

Glossary of Commonly Used Terms for Mushroom Farming

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Note: Definitions are non-technical and are only intended as an aid to those people new to mushroom farming. The terms are listed alphabetically.

AEROBIC FERMENTATION: The process whereby a material requires available oxygen to maintain reproduction of microorganisms.

AGARICUS BISPORUS: Common cultivated mushrooms, in a variety of lines.

AMMONIA: Necessary by-product of Phase I produced during the fermentation and decomposition processes. Should be converted to microbial protein and eliminated during Phase II composting. Free ammonia at the end of Phase II composting is toxic to the mushroom mycelium.

ANAEROBIC FERMENTATION: The reverse of aerobic or otherwise the lack of oxygen during fermentation - undesirable.

BIOLOGICAL EFFICIENCY (BE): One way to express the productivity of a substrate. BE = lbs of fresh weight of mushrooms/ lbs of dry weight of substrate at spawning time. The range of BE for a commercial farm varies between 60-120%.

BLENDED COMPOST: A mixture of wheat straw bedded horse manure and other materials such as hay, wheat straw, corn cobs, cotton seed hulls, etc. in several formulations, i.e., 80% H.M., 20% hay and cobs, etc

BREAK: See Crop, Cropping Cycle.

BREWERS GRAIN: Grain hulls, residue from breweries, having a nitrogen content of 4.0 to 4.3%.

BUTTONS: Marketable mushrooms, but not mature.

CARBON DIOXIDE (CO₂): A by-product of the microorganisms during fermentation in both Phase I and II. It is also a very important by-product of spawn run, casing and later in production.

CASING: The casing operation is the fourth step in mushroom farming and is a top-dressing placed directly on spawn-run compost from 14 to 21 days after the spawning operation.

CASING LAYER: The top-dressing is required to induce the fruiting of the mushroom mycelium. Peat moss with limestone is main casing material used world wide. Spent mushroom substrate and loam top-soil can also be used.

CASING INOCULUM (CI): Low nutrient materials like vermiculite, peat or spent mushroom substrate that is sterilized and then it is fully colonized with mushroom mycelium. This material is then added to the casing layer to speed up the colonization of the casing layer and shorten the time to harvesting. Fully colonized spawn run compost may also be used but must be free of all molds or potential pathogens. Adding this compost at casing (CAC) is not as commonly used as CI.

COLONIZE: The process of the thread-like strands of growth, called mycelium, that develop in the compost after having grain spawn applied.

COMPETITOR MOLDS: Any of a variety of molds, when present in the compost or casing, which compete for nutrients, inhibits or destroys mushroom mycelium.

COMPOSTED SUBSTRATE (COMPOST): A mixture of organic and inorganic substances, managed specifically to produce nutrients (food) selectively, favorable to the growing of the common cultivated mushroom.

COMPOST TURNER: A machine specially designed to manipulate the raw materials (compost) in Phase I into a homogenous rick or pile.

COOKOUT: See Pasteurization.

CROPPING, CROPPING CYCLE: The sixth step in mushroom fanning begins 16-20 days following casing when the first mushrooms are harvested. Mushrooms are generally harvested (picked) for 3 to 5 days, followed by several days when no mature mushrooms are present. The period between harvesting is used for watering the casing layer. This cycle is repeated in a rhythmic fashion for the duration of the crop and is also called a break or flush.

CULTIVAR: See Line.

DOUBLE: The term used to indicate a standard mushroom-growing house, usually but not necessarily having 8,000 square feet of surface growing area.

DRY -MATTER (expressed in percent): Pertains to the amount of compost sample remaining after having been dried in an oven at 100°C for a 24-hour period. Precise weighing and handling is required to assure accurate data.

FILLING: The moving of compost from Phase I into containers or a structure to undergo Phase II composting

FIRST BREAK: The time when the first mushrooms of each crop are harvested, usually

16-20 days following casing.

FLUSH: See Crop, Cropping Cycle.

FLUSHING: Another important step required to promote the development of mushroom initials. Fresh air is introduced to reduce the level of carbon dioxide produced by mushroom mycelium. Temperature and relative humidity is also adjusted to move or hold back pin development.

FRIABLE: The physical structure and condition of loam top-soil, i.e., crumbly.

FRUITING: See Pinning.

FUNGI: Plant life lacking chlorophyll and therefore lacking the capacity to produce or convert chemicals into complex life substances.

GYPSUM, AGRICULTURAL: A naturally occurring mineral consisting of calcium sulfate. It is used in Phase I composting to prevent greasiness.

HOMOGENOUS MIX: The thorough and complete mixing of all materials used.

HORSE MANURE: One of the basic bulk materials used mushroom growers for substrate preparation. Wheat-straw bedding, containing very little hay, wood shavings, sawdust, or other foreign bedding materials is used. Horse manure bedded on non-fibrous material is not usable as a bulk ingredient.

HYPHAE: Single strands of mushroom mycelium.

INOCULATE: See Spawning.

ISOLATE: A product of a tissue, multi-spore or single spore culture maintained on a nutrient medium.

LINE: A mushroom isolate maintained over time.

MESOPHILIC: The first microorganisms to become active in Phase I compost and as they grow and multiply causing temperatures to increase rapidly. These initial mesophilic organisms are incapable of growth at temperatures exceeding 45°C (112°F).

MICROORGANISMS: The smallest form of living organisms (or animal life) found in most raw materials and can only be seen by use of a microscope.

MOISTURE: In mushroom growing, refers to a certain amount of water diffused in the compost, casing layer, etc. Moisture is one of the most important, measurable elements to be monitored during the entire mushroom growing process.

MUSHROOM: Fruit body of the mycelium at the surface of the casing layer. Sporophore is another term for mushroom fruiting body.

MUSHROOM CAP: The very top portion of the mushroom, sitting (attached) on top of the stipe (stem). The cap is the only part of the mushroom that may have a different color as related to the 'line' being grown.

MUSHROOM INITIALS, PINS, PINHEADS, OR PRIMORDIA: mushrooms, 1/8 to 1/4 inch in diameter. The first formation of the mushroom fruiting body and describes the different developmental stages of the mushroom.

MUSHROOM MYCELIUM: The white or grayish white, thread-like growth that develops after spawning. It is the conduit through which the mushroom gets its nourishment from the compost.

NITROGEN: An important and measurable element of substrate. Results on a dry weight basis are used by growers to monitor supplementation during Phase I substrate preparation and at spawning for efficiency of Phase II composting.

NUTRIENTS: Those ingredients added at the beginning of Phase I composting that are directed at feeding the microbial population. Nutrients added at spawning are directed toward actual consumption by the mushroom itself.

PASTEURIZATION: The act of freeing the compost of undesirable microbes, like fecal coli forms, nematodes, and insects, during Phase II composting. This step in composting is performed under controlled environmental conditions at lower temperatures than Phase I composting.

PEAT, SPHAGNUM: A decomposed material fanned from sphagnum moss, considered a superior casing material.

PEAK HEAT: See Pasteurization.

PESTS, MUSHROOM: All unwanted organisms which interfere with mushroom production, that by infestations, compete for nutrients needed by the mushroom, or directly attack the mycelia strands or the mushroom itself. Example pests are nematodes, mushroom flies, virus diseases, mummy, fungal pathogens, competitor molds.

PHASE I COMPOSTING: The first step of six steps involved in mushroom farming. This first step is to create compost with sufficient nutrients to grow mushrooms and at the same time, provide little or no nutrition for other fungi or competitor organisms. This process involves much higher temperatures than those required in Phase II composting.

PHASE II COMPOSTING: The second step in mushroom farming, after Phase I composting is complete and the compost has been filled into containers or into a structure. Phase II composting has two main purposes: formal conditioning of compost so

it becomes mushroom specific (absence of ammonia and readily available carbohydrates) and pasteurization. This step is performed under controlled environmental conditions and at much lower temperatures than Phase I composting. See Pasteurization.

PINNING: The fifth step in mushroom farming and is initiated when rhizomorphs form in the casing and then emerge at the surface of the casing. There are two important steps involved in causing the mycelium to go from the vegetative stage to the fruiting stage. The two steps are to lower the air temperature approximately 10°F and introduction of outside fresh air to purge the CO₂ from the surface of the casing. At the time of pinning, a final watering is sometimes added to protect against drying out of the casing layer due to the introduction of fresh air.

PINS: See Mushroom Initials.

POULTRY MANURE: Phase I compost supplement used in two forms, i.e., mechanically dried & pulverized or raw, uncured. In either form it is used as a source of nitrogen at the beginning of Phase I composting. Nitrogen content varies but should be approximately 4%.

PRE-WET TURNER: A machine specially designed to manipulate the raw materials (compost) in Phase I into a homogenous material, usually in a windrow not rick

PRIMORDIA: See Mushroom Initials.

PRODUCTION CYCLE: The total time of mushroom growing beginning with build through to steam-off and clean-out

RECIPE, COMPOST: Proven-formulations for the use of various raw materials used to produce compost favorable to the growing of the common cultivated mushroom.

RELATIVE HUMIDITY (RH): The ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature. Various methods of measuring RH is available but the sling type apparatus or wet-bulb, dry-bulb is the most used.

RHIZOMORPHS: The visibly thick strands or cord of compacted mycelia which is the stage between the mycelium and mushrooms. Mushrooms actually form from rhizomorphs.

RICK (WINDROW, PILE): Phase I composting term for the windrow of homogenous mix of raw materials used to produce mushroom compost. The rick has straight and tight sides and looks like a loaf of bread.

RHYTHM: Refers to the cycles that develop after the first mushrooms are harvested.

ROSE FACE: A specially handcrafted and drilled device used for applying water to the

casing layer from the day of casing and throughout the cropping period. Rose faces come in various sizes, hole sizes, that are selected by each mushroom farmer according to his needs or experience with his particular casing material.

SCRATCHING: Not a recommended practice, however, it is performed by loosening the casing layer by home-made devices, usually a narrow board with nails driven through it. Scratching is normally done to a depth just short of where the growth of mycelium is observed. The reasons mushroom farmers perform this extra step varies, however, sealing is the normal cause.

SEALED: An undesirable condition of the casing layer produced by too much water applied at one time to a particular area, or with too much force. This condition exists when particles of the casing soil re-align themselves in a pattern that drastically reduces the surface pore space. Very few, if any, mushrooms are found on a sealed casing layer.

SPAWN: Rye, wheat, millet, or sorghum grain cooked with water and chalk, then sterilized. Mycelium is added and allowed to grow for 10-17 days. At this time the mycelium will have completely colonized the grain and is called spawn.

SPAWNING OPERATION: Another step in mushroom farming, which is the placement of a spawn into compost prepared in Phase I and Phase II composting. By whatever method chosen or available, the importance of cleanliness, applying and mixing thoroughly cannot be over emphasized.

SPAWNING RATE: Amount of spawn per square foot or, by weight, placed into the compost immediately after Phase II composting. Rates vary among mushroom farmers and can be as low as 1 unit (less than a quart) per 10 ft² of surface area, to as great a rate as 1 unit per 5 ft². The actual rate used will be determined by experimentation with the system each mushroom farmer has in his care.

SPAWN RUN: The time between spawning and casing, during which the mycelium fully colonizes (grows through) the mushroom compost.

SPENT MUSHROOM SUBSTRATE: Substrate is removed from each house after it has been steamed off (sometimes called 'cooked-out' or 'post crop steaming'). It is usually 'aged' by spreading it on vacant fields, allowing it to be weathered for about 2 1/2 years before being reused as compost casing.

SPORES: Mushroom spores are produced on the gills of the cap of the mushroom. They are microscopic spheres roughly comparable to seeds of higher plant life. Spores are ~ used to spawn mushroom compost.

SPOROPHORE: See Mushroom.

SQUARE FEET: The unit of measurement used in most calculations or determinations in mushroom culture. It is a reference to surface area (length times the width) which is

used from the inception of building a new mushroom farm, to how much pesticide to apply, to how a crop is yielding, i.e., pounds of mushrooms picked per square foot of surface area.

STERILIZE: In mushroom farming, all equipment, such as utensils, knives, etc., that will come in contact with the mushroom or substrate after Phase II, must be sterilized to clean and free it from harmful pathogens. Note: Compost is not sterilized in Phase II.

SUPPLEMENTS: In Phase I composting: standard supplements include dried or raw poultry manure, brewer's grain, cottonseed meal, agriculture gypsum, cottonseed hulls, crushed corn cobs, cocoa shells and possibly others, depending on the recipe. See Nutrients. After Phase II, supplements include cracked soybean, corn by-products that are treated to delay the release of the nutrients so that they are available to the slower growing mushroom mycelium and not available to the faster growing weed molds.

SYNTHETIC COMPOST: Compost made with bulk ingredients other than horse manure. Various recipes are used where straw, hay, are supplemented with supplements like crushed corn cobs, cottonseed hulls, poultry manure and sometimes are inorganic forms of nitrogen (e.g. urea, ammonium nitrate) are used.

THERMOCOUPLE: A special temperature sensing device, consisting of two dissimilar metals, manufactured in a stainless steel sheath. These devices require special electronic equipment to accurately read whatever medium they are placed in. Thermocouples are normally used in Phase I, Phase II or Phase III as well as any place where remote reading of temperatures are necessary or advantageous throughout the cropping cycle.

THERMOPHILES: These are heat loving organisms that survive and multiply in temperatures up to 150°F. See Microorganisms.

TURNING: Occurs during Phase I composting and after building a rick or in a bunker. It means to tear apart the rick, mixing the colder outside with the hotter inside compost, while adding supplements or water or neither, depending on each composter's regimen.

VEGETATIVE: The growth of mycelium from spawning through to pinning. In order to cause fruiting (form mushroom initials), all vegetative growth must cease. See Pinning.

VENTILATE: Introduction of outside fresh air during Phase II composting, the fruiting or pinning process and throughout the cropping cycle.

YIELD: The pounds of mushrooms harvested per square foot. Mushroom growers manage and make economic and cultural decisions based on variations yield.