

# Effect of compost on white button mushrooms



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### General Mushroom Information and Life Cycle

A mushroom's scientific name is *Agaricus campestris*. Mushrooms have been known for thousands of years as a food, medicine, and even to create "spiritual visions" (i. e. "magic mushrooms") This mysterious organism, often thrown into the same category as plants, is actually another species altogether. An entire underground world remains unseen to the human eye, yet has the unbelievable power to change the world, one ecosystem at a time.

Mushroom production begins in spores or "seeds," (not the technical term,) are released from the gills of the mushroom underneath the cap. However, the mushrooms visible above ground are not the whole fungi; they are merely the fruiting bodies of an underground organism called fungi mycelium. Similar to vegetables like corn or potatoes, these fruiting bodies "fruit" slowly. When mushrooms fruit under the right conditions at the most beneficial site, they will produce there year after year.

"It's the reverse of photosynthesis. Mushrooms take in carbon and consume oxygen, while plants consume carbon dioxide, and create carbon and oxygen." (Paul Stamets, founder of Fungi of Olympia, Wash. and author of six books on mushroom culture) Due to mushroom's many benefits, this fungi is the only one humans cultivate intentionally. It is important to not assume a mushroom is healthy to consume from the wild, because many mushrooms are poisonous and it is difficult to tell poisonous types from others. When

they are safe to eat, mushrooms play a huge role in keeping the human immune system healthy.

Mushrooms are a simple addition to any household and require little work to produce a large quantity of a delicious ingredient for dinnertime. The major components to control while growing mushrooms at home are humidity and temperature. They thrive when the temperature starts at a humid 70° while the mycelium grows, then stays humid and around 55° and 60° F. Loose or bottled spawn or ready-to-go mushroom kits can be purchased from catalog companies to simplify and quicken the at home growth process. They come infused with the required nutrients and soil in a box, simply instructing the user to keep the topsoil moisturized and to store the box in a humid section

Companies that produce huge amounts of mushrooms use marker assisted selection, an improved type of selection paired alongside classical mushroom breeding techniques. Other methods of increasing mycelium fungi production are being explored and implemented to modify and transform series of mushroom strains. Genetic transformation allows possibilities of genetic integration from efficient DNA traits of other strains or species to express themselves in one quality product.

### Mycelium

Mycelium are thin, white, thread-like “ roots” of fungi that must develop fully before any fruiting bodies become visible aboveground. Mycelia communicate signals from plant to plant. For example, it might send a chemical signal that a tree is sick that causes other trees nearby to build up their immune systems and avoid the same sickness.

The largest known organism in the world is a 2,400 acre mycelium growth in Oregon, US. It is not unusual for a mycelium organism to stretch for miles under forests. Mushrooms are not the only ones with mycelium. In fact, most fungi grow with mycelium. Common household fungal systems recognizable to most are easily visible mycelia that provide an example for mushroom's underground mycelium. Mycelia grows faster where there are less nutrients to search for a site rich in food. It grows slowly where its food is abundant so that it can extract the materials needed to stay alive.

The explanation for mushrooms growing in "fairy rings" lies with mycelia. It grows in a donut ring shape, rather than a pie shaped, leaving an area drained of supplies to branch outward into new regions. "... mushroom mycelium is hungry. It wants to run." (Paul Stamets)

The organism expands as spores germinate and produce hypha (aka, germ tube), which are similar to branches of a tree, except they are microscopic and grow outwards from other hypha. Hypha increase in growth only lengthwise – the width stays around one one-hundredths of a millimetre around. They cross-connect, intertwining, which helps transport nutrients to where they need to be. Lots of hyphae grow in bundles, or mycelial cords and each species of fungi has a different type of branching pattern.

In order to produce fertile mycelium, a network of cells with two nuclei fused in the cell and two spore mating types each are required. Meiosis of these non-sister cells produces a heterokaryotic mycelia. Single spore cultures can also produce mushrooms as long as one single spore "seed" has two mating types.

In the big picture, mycelium restores the environment and neutralizes toxins with its natural digestion of nutrients. Some mushroom's mycelia can digest recalcitrant bonds (bonds that are resistant to the breakdown of a substance into smaller, less toxic molecular bonds.) They can separate bonds in human-produced pollutants to keep the entire ecosystem thriving. Mycelia is able to transform polycyclic aromatic hydrocarbons from oil wastes or coal tar into food for itself. All types of fungi do this by releasing enzymes into the soil or surrounding area to break down polymers and absorb simple sugars from the waste into their hyphal walls.

### Mushrooms Breakdown Toxic Materials

The discovery of mushrooms' distinct ability to break down harmful toxins and pollutants has and will continue to benefit the environment. The fact that humans can play a huge role in creating a healthier ecosystem by treating toxics with mycelium has almost unlimited benefits. In 2003, the gas stations "Chevron" and "Texaco" were reported by over thirty-thousand angry Ecuadorians to dump eighteen and a half billion gallons of toxic waste into pits in Ecuador. This damaging act of spillage resulted in the flow of harmful poison into residents water systems, and injuring the environment in more ways than one.

Research projects have been conducted on many sites to conclude how the disintegration of toxins is not unlike that of other materials. Fungi secrete enzymes that break down toxins in the same way they split wood and straw's chemical bonds. In one project, two piles of toxic soils near an oil pit were treated with different substances. After a year, the soil with mycelium

and substrate had invited worms and bugs to help restore the soil. There were no signs of crude, and the toxins had been completely neutralized. The pile that had not been treated with mycelium fungi was still very toxic, and had a crude odor and felt oily to the touch. This mycelium method proves effective on large scale oil spills from companies, and is a cheaper, more ideal answer to fuel wastes in backyards or farms.

The conversion of waste to mushroom development, or mycoremediation, causes hundreds of environmental and community improvements to open up. Food is provided, jobs are created, family incomes are enhanced, the burning of waste is cut back. This helps lower air pollution, lessen forest fire danger, manage environmental cleanup, protect the mushrooms, and create opportunities to effectuate mushroom substrate for compost and bioremediation. Paul Stamets meant when he said, "Fungi govern the decomposition cycles, and make it possible for natural biological systems to operate. They are tremendous allies for the health of people and the planet."

Another huge use for fungi is to turn mushrooms themselves into a substrate for other plants. Mushroom substrates replenish humus and organic matter by cutting carbohydrates in the soil in half in as short a period as one week. Mushroom compost farms are helpful for the plant the mushroom substrate will be treating. It also helps in creating an outlet for the waste disposal of the materials put inside this nutritious plant formula.

More productive composts are being searched for to mix substances in a substrate to support plant growth, eliminate toxins, and keep fungi surviving.

### The White Button Mushroom

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In the United States as of 2010, 90 percent of mushrooms consumed were white button mushrooms. They are simple to grow at home, and provide several important health benefits to the human body. White button mushroom, *Agaricus bisporus*, are valuable medicinally, but are mostly known as “portobello” and used as a soup ingredient, pizza topping, or other consumption delectable.

A study on an animal-model and cell-structure experiment at Jean Mayer USDA Human Nutrition Research Center at Tufts University concluded that white button mushrooms support natural killer cells. The researchers found that these particular mushrooms produce many antiviral proteins and other helpful enzymes that can repair or protect tissue. They also found that white button mushrooms dendritic (transport functioning) cells to mature from bone marrow. The dendritic cells synthesize T cells, which are white blood cells that recognize other foreign materials and transport the materials from the pathogens to defense system cells. Here, the immune system cells are activated by an enzyme and begin defending against pathogens.

This defense function will, when successful, defend against diseases like the La France disease that attacks white button mushrooms, and sneak-attacks the mycelium without any surfacely visible symptoms.

### Ideal Growth Mediums for Mushrooms

New and improved cultivation techniques and the improvement of composting have been able to increase the available cultivation area of mushrooms. As more and more mushroom farms experiment, each type of mushroom’s food has been discovered and brought to its greatest potential

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as a nutrient. The best types of nutrients required for mushroom growth include many of the same things plants, animals, and humans need as fuel like sugars, starches, cellulose, lignan, and nitrogen.

To prepare mushroom spawn before it starts to grow mycelia, grain or non-waste plants are excellent sources. Straw, sawdust, and other mixtures in a compost make good alternatives, though. A diet of horse manure and straw mixed in with the soil site for growth provides the exact nutrients mushrooms need. This method is proved to work best if the compost is first turned three or four times for a week before it is used.

Another compost method involves corncobs, straw, water, leaf mold, tankage, granite dust, rotted compost, and sand combined into a multi-ingredient compost for mushroom growth. These organic materials all work perfectly, and mostly every natural material that would be found rotting into the ground is useful to provide necessary nutrients. Chopped hay, chicken, bullocks, and horse manure, cereal straw, elephant grass, or sawdust will also provide enough nurture for the organism.

Fermented horse manure and chopped tobacco stems are the fastest growing substrate for *Agaricus bisporus* spawn.

Over one hundred fifty types of waste have been tested to grow mushrooms. Depending on the type of fungi, obviously different types of compost will create more health and growth opportunities, but mushrooms will only survive where their conditions for life are met.