



DEVELOPMENT OF A COMMON FRAMEWORK FOR A SUSTAINABLE AND CIRCULAR BIOECONOMY



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Exemplary case for a sustainable and circular bioeconomy in the Polish South Baltic Area Region

Challenges in Mushroom and compost production

Mission and vision

Uźranki is in the Warmia and Mazury Region, near the city of Mrągowo and is 75 km from the capital of the region Olsztyn. This region is a land with a large amount of lakes and forests (about 30% of the area). Due to the high afforestation rate and low indicator of urbanization and industrialization, air in Mazury is very clean. It is known for producing good quality food. Pieczarki Mazurskie Fedor was established in 1988 as a family company. The company is the biggest of Poland's mushroom producers, which is its main product. The company consist of a few mushroom farms which cover a producing area of above 19.000 m². It should be noted that all production buildings are equipped with air conditioning systems which enable the control of mushroom growing parameters, such as temperature, humidity, air movement and carbon dioxide. It should also be emphasized that the mushroom farms use compost made in the company's own compost production facility which is also located on the production premises. All mushrooms are harvested by hand. After harvesting mushrooms go directly into a vacuum cooling chamber and are cooled to a temperature of 2°C. After three harvesting cycles all the mushroom growing chambers are thermally disinfected and the compost is replaced. The Pieczarki Mazurskie Fedor company works continuously over the year. The company has its own straw storage (area above 10.000 m²) for the production of compost. The maximum amount of stored straw is about 100.000 tons, which is enough for two years of the company's production.

Principle 1: Cascading approach

Promising opportunity for the utilization of mushroom substrate for different uses.

Principle 2: Use of waste, by-products and residues

Use of straw and wood pellets.

Principle 3: Circular economy approach

Recycling of nutrients.



Figure 1. Straw bales storage.

Technology description

The production of mushrooms is about 3.000 tons per year. Before sale, mushrooms are packed according to individual customers requirements or in the standard way:

- kg boxes loose
- box with tray 4 × 500 g
- box with tray 4 × 400 g
- box with tray 6 × 250 g

The mushrooms might also be sorted in different sizes:

- 4 cm
- 5 cm
- 6 cm
- more than 6 cm “Riesen”

Waste from processing (spent mushroom substrate) is stored at the company field and sold to local farmers as a fertilizer. The company produces over 300 tons of spent mushroom substrate weekly.



Figure 2. Heaps of spent mushroom substrate.



Figure 3. Pieczarki Mazurskie Fedor, Poland [<https://www.youtube.com/watch?v=LOtbrlHjRcU>].

Investment and economy

Pieczarki Mazurskie Fedor in Użranki is a dynamic company that is still growing and makes great efforts to be a modern and eco-friendly processing plant that produces high-quality products.

Material flow

The company possesses their own source of heat, two boilers with a 500 kW performance each. The boilers are fired with wood pellets. One of the boilers is used to produce technological steam and the second one is used for hot water production. The company also needs electric energy to cool mushroom growing chambers and for the technological process of compost.

Below are presented some flow charts for mushrooms

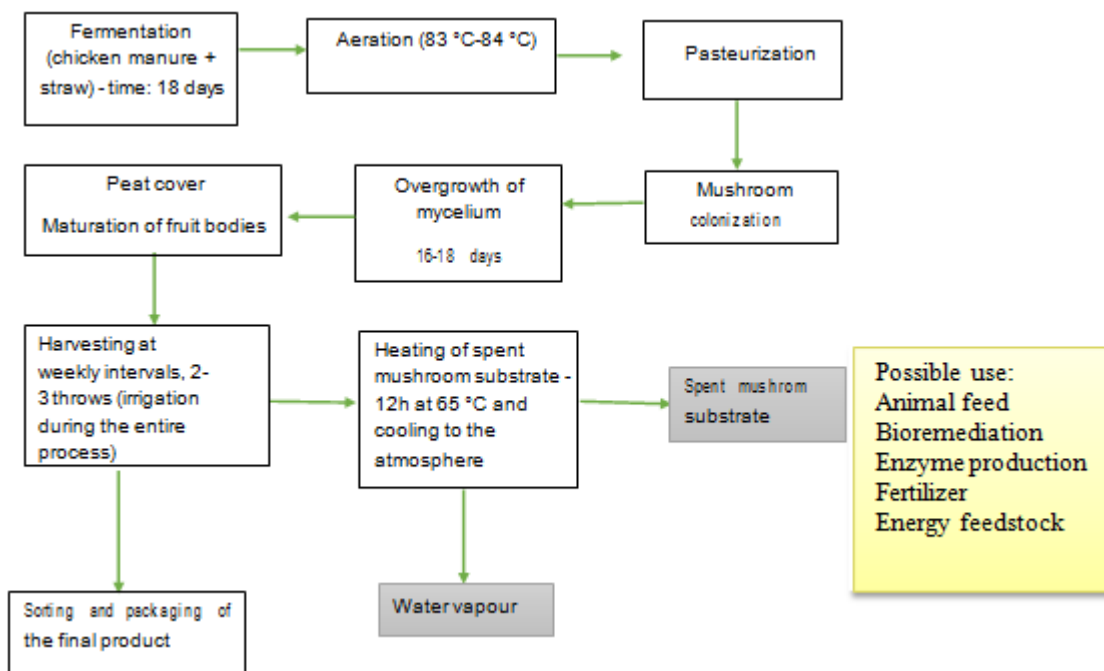


Figure 4. Flow chart for the mushroom production.

Estimated environmental and economic benefits

The price of products varies depending on the market. The main recipients of mushrooms are companies from western Europe: England, the Netherlands, Germany and France. Only 3% of the company's production is sold to the Polish market.

Lessons learned and recommendations

Pieczarki Mazurskie Fedor is a well-operating company that produces high-quality mushrooms. The clients of the company are all over the world. The largest recipient is England, but a lot of products are exported to Germany, the Netherlands and France.

A big issue for the company is the relatively high price of straw (40 Euro per ton) and low price of spent mushroom substrate (3 Euro per ton) which is used as a fertilizer. The company should start cooperating with Universities, Research Centers or biological and chemical laboratories to find new

solutions in the field of bio-plastic, food supplements or pharmaceuticals from the high value waste that contains huge amount of macronutrients (P_2O_5 , K_2O , CaO , MgO , Na_2O , P, K, Ca). The next issue is to change the heat source used to a more environmentally friendly setup. One option is to install a waste heat recovery system from the chiller installation. The Company is also interested in using organic waste (spent mushroom substrate) partly as a fuel in the burning system. It is also a possibility to use spent mushroom substrate as a substrate in the biogas production process.

The future

The company needs to solve a problem with the growing use of electric and heating energy. It is especially important due to the fact that the price of electric energy in Poland is growing faster than in Western Europe. The new heating system should be installed. What is also needed is a waste heat recovery system from chillers as well as short term, storages of heat and cool. The possibility to use spent mushrooms substrate as a substrate in biogas production should also be considered.