MECHANIZATION AND POSTHARVEST FOR SUPPORTING SUSTAINABLE RICE PRODUCTION

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Rice Seminar, AGRITECHNICA ASIA 2022

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CGIAR IRRI

Since January 2022 merged under OneCGIAR

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IRRI

Asian Rice Farming Communities

Average farm size: 1-2 ha

Landless laborers, getting less and expensive

Feminization of rice farming

Will these kids take over the farm?

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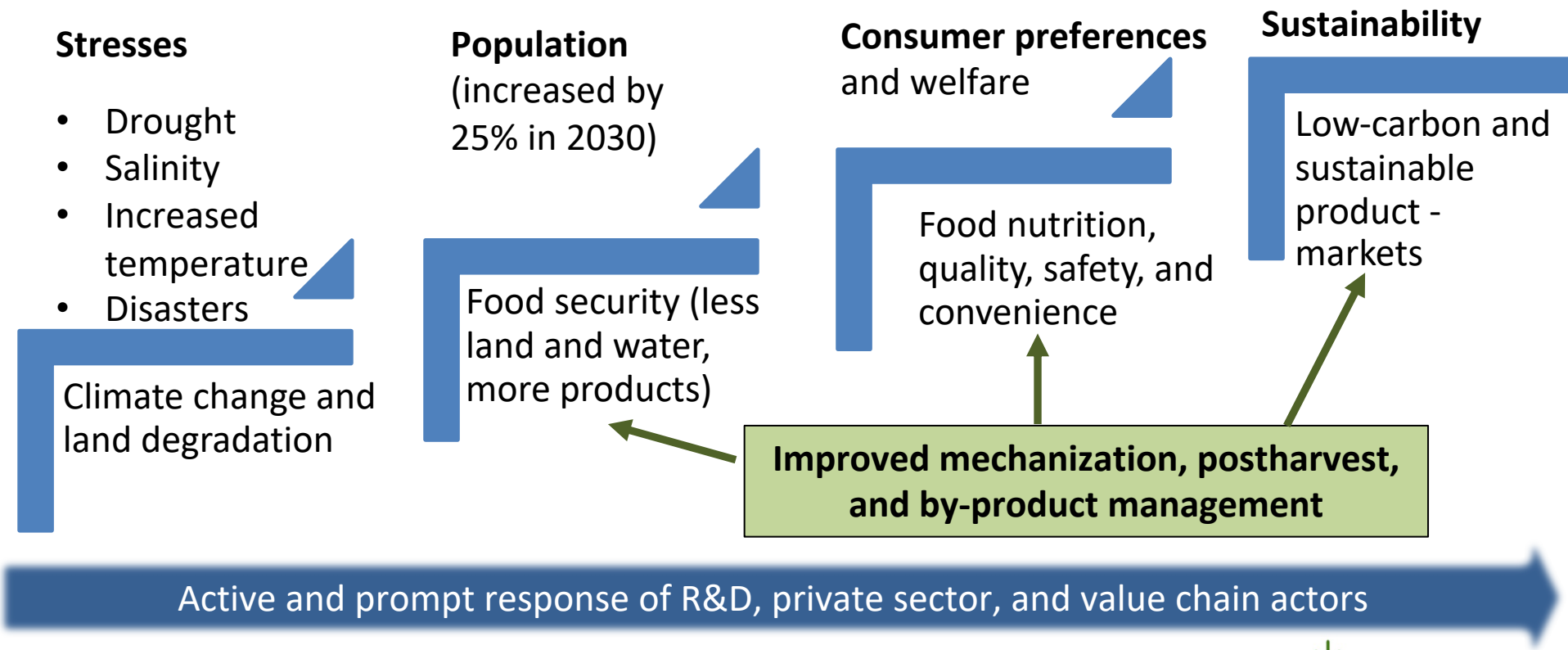
Drivers of mechanization and postharvest improvements



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War in Ukraine: Fears for impact on global hunger after ‘agricultural fields turned into battlefields’

An eyewitness account from the World Food Programme's Tomson Phiri in Lviv shows how the agency is collaborating to expand its reach as other crisis-hit countries feel the heat

13 April 2022

Wrong Mechanization Approaches - Machine "Graveyards"

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Need for scale appropriate technology

Lessons learned from our projects: Constrains for improving mechanization and postharvest

- **Inefficient farming systems**, lack of integration, and low precision ➔ loss and overuse of inputs (high yield gaps, postharvest losses still 16-30%)
- **Inappropriate technologies**, wrong targeting and scaling, i.e., not considering context-specific needs
- Farmers have **limited access** to technologies / equipment and end-market information
- Need for a stronger **horizontal integration** (e.g., cooperatives, small farmer large field model) facilitation of **vertical integration** (e.g., contract farming, integrated mechanization, etc.)
- In the past often **lack of involving private sector** in designing and planning, customization, commercialization and out-scaling in public sector projects

Success: Mechanizing Harvesting

Phase 1

Reaper

Axial flow thresher

Phase 2

Experimenting with different concepts

Large, Western combines

Vietnamese mini combine on WEPA Farm, Nigeria

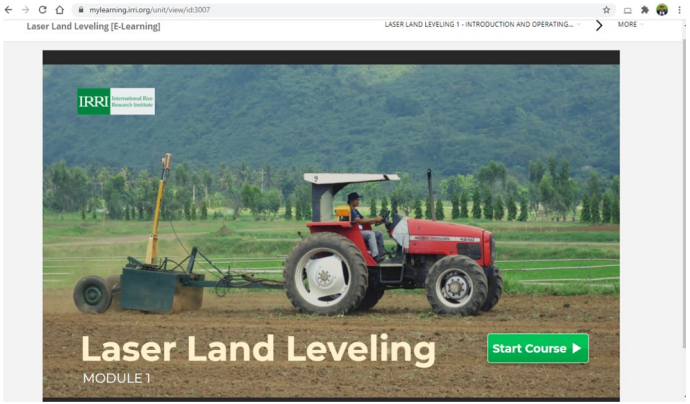
Consolidation

Mekong Delta, Central Plains of Thailand, and Cambodia are fully mechanized

The Small Rice Combine

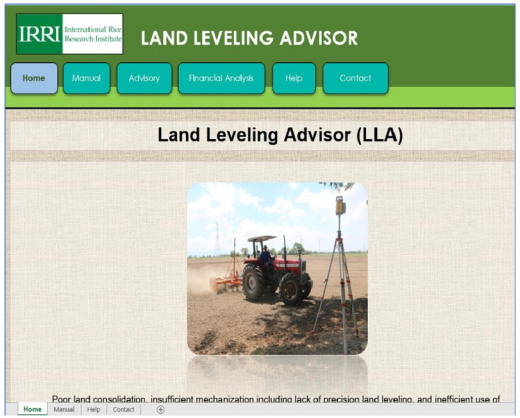
2-2.5 m cutting width
Axial flow, Axial-tangential flow
All have tracks
Cuts harvesting cost by half

Laser land leveling interventions in Southeast Asia



E-learning module

Standards in the Philippines and Thailand



LLL adviser tool

Capacity building

Benefits

- Optimized water and crop management.
- Saving land use, water, and agronomic inputs, increasing yield, and decreasing postharvest losses
- Decreasing emissions by 1,151-1,486 kg CO_2-eq ha^{-1}.

Next challenge: Crop establishment

Manual broadcasting

Manual transplanting phased out (cost)
Replaced by **broadcasting** or **drum seeder**

Mechanical transplanting

Japan, Korea

Very limited application in South and Southeast Asia
Key problem: Seedlings

Drum seeder

Pneumatic broadcasting

Direct seeding

Wet and dry
Starting with conservation farming, Direct Seeded Rice Consortium (DSRC) at IRRI

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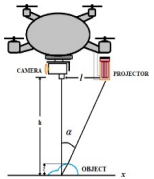
Integrated mechanization, precision farming, and digital agriculture

- Precision land leveling
- Mechanized/ Precision direct seeding
- Precision and Digital tool for site specific nutrient management
- Smart harvest and postharvest management
- Sustainable residue management
- Assessment tools for C-Footprint along rice value chain

Drone

Topographic survey + precise altitude measurements

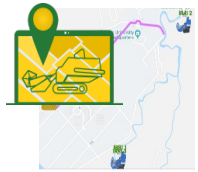


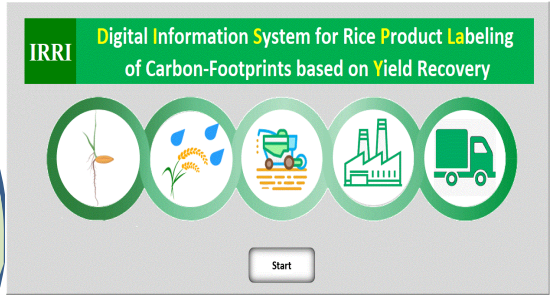
Rice Crop Manager (RCM)

Crop management database

EasyFarm

Optimized scheduling

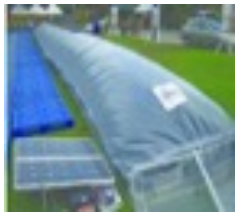


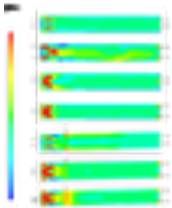


EasyHarvest for smart mechanization and postharvest management

Optimized Scheduling and Operations: combine harvester, laser leveling machines, transplanters, straw balers, etc.

Smart fertilizer and pesticide application (image processing – based)

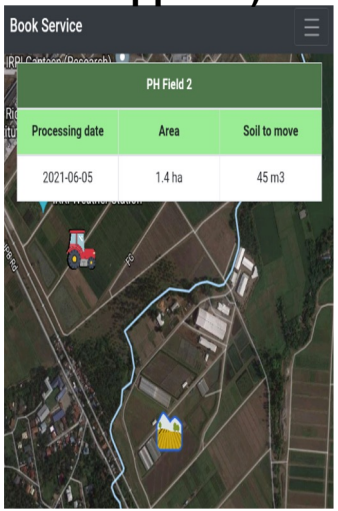




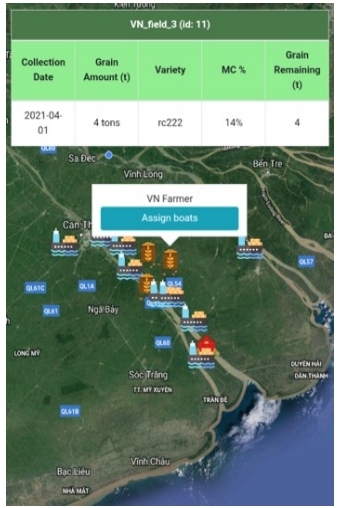
Smart Postharvest management (drying and storage, modeling and remote sensing based)

Digital optimized logistics for wet paddy and rice straw

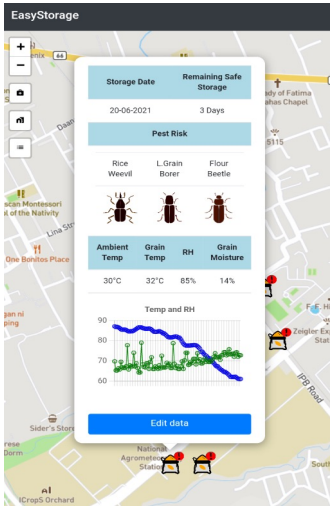
Uber-like booking service (testing in the Philippines)



Paddy logistics (testing in Vietnam)



Smart storage management (testing in Vietnam)

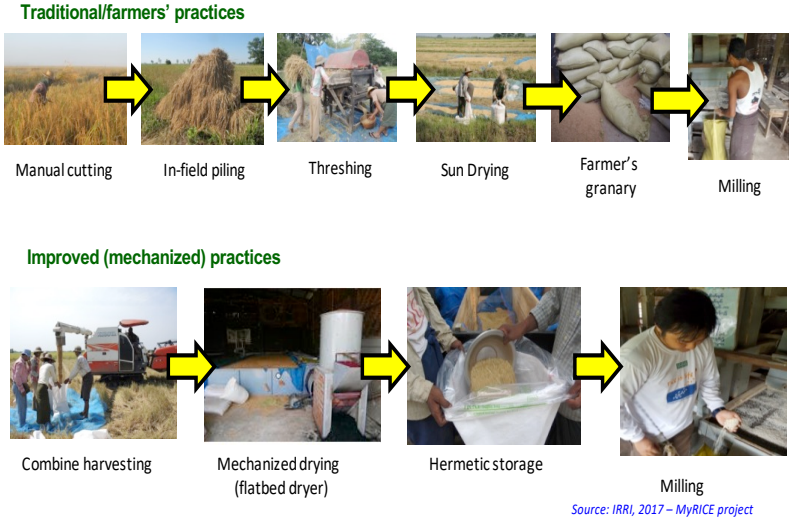


Decision supports for best practices fixing into the value chain and sustainable rice production

More info: IRRI Booth, Dr. Nguyen Van Hung
www.irri.org

Best postharvest management practices for sustainable rice production

Example: IRRI research in Myanmar: Farmer # Improved practices



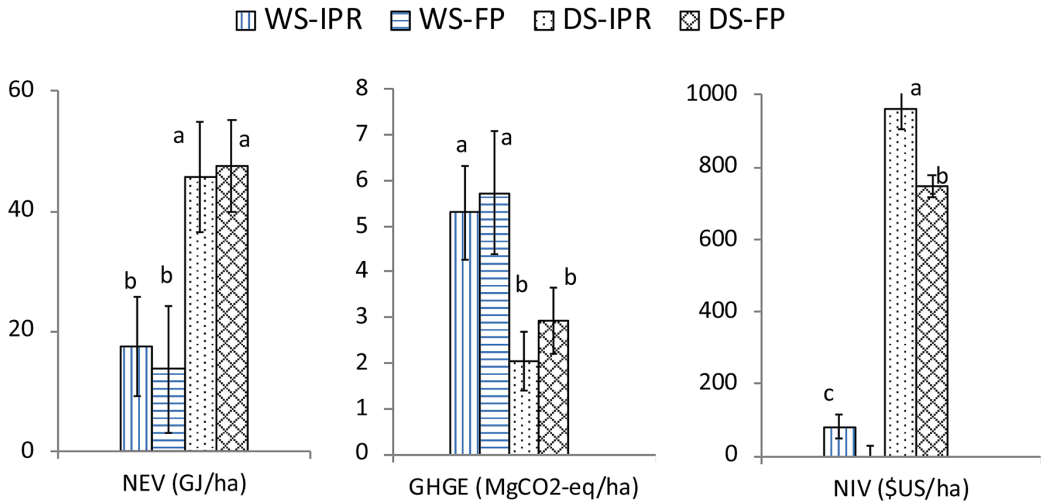


Figure 4. Energy balance, GHGE, and cost-benefits of rice production with different harvest and post-harvest practices. *WS* wet season, *DS* dry season, *IPR* improved practice, *FP* farmer practice; In a factor (i.e. NEV, GHGE, and NIV), numbers followed by same letters are not significantly different by F-test at 0.05 level.

Source: Gummert et al., 2020.
https://doi.org/10.1038/s41598-020-76639-5.

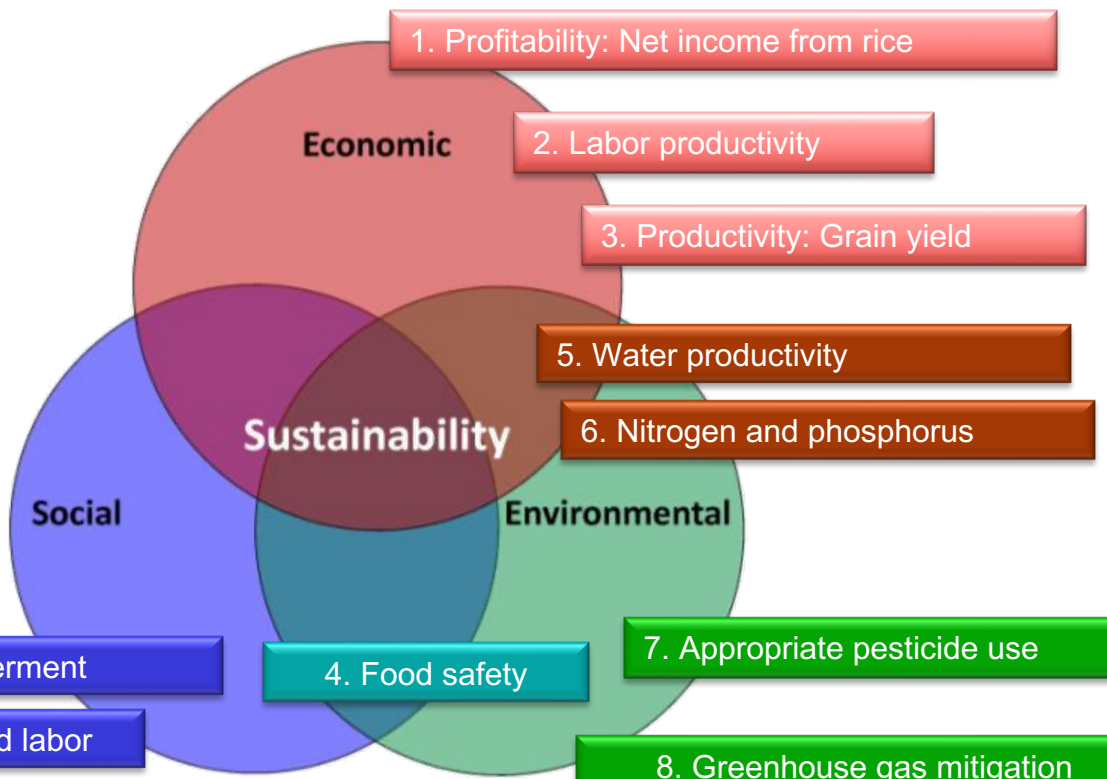
Sustainable Rice Production

CURRENT RICE SECTOR CHALLENGES

- Stagnating yield growth
- Resource inefficiency
- Environment / biodiversity impacts
- Contribution to climate change
- Impacts of climate change
- Low farmer incomes

SRP Sustainable Rice Platform

- Unique standard
- Supported by a global multi-stakeholder network
- Tailored to smallholder needs
- Aims to maintain productivity while minimizing environmental and social footprint



This afternoon

Session 1: Mechanization and Postharvest Management for Zero Footprint and Sustainable Rice Production

1. Climate Smart Rice Farming – Thailand
2. Mechanization and value chain improvement, Vietnam – Vietnam
3. Sustainable mechanization – Philippines
4. Assessing carbon footprint – Global
5. Modernized and low carbon footprint in Vietnam
6. Integrated mechanization and precision farming – Asia
7. Direct seeding – Philippines and Vietnam

Questions and answers

Session 2: Smart Farming

1. Digital agricultural innovations – Global
2. Smart technologies for rice farming – Vietnam
3. IT and decision support systems for sustainable rice production – Austria
4. Sustainable water management – Philippines

Questions and answers

Rules for speakers
15 minutes speaking time
Reminder 3 minutes before end
If finish earlier, time for questions
If not –> Q&A time after sessions

If you have further questions: IRRI booth in the exhibition hall, m.gummert@irri.org