CSAM
Centre for Sustainable Agricultural Mechanization

ESCAP

National Priorities in Sustainable Mechanization: Climate-Smart Solutions & Crop Residue Management in Sri Lanka

Presenter's Name: Mrs. G.G.Viola Shyamali
Presenter's Title: Additional Director General of Agriculture (Development)
Other Participants: B.M. Kumuduni Senarathna
: G.A. Achini Sashikala
Presenter's Organization: Department of Agriculture, Sri Lanka

Eleventh Regional Forum on Sustainable Agricultural Mechanization
Climate-smart Agricultural Mechanization for Sustainable Crop Residue Management and Resilient Agrifood Systems
26-28 October 2026 – Tianjin, China

National mechanization overview and needs

1. Lowering COP & Increasing Farmer Income

Halving labor expenditure through scale-appropriate tools to ensure smallholder farm profitability.

2. Modernization & Precision Agro-Tech

Scaling smart machinery, drones, and precision tools across diverse topographies and land sizes.

3. Food & Nutrition Self-Sufficiency

Securing yield stability across paddy, pulses, onions, potatoes, and high-value horticulture crops.

4. Resilience & Resource Efficiency

Integrating water-saving mechanisms (AWD) and eco-friendly land management practices.

5. Youth Integration & Entrepreneurship

Fostering youth-led Custom Hiring Centers (CHCs) and machinery service business models

National mechanization overview and needs

Crop Sector	Major Topography	Current Mechanization Level	Critical Machinery Requirements
Paddy (Rice)	Low-Country Flat Lands	High (Harvesting); Low/Moderate (Transplanting)	Mechanical Transplanters, Laser Land Levelers, Agri-Drones
Potato	Up-Country Undulated Lands	Low (Tillage only)	Ridge/Bed Formers, Small-Scale Potato Diggers/Harvesters
Onion	Low/Mid-Country Flat & Undulated	Low	Bed Preparation Implements, Onion Harvesters, Sorting Machines
Field Crops (Mungbean/ Cowpea)	Low/Mid-Country Flat & Small Lands	Low/Moderate	Multi-Crop Seed Drills, Small Scale Multi-Crop Threshers
Horticulture (Beans/Brinjal)	Mid & Up-Country Terraced/Small Lands	Very Low	Mini-Tillers, Plastic Mulching Machines, Precision Sprayers





1.While paddy harvesting is largely mechanized through combine harvesters, paddy transplanting remains a critical gap.
2.Non-paddy sectors (OFCs, horticulture, root crops) in undulating and terraced topographies require specialized mini-machinery and smallholder-friendly implements.

Highly diverse Agro-ecological regions in Sri Lanka









36 Agroecological regions







National Initiatives/Solutions in relation to **Water Conservation, Precision Land Management**

1. Water Conservation & Precision Land Management



- **Laser Land Leveling (LLL):**

Promoting laser-guided leveling in selected paddy schemes (Dry & Intermediate Zones).



- **Enabling Alternate Wetting and Drying (AWD):**

Precise leveling facilitates controlled flooding and drying cycles, drastically reducing water usage, preventing soil degradation, and reducing anaerobic methane emissions (CH_4).

National Initiatives/Solutions in relation to Precision Input Delivery

2. Precision Input Delivery & Technology Adoption

Deploying Agricultural Drones for targeted agrochemical applications, minimizing environmental runoff.

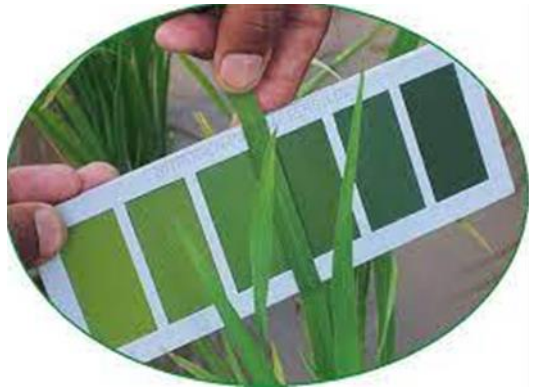


•**Resource Optimization:**

Reduces chemical runoff into sensitive aquatic ecosystems, cuts labor inputs, and prevents chemical exposure to operators.

•**Split Nitrogen (N) Application Guidelines:**

•Optimizes crop N-uptake efficiency, avoids late-stage N-stress during panicle emergence, and minimizes N_2O volatilization and nitrate leaching in flooded soils.



•Use of Leaf Colour Chart for Reduced N fertilizer usage

National Initiatives/Solutions in relation to Conservation Tillage

3. Conservation Tillage & Direct Seeding for Other Field Crops (OFCs)

- **Direct Seeding (DS) Implements:**

Promoting multi-crop seed drills and direct-seeding implements for pulses and grain legumes (*Mungbean, Cowpea*).

- **Reduced-Tillage Equipment:**

- Preserves soil organic carbon, protects beneficial soil fauna, retains soil moisture, and reduces fuel consumption during land preparation.

National Initiatives/Sustainable Crop Residue Management and Soil Health

1. Overcoming the Rice Straw Challenge

•Recommendation to avoid Open-Field Straw Burning:

In line with the DOA's Soil Health Guidelines, the DOA does not recommend burning rice straw.

Burning destroys critical organic matter, volatilizes essential Nitrogen and Sulfur, and severely damages soil biota

•Alignment with CSAM ISM Initiative:

Actively integrating regional best practices under UN CSAM's Integrated Straw Management (ISM) framework to eliminate open burning across South Asia.

National Initiatives/Sustainable Crop Residue Management, Soil Health & GHG Mitigation

2. Mechanized In-Situ Straw Incorporation & Soil Health

•Mechanization and straw Incorporation:

Incorporate rice straw back into paddy soils.

•Potassium (K+) Dynamics:

•Islandwide research confirms that retained straw acts as a natural Potassium reservoir.

Water-soluble K^+ released from stubble buffers soil exchangeable K, reducing dependence on synthetic Muriate of Potash (MOP) during early growth.

•Organic Matter & Approved Amendments:

Incorporated straw, cattle/green manure, and decomposed compost increase soil organic carbon to sustain Cation Exchange Capacity (CEC).



National Initiatives/Sustainable Crop Residue Management, Soil Health & GHG Mitigation

3. Greenhouse Gas (GHG) Mitigation & Methane Control

•Controlled Decomposition Strategy:

Raw straw incorporated into flooded fields under anaerobic conditions generates methane (CH_4).

Guidelines specify chopping and partial aerobic decomposition before flooding to mitigate GHG emissions (*IPCC Paddy Guidelines & IRRI Climate-Smart Manuals*).

4. Ex-Situ Straw Utilization

•Scaling up straw residue for off-field commercial value chains:

- •Fodder & silage production
- •Bio-energy, biochar, and thermal power generation
- •Mushroom cultivation substrate & industrial paper manufacturing

In-Situ Straw Chopping & Soil Incorporation

We hope to receive further support through this program to promote these agricultural machinery options in Sri Lanka



Tractor-Mounted Straw Chopper / Shredder

Shreds loose paddy straw into fine fragments directly in the harvest field.

Rotavator & Reverse Rotavator Mixers

Incorporate shredded residue into the soil to boost organic matter and carbon retention.

Ex-Situ Straw Baling & Value Chains



Mini Round & Square Straw Balers

- Compress field straw into 25–30 kg transportable bales for commercial sale.

Dairy Fodder & Mushroom Substrates

- Supply baled straw to cattle feed mills, bioenergy, and agricultural industries.

Direct Seeding & Mulching Machinery



Happy Seeder & Super Seeder

- Cuts, lifts straw, and sows seed directly in heavy residue without field tillage.

Paddy Straw Mulchers & Pelleting Presses

- Spreads surface mulch for moisture conservation or densifies straw into industrial fuel pellets.

Opportunities for regional cooperation

Integrated Straw Management (ISM) Alignment
Adopting regional best practices and machine testing standards to eliminate open-field burning.

Custom Hiring & Service Center Models
Establishing sustainable PPP hiring models for expensive machinery (combine harvesters, laser levelers).

Capacity Building & Technology Transfer
Joint research with UN CSAM member states on small-scale terraced machinery and precision drone technology.



Facilitate regional machinery evaluation and local fabrication of smallholder tools in Sri Lanka.

THANK YOU

Logo: Department of Agriculture, Sri Lanka

Contacts

Tel: +94812388332 +94714428123

Email: shyamaliggv@gmail.com

Website: doa.gov.lk

ESCAP | CSAM Centre for Sustainable Agricultural Mechanization