

Managing rice straw for food, feed, and bioenergy

Mushroom production



Rice straw soil incorporation



Using rice straw for ruminants feed



Rice straw composting



Mushroom production



Outdoor mushroom growing



Indoor mushroom growing

The edible rice straw mushroom (*Volvariella volvacea*) is considered to be one of the easiest mushrooms to cultivate because of its short 14-day incubation period. This tropical species thrives best at 30–35°C for mycelia development and 28–30°C for fruiting body production.



Features:

- Farmers can easily learn cultivation practices
- Low investment cost; main inputs: rice straw, spawn, growing area rental, labor, and irrigation
- Growing and harvesting period: 1 month
- Mushroom yield: 0.8 kg of mushrooms per 10 kg of dried straw
- Net profit: 50–100 USD/t of straw
- Low GHG emissions during mushroom production
- GHG increased if remaining straw is used as organic amendment

Features:

- Environmental condition and cultivation technology need to be controlled strictly
- Higher investment cost than outdoor practices that include the growing house and related equipment
- Mushroom yield: 2 kg of mushrooms per 10 kg of dried straw
- Net profit: 100–120 USD/t of straw
- Low GHG emissions during mushroom production
- GHG increased if remaining straw is used as organic amendment

Using rice straw for ruminant feed



Rice straw has limited nutrients to be used as the only source of food for ruminants, but it can be treated to increase energy and protein supplies. In general, the daily maximum intake of rice straw by ruminants is about 1.0–1.2 kg/100 kg of live weight.



Processed rice straw fodder



Features of rice straw silage bags

- Add lime and urea in layers when filling the silage bag
- Product can be used after 2-week ensilaging
- Cost after treatment: 20–30 USD/t
- High GHG emissions from ruminants but consider generation of additional products (meat, milk)

Features of loose rice straw in silage:

- Lime and urea are added in layers when filling the silo
- Product can be used after 2 weeks of ensilaging
- Test and treat for mycotoxins if deemed necessary
- At dairy farms with about 15,000 milk cows: using imported straw, cost was USD 400/t in the past; from 2016 on, using urea-treated rice straw, cost is USD 150/t
- High GHG emissions from cattle but consider the generation of additional products (meat, milk)

Rice Straw Soil Incorporation



In manual harvesting options, only a small proportion of the total crop residue is often incorporated into the soil. However, where combine harvesting and straw baling are done, all of the straw biomass is incorporated into the soil during land preparation.

- Soil fertility can be maintained and enhanced
- Helps maintain nutrient balance in rice production
- Speed of straw degradation in soil is influenced by residue composition, quality, and external factors (such as temperature, moisture, method of incorporation, time, and soil gases)
- Strongly increases GHG emissions during the following rice season

Rice Straw Composting



Features:

- Optimized composting process and C:N ratio composition that enhances available nutrients in the soil.
- Compost material can be used as medium for growing vegetables and other crops or spread onto the rice field as a soil amendment.
- Capacity of the system (35-hp tractor and compost turner) is 20–25 t of straw/hr. Cost of compost product is about 80–100 USD/t.
- Low GHG emissions during composting; moderate emissions during rice season.

Rice straw left in the field after harvest is collected and mixed with animal manure and allowed to degrade in the field by composting. A compost-turning machine improves decomposition and enhances the quality of the compost.