Name of Solution:

Technologies for postharvest management

Submitter: (International Rice Research Institute - IRRI)

Solution Overview: *What is it, and what problem does it solve? Brief 2–3 sentence description.*

Drying technologies – Including flatbed dryer, solar bubble dryer, collapsible dryer, etc. offer low-cost, energy-efficient alternatives to traditional sun-drying. These systems reduce postharvest losses, ensure uniform drying, and significantly improve grain quality and shelf life. By reducing dependence on weather conditions, these technologies are crucial for reducing postharvest losses caused by unpredictable weather.

Hermetic storage - are farmer-friendly storage solutions (Super Bag and Cocoon) designed to preserve cereal grains and other crops safely over extended periods without the use of chemicals. These hermetic structures prevent the development of molds, including harmful aflatoxins and mycotoxins, by creating a controlled storage environment.

Compost turner - is an innovative farm implement for mechanized rice straw composting. It is used to aerate and mix waste materials, speeding up the composting process. By regularly turning the compost windrow, it ensures even decomposition, maintains optimal moisture and oxygen levels, and reduces foul odors. Ideal for farms and large-scale composting operations, compost turner improves efficiency and produces high-quality compost faster and more consistently than manual methods.

Key Features & Benefits: *Main components and why it is useful? Bullet points summarizing methods, tools, and value added.*

Drying technologies - The aim is to reduce the moisture content in paddy using heat, which leads to the evaporation of water and results in dried paddy with a desired moisture content of 12–14% for grain use and 9–12% for seed purposes. Key features of these drying technologies include short drying times, efficient heat transfer, minimal product degradation, and energy savings. They are widely used across the rice production value chain.

One such innovation is the Solar Bubble Dryer, developed by IRRI and scaled across Asia. It is an inflatable solar tunnel equipped with two solar-powered blowers. It comes in two capacities—0.5 tons and 1 ton—with the 1-ton model measuring 25m x 2m. The system operates solely on solar energy, with no operating costs except for labor. Drying time is comparable to traditional sun drying on sunny days and takes about two days under cloudy skies. It offers protection from rain and animals, enhances rice grain quality, and reduces paddy losses to less than 1%, compared to 5–10% in traditional methods.

Cost (INR): ₹1.7 lakh for 0.5-ton capacity and ₹2.8 lakh for 1-ton capacity.

Usage: Suitable for drying paddy, maize, cocoa, pulse crops, vegetable seeds, and other cereals.

Hermetic storage - Hermetic storage solutions such as Super Grain Bags (SGBs) and cocoons offer superior protection by maintaining optimal moisture levels, preventing pest infestation, and preserving seed quality. SGBs improve seed germination compared to jute bags and significantly reduce pest incidence. When properly sealed, the respiration of grain and insects inside the bag lowers oxygen levels from 21% to around 5%. This oxygen reduction effectively reduces insect populations to fewer than 1 insect per kilogram of grain—often within 10 days—without the use of insecticides.

The stable internal moisture conditions prevent both wetting and drying of the grain, reducing grain cracking and improving head rice recovery. Grain breakage during processing can be as low as 0–1%, compared to 10–12% using traditional storage methods.

While SGBs and cocoons involve higher initial costs than jute bags, their long-term benefits—such as quality preservation and reduced losses—justify the investment.

Cocoon bag: Cost (INR): ₹30,000 (1 ton) and ₹2,00,000 (5 tons); Available sizes: 1–200 tons
Usage: Hermetic storage of paddy, wheat, maize, pulses
Super Bag: Cost (INR): ₹100–120 per 50 kg bag

Usage: Hermetic storage of paddy, wheat, maize, pulses

Compost turner - The machine efficiently converts paddy straw into compost in 60–75 days, compared to the conventional 120-day process. It significantly improves compost quality by optimizing nutrient balance and enhancing the decomposition process. The compost is typically produced from rice straw mixed with 20–40% animal manure to achieve an optimal carbon-to-nitrogen (C/N) ratio of 25:1.

One tonne of rice straw compost can fetch around ₹3,000–4,000 ($40–50), providing an additional income source for rural communities.

Cost (INR): ₹4.0–8.0 lakh

Field capacity: 0.5–1 tonne/hour

Usage: Compost preparation

Compost Turner Specifications: Hauled by a 30–35 HP tractor

Capacity: 25–30 tons/hour per pass

Overall dimensions (L x H x W): 3500 x 1350 x 800 mm

Rotor (turning drum) length: 2 m

Windrow dimensions (Width x Height): 1.2 x 0.7 m

Fuel consumption: 0.1–0.15 liters of diesel per tonne of compost.

Where It Works and Where It Can Work: *Existing and potential target regions, agroecologies, or farming systems. Include examples if available*

The **solar bubble dryer** works in humid region but also in sunny. It is scaled in the Philippines, Vietnam, Indonesia, Thailand, India. Tagert regions: Africa and Asia.

The **cocoon and super bags** work globally and scaled in India, Kenya, Ethiopia, etc. and target regions are Africa and Asia.

The **compost turner** works globally and scaled in Vietnam. It is introduced in the past 2 years in India. Target regions are Africa and Asia.

Evidence & Impact: *What results has it shown? Stats, pilot outcomes, or testimonials*

Solar bubble dyer technology is introduced and commercialised in India to dry paddy and other crops/vegetables susceptible to high moisture content at harvest, more a million are used by farmers in India.

Cocoons - 2500 plus units and **super grain bags** - 2 million plus units used by farmers alone in India.

The compost turner converts paddy straw and animal manure into compost within 60-75 days-reducing composting time by 50% while enhancing organic carbon and nitrogen content. The technology is now ready for commercialization and the number of produced are unknown as today.

Scalability & Adoption Support: *Why it can be scaled and what's needed to adopt it? Low-cost, adaptable, partner-ready, etc.*

Solar bubble dryer: Considering the value for money and the risks of not drying freshly harvested paddy (with 22–25% moisture content), which can lead to 10–100% harvest loss, the investment is well justified. It also increases the market value of paddy for farmers, especially in high-humidity areas where millers lack drying infrastructure. Its use can be extended to other crops, including vegetables, making it a versatile solution. The unit is ready-to-use and easily transportable.

Cocoon and super bags: Both have proven to be effective hermetic storage technologies and can be locally manufactured in regions with established plastic and polyethylene industries. They are also ready-to-use products that can be deployed globally as needed. Their affordability—especially when purchased in bulk—makes them accessible, and their ability to preserve grain quality is crucial for smallholders to store paddy and sell when market prices are more favorable.

Compost turner: The machine operates with a 50 HP tractor, processes 6,250 t of compost annually with a field capacity of 25 t per hour is economically viable if compost utilization culture is adopted by farmers for a secured market, but even without further sell, it is a justified investment for farmer own crops cultivation. It can be customized as per farmer's requirement (small, medium, and large).

Partners & Contact Info: *Who's involved and how to connect? List of key contact and partners + email / phone.*

Contact: Dr. Rabe Yahaya, Senior Scientist and Head of CESA - Centre of Excellence for Sustainable Agriculture, Email: r.yahaya@cgiar.org
Phone : +919870243508.

Dr. Suryakanta Khandai, Senior Associate Scientist-I - Mechanization and Postharvest,
Email: s.khandai@cgiar.org