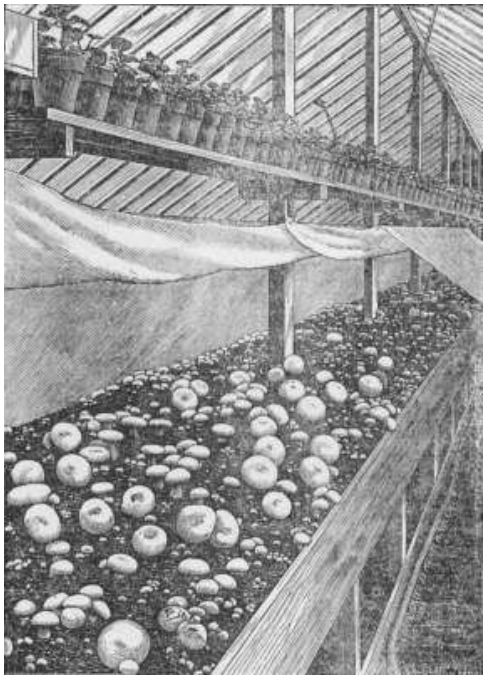
Old Time Mushroom Growing Methods

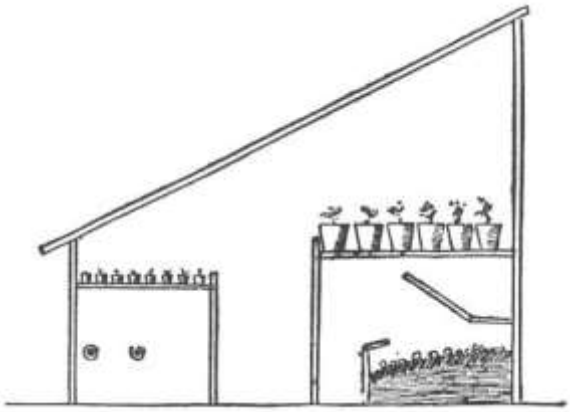
This book is a simple guide to methods that were being used over 100 years ago to grow mushrooms. These techniques still work and offer value to modern growers. Some methods in fact have hardly changed in the last 100 years.

It includes text from a published work on Mushroom Growing from many years ago that is now in the public domain. We are providing here for reference, and support of your own growing methods.



GROWING MUSHROOMS IN SHEDS

Anyone who has a snug, warm shed, may have a good mushroom house, but it is imperative that the floor should be dry, and the roof water-tight. Of course a close shed, as a tool-house or a carriage-house, is better than an open shed, but even a shed that is open on the south side, if closely walled on the other sides, can also be made of good use for mushroom beds. While open sheds are good enough for beds that yield their crop before Christmas, they are ill-adapted for midwinter beds. The temperature of the interior of a mushroom bed should be about 60° during the bearing period, and the temperature of the surface of the bed 45° to 50° at least; if lower than that the mycelium has a tendency to rest, and the crop stagnates. Now this temperature cannot be maintained in an open shed, in hard frosty weather, without more trouble than the crop is worth. The beds would have to be boxed up and mulched very heavily. And even in a close, warm shed, protection in this way would have to be given, but the bed should not be under the penetrating influence of piercing winds and draughts. The mushroom beds should therefore be made in the warmest parts of the warmest sheds.



The beds should be made upon the floor and as much to one side as possible, so as to be out of the way, and in form flat on the ground, or

rounded up against the sides of the shed; in the latter case the house should be well banked around on the outside with litter or tree leaves or earth, so as to exclude frost from the lower part of the walls, and thereby prevent the manure in the beds from getting badly chilled. The beds should be made deeper in a cool shed than in a cellar or warm mushroom house, so that they may retain their heat for a long time.

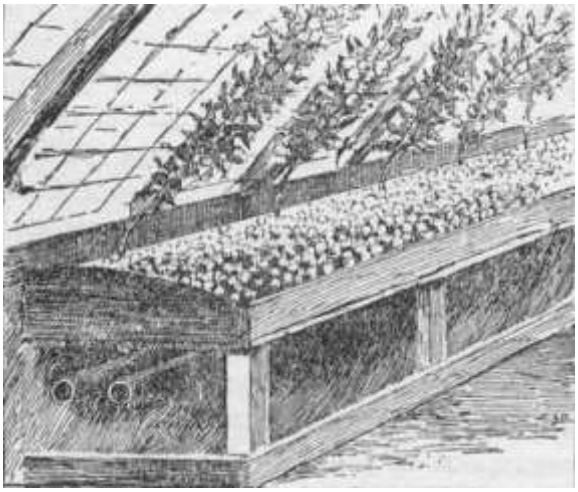
Shelf beds should not be used in unheated sheds, because of the difficulty in keeping them warm in winter. As a rule, shelf beds are not made as deep as are those upon the floor; hence they do not hold their heat so long. When cold weather sets in it is easy to box up and cover over the lower beds to keep them warm, but in the case of shelf beds, that are exposed above and below, it is more trouble to protect them sufficiently against cold than they are worth.

Generally speaking, the term shed is applied to unheated, simple wooden structures; for instance, the wood-shed, the toolshed, a carriage-house, or a hay-barn. But we often use the name shed to designate heated buildings, as the potting and packing sheds of florists. Were it not that these heated sheds are simply workrooms, and where there is a great deal of going out and in, and, consequently, draughts and sudden and frequent fluctuations of temperature, the treatment of mushroom beds made in them would be the same as that advised for regular mushroom houses; but as the circumstances are somewhat different the treatment, too, should not be the same. A warm potting shed is an excellent place for mushroom beds. Here they should be made under the benches and covered up in front with thick calico, plant-protecting cloth, or light wooden shutters, to exclude cold currents and sudden atmospheric changes, and guard against the beds drying too quickly.

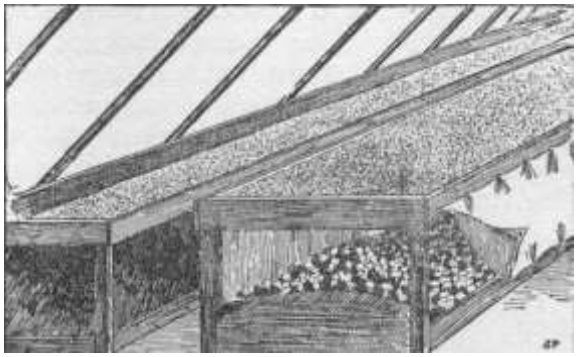
GROWING MUSHROOMS IN GREENHOUSES

Anyone who has a greenhouse can grow mushrooms in it. And it does not matter what kind of greenhouse it is, whether a fruit house, a flower house, or a vegetable house, it is available for mushrooms. One of the advantages of raising mushrooms in a greenhouse is that they grow to perfection in parts of the greenhouse that are nearly worthless for other purposes; for instance, under the stages, where nothing else grows well, although rhubarb and asparagus might be forced there, and a little chicory and dandelion blanched.

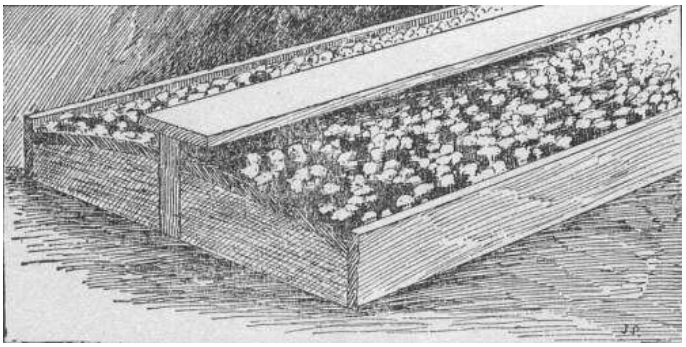
Cool greenhouses, in all cases, are better for mushrooms than hothouses. Cool houses are seldom kept at a lower temperature than 45° or 50° in winter, while hothouses run from 60° to 70° at night, with a rise of ten to twenty degrees by day, and this is too hot for mushrooms. It is a very easy matter, by means of covering with hay or boxing over and covering the boxing with hay or matting, to keep a mushroom bed in a cool house warm and free from marked changes in temperature; but it is a difficult matter to keep a mushroom bed in a hothouse cool enough and prevent sudden rises in temperature.



On Greenhouse Benches.—It sometimes happens that the beds are formed on the greenhouse benches, and the mushrooms occupy the same place that might be assigned to roses or any other planted-out crop. The beds on the benches are made one board deep, that is, eight to ten inches of short, fresh manure, and otherwise as in the case of beds anywhere else. After the beds are spawned and cased with soil, by covering them over with a layer of straw litter or hay, sudden drying out of the surface is prevented, and in order to further prevent this drying it is a good plan to sprinkle some water over the mulching every day or two, but not enough to soak through into the bed. About the time the young mushrooms commence to show themselves, remove the mulching and replace it with a covering of shutters raised another board's height above the bed, or with strong calico or plant-protecting cloth hung curtain-fashion over the beds.



The greenhouses in which the mushrooms are grown are orchard houses, that is, glasshouses in which peach and nectarine trees are grown and forced. As these trees fruit and finish their growth early, it is necessary that they be kept as cool and inactive as possible in the fall and early winter, and started again into growth in late winter. In the fall, therefore, the fermenting material being confined in frames retains warmth enough for the proper development of the mushrooms, and as the winter advances and the heat in the frames begins to wane it becomes necessary to begin heating the greenhouses in order to start the trees into bloom and growth, and thus are provided very favorable conditions for the continued production of the mushroom crop.



The frames used are common hotbed box frames seven feet wide and carrying three and one-half feet wide sashes. A string of them is run along the middle of the greenhouses, for greenhouse after greenhouse is occupied by them. They are flat upon the floor, and in the early part of the season alone in the greenhouses. But as the winter advances a temporary staging is erected over these frames, on which peas, beans, or other flowers or vegetables are to be grown. These love the light and a position near the glass, whereas the mushrooms grow perfectly well in the dark quarters of the frames under the stages. If he did not grow mushrooms under these stages the room would be unoccupied, hence unproductive; but by occupying it with mushrooms he not only gets

peaches and snap beans at once out of the same greenhouse, but also a crop of mushrooms, often worth as much as the other two.

In preparing the beds in the frames they were made up a foot deep, very firm, and with New York stable manure brought direct from the cars. There was no preliminary preparation of the manure. A layer of loam one and one-half inches deep was then spread over the surface and forked into the bed of manure one and one-half inches deep, so as to form an earthy mat three inches deep. This was then packed solid with the feet, and a two-inch layer of loose manure added all over. In about ten days the temperature three inches below the surface was about 95°, and the beds were then spawned. In spawning, drills were drawn across the beds about a foot apart and just deep enough to touch but not penetrate the earthy mat before referred to. The broken spawn was then sown in the drills and covered with a layer of loam one and one-half to two inches deep, which was tamped slightly. The sashes were then put on and tilted up a little to let the moisture escape. By the time the mushrooms appeared there was very little need of ventilating, as the condensation of moisture on the glass was scarcely apparent; but ventilation is easily guided by the appearance of moisture on the glass, the more of this the more ventilation should be given. To begin with, there was no attempt at shading the frames; but as soon as the mushrooms began to appear the beds were shaded, and mostly by the crops of other plants on the stages above them. These frame beds were made up last October, and began bearing in December, and on March 14 Mr. Gardner wrote me: "The mushrooms in my frames have done grandly. I cut large basketfuls to-day of the finest mushrooms I have ever seen, some of them measuring five inches in diameter before being fully expanded."

And further, in submitting the above notes to him for verification, he adds: "There is one vital point we should impress upon all who grow mushrooms in frames or under greenhouse benches, namely, that sudden changes of temperature must be avoided. While light, in my opinion, is good for mushrooms, it causes a rise of temperature, and this we must guard against. In order to maintain a uniform temperature all glass exposed to light or heat in any other way should be covered with some non-conducting material. Rye straw is the best thing for this purpose that I know of. Indeed, neglect of this simple matter, in cases where sunlight and heat from hot-water pipes come in contact with the young mushrooms or mycelium on the surface of the beds, is the cause of many failures in growing in frames and greenhouses."

Under Greenhouse Benches

Open empty spaces under the stages anywhere are good places for mushroom beds. However, carefully observe a few points, to wit: A dry floor under the beds is imperative, for a wet floor soaks and chills the beds, and renders them unhealthy for the spawn; but the common earth floor is good enough, provided water does not stand upon it at any time; if it does, the floor to be under the beds can be rendered dry by raising it a little higher than the general level, or using a flooring of old boards. Beds should not be built close up against hot-water pipes, steam pipes, or smoke flues, as the heat from these when they are in working condition will bake the parts of the beds next to them and render them unproductive, and also crack and spoil the caps of the mushrooms that come up within a foot or two of the pipes. But this injury from hot pipes and flues can be lessened greatly by boxing the pipes, so as to shut off the heat from the mushroom beds and allowing it full escape upward; then the beds can be made, with safety, up to within a foot of the pipes. As a rule, hot-water pipes are run around under the front benches of a greenhouse, then it would not be advisable to make beds under those benches. The middle bench is the one most commonly free from pipes,

hence the one best adapted for beds. It has more headroom, and therefore easier working facilities. Steam-heated greenhouses generally present the best accommodations for mushroom beds, because the pipes occupy less room under the benches than do those for hot water, and they are always kept higher from the ground.

Among Other Plants on Greenhouse Benches.

It sometimes happens that mushrooms spring up spontaneously among the roses, carnations, violets, mignonette, and other crops that are grown "planted out" on the benches, and this is particularly the case where fresh soil had just been used, in whole or part, for filling the bench beds. These mushrooms come from natural spawn contained in the loam or manure before they were brought indoors, and which is apt to be true virgin spawn. The mushrooms are generally of the common kind, grown from brick spawn, but occasionally a much larger and heavier sort is produced, and this is the "horse" mushroom. It is perfectly good to eat, only of coarser quality than the other.

A fair and certain crop can be obtained by planting pieces of spawn in the beds here and there between the plants and where they will be least likely to be soaked with water. In order to further insure the development of the spawn, holes about the size of a pint cup should be scooped out here and there over the bed, and filled up solidly with quite fresh but dry horse droppings, with the piece of spawn in the middle, and covered over on top with an inch of loam, so as to leave the whole surface of the bed level. So small a quantity of dry manure surrounded with cold earth will not heat perceptibly, and the moisture of the loam about it will soon moisten it, no matter how dry it may be. The dry, fresh

droppings are the very best material for starting the mycelium into growth.

Growing Mushrooms in Rose Houses

George Savage, the head gardener at Mr. Kimball's greenhouses, Rochester, N. Y., grows mushrooms very successfully under the benches of the rose houses. When he makes up his earliest mushroom beds in the fall the rose house is kept cool, and this is an advantage to the mushroom beds, which get all the warmth they need from the fermenting manure; but as November advances, and the heat in the beds begins to wane the rose houses are "started," and this artificial warmth comes in good season to benefit the growing mushrooms. The roses, in this case, are planted out on benches, hence there is scarcely any dripping of water from above upon the mushroom beds below.

Mr. George Grant, of Mamaroneck, N. Y., who grows mushrooms in the greenhouse, I called to see last January, and was very much pleased with his simple and successful method. The beds were then in fine bearing, very full, and the crop was of the best quality. The beds were made upon the earthen floor of his tomato-forcing house and under the back bench. The bed was flat, seven to eight inches deep, with a casing of a ten-inch-wide hemlock board set on edge at the back, and another of same size against the front. The bed was made of horse droppings, six inches deep, and molded over with fresh loam one and one-half inch deep. Over the whole, and resting on the edges of the hemlock boards, was a light covering of other boards, with a sprinkling of hay on top of them to arrest and shed drip, and maintain an equable temperature in the bed.

Mr. Abram Van Siclen, of Jamaica, Long Island, is one of the largest mushroom growers for market in the country, as well as one of the most extensive growers of market-garden truck under glass around New York. He devotes an immense area under his lettuce-house benches to the cultivation of mushrooms. The beds are made upon the floor in the usual way, only for convenience' sake, to admit of plenty of room in making up the beds and gathering the crop, besides avoiding the necessity for building higher structures than the ordinary lettuce greenhouses, the mushroom beds are sunken about eighteen to twenty-four inches under the level of the pathways. As the lettuces are planted out upon the benches there is very little drip from them, hence the sunken beds are well enough. And the temperature of a lettuce house is about right for a long-lasting mushroom bed. Light is excluded by a simple covering of salt hay laid over the beds, and sometimes by light wooden shutters set up against the aperture between the lettuce benches and the floor, in this way boxing in the mushrooms in total darkness.

Mr. William Wilson, of Astoria, has an immense greenhouse establishment near New York. In his greenhouses, under both the side and middle benches, he grows mushrooms, and when I saw them in January there were about 300 square yards of beds. The beds were flat, about nine inches thick, built upon the ground, and protected from strong light by having muslin tacked over the openings between the benches and the beds alongside the pathways. But his crop was suffering from drip. Mr. Wilson told me he could not begin to supply the demand. He says whatever he makes on mushrooms is mostly clear gain. They occupy space that otherwise would remain unoccupied, and he needs the manure and the loam in his florist business, and it is in better condition for potting after it has been rotted in the mushroom beds than it was before it was used for this purpose.

GROWING MUSHROOMS IN THE FIELDS

Under suitable conditions we can grow mushrooms easily and abundantly in the open fields, and the planting of the spawn is all the trouble they will cause us. During the late summer and fall months mushrooms often appear spontaneously and in great quantity in our open pastures, but in their natural condition they are an uncertain crop, as in one year they may occur in the greatest abundance, and in the next perhaps none can be found in the fields in which they had been so numerous the previous year. Why this should be so is not very clear. The popular opinion is that after a dry summer mushrooms abound in the fields, but after a wet summer they are a very scarce crop; and the inference is that the moisture has killed the spawn in the ground. This may be true to a certain extent, but how does it happen—as it certainly often does—that good spawn planted by hand in the fields in early summer will produce mushrooms toward fall no matter whether the summer has been wet or dry? At the same time, it is true that a wet spell immediately succeeding the planting of the spawn will kill a great deal of it.

As a rule, wild mushrooms abound most in rich, old, well-drained, rolling pasture lands, and avoid dry, sandy, or wet places, or the neighborhood of trees and bushes. In attempting to cultivate them in the open fields we should endeavor to provide similar conditions. Then the chief requisite is good spawn, for without this we cannot raise mushrooms.

About the middle of June take a sharp spade in the pasture, make **V** or **T**-shaped cuts in the grass sod about four inches deep and raise one side enough to allow the insertion of a bit of spawn two to three inches square under it, so that it shall be about two inches below the surface, then tamp the sod down. By cutting and raising the sod in this way, without breaking it off, it is not as likely to die of drought in summer. In

this way plant as much or little as may be desired and at distances of three, four, or more feet apart. During the following August or September the mushrooms should show themselves, and continue in bearing for several weeks.

Mr. Henshaw, of Staten Island, who has been very successful in growing mushrooms in the fields as well as indoors, writes to me as follows: "You ask me to give you my plan of growing mushrooms in the fields during the summer. It is very simple. About the end of June, or as soon as dry weather sets in, we remove the old beds from our mushroom house, and if there should be any live spawn in the bottom of our beds we put it in a wheelbarrow and take it to the field, where we plant it in the open places, but never under trees. In planting, we lift a sod and put a shovelful of the manure containing the spawn in the hole, then replace the sod and beat it down firm; this we do at distances of twelve feet apart. If we have no live spawn from our indoor beds we take the common brick spawn, and put about a quarter of a brick into each hole, returning and beating down the sod as already stated. This is all that is done. If there comes a dry time after the spawn is put in the pasture we are sure to have a good supply of mushrooms in the fall."

A few years ago Carter & Co., seedsmen, London, sent this to one of the gardening periodicals: "The following mode of growing mushrooms in meadows by one of our customers may be interesting to your readers: In March (May would be soon enough here) he begins to collect droppings from the stables. These, when enough have been gathered together, are taken into the meadow, where holes dug here and there about one foot or eighteen inches square are filled with them, the soil removed being scattered over the surrounding grass. When all the holes have been filled and made solid he then places two or three pieces of spawn about one inch square in each hole, treads all down firmly,

replaces the turf and beats it tightly down. Under this system, in August and September mushrooms appear without fail in abundance and without any further care. The method is simple and the result certain. Therefore all who happen to have a meadow, paddock, or grass field, and are fond of mushrooms, should try the experiment.... In the case in question fresh holes were spawned every year."

MANURE FOR MUSHROOM BEDS

In order to grow mushrooms successfully and profitably a supply of fresh horse manure is needed, and this should be the very best that is made, either at home or bought from other stables. The questions of manure and spawn are the most important that we have to deal with. Very few make their own spawn, as it is bought and accepted upon its good looks,—often rather deceptive,—but the manure business is entirely in our own hands, and success with it depends absolutely upon ourselves. We cannot reasonably expect good results from poor manure nor from ill-prepared manure. It is only from the very best of horse manure prepared in the very best fashion that we can hope for the very best crops of the best mushrooms.

Horse Manure.

There are various kinds of horse manure, differing materially in their worth for mushroom beds. The kind of manure depends upon the condition of the horses, how they are housed, fed, and bedded, and how the manure is taken care of. But while the manure of all healthy animals is useful for our purpose, there still is a great choice in horse manure. If we are dependent upon our home supply we may use and make the best

of what we have, but if we have to buy the manure we should be very particular to select the best kind of manure and accept of no other.
The very best manure is that from strong, healthy, hard-worked, well-kept animals that are liberally fed with hard food, as timothy hay and grain, and bedded with straw. And if the bedding be pretty well wetted with urine and trampled under the horses' feet, so much the better; indeed, this is one reason why manure from farm and teamsters' stables is better than that from stylish establishments, where everything is kept so scrupulously dry and clean.

The fresher the manure is the better, still manure that is not perfectly fresh may also be quite good. Stable manure may accumulate in a cellar for a couple of months, and still be first rate. After our hotbed season is over I stack our stable manure high in the yard, and from June until August, as the manure is taken away from the stable each day, it is piled on the top of this stack. My object is to keep it so dry that it can neither heat nor rot. In August the stack is broken down and the best manure shaken out to one side for mushrooms, and the long straw and rotted parts thrown to the other side. This short manure, when moistened with water and thrown into a heap, exposed to the sun for a day or two, will heat up briskly. The beds illustrated in Fig. 19 were made from manure prepared in this way in August.

In the case of quite fresh manure, let it accumulate for a few days, or a fortnight, even, until there is enough of it to make up a bed, and then prepare it. Be very particular to prevent, from the first, its heating violently or "burning" while accumulating in the pile. Beds made from very fresh manure respond quickly and generously. The crop comes in heavily to begin with, and continues bearing largely while it lasts, but its duration is usually shorter than in the case of a bed made up of less fresh

manure. But altogether it yields a better and heavier crop than a bed that comes in more gradually and lasts longer, and the mushrooms are of the finest quality.

Some growers use the droppings only, and reject all of the straw part, or as much of it as they can conveniently shake out. This gives them an excellent manure and perhaps the very best for use on a small scale or in small beds. When mushrooms are to be grown in boxes, narrow troughs, half barrels, and other confined quarters, it is well to concentrate the manure as much as possible—use all the droppings and as little straw as you can. But droppings alone for large beds would take too much manure and cost too much, and they would not be any better than with a rougher manure.

Always preserve the wet, straw part of the manure, along with the droppings, and mix and ferment them together, and in this way not only add largely to the bulk of the pile, but secure the benefits afforded by the urine without reducing, in any way, the strength or fermenting properties of the manure. Shake out all the rank, dry, straw part of the manure and lay it aside for other purposes. This may be of further use as bedding in the stables, covering the mushroom beds after they have been made up, or for hotbeds; if well wetted with stable draining, or even plain water, it forms a ready heating material.

Many a time when we have been short of home-made manure I have bought some loads here and there from different stables in the village, and mixed all together and made it into beds with excellent results. Sometimes when the manure under preparation had been rather old and

cool, I have added a fifth or tenth part of fresh droppings to it, with very quickening effect in heating and apparent benefit to the crop.

It is generally believed that the manure of entire horses is better for mushrooms than that of other horses, but positive evidence in this direction has never come under my observation. Some practical men assert that there is no difference. Mr. John G. Gardner, at the Rancocas Farm, who has had abundant opportunity to test this matter, tells me that he has given it a fair trial and been unable to find any difference in the quality or quantity of mushrooms raised from beds made from the manure of entire horses and those raised from beds made from the manure of other equally as well fed animals. But the Parisian growers insist that there is a difference in favor of entire horses, especially in the case of hard-worked animals such as are engaged in heavy carting.

Manure of horses that are largely fed with carrots is emphatically condemned by most writers on the cultivation of mushrooms; indeed, it is one of *the* points in every book on mushrooms which I have read. Let us look at a few practical facts: There are at Dosoris two shelf beds in one cellar; each is thirty feet long, three feet wide, and nine inches deep, and both are bearing a very thick crop of mushrooms. The material in these beds consists of horse manure three parts and chopped sod loam one part, which had been mixed and fermented together from the first preparation. The manure was saved from the stables on the place in November, '88, the materials prepared in December, the beds built Dec. 17, spawned Dec. 24, molded over Dec. 31, and first mushrooms gathered Feb. 7, 1889. These beds bore well until the middle of April. The mushrooms did not average as large as they did on the deeper beds upon the floor of the cellar, but they ran about three-fourths to one ounce apiece, and a good many were more than this. It is most always the case,

however, that the crop on thin shelf beds averages less than it does on thick floor beds, and especially is this noticeable after the first flush of the crop has been gathered, no matter what kind of fermenting material had been used. At the time when the manure used for these beds was being saved at the stable the horses were only very lightly worked, and to each horse was fed, in addition to hay and some oats and bran, about a third of a bushel of carrots a day. And this is the manure used for the late mushroom beds, and yet good crops and good mushrooms are produced. This is not only the experience of one year's practice but the regular routine of many.

Perhaps someone would like to ask: Do you consider the manure of carrot-fed horses as good as the manure of animals to which no carrots or other root crops had been fed? My answer is—decidedly not. While the manure of carrot-fed animals is not the best, at the same time it is good, and anyone having plenty of it can also have plenty of mushrooms. The complete denunciation of the manure of carrot-fed horses so emphatically stereotyped upon the minds and pens of horticultural writers is not always founded on fact.

Manure of Mules.

This is regarded as being next in value to that of entire horses, and some French growers go so far as to say that it is quite as good. Mr. John G. Gardner tells me of an extraordinary crop of mushrooms he once had which astonished that veteran, Samuel Henshaw, and that it was from beds made of manure from mule stables. Certainly the heaviest crop of mushrooms I ever did see was at Mr. Wilbur's place at South Bethlehem, Pa., four years ago, and the beds were of clean mule droppings from the

coal mines. Mule manure can be had in quantity at our mule stock yards, which are in nearly every large city in the Middle and Southern States. Getting it from the mines costs more than it is worth, except as a fancy article; the men will not collect and save it for any reasonable price.

Cellar Manure.

Many stables have cellars under them into which the manure and urine are dropped at every day's cleaning. These cellars are not generally cleaned out before a good deal of manure has accumulated in them, say a few weeks', or a few months', or a winter's gathering, and it is commonly pretty well moistened by the urine. If this manure has not become too dry and "fire-fanged" in the cellar it is splendid for mushrooms. We buy a good deal of it, but are particular to reject the very dry and white-burned parts. Sometimes the manure from the cow-stables, as well as from the horse-stables, is dropped together into the cellar; then I would give less for the manure, especially if the cow manure predominated, because in the working it keeps too cold and wet and pasty; but if there is not cow manure enough to give the mass a pasty character it will make capital mushroom beds. Pigs often have the run of the manure-cellar, as is generally the case in farmyards. I would not use any part of this mixed pig manure. Mycelium evades hog manure; besides it is impure and malodorous, and a propagating bed for noxious insect vermin. It matters very little what kind of bedding is used, in the case of cellar manure, but I would not buy it if sawdust or salt hay had been used as bedding. Neither of these materials, in limited quantity, is deleterious to the mushrooms; at the same time, they are far less desirable than straw, field hay, German peat moss, or corn stalks, and there are risks enough in mushroom-growing without courting any that we can as well avoid.

City Stable Manure.

Around New York this can always be had in any quantity at a reasonable rate, and it is first-rate manure for mushroom beds. Market gardeners haul in a load of vegetables to market and bring back a load of manure; others may buy and haul home manure in the same way, or make arrangements with a teamster to do it for them. But the whole matter of city manure is now so deftly handled by agents, who make a special business of it, that we can get any quantity of manure, from a 500 lb bale to an unlimited number of loads, and of most any quality, delivered near or far, inland or coastwise, at a fairly moderate price. It is the city stable manure that nearly all our large market growers use for their mushroom beds. When they get it at the stables and cart it home themselves they know what they are handling, and should take only fresh horse dung. In ordering it of an agent be particular to arrange for the freshest and cleanest, pure horse manure. They will get it for you. We get several hundreds of loads of this selected manure from them every year for hotbeds, and find it excellent. We also get 1000 to 2000 loads of the common New York stable manure a year for our general outdoor crops, and it also is capital manure in its way, but not so good as the selected manure for mushrooms. It is mixed a little and smells very rank, and in mushroom beds usually produces a good deal of spurious fungi. Most all of our largest mushroom growers, Van Siclen of Jamaica, Denton of Woodhaven, Connard of Hoboken, and others, live within easy hauling distance of the city, and are able to select and get the very choicest manure at a very cheap rate.

Baled Manure.

Within a year or two a good deal of our city horse manure has been put up in bales and thus shipped and sold. Each bale contains from 350 to nearly 500 lbs, and is made up, pressed and tied in about the same way as baled hay. The principal advantages of the bales are these: Only the cleanest horse manure is put up in this way; cow manure, offal, spent hops, or other short or soft manures are not included in the bales, nor, on account of shipping considerations, are malodorous manures of any sort permitted in them. The railroads allow baled manure to be put off on their platforms, and closer to their stations than they would allow loose manure; and it often happens that an agent will send a carload to a railroad station and dump it off there so that the people around who have only small garden lots can have an opportunity of buying one or more bales, just as they need it, and without, as is generally the case, having to buy a whole load when they need only half a load. These bales are quite a boon to people who would like to have a small bed of mushrooms in their cellar and who have no other manure. Bring home one or more bales, open them, spread out the manure a little, and when it heats turn it a few times, and it will soon be ready for use. Or if you do not wish to litter up the place, roll the bales into the cellar, shed, or wherever else you wish to make use of them, and mix about one-fourth of their bulk of loam with the manure and make up the bed at once.

The Board of Health of New York city is very emphatic in its endeavors to rid the city of any accumulation of manure and, a year ago, had under consideration a plan to compel the manure agents, for sanitary reasons, to bale the stable manure. And perhaps this is the reason why it is so easily procured, to wit: A New York gentleman, desirous of engaging in the mushroom-growing business, writes me: "I get my manure from the

city in bales. All it costs me is the freight to my place at White Plains." Lucky gentleman! With any amount of the best kind of stable manure gratis, no wonder he wishes to embark in the mushroom ship.

Cow Manure.

This is sometimes used with horse manure in forming the materials for a mushroom bed, and several European writers are emphatic in advocating its use. But I have tried it time and time again, and in various ways, and am satisfied that it has no advantage whatever over plain horse manure, if, indeed, it is as good. It is not used by the market growers in this country.

The best kind of cow manure is said to be the dry chips gathered from the open pastures; these are brought home, chopped up fine and mixed with horse manure. The time and expense incurred in collecting and chopping these "chips" completely overreach any advantages that might be derived from them, no matter how desirable they may be. The next best kind of cow manure is that of stall-fed cattle, to which dry food only, as hay and grain, is fed. This is seldom obtainable except in winter, and is then available for spring beds only. This I have used freely. One-third of it to two-thirds of dry horse manure works up very well, heats moderately, retains its warmth a long time, also its moisture without any tendency to pastiness; the mycelium travels through [Pg 66]it beautifully, and it bears fine mushrooms. Still, it is no better than plain horse manure. The poorest kind of cow manure is the fresh manure of cattle fed with green grass, ensilage, and root crops; indeed, such manure cannot be used alone; it needs to be freely mixed with some absorbent, as dry loam, German moss, dry horse droppings, and the like,

and even then I have utterly failed to perceive its advantages; it is a dirty mass to work, and quite cold.

In the manufacture of spawn, however, cow manure is a requisite ingredient, and here again the manure of dry fed animals is better than that of those fed with green and other soft food. But my chief objection to the use of cow manure in the mushroom beds is that it is a favorite breeding and feeding place for hosts of pernicious bugs and grubs and earth worms,—creatures that we had better repel from, rather than encourage in, our mushroom beds.

Sawdust Stable Manure for Mushroom Beds.

This is the manure obtained from stables where sawdust has been used for bedding for the horses. It is a good absorbent and retains considerable of the stable wettings. Such manure ferments well, makes up nicely into beds, the mycelium runs well in it, and good mushrooms are produced from it. But if I could get any other fairly good manure I wouldn't use it. I remember seeing it at Mr. Henshaw's place some years ago. He had bought a quantity of fresh stable manure from the Brighton coal yards, where sawdust had been used for bedding for the horses, and this he used for his mushroom beds. I went back again in a few months to see the bed in bearing, but it was not a success. At the same time, some European growers record great success with sawdust stable manure. George Bolas, Hopton, Wirkeworth, England, sent specimens of mushrooms that he grew on sawdust manure beds to the editor of the *Garden*, who pronounced them "in every way excellent." Mr. Bolas says: "In making up the bed I mixed about one-third of burnt earth with the sawdust, sand, and droppings. The mushrooms were longer in

coming up than usual, the bed being in a close shed, without any heat whatever. They have, however, far exceeded my expectations."

Richard Gilbert, of Burghley, also wrote to the *Garden*, April 25, 1885: "There is nothing new in growing mushrooms in sawdust. I have done it here for years past; that is to say, after it had done service as a bed for horses, and got intermixed with their droppings. I have never been able to detect the least difference in size or quality between mushrooms grown in sawdust and those produced in the ordinary way."

Tree Leaves.

Forest tree leaves are often used for mushroom beds, sometimes alone, instead of manure, but more frequently mixed with horse manure to increase the bulk of the fermenting material. Oak tree leaves are the best; quick-rotting leaves, like those of the chestnut, maple, or linden, are not so good, and those of coniferous trees are of no use whatever. As the leaves must be in a condition to heat readily they should be fresh; such are easily secured before winter sets in, but in spring, after lying out under the winter's snow and rain, their "vitality" is mostly gone. But we can secure a large lot of dry leaves in the fall and pile them where they will keep dry until required for use. As needed we can prepare a part of this pile by wetting the leaves, taking them under cover to a warm south-facing shed, and otherwise assisting fermentation just as if we were preparing for a hotbed. While moistening the leaves with clean water will induce a good fermentation, wetting them with liquid from the horse-stable urine tanks will cause a brisk heat, and for mushrooms produce more genial conditions.

Mushroom beds composed in whole or part of fermenting tree leaves should be much deeper than would be necessary were horse manure alone used; for half leaves and half manure, say fifteen inches deep; for all leaves, say twenty to thirty inches deep.

While mushroom spawn will run freely in leaf beds and we can get good mushrooms from them, my experience has satisfied me that we do not get as fine crops from these beds or any modification of them as from the ordinary stable manure beds. And we cannot wonder much at this, considering that the wild mushroom is scarcely ever found in the neighborhood of trees or where leaf mold deposits occur.

Spent Hops.

We can make good use of this in one way. If we are short of good materials for a mushroom bed, we can first make up the beds eight or ten inches deep with fermenting spent hops, and above this lay a four or five inch layer of horse manure, or this and loam mixed. The hops will keep up the warmth, and the manure affords a congenial home for the mushroom spawn. But we should never use spent hops alone, nor so near the surface of the beds that the spawn will have to travel through it.

Spent hops can be had for nothing, and our city brewers even pay a premium to the manure agents to take the hops away.

PREPARATION OF THE MANURE

Get as good a quality of fresh horse manure as you can, and in sufficient quantity for the amount of bed or beds you wish to make. Next get it into suitable condition for making up into beds. This can be done out of doors or under cover of a shed, but preferably in the shed. Out of doors the manure is under the drying influence of sun and wind, and it is also liable to become over-wetted by rain, but under cover we have full control of its condition. All the manure for beds between July and the end of October is prepared out of doors on a dry piece of ground, but what is used after the first of November, all through the winter, is handled in a shed open to the south. During the autumn months we get along very well with it out of doors; after every turning cover the heap with straw litter to save it from the drying influences of sun and wind. Remove this covering when next turned, and lay light wooden shutters on top of it as a precaution against rain. In the shed in winter the manure is protected against rain and snow and we can always work it conveniently; when the shed is open to the south—as wagon and wood-sheds often are—we get the benefit of the warm sunshine in the daytime in starting fermentation in the manure, but in the event of dull, cold weather, cover up the pile quite snugly with straw and shutters to start the heat in it. Altogether, a warm, close shed would be better.

It seldom happens that one can get all the manure he wants at one time; it accumulates by degrees. This is the case with the market grower who uses many tons, and hauls it home from the city stables a little at a time; also with the private grower, who uses only a few bushels or half a cord, and has it accumulate for days or weeks from his own stable. As the manure accumulates throw it into a pile, straw and all, but not into such a big pile that it will heat violently; and particularly observe that it shall not "fire-fang" or "burn" in the heap. If it shows any tendency to do this, turn it over loosely, sprinkle it freely with water, spread it out a little, and

after a few hours, or when it has cooled off nicely, throw it up into a pile again and tread it firmly to keep it moist and from heating hastily.

When enough manure has accumulated for a bed, prepare it in the following way: Turn it over, shaking it up loosely and mixing it all well together. Throw aside the dry, straw part, also any white "burnt" manure that may be in it, and all extraneous matter, as sticks, stones, old tins, bones, leather straps, rags, scraps of iron, or such other trash as we usually find in manure heaps, but do not throw out any of the wet straw; indeed, we should aim to retain all the straw that has been well wetted in the stable. If the manure is too dry do not hesitate to sprinkle it freely with water, and it will take a good deal of water to well moisten a heap of dry manure. Then throw it into a compact oblong pile about three or four feet high, and tread it down a little. This is to prevent hasty and violent heating and "burning," for firmly packed manure does not heat up so readily or whiten as quickly as does a pile loosely thrown together. Leave it undisturbed until fermentation has started briskly, which in early fall may be in two or three days, or in winter in six to ten days, then turn it over again, shaking it up thoroughly and loosely and keeping what was outside before inside now, and what was inside before toward the outside now; and if there are any unduly dry parts moisten them as you go along. Trim up the heap into the same shape as you had before, and again tread it down firmly. This compacting of the pile at every turning reduces the number of required turnings. When hot manure is turned and thrown loosely into a pile it regains its great heat so rapidly that it will need turning again within twenty-four hours, in order to save it from burning, and all practical men know that at every turning ammonia is wasted,—the most potent food of the mushroom. We should therefore endeavor to get along with as few turnings as possible; at the same time, never allow any part of the manure to burn, even if we have to turn the heap every day. These turnings should be continued until the manure has lost its tendency to heat violently, and its hot, rank smell is gone,—usually in about three weeks' time. If the manure, or any part of it, is too dry at any turning, the dry part should be sprinkled with water and kept

in the middle of the heap. Plain water is what is generally used for moistening the manure, but I sometimes use liquid from the stable tanks, which not only answers the purpose of wetting the dry materials, but it also is a powerful stimulant and welcome addition to the manure. But the greatest vigilance should be observed to guard against over moistening the manure; far better fail on the side of dryness than on that of wetness.

If the manure is too wet to begin with it should be spread out thinly and loosely and exposed to sun and wind, if practicable, to dry. Drying by exposure in this way is not as enervating as "burning" in a hot pile, and better have recourse to any method of drying the manure than use it wet. If, on account of the weather or lack of convenience for drying, the manure cannot be dried enough, add dry loam, dry sand, dry half-rotted leaves, dry peat moss, dry chaff, or dry finely cut hay or straw, and mix together.

The proper condition of the manure, as regards dryness or moistness, can readily be known by handling it. Take a handful of the manure and squeeze it tight; it should be unctuous enough to hold together in a lump, and so dry that you cannot squeeze a drop of water out of it.

Some private gardeners in England lay particular stress upon collecting the fresh droppings at the stables every day, and spreading them out upon a shed or barn floor to dry, and in this way keeping them dry and from heating until enough has accumulated for a bed, when the bed is made up entirely of this material, or of part of this and part of loam. But market gardeners, the ones whose bread and butter depend upon the

crops they raise, never practice this method, and that patriarch in the business, Richard Gilbert, denounces the practice unstinted.

Different growers have different ideas of preparing manure for mushroom beds, but the aim of all is to get it into the best possible condition with the least labor and expense, and to guard against depriving it of any more ammonia than can be helped. See Mr. Gardner's method of preparing manure,

MAKING UP THE MUSHROOM BEDS

The place in the cellar, shed, house, or elsewhere, where we intend to grow the mushrooms, should be in readiness as soon as the manure has been well prepared and is in proper condition for use. The bed or beds should be made up at once. The thickness of the beds depends a good deal upon circumstances, such as the quality of the manure,—whether it is plain horse manure, or manure and loam mixed together,—or whether the beds are to be made in heated or unheated buildings, and on the floor or on shelves. Floor beds are generally nine to fifteen inches deep; about nine inches in the case of manure alone, in warm quarters, and ten to fourteen inches when manure and loam are used. In cool houses the beds are made a few inches deeper than this so as to keep up a steady, mild warmth for a long time. The beds may be made flat, or ridged, or like a rounded bank against the wall; but the flat form is the commonest, and the most convenient where shelves are also used in the same building. Shelf beds are generally nine inches deep; that is, the depth of one board.

In making up the beds, bring in the manure and shake it up loosely and spread it evenly over the bed, beating it down firmly with the back of the fork as you go along, and continue in this way until the desired depth is attained. If it is a floor bed and there is no impediment, as a shelf overhead, tread the manure down firmly and evenly; if the manure is fairly dry and in good condition it will be pretty firm and still springy, but if it is too moist and poorly prepared treading will pack it together like wet rotten dung.

Now pierce a hole in the bed and insert a thermometer. There are "ground" or "bottom-heat" thermometers, as gardeners call them, for this purpose, but any common thermometer will do well enough; and after two or three days examine this thermometer daily to see what is the temperature of the manure in the bed. In roomy or airy structures or where only a small bed has been made it may, in the meantime, be left in this condition. But in a tight cellar I find that the warm moisture arising from the bed condenses in the atmosphere and settles on the top of the manure, making it perfectly wet. In order to counteract this, as soon as the bed is made up I spread some straw or hay over it loosely; the moisture settles on the covering and does not reach through to the manure. Beware of over covering, as such induces overheating inside the bed. At spawning time remove this covering. The bed will then have become so cool (80° or 90°) that there is very little evaporation from it, consequently little danger of surface-wetting.

The Proper Temperature.

This, in mushroom beds, depends upon the materials of which they are composed, their thickness, how they are built, the situation they are in, and other circumstances. If the manure was good and fresh to begin with, carefully prepared and used as soon as ready, the bed in a few days will warm up to 125°, or a little more or less, and this is very good. My best beds have always shown a maximum heat of between 120° and 125°. Had the manure been used a few days too soon the heat would rise higher, perhaps to 135°, but this is too warm; in this case I would fork over the surface of the bed a few inches deep to let the heat escape, and after a couple of days compact the bed again. Boring holes all over the surface of the beds with a crowbar is the common way of reducing a too high temperature, and when the heat has subsided sufficiently fill up these holes with finely pulverized dry loam. With loam we can fill them up perfectly, but we cannot do this with manure, and if left open they

remain as wet sweat holes that are very deleterious to the spreading spawn.

A too high temperature in the beds should be sedulously guarded against, for it wastes the substance of the manure, dries up the interior of the bed, and the mushroom crop must necessarily be starved and short.

Provided that the manure is fresh and good and has been well prepared, if the beds, after being made up, do not indicate more than 100° or 110° no alarm need be felt, for excellent crops will likely be produced by these beds. The thicker the beds are the higher the heat will probably rise in them. Firmly built beds warm up more slowly than do loosely built ones, and they keep their heat longer. If the materials are quite cool when built solidly into beds they are not apt to become very warm afterward. But I always like to make up the beds with moderately warm manure.
It sometimes happens that circumstances may prevent the making up of the beds just as soon as the manure is in prime condition, and even after they are made up the heat does not rise above 75° or 80°. In such a case if the manure is otherwise in good condition and fresh, it is well enough and a good crop may be expected. But if the manure, to begin with, had been a little stale, rotten and inert, I certainly would not hesitate to at once break up the bed, add some fresh horse droppings to it, mix thoroughly, then make it up again. Or a fair heat may be started in such a stale bed by sprinkling it over rather freely with urine from the barnyard, then forking the surface over two or three inches deep and afterward compacting it slightly with the back of the fork. Spread a layer of hay, straw, or straw stable litter a few inches deep over the bed till the heat rises. If the manure had been moist enough this sprinkling should not be resorted to, but the fresh droppings added instead. When it is

applied, however, great care should be taken to prevent overheating; a lessening or entire removal of the straw covering, and again firmly compacting the surface of the bed will reduce the temperature. Some saltpeter, or nitrate of soda, an ounce to three gallons of liquid, will encourage the spread of the mycelium after the spawn is inserted; a much stronger solution of these salts can now be used than would be safe to apply after the mycelium is running in the bed.

When loam and manure mixed together comprise the materials of which the bed is made, the temperature is not likely to rise so high as when manure alone is used, but this matters not so long as the materials of which the bed is composed are sweet and fresh and not over-moist. But if the materials are cold and stale treat as recommended for a manure bed, always bearing in mind that it is better to have a cold bed that is fairly dry than one that is wet, or, indeed, a warm one that is wet.

Mr. Withington, of South Amboy, has a good word to say for beds of a low temperature. He writes me: "Our beds kept in good bearing two months, though they have borne in a desultory way a month longer. Our best bed this season was one that was kept at an even temperature. The manure never rose above 75° when made up, and decreased to about 60° soon after spawning. Kept the house at 55°."