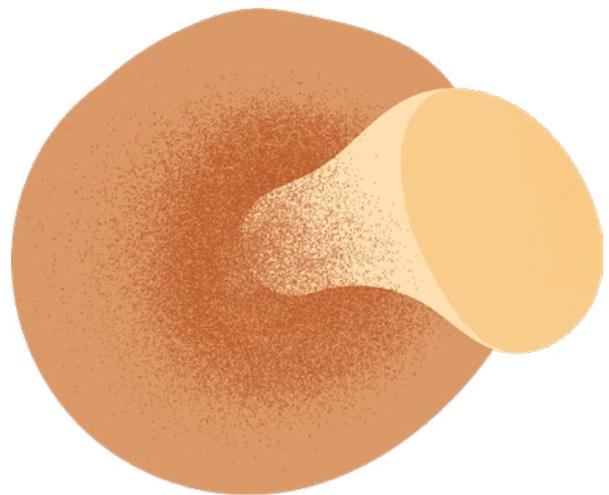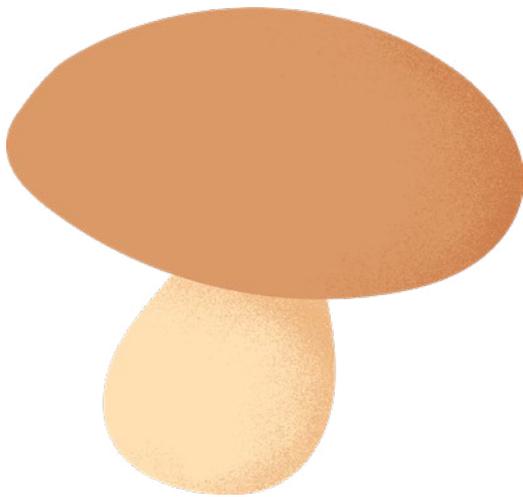# Fungi Farming

Year 3 – Science; Technologies
Year 4 – Science; Technologies
Year 5 – Science; Technologies
Year 6 – Science; Technologies

(Science, Yr 3, ACSSU094)
The growth and survival of living things are affected by physical conditions of their environment

(Science, Yr 4, ACSSU073)
Living things depend on each other and the environment to survive

(Science, Yr 5, ACSSU043)
Living things have structural features and adaptations that help them to survive in their environment

(Science, Yr 6, ACSSU094)
The growth and survival of living things are affected by physical conditions of their environment

(Technologies, Yrs 3 & 4, ACTDEK012)
Investigate food and fibre production and food technologies used in modern and traditional societies

(Technologies, Yrs 5 & 6, ACTDEK021)
Investigate how and why food and fibre are produced in managed environments and prepared to enable people to grow and be healthy

Cross–curriculum priorities

Asia and Australia's engagement with Asia

Sustainability

Fungi Farming

Fee, Fi, Fo — Fungi

Fungi are remarkable. Not plants, not animals — they are in a class of their own. Fungi feed on dead matter (thankfully, plant matter) and the mushrooms we eat are by no means the whole story... Here we get close to the life cycle of fungi and grow our own.

Equipment:

At least 1 fresh white or Swiss Brown mushroom per student

A mushroom kit, in a cardboard box

A spray bottle containing only water

A place to put the kit where it will maintain a steady temperature and where students can get to it each day to spray it with water)

(optional) pH testing kit

Duration:

45 minutes — 1 hour

Location:

The classroom

Students will be looking after the mushroom kit for a few weeks. You want to find a place to put it where it won't get disturbed and where the temperature stays fairly constant. We've seen them in storage rooms, garages and garden sheds — just don't let it get too hot or dry out!

Notes:

Getting familiar with fungi

👁 Watch the segment on the mushroom farm from **Episode 26 — Eddie Woo and the Fun Guys (who are actually quite serious)** together.

● Students handle the mushrooms. Show them how to pop the caps off, and peel the skin from the lip around the edge of the cap (known as the margin).

❓ Discuss: While they handle the mushrooms, point out the developing gills and explain the following facts

◇ Mushrooms are not plants (or animals). They are fungi, which is a different kingdom in the classification of living things.

◇ The mushrooms we eat are not the whole organism. They are the fruiting body (like an apple is not the whole tree).

◇ The main growing body of a fungus is the mycelium. This is a network of furry thread–like strands that grow through the soil.

❓ Ask: Has anyone ever seen white, very fine threads in the compost or under rotting leaves? That is mycelium.

◇ Mycelium has many functions: it holds a lot of water in the soil. It farms nutrients out of leaf litter and soil. It forms a network that can send signals to other plants — like the internet mycelium network Billy encounters — and it can transfer chemicals.

◇ Mycelium is a saprophyte — that means it lives on dead tissue (i.e. the organic matter in the compost). This makes it very useful to plants because organic matter such as dead leaves is broken down for them. (And you thought zombies were just for horror stories!)

◇ When mycelium is mature, the fruiting body develops. The mushroom fruiting body grows above ground. Often that's the first sign WE know about the network of mycelium underneath.

◇ As the fruiting body — the mushroom — opens, gills underneath ripen. When they are ready, they release spores — sometimes millions of them in one day — into the air.

◇ Spores land in soft compost, and if it's moist enough, mycelium begins to grow again and the cycle repeats....

Observations

❓ Ask students to describe the texture of a mushroom. Is it more like an apple or a sponge? What do students think that means when it comes to cooking mushrooms? Will they hold other flavours well? Do students think they are made of a lot of water? (Mushrooms are about 91% water.)

Fungi farmers

[?] Discuss the way farmers grow mushrooms.

◇ Farming mushrooms means imitating their natural habitat. For brown and white mushrooms, the most common farmed types, this mean imitating a moist, gloomy forest floor with plenty of decomposing leaves and vegetation.

◇ Large climate-controlled sheds keep temperature and humidity regular. Mushrooms like a steady temperature of about 20 degrees and a humidity of 88–91%.

◇ Mushroom farmers put the compost in huge trays (about 1.5 x 3 meters).

◇ They mix the spawn in.

◇ Then a 40mm layer of what's called 'casing' goes on top. The casing layer has no food value to the mycelium, so the mycelium thinks it's at the end of its lifecycle and it goes into the fruiting stage. Casing basically shocks the mycelium, forcing it to fruit.

◇ Mushrooms fruit about 2 weeks after the casing is added. First, pins will appear, then these will turn into buttons, then caps and finally, flats (which are mature enough to produce spores).

◇ A mushroom doubles in weight every 24 hours between the pin and cap stages!

Shroom to Grow!

The casing is deliberately put on in lumps and bumps. This means that the mushrooms grow at different heights. They can expand without bumping into each other — 'shroom space saving!

Manage your own mycelium!

◇ Show students the mushroom kit.

◇ Weigh the kit before you water it. Write down the weight.

◇ Point out the compost and explain that it is soft and full of organic matter (usually wheat straw, chicken manure and gypsum).

◇ Wet the surface of the mushroom kit with the spray bottle.

◇ The compost will look dark, but after about 3 days of daily water spritzing, white mycelium threads should start to show on the surface.

● (Optional) Use the pH kit to test the pH of the mushroom kit. It will probably start at about 8 and as the mushrooms develop over 2–3 weeks, it should lower slightly to 7 (nearer to neutral).

✎ While waiting for the mycelium in the kit to mature and begin to grow fruiting bodies (mushrooms), students research climate-controlled mushroom farming in Australia.
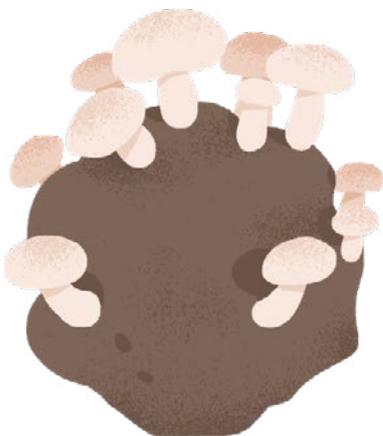
Topics for independent research:

◇ How did traditional mushroom farmers grow their fruit? (On inoculated logs, in caverns or dark stone rooms that stayed cool and moist.)

◇ How is mushroom compost made? Students research the mix of chicken manure, wheaten straw, gypsum and water needed. Why are these ingredients ideal for the nurturing of mycelium? Students find out how to make bulk hot compost (that goes up to 78°C).

◇ What extremes of temperature do mushroom growing barns need to withstand? (If it's got to be a constant 20 degrees inside, how much does the shed need to be heated on a typical cold winter day — and how much does it need to be cooled on a hot summer day?

◇ Mushroom farmers can only use the compost once. For food safety reasons, it needs to be discarded and refreshed. They can get chicken poo and wheat straw (the stem of wheat plants) as waste products but they also need to add gypsum, which is a source of calcium. Students research what can be done with used (or 'spent') mushroom compost. Students propose a business or energy producing idea that takes this waste stream and makes it useful.

100% Efficient

On a mushroom farm, good yield represents 100% biological efficiency.

What does that mean?
The dry amount of compost we put on the tray should equal the wet rate of mushrooms we harvest. It's a 1:1 relationship, or 100% biological efficiency.

30 kilos dry matter = 30 kilos mushrooms.

Water is an input too (which is why they have compost left over at the end.)

Lexicon

Inoculate to introduce cells or organisms into a living thing.

Mycelium the core body of a fungus, white, furry thread-like strands that form a network in the soil.

Saprophyte an organism that lives on dead tissue.

Spawn (multiple of spore) mushrooms produce spawn, like seeds, when they are mature. A single mushroom can release thousands of tiny spawn.