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

Anshuman Varma
Programme Officer and Deputy Head
Centre for Sustainable Agricultural Mechanization (CSAM)
United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)
OVERVIEW

1. Session
2. Contents
3. Key Takeaways
1 Session
Objectives of the Session

About ESCAP-CSAM

About CSAM’s Regional Initiative on Integrated Management of Straw Residue
Objectives of the Session

About ESCAP-CSAM

About CSAM’s Regional Initiative on Integrated Management of Straw Residue
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.
  
  o 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

South-South and Triangular Cooperation underlies all of CSAM’s work
Objectives of the Session

About ESCAP-CSAM

About CSAM’s Regional Initiative on Integrated Management of Straw Residue
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:
  o To develop an innovative, circular and green model of integrated straw management
  o To enhance awareness of farmers and other key stakeholders on technologies and models for integrated straw management
  o 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:
  o Sensitize stakeholders and highlight economic benefits of sustainable & integrated straw residue management to farmers
  o 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)
- c) Sewage disposal through cow manure drain trap
- d) Dry-wet cow manure separation
- e) Returning cow manure to the field
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

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

c) Returning biogas residue to the field (Before winter wheat planting)
Pilot Project on Integrated Straw Management in China

• Positive Outcomes (July 2019 to Aug 2021):
  o 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 CO₂ emissions per year.
  o 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
  o 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
  o 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 Vietnam

- 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):
  o Promoted ‘In-door mushroom growing technology’ applying a steam sterilizer and water supplying system
  o Indoor mushroom growing technology demonstrated as superior to traditional/ outdoor method:
    o Higher mushroom yield - rice straw using efficiency of approximately 26% compared to 13-15% in traditional method
    o Lower production cost
    o Higher mushroom quality
  o Substrate after mushroom growing used as a natural fertilizer - considerably reduced application of chemical fertilizers and lowered production cost
  o 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:
  o **Cambodia:** Department of Agricultural Engineering/GDA, Ministry of Agriculture, Forestry and Fisheries & Swisscontact
  o **Indonesia:** Indonesian Centre for Agricultural Engineering Research and Development, Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture
  o **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):
  o Establishment of pilot sites
  o Field trials
  o Modification of machinery
  o Capacity building and community awareness sessions
  o Regional study tour

• Technical Modes: In-situ and ex-situ utilization of straw (as fodder and fertilizer) based on country needs
3
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.
Contact Us

Centre for Sustainable Agricultural Mechanization, United Nations Economic and Social Commission for Asia and the Pacific

• Address: Room 2060, 20th Floor, Beijing Sunflower Tower 37 Maizidian Street, Chaoyang District, Beijing 100125, P.R. China
• Telephone: (86-10) 8225 3580/81/82/85
• Website: un-csam.org
• Email: varmaa@un.org
Thank You

CASIC 2nd Annual CA & SI and Agroecology Regional Workshop

28-29 September 2021
Virtually Workshop
CAMBODIA