

Supplementary material

Details on research facilities and design

Each type of substrate (classical - a1, synthetic - a2, mixed - a3 and reed - a4) was prepared in a composting tank, respecting the proportions of raw and auxiliary materials in the established recipes. The raw and auxiliary materials were transported mechanically from the storage place to the composting plant, as well as the substrate obtained in these plants to the culture chambers.

Watering of materials - pre-soaking - anaerobic composting

Phase I – pre-soaking (anaerobic phase) took place over 5-6 days in the composting tank (Figure S1).



Figure S1. Phase I - compost components presoaking (watering).

Source: Original photo, SC CIUPERCĂRIA SRL, Aghireșu-Fabrici, Cluj County [24, Fig. A2. (e)].

Given that the experimental composting plant has a capacity of 1m³ for an experimental variant, on the 6th day, the temperature of the compost was raised to 60 °C to start the process of anaerobic fermentation of the compost.

Aerobic composting

At the beginning of the aerobic composting, the aeration installation is turned on, to introduce air into each composting tank. On the 7th day, the compost aeration starts with 25 m³ of air / ton / hour, then on the 11th day it is reduced to 10 m³ of air / ton / hour, and from the 15th day only 5 m³ of air / ton / hour was administered.

The air is introduced into the compost tank under the grate on which the compost is placed (Figure S2). The introduced air is filtered through a HEPA 13 filter.

Also in this stage, the compost will be turned by removing it on the tank door and reintroducing it into the composting tanks.

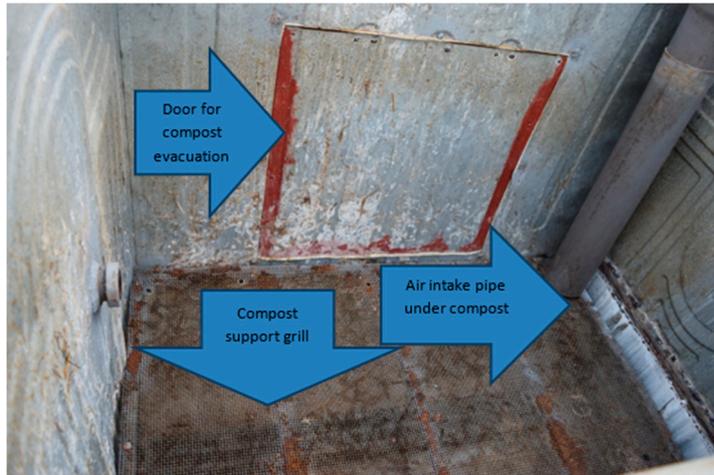


Figure S2. Composting tank, internal view.

Source: Original photo, SC CIUPERCĂRIA SRL, Aghireșu-Fabrici, Cluj County

Pasteurization

The second phase of compost preparation is the heat treatment, pasteurization. This was done by raising the temperature of the compost to 58-60 °C for about 8 hours, then lowering the temperature of the compost to 50 °C with a mixture of fresh air and continuing to cool to 45 °C.

The temperature of 45 °C was maintained until the ammonia content of the compost fell below 0.05% and the pH stabilized in the range of 7.3-7.5.

To prepare the compost for spawning, its temperature was lowered to 25 °C with the help of ventilation.

Spawning

The substrate was placed in the culture spaces, on shelves, in frames with an area of 1 m² for each experimental variant (Figure S3).



Figure S3. Placing the compost in culture spaces, in 1 m² frames.

Source: Original photo, SC CIUPERCĂRIA SRL, Aghireșu-Fabrici, Cluj County.

After acclimatization of the mycelium in the growing space, inoculation was carried out by spreading the mycelium evenly on the surface of the compost, then, by incorporating it into the compost mass, to a depth of 10-12 cm. The rate of mycelium used for sowing was 1%, relative to the mass of the compost. From the amount of mycelium used for sowing, a quantity of 10% was retained, which after compaction of the compost was spread on the surface of the layers as a control mycelium.

Incubation – mycelium running

During the mycelium running period, in the growing space, the microclimate conditions were ensured by the computerized Fancom 765.xl system (Figure S4).



Figure S4. 765.xl Fancom control system for mushroom growing microclimate conditions control.

Source: Original photo, SC CIUPERCĂRIA SRL, Aghireșu-Fabrici, Cluj County.

During the incubation period, the ventilation was performed with minimum intensity, with an air change per hour.

Substrate ruffling

On the 10th day after spawning, the nutrient substrate was ruffled in order to break the mycelial hyphae, scatter them throughout the substrate, aerate the substrate and create favorable conditions for the rapid and complete spreading of mycelium in the entire substrate mass. The ruffling was performed by mobilizing the substrate, as it was more than half filled with mycelium (Figure S5).



Figure S5. The substrate aspect after ruffling.

Source: Original photo, SC CIUPERCĂRIA SRL, Aghireșu-Fabrici, Cluj County.

Casing

The casing of the substrate was carried out on the 15th day after spawning (Figure S6).



Figure S6. The substrate aspect after ruffling.

Source: Original photo, SC CIUPERCĂRIA SRL, Aghireșu-Fabrici, Cluj County.

The casing was made by placing over the compost a mixture of 3-4 cm thick of casing mixture, with a granular structure, consisting of 2-3 mm particles of black peat, celery soil, limestone and sand, with a slightly alkaline pH (7.5-7.8), 2.7% calcium content and 0.15% organic nitrogen. The casing mixture was applied in a gentle state, with a humidity of 71%.

Casing layer ruffling

On the 10th day after casing, the mycelium spread about 2/3 of the casing (Figure S7). At this time, the casing layer ruffling has been performed.



Figure S7. The casing layer surface before ruffling.

Source: Original photo, SC CIUPERCĂRIA SRL,
Aghireșu-Fabrici, Cluj County.

Pinhead formation

The transition to fruiting took place 5 days after cover layer ruffling, when the mycelium reached the surface of the cover layer again (Figure S8).



Figure S8. Mycelium reached the surface of the cover layer.

Source: Original photo, SC CIUPERCĂRIA
SRL, Aghireșu-Fabrici, Cluj County.

Since the transition to fruiting until the beginning of the formation of primordia 7 days have passed (Figure S9).



Figure S9. Pinhead formation.

Source: Original photo, SC CIUPERCĂRIA
SRL, Aghireșu-Fabrici, Cluj County.

Harvesting

At 2-3 days after the appearance of the primordia, the harvest begins (Figure S10).



Figure S10. The *Agaricus blazei* Murrill mushrooms before harvesting.

Source: Original photo, SC CIUPERCĂRIA SRL, Aghireșu-Fabrici, Cluj County.

The rhythm of the harvests depends on the mushroom growth and the condition of the velum (Figure S11), determined by the temperature of the culture place, so that it does not break.



Figure S11. Harvested *Agaricus blazei* Murrill mushrooms with the partially unfolded velum.

Source: Original photo, SC CIUPERCĂRIA SRL, Aghireșu-Fabrici, Cluj County.

Spent substrate evacuation

After harvesting, the used substrate (Figure S12) was removed from the culture chambers and transported mechanically to a plant waste composting platform.

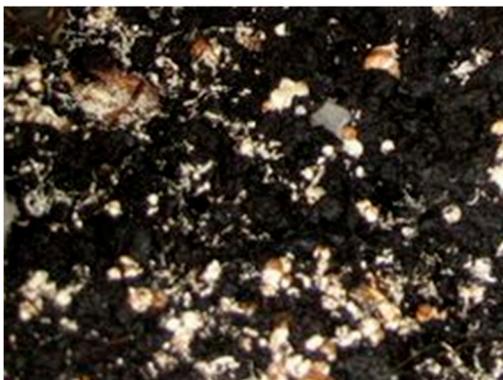


Figure S12. *Agaricus blazei* Murrill mushrooms spent substrate.

Source: Original photo, SC CIUPERCĂRIA SRL, Aghireșu-Fabrici, Cluj County.