

**Quick Facts**

Mushrooms are an edible fungi generally considered a gourmet culinary item.

Horse manure is the basic growing media component although effective substitutes are available.

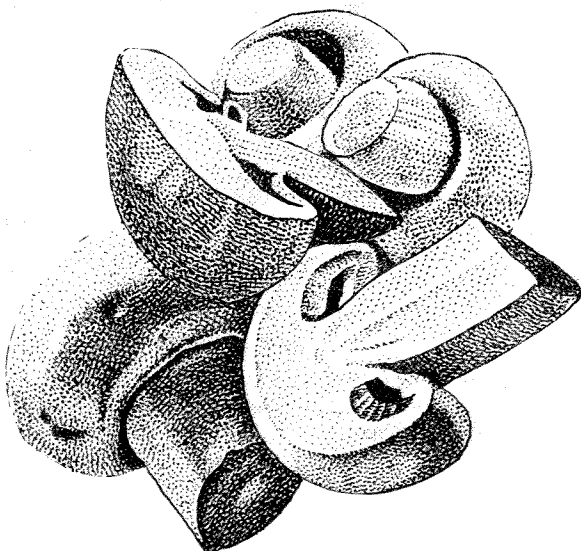
Composting and pasteurization of the growing media ingredients are necessary before they can be used to produce mushrooms.

Spawn is the mycelia that is planted to produce the mushrooms; it is produced by commercial mushroom laboratories.

Casing refers to the application of pasteurized soil over the beds after the spawn has covered the bed with mycelia.

The first mushrooms may be harvested five weeks after the spawn is planted.

A critical mass of 1 ton (907 kilograms) of compost ingredients is necessary to develop the temperatures needed to grow mushrooms.



Mushrooms (*Agaricus bisporus*) are fleshy, edible fungi that generally are considered a gourmet culinary item. Mushrooms are grown

from mycelia called "spawn" that usually is purchased. This spawn is used to inoculate prepared beds on which the mushrooms are grown.

Growing Factors

Horse manure is the primary compost ingredient used for growing mushrooms. However, compost mixes requiring no horse manure have been formulated. An example of each is given in Table 1. In either case, the ingredients are layered in long piles according to the formula being used. The pile is then watered, applying as much water as the pile will hold without run off. The pile is then turned with a shredding machine. The next day it is again watered and turned. Two days later the pile is again turned without any additional water and in two more days it is again turned as it is being moved into growing beds.

The beds are located in the growing house and hold 9 inches (23 centimeters) of compost. Some water may be added as the beds are filled. Live steam is then introduced into the house to bring the house temperature to 120°F (49°C) for six hours. During this time the compost temperature will climb to 125°F (52°C). The steam is turned off and the air temperature gradually falls back to 100°F (38°C), while the compost temperature continues to rise to 130°F (54°C) where it remains for three days before beginning to drop. Should the temperature rise to 140°F (60°C), the beds should be watered again.

Steam is then reintroduced to bring the temperature of the compost to 140°F (60°C) for five hours. The compost temperature is then dropped 5°F (-15°C) per day over the next three days by careful ventilation. During this time ammonia is readily converted to nitrates. When there is no longer any smell of ammonia, the compost temperature may be lowered to 75°F (24°C) and inoculated with spawn.

Spawn is the cottony fibers produced by mushroom spores after they germinate. It usually is purchased from laboratories that specialize in culturing spawn. The purchased spawn is broken

^{1/}Jim Ells, CSU extension associate professor, horticulture (4/1/81)

up and distributed over the top of the pasteurized beds and worked into the surface. The temperature is maintained at 70°F (21°C) the first week after spawning and then lowered to 65°F (18°C). The bed moisture should not drop below 65 percent and the house should receive some ventilation.

After two weeks the cottony growth of mushroom spawn will have permeated throughout most of the bed. At this point the beds are "cased" by applying an inch (2.5 cm) of pasteurized loam over the beds. The loam should resemble that of a good garden soil and be heated to 180°F (82°C) for 30 minutes to effect pasteurization.

For the next two weeks the beds are kept at 55°-60°F (13°-18°C) and watered lightly to maintain bed moisture. Near the end of this period, flushes of mushrooms should appear. These flushes are harvested 4 to 7 days after they appear. The harvest period lasts for two months if the temperature is maintained at 65°F (18°C) and three months at 55°F (13°C).

Ventilation is important to keep the gasses (ethylene, acetaldehyde, acetone, ethyl alcohol, ethyl acetate and CO₂ that are produced at safe levels. CO₂ will produce spindly stems at a concentration of 1 percent.

Light is not necessary for mushroom production and therefore is excluded. Its presence would encourage the growth of green plants and make it more difficult to maintain uniform temperatures, bed moisture and humidity.

Disease Control

Should disease appear, the affected area should be isolated by cutting a trench around it. The temperature should be lowered to 55°F (13°C) and ventilation should be increased. The infected area then should be drenched with a 1:19 Formalin:water solution that will sterilize the area, killing the mushrooms. This is preferable to trying to remove the contaminated compost.

Benlate is the only registered pesticide for use on mushrooms. It is labeled for the control of verticillium spot (dry bubble) and should be used if this disease occurs.

Diazinon may be used as an insecticide in the mushroom house prior to spawning, but no insecticide is registered for use on mushrooms.

The paucity of registered pesticides for mushrooms, makes apparent the need for compost pasteurization and sanitation.

Harvest

Mushrooms are picked just before the veil breaks exposing the gills. At this point the cap should be 1-3 inches (3-8 cm) in diameter. The mushrooms are picked with a twisting motion and removed with as little damage to the bed as possible. For fresh market the stems are trimmed to remove the rhizomorph hair "roots." At 90 percent relative humidity and 32°F (0°C), mushrooms will store for one week.

A critical mass of about 1 ton (907 kilograms) of material is necessary to generate the temperatures described. When operating on a smaller scale it takes longer to arrive at a good compost.

Home Production

Home production is possible on a small scale by making compost, pasteurizing it as described and inoculating it with spawn. The spawn may be purchased from: Burpee Seed Co., Warminster, Penn. 18991, Henry Field Seed and Nursery Co., Chenandoah, Iowa 51601; R. H. Shumway, Rockford, Ill. 61101; and perhaps other seed outlets. Much work can be avoided if the home gardener can purchase compost already pasteurized, spawned and cased from a commercial mushroom producer.

Table 1: Compost formulations for growing mushrooms¹

Ingredient	Fresh weight (lb)*	Dry weight (lb)*	Percent N	Pounds N*
Horse Manure Mix				
Horse manure	1755	1097	1.2	13.2
Chicken manure	164	131	4.0	5.2
Brewers grain	55	55	4.0	2.2
Gypsum	26	26	0.0	0.0
	2000	1309		20.6
20.6 ÷ 1309 = 1.57% N				
Synthetic Mix				
Legume hay	857	731	2.0	14.6
Corn cobs	857	731	.3	2.2
Chicken manure	218	138	4.0	5.5
NH ₄ NO ₃	17	17	32.0	5.4
KCL	17	17	0.0	0.0
Gypsum	34	34	0.0	0.0
	2000	1668		27.7
27.7 ÷ 1668 = 1.66% N				

¹Formulations developed by Penn State University.

*To convert to metrics use the following conversion:
1 pound = .45 kilogram.