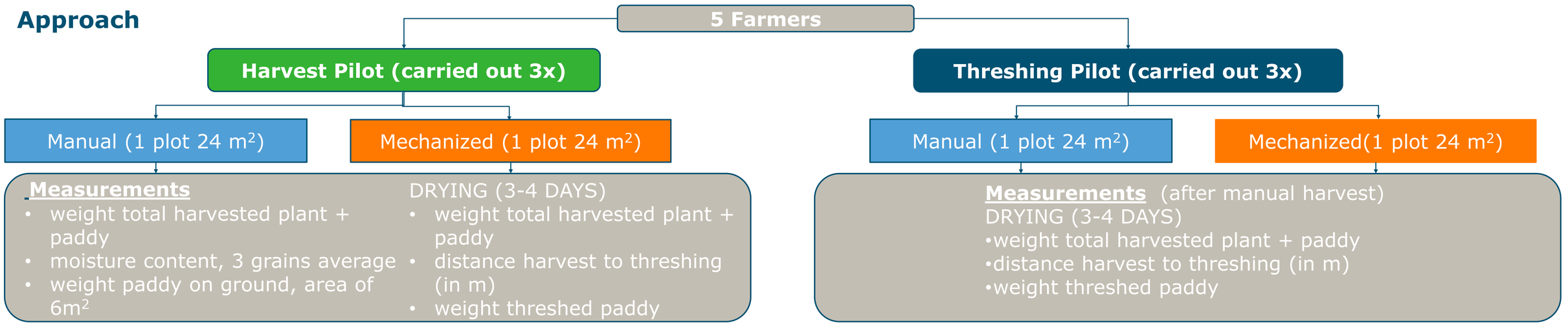

Figure 2. Set up of the three interventions scenario and comparison with the baseline

Results & Discussion

Annually almost one ton (920 kg) food loss reduction of rice can be achieved per farmer/year, equivalent to approximately 14 % of the yield. Mechanization is thereby increasing farmers income by approximately US$ 400 per farmer/year. Moreover, the introduction of mechanization can avoid GHGe per unit food available for consumption, equivalent to ~ 3.3 ton CO2-eq. production-related GHGe per farmer/year. This includes effects of fuel use of the reaper and thresher. Moreover, introduction of mechanization can save about 200 labour hours ha^{-1} $year^{-1}$. The upfront cost from mechanization are ~US$ 3,000. The challenge is to overcome those investments.

Criteria	Baseline: Man. Harv. +Man.Thres.	Scenario 1: Shift baseline to Mech. Harv.	Scenario 2: Shift baseline to Mech. Thresh.	Scenario 3: (1+2) Mech. Harv. & Mech. Thresh.
Loss reduction & profit increase ha^{-1} $year^{-1}$	-	299 kg = 126 US$	180 kg = 76 US$	479 kg = 202 US$
Loss reduction &profit increase farmer Olam/year (1.92ha)	-	575 kg = 243 US$	346 kg = 146 US$	921 kg = 389 US$
Costs of buying machine	-	2,050 US$ (reaper)	875 US$ (thresher)	2,925 US$
Labour hours saved ha^{-1} $year^{-1}$	-	144	62	206
GHGe per kg produced paddy rice (kg CO_2-eq. per kg threshed rice)	4.4	4	4.1	3.7
Climate impact of mechanization (emissions avoided, kg CO_2-eq)				
per ha/year	-	1,042	716	1,696
per farmer Olam (1.92ha)/year	-	2,000	1,374	3,256
All rice farmers in Nigeria (1.43 mln ha) (Mton CO2-eq)	-	3.3	2.29	5.4

Table 1. Results per harvest of switching to mechanized harvesting and/or threshing

Conclusions

Introducing mechanized harvesting combined with mechanized threshing is the optimal scenario. Reducing losses by investing in mechanization provides an attractive return of investment, and has a positive climate impact. As policy advice, mechanization should be part of agricultural development strategies to improve food security and farmers' incomes and to effectively reduce the climate impact of the hotspot product rice.

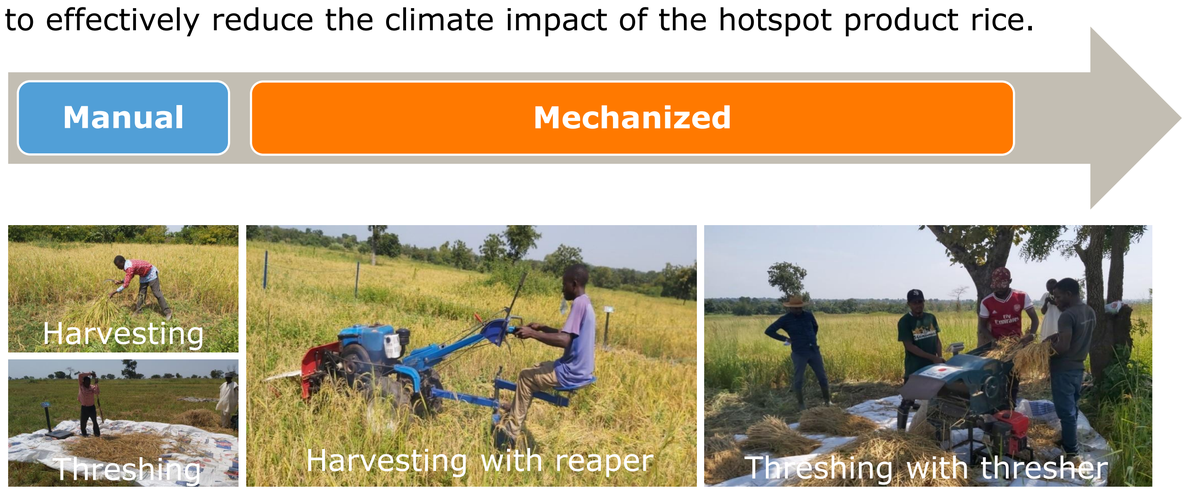

Figure 3. Photos from the field, from manual practices towards mechanization

Acknowledgements

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Wageningen University & Research
P.O. Box 123, 6700 AB Wageningen
Contact: name.surname@wur.nl
T + 31 (0)317 12 34 56, M +31 (0)6 12 34 56 78
www.wur.nl/xxxxx