CASIC 2nd Annual CA & SI and Agroecology Regional Workshop

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Virtual Workshop
CAMBODIA

Mechanization Solutions for Integrated Management of Straw Residue in Asia-Pacific

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OVERVIEW

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Session

Objectives of the Session

- About ESCAP-CSAM
- About CSAM's Regional Initiative on Integrated Management of Straw Residue

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About ESCAP-CSAM

- **Regional institution** of United Nations ESCAP hosted in China since 2003
- **Vision:** To achieve production gains, improved rural livelihood and poverty alleviation through **sustainable agricultural mechanization** for a more resilient, inclusive and sustainable Asia and the Pacific
- Dedicated to promoting **international cooperation and partnership** in sustainable agricultural mechanization.
    - Asia-Pacific regional hub for **South-to-South and Triangular Cooperation** servicing **62 ESCAP member States and associate members.**
- Focusing on **Sustainable Development Goals** (SDG) 2 (Zero Hunger), SDG 1 (no poverty), SDG 17 (Partnerships for the Goals)

CSAM's Key Functions to enable Sustainable Agricultural Mechanization

Regional Cooperation

Capacity Building

Research and Advisory

Communication and Outreach

Partnership Building

South-South and Triangular Cooperation underlies all of CSAM's work

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Contents

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Burning of Crop Residue and Mechanization Solutions

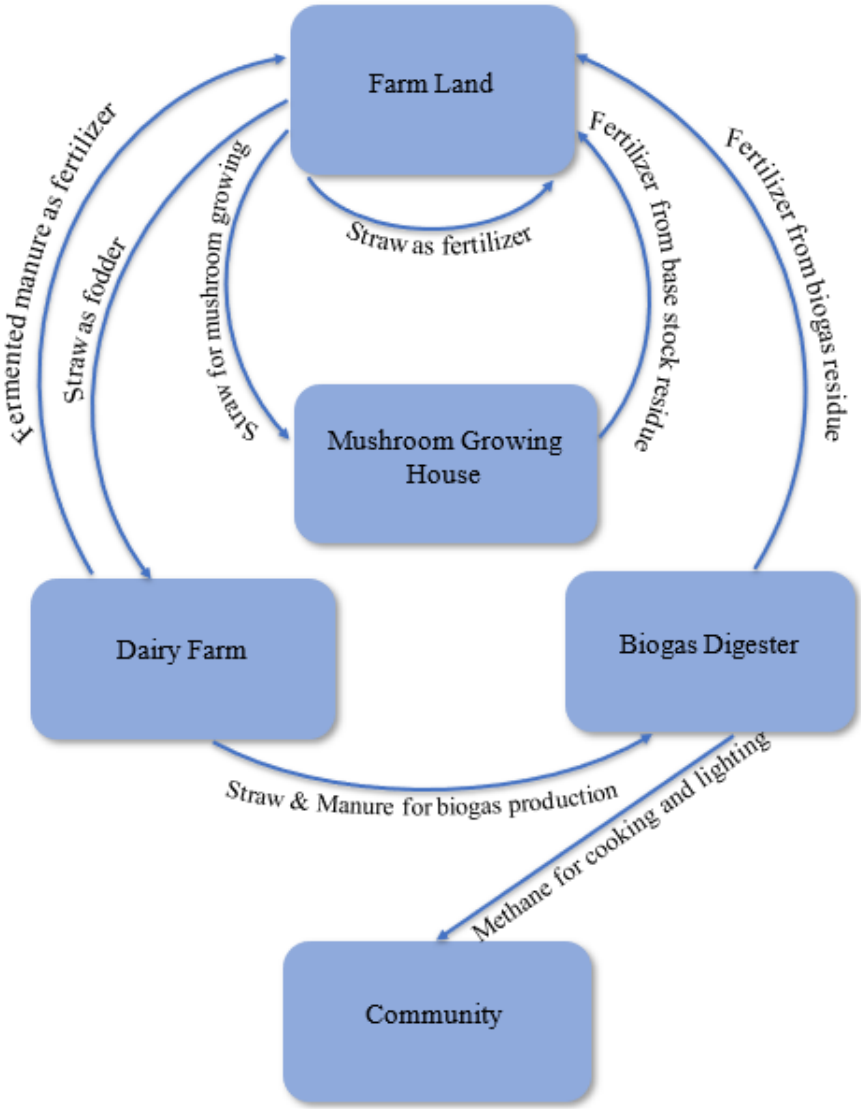
- **Asia is the largest producer of crop residue annually producing 600-800 million tonnes of rice straw alone**
- **Crop residue burning is a serious concern in many countries of the region leading to:**
  - Negative impact on soil nutrients, pH, moisture, organic matter, fertility
  - Air pollution, transboundary haze and GHG emissions
  - Public health hazard, transportation disruptions
- **Residue burning is against the CA principles of minimum soil disturbance and permanent soil cover**
- **Agricultural machinery can provide sustainable solutions to address residue burning**

Regional Initiative on Integrated Management of Straw Residue

- Launched in 2018 with Pilot Projects in China and Viet Nam
- Aim:
  - To develop an innovative, circular and green model of integrated straw management
  - To enhance awareness of farmers and other key stakeholders on technologies and models for integrated straw management
  - To upscale application of successful integrated straw management technologies and models

Circular Model of Straw Utilization

- The Regional Initiative on Integrated Straw Management is promoting application of agricultural machinery and practices for sustainable, circular use of straw residue **as fertilizer, fodder, substrate for mushroom-growing, and biogas production**.
- Priorities for country pilots:
  - Sensitize stakeholders and **highlight economic benefits** of sustainable & integrated straw residue management to farmers
  - **Incentivize adoption** of sustainable mechanization solutions and encourage **adaptation** to match local needs



Pilot Project on Integrated Straw Management in China

- Location: Laixi, Qingdao, Shandong Province
- Partners:
  - China Agricultural University (CAU)
  - Qingdao Administration of Agriculture and Rural Affairs
  - Laixi Administration of Agriculture and Rural Affairs
  - Qingdao Zhitao Agricultural Machinery Specialized Cooperative
- Technical Modes: Straw used as fertilizer, fodder, bio-gas production in a circular manner

Technical Mode: Straw used as Fertilizer

1) Returning straw to the field

a) Wheat harvesting and straw chopping

→

b) Maize no-till planting

→

c) Maize harvesting

↓

d) Straw chopping and mixing with soil

←

e) Wheat planting

←

f) Sprinkling irrigation

←

g) Seedling emergence

Technical Mode: Straw used as Fertilizer

2) Returning cow manure to the field

a) Feeding cows

→

b) Cow manure composting in fertilizer processing factory (using cow manure rotator)

e) Returning cow manure to the field

←

d) Dry-wet cow manure separation

←

c) Sewage disposal through cow manure drain trap

Technical Mode: Straw used as Fodder (Ensilage Maize)

a) Maize harvested by maize ensilage harvester

→

b) Compacting straw

↓

c) Straw fermentation

←

d) Processing fodder

←

e) Feeding cows

Technical Mode: Returning Biogas Slurry/Residue to the Field

a) Biogas production

→

b) Separation of biogas slurry/residue

↓

c) Returning biogas residue to the field
(Before winter wheat planting)

←

d) Returning biogas slurry (with water) to the field
(After winter wheat germination)

Pilot Project on Integrated Straw Management in China

- Positive Outcomes (July 2019 to Aug 2021):
  - 172 tons of wheat and maize straw per year **sustainably utilized** from 7 ha pilot demonstration site amounting to an **equivalent reduction of 221 tons in CO_2 emissions** per year.
  - **Soil Organic Matter** under three approaches (returning straw to the field, returning cow manure to the field and returning biogas slurry & residue to the field) **increased to 2.21%, 2.23% and 2.24% respectively over a 1-year period**, from initial value of 2.1
  - New formula of cattle fodder from ensilage process **improved milk production by 1 ltr/day/cow**, increasing value of milk produced by 69 USD/day for 100 cows
  - **Net income** from sustainably returning straw to the field and returning cow manure to the field increased **by 456 USD/ha and 525 USD/ha** respectively

Snapshots of Pilot Project on Integrated Straw Management in China

Pilot Project on Integrated Straw Management in Viet Nam

- Location: Can Tho City
- Partner: Sub-Institute of Agricultural Engineering & Post-harvest Technology (SIAEP)
- Technical Mode: Straw used as substrate for mushroom growing

Pilot Project on Integrated Straw Management in Viet Nam

- Positive Outcomes (January 2018 to March 2019):
  - Promoted **'In-door mushroom growing technology'** applying a steam sterilizer and water supplying system
  - Indoor mushroom growing technology demonstrated as **superior to traditional/ outdoor method**:
    - **Higher mushroom yield** - rice straw using efficiency of approximately 26% compared to 13-15% in traditional method
    - **Lower production cost**
    - **Higher mushroom quality**
  - Substrate after mushroom growing used as a natural fertilizer - considerably **reduced application of chemical fertilizers** and lowered production cost
  - **Improved porosity and fertility of soil** and reduced negative impact on environment induced by straw burning

Snapshots of Pilot Project on Integrated Straw Management in Viet Nam

Regional Knowledge Sharing: Study Tours in India and China

Integrated Straw Management Regional Study Tour, 7-10 November 2019, Ludhiana, India

Virtual Workshop and Demonstration, 28 October 2020, Laixi, China

Expanding the Initiative - New Pilot Projects in Cambodia, Indonesia & Nepal *(under initiation)*

- Partners:
  - **Cambodia:** Department of Agricultural Engineering/GDA, Ministry of Agriculture, Forestry and Fisheries & Swisscontact
  - **Indonesia:** Indonesian Centre for Agricultural Engineering Research and Development, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture
  - **Nepal:** Department of Agricultural Engineering, Purwanchal Campus, Institute of Engineering, Tribhuvan University; local enterprise; Department of Agriculture

Expanding the Initiative - New Pilot Projects in Cambodia, Indonesia & Nepal *(under initiation)*

- Planned activities (2021-2022):
  - Establishment of pilot sites
  - Field trials
  - Modification of machinery
  - Capacity building and community awareness sessions
  - Regional study tour
- Technical Modes: In-situ and ex-situ utilization of straw (as fodder and fertilizer) based on country needs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Key Takeaways

What are the Key Takeaways

- Asia is the largest producer of crop residue and **straw burning** is a shared and transboundary concern in the region
- Burning of straw residue poses an important **challenge to CA/SI** and to nature positive production
- **Agricultural machinery** can provide sustainable solutions to address residue burning but **local adaptation, community engagement, capacity building and regional cooperation** are critical
- CSAM is making efforts via its Regional Initiative on Integrated Straw Management towards a **sustainable, circular model of using straw residue**
- Demonstration of **positive results** from China and Viet Nam has helped secure additional donor funding for **expansion** to new countries

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Thank You