Sustainable use of waste biomass in Thailand with the aim of adding high value to it
Sustainable use of disposable biomass in Thailand with the aim of creating high added value

(Kyoto Prefecture University, Graduate School of Life and Environmental Sciences) Nobuhiko Kasuya, Yuto Kawashima, Takashi Hosoya, Hisashi Miyato,
(Graduate School of Science and Technology) Toshiyuki Yokoi,
(Chulalongkorn University) Chanoknun Kalvibool, Chawalit Ngamcharussrivichai,
(TISTR, Thailand) Yoothana Thanmongkhon, Lalita Attanatho

(Kyoto Pref. Univ.) ○Nobuhiko Kasuya, Yuto Kawashima, Takashi Hosoya, Hisashi Miyafuji,
(Science Tokyo) Toshiyuki Yokoi, (Chulalongkorn Univ.) Chanoknun Kalvibool,
Chawalit Ngamcharussrivichai, (TISTR, Thailand) Yoothana Thanmongkhon, Lalita Attanatho

[Introduction]

Thailand is one of Southeast Asia's leading agricultural countries, with approximately 44% of its land area being farmland. This results in the generation of large amounts of waste biomass (hereinafter referred to as waste biomass) from the harvesting and processing of agricultural products, such as rice straw, rice husks, sugarcane leaves, bagasse (sugarcane waste), and oil palm empty fruit bunches and shells. The incineration of this waste biomass is considered one of the causes of air pollution in Thailand (PM2.5 (fine particulate matter) and carbon dioxide emissions). In order to solve these social issues and achieve economic growth, the Thai government has been promoting the "Bio-Circular-Green (BCG) Economy" since 2019, which integrates the three elements of bioeconomy, circular economy, and green economy, aiming for sustainable development. The BCG economic model is based on the United Nations' Sustainable Development Goals (SDGs).

This also aligns with the five goals of the 2015-2037 Plan. Against this backdrop, attention is being focused on the shift from fossil fuels to biomass energy and the use of waste biomass. According to the Alternative Energy Development Plan (AEDP) 2015-2037 published by the Thai government, the goal is to increase the proportion of renewable energy in Thailand's total energy consumption to 30 % and promote biomass energy in the future. As a result, demand for biomass as an energy source is increasing in factories and power plants. Meanwhile, bioproducts such as bioplastics, which are expected to offer higher added value than fuels, face cost challenges compared to fossil fuel-based products, and their use has not progressed. Therefore, this report aims to clarify the utilization status of waste biomass from rice, oil palm, and sugarcane, which account for the majority of waste biomass, including from a sustainable use perspective.

[Method]

Thai government agencies (such as the Department of Alternative Energy Development and Efficiency (DEDE), the Office of Agricultural Economics (OAE) and Department of Agricultural Extension (DOAE) of the Ministry of Agriculture and Cooperatives (MOAC)) (Table 1), we visited Thailand in September 2024, September and December 2025, and interviewed officials from relevant government agencies, factories, and farmers (Photos 1 and 2).

Table 1. Main uses of waste biomass in Thailand (tons per year)

waste biomass		Usage amount	Unused amount	total
Rice	rice straw	1,086,774	12,233,226	13,320,000
	rice husks	3,680,679	916,898	4,597,578
	total	4,767,453	10,557,806	17,917,578
Oil palm	stem	0	1,441,884	1,441,884
	leaves/branches	326,451	10,202,823	10,529,274
	fruit bunch	1,417,539	972,083	2,389,622
	fiber	1,418,838	0	1,418,838
	shell	298,702	0	298,702
	total	3,461,530	12,616,790	16,078,320
sugar cane	leaf	815,995	6,994,959	7,810,955
	Bagasse	7,701	7,644,639	7,652,340
	total	823,696	14,639,598	15,463,294
cassava	root	0	4,171,526	4,171,526
natural rubber	roots, stems, leaves	70,383	737,641	808,024
	Slab material	1,939,260	0	1,939,260
	Tips	484,815	0	484,815
	total	2,494,458	737,641	3,232,099

Source: Biomass Database Potential in Thailand
Survey results on biomass resource volume by the Ministry of Energy of Thailand
(https://weben.dede.go.th/webmax/content/biomass-database-potential-thailand)

Photo1 A meeting in Thailand

Photo2 Machine harvest of sugarcane

[Results and Discussion]

The waste biomass from rice is rice straw and rice husks. Rice straw is often burned in the open, but it is believed to be a cause of air pollution (PM2.5) in the Bangkok area, and as a preventative measure, a ban on open burning has been announced for February and March 2026. Options other than incineration include plowing into rice fields, compressing it into bales (for animal feed), and processing (only for certain purposes) (rice straw is not covered by the GAP certification system). As for rice husks, since rice is collected as is at the rice mill after harvest, how they are handled is up to the rice mill. In addition to generating electricity and using it for heat, they can be sold to poultry farms, and the black rice husks that remain after burning can also be

used as fertilizer.
In the case of oil palm, the leaves, branches and trunks that are cut before the fruit is harvested are left unused as waste biomass. Oil palm leaves are left on farmland not only for fertilizer purposes, but also because covering the soil with leaves has a moisturizing effect. The leaves have thorns, making them difficult to handle locally. The fibres and shells generated during the processing process are often reused for purposes such as generating electricity and heat. All of the factories we visited use RSPO-certified materials, with 40% coming from individual farmers and 60% from collectors (Lantees).
The main waste biomass is the leaves from sugarcane harvesting and bagasse from the sugar manufacturing process. The leaves remaining after harvesting are either left as they are for fertilizer or moisture retention, or, if machinery is available, compressed and used for power generation or animal feed. A subsidy system has been established for the purchase of this machinery. Meanwhile, 47% of sugarcane leaves are burned in the open, which is one of the main causes of PM2.5. With regard to bagasse, a common usage method is to use it to generate electricity for the factory at sugar factories with power generation facilities, with the surplus electricity being sold.
From the above, it can be said that there are still many unused resources, and that the government is providing institutional support for the utilization of waste biomass as a measure to prevent open burning and combat climate change.Furthermore, of the three crops mentioned above, rice and sugarcane are mainly produced in the central, northeastern, and northern parts of Thailand, while oil palm is produced in the south, so when actually using them, it is necessary to take into account that the transportation costs of the raw materials vary depending on the crop type.

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