

SUSTAINABLE UTILIZATION OF RICE STRAW IN TAIWAN

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GREENHOUSE GAS EMITTED BY RICE CULTIVATION



- Among the 10 ASEAN countries, GHG emitted by rice cultivation is between 64% and 0% of the total emissions.

Country	Rice Cultivation	Total	Percent
	(Million tonnes CO ₂ EQ)		
Philippines	45	70.3	64%
Thailand	50.4	84.1	60%
Cambodia	14.2	24.2	59%
Vietnam	35.7	83.6	43%
Myanmar	28.6	78.1	37%
Laos	2.6	11.6	22%
Indonesia	61.6	401.3	15%
Malaysia	3.2	45.8	7%
Brunei	0	0.5	0%
Singapore	0	0	--

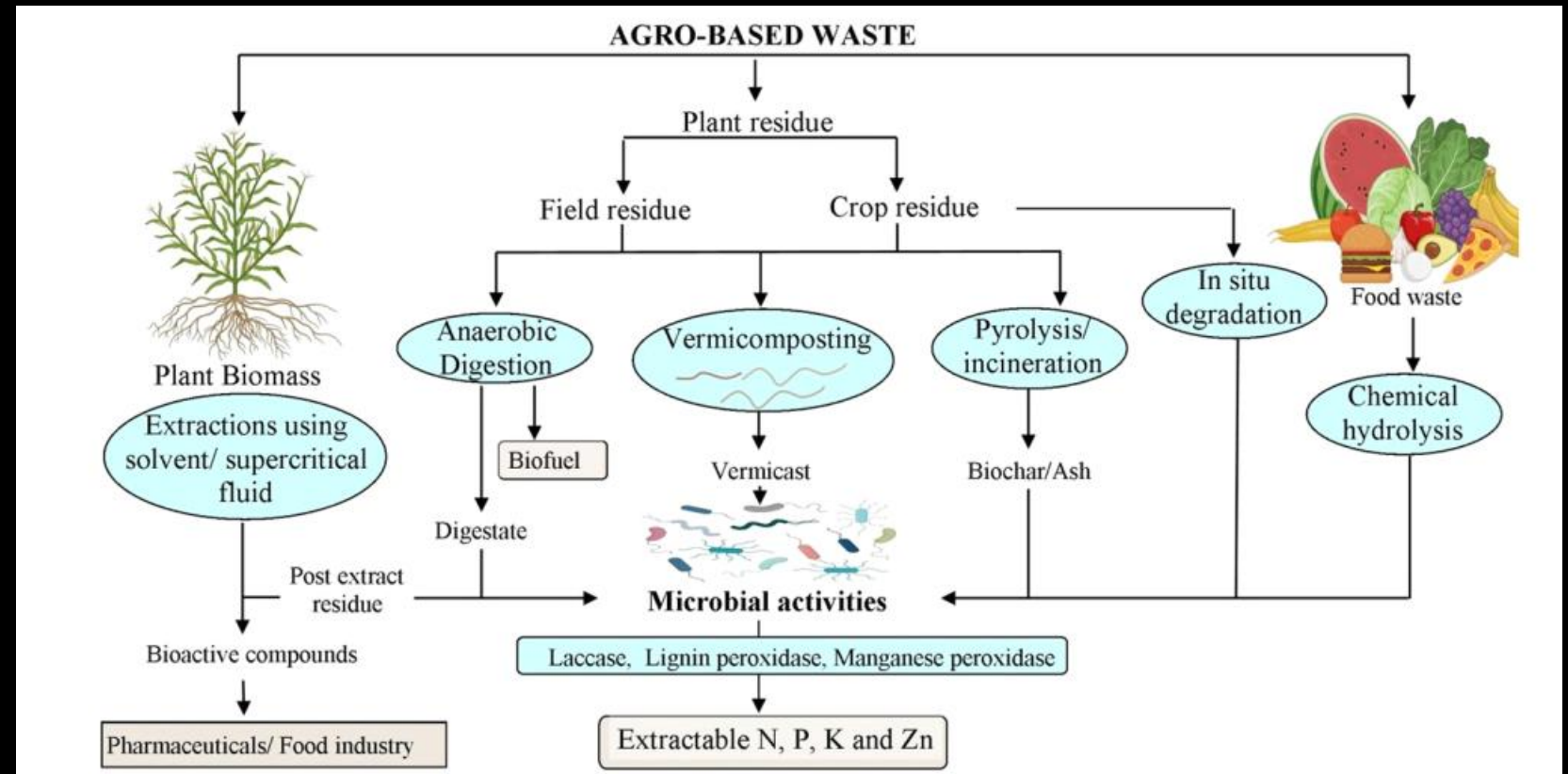
(Source: FAO 2023. Emission totals)

CIRCULAR AGRICULTURE: DEALING WITH AGRICULTURAL AND FOOD WASTES

- Agricultural wastes (AW) recycling in Asia would be an important route to increased sustainability and decreased carbon emissions.
- Thailand, Indonesia, Philippines, and Vietnam produce more than **38 million tons of rice husks** and 34 million tons of bagasse every year.

APPROACHES TO CONVERT AGRICULTURAL WASTE INTO EXTRACTABLE FORMS OF NUTRIENTS AND VALUE-ADDED PRODUCTS

- **Agricultural waste** is biodegradable and nutrient-rich.
- It has enormous potential when appropriately managed.



REUSE OF RICE STRAW

- **Agriculture:** animal feed, mulch, organic fertilizer, mushroom cultivation, biochar production
- **Industry:** building materials, pulp for paper and packaging materials, **energy generation** (feedstock for biogas production, burned for electricity generation)
- **Handicrafts:** **rice straw ropes**, sumo wrestling rings, rice straw handbags, rice straw mats, shimenawa ropes for Japanese Shinto rituals



RICE STRAW TRADING MECHANISM IN TAIWAN

- **Public domain:** Taitung County Environmental Protection Bureau posts the list of SME that buy rice straw. Farmers also post the information on the '**Rice straw Trading Platform**' to attract buyers.
- **Public domain:** The Straw-Sandal Mound Cultural and Educational Association in Caotun Township organizes **workshops** for making sandals, artwork, and landscape design objects using rice straw.
- **Private sector:** **Farmer's Association**

ENVIRONMENTAL PROTECTION

- To reduce the dispersal of particulate dust (PM10 conc. $>150 \mu\text{g}/\text{m}^3$) from the Beinan River (卑南溪) in Taitung County, woven rice straw mats with green vegetation were used to cover the exposed area as a part of the **River Green Belt Forestation Project** sponsored by the Ministry of Environment.





ENERGY GENERATION

- In Guanshan Township, Taitung County (Taiwan), approximate **600 tons** of rice straws are annually collected from 50 hectares of paddy rice fields.
- The rice straws are crushed, dried, and pelleted into **solid renewable fuel**.
- The net calorific value is 3,298 kcal/kg, about 56% of coal (5,890 kcal/kg).
- The volume of rice straw is greatly reduced, bearing the characteristics of easy storage, convenient transportation, and high safety (the ignition point of the pelleted rice straw is **300°C**).

MECHANIZED TRAILER FOR CRUSHING AND PELLETING RICE STRAW

- National Formosa University, sponsored by the Ministry of Agriculture, designed and built the mechanized trailer for a demo in Hualien County.



Photo courtesy of Dr. Tai, S. G., Chairman of the Department. Agricultural Technology, NFU

RICE STRAW ROPE

- The rice straw rope industry involves the traditional craft of twisting rice straw into ropes, which has been modernized with machinery to increase production and expand its uses.
- These ropes are used in traditional applications like packaging and agriculture. They are also used for ritual ceremonies and tournaments.
- The industry provides farmers with additional incomes during crop off-seasons and turns rice straw waste into valuable products.



RICE STRAW ROPE ASSOCIATION

- The first Straw-Rope Production Association in Taiwan was established in 2006 to co-produce and co-sell related straw products (straw ropes and sheets, mainly), to resolve the problems of burning straws in the open air, and turn the waste into valuable products.
- The straw rope products are exported to Japan, and farmers in this association can earn extra income during their off-farming seasons.



Fong Chow Enterprise Co., Ltd., Taiwan

AUTOMATIC RICE STRAW ROPE MAKER



https://www.youtube.com/watch?v=xCrHJP5_-_4&t=40s

Place rice straws on the ROPE MAKER, and the straw ropes of 8 mm to 13 mm in diameter are automatically produced. →

機械規格 Specification

尺寸	Size	(長)420×(寬)83×(高)143公分	(L) 420×(W) 83× (H) 143 cm
重量	Weight	500KG	500 Kg
工作效率	Efficiency	每小時25KG±10%	25KG±10%
馬力	Motor	1 1/2HP	1 1/2HP

INSTALLATION ART

- Art has always held a significant place in society, influencing and reflecting the culture and community it emerges from.
- It invites conversation, challenges, and perceptions, and encourages us to reshape the environment around us.



RICE STRAW INSTALLATION ART

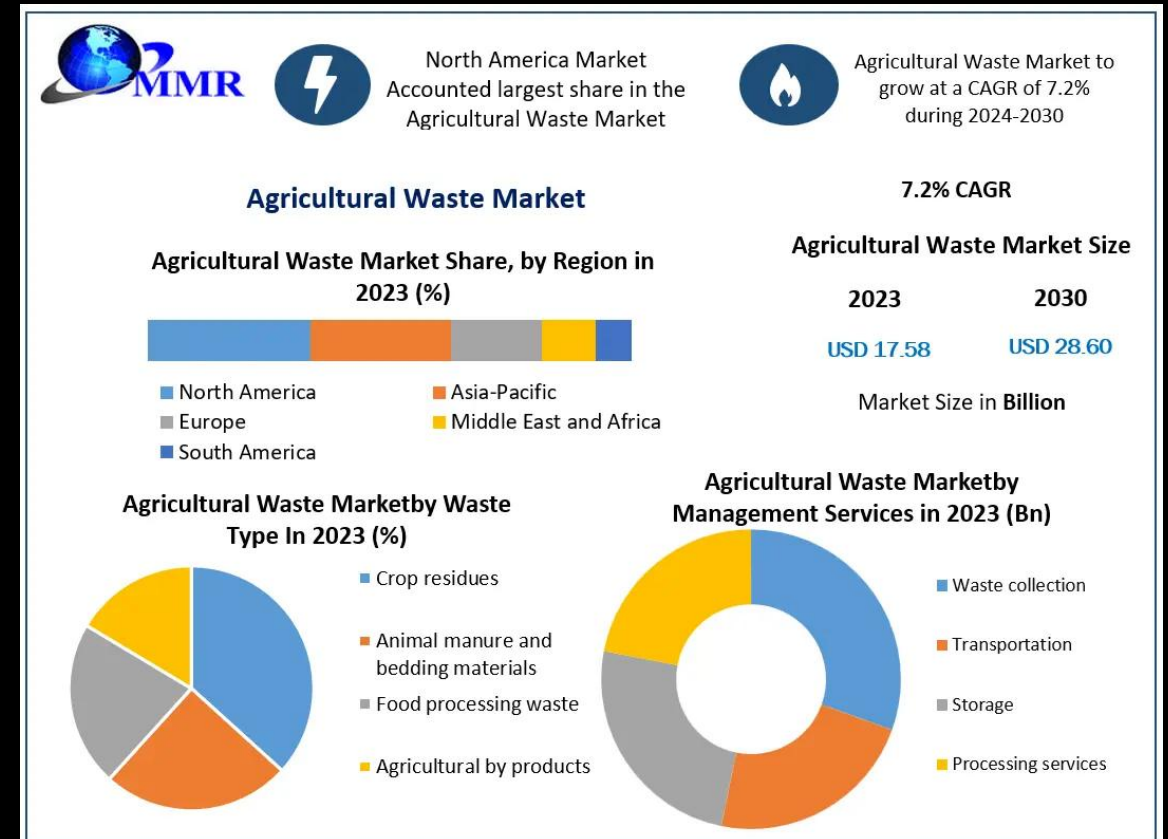
Environmental Sustainability and Art Creation for Agro-tourism

- Location: Luoshan Village, Fuli Township, Hualien County
- **Fuli Farmers Association** initiated the annual “Rice Straw Installation Art” Exhibition in 2019.
- The exhibition aims at **creating landscapes with farmers**, inviting artists and universities to cooperate with local farmers and high school students to construct rice straw sculptures and artwork using rice straws, bamboo, and other bio-degradable materials.



GLOBAL AGRICULTURAL WASTE MARKET (2024-2030)

- **Global Agricultural Waste Market** was valued at USD 17.58 Bn in 2023 and is expected to reach USD 28.60 Bn by 2030, at a **Compound Annual Growth Rate of 7.20%** from 2024 to 2030.
- The market undergoes substantial growth, propelled by **technological advancements**, increasing **environmental consciousness**, and the adoption of **circular economy** principles.
- The market offers immense growth opportunities for manufacturers through a focus on sustainability, innovation, and global expansion.



BUY AND SELL AGRICULTURAL WASTE

- Exporting straw rope requires compliance with plant quarantine regulations, which vary by country. Generally, this involves obtaining a phytosanitary certificate from the exporting country's plant protection organization, ensuring the rope is free from pests and diseases.
- International trade of straw and forage for animal feed, for example, must not contain visible contaminants that could transmit diseases.
- Check the specific import requirements of the destination country using their biosecurity import conditions system (BICON) or similar resources.

THANK YOU FOR LISTENING

From soil
Return to earth

