UPCYCLING SPENT MUSHROOM COMPOST OFFERS ENVIRONMENTAL ADVANTAGES

A new process developed by the family-owned company Champignon Kwekerij Gemert (CKG) not only turns spent mushroom compost into Champost, a sought-after soil improver. It also results in savings of 1.5 million cubic metres of natural gas, reduces CO2 emissions and has earned CKG a 10,000 Euro prize as winner of the Biobased Economy Competition East Brabant. The idea for Champost arose from the company’s need to find an economical and environmentally friendly way of disposing of a waste product from its mushroom production operations. With Champost CKG has found a way to ‘upcycle’ its waste and turn it into a valuable new product. “CKG’s initiative,” says Alderman Roël Hoppezak, “is a good example of how the Gemert - Bakel municipality is working to be in the forefront of developing an economy based on renewable resources.”

By Joost van Kasteren

CKG, a company founded and run by the Van den Boomen family, grows mushrooms at the edge of the Dutch village of Gemert in South-East Brabant, and produces around one hundred thousand kilograms of mushrooms each week for the canning and freezing industry. “That means that every week, two of our eight cells - each slightly less than half a football field in size (1900 m2) - are filled with compost and a layer of mulch,” says Pieter van den Boomen, who, along with his parents manages the company.

Mushroom growing makes waste

Mushroom compost consists of a mixture of horse manure, chicken manure and straw which has been inoculated with mycelium, from which the mushrooms will grow. To prevent drying, the compost is covered by a mulch layer of peat imported from Germany. The mushrooms are harvested in two ‘flights’, the first after 16 days, and the second after 24 days, by automatic cutting blades. After the second flight, the spent compost is removed and the cell is cleaned in preparation for the next four-week growing cycle.

Because each cell contains more than 160 tons of compost, the company is faced with removing around 300 to 350 tons of spent compost every week. This compost is not easy to get rid of. “The strict legislation for manure makes it difficult to find customers for spent mushroom compost in the Netherlands,” explains Pieter’s father, Hans van den Boomen. “As a result we currently export our used compost to Germany at a cost of 12 euros per tonne. Because spent mushroom compost consists of 60 to 70 percent of water, 7.20 of those euros are used for moving water -- so finding a way to remove water from the compost seemed to be a sensible way to reduce our transport costs.”

All in the family

To find the best way to do this, Hans turned for help to his brother, Henk van den Boomen, an independent consultant with many years of experience in developing and building systems for composting and drying of various waste streams. The two brothers worked together to develop an efficient, effective and environmentally friendly way to remove water from the used compost to reduce its weight and save on transport costs.

“We spread a 2.5 - 3 metre thick layer of spent compost on the floor of my brother’s composting tunnel, which we used for testing,” explains Henk. “We then blew air through holes in the floor to dry the compost to remove water, and this started the composting process.”

Composting is a controlled digestion process in which bacteria and fungi break down part of the organic matter. The process produces a lot of heat. During composting, the temperature in the layers can reach 70 - 80 C. The high temperatures kill any harmful microorganisms, effectively pasteurizing the compost. Champost, the product of the composting process developed by the Van den Boomen brothers complies with the European regulations for
temperature treatment and, therefore can be exported as a soil improver. The heat produced during the composting process is captured and used to reduce the company’s fuel bills and with that it also reduces its CO2 emissions.

**CO2 savings**

CKG uses 300,000 cubic metres of natural gas per year to heat the cells. “Replacing even part of that by the ‘free’ heat derived from the composting process is not only good for the wallet, but also for the environment”, says Pieter van den Boomen.

The heat generated during the production of Champost is equivalent to that produced by the burning of 1.5 million cubic metres of natural gas. “If all heat is generated during the composting is used, we could prevent the emission of 3,000 tons of CO2 each year,” says Willem Elsinga of the eponymous bureau for policy planning and innovation, a consultant involved in the project. “The average household produces 8.5 tonnes of CO2 per year; 3000 tons of CO2 is equivalent to the amount of CO2 emitted by more than 350 households.”

CO2 emissions are further reduced by reducing transport. Drying and composting the spent mushroom compost reduces its moisture content from 70 to 40%. This, in turn, reduces the weight of the material transported by around 5,400 tons annually. “As a result we are able to reduce the number of truck loads needed to transport Champost by around 700, reducing our CO2 emissions even further”, says Pieter van den Boomen. “It also allows us to save on transportation costs.”

**Environmental advantages**

The environmental advantages of the Champost process don’t end there. The heat generated during composting is also being put to good use. “We rely on a layer of peat on top of the mushroom compost to retain moisture in cells,” explains Pieter van den Boomen. “But we found that the mixture of peat and spent mushroom compost does not compost well. So we tried stripping off the peat layer, composting the spent mushroom compost on its own, and using some of the heat generated to dry the peat.” This works well and offers further environmental advantages.

The peat is mainly excavated in Germany. In its natural state peat stores a lot of carbon. Drying and re-using the peat from the mushroom cells saves on raw material avoids the need to excavate around 1,000 tons of peat per year. In addition it reduces CO2 emissions by more than 1,700 tonnes. CKG are also investigating whether the ‘recycled’ peat can be used as a potting compost, and looking for uses for the residual heat that remains surplus to CKG’s own requirements.
**Heat transport**

One idea under investigation is to transport the residual heat to nearby growers via an underground pipeline. One neighbour who would be glad to receive it is Wim Verhoeven, who grows strawberries and asparagus. “The heat will be very welcome, particularly in the spring and autumn to heat the greenhouse -- which covers around about an acre, the size of a soccer field -- where I grown strawberries”, he says. “I can also use the heat to heat my asparagus plants. These are grown in the soil under a plastic cover. If I can keep the plants warm, I can harvest them earlier and get a higher price than I would in the asparagus season. The heat will also benefit the asparagus plants in summer when the plants stock up on sugar to gain strength for the winter.”

**Soil improving products**

The Champost produced from the composting process will also find an excellent application as a soil improver and fertiliser. “The composted product has high content of organic matter,” says Ronald Verberne of Ingenia, an engineering consultancy based in Eindhoven. “Mixing Champost with topsoil it improves soil structure and water retention. The addition of the organic matter to the soil also stimulates microbial life. This, in turn helps the plant to better absorb the necessary nutrients.”

Champost can also be used to improve soil fertility, by increasing the availability of potassium, nitrogen and phosphate. If these elements prove to be present in suitable amounts Champost could well become a sought-after commodity by local farmers and specialist growers.

For example, thanks to the mycelium present in mushroom compost, Champost has a high potassium content, of around 30 to 35 kg per tonne. The high potassium content makes it a potentially interesting fertilizer for vineyards in Germany and France.

The quality of the Champost can be further improved by adding dried pig manure to the spent mushroom compost before composting. “Pig manure, which is readily available locally, offers several advantages,” says Verberne: “Its addition increases the amounts of phosphate in Champost. In addition, the nitrogen from pig manure, which is released as gaseous ammonia during composting, can be recovered into a solution of ammonium sulfate using the scrubbers, which are required under environmental legislation. This, in turn, can be added to the Champost mix.”

Researchers at the Green Campus in Helmond plan to study the effect of the enriched Champost on plants, focusing specifically at the uptake of nutrients by the plant and the percentage of nutrients leached into soil and groundwater.

**Overcoming opposition**

Not all composting initiatives are welcomed by local residents. Recently an initiative for large-scale processing of pig manure in the Gemert - Bakel municipality...
was nipped in the bud because of opposition from local residents. “Although the processing of pig manure is generally met by suspicion in and around the municipality of Gemert-Bakel, the composting project proposed by CKG is different,” says Alderman Roël Hoppezak, who is also an Ambassador for the Biobased Economy of the City Region Eindhoven (SRE). “It mainly involves the relatively small scale controlled composting of spent mushroom compost by a family-run business operated by a well respected local family. “To reassure the community we try to show people what we are doing,” adds Pieter van den Boomen. “That’s why we don’t put our composting tunnels somewhere out back, hidden behind conifers, but locate them so that they are very visible along the main road into the village. Anyone passing by will be able to see what we doing.”

The three composting tunnels and accessory installations will be placed in a building designed by Dennis van de Rijdt, an architect from Denkkamer Architectuur en Onderzoek. “It will be a sustainable building,” he says. “To emphasize that there is nothing to hide, the facade on the side of the road will include translucent panels of plastic (polycarbonate) so people can see what is going on. It will also include a lighting system which, among other things, will show the location and extent of the biological activity and how much energy is being generated. In this way we hope to remove any doubts about the process and demonstrate that the conversion of waste into bio-based energy is useful, necessary, and above all, sustainable.”

Encouraging ideas for the best biobased economy

In order to search for new ideas for high-quality application of residues from agriculture and manufacturing in the Biobased Economy four organizations in East-Brabant, including the Brabant Development Agency (BOM), Avans University of Applied Sciences and Agrifood Capital North East Brabant and City Region of Eindhoven (SRE), clubbed together in mid-2013 to organize a competition. The winner was Champignonkwekerij Gemert (CKG) BV, a company owned and run by the Van den Boomen family, who are now receiving expert support to help them develop their ideas and plans.

The competition formed part of the BioenNW project. This project, which involves five European regions, is supported by the European Union and co-financed by the Interreg IVB North West Europe Programme. “As a result of this collaboration local projects receive international exposure,” says Jan Westra of SRE, “The more widely we can spread the new ideas that emerge, the more the environment will benefit.”