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# Waste to Wealth: Crop Stubble as a Business Opportunity

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**ABSTRACT**

The multitude of agricultural activities increases the number of agro-products produced and this has led to an overall increase in environmental pollution and waste generation. The harvest waste, which is more popularly termed as crop residue, can contain both the field residues that are left in an agricultural field or orchard after the crop has been harvested and the process residues that are left after the crop is processed into a usable resource. Agricultural waste is defined as unwanted material produced as a result of agricultural activities (*i.e.*, manure, oil, silage plastics, fertilizer, pesticides and herbicides, wastes from farms, poultry houses and slaughter houses; veterinary medicines, or horticultural plastics) waste which is generated from both livestock and crop is known as agricultural waste. There are several initiatives and measures such as subsidies are given by Indian government to boost such starts where agricultural wastes are being converted to wealth through emerging technologies such as paper from sugarcane bagasses, mushroom cultivation through cotton stalks. Various crop waste i.e. rice straw, sorghum stalk, sugarcane trash, rotten vegetable and fruit, *etc.* are used in various business. In India, agricultural wastes are not managed efficiently, although many technologies are available to recycle and reuse agricultural waste but more efforts should be encouraged to reuse and recycle as much as we can. Residues have economic value, but in India, a large amount of crop residue is available, so this can be used as an opportunity.

**Key Words:** Agricultural waste, Wealth, Crop stubble, Organic matter and Crop residue

## INTRODUCTION

The growing demand for food in developing countries has led to tremendous increase in food production around the world. As a result, agro-based enterprises are lucrative in both developed and developing nations. Due to the wide range of agricultural operations, more agro-products are created, which has increased waste production and environmental degradation overall. Harvest trash, more often known as crop residue, can include both the process leftovers that remain after the crop has been turned into a useful resource and the field residues that are left in an agricultural field or orchard after the crop has been harvested. Stalks and stems, leaves, and seed pods are some common examples for field residues. Molasses and sugarcane bagasse are two excellent examples of process leftovers. Cellulose, hemicellulose, and lignin make up the majority of plant biomass, with minor quantities of pectin, protein extracts, carbohydrates, nitrogenous material, chlorophyll, and inorganic waste. Crop parts that are not used for food, like the husk, straw, and stalks, are classified as lignocellulosic biomass. The majority of the lignocellulosic biomass is derived from the main crops farmed worldwide: maize, wheat, rice, and sugarcane, in that order. The value of lignocellulosic biomass, which is made up of cellulose, hemicellulose, and lignin, is becoming more widely acknowledged.

### *Agricultural Waste and its Types*

#### What is Agricultural Waste

Agricultural waste is defined as unwanted material produced as a result of agricultural activities (*i.e.*, manure, oil, silage plastics, fertilizer, pesticides and herbicides, wastes from farms, poultry houses and slaughter houses; veterinary medicines, or horticultural plastics) Waste which is generated from both livestock and crop is known as agricultural waste.

#### What is Crop Stubble

Crop stubble is the straw and crown of plants left on the soil surface after harvest. Stubble also includes straw and chaff discharged from the harvester (header). It is also known as ‘residue’ or ‘trash’.

#### Types of Agricultural Waste

Crop waste: - Rice straw, sorghum stalk, sugarcane trash, rotten vegetable and fruit, *etc.*

Livestock waste: - Cow dung, poultry litter, slaughterhouse waste, fish pond waste, *etc.*

Agro-industrial waste: - Rice husk, saw dust, bagasses, pressmud, *etc.*

Pesticide waste: - Fertilizer run-off, insecticide and herbicide reaching soil and water

(Banga & Kumar, 2019)

**Biomass residues can be categorized into three main groups:**

Primary biomass residues: - Available at the farm

Secondary biomass residues: - Released in the agro-food industry

Tertiary biomass: - Remaining after use of products

Crop residue generation in India compared to other select nations in the same region

India generates a total of 500.00 million tonnes/year Crop residue and 360.00 million tonnes used for feed, fuel, and other home and industrial reasons

**Table 1: Crop residue generation in India**

| **Country** | **Crop residue Generated (Millions tone/year)** |
|---|---|
| India | 500.00 |
| Bangladesh | 72.00 |
| Indonesia | 55.00 |
| Myanmar | 19.00 |

The Indian Ministry of New and Renewable Energy (MNRE) reports that the country produces 500 million tonnes (Mt) of agricultural residue annually on average. The majority of agricultural residue is utilized for fuel, feed, and other domestic and commercial purposes, according the same study. A surplus of 140 million tons remains, nevertheless, of which 92 million tons are burnt annually. Additionally, it is important to note that the volume of agricultural waste burned in India is far greater than the overall amount of agricultural waste produced other nations in the region.

**Reasons for Burning the Stubble**

- Short time period between paddy harvesting and sowing of wheat
- Big size of the farms and Scarcity of labor for manual harvesting
- Use of combine harvester with the growth of mechanization, they leave 6-10cm paddy stalks on the field. (crop residue 9 tone/ha in field)
- Lack of incentives and equipment to cut the stubbles to most of the farmers
- Lack of market utilities of residue
- Cost of cleaning the field with manual labor is more expensive than the fines charged by Government

(Porichha *et al*, 2021)

**Impact of Stubble Burning on Environment**

- **Air Pollution**

**Emission Statistics:**

Approximately 22 Mt of $CO_2$, 0.92 Mt of CO, and 0.03 Mt of $SO_2$ are generated annually from 15 Mt of rice residues in Punjab.

**Air Quality Standards**

UN standards for PM2.5: 10 $g/m^3$, India's National Air Quality Standard: PM2.5 permissible level at 40 $g/m^3$, Delhi NCR's average PM2.5 level: 97 $g/m^3$, double India's standard and ten times higher than UN guidelines.

**Health Impacts**

Burning crop residues can lead to respiratory issues like coughing, asthma, emphysema, and bronchitis

**Public Health**

OECD (The Organization for Economic Cooperation and Development) estimates predict around 20,000 premature deaths in Delhi NCR due to air pollution. Expected to rise to 30,000 by 2025 and 50,000 by 2050.

**Impact on Soil Fertility**

Due to burning of rice and wheat residue diminish more than 50% Bacterial population 0-15 cm soil loss. Depletion of microorganisms. Loss 80% N, 25% P, 21% K, 4-6% of soil Sulphur. Destroy unwanted bugs and diseases borne by the soil.

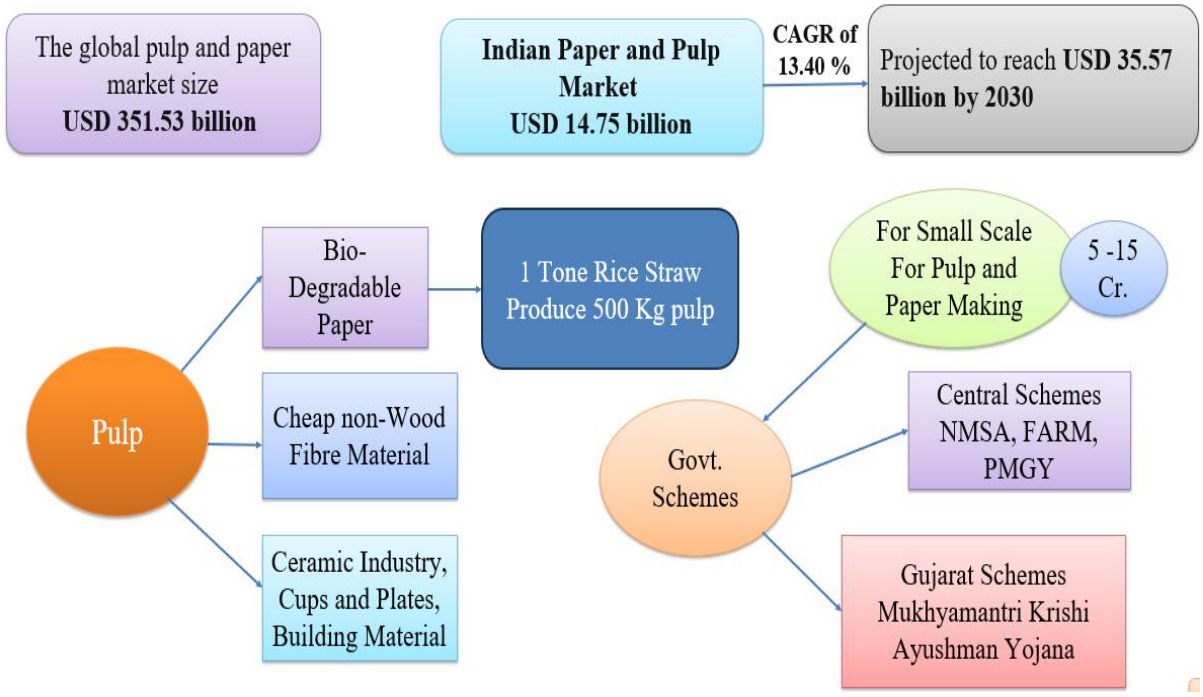
(Kumar *et al,* 2015)

**why we need to manage agricultural west**

- To safeguard natural resources (water, soil and air) for present and future generation
- To slow down the process of climate change through minimizing the GHGs emissions
- To reduce the risk of disease breakdown and its spread
- To generate employment and revenue
- To generate employment and revenue
- To reduce the loss of valuable land due to landfilling
- To maintain and improve the value of land

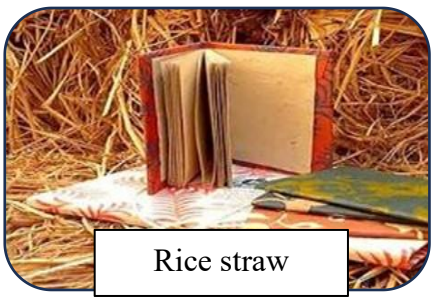
(Rahman *et al*, 2023)

**Pulp extraction from Rice straw**




## Product of Pulp extraction from rice straw

Rice straw paper making



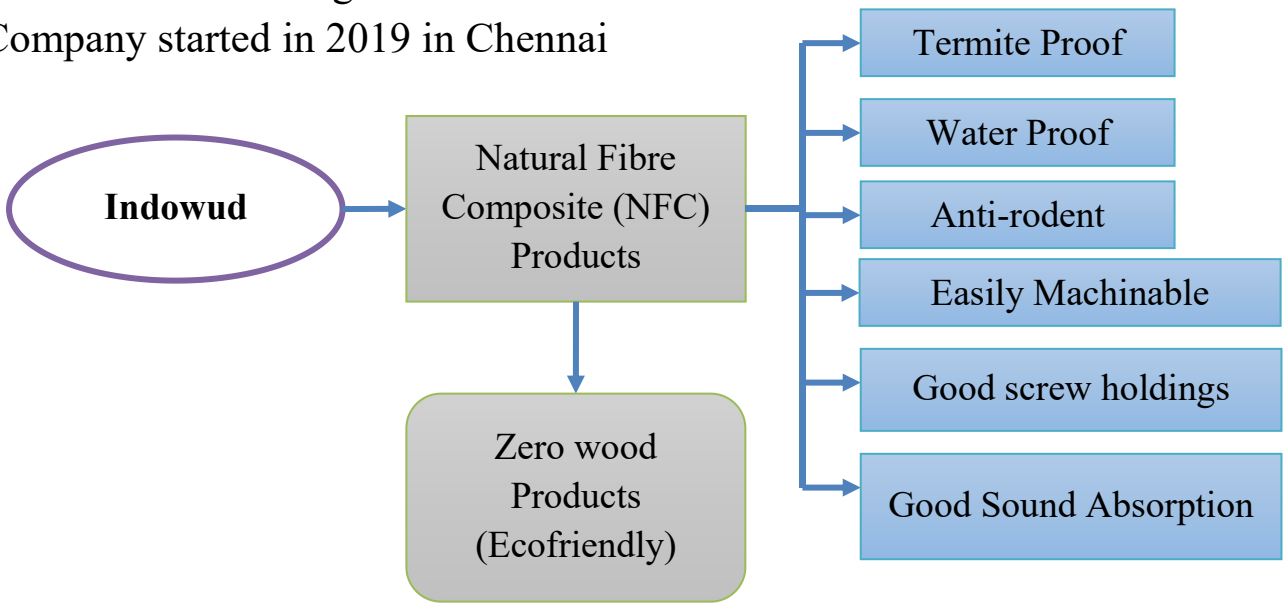
Rice straw

**Indowud**

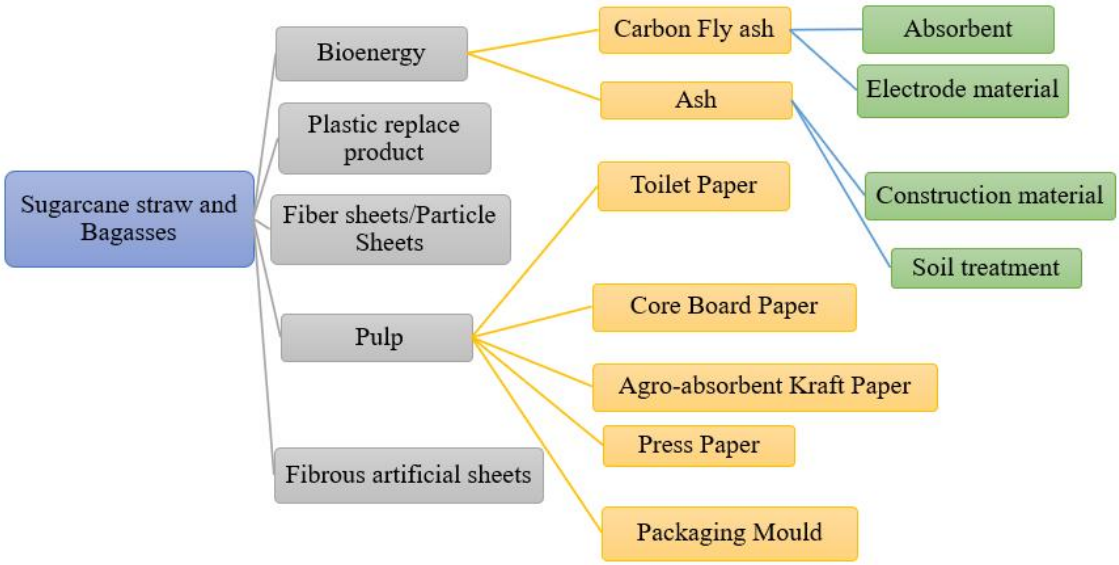
NFC Door frames


NFC Door frames

Mr. Bengani
Company started in 2019 in Chennai



**Different business from sugarcane straw and bagasses**




(Santos *et al,* 2020)

**Oyster Mushroom Cultivation by using Cotton stalks**

- ❑ Production of Mushroom 2022 – 280 Metric Tons in India
- ❑ Global Market USD 52.07 billion in 2022. And expected in 2030 is 89.55 at 7.8% CAGR
- ❑ Mushroom cultivation is a profitable agri-business endeavour that may utilize rice straw in an environmentally friendly manner. Rice straw is used as a base material that can provide 50–100 kg of mushrooms per 1 tonne of dried straw. The paddy straw mushroom is one of the easiest mushrooms to cultivate because of its short incubation period of 14 days, converting 300 kg crop residue into 10 kg yield of mushrooms.

(Kimothi *et al*, 2020)

**Vermicompost and Vermiwash**

Vermicompost market in 2022 is $85.39million and market forecast in 2030 $270.25 million at 15.50% CAGR.

Biodegradable Input

**Endogenous Inputs**

- Root exudates
- Rice Straw
- Crop Waste
- Soil minerals
- Plant leaves and fruits
- Dead microorganisms
- Any other agro-waste

**Exogenous Inputs**

- Organic amendments
- Cow dung, cattle dungs
- Poultry litters
- Coco coir.
- Biodegradable organic waste

- Vermicast with worms

**Organic matter output**

- Improve soil quality of agriculture fields by
- Lowering C:N ratio
- Improving the NPK value of soil

**Government Initiatives**

**The interim Union Budget 2024-25**

- Allocated funds for developing a robust biomass supply chain, which supports the creation of products like biofuels and briquettes from crop residue. This move aims to reduce stubble burning by taking crop residue off the farm. (pib.gov.in, 2024)

**Crop Residue Management Scheme:**

- The Central Government has so far released funds to the tune of about ₹3,333 crore
- State Government of Punjab, NCR States and GNCT of Delhi for subsidized procurement of machines by individual farmers / custom hiring centres and cooperatives to facilitate in-situ management of paddy straw as also for baling / raking machines and equipment to facilitate ex-situ applications. (pib.gov.in, 2023)

**National Thermal Power Corporation**

- The Government of India recently directed the (NTPC) to mix crop residue pellets (nearly 10%) with coal for power generation. This helped the farmers with a monetary return of approximately ₹5500 (77 USD) per ton of crop residue. These lucrative measures are yet to be in action and it can be profitably exploited by the farmers.

**Agro Machinery Service Centre's (AMSC)**

- The project started by the Government of Punjab to offset the high cost of machinery and make available the machinery for use on a rent basis. Any individual farmer, cooperative society, and entrepreneur could initially set up the AMSC and subsidies were provided by the government. It was made mandatory for the AMSC to have a happy seeder and Laser land leveler.

**Atma Nirbhar Gujarat Scheme 2022**

- **Capital Investment Subsidy:**
- Eligible micro enterprises shall be given capital investment subsidy ranging between ₹10 to ₹35 Lakhs.

**Interest Subsidy:**

- Interest subsidy ranging from 5 to 7% in case of MSMEs
- Large and thrust sectors interest subsidy @ 7% with an upper cap ranging between 1 to 1.2 % of the EFCI (Estimated Fixed Capital Investment) per annum for a period of 5 to 10 years
- For Mega industrial units Interest subsidy @ 7% subject to maximum of 1.2% of EFCI per annum for 10 years.

In India, waste-to-wealth industries face several challenges. Firstly, there's inadequate infrastructure for waste segregation and processing. Limited awareness and public participation hinder efficient waste management practices. Regulatory hurdles, including complex permitting processes and inconsistent policies, deter investment. Additionally, the lack of proper technology and skilled labor constrains the scalability and effectiveness of waste-to-wealth initiatives. Moreover, market demand for recycled products remains relatively low, affecting the economic viability of such ventures. Lastly, societal attitudes towards waste often prioritize disposal over recycling, presenting a cultural barrier to sustainable waste management practices. Overall, addressing these challenges requires a concerted effort from government, industry, and society to promote a circular economy model and incentivize innovation in waste management.

## Conclusion

Crop stubble presents a significant environmental challenge in India due to its burning, contributing to air pollution and climate change. Turning agricultural waste into wealth will help in achieving sustainable agricultural development, also doubling farmer's incomes besides making our country cleaner and environment friendly. In India, agricultural wastes are not managed efficiently, although many technologies are available to recycle and reuse agricultural waste but more efforts should be encouraged to reuse and recycle as much as we can. Residues have economic value, but in India, a large amount of crop residue is available, so this can be used as an opportunity. The youth of India should come forward and create new innovations that benefit sustainable development and manage crop residue.

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