
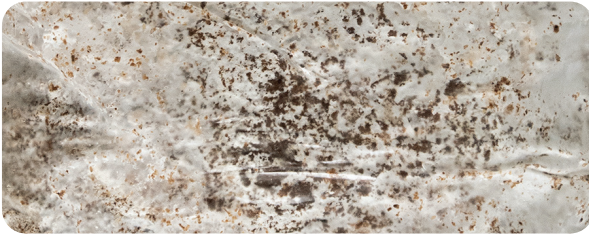


# M U S H R O O M C U L T I V A T I O N IN BEDS USING GRAIN & SAWDUST SPAWN



**NORTH SPORE**

- Grain spawn will store for three months in a refrigerator while sawdust spawn will store for six months to a year. The fresher the better, but mycelium is pretty resilient. If you don't get around to inoculating right away, tuck it away in your refrigerator until you're ready. **NOTE: Pink oyster and almond agaricus cannot be refrigerated. Almond agaricus will keep at room temperature for six months while pink oyster is best used within one month of receipt.**
- Only open your spawn bag when you are ready to use it. Opening it prematurely will increase the risk of it molding.
- It is not ideal to use spawn for more than one inoculation day.



### Is My Mushroom Spawn Moldy? ▲

Mushroom spawn will naturally develop a white (or yellow for chicken of the woods), mold-like layer called mycelium. This branching network of threads is the primary body of fungi, the vegetative structure. A good analogy is if a mushroom is like an apple, then mycelium is like an apple tree. Seeing mycelium grow through your bag is normal and indicates healthy mushroom spawn. Break up your spawn bags thoroughly before use.

Often, mycelium is broken up in shipping, so it can appear less myceliated. Let it sit for a few days and it should bounce back.

**UNLIKE INTENSIVE INDOOR CULTIVATION OR GROWING ON LOGS, MAKING MUSHROOM BEDS IS EASY AND DOESN'T REQUIRE ANY SPECIAL TOOLS OR TECHNOLOGY.**

### SPAWN

Where pest pressure is high, sawdust spawn is a better choice than grain spawn. Grain spawn can however give a boost of nitrogen to carbon heavy substrates such as hardwood leaves, straw and sawdust. One bag of spawn can inoculate a 4'x4' space or roughly 16 square feet.

### SUBSTRATE

Different species have different substrate preferences! Refer to the section on the species you will be growing for information on what substrate is best to use in your bed. If you create a bed with a substrate composed of smaller particle sizes or create a casing layer for your bed testing the field capacity of your substrate is a helpful practice!

### Field Capacity

Ideal moisture levels for mushroom growing can be tested by squeezing a handful of substrate tightly in your hand. A few drops of water should come out. If it's a steady stream, it's too much water. If it's tough to get any drips, it's not hydrated enough. We call this field capacity.

### WATER

Keep your mushroom bed watered as you would plants in a garden. The substrate should be moist but not soggy.

### BROWN CARDBOARD (OPTIONAL)

If there's grass or stubborn weeds growing on your site, you can help to smother them by laying down some brown cardboard first. Keeping the cardboard in place is optional but can help in weed suppression. Saturate the cardboard before beginning to layer on your substrate.

### **Difficulty:** Beginner

Perhaps the easiest mushroom to grow outside in beds is the wine cap, *Stropharia rugosoannulata*. This is a tasty mushroom you're not likely to find at the grocery store! You may hear it called king stropharia or garden giant-- sometimes the caps can grow as big as plates! It's an incredibly robust mushroom, growing quickly on all sorts of woody debris and resilient to a range of environmental conditions. We've had great success with mulching around vegetables or even in garden paths. They'll also tolerate a bit more sun exposure than other species of mushrooms. Wine cap is being researched for its use in making nutrients more bioavailable to edible plant species and growing on wood chips has been shown to increase soil permeability.

Once you have a patch established, it's pretty easy to use that as a sort of "mother patch" to inoculate other areas. They'll typically fruit within the first 6 months of inoculation provided there's adequate moisture and it's warm enough.

**Recommended Substrates:** *Hardwood chips, sawdust, straw, agricultural byproducts such as rice or bean hulls, corn stalks, etc.*

These decomposer fungi thrive on hardwood chips and straw. Wine cap especially love soft hardwoods, like poplars and aspens. Although softwoods aren't generally recommended for mushroom cultivation, wine cap can tolerate some in your mix. Shoot for no more than 50%. You can even combine wood chips and sawdust, straw or agricultural byproducts. Wine cap seem to do better if the beds have a variety of particle sizes which can also help with moisture retention. Avoid branches or other very large pieces of wood as these take longer to colonize and can create too much air space in the bed.

If you can, look for freshly cut chips. It'll give the wine cap a leg up on any microbial competition. These tough fungi can grow well on more mature materials, too, as long as there's no other obvious fungal activity. Many folks have success with the chip mixes coming from roadside crews pruning under power lines - and it's a free resource!

Wine cap can also be grown on straw, though it is less ideal and the beds will not last as long as when they are composed of wood chips. Chopping the straw into 1-3" pieces gives the mycelium the ideal particle size to spread across. Larger pieces will work, too, but should be tamped down some to reduce air pockets.



Wine cap trap parasitic nematodes, making them a valuable addition to your home garden!

## NAMEKO

### *Difficulty: Advanced*

In East Asia the amber colored *Pholiota nameko* is found growing in clusters in the wild, on stumps and fallen trees, typically oak and beech. Appropriately, nameko translates to “slippery child” in Japanese because of the layer of shiny gelatin coating its cap. This coating is in part galacturonic acid, the primary component of pectin which is extracted from ripe fruits and used as the gelling agent in jellies and jams. In Japan, nameko is second only to shiitake in popularity and traditionally used in both miso soup and hot pot dishes known as nabemono or nabe. It has an aroma and taste that walks the line of being both fruity and earthy and is best eaten sautéed or used to lightly thicken soups and sauces.



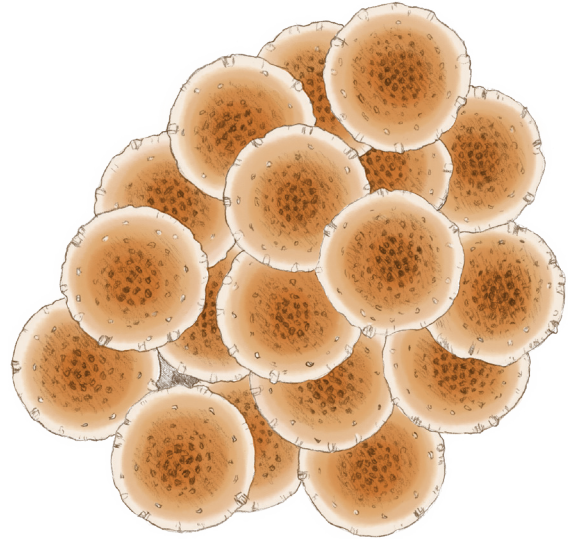
We recommend using larger chips for this species as their caps have a tendency to stick to substrate as they push up through it. They prefer to fruit during the cooler months, often after a sudden drop in temperature.

### ***Recommended Substrates for Nameko and Chestnut:***

*Freshly chipped hardwood*

Nameko and chestnut mushrooms are not as aggressive as the other hardwood loving species of mushrooms that can be grown in beds. Because of this, freshly cut chips, chipped no more than approximately one month prior to inoculation will work best. This will give the mushrooms a leg up on any microbial competition, including other species of fungi. Many folks have success with the chip mixes coming from roadside crews pruning under power lines - and it's a free resource!

## CHESTNUT



### *Difficulty: Advanced*

Like nameko, *Pholiota adiposa* or chestnut mushrooms grow in clusters on stumps and fallen broadleaf trees, typically oak and chestnut. Chestnut sometimes have sticky scales on their stalk but their most recognizable feature is the white or sulfur colored tufts that adorn their caps, especially on the outer edges. In Japanese cuisine they can be used to make a stock called dashi, the base for many dishes and soups including miso soup. Chestnut mushrooms have a full flavor that is evoked with thorough cooking; we recommend you use its rich, nutty flavor as a compliment to autumn soups. Like namekos, chestnuts prefer to fruit during the cooler months. **Chestnuts have poisonous look alikes, be sure to properly identify them! Be familiar with the deadly *Galerina autumnalis*.**



### ***Difficulty: Beginner***

*Pleurotus spp.*, are the most vigorous mushrooms that we cultivate, readily outgrowing competitors and potential contaminants. These brightly colored mushrooms are pretty adaptable both in temperature and substrate preference. Meaty in texture and flavor, they're truly a culinary delight. For these reasons, oyster mushrooms are well suited for beginners looking to get their feet wet in outdoor mushroom growing. Grain spawn or sawdust spawn will work well here since oyster mushrooms grow so quickly. All the oyster varieties can be grown in outdoor beds including: blue, pink, golden, italian, black king, king trumpet, and snow. Try some different ones out!

Pink oyster mushrooms are a heat loving species (remember to never put the spawn in the fridge!) and should only be planted when average temperatures reach 50 degrees F. Take note that this species will die under 35 degrees F and therefore may not overwinter depending on your grow zone.

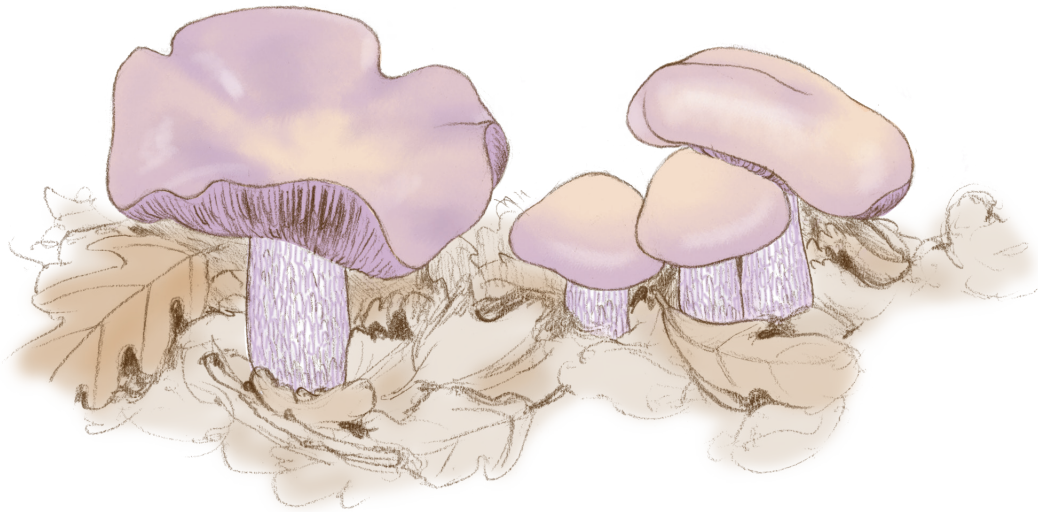
We've also successfully grown blue oyster mushrooms in our raised garden beds by sprinkling grain spawn directly on the beds in the spring. We had oysters growing right out of our soil within a few weeks! There's lots of room for experimentation with these techniques, so don't hesitate to try different things out!

***Recommended Substrates:*** *Straw, agricultural byproducts, hardwood chips*

Oysters prefer straw to denser woody substrates such as wood chips. You can soak your straw beforehand if you want, spray between the layers, or water it all in one go at the end. Feel free to use other agricultural byproducts here in place of straw - sometimes the best material is the one easiest to find!

**"PINK OYSTER MUSHROOMS ARE A HEAT LOVING SPECIES AND SHOULD ONLY BE PLANTED WHEN AVERAGE TEMPERATURES REACH 50 DEGREES F."**





**Difficulty: Intermediate**

*Clitocybe nuda* are less commonly cultivated than many other species of mushrooms in part because their yield can be a bit unpredictable. In their wild form, they push up from forest duff as temperatures start to dip below freezing, lilac beacons in a sea of brown. Their texture is silky and they make a great addition to soups, stews, or gumbos. Be careful to properly identify these mushrooms before consuming them though, as there are some poisonous purple mushrooms that can grow in similar habitats. Spore prints can be very helpful in distinguishing them from *Cortinarius* species of concern.

Depending on your conditions, the mycelium may be ready to fruit in 4-12 months. The ideal temperature range for this stage is between 40-70 degrees, and blewits need dips into below-freezing temperatures to cue mushroom formation. Often, this naturally happens in the fall after a full season of growing.

**“IN THEIR WILD FORM, THEY PUSH UP FROM FOREST DUFF AS TEMPERATURES START TO DIP BELOW FREEZING, LILAC BEACONS IN A SEA OF BROWN.”**

**Recommended Substrates:** *Partially composted yard waste such as hardwood leaves, grass clippings, twigs and tree bark. Composted mixtures of manure and straw or agricultural byproducts.*

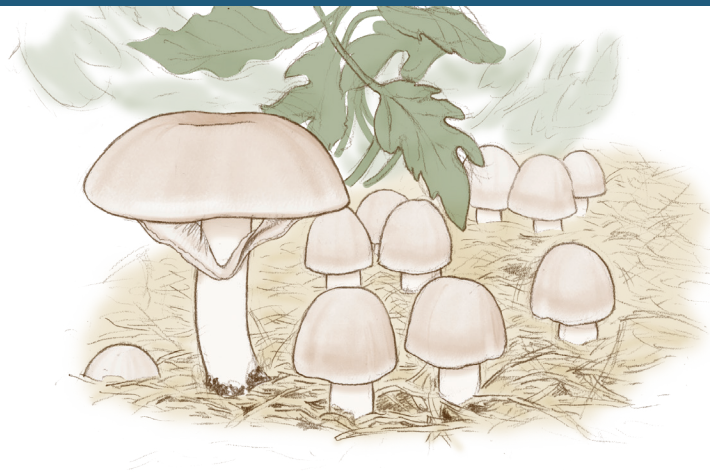
Similar to almond agaricus, they like a complex material to grow on. Consider making a blend of semi-composted manure, spent mushroom blocks, leaf litter, sawdust, kitchen scraps, grass clippings, cereal straws, and agricultural byproducts like bean hulls, corn stalks, etc.. Use materials that are abundant and accessible in your area and avoid anything that’s potentially been sprayed by chemicals.

## ALMOND AGARICUS

### **Difficulty: Intermediate**

*Agaricus blazei* mushrooms derive their name from their almond scent and are in the same family as white button, portabella, and crimini mushrooms. All of these mushrooms can be prepared and cooked in a similar fashion, though almond agaricus boasts the highest protein content of them all!

Generally, almonds are slower growing and need warmer temperatures than many species of mushrooms commonly cultivated. Avoid inoculating until temperatures are above 50 degrees consistently and remember to keep the grow well hydrated especially through the spawn run. For the primary phase of growing, or spawn run, the ideal temperature range is between 70-80 degrees and for fruiting, or mushroom formation, it's a bit hotter at 75-85 degrees. You can begin to look for a first fruiting approximately three months after inoculation depending on temperature. Since they like it toasty, we've seen them do well in greenhouses and high tunnels, where they can help with season extension and gas exchange with plants. This species will die under 35 degrees F and therefore it is unlikely that your almond agaricus crop will overwinter unless it is in a greenhouse. If you live in a warmer climate, and your bed is well-mulched in the fall, you are more likely to see growth again the following year.



**Recommended Substrates:** *Composted mixture of manure and straw, hardwood leaves or agricultural byproducts. A good quality manure based bagged compost.*

Much like their cousins in the agaricus family, almonds are secondary decomposers and need microbial communities to properly form mushrooms. So, they prefer substrates that are already partially broken down, ideally a complex versus basic mixture. We recommend using a blend of finished composted materials including: manure, hardwood leaves, cereal straws, and other agricultural by-products like corn stalks, bean hulls, etc. Sometimes mixing in a material with good water holding capacity, like coco coir or sphagnum moss, can help keep moisture levels high for good mycelium growth. This is especially useful for dry climates or in places where regular watering is difficult. Feel free to use materials that are abundant and accessible in your area. It's worth keeping in mind when sourcing materials that it's wise to avoid anything that's been sprayed by pesticides, herbicides, or fungicides. If you can find a good bagged garden compost, formulated from a mix of materials and rich in aged manure, that's also a solid option for growing!



**TIMING**

You can make edible mushroom beds anytime as long as you leave plenty of time for the fungi to establish itself before temperatures drop below freezing. Same year fruitings are more likely to occur if you inoculate earlier in the year than later. **Heat-loving species like pink oysters and almond agaricus should only be planted when average temperatures reach 50 degrees F.** Take note that these species will die under 35 degrees F and therefore may not overwinter depending on your grow zone.

**SITE SELECTION**

Mushrooms grow best in partial shade with little direct sun. Ideal locations may be at the edge of fields and woods, around the base of trees, in perennial gardens, or as part of the mulch in and around vegetable gardens, where plant foliage may provide some shade. Broadleaf crops in particular, such as cucurbits, make good companion plants.

**SITE PREPARATION**

Before you inoculate, you will want to prepare your space. Clear out any plants or debris until you get to bare ground, wine caps in particular like to be in contact with the soil. Some folks dig down a couple of inches so that when the bed is finished, it's level with the surrounding space. Grass or stubborn weeds growing on your site can be smothered by laying down some brown cardboard first. Keeping the cardboard in place is optional but can help in weed suppression. Saturate the cardboard before you begin to layer on substrate. You can also create a raised bed specifically for your mushrooms! Inoculated logs make a great border for a mushroom bed. Feel free to get creative with your bed shape!

**Straw Versus Hay**

It's important to use straw instead of hay because hay contains seed heads, nutrient-dense clusters ripe for contamination, and will sprout into weeds in your bed. Straw bales or bagged chopped straw can often be found at garden centers, agricultural supply stores, or even nearby farms.

**If you've gardened before, you may be familiar with the lasagna method for sheet mulching. This process is pretty similar - stacking layers of mushroom spawn and substrate - the material for it to grow on.**

1. Break up your grain or sawdust spawn.
2. Spread your substrate of choice over the soil or cardboard, about 1" deep.
3. Sprinkle the spawn on top, crumbling any big chunks up as you go.
4. Add a second layer of substrate about 2" thick.
5. Repeat until you've run out of spawn or reached your desired bed height (between 3-6" of substrate is adequate for most species but wine caps will benefit from a minimum of 6"). A layer of the substrate should be on top to protect the spawn from exposure to the elements.
6. Thoroughly water the bed & keep it moist while the fungi grow.
7. Optional: cover your substrate with 1-2" of straw to act as a mulch layer for moisture retention. Or, a tarp or other plastic sheeting can be used to prevent the bed from drying out. This is useful for straw beds or in especially hot or dry climates.



▲ Nameko mushrooms fruiting in a wood chip bed



## BUILDING YOUR BLEWIT BED

1. Break your spawn into medium-sized pieces about 1-2” around; they’ll regrow faster if the mycelium isn’t totally broken up.
2. Scatter pieces evenly across the bottom of your bed.
3. Spread your composted substrate of choice over the spawn, 2-3” deep. Smooth it out as you go to avoid any large air pockets. (Between layers, you can add torn-up dye-free cardboard and gently water to hydrate the materials.)
4. Scatter pieces of spawn evenly across the top.
5. Add a second layer of substrate 2-3” deep.
6. Repeat until you’ve run out of spawn or reached your desired bed height, between 6-10” deep.
7. Thoroughly water the bed & keep it moist while the mycelium grows.
8. Cover your substrate with 1-2” of mulch to help keep moisture in and protect the mycelium from direct exposure to sunlight. Feel free to use straw, hardwood leaves, or wood chips. Or, a tarp or other plastic sheeting can be used to prevent the bed from drying out.
9. Optional: Casing your bed. If your bed is fully myceliated (you can gently brush some compost aside and should see white strands of mycelium running through your compost bed) and temperatures and humidity are right and primordia still haven’t formed, it can be helpful to add a casing layer. This step can help give the mycelium the extra push to fruit by creating a microclimate at the surface of the substrate and introducing beneficial microbes into the mix. The base material of your casing layer should be a neutral substrate like potting soil, coco coir, or sphagnum moss. Hydrate it to field capacity and adjust the pH to about 7 by adding garden lime as needed. Finish it off by introducing a handful of your native soil which should be rich with microbes. When you’re done, spread about 1-2” of the casing material on top of your container or bed, smoothing it out so there are no air pockets.
10. Water the casing layer and keep an eye out for mushroom pins!

## BUILDING YOUR ALMOND AGARICUS BED

### **DO NOT REFRIGERATE YOUR ALMOND AGARICUS SPAWN!**

1. Spread your composted substrate of choice over the site you have prepared, 4-8” deep. (More substrate will provide food for a longer period of time, but will likely take longer before fruiting.)
2. Break the almond agaricus spawn into medium-sized chunks, about 2” around.
3. Bury the pieces a couple of inches from the surface, evenly spaced about 4-6” apart. The depth can vary a bit with some pieces deeper than others.
4. Thoroughly water the bed & keep it moist while the mycelium grows.
5. Optional: Cover your substrate with 1-2” of mulch to help keep moisture in and protect the mycelium from direct exposure to sunlight. Feel free to use straw, hardwood leaves, or wood chips. Or, a tarp or other plastic sheeting can be used to prevent the bed from drying out. This is useful in especially hot or dry climates.
6. Optional: Casing your bed. If your bed is fully myceliated (you can gently brush some compost aside and should see white strands of mycelium running through your compost bed) and temperatures and humidity are right and primordia still haven’t formed, it can be helpful to add a casing layer. This step can help give the mycelium the extra push to fruit by creating a microclimate at the surface of the substrate and introducing beneficial microbes into the mix. The base material of your casing layer should be a neutral substrate like potting soil, coco coir, or sphagnum moss. Hydrate it to field capacity and adjust the pH to about 7 by adding garden lime as needed. Finish it off by introducing a handful of your native soil which should be rich with microbes. When you’re done, spread about 1-2” of the casing material on top of your container or bed, smoothing it out so there are no air pockets.
7. Water the casing layer and keep an eye out for mushroom pins!

**THE FIRST FEW WEEKS**

Don't let your mushroom bed dry out! This is critical in the first few weeks, while the mycelium spreads through your bed. Fungi need a pretty moist environment to grow but there is a balance to strive for. If your bed is too water-logged, it'll create an anaerobic environment where bacteria will flourish. Water your bed as much as you'd water a vegetable garden.

If you find your bed is drying out quickly between waterings you can cover your substrate with 1-2" of straw to act as a mulch layer for moisture retention. Or, a tarp or other plastic sheeting can be used to prevent the bed from drying out. This is useful for straw beds or in especially hot or dry climates.

**LONG TERM CARE**

Once established, mushroom beds require little maintenance outside of occasional watering during droughts. You can check on your bed every week or so to monitor moisture levels and how well the mycelium is growing. Once the mycelium has completely grown through the chips, you may notice tiny mushrooms, or pins, forming. If you've covered your bed with a tarp or plastic, that's a cue to remove it so mushrooms can form. This process can take anywhere between four weeks to several months after inoculation, depending on the species, your climate, the substrate, and how heavily you spawned the bed.

Fresh substrate can be added each year to maintain the health of the bed, and give it some extra food to eat.

**BEFORE WINTER COMES**

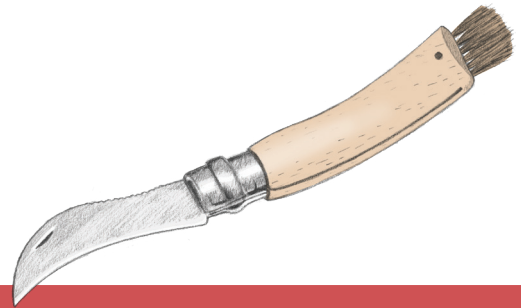
In climates with snowy winters we recommend adding an insulating layer of substrate in the late fall. You can cover your bed with any number of insulating materials such as wood chips, straw and leaves. In the spring rake away most of the insulating layer leaving some in place for moisture retention. If you use a substrate that your species of mushroom can feed off of you will also be providing it with extra food for when the mycelium wakes up in the spring!

Pink oysters and almond agaricus are considered annuals in areas with snowy winters as they will not overwinter outside, even if their beds are well insulated.

**BEFORE YOU EAT ANY MUSHROOMS, IT'S EXTREMELY IMPORTANT THAT YOU PROPERLY IDENTIFY THEM. IT'S POSSIBLE FOR OTHER NATIVE FUNGI TO SPROUT FROM YOUR BED AND SOME SPECIES HAVE POISONOUS LOOK ALIKES, SO YOU NEED TO BE SURE OF WHAT YOU'RE EATING.**

We recommend using more than one method of ID. For example a book with a dichotomous key such as *Mushrooms Demystified* by David Arora as well as the help of a seasoned forager or a forum on social media to help you confirm your find. Spore prints can go a long way in helping you differentiate one species from another.

If you're 100% positive of the ID, great! Harvest your mushrooms a little before their caps flatten out. That's usually before they release their spores, which can affect the mushroom's flavor. Use a sharp knife or scissors to cut them, or reaching under the cap, twist the mushroom to free it from its mycelial anchor. Enjoy the bounty of your mushroom beds! Share with us what you've grown!



**NORTH SPORE OFFERS A MUSHROOM HARVESTING AND FORAGING KNIFE FROM FRENCH KNIFE MAKER OPINEL. SHARP, RELIABLE AND LIGHT-WEIGHT WITH A BRUSH ON THE BOTTOM OF THE HANDLE THAT MAKES CLEANING MUSHROOMS IN THE FIELD OR LOG YARD A BREEZE.**

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