

GROWING MUSHROOMS IN BUCKETS

MUSHROOM CULTIVATION IN REUSABLE CONTAINERS





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MUSHROOM GROWING IN REUSABLE CONTAINERS

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Key terms



Fungi

A fungus is the type of organism that mushrooms belong to. Mushrooms are the fruiting bodies of fungi



Species

The type of mushroom, eg. White Oyster



Mycelium

The thread-like network of hyphae (almost like the 'roots') that make up most of the fungal organism, which develops from the spawn



Substrate

The material which the mushrooms grow on



Spawn

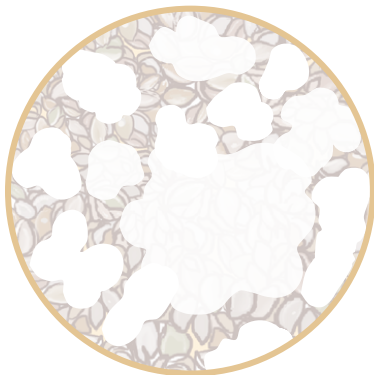
The mushroom culture you use, almost like the 'seedlings' of the mushroom

Key processes



Inoculation

Adding the culture, or the spawn, to the substrate



Colonisation

When the mushroom culture grows on the substrate



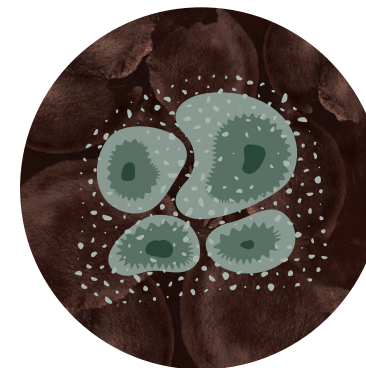
Pasteurisation

Removing potentially harmful organisms such as bacteria, but keeping the beneficial ones



Sterilisation

Removing all forms of living organisms from a surface or from your substrate (instead of pasteurisation)



Contamination

What happens when sterilisation or pasteurisation has failed and other organisms like bacteria or mould takes over, and spoils your batch. You will notice discolouration or bad smells. You can compost contaminated batches



To avoid contamination, you must keep the whole work area as clean and free from bacteria as possible.

PART ONE

Mushroom Growing:
an overview and how to begin



Why Grow Mushrooms?

For Nutrition

Mushrooms are a fantastic source of nutrition. Each edible species contains:

- fibre (soluble and insoluble)
- protein
- vitamins
- minerals
- anti-oxidants
- amino acids

For Regenerative Livelihoods

Growing mushrooms can generate livelihoods as well as food resilience. They are a high value crop, so can be sold, shared or traded. Growing mushrooms in collaboration with others helps build community and an ongoing source of food to share.



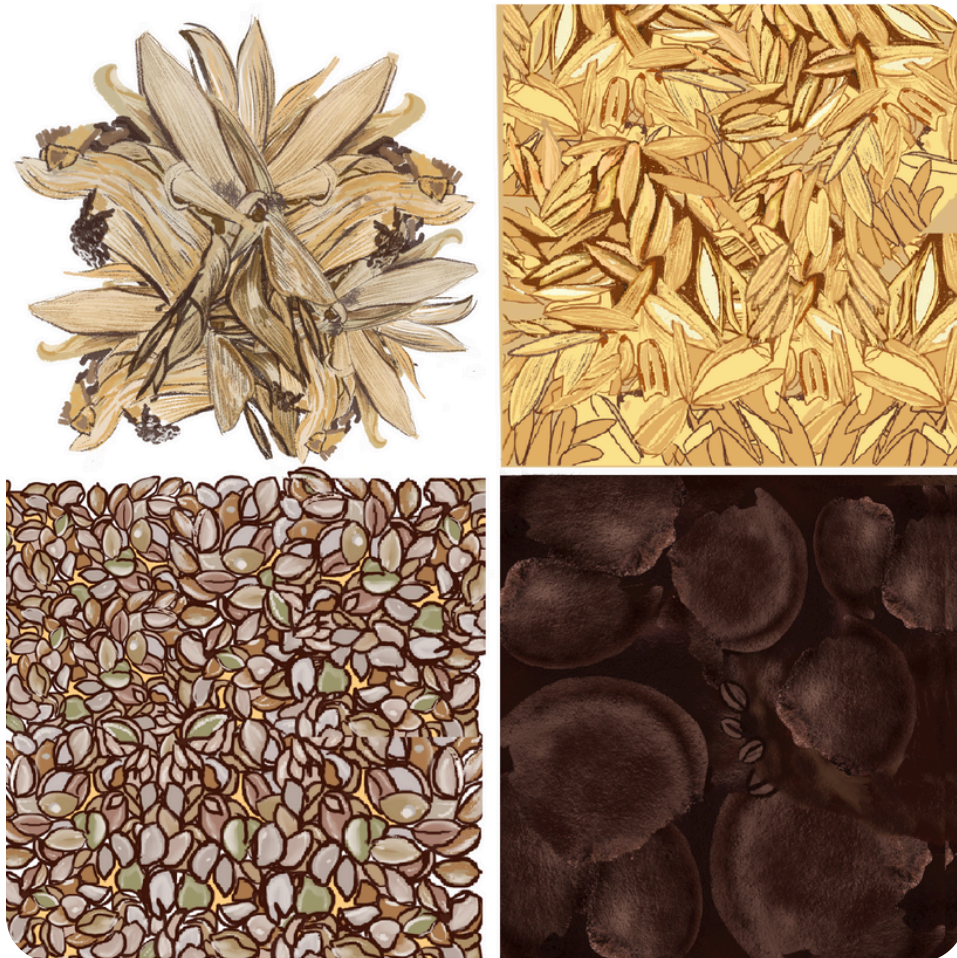
Putting any harvested mushrooms in direct sunlight for 15 minutes before cooking and eating them may add to the vitamin D they contain.



Choosing Mushroom Species and Substrates

With your community, you will need to ask yourself some questions to find out the best mushrooms and materials to work with. For example:

- What species of mushrooms are already growing in your area, either in nature or in local food production?
- What organic materials grow locally in abundance, that could be appropriate for use as a substrate?
- Which mycelia are available from a local university or lab?



Choosing the Substrate

Which organic waste materials are available?
Straw, maize or rice husks, millet, coffee grounds?

These will determine which varieties of mushrooms you can grow.



Choosing the Mushroom Species

The substrate, the climate conditions, and the mycelium available will also determine what you can grow.

Oyster is relatively resilient and grows fast on many different kinds of substrate, with less risk of contamination.

What you will need to get started

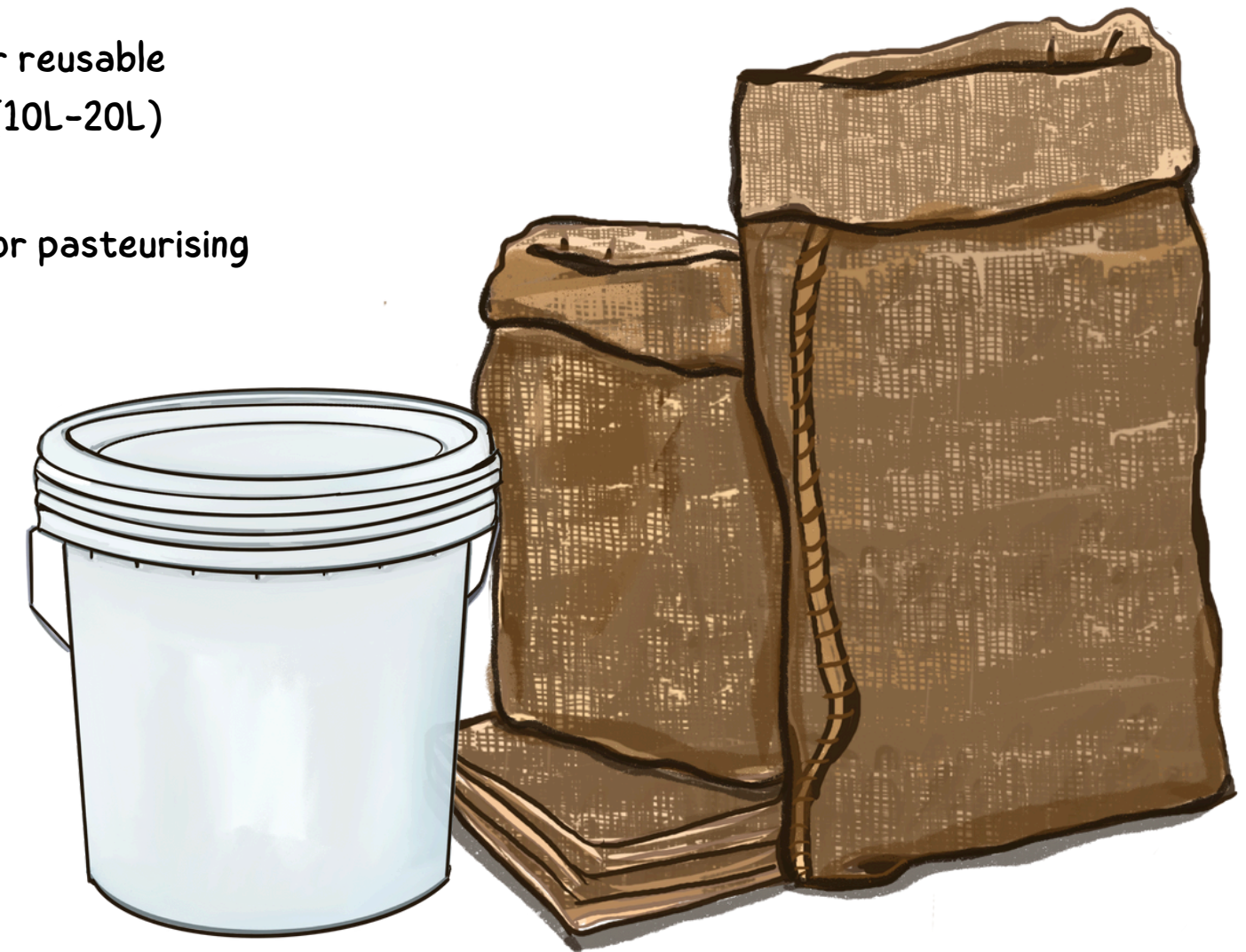


Spawn can be sourced from local mycological labs or universities.

- A straw bale or other substrate
- Blade to chop substrate
- Mushroom mycelium spawn (best obtained from a lab)
- Alcohol spray for sterilising surfaces
- Pasteurising additive (eg. pasteurised bran or hydrated lime)



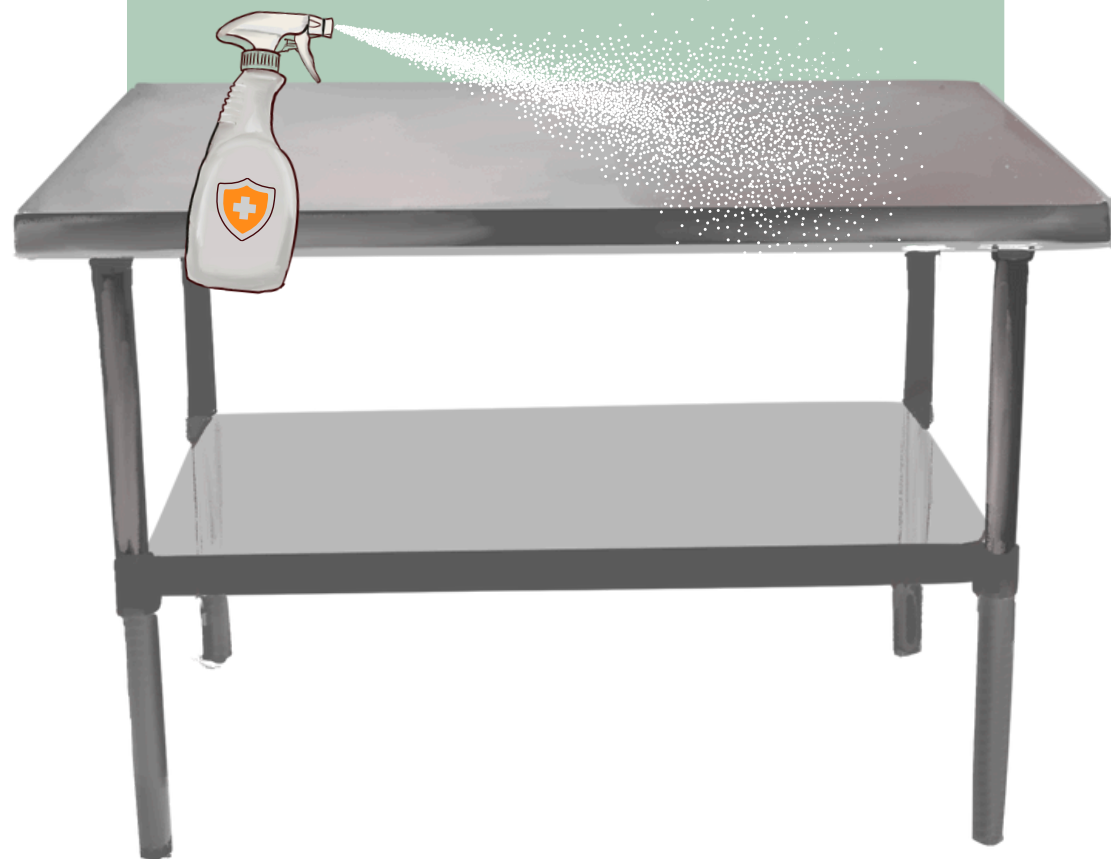
- Hessian sack, pillow case, mesh or plastic sack to pasteurise
- Breathable, gauze tape or first aid plasters to cover holes if using single bucket method
- A drill or hot iron to make holes (1/2", 2.5cm)
- A weight to hold substrate submerged when pasteurising
- Sealable buckets or reusable growing containers (10L-20L)
- Large containers for pasteurising
- Rubber gloves
- Clean water



Different stages of growing need different conditions

Innoculation

Needs to be done on a surface that has been sterilised with alcohol or diluted peroxide, so either plastic or metal



Colonisation

Needs to take place in a dark cool place (a shelf or a cupboard) that is not too dry



Paint wooden structures with an anti-fungal treatment

Fruiting

Needs a light, well ventilated and humid environment, such as a polytunnel or shed, between 18-26 degrees celcius



You can grow in a space at home, in a polytunnel or in a small shed. All three processes can take place within the same area if you can change temperature, light and other conditions. If you are doing continuous cultivation you will need different spaces to create the conditions for different stages simultaneously.

PART TWO

How to find materials, pasteurise,
sterilise and inoculate

Eliminating Other Microorganisms

Before you inoculate the substrate by mixing it with mushroom spawn, it must be free from potentially pathogenic bacteria. This can be done through Sterilisation or Pasteurisation.



Steam sterilisation

Steaming your substrate in a container of boiling water over 4-5 hours

① STERILISATION



Cold water fermentation

Soaking your substrate in water for 3-15 days to kill aerobic organisms

① PASTEURISATION



Lime pasteurisation

Soaking your substrate in a hydrated lime bath to kill ph-sensitive organisms

① PASTEURISATION

How to do steam sterilisation



You will need:

- A cheap available source of fuel so you can keep the substrate steaming for several hours
- A firepit
- A large metal drum filled 1/4 with water
- A cloth or mesh to hold the substrate sacks within the metal drum
- Your substrate in a cloth bag



1. Prepare the metallic drum

Put the metal drum over the fire pit, and fill it a quarter with water. Place the substrate bags in the drum, and you may want to use a cloth or mesh to hold all the substrate bags together and above the waterline.



2. Light a fire underneath the drum

Cover the metal drum. Light a fire, and prepare to add more wood or other fuel source.



3. Steam the substrate

Continually steam the substrate sacks for five hours so the substrate is fully sterilised. Then, allow to cool so you can handle the sacks.



4. Drain the substrate

Disinfect your work surface, gloves and hands, and once the substrate sacks are cool enough, squeeze out as much water as you can. It should be moist but not dripping. Add a pasteurised nutrient source like bran to the substrate.

Pasteurisation

When growing outside a lab, pasteurisation may be easier unless you have a source of cheap fuel for steaming.

Cold water fermentation can be a good method if using straw or wood chips as substrate as it requires very few resources and labour.

If using another substrate like rice husks, bagasse, or cotton husks, you may need to add extra ingredients as a nutrient source to aid the fermentation process, such as sugars or lactobacillus.

Make sure to pasteurise any nutrition source you may add. The mycelium will need a source of nutrition, like bran, to consume in order to grow mushrooms.



The warmer the air temperature, the faster the fermentation will happen. Check the smell! It will start to bubble and smell when it is ready.



Time

Between three and fifteen days



Look

Becomes a little bubbly



Smells

Slightly sweet and sour



How to do cold water fermentation



You will need:

- Your substrate medium and a nutrient source, like bran if possible
- Hessian or cloth sacks to fill with your substrate material
- A large barrel or container with a loose-fitting lid
- Hooks for hanging sacks of substrate to drain the substrate after fermentation is complete



1. Prepare substrate and fill sacks

If using straw or maize husks as a substrate, cut into maximum 5cm pieces and fill the hessian sacks.



2. Submerge in water

Place the filled hessian sacks in a large container and cover with clean water. Make sure all the substrate is completely underwater with none poking out.



3. Cover and leave for 3 - 10 days

Cover the barrel with a lid to prevent insects entering, but leave a small gap for air. Leave for 3 to 10 days. It's ready when it's bubbly and with a fermenting scent.



4. Hang to drain

Hang the sacks on a hook to fully drain the substrate before using it.

How to do lime pasteurisation



You will need:

- Hydrated Lime (Calcium Hydroxide)
- 175g per 100L of water
- Your substrate in a cloth bag
- Water, and a stick for stirring
- A big container for soaking
- Gloves, mask and goggles or glasses

Its best to use the lime pasteurisation method for less nutritious substrates like straw and sugarcane pulp. You can also use it to pasteurise other substrates like sawdust and hardwood pellets.



1. Prepare safety materials

Due to the extremely alkaline nature of Hydrated Lime, you must wear gloves, goggles, and cover your nose and mouth. Lime is extremely irritating to the eyes, lungs, and skin.



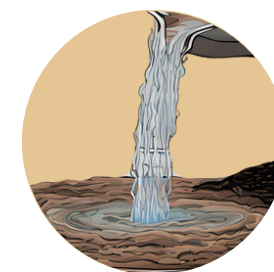
3. Soak the substrate

Soak the sack with the substrate in it for 12 to 24 hours. Make sure it is fully submerged underwater, and you may need to weigh it down. Then, hang the sacks out to dry.



2. Mix the lime and water

Mix 175g of Hydrated Lime with 100L of water and stir with a large stick. Make sure you do not get any Lime in your eyes, nose, mouth or on your skin.



4. Carefully dispose of Lime water

The pH level of the Lime water will drop as it is being used. You can use a pH test strip to check whether the water is safe to dispose in your garden (less than pH9). Otherwise, you should let the water stand for a week before disposing, or mix with something acidic like lemon juice or vinegar.

PART THREE

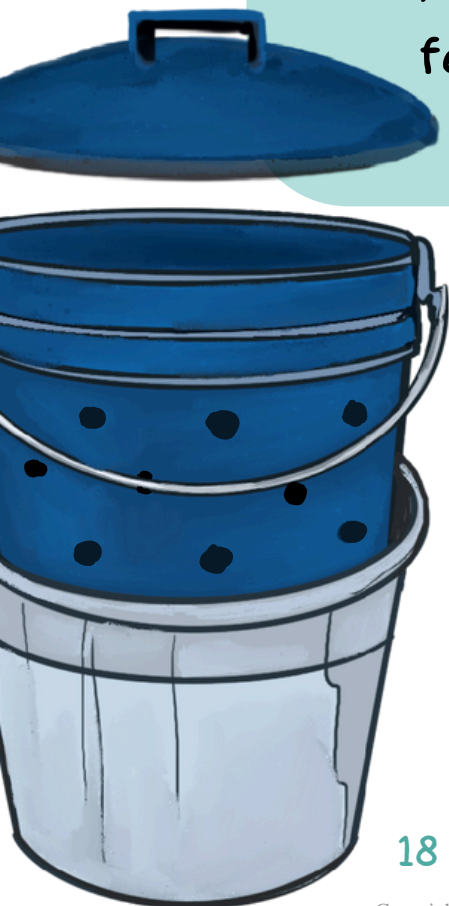
Growing and harvesting mushrooms

Preparing the mushroom buckets

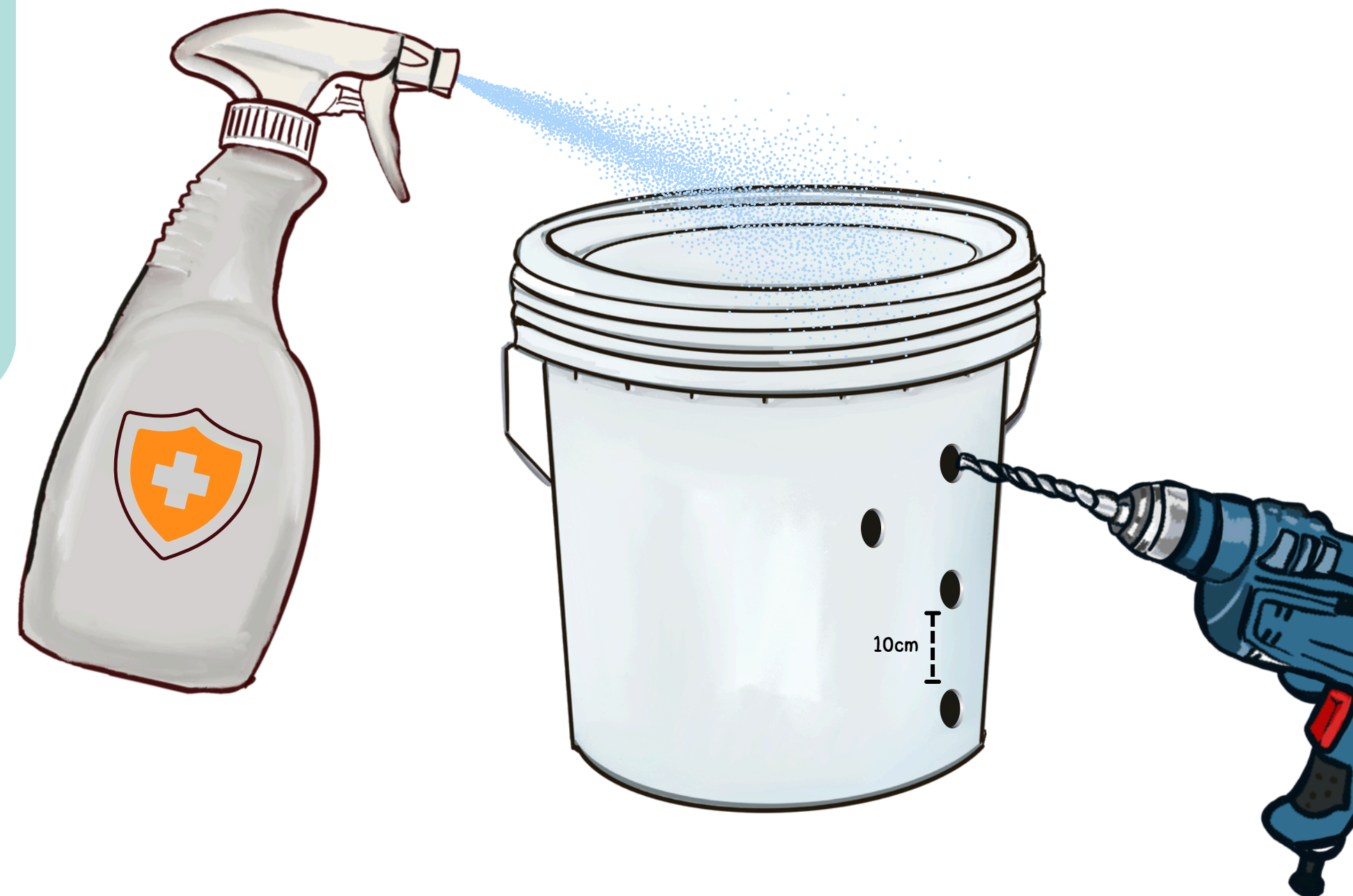


You will need:

- A round tool or a drill to safely cut holes in the containers
- Clear buckets or containers (10-20 litres - start with smaller amounts in the beginning as there's a higher likelihood of contamination in the learning process)
- Some breathable tape, such as sticking plasters for wounds, to cover the holes or a larger bucket to protect your growing container during colonisation
- Alcohol or a method of cleaning the containers before filling
- A clean big tarp or sheet to lay the substrate on after fermentation is complete



Always wear clean gloves, sprayed with disinfectant like alcohol, and clean the buckets thoroughly with a strong disinfectant and leave to dry.



Preparing the mushroom buckets

Once the bucket is thoroughly disinfected and dried, cover all the holes with fabric or paper tape. Fill the containers with layers of substrate and mycelium, (around 10% mycelium, 90% substrate) to the top. Close the lid very firmly so no bacteria can get in.

Anything sticking out of the top of a container will contaminate the whole mix, so make sure that nothing is poking out the holes or the lid.



- ✓ 10% mycelium layered with 90% substrate
- ✓ Bucket lid firmly closed
- ✓ All holes are covered



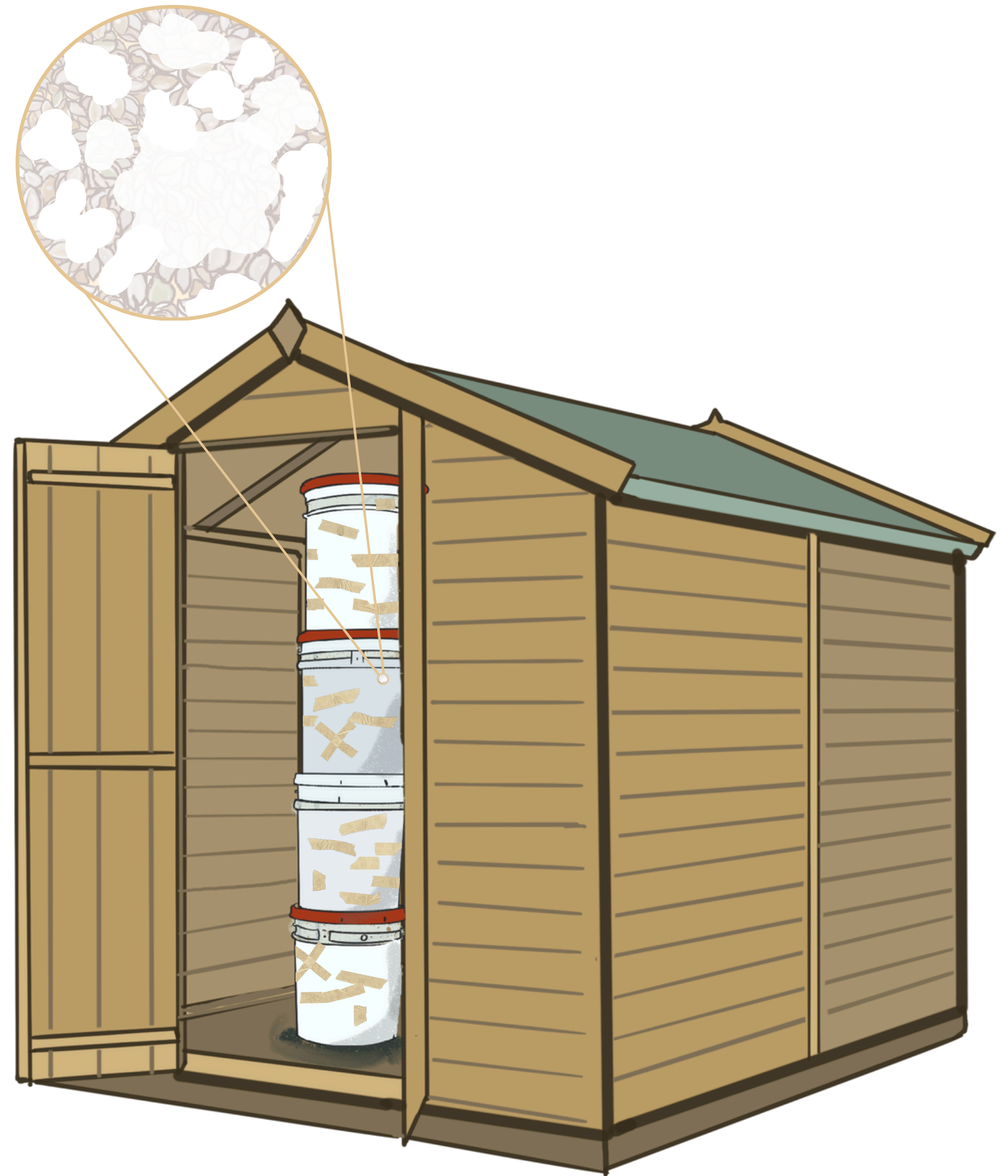
- ✗ Substrate not fully contained
- ✗ Bucket lid open
- ✗ Holes uncovered or not fully covered

Colonisation

Leave buckets to colonise in a clean space out of direct sunlight, around 21 degrees C for 2-6 weeks, checking every week on the progress through a hole in the bucket by peeling back the tape, not removing the lid.

If the temperature is a lot colder it will slow down colonisation.

When all the holes have turned white with mycelium, move the buckets to a humid growing space so they will start fruiting mushrooms. Remove the tape or the outer bucket so the holes are exposed and the mushrooms can grow out the side. You should start to see mushrooms growing within two weeks.





Harvesting the mushrooms

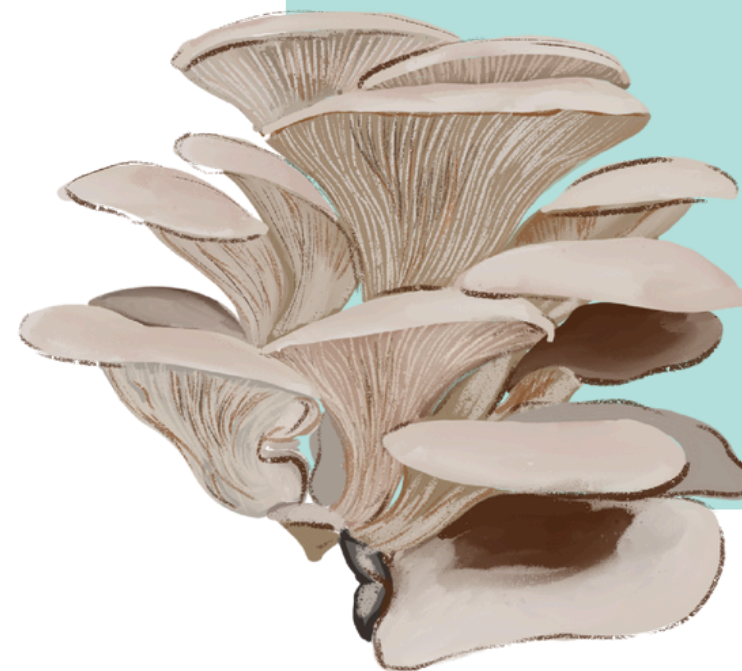
You can harvest the mushrooms before they release their spores and the mushroom 'cap' flips upwards.

The mushrooms can be used immediately, or dried on trays in the sun with air circulating. If drying, make sure you dry them fully so there is no moisture, and then you can keep the dried mushrooms for many months before cooking.

Once you have fully harvested from the buckets, replace tape or the outer bucket to retain moisture. Leave mycelium to rest for one week before beginning a second harvest.



Only ever eat mushrooms if you are sure that it is the variety you are producing. Do not eat wild mushrooms unless you are certain of the species.



Ready to harvest

- You are certain about the variety of edible mushroom you are growing
- There is no discolouration or mould
- Mushrooms have their 'caps' turned down, before the caps start to turn upwards



Too late to harvest

- Mushrooms look wet, wrinkled, or smell fishy
- Mushrooms are discoloured or very wet and soft to the touch

The Second Harvest

After leaving the buckets to rest for a week, rehydrate the substrate by spraying or submerging in cold water.

Re-open the holes on the bucket, and return it to your fruiting area. You should get more mushrooms within a couple of weeks.

You can do this for three or more harvests, then you must dispose of the substrate and start with fresh substrate once the mycelium stops fruiting. You can put the substrate and mycelium mix onto your compost heap to create some nutritious compost. Then, thoroughly clean the buckets and start the process again.



If you see contamination (like green or pink or blue spots or growths) on a growing mushroom, remove that bunch of mushrooms from the grow room and dispose in a compost area.

If you see contamination on a substrate (i.e. in one of the holes that mushrooms are growing from), dispose of the whole bucket and clean thoroughly before the next round of inoculation.





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