Rice-based mushroom
PRODUCTION MANUAL
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Philippine Rice Research Institute
2018
Mushroom and rice not only look good together on our plates but both also provide nutrients our bodies need. But there is more to rice and mushroom than what we see, smell, and taste. It’s a relationship that goes back to how they can not only be eaten together, but also produced together.

This booklet will be your guide on rice-based mushroom production. It presents a step-by-step procedure that you can easily follow. Through this booklet, we hope to inspire more Filipinos to venture into growing mushrooms to have available and nutritious food, and have another source of income.

The demand for mushrooms is growing due to their nutritional benefits. With high demand comes opportunity for work and additional income. Rice production is a major means of livelihood. Complementing this with mushroom-growing will raise income and offer more jobs for people in a community.

Being able to produce our own food is an advantage. We do not only save money, we are also assured that the food we eat is safe. Growing mushrooms is a good complement of rice production. For instance, instead of burning rice straw, it can be used as substrate for mushroom. This practice not only ensures food supply but also helps care for the environment. Also, growing mushrooms offers benefits. It’s like growing one’s own vitamins and minerals, because mushrooms have plenty of these. We are used to seeing backyard vegetables, but this manual will enable you to also grow mushrooms at the comfort of your homes.

So as you go through the pages of this manual, we hope you will look forward to growing your own mushrooms. And we hope that your mushrooms will turn into healthy meals and money for your family.

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DEFINITION OF TERMS

**Autoclave**
A steam vessel to sterilize culture media and grain spawn.

**Casing**
Provides physical support, moisture, and gas exchange to the fruiting logs/bags that will induce the formation and growth of milky mushroom fruiting bodies. The common casing materials are rice hull, mud, or carbonized rice hull.

**Contaminants**
Unwanted foreign organisms in the growing medium.

**Flushes**
Rhythmic cycles of mushroom fruiting body development.

**Fruiting bodies**
Harvested umbrella-like edible portion of mushrooms.

**Grain spawn**
Mushroom seed propagated for mass production of mushrooms.

**Incubation**
Period when the mushroom mycelium slowly grows through the substrate after grain spawn inoculation.

**Inoculation**
Act of transferring mushroom tissue or seed into a specific culture medium or substrate.

**Mycelium**
Whitish to grayish thread-like streak that grows on the substrate after spawning.

**Pasteurization**
Process of eliminating unwanted organisms in the substrates through steam heat between 60 and 80°C for 6 to 8 hours.
Pure culture
Isolate or culture of the target microorganism without any contamination.

Relative humidity
Amount of water vapor present in the air expressed in percent.

Spawn
Mushroom planting material or seed for mass production.

Spawning
Act of inoculating or planting the spawn into the substrate.

Spawn running
Growing phase of the mushroom where mycelium grows into the substrate.

Sterilization
Process of destroying or eliminating all forms of life and contaminants in the culture media or substrates through heat treatment.

Stock culture
Storing mushroom pure culture under refrigeration to ensure vigor and yield potential for about 12 months.

Stock sub-culture
Next-generation culture derived from the mother or pure culture of the organism.

Substrates
Organic materials with high lignin content that supports the growth and development of mushroom fruiting bodies.

Tissue culture
Process of growing mushroom planting materials or cultures derived from the tissue of a young and healthy mushroom fruiting body.
Mushroom-growing is exciting, rewarding, and can revive or tighten the connection between nature and people.
Many people consider mushroom as an important commodity, both as food and livelihood source. Nowadays, the interest in mushroom as source of healthy nutrients, medical compounds, and dietary supplement is growing.

Mushroom protein content is comparable to those in legumes, leafy vegetables, corn, and milk. It contains fats, phosphorus, iron, selenium, potassium, copper, and vitamins such as thiamine, riboflavin, ascorbic acid, folate, pantothenic acid, ergosterine, niacin, and nicotinic acid. Mushroom has low calories and cholesterol.

Mushrooms are reported to treat migraine and headache, hypertension, arthritis, bronchitis, asthma, anorexia, gastritis, hemorrhoids, hyper-cholesterolaemia, nephritis, dysmenorrhea, constipation, lupus erythematousus, hepatitis, leucopenia, cardiovascular problems, and cancer. The antioxidant capacity of mushroom is comparable to those of carrots, tomatoes, green and red peppers, pumpkins, and green beans.

Mushroom contains selenium, a vital mineral for liver enzyme function that helps detoxify some cancer-causing compounds in the body, prevent inflammation, and decrease tumor growth rates. Potassium and sodium work together in the body to help regulate blood pressure. Its high fiber content also aids in lowering blood glucose levels in the body. Mushroom is creating a rapidly growing new food category for the health-oriented public.

Apart from its health and nutritional benefits, mushroom is a cash crop with immediate economic benefit. Some mushrooms are fast-growing that they can be harvested in 3 to 4 weeks after spawning. The harvested fruiting bodies are sold either as a supplement or a major source of family income. Mushroom production is labor-intensive. It creates employment opportunities for various people in the rural communities, including women, youth, landless service providers, retirees, and people with disabilities.

Rice straw is one of the most common substrates used for growing mushrooms. In the Philippines, around 11.3 million metric tons (PhilRice 2016) of rice straw is produced annually, which is basically used as feed supplement for livestock, mulching materials
for growing crops, or substrate in making compost. However, much of the rice straw being produced is disposed of through open field-burning, contributing to environmental pollution.

The availability and accessibility of abundant rice straw opens up opportunities for the development of mushroom enterprises in the rural communities. The common mushroom strains that can be grown with rice straw are paddy-straw mushroom (Volvariella volvacea), oyster mushroom (Pleurotus sp.), milky mushroom (Calocybe indica), and reishi mushroom (Ganoderma sp.).
STRUCTURES, TOOLS, AND EQUIPMENT FOR RICE-BASED MUSHROOM PRODUCTION
1. Soaking Tank
This is where the rice straw is soaked to make it soft and pliable for enhanced decomposition and processing into mushroom substrate. Ordinary containers like basins or drums can be used for soaking small volume of rice straw. Commercial-scale volumes require larger tanks.

2. Working Area
This is the place where chopping, shredding, substrate-mixing, and making fruiting bags are done. The working area can be a shed with cemented flooring, with enough space for the activities.

3. Pasteurizer Assembly
Shown on page 6 is the pasteurizer assembly attached to the continuous rice hull carbonizer (PAA-CtRHC) developed by PhilRice. The heat generated during the carbonization process boils the water that provides steam heat to the box-type pasteurizing chamber with a capacity of around 570 0.75-kg fruiting bags/cooking cycle. Another model is the drum-type PAA-CtRHC with one or two drums for small-scale pasteurization. Rice hull or other farm biomass fuels the carbonizer. Carbonized rice hull (CRH) is the by-product of carbonization.
Inside the inoculation room
4. Mushroom-Growing House
This house provides suitable conditions for growing mushrooms such as proper ventilation, humidity, temperature, and light. The usual construction materials include wood, bamboo, palm leaves, cogon, hay, plastic, rubber, and metal sheets.

Thatch houses made of local materials are common simple mushroom-growing houses. Existing structures like garage or vacant rooms can also be adapted for the purpose. The mushroom houses can be built on soil surface with gravel flooring or slightly inclined cemented floors to allow easy draining of excess water. Their doors should be wide enough for easy access. The aisles must provide enough space for workers to move around.

Also, the highest portion of the mushroom racks must be reachable by the workers. The mushroom-growing house must use insulation, screens, barriers, and other materials to limit entry of contaminants and maintain good growing conditions. The doors must be closed properly and the windows installed with fine screens to prevent the entry of insects. The house must also be rat and bird-proof.

5. Inoculation Room
This is a small aseptic or sterile room used for inoculating and incubating mushroom cultures, and spawning mushroom fruiting bags. It can be a portion of the mushroom-growing house or can be a room in an adjacent building. The interior of the inoculation room must be insulated with non-biodegradable materials. All its interior surfaces must be smooth for easy cleaning. The equipment needed in the room are the inoculation chamber, refrigerator, and shelves.
6. Incubation Room
This room is a place to induce mycelial growth of mushroom fruiting bags. It can be a part of the mushroom-growing house or a separate room adjacent to the inoculation room. The interior of the incubation room must be insulated with non-biodegradable materials, fine screens installed on the windows, and the doors fitted with barriers to reduce entry of insects and contaminants. It should also be darker than the mushroom-growing house.

7. Inoculation Chamber
This is an enclosed chamber with front glass pane as see-through window and door opening with two hand-holes at the lower front. The chamber is used for inoculating mushroom cultures to prevent contamination.

8. Stacking Racks
These are installed inside the incubation room and mushroom-growing house. They are used for piling fruiting bags during the incubation and fruiting periods. The racks are either hanging, pyramid, or cabinet models. The hanging racks use small nylon ropes hanged parallel to each other, with bamboo or welded wire base. The pyramid racks are triangular shelves made of wood or bamboo. The cabinet rack is a shelf also made of bamboo or wood.

9. Autoclave
This is a pressurized vessel with precise temperature and pressure regulation used to sterilize or eliminate any possible contaminants of the mushroom culture media, to ensure their integrity.

10. Refrigerator
This is used to store culture media and mushroom stock cultures to ensure their integrity for a longer period.
11. Weighing Scale
This is used to ensure exact weights of the materials used in preparing culture media, as well as products.

12. Shredding Machine
This is used to cut the substrates into smaller pieces that enhance the mixing and making of fruiting bags, as well as hasten mushroom growth. The size of shredding machines depends on the volume of substrates to be processed.

13. Hayfork
This is a tool for collecting and piling rice straw.

14. Bolo & Chopping Board
These are used for cutting small volumes of mushroom substrates in the absence of a shredding machine.

15. Fruiting Bag Molder
This is made up of PVC pipe or metal sheet with the size of the PP bag. This tool facilitates the bagging of rice-straw substrates into mushroom fruiting bags.

16. Pushcart
This is used to transport fruiting bags and other heavy materials from one place to another.
17. Cooking Set
The set includes a gas stove, b casserole, 
c ladle, d spoon, e funnel, f strainer, g basin, 
h knife, and i chopping board; used in the 
preparation of culture media.

18. Laboratory Tools & Equipment
These are the j alcohol lamp, k inoculating 
needle, l marker, and m cutter; used in the 
preparation of tissue, stock, and sub- 
cultures of mushrooms.
Mound stock-piling
The larger portion (rainfed) of our rice areas produces rice straw only once a year. Therefore, it is important to collect and store rice straw to have continuous supply. Fresh rice straw can be collected for immediate use or short-term storage. Dry and clean rice straw can be stored longer.

- Mound stock-piling is the most common method of rice straw storage. Dry and clean rice straw is piled layer-by-layer around a bamboo pole forming a pyramid mound.

- Rice straw bundles are preferred in some areas. Dried rice straw is tied in bundles then stored in sheds.

- Straw bales are rice straw compressed by a baler machine. The bales are piled in warehouses for longer storage.
The growth dynamics of mushrooms are similar with other agricultural crops. The vegetative growth phase of plants is exemplified by the mushroom mycelial growth. Their reproductive growth phase is represented by the development of an umbrella-like body called mushroom fruiting bodies.

The cultivation principles for mushrooms are generally similar, although practical technologies for each species cultivated slightly differ. Technologies are modified and adjusted according to the materials, conditions, and species of the mushroom.
HOW TO PREPARE MUSHROOM CULTURE MEDIA

The potato sucrose agar (PSA) or potato sucrose gelatin (PSG) are the simplest and most commonly used mushroom culture media because these are cheap and readily available.

Preliminaries:
To make PSA or PSG mushroom culture media, prepare 250 grams peeled and cubed potatoes, 10 grams sugar, 20 grams agar or shredded gelatin, and 20 clean flat bottles.

Boil the potatoes in one liter of water until tender. Collect the broth then add water until the volume reaches one liter.
Boil the broth again, then slowly add sugar and agar or gelatin. Continue stirring until the agar or gelatin has melted.

Dispense approximately 50 ml broth in each clean flat bottle using a funnel. The broth can fill around 20 flat bottles.
Plug each flat bottle with rolled cotton. Cover the bottle with a piece of paper secured with rubber band to prevent the cotton from absorbing moisture during sterilization.

Sterilize the culture media in the flat bottles in an autoclave at 15 psi, 121°C for 30 minutes.

Turn off the autoclave after sterilization then wait for the pressure to reach zero before opening it.
Remove the flat bottles with the sterilized culture from the autoclave then arrange them in slanting position. Allow them to cool until the culture media solidify and are ready for inoculation or storage for future use.
How to Prepare Mushroom Tissue Culture

Tissue culture is one of the recognized methods to maintain the breed of high-yielding mushroom strains.

Preliminaries:
Choose healthy, big, and mature mushroom fruiting bodies for tissue culture. Put the selected bodies on a clean, open container lined with tissue paper and leave them in a well-ventilated room for one hour to reduce the moisture content.

Follow the procedure below in preparing tissue culture.

Note

Tissue culture produces white mycelial growths. Yellow, blue, green, or grey mycelial growths are fungal contaminants while creamy and shiny growths are bacterial contaminants.
Disinfect the hands and arms with rubbing alcohol before beginning inoculation activities.

Wipe the inside walls of the inoculation chamber with tissue paper or cotton moistened with rubbing alcohol to disinfect it before inoculation.
Put inside the inoculation chamber the mushroom fruiting bodies, slant culture media in flat bottles, alcohol lamp, match, inoculating needle, and cutter.

Light the alcohol lamp, then flame-sterilize the inoculating needle and cutter.
Split the mushroom fruiting body in half with your hands to expose the middle part.

Slice a square millimeter tissue of the exposed middle part of the mushroom fruiting body with the sterilized cutter.
Pick the sliced mushroom tissue using the sterilized inoculating needle.

Hold the bottom of the flat bottle with culture medium with one hand.

The other hand holds the inoculating needle with the mushroom tissue, then remove the cotton plug on the flat bottle using the little and ring fingers.
Flame-sterilize the opening of the bottle with the alcohol lamp.

Carefully place the sliced mushroom tissue at the center of the culture medium inside the flat bottle. Then, flame-sterilize again the opening of the bottle with the alcohol lamp.
Seal the flat bottle with inoculated culture medium using cotton plug.

Properly label the flat bottles with inoculated culture media. Write the date of inoculation and type of mushroom inoculated or cultured.
Incubate the tissue cultures for about 10 days with the following temperatures: oyster mushroom at 25-30°C, paddy mushroom at 30-35°C, and milky mushroom at 25-35°C.

**Note**

Repeat the procedure until the desired number of tissue culture bottles has been accomplished.
HOW TO PREPARE MUSHROOM PURE CULTURE

Pure culture is derived from reproducing the tissue culture. The pure culture maintains the desired quality of the mushroom specie while multiplying it.

Follow the process below to prepare pure culture:

Disinfect the hands and arms with rubbing alcohol before doing inoculation activities.
Disinfect the walls of the inoculation chamber by wiping them with cotton moistened with rubbing alcohol.

Place in the chamber the alcohol lamp, match, tissue culture stock, flat bottles with culture media, and inoculating needle.
Light the alcohol lamp. Remove the cotton plug of the tissue culture stock then flame-sterilize the opening of the bottle with the alcohol lamp.

Flame-sterilize the inoculating needle then use it to slice a square millimeter of mycelial block from the tissue culture stock.
Pinch the sliced mycelial block with the inoculating needle. Take it out carefully and avoid contact with any surface.

Flame-sterilize again the opening of the bottle of the tissue culture stock then seal it with the cotton plug. Set it aside.
Hold the bottom of the flat bottle of culture medium with one hand, then remove the cotton plug with the middle and ring fingers of the hand holding the inoculating needle with the sliced mycelial block.

Flame-sterilize the opening of the flat bottle over the alcohol lamp. Carefully place the mycelial block at the center of the culture medium inside the flat bottle.
After inoculating, flame-sterilize again the opening of the bottle then seal it with the cotton plug. Repeat the procedure until the desired number of pure culture bottles is inoculated.

Properly label the inoculated culture media with the date of inoculation and type of mushroom inoculated.
Incubate the inoculated culture media for 7 to 10 days at temperatures 25-30°C for oyster mushroom, 30-35°C for paddy mushroom, 25-35°C for milky mushroom, and 25-30°C for reishi mushroom.
Proper maintenance of mushroom stock cultures of tissue and pure cultures is important to preserve the mushroom’s vigor and quality such as acceptable yield, flavor, and texture.

The stock cultures of most mushrooms can be stored in the refrigerator for 6 to 12 months without losing their yield potentials except paddy-straw mushroom (*Volvariella volvacea*), which is sensitive to cool temperature. It only requires room temperature for its storage. Revive the paddy-straw mushroom stock culture when the substrate starts to dry up.

Mushroom stock cultures must be labeled properly indicating the specie and source, and the date of culture for proper monitoring. Prepare at least two bottled cultures of the target specie when reviving the stock culture.
HOW TO PREPARE GRAIN SPAWN

Grain spawn is the seed or planting material for growing mushrooms. Rough rice, sorghum seeds, or cracked corn seeds are commonly used in making grain spawns for oyster, milky, and reishi mushrooms. The main advantage of using grains as culture medium for mushroom is that they contain high nutrition and are easier to inoculate.

The most common containers for making mushroom grain spawns are heat-resistant polypropylene (PP) bags, bottles, or jars.

The following are the procedures in making mushroom grain spawns:

Prepare 10 kg rough rice, sorghum, or cracked corn seeds. Clean the seeds and remove foreign materials by washing it 3 times or until the wash water becomes clear.
Boil the seeds just to soften the outer layer. Do not overcook or let the grains crack to prevent them from becoming sticky.

After boiling, pour the seeds on a strainer to remove excess water and let them dry until the moisture content is about 65%, or no water drips between the fingers when the seeds are squeezed.
Sterilize the culture medium in an autoclave at 121°C, 15 psi, for 30 minutes. Wait until the autoclave temperature drops to zero before opening it.
Remove the sterilized culture medium from the autoclave and cool it down inside the inoculation room.

Sterilize the inoculation chamber by wiping the inside walls with cotton moistened with rubbing alcohol. Place inside the chamber the alcohol lamp, match, inoculating needle, bags of grain culture media, and the pure or sub-culture of the mushroom to be inoculated.
Flame-sterilize the inoculating needle over the alcohol lamp. Open the bottle of pure or sub-culture, then sterilize its opening. Slice a square millimeter of mycelial block from the pure culture with the sterilized inoculating needle. Inoculate it into the sterilized grains in the PP bags.

Repeat the procedure until the desired quantity of grains is inoculated.

Label the PP bags inoculated with the date of inoculation and type of mushroom inoculated.

Incubate the inoculated grain cultures at 25-30°C for 2 weeks or until the mycelial growth has reached the bottom of the PP bag.
HOW TO PREPARE RICE-STRAW FRUITING BAGS

Oyster, reishi, and milky mushrooms are some of the species that can be produced in fruiting bags. Use 6 x 12 or 8 x 12-inch size PP bags.

These are the procedures in preparing rice-straw fruiting bags:

Soak the rice straw in the soaking tank to make it soft and easier to process.

Old-stock rice straw needs at least 3 hours of soaking. Fresh rice straw needs around 12 hours to make it soft and pliable.
Remove the rice straw from the tank after the desired hours of soaking. Pile the rice straw on an elevated platform to drain the excess water.

Cover it with plastic sheet and let it pre-decompose for 5 to 7 days. This process reduces bioactive substances and further softens the rice straw.
Shred the pre-composted rice straw using a shredding machine or chop it with bolo 2 to 3 inches long.

After shredding, formulate the rice-straw substrate by mixing 3 parts/volume (p/v) of sawdust to 7 p/v of rice straw.

Check the moisture of the substrate mixture. The ideal moisture is around 65% or no dripping water when the substrate is squeezed by hand. If the substrate is too wet, let it air-dry until the desired moisture is attained.
Molder is used to facilitate bagging. Insert the molder inside the PP bag. Fill it with substrate mixture.

Compress the substrate mixture with a GI pipe pounder. After filling, pull off the molder with your hand while clamping the bag with your feet. One fruiting bag weighs from 750 to 1,000 grams depending on the size of PP bags used.
Tie the opening of the PP fruiting bag with a rubber band.

Repeat the procedure until the desired number of fruiting bags is met.

Note

The procedure in making milky mushroom fruiting logs is similar with the procedure above but the PP bag used is 12 x 28 inches. Each milky mushroom fruiting log weighs 4.5 to 5.0 kilograms.
After making the desired number of mushroom fruiting bags, they are pasteurized to eliminate unwanted organisms from the substrate and reduce possible contamination. Pasteurization is done by steam-heating the fruiting bags at temperature 60 to 80°C for 6 to 8 hours.

The Pasteurizer Assembly (see page 51) attached to the Continuous Rice Hull Carbonizer (PAA-CtRHC) developed by PhilRice is used. The box and dome-type model accommodates more than 500 fruiting bags; the drum-type is only 80 fruiting bags per drum.

The PAA-CtRHC is fueled with 8 bags of rice hull per cooking and also produces around 35 kg of CRH as by-product.
PLANTING OR SPAWNING MUSHROOM FRUITING BAGS

Spawn is the general term for mushroom seeds used in inoculating mushroom substrates or fruiting bags.

Preliminaries:
Planting or spawning must be done inside the inoculation room to avoid contamination. Place the pasteurized fruiting bags and grain spawn inside the inoculation room before spawning. One bag of 500g grain spawn can plant 100 to 150 750-gram mushroom fruiting bags.

Disinfect the hands and arms with rubbing alcohol before spawning to reduce possible contamination.
Crumble the grain spawn to loosen the grains for easier spawning or planting.

Remove the rubber-band tie of the mushroom grain spawn to open. Open also the sterilized fruiting bag by removing the rubber-band tie. Plant the sterilized fruiting bags by pouring 3 to 5 grams of mushroom grain spawn into the bags.
Close the inoculated mushroom fruiting bag by tying it again with the rubber band. Repeat the process until all the mushroom fruiting bags had been planted or spawned.

Incubate the spawned fruiting bags inside the incubation room at 25 to 30°C temperature and subdued light for 3 to 4 weeks for oyster and milky mushrooms. The incubation period of *Ganoderma* is around 25 days.
MUSHROOM FRUITING AND HARVESTING

The mushroom-growing house conditions for oyster (*Pleurotus*) and Reishi (*Ganoderma*) mushrooms should have 25 to 30°C temperature, RH of 85-95%, and unsubdued light.

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Procedures in growing and harvesting oyster (*Pleurotus*) and reishi (*Ganoderma*) mushrooms:

Transfer the good-quality fruiting bags with all-white mycelial growths to the growing house. Arrange them in hanging ropes.
Make an opening of the fruiting bags to induce fruiting body formation. The opening can be one or both ends or slits. Mushroom grows faster when more openings are made but the productive cycles will be shorter.

The fruiting bodies start to grow 3-5 days after opening or slitting the fruiting bags.
Spray water regularly to maintain high relative humidity in the growing house. Avoid spraying the mushrooms directly especially the pin heads to avoid rotting. You can also wet the floor or leave inside the house open containers filled with water.

Harvesting is done by holding the fruiting bodies and pulling them gently. Oyster mushroom pin heads can be harvested in 3-5 days. It has eight growth flushes for one growing cycle, which lasts for 2-3 months. The 0.75 to 1-kg mushroom fruiting bag produces around 200 grams mushroom under optimal growing conditions.

The fruiting bodies of reishi (*Ganoderma*) mushroom are fully matured and ready for harvest when the cap turns reddish brown with spores shedding on the top of the cap. There are two to three growth flushes in one growing cycle, which takes about four months.

After harvesting, scrape any remaining mushroom remnants on the opening or slit of the fruiting bag to avoid rotting or contamination. Repeat step 4 (see above).
Procedures in growing and harvesting milky (Calocybe) mushroom

The mushroom-growing house conditions for milky (Calocybe) mushroom should have 30 to 35°C temperature, RH of 85-95%, and unsubdued light.

Remove the rubber bands to open the mushroom fruiting bags.
Place a layer of 2-3cm-thick carbonized rice hull or rice hull on top of the ramified substrate in the mushroom fruiting bag.

Arrange the fruiting bags in rows but leave spaces in between for easy movements. Spray water to maintain the moisture content of fruiting bags.
The pin heads or fruiting bodies start to grow 15 days after casing, and are ready for harvest after another 7 days.

To harvest, hold the base of the mushroom fruiting body then twist and pull gently.
After harvesting, scrape any remaining remnants then level the casing. There are two to three flushes per growth cycle that will last for 2 months.

Spray the casing to prevent the mushroom fruiting bag from drying. Spray 2 to 3 times a day during hot and dry weather.
Growing and harvesting milky (*Calocybe*) mushroom in fruiting logs (12x 28-inch size PP bags or around 5 kilograms)

Cut the mushroom fruiting log crosswise in layers of 6 equal thicknesses of approximately 7.5 cm.
Place the cut layer of fruiting log inside the growing container or pot. Case the layer of fruiting log by covering it with 2 to 3 centimeters of rice hull or CRH. The casing can be enriched with 25% vermicast (p/v).
It takes 10 days for the casing to be ramified and another 3 to 5 days for pin heads to grow. The mushroom fruiting body can be harvested 5 to 7 days later.

To harvest, hold the base of the mushroom fruiting body then twist and pull gently.

After harvesting, scrape any remaining remnants then level the casing. There are two to three flushes per growth cycle that will last for 2 months.

Spray the casing to prevent the mushroom fruiting substrate from drying. Spray 2 to 3 times a day during hot and dry weather.
PRODUCING PADDY-STRAW MUSHROOM (Volvariella volvacea)

Procedure in preparing planting spawns of paddy-straw mushroom:

Weigh 10 kg of tobacco midribs then soak them in clean water overnight.
After soaking, wash the tobacco midribs thoroughly then drain excess water.

Chop the tobacco midribs 2 to 4 cm long.
Boil the chopped tobacco midribs for 30 minutes to remove toxicants and soften them. Drain the excess water and air-dry until the moisture content reaches around 65%.
Prepare the substrate by mixing 8 parts of tobacco midribs to 2 parts sawdust.

Fill the PP bag (size 6 x 12 inches) with approximately 350 grams of substrate.
Insert a PVC neck to serve as opening of the bag, then secure it with rubber band.
Plug the opening of the PVC neck with rolled waste cotton, then cover it with paper secured with rubber band to prevent it from soaking during sterilization.

Sterilize the spawn substrate bags in an autoclave at 121°C, 15 psi, for 30 minutes.

Open only the autoclave after the temperature has dropped to zero. Remove the sterilized PP bags with spawn substrates from the autoclave. Place them inside the inoculation room to cool down.
During inoculation, flame-sterilize the inoculating needle above the alcohol lamp. With the sterilized needle, cut one square millimeter of mushroom mycelia block from the pure culture. Remove the waste-cotton plug of the sterilized spawn substrate, then place the block at the middle of the spawn substrate. Return the cotton plug. Repeat the process until the desired number of spawn substrates had been inoculated.
Incubate the inoculated spawn substrates at room temperature for two weeks or until the mycelia growth reaches the bottom of the substrates.

Two bags of planting spawn can inoculate a 3-meter-long mushroom bed with 6 layers.
GROWING PADDY-STRAW MUSHROOM IN BEDS

Paddy-straw mushroom can be grown outdoors or indoors.

Soak the rice straw for 12 hours to make it soft, pliable, and enhance decomposition.
After soaking, rinse the rice straw 2 to 3 times to remove slime and reduce acidity.

There are two methods of preparing rice-straw beds. The more common method is tying the rice straw in bundles, and the other is using a straw bed molder.

Beds of rice-straw bundles are layers of bundles measuring 15 cm diameter and 30 cm long. The mushroom bed dimension is around 30 cm wide, 100 cm tall, and 100 to 150 cm long.

Rice-straw beds are made by arranging layers of rice-straw bundles. After each straw layer, mushroom planting spawns are laid uniformly on both edges of the straw bed. Repeat the process until the desired bed dimension is constructed. Repeat the process until the desired number of mushroom beds is constructed.
For straw beds using a molder, place a layer of rice-straw substrate inside the molder approximately 20-cm-thick then sprinkle mushroom planting spawn over the substrate. Place another substrate and repeat the process until the molder is full. Gently remove the molder. Repeat the process until the right number of beds is constructed.
Right after making and spawning the mushroom beds, cover them with plastic sheets and let them incubate to allow the mushroom mycelia to grow for 10 to 15 days.

Once the mushroom pin heads are observed, lift the plastic-sheet cover to introduce fresh air then secure it after a minute to prevent possible contamination. The reintroduction of fresh air expels carbon dioxide to enhance the growth and development of mushroom fruiting bodies.

Water the surrounding of the mushroom beds to lower the temperature and synchronize the formation of mushroom fruiting bodies.

The first harvest flushes start at 14 days after incubation, which will continue for about 5 days. To harvest, hold and gently pull the mushroom buttons until they are detached from the substrate. Be sure to remove all the mushroom stumps to prevent infecting the adjacent pin heads. Sprinkle tap water over the beds after harvesting, then cover the beds again to prevent contamination. The harvesting period for one production cycle will take around one month.

Each layer of the mushroom beds can be sprinkled with 10 grams urea and 30 grams sugar mixed in four liters of water during planting or spawning to increase yield.
REFERENCES


ACKNOWLEDGMENT

The authors sincerely thank the Korea Program on International Agriculture (KOPIA), the Department of Agriculture (DA) - Bureau of Agricultural Research, and the DA - Regional Field Office 3 for the financial support and production of this booklet.
We are a chartered government corporate entity under the Department of Agriculture. We were created through Executive Order 1061 on 5 November 1985 (as amended) to help develop high-yielding, cost-reducing, and environment-friendly technologies so farmers can produce enough rice for all Filipinos. We accomplish this mission through research for development work in our central and seven branch stations, including our satellite stations, coordinating with a network that comprises 59 agencies strategically located nationwide. To help farmers achieve holistic development, we will pursue the following goals in 2010-2020: attaining and sustaining rice self-sufficiency; reducing poverty and malnutrition; and achieving competitiveness through agricultural science and technology. We have the following certifications: ISO 9001:2008 (Quality Management), ISO 14001:2004 (Environmental Management), and OHSAS 18001:2007 (Occupational Health and Safety Assessment Series).

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