

Integrated Mechanization and Precision Farming for Reducing Carbon Footprint in Rice Production

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This talk

- Major problems/ challenges in rice production
- Where and how can we reduce carbon footprint in rice production?
- Innovations and solutions (focused on integrated mechanization, postharvest and digital agriculture)

Major challenges and problems on rice production in SEA

- Small size/ fragmented and unlevelled field
- High seed rate & agrochemical overuse
- Inefficient Water management
- Postharvest losses
- Rice straw burning & incorporation in flooded field

Above factors lead to high C-footprint

Demand and trend

- Less inputs (land, chemicals, etc.), more food → productivity
- Food demand will double by 2050
- Trend toward sustainable consumption
- Country's priority of reducing GHG emission in agriculture and focused rice production

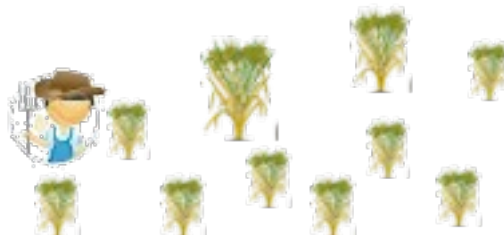


Harvesting loss due to poor scheduling

Providers of combine harvesters

Early harvest, still immatured → loss

First come, first served ?



Waiting for combine → delay → loss



Poor communication, Poor matching of field conditions with machineries,
poor scheduling → low operation efficiency and high losses

Postharvest losses (quality and quantity) during logistics, drying, and storage



Sowing at the same time, harvest at the same time → insufficient drying capacity → **Delay of drying**

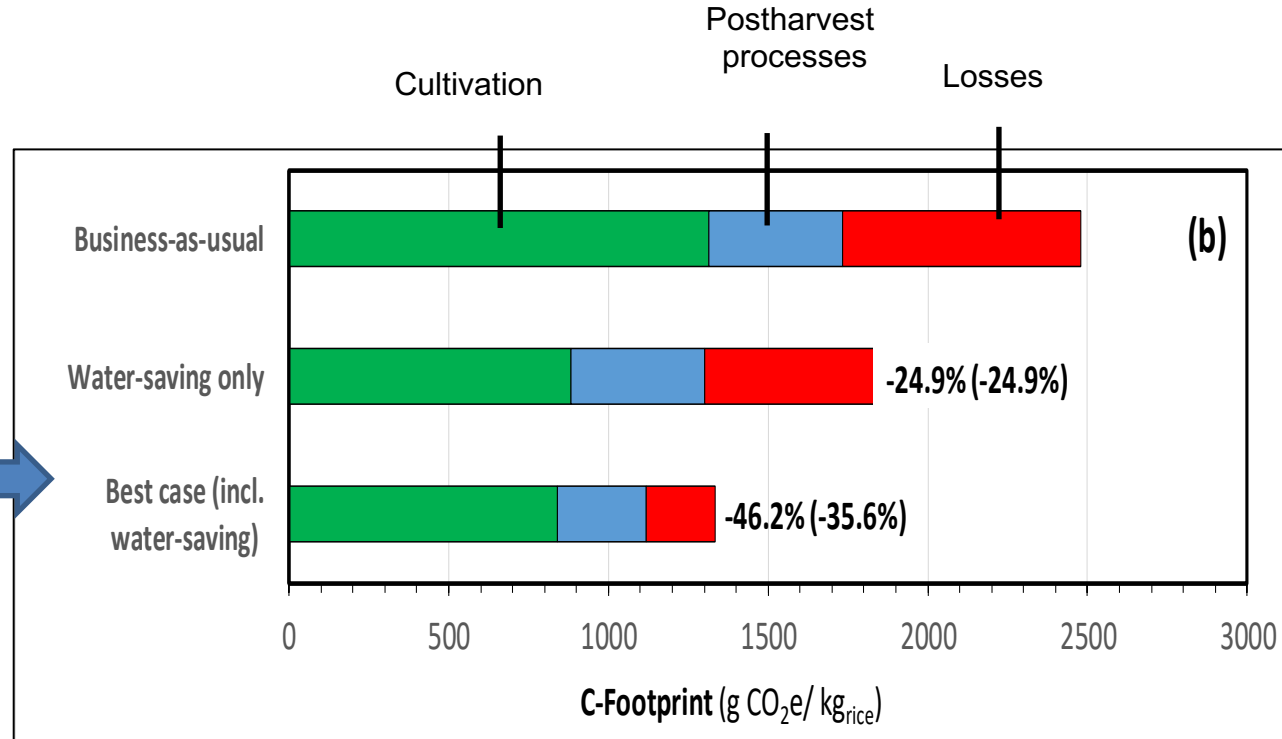


Low quality dryer and lack of knowledge on drying technology/ operation

Where and How can reduce carbon footprint in rice production?

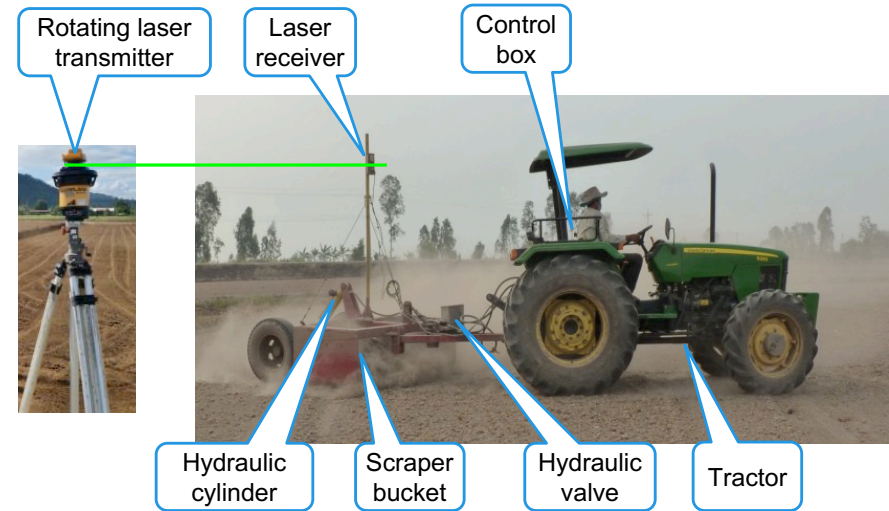
Reducing C-footprint by introducing more efficient solutions for

- water management,
- optimized inputs,
- minimized energy consumption, crop and postharvest losses



Laser land leveling for sustainable rice production

- ❑ 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 CO₂-eq ha⁻¹.
- ❑ net profit of USD 52-84 ha⁻¹ per rice production season in SEA.



More info: Nguyen-Van-Hung, et al., 2022.
<https://doi.org/10.1007/s11119-022-09900-8>.

Improved DSR

- Seeding cost = 1/3-1/2 of mechanized transplanting
- Seeding rate = 50 kg/ha = 1/5-1/3 of the common broadcast seeding practice in Vietnam → reducing fertilizer use by 20-30% and reducing risk of pest/ diseases and lodging
- No yield penalty (average yield = 8t/ha at 14%MC)



APV – mechanized DSR (50kg/ha)



Broadcast and blower seeding (180kg/ha)

Drying and Storage

Solar Bubble Dryer: uses only solar energy, zero emission, for rice and mushroom



Flatbed dryer: 4-50 t/batch
Two stage drying system: 1,000 t/day



Hermetic Storage (small and industrial scales)

No energy consumed, no pesticide used



Innovations to upgrade rice straw value chains

Innovations for improving rice straw value chains





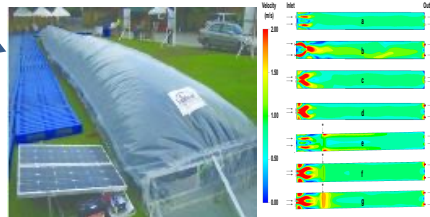
RCM (Field and farmer characterization)



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



Smart fertilizer and pesticide application (image processing – based)



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

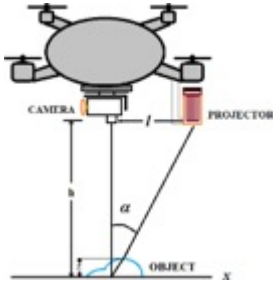
Decision supports for best practices fixing into the value chain and sustainable rice production

Smart learning and adapting

Integrated mechanization and precision solutions to increase farming efficiency

Drone

Topographic survey +
precise altitude
measurements



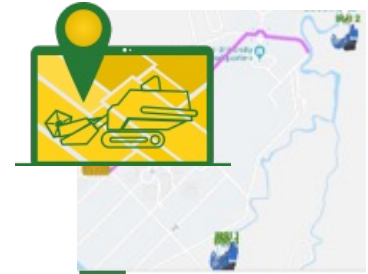
Rice Crop Manager (RCM)

Crop
management
database



EasyLeveling

Optimized
scheduling

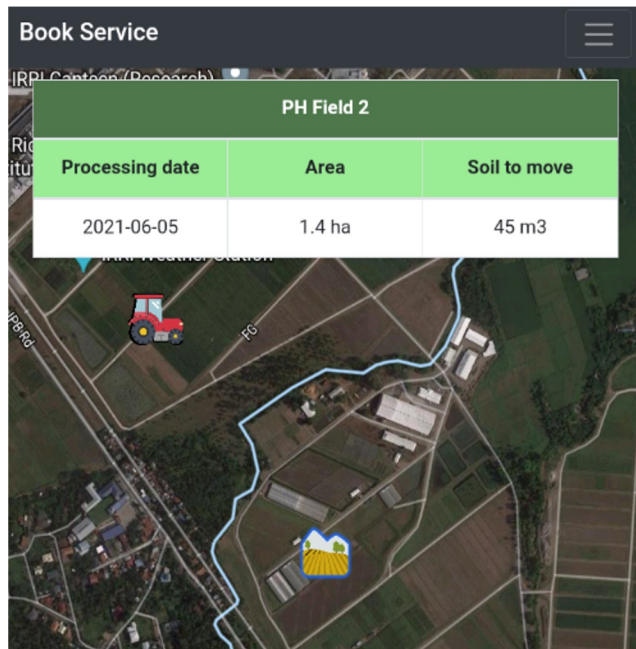


Optimized Laser Land Leveling Operations

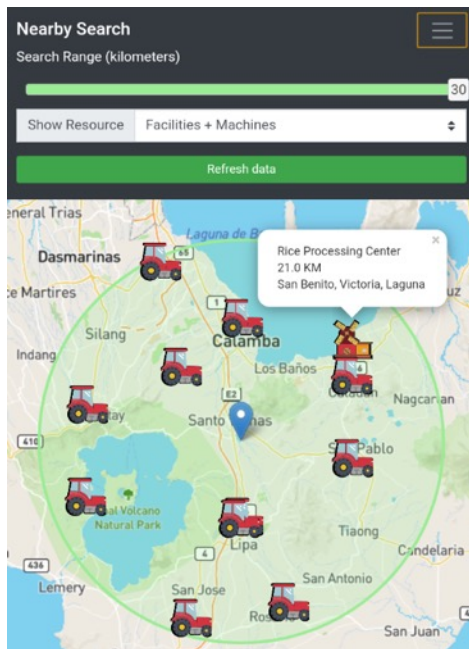


EasyHarvest piloted in the Philippines

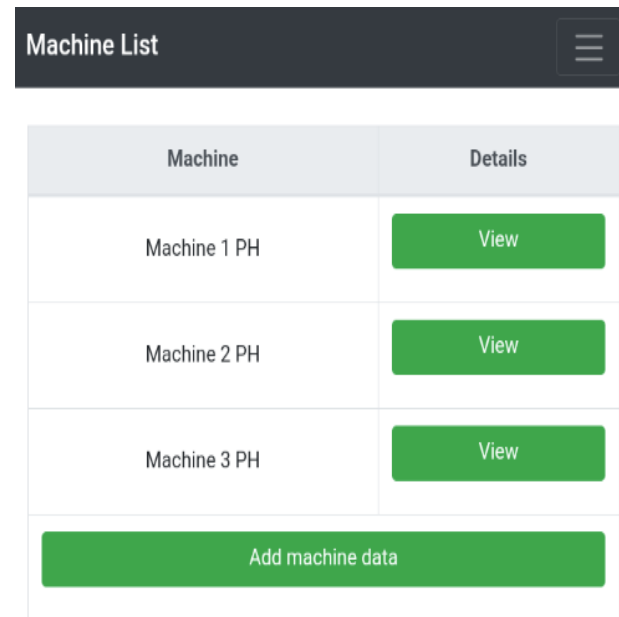
Agricultural machinery search, booking, and service recommendation



Uber-like booking service

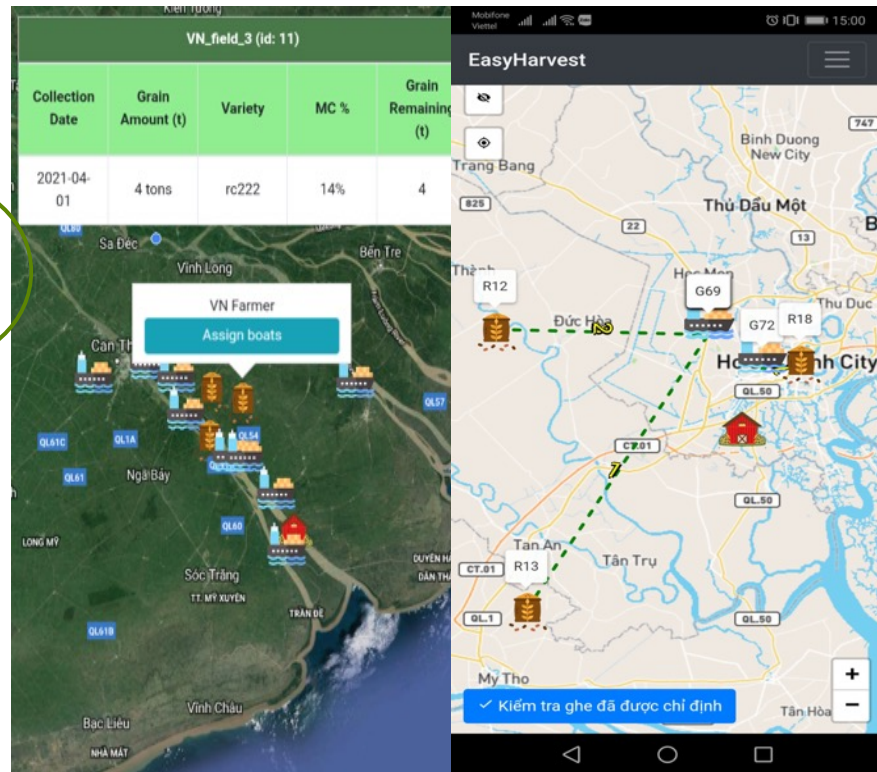
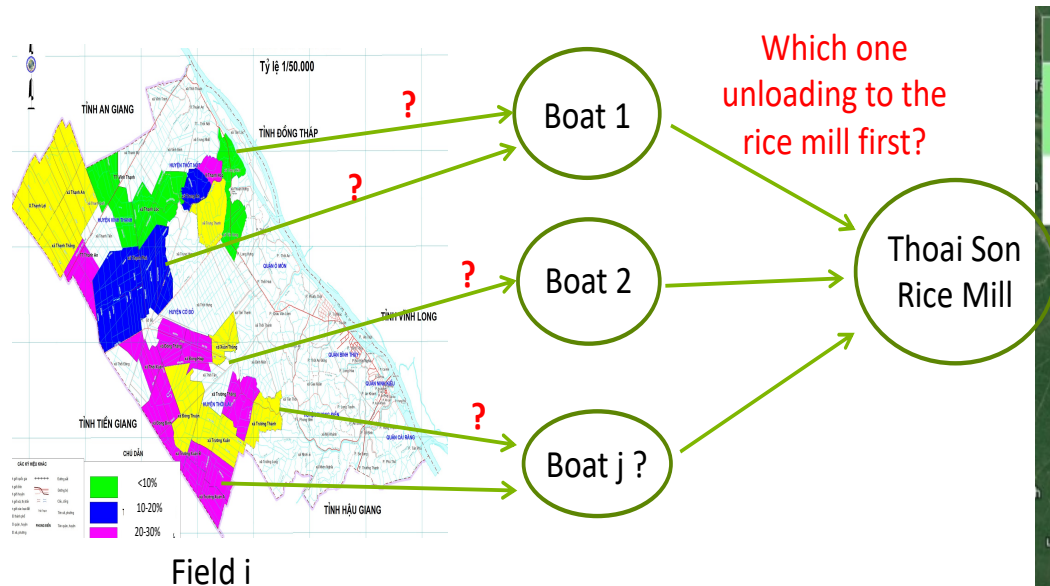


Nearby search



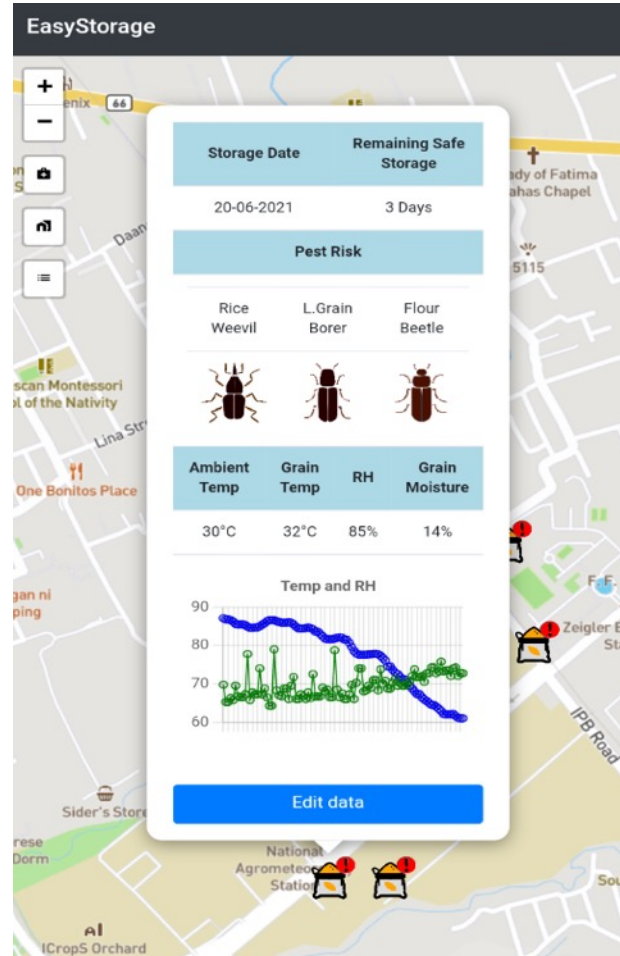
View info of machines and fields

EasyHarvest piloted in Vietnam for optimized wet paddy logistics



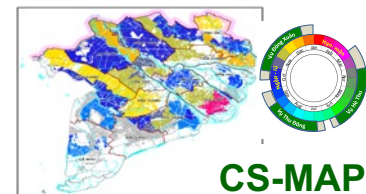
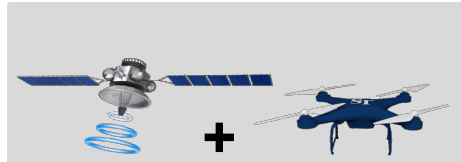
Being tested for Loc Troi Group:
For facilitation, management and optimized scheduling wet paddy logistics, matching between rice fields, harvest, and drying capacity/ availability

EasyHarvest piloted in Vietnam for smart storage management



Inform paddy storage performance, insects, and safe storage time

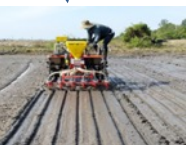
Integrated farm clustering



Rice straw based Green Circular Economy



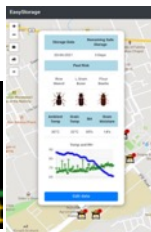
Laser leveling



Precision DSR



Rice crop manager (SSNM)



Optimized scheduling of mechineries, logistics, and postharvest management



Farmers

Service providers

Rice mills/ exporters

Carbon footprint analysis + value chain traceability (CF-rice calculator)



Thank you.

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100 – 1200 µl LTS

