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PETUNJUK TEKNIS BUDIDAYA JAMUR SHIITAKE

Technical Guideline for Shiitake Mushroom Cultivation



Oleh/By
Sihati Suprpti and Djarwanto

PUSAT PENELITIAN DAN PENGEMBANGAN TEKNOLOGI HASIL HUTAN
(Research and Development Center for Forest Products Technology)
BADAN PENELITIAN DAN PENGEMBANGAN KEHUTANAN
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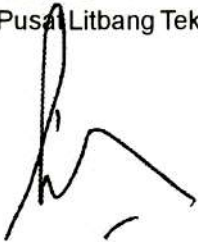
KATA PENGANTAR

Jamur shitake (*Lentinula edodes*) merupakan salah satu jamur kayu yang enak dimakan, dan telah lama menjadi bagian dari sumber bahan pangan dan obat yang dapat diperoleh dari hutan. Jamur shiitake termasuk hasil hutan bukan kayu yang selama ini kurang mendapat perhatian. Oleh karena itu sudah selayaknya jamur, yang merupakan bagian dari kekayaan keanekaragaman hayati Indonesia digali dan dimanfaatkan demi kesejahteraan masyarakat. Saat ini jamur shiitake merupakan salah satu komoditi yang prospektif sebab makin banyak orang mengetahui nilai gizi, rasanya yang lezat dan manfaatnya bagi kesehatan. Di Cina jamur ini dinobatkan sebagai ratu jamur (*the queen of mushrooms*) karena kelezatannya dan manfaatnya untuk kesehatan. Bahkan sejak ribuan tahun lalu jamur ini dipercayai sebagai "elixir of life" atau makanan dan obat yang dapat membugarkan dan menyehatkan manusia sehingga terhindar dari penyakit dan dapat memperpanjang usia. Makin berkembangnya perekonomian maka usaha tani jamur juga semakin berkembang. Usaha tani jamur shiitake dapat dilakukan dan dibiayai oleh masyarakat sendiri karena dapat dilakukan memakai teknologi bersih lingkungan memanfaatkan limbah kayu gergajian dengan modal yang relatif rendah. Selain itu akan didapat hasil samping berupa kompos dari sisa media untuk pupuk tanaman. Dengan demikian budidaya jamur shiitake dapat mencapai dua tujuan utama dalam pengolahan hasil hutan menuju industri bebas limbah dan sekaligus meningkatkan pendapatan petani sekitar industri pengolahan kayu/hutan.

Harapan kami semoga petunjuk teknis ini dapat membantu masyarakat pengguna, para penyuluh kehutanan sebagai salah satu sarana perhutanan sosial, serta bagi petani jamur dalam upaya mengembangkan usaha mandiri dibidang jamur kayu.

Bogor, Maret 2004

Kepala Pusat Litbang Teknologi Hasil Hutan



Dr. Ing. Ir. Hadi Daryanto, DEA

FOREWORDS

Shiitake mushrooms reveal one of the several kinds of mushroom that can be deliciously eaten and for long have signified as part of essential food source and medicine/ drugs procured from forest. Shiitake mushrooms belong to the non-wood forest product commodity, and as of this occasion unfortunately are still lacked of adequate attention. Therefore, it will be appropriate that such mushrooms which become part of the biodiversity wealth of Indonesia are looked after and utilized for the welfare of the Indonesian community themselves. Nowadays, shiitake mushrooms have offered one of the prospecting commodities, since more and more people recognize their nutritious value, delicious taste, and uses for human health. In China, these mushrooms have been inaugurated as the queen of mushrooms again due to their delicious taste and uses for health. Even thousand years ago, particular people believed these mushrooms as a remarkable "elixir of life". This is because shiitake mushrooms which are edible and concurrently afford drug efficacy can bring to humans energetic vitality and vigorous health, thereby affording their immunity to painful diseases and prolonging their lives. With the ever-prospering economy, as the consequence, the mushroom-cultivation operation may also become thriving. Moreover, such enterprise can proceed exhilaratingly and be financed by the community themselves. This is because mushroom-cultivation activities are performed using what is called "clean technology process", which utilizes wood-sawdust waste with relatively low-cost capital. In addition, the mushroom-cultivation activities yield the accompanying stuffs, such as compost, and spent media which are beneficial as green or organic fertilizer. In this way, shiitake mushroom cultivation will expectedly achieve two main objectives in the processing of forest products toward establishing zero-waste industries and concurrently increasing the income of farmers residing around wood-processing industries or forest.

After all, the authors place profound expectation that this manual can be useful for the user community, forestry-extension services, as well as mushroom farmers towards achieving self sufficiency in the growing or cultivation of wood-based mushrooms.

Bogor, March, 2004

Director
Research and Development Center for Forest Products Technology



Dr. Ing. Ir. Hadi Daryanto, DEA.

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PETUNJUK TEKNIS BUDIDAYA JAMUR SHIITAKE

I. PENDAHULUAN

1. Latar Belakang

Berdasarkan penelitian, besarnya rendemen industri penggergajian kayu berkisar antara 40-60% dari volume dolok, sehingga limbahnya 60-40% yang terdiri dari simpiran, potongan ujung dan serbuk gergaji. Sedangkan rendemen penggergajian dolok kayu diameter kecil (15-30 cm) berkisar antara 32,61-45,31 % (Rachman dan Malik, 2000), dengan demikian limbah pengolahan kayu dapat mencapai 67%. Limbah serbuk gergaji tersebut diperkirakan 15% dari volume dolok. Limbah serbuk gergaji tersebut umumnya belum banyak dimanfaatkan bahkan hanya dibuang di pinggir sungai atau lahan/tanah kosong di sekitar lokasi penggergajian. Untuk meningkatkan efisiensi pemanfaatan kayu maka perlu dicari alternatif pemanfaatan limbah tersebut. Salah satu caranya yaitu dengan memanfaatkan serbuk gergaji untuk media jamur shiitake (*Lentinula edodes*).

Jamur shiitake merupakan sumber bahan pangan yang bernilai gizi tinggi, mengandung protein, karbohidrat, lemak, mineral dan air, serta memiliki efek medis. Jamur tersebut dikenal dengan nama shiitake di Jepang, hoang-ko, donggu, huagu, xiangxun gill fungus di Cina. Di Asia jamur tersebut tumbuh secara alami pada kayu daun lebar yang telah mati (Diehle & Royse, 1986). Di Indonesia jamur ini dapat ditemukan pada kayu mati, yang oleh masyarakat dikenal sebagai jamur apem, jamur pasang (Jawa Tengah

TECHNICAL GUIDELINE FOR SHIITAKE MUSHROOM CULTIVATION

I. PREFACE

1. Background

According to some research, it was stated that the recovery of sawmill industries ranged between 40 to 60 % of the log volume, therefore the sawmill waste could reach up to 60% containing slabs, end cutting, and sawdust. However the recovery of small diameter log (15 to 30 cm in diameter) ranged between 32.61 to 45.31 % (Rahman and Malik, 2000), which mean that amount of sawmill waste could reach up to 67%. Sawdust alone was estimated 15% of log volume. As a waste, most of the sawdust still remains unutilized and instead is just disposed along riverbank or dumped on a site nearby the sawmill. To deal with the non-emission industries era, such waste should be utilized efficiently and effectively. Many ways could be play in utilizing sawdust waste, among which are as the medium for the cultivation of shiitake (*Lentinula edodes*).

In some countries, *Lentinula edodes* has become popular as a food with high nutrition value, containing protein, carbohydrate, fat, mineral, and water. In addition, this mushroom can also afford positive medical effect on human health. Shiitake is a Japanese name for *Lentinula edodes*, while in China it is called as hoang-ko, donggu mushroom, huagu mushroom, xiangxun gill fungus. In the Asian region, this mushroom is found growing naturally on dead tree of hardwood or broadleaf (Diehle & Royse, 1986). In Indonesia, this mushroom is often found on dead tree and by local people

dan Jawa Timur), supu jengkol (Jawa Barat) dan kulat (Kalimantan). Di Cina, jamur ini dinobatkan sebagai ratu jamur (*the queen of mushrooms*) karena kelezatannya dan manfaatnya (Zhang *et. al.*, 1995).

Jamur shiitake tersebut dapat dibudidayakan pada substrat serbuk gergaji secara industri di ruangan yang dikontrol faktor lingkungannya sehingga dapat memberikan hasil yang optimal dan lebih cepat dibandingkan menggunakan dolok (Diehle & Royse, 1986). Di Indonesia jamur ini telah dibudidayakan memakai teknologi sederhana menggunakan bahan media dari serbuk gergaji kayu ditambah bahan suplemen antara lain dedak, biji-bijian, pupuk, mineral dan air (Suprapti dan Djarwanto, 1994).

Memperhatikan bahwa manfaat jamur shiitake, yang dapat diusahakan sebagai tanaman budidaya dengan teknologi sederhana, maka upaya pengembangan budidaya jamur tersebut diharapkan dapat meningkatkan nilai tambah limbah, membuka kegiatan usaha rumah tangga dan menambah penghasilan masyarakat, khususnya penduduk di sekitar hutan dan daerah penyangga.

2. Tujuan

Petunjuk ini dimaksudkan sebagai panduan budidaya jamur shiitake dengan menggunakan media dari limbah kayu terutama serbuk gergaji. Tujuannya untuk memberikan kesatuan pengertian dan penafsiran bagi semua pihak, khususnya masyarakat sekitar hutan dalam upaya memanfaatkan limbah serbuk gergaji kayu untuk budidaya jamur shiitake, yang mempunyai nilai gizi tinggi.

it called as "jamur apem" or "jamur pasang" (Central Java), "supu jengkol" (West Java), and "kulat" (Kalimantan). In China, this mushroom was inaugurated as the queen of mushroom due to its deliciousness and usefulness (Zhang *et. al.*, 1995)

Shiitake could be cultivated on sawdust medium placed in a conditioning room at industrial scale so it would give optimum yield in shorten period rather than being cultivated on wood log (Diehle & Royse, 1986). In Indonesia, this mushroom was being cultivated through simple technology using medium made up of sawdust added with supplement materials such as rice bran, grains, fertilizers, mineral, and water (Suprapti dan Djarwanto, 1994).

Considering that shiitake mushroom can afford an economical value and can be managed by simple technology, then it will be worth increasing added value of wood waste especially sawdust, to provide the opportunity for house bussines and give more income for people especially for who live around the forest and bufferzone area.

2. Objective

This guideline is proposed for cultivation guidance of shiitake mushroom through simple technology using wood wastes especially sawdust. The objective is to gain consensus in clarification and implication for all the involved parties or stakeholders, especially the community who live around the forest, in an attempt to utilize sawdust as the cultivation media of shiitake mushroom with satisfactory economical prospects.

3. Ruang Lingkup

Petunjuk ini menjelaskan tahapan proses pengerjaan budidaya jamur shiitake mulai dari pembuatan bibit jamur, penumbuhan jamur sampai dengan pemanenannya dan kandungan gizi serta perkiraan biaya usahanya.

II. PEMBUATAN BIBIT JAMUR SHIITAKE

Pembuatan "Media Agar" untuk Biakan Murni <ul style="list-style-type: none">• Media kentang dekstrose agar (AKD)• Media malt ekstrak agar (MEA)
Pembuatan Biakan Murni dengan Cara Kultur Jaringan
Inokulasi dan Perbanyakan Biakan murni
Penyiapan Bibit Jamur

1. Pembuatan "Media agar" untuk biakan murni

Dapat dilakukan dengan beberapa cara antara lain :

- a. Media ekstrak kentang dekstrose agar (AKD)

Bahan :

- Kentang 200 gram
- Dekstrose 5 gram
- Agar-agar 20 gram
- Air suling 1 liter

Cara Kerja :

- Kentang diiris ukuran $1 \times 1 \times 1 \text{ cm}^3$, direbus selama satu jam, bila perlu ditambah air lagi hingga volumenya tetap, disaring dengan kain kasa sehingga diperoleh filtrat atau cairan ekstrak kentang

3. Scope Domain

This guideline described systematically the staged procedur of shiitake mushroom cultivation starting from spawn preparation, cropping up untill the harvesting process. Also described here are nutrient content in mushroom and analysis on cost-related operation.

II. SHIITAKE SPAWN PREPARATION

Preparation of "Agar medium" for pure culturing <ul style="list-style-type: none">▪ Potato dekstrose agar (PDA) medium▪ Malt ekstrak agar (MEA) medium
Pure culture preparation through mushroom tissue culturing
Inoculation and multiplication of pure culture
Spawn preparation

1. Preparation of "Agar medium" for pure culturing

Could be done by some ways such as :

- a. PDA (potato dextrose agar) medium

Materials :

- Potato 200 grams
- Dextrose 5 g
- Agar 20 g
- Distilled water 1 litre

Procedure :

- Slice the potato 1-cm by 1-cm by 1-cm in size, boiled in 1 liter water for 1 hour, add water when necessary untill the volume of water remain approximately constant, filter it using muslin sieve and separate the filtrate

- Filtrat ditambah gula dan agar-agar, dipanaskan sampai larut sempurna, masukkan media ke dalam tabung kaca (*test tube*) atau botol kecil, sumbat mulut tabung dengan kapas, sterilkan menggunakan autoklaf atau *pressure cooker* pada suhu 121°C, tekanan 1,5 atmosfer selama 30 menit
 - Angkat media hati-hati, letakkan tabung secara miring, biarkan dingin sampai media membeku. Setelah dingin, "media agar" diinokulasi dengan biakan murni jamur shiitake secara aseptis
 - Simpan di ruang tertentu, biarkan sampai pertumbuhan miseliumnya merata (Gambar 1).
- Add the filtrate with dextrose and agar, continue cooking until dissolved thoroughly, put the medium in test tube, plug the tube mouth with cotton butt, then sterilize it using autoclave or pressure cooker at 121°C in temperature, and 1.5 atmosphere in pressure for 30 minutes
 - Take the medium carefully, put the tube slanted on tube-rack, let it cool down till the medium is coagulated, then inoculated with the pure culture of shiitake aseptically
 - Place it in an incubation room, let the mycelium growth evenly (Figure1).

b. Media malt ekstrak agar (MEA)

Bahan :

- Malt ekstrak 30 gram
- Bacto agar 20 gram
- Air suling 1 liter

Cara Kerja

- Campurkan ketiga bahan sambil di panaskan hingga tercampur merata
- Masukkan ke dalam tabung kaca kira-kira sepertiga volume tabung, kemudian mulut tabung ditutup dengan kapas steril
- Sterilkan dengan autoklaf atau *pressure cooker* pada suhu 121°C, tekanan 1,5 atmosfer selama 30 menit
- Angkat media hati-hati, letakkan tabung secara miring, biarkan sampai dingin hingga media membeku. Setelah dingin, "media agar" diinokulasi dengan biakan murni jamur shiitake
- Simpan di ruang tertentu, biarkan sampai pertumbuhan miseliumnya merata.

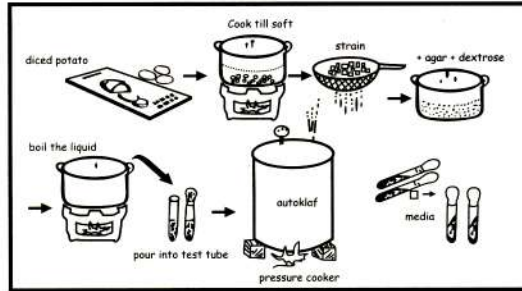
b. MEA medium

Material

- Malt extract 30 grams
- Bacto agar 20 grams
- Distilled water 1 litre

Procedure

- Mix the three materials above while being cooked until all media mix homogenously
- Put in test tube as much as one third of tube's volume then plug the tube mouth with sterilized cotton butt
- Sterilize it using autoclave or pressure cooker at 121°C in temperature, and 1.5 atmosphere in pressure for 30 minutes
- Take the medium carefully, put the tube slanted on tube-rack, let it cool until the medium is coagulated, then inoculated with shiitake pure culture aseptically
- Place it in an incubation room to let the mycelium growth evenly.



Gambar 1. Pembuatan media "ekstrak kentang dekstrose agar"
(Figure 1. Preparation Potato dextrose agar medium)

2. Pembuatan Biakan Murni dengan Cara Kultur Jaringan

- Siapkan "media agar" dan tubuh buah jamur shiitake
- Jarum ose serta inkas atau "laminar flow cabinet", dibersihkan menggunakan disinfektan
- Tubuh buah jamur shiitake yang masih muda, terlindung, bersih dan bebas hama dibersihkan menggunakan disinfektan, cuci dengan air suling, dipotong 3 mm x 3 mm, masukkan ke dalam "media agar"
- Biarkan (3-4 hari) sampai terlihat pertumbuhan miseliumnya (berwarna putih seperti benang halus)
- Miselium dipindahkan ke "media agar" lain, demikian seterusnya sampai mendapat biakan murni.
- Biakan murni tersebut kemudian ditumbuhkan pada media yang mirip dengan aslinya untuk mengecek kebenaran apakah miselium tersebut membentuk tubuh buah yang sama dengan induknya (Gambar 2).

3. Inokulasi dan Perbanyak Biakan Murni

- Inokulasi yaitu menularkan biakan murni dari tabung reaksi ke dalam tabung reaksi lain yang berisi "media agar"

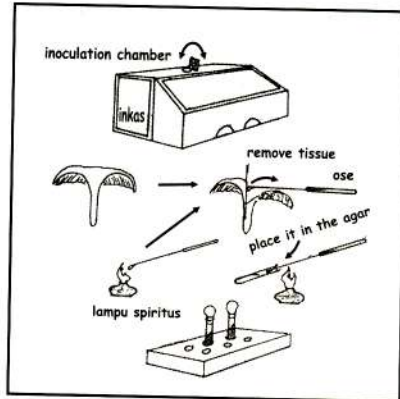
2. Pure culture preparation by tissue culturing

- Prepare agar medium and the selected fruit body of shiitake mushroom
- Clean the tools (laminar flow cabinet, niddle, pinset, and knife) using disinfectant
- Select a fresh fruit body of mushroom, cut the lamella for about 3-mm by 3-mm in size, wash in disinfectant for second, rinse in distilled water then put on agar medium by aseptically
- Put in an incubation room (3 to 4 days) to let the mycelium grow which looks like white smooth-fiber.
- Tansfer one niddle of the mycelium to a new medium, again and again until be a pure culture is obtained
- Cultivate the pure culture on the same type of medium where the mushroom is taken to check the viability in forming fruit body like its parent (Figure 2).

3. Inoculation and Multiplication of Pure Culture

- Inoculation is transferring pure culture from a tube to other new tube containing agar medium

- Inokulasi dilakukan dalam ruang steril berupa kotak inkas atau "laminar flow cabinet".
- Inoculation is done in a sterilized room such as incash-box or laminar flow cabinet



Gambar 2. Pembuatan biakan murni dengan cara kultur jaringan
(Figure 2. Preparation of pure culture by tissue culturing)

Persiapan

- Ruang inokulasi dan peralatan pinset, spatula kecil atau jarum ose yang akan digunakan serta tangan dibersihkan dengan disinfektan
- Gunakan bahan kimia disinfektan yang tidak mudah terbakar
- Apabila menggunakan formalin, inokulasi dilakukan pada hari ketiga setelah ruang dibersihkan
- Apabila menggunakan alkohol $\geq 70\%$, inokulasi dilakukan 10 menit setelah ruang dibersihkan
- Apabila menggunakan sinar ultra violet (UV), inokulasi dilakukan setelah 10 menit lampu dimatikan.

a. Inokulasi secara aseptis

- Pinset, spatula kecil atau jarum ose dipanaskan sampai panas atau membara, biarkan agak dingin kemudian panaskan mulut tabung yang berisi "media agar" (tutup kapas dibuka) lalu pindahkan potongan biakan murni jamur ke dalam "media agar", dan tutup lagi dengan kapas tersebut

Preparation

- Clean the tools and room, and your hand using disinfectant
- For safety precaution, use inflammable disinfectant
- When using formaline: inoculation is conducted three days after cleaned
- When using alcohol $\geq 70\%$: inoculation is conducted held at 10 minutes after cleaned
- When using ultra violet ray: inoculation is conducted 10 minutes after the UV lamp is turned off.

a. Inoculation in aseptical way

- Set on fire the pinset, spatulla or niddle and let it rather cooler, then pass the tube mouth on fire (open the cotton lid) and transfer a 3 by 3 mm slice of pure culture to another new test tube containing the sterilized agar medium, and then close the tube with the cotton lid

- Media yang telah diinokulasi jamur disimpan pada rak atau tempat penyimpanan tabung reaksi.
- b. Perbanyakkan
 - Satu tabung biakan murni dapat diperbanyak menjadi 20 tabung biakan pada "media agar" baru.

4. Penyiapan Bibit Jamur

Media bibit jamur dapat dibuat dari limbah lignoselulosa seperti serbuk gergaji kayu, dan biji-bijian seperti sorgum, beras, jagung dan gandum. Media yang umum dijual dipasar adalah yang dibuat dari serbuk gergaji.

a. Media bibit dari serbuk gergaji

Bahan

- Serbuk gergaji kayu 100 bagian
- Bekatul atau dedak halus 10 bagian
- CaCO_3 satu bagian
- Gips satu bagian
- Air suling secukupnya.

Cara kerja

- Bahan-bahan tersebut dicampur rata
- Tambahkan air suling sampai adonan dapat dikepal dan airnya tidak menetes
- Masukkan ke dalam botol sambil agak dipadatkan
- Sumbat mulut botol dengan kapas, lapiasi bagian luar sumbat dengan kertas atau plastik
- Sterilkan dengan autoklaf atau *pressure cooker* pada suhu 121°C , tekanan 1,5 atmosfer selama 30 menit
- Angkat media dan biarkan sampai dingin, kemudian diinokulasi miselium jamur dari biakan murni. Satu tabung biakan murni dapat digunakan untuk 10 botol bibit

- Inoculated medium is then kept on a rack or test tube slanter.

b. Replication

- One test tube of pure culture can be multiply to 20 tubes.

4. Spawn preparation

Spawn medium could be made of lignocellulosic-wastes such as sawdust, and grains like sorghum, rice, corn, and wheat. Most of media sold in the market are made of sawdust.

a. Spawn on sawdust medium

Materials

- | | |
|-------------------|--------------|
| - Sawdust | 100 parts |
| - Rice bran | 10 parts |
| - CaCO_3 | 1 part |
| - Gypsum | 1 part |
| - Distilled water | as necessary |

Procedure

- Mix all those materials homogeneously
- Add with water till the batter could be clod or squeezed firmly with no dropping of water any longer
- Put in a bottle and lightly densified
- Close the bottle with cotton butt, and wrap the outside lid with a paper or plastic
- Sterilize it in an autoclave or pressure cooker at 121°C in temperature, 1.5 atmosphere in pressure for 30 minutes
- Let it cool, then inoculated it with pure culture. One test tube of pure culture can be used for up to 10 bottles
- Keep in a room with temperature 25 to 30°C to let the mycelium grow evenly on the surface of medium for 17 to 30 days (Figure 3).

- Simpan di ruang tertentu pada suhu 25 - 30°C, biarkan miselium tumbuh memenuhi seluruh permukaan media, selama 17 - 30 hari (Gambar 3).

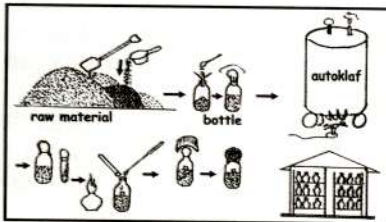
b. Media bibit dari biji sorgum

Bahan

- Biji sorgum berkualitas baik secukupnya
- Air bersih secukupnya.

Cara kerja

- Biji sorgum dicuci kemudian direndam selama satu jam
- Buang biji yang terapung/ mengambang dan yang terdapat noda berwarna hitam
- Rebus biji sorgum selama sekitar 15 menit sejak air mendidih
- Angkat dan tiriskan biji tersebut sampai tidak berair atau bekas airnya terbuang
- Masukkan biji yang masih panas ke dalam botol
- Sumbat mulut botol dengan kapas, lapiasi bagian luar sumbat dengan kertas atau plastik
- Sterilkan dengan autoklaf atau *pressure cooker* pada suhu 121°C, tekanan 1,5 atmosfer selama 30 menit
- Angkat media dan biarkan sampai dingin, kemudian diinokulasi miselium jamur dari biakan murni. Satu tabung biakan murni dapat digunakan untuk 10 botol bibit
- Simpan diruang pada suhu 25-30°C, biarkan miselium tumbuh memenuhi seluruh permukaan media, selama 1-2 bulan (Gambar 4).



Gambar 3. Penyiapan bibit jamur
(Figure 3. Preparation of mushroom spawn)

b. Spawn on sorghum grains medium

Materials

- Good quality sorghum grains
- Clean water in sufficient amount

Procedure

- Wash the grains and soak for an hour
- Clean them from floated and black node grains
- Boil it for 15 minutes
- Drain and put in bottle
- Plug the bottle with cotton butt, then sterilize it using an autoclave or pressure cooker at 121°C in temperature, 1.5 atmosphere in pressure for 30 minutes
- Let it cool and inoculated with pure culture. One tube of pure culture can be used for up to ten bottles
- Keep in a room with temperature of 25 to 30°C, and let the mycelium grow evenly on the surface of medium for 1-2 months (Figure 4).



Gambar 4. Bibit jamur yang sudah siap untuk ditularkan
(Figure 4. Mushroom spawns ready for inoculation)

5. Persyaratan Bibit Jamur

Bibit jamur yang baik memiliki pertumbuhan miselium optimum: tidak terlalu tua, tidak terlalu muda, berumur sekitar 2 bulan.

Hindari!

- Bibit yang miseliumnya tumbuh tipis, tidak merata dan terlalu tebal.
- Bibit yang terkontaminasi atau terserang hama.
- Bibit yang telah tumbuh tubuh buahnya.

III. PENUMBUHAN JAMUR SHIITAKE

<p>Persiapan Bahan Media Pertumbuhan Jamur</p> <p>Bahan utama</p> <ul style="list-style-type: none">❖ Serbuk gergaji kayu <p>Bahan tambahan</p> <ul style="list-style-type: none">❖ Dedak❖ Biji-bijian❖ Pupuk❖ Mineral❖ Air
<p>Pengemasan media pertumbuhan jamur</p>
<p>Sterilisasi</p>
<p>Inokulasi atau pembibitan</p>
<p>Inkubasi</p>
<p>Penumbuhan tubuh buah jamur</p>
<p>Pemeliharaan</p>
<p>Pemanenan</p>

5. The requirement of mushroom spawn

A good quality spawn: the mycelium growth is optimum, not too dense nor too thin, the age around 2 months.

Avoid!

- Spawn with too thin or too thick mycelium and growing clustered
- Contaminated or attacked by pest
- The fruit body of the spawn has already grown.

III. CROPPING OF SHIITAKE MUSHROOM

<p>Cropping Medium Preparation</p> <p>Main material</p> <ul style="list-style-type: none">❖ Wood sawdust <p>Supplement materials</p> <ul style="list-style-type: none">❖ Grains❖ Fertilizer❖ Mineral❖ Water
<p>Bagging of cropping medium</p>
<p>Sterilization</p>
<p>Inoculation or spawning</p>
<p>Incubation</p>
<p>Cropping the fruit bodies</p>
<p>Maintenance or nurseries</p>
<p>Harvesting</p>

1. Persiapan Bahan Media Pertumbuhan Jamur

a. Serbuk gergaji kayu

- Serbuk gergaji hampir semua jenis kayu dapat digunakan

- Serbuk gergaji kayu keras (kelas I-II) seperti jati (*Tectona grandis*).

- Serbuk gergaji kayu lunak (kelas III-V) yang dapat digunakan antara lain karet (*Hevea brasiliensis* Muell Arg.), pulai (*Alstonia scholaris* R.Br), sengo (*Paraserianthes falcataria* (L.) Nielsen), aren (*Arenga pinnata* Merr.), mahoni (*Swietenia mahagoni* Jack. and *S. macrophylla* King.), kemiri (*Aleurites moluccana* Willd), jengkol (*Pithecelebium jiringa* Prain.), saninten (*Castanopsis argentea* A.DC.), ampupu (*Eucalyptus urophylla* ST. Blake), leda (*Eucalyptus deglupta* BL.), suren (*Toona sureni* Merr.), kemang (*Mangifera caesia* Jack.), mangium (*Acacia mangium* Willd.), meranti (*Shorea platyclados* V.Sl.) (Suprapti, 1993; Suprapti & Djarwanto, 1994, 1995, 1996; Djarwanto dan Suprapti, 1999, Djarwanto dkk., 2001, 2002).

- Serbuk gergaji sebaiknya telah kering, dipilih yang berukuran sedang, sekitar 20 - 60 mesh.

b. Dedak

- Dedak yang ditambahkan sebesar 10 - 20 % dari bobot bahan media kering (Suprapti, 1988)
- Gunakan dedak halus dan masih segar.

1. Preparation materials of the medium for cropping mushroom

a. Wood sawdust

- Sawdust of whatever wood species can be used as cropping medium.

- Sawdust of hard-texture woods (Class I-II) such as teak (*Tectona grandis* L.f.).

- Sawdust of soft-texture woods (Class III-V) can be utilized as rubberwood (*Hevea brasiliensis* Muell Arg.), pulai (*Alstonia scholaris* R.Br), sengo (*Paraserianthes falcataria* (L.) Nielsen), aren (*Arenga pinnata* Merr.), mahoni (*Swietenia mahagoni* Jack. and *S. macrophylla* King.), kemiri (*Aleurites moluccana* Willd), jengkol (*Pithecelebium jiringa* Prain.), saninten (*Castanopsis argentea* A.DC.), ampupu (*Eucalyptus urophylla* ST. Blake), leda (*Eucalyptus deglupta* BL.), suren (*Toona sureni* Merr.), kemang (*Mangifera caesia* Jack.), mangium (*Acacia mangium* Willd.), meranti (*Shorea platyclados* V.Sl.) (Suprapti, 1993; Suprapti & Djarwanto, 1994, 1995, 1996; Djarwanto dan Suprapti, 1999, Djarwanto *et al.*, 2001, 2002).

- The sawdust in dried condition and with 20 to 60 mesh in size will be suitable or appropriate for cropping medium.

b. Rice bran

- The rice bran has to be added 10 to 20 per cent in dry-weight of total medium (Suprapti, 1988).
- Use fresh and fine rice bran.

Hindari!

- Dedak yang terkontaminasi jamur pewarna atau telah dihinggapi hama.
- Dedak dari sekam yang digiling.

c. Biji-bijian

- Jumlah suplemen gabungan dedak dan biji-bijian atau tepungnya sekitar 20 % dari bobot bahan media kering (Suprapti dan Djarwanto, 1995).
- Biji-bijian berupa sorgum (*Sorghum vulgare* L.), jawawut (*Panicum viride* L.), millet (*Pennisetum* sp.), beras, jagung dan gandum, cocok dipakai dalam bentuk butiran maupun telah digiling.
- Gunakan biji-bijian yang masih bagus, bebas serangan hama dan penyakit.

d. Pupuk

Pupuk yang ditambahkan ke dalam media dapat berupa :

- Pupuk buatan antara lain trisuperfosfat, trisodium fosfat, urea, ammonium sulfat (ZA) dan NPK. Pupuk buatan yang ditambahkan pada media yang dipakai secara langsung sebaiknya kurang dari 0,5% (Suprapti, 1989), sedangkan untuk bahan yang diperam beberapa hari kurang dari 1%.
- Pupuk organik seperti daun-daun dari famili leguminoceae. Pupuk organik seperti daun turi (*Sesbania grandiflora* (L.) Poir) dan lamtoro (*Leucaena leucocephala* Lam. De Wit.) yang ditambahkan untuk media sebaiknya kurang dari 10 % (Suprapti & Djarwanto 1995).

e. Mineral

- Mineral kalsium yang ditambahkan ke dalam media antara lain gips, kapur, kalsium karbonat, kalsium oksida dan kalsium difosfat.

Avoid!

- Rice bran that has been contaminated by stain fungi or attacked by pest on it.
- Ground rice peel

c. Grains

- The supplement in total which is combination of rice bran and grains or its flour is about 20% in dry weight medium materials (Suprapti and Djarwanto, 1995).
- Grains such as sorghum (*Sorghum vulgare* L.), jawawut (*Panicum viride* L.), millet (*Pennisetum* sp.), rice, corn, and wheat; which has been ground or in small-size particles is suitable for the cropping medium.
- Please use the grains which are still in good condition and free of pest and disease attack.

d. Fertilizer

Fertilizer is added on medium such as:

- Chemicals i.e. trisuper-phosphate, trisodium-phosphate, urea, ammonium phosphate, and NPK. The chemical fertilizer as added in the fresh medium should be less than 0.5 % by weight (Suprapti, 1989). Whereas, the medium which has been composted (for couples days) can be added less than 1 percent by weight.
- Organics fertilizers such as leaves of *Leguminoceae* trees. Organics fertilizer like turi and lamtoro leaves as added to the medium should be less then 10 percent by weight (Suprapti & Djarwanto 1995).

e. Minerals

- Calcium: such as gypsum, lime, Calcium carbonate, Calcium oxide, and Calcium diphosphate.

- Dalam pembuatan media secara langsung, kapur yang ditambahkan berkisar antara 1-2,5%, sedangkan untuk yang diperam dahulu beberapa lama dapat menggunakan 2- 10 %.
- Banyaknya gips atau CaCO_3 yang ditambahkan 0,5 - 1,5 % (Suprapti dkk., 1994).
- Ke dalam media dapat ditambahkan dua macam mineral kalsium secara bersama-sama.

Usahkan :

- pH media mendekati netral
- Jika asam ditambah kapur atau CaO
- Jika basa dapat ditambahkan gips, CaCO_3 atau kalsium difosfat
- Jika pH media netral dapat ditambahkan gips dan kapur atau gips dan CaCO_3 .

f. Air

- Air yang ditambahkan merupakan air bersih seperti air sumur, air gunung atau air suling.
- Jumlah air yang ditambahkan tergantung bahan medianya.
- Penambahan air dianggap cukup apabila media dapat dikepal dan airnya tidak menetes, dan jika dilepas tidak buyar.

Hindari

- Pemakaian air yang mengandung khlor tinggi misalnya air ledeng dapat menghambat pertumbuhan jamur.
- Pemakaian air kotor.

g. Kantong plastik

Kantong plastik yang digunakan adalah berisi sekitar 1 kg media dan tebal 0,4-0,7 mm

- The lime to be added is about 1 to 2.5 percent in weight for fresh medium, or 2 to 10 percent for composted medium
- The gypsum and CaCO_3 to be added is 0.5 to 1.5 % in weight (Suprapti *et al.*, 1994)
- To the medium could be added two kinds of calcium mineral simultaneously.

Compulsory remarks :

- Medium acidity (pH) close to neutral
- When the media is rather acidic, please add with lime or CaO
- When it is rather alkaline, please add with gypsum, CaCO_3 or calcium di phosphate
- When it is neutral, please add with gypsum and lime or gypsum and CaCO_3 .

f. Water

- Use clean water e.g. from well/ spring, mountain, or distilled water
- The volume of water as added into the medium depends on the existing moisture content of the materials making up the medium, particularly sawdust
- Addition of water is regarded as enough when the medium can be squeezed until the water no longer oozes out, and when the squeezing is relieved the medium remain compact or does not go brittle.

Avoid !

- Using water with high chloride content such as running or tap water may inhibit the mushroom growth
- Using sewage or dirty water.

g. Plastik bag.

Plastic bag used is the one with 0.4 - 0.7 mm thick and can accommodate around one kilogram of media.

2. Pengemasan Media Pertumbuhan Jamur

- Media pertumbuhan jamur shiitake merupakan campuran serbuk gergaji kayu, dedak, biji-bijian (tepung), mineral dan air.
- Komposisi campuran bahan-bahan tersebut dapat bervariasi sesuai dengan jenis atau strain jamur yang akan dibudidayakan, seperti contoh pada Tabel 1 berikut :

Table 1. Contoh komposisi media jamur shiitake

Table 1. The sample of shiitake media formula

Bahan (Raw material)	Komposisi media jamur shiitake (Formulae of shiitake media);bagian/part			
	I	II	III	IV
Serbuk gergaji (Sawdust)	100	100	100	100
Dedak (Rice bran)	10	10	15	17
Sorghum	5	-	-	-
Tepung jagung (Ground corn)	-	5	-	-
Jawawut	-	-	5	-
CaCO ₃	1	1	-	1
Gips (Gypsum)	0,5	0,5	-	0,5
Trisodium phosphate (TSP)	-	-	-	0.3

Cara kerja pengemasan media pertumbuhan jamur shiitake dapat dilaksanakan sebagai berikut :

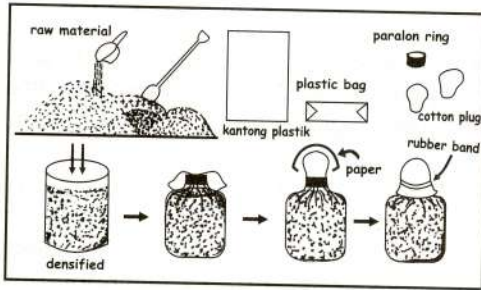
- Campurkan bahan media hingga homogen lalu tambahkan air hingga dapat dikepal
- Masukkan media ke dalam kantong plastik PVC tahan panas sambil agak dipadatkan
- Bentuk seperti botol dengan memberi leher dari cincin paralon atau bambu atau plastik
- Sumbat dengan kapas, kain atau gabus
- Lapsi sumbat tersebut dengan kertas atau plastik dan diikat dengan karet gelang (Lihat Gambar 5, 6 dan 7).

2. Bagging of Cropping Media

- The cropping media is made up or composed of e.g. sawdust, rice bran, grains (or its flour), mineral and water
- The media can vary in its composition depending on particularly the strain of shiitake mushroom to be cultivated, as an example depicted in Table 1 i.e. (designated as no I, II, III, and IV) :

Procedures in the bagging of cropping medium are follows :

- Mix the materials for the medium until homogenous then add water until sequeezable
- Put in the heat-resistant PVC (polyvinyl chloride) plastic bag while compacting the content
- Shape it to the one like a bottle by giving a neck made of paralon ring, bamboo or hard plastic ring
- Plug the "bottle" mouth with cotton butt, fabric or cork
- Cover the plug with a piece of paper or plastic, and tighten it with rubber band (See figures 5, 6, and 7).



Gambar 5. Pembuatan media produksi
(Figure 5. Preparation of cropping medium)



Gambar 7. Pengemasan media
(Figure 7. Bagging of media)

3. Sterilisasi

Sterilisasi dimaksudkan untuk membunuh mikroorganisme lain yang tidak dikehendaki. Sterilisasi dapat dilakukan dengan beberapa cara :

- Menggunakan autoklaf pada suhu 121°C , tekanan sebesar 1,5 atmosfer, selama 30 menit.
- Menggunakan steamer (drum pengukus atau kamar kedap udara) memerlukan waktu lebih lama karena tekanan dan suhunya kurang tinggi (Lihat Gambar 8). Selain itu, ukuran steamer juga mempengaruhi waktu yang diperlukan dalam sterilisasi.

Jika menggunakan steamer (drum pengukus):

- ukuran besar dengan suhu $75-90^{\circ}\text{C}$ maka lama pemanasan 6 - 8 jam.
- ukuran sedang dengan suhu $92-95^{\circ}\text{C}$, lama pemanasan adalah 4 jam.
- steamer isi 200 liter dengan suhu $100 - 102^{\circ}\text{C}$ memerlukan waktu pemanasan 1 jam.

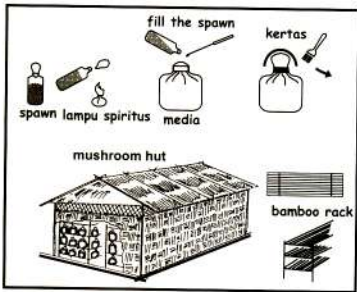


Gambar 6. Aktivitas dalam pembuatan media
(Figure 6. Activities on the preparation of cropping media)

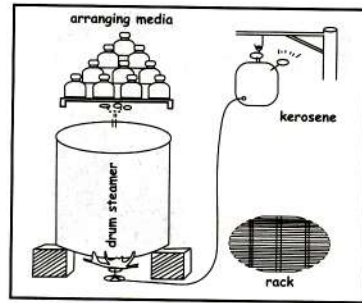
3. Sterilization

Sterilization is intended to intensely kill other micro-organisms that are unexpected in the medium. It can be conducted by several methods :

- Using an autoclave at 121°C in temperature and 1.5 atmosphere in pressure for 30 minutes.
- Using steamer (tank-steamer, chamber), it takes longer time because the temperature and the pressure are not high enough (See Figure 8). The volume of the steamer will affect the duration which is required for the sterilization process. Further, if using drum steamer :
 - with large-size drum, then the duration of sterilization should proceed at $75 - 90^{\circ}\text{C}$ for 6 - 8 hours
 - with medium-size drum, then the duration of sterilization should proceed at $92 - 95^{\circ}\text{C}$ for 4 hours
 - with 200-litre capacity steamer, then the duration of sterilization should proceed at $100 - 120^{\circ}\text{C}$ for one hour.



Gambar 9. Penularan bibit jamur ke dalam media produksi
(Figure 9. Inoculation of spawns to the cropping medium)



Gambar 8. Sterilisasi media
(Figure 8. Sterilization of media)

4. Inokulasi atau Pembibitan

Inokulasi, yaitu memasukkan bibit jamur ke dalam media secara aseptis di ruang steril (Gambar 9):

- Spatula kecil, pinset dan tangan dibersihkan dengan larutan disinfektan
- Buka dan panaskan mulut kantong media yang telah steril dan juga mulut botol bibit jamur lalu ditutup kembali
- Panaskan spatula tersebut kemudian pindahkan bibit ke dalam media kantong dan selanjutnya disimpan di ruang inkubasi
- Setiap satu botol bibit dapat digunakan untuk 20 kantong media.

5. Inkubasi

Inkubasi, yaitu penyimpanan media yang telah diinokulasi di ruang tertentu yang bersuhu $\pm 25^{\circ}\text{C}$ atau pada suhu kamar untuk memberi kesempatan tumbuh miselium. Media diletakkan pada rak bertingkat dan pada suatu tempat disusun berjejer atau miring serta rapat. Lihat Gambar 10.

4. Inoculation or spawning

The inoculation is transferring such spawn on mushroom medium aseptically in to a sterile room or chamber. See figure 9

- Clean the spatulla, pinset and your hands with disinfectant solution, and light the spiritus lamp
- Open the plug of the bag containing medium, wich has been sterilized, and then heat it close the fire of spirit lamp. Also, open the bottle containing the mushroom spawns
- Pass the spatulla onto the fire, then tranfer the spawns to the cropping medium. Afterwards, close both medium and spawn with their own plugs
- Store the media which has been spawned in the incubation room
- One bottle of spawn is sufficient to inoculate about 20 bags medium.

5. Incubation

Incubation is to store the inoculated medium in a special room with temperature $\pm 25^{\circ}\text{C}$ or in a room with ambient emperature to let the mycellium grow. The media are stacked in a row of a rack wich has been arranged in their position close to each other, as seen on figure 10.



Gambar 10. Susunan media pada rak di ruang inkubasi
(Figure 10. Arranging of media on the shelf)

6. Penumbuhan Tubuh Buah Jamur Setelah media dipenuhi miselium jamur (4-8 minggu setelah inokulasi):

- Kantong plastik dibuka atau dirobek di bagian atas atau bagian lehernya untuk memberi kesempatan tubuh buahnya tumbuh
- Simpan di ruang penumbuhan jamur atau ruang kultivasi. Media diletakkan pada suatu tempat atau rak bertingkat berderet dan disusun berjejer dengan jarak sekitar 15 cm, Lihat Gambar 11, 12, 13.

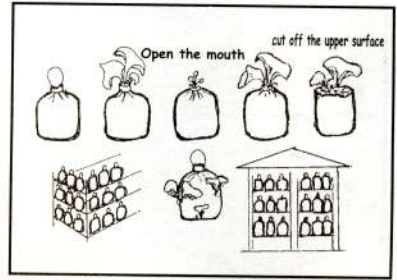


Gambar 12. Gubug penumbuhan jamur atau ruang kultivasi
(Figure 12. Mushroom hut or cultivation room)

7. Pemeliharaan Media

Kondisi lingkungan di dalam ruang penumbuhan jamur dipertahankan agar optimal :

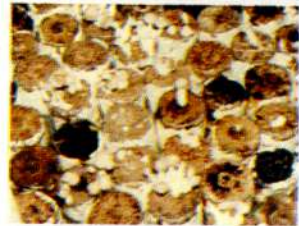
- Simpan media dalam ruangan yang bersuhu sekitar 20°C
- ventilasi atau aerasi cukup
- Intensitas cahaya sekitar 50 lux



Gambar 11. Penumbuhan jamur dalam gubug jamur
(Figure 11. Growing of mushroom on mushroom hut)

6. Cropping the Mushroom's Fruit Body After the media are full of mycellium (usually 4 to 8 weeks after inoculation):

- Slit or tear off the plastic bag starting from the upper part, or open its neck, to let the fruit body grows
- Place in the cultivation room. Media are put in rows of racks with interspace between them about 15 cm, as seen on figures 11, 12, 13.



Gambar 13. Tubuh buah jamur shiitake mulai muncul
(Figure 13. The fruit body of shiitake begins to appear)

7. Maintenancing the medium

The air or atmosphere in the cropping room should be kept in optimal condition :

- Optimum temperature around 20°C
- Sufficient ventilation or air circulation
- Enough light with intensity around 50 lux

- Usahakan kelembaban ruang terjaga, berkisar antara 80-93 % dengan menyemprotkan air bersih secara berkala menggunakan sprayer atau alat penyemprot yang lembut
 - Jaga kebersihan ruangan kultivasi untuk mencegah timbulnya hama dan penyakit. Adanya hama dan penyakit dapat menurunkan kualitas produk dan jumlah (kuantitas) produksinya.
8. Pemanenan
- Jamur dipanen apabila tubuh buah jamur telah masak petik (d disesuaikan dengan permintaan konsumen misalnya masih kuncup, setengah mekar atau agak mekar), umumnya umur 3-14 hari setelah nampak primordia (bakal jamur), yang dapat dilihat pada Gambar 14, 15, dan 16. Permulaan panen jamur terjadi pada umur 50-215 hari setelah inokulasi atau pembibitan (Suprpti Djarwanto 1995; dan Djarwanto dkk, 2001; 2002)
 - Pemanenan dilakukan dengan cara mencabut semua tubuh buah jamur sampai ke akarnya dengan menggunakan tangan bersih
 - Apabila dalam satu rumpun terdapat tubuh buah yang masih kecil atau muda maka sebaiknya dipanen semuanya atau sekaligus
 - Pemanenan jamur sebaiknya dilakukan pagi hari sebelum media disiram air atau disesuaikan dengan kebutuhan pasar (pagi, siang, sore dan malam).
- Keep the air humidity on 80 to 93 percent by spraying clean water periodically using fine sprayer
 - Keep clean the environment to prevent from pest and disease. Pest and disease can worsen the mushroom products with respect to qualities as well as volume (quantity).
8. Harvesting
- The mushroom can be harvested when the fruit body has ripened optimally. The ripening usually takes 3 to 14 days after the appearance of the primordium, as shown on Figures 14, 15, and 16. The initial harvesting was be conducted on the 50th to 215th day after the inoculation or spawning (Suprpti Djarwanto, 1995 and Djarwanto *et al*, 2001)
 - Harvesting is conducted by pulling out the whole fruit bodies all the way to their roots with clean hands. Even the fruit body as such can still contain small and baby mushroom
 - Harvesting is best to be done in the morning time before being watered in accordance with the market demand (e.g. morning, noon, afternoon or night).



Gambar 14. Jamur shiitake yang sedang tumbuh
(Figure 14. Shiitake in the growing process)

IV. PENANGANAN PASCA PANEN JAMUR SHIITAKE

- Bersihkan tubuh buah jamur dan media yang menempel, dan potong pangkal tangkainya
- Simpan di tempat dingin seperti lemari es (refrigerator) atau di ruangan ber-AC (air-conditioned). Di dalam lemari es; jamur di masukkan dalam kantong plastik yang diberi lubang. Disimpan pada kotak plastik dalam keadaan terbuka di dalam lemari es dapat tahan satu bulan namun jamur akan kehilangan kandungan air bahkan dapat mengering. Jamur ini apabila disimpan di tempat panas akan menimbulkan bau yang tidak sedap
- Jamur dikeringkan di bawah sinar matahari atau oven atau diasap diatas api
- Jamur dimasak sebagai sayuran (ditumis, dibuat sayur lodeh, sup, keripik, pepes, bakwan, lumpia, tempura, pangsit dan lain-lain). Jamur ini beraroma petai atau jengkol sehingga jangan kaget apabila setelah makan jamur ini mulut dan urine bau petai.



Gambar 15. Jamur yang siap dipanen
(Figure 15. Shiitake mushroom ready for harvesting)

V. PEMASARAN

- Shiitake dapat dijual segar maupun kering
- Untuk usaha tani jamur di tempat

IV. THE HANDLING OF POST-HARVESTED MUSHROOM

- Clean the fruit body from medium, and cut off the stipe using scissors
- Place it in a cool room or refrigerator. If stored in a refrigerator, the fresh shiitake should be wrapped in perforated plastic bags. In this way, the mushroom can stay in good condition for about one week. However, if placed on the plastic tray inside the refrigerator, the mushroom can last at most for one month. Unfortunately, the mushroom as such will suffer from drought. When the mushroom is placed in a warm or hot room, it will emit an inconvenient smell
- Sun-drying or oven-drying or smoked above fire of mushroom can also be done to the shiitake. In the way, the mushroom in the storage can last long
- Cook mushroom such as 'tumis', "lodeh", soup, 'pepes', 'bakwan', lumpia, tempura, pangsit and crispy or fried mushroom. This mushroom cooked stuff will taste like "petai" and "jengkol". Moreover, people who eat this food stuff will suffer a bad smell from their mouth/breath as well as their urine.

V. MARKETING

- Shiitake can be sold in fresh and dried condition
- Mushroom business can be challenging opportunity for the farmer endeavor at a new location and therefore should be anticipated for the convenient market guarantee. However, it should be bear in mind that the Indonesia community still mostly do not consume mushroom as their daily menu.
- Therefore, intensive promotion is a

baru maka pemasaran merupakan tantangan yang harus diantisipasi dalam memperoleh jaminan pasar. Pada umumnya secara kultural masyarakat Indonesia tidak terbiasa mengonsumsi jamur

- Langkah-langkah yang pernah dilakukan yaitu mengenalkan produk atau promosi jamur dengan cara memberi jamur segar, mengajarkan cara memasak dan menghidangkan aneka masakan jamur pada acara pertemuan kaum ibu. Makin sering mencicipi masakan jamur nampak makin suka dan ketagihan jamur. Akibatnya jamur dapat digunakan untuk menganekaragamkan menu masakan sehari-hari. Diversifikasi pangan ini diharapkan dapat menciptakan dan memperluas pasar
- Jamur dapat pula dijual di pasar swalayan, restaurant dan hotel.



Gambar 17. Bekas media jamur shiitake
(Figure 17. Spent compost of shiitake mushroom)

VI. MANFAAT DAN KANDUNGAN GIZI JAMUR SHIITAKE

1. Manfaat

- Sumber bahan pangan yang bernilai gizi tinggi
- Bahan obat. Jamur ini memiliki efek medis yang dapat dimakan mentah atau direbus di atas api kecil sampai airnya berwarna coklat. Jamur ini

significant key to successful introducing and endeavoring in shiitake mushroom. Preliminary studies that should be taken are e.g. introducing or promoting mushroom to the community free of charge, providing a lecture (brief and practical instruction) on how to cook food stuffs involving shiitake mushroom deliciously and serve the results attractively on the table, for example, during the informal meeting or get together among housewives. In this way, expectedly, the more frequently they taste the mushroom, the more they will like it and sooner or later will get attracted or addicted. In consequence, mushroom can be served with other food ingredients in numerous recipe varieties as a daily menu. Hence, such food diversification can afford market extension of mushroom

- Mushroom can also be sold at supermarkets, restaurants, and hotels.



Gambar 16. Jamur sedang dipanen pada media yang berumur 12 bulan
(Figure 16. Mushroom being harvested at 12-months age)

VI. BENEFIT AND NUTRIENT CONTENT OF SHIITAKE MUSHROOM

1. Benefit

- Food source with high nutrient value
- Cure effect. To some extent, this mushroom can afford its efficacy in

telah dikemas dalam bentuk pil, tablet, kapsul, tonic (minuman berkasiat), cairan injeksi

- Memiliki efek antifungal
- Antitumor efek. Dapat menghambat pertumbuhan kanker *sarcoma* pada tikus percobaan sebesar 80 % (Chang, 1993)
- Antiviral efek. Dapat melawan influenza secara invitro atau invivo
- "Hypolipidemic activity" : Menurunkan kadar kolesterol pada tikus sekitar 24%, yang diberi makan jamur selama 10 minggu (Cochran, 1978).

2. Kandungan Gizi

Jamur shiitake mengandung protein, karbohidrat, lemak, mineral dan vitamin yang besarnya tergantung pada strainnya. Berdasarkan hasil analisis kimia bahwa nilai gizi jamur tersebut umumnya lebih baik daripada sayuran dan buah-buahan (Tabel 1). Kandungan protein Jamur shiitake cukup lengkap, yakni meliputi 16 asam amino esensial, yaitu isoleusine, leusine, lysine, methionine, phenylalanine, tyrosine, threonine, valine, argenine, histidine, alanine, aspartic acid, glutamic acid, glycine, proline dan serine.

remedying particular disease problems

- The shiitake can afford antifungal effects
- Antitumor effects. According to the report, shiitake is able to inhibit the growth of sarcoma cancer by 80 percent, as proved on remedial tried that used rat sample (Chang, 1993)
- Antiviral effects. This mushroom can have effect on remedying influenza disease in vitro as well as in vivo
- Hypolipidemic activity. Shiitake can have hypocholesterolamic effects as medicinally tested on rat, i.e. considerably reducing the cholesterol content by 24 percent in its body, after being fed with shiitake mushroom for 10 weeks (Cochran, 1978).

2. Nutrient Content

Shiitake contains protein, carbohydrate, fat, minerals, and vitamins, in particular level depending on the strain of shiitake. Result of biochemical analysis revealed that the nutrition value of mushroom is prevalently better than that of vegetables and fruits (Table 1). Besides, the content of protein in its body is containing 16 essential amino acid i.e. isoleusine, leusine, lysine, methionine, phenylalanine, tyrosine, threonine, valine, argenine, histidine, alanine, aspartic acid, glutamic acid, glycine, proline and serine.

Tabel 2. Nilai gizi jamur shiitake (*Lentinula edodes*) per 100 gram bahan
Table 2. Nutrition value of shiitake (*Lentinula edodes*) per 100 grams material

Sampel (Sample)	Kadar air awal (Initial moisture)	Protein	Lemak (Fat)	Karbohidrat (Carbohydrate)	Fiber (Serat)	Abu (Ash)	Kalori (Energy value) ; kcal
Segar (Fresh)	90.0	17.5	8.0	67.5	8.0	7.0	381
	91.8	13.4	4.9	78.0	7.3	3.7	392
Kering (Dried)	18.4	13.1	1.2	79.2	14.7	6.5	333
	15.8	10.3	1.9	82.3	6.5	5.5	375

Sumber (Source) : Crisan and Sands, 1978.

VII. ASPEK EKONOMI

Salah satu faktor utama dalam usaha tani jamur yang menjadi prioritas untuk menjadi bahan pertimbangan adalah aspek ekonomi. Pengamatan di lapangan menunjukkan bahwa keuntungan atau kerugian pengusaha tani jamur sangat bervariasi. Beberapa faktor yang dapat mempengaruhi usaha tersebut yaitu kemampuan teknologi budidaya yang meliputi pembuatan bibit, pemilihan bibit yang berkualitas, pemilihan media, pemeliharaan, sumberdaya manusia yang berkualitas (tenaga yang trampil, rajin, ulet, telaten, dan motivasi kuat), teknologi penanganan pasca panen dan pemasaran.

Selain itu, diperlukan pula modal baik yang berupa modal tetap maupun yang tidak tetap. Modal tidak tetap meliputi bahan-bahan yang digunakan untuk memproduksi jamur tersebut. Biaya ini dapat mulai diperbarui pada bulan ketujuh (untuk media dari serbuk gergaji kayu lunak) sampai umur pakai rumah jamur tersebut habis. Kelayakan usaha sangat tergantung pada modal tidak tetap dan harga jual produk jamur. Modal tetap terdiri dari lahan (lokasi budidaya), bangunan dan peralatan. Bangunan dapat bervariasi mulai dari dinding bilik, kayu, atau tembok; atap nipah, bilik, injuk, atau genting dan lantai tanah atau semen. Hasil survey, biaya yang diperlukan untuk membuat kumbung atau rumah jamur umumnya \geq Rp. 1.500.000,- dengan umur pakai $>$ 2 tahun. Lokasi dipilih yang faktor lingkungan sesuai yaitu pada ketinggian tempat lebih 700 meter dari permukaan laut atau lebih, suhu udara kurang lebih 20°C dan kelembaban udara 80-93 %, mudah dijangkau dan dekat dengan tempat pemasaran, serta

VII. ECONOMICAL ASPECTS

One aspect to be considered in the cultivation of mushroom is economical aspect. From the benefit cost analysis, it found that the profit and lost of the mushroom farmers were varies. Some factors known could affect to that business i.e. the ability in managing cultivation technology covering spawn preparation, choosing best spawn, medium, cropping or nursery, human resource (skill labor, effortness, and motivation), and post harvest handling and marketing.

Besides those, it needs capital cost; fixed cost and operational cost. Capital cost covers materials used for producing mushroom. Those costs are renewable at the seventh month (for medium made of soft-texture wood) up to the service life of mushroom's hut.

Feasibility of the business mostly depends on the fixed cost and market value of the product.

The fixed cost refers to the area (cultivation site), building, and tool or equipment. The building can be made up of various materials, e.g. wall which is constructed of woven bamboo, wood, or bricks; roof of leaf of palm (nipah), woven bamboo, arenga fiber, or clay tile; and floor of soil or cement. Result of assessment revealed that the cost as required to erect "kumbung" or called as mushroom house/hut priced more than Rp. 1,500,000 with service life about 2 to 3 years. Further, selecting the location for mushroom cultivation should consider environment factors, such as altitude (i.e. usually 700 meters above sea level, or over), temperature (around 20°C), and humidity (80-93%), being achievable and near the market, the availability of main as well as supplemental materials (e.g. heat resistance plastic bags, sawdust, rice bran and water which in quantity and cleaning are adequate, and the existing of man power. The lower the fixed cost,

ketersediaan bahan baku (kantong plastik tahan panas, serbuk gergaji, dedak dan air) memadai dan juga ketersediaan tenaga kerja. Makin rendah biaya tetap maka akan makin cepat modal tersebut kembali. Makin tinggi biaya tetap tersebut maka akan makin lama modal tersebut kembali.

1. Perkiraan biaya

Perkiraan biaya operasional pembuatan sebuah gubug jamur isi 10.000 kantong media (Tabel 3).

Modal tetap (Pengadaan alat dan bangunan dengan masa pakai 3 tahun).

2. Penerimaan

Jika rata-rata produksi jamur segar 100 gram/kantong selama 12 bulan maka produksi 10.000 kantong adalah 1.000 kg, dan harga rata-rata jamur segar Rp. 20.000,-; maka Total harga jamur $1.000 \times \text{Rp } 20.000 = \text{Rp } 20.000.000,-$

Penerimaan bersih selama 12 bulan adalah harga jamur dikurangi biaya produksi yaitu $\text{Rp } 20.000.000 - \text{Rp } 13.830.000 = \text{Rp } 6.170.000,-$

3. Pertimbangan Penghasilan

a. Break event point (BEP) volume produksi = total biaya: harga satuan = 691,5

→ Titik balik modal terjadi jika produksi jamur segar sebanyak 692 kg.

b. BEP harga produk = total biaya: volume produksi = 13.830,-

→ Titik balik modal terjadi jika harga jamur segar sebesar Rp 13.830/kg

c. Revenue Cost Ratio (RCR) = Total harga produk dibagi Total biaya produksi = 1,45

→ Setiap penambahan biaya Rp 1,- akan diperoleh penerimaan Rp 1,45.

the sooner or the faster the duration to gain return on currency investment, and vice versa (covering of land, building, and toolkits).

1. Cost approximation

Approximation of operational cost or expenses in erecting the mushroom hut that can accomodate 10,000 bags media is described in the Table 3 (i.e. under the assumption that the service life of building and tool/equipment is 3 years).

2. Revenue

If the average production of mushroom by weight per plastic bag was 100 grams for twelve months cultivation. Projected production of mushroom yield for 10,000 bags was 0.10 kg by $10,000 = 1,000 \text{ kg}$. The price of mushroom in the market was Rp 20,000 per kg. Therefore, gross revenue was $1,000 \text{ by } \text{Rp } 20,000 = \text{Rp } 20,000,000.00$. Total of net revenue for 12-month duration was price of mushroom product (Rp 20,000,000) minus the overall cost (Rp 13,830,000) = Rp 6,170,000.

3. Benefit cost analysis

a. Break even point (BEP) at the quantity of mushroom production was the entire cost divided price per kilogram, i.e. $13,830,000 : 20,000 = 691.5$. Therefore, the return on investment (ROI) would be reached at production of fresh mushroom as much as 692 kg

b. Mean while, the BEP price of mushroom was entire cost divided by the quantity of production, i.e. $13,830,000 : 1,000 = 13,830$. Therefore, the ROI would occur at the selling price of mushroom, i.e. Rp 13,830 per kg.

c. The revenue cost ratio (RCR) was total proce of production divided by the entire cost, i.e. $20,000,000 :$

d. Net Present Value (NPV) = $[\text{Total harga} \times 1 / (1 + \text{bunga per bulan})^{12}] = 16.395.177,13$.

→ Dengan asumsi bahwa bunga bank 20%/th, penerimaan yang akan diperoleh 12 bulan mendatang se-benarnya senilai Rp 16.395.177,13.

13,830,000 = 1.45. Therefore, the quality of revenue for every increase of cost as much as Rp 1.00 was Rp 1.45.

d. The net present value (NPV) at bank interest 20 percent per year for 12 months of implementation was [total

Tabel 3. Perkiraan biaya operasional pembuatan sebuah rumah jamur
(Table 3. Approximation of operational cost in erecting of a mushroom hut)

Nr.	Nama barang (Interest items)	Volume	Harga satuan (Price per piece) ;Rp	Harga (Total price);Rp
A	Modal tetap (Fixed cost)			
	Rumah jamur (Mushroom's hut) 9 m x 6 m	54 m ²	40.000	2.160.000
	Rak kayu dan bambu (Wooden and bamboo rack)	5 set	400.000	2.000.000
	Kompor mawar (Burner)	4 set	60.000	240.000
	Drum	4 set	100.000	400.000
	Sekop (Shovel)	1 pc	25.000	25.000
	Sprayer	1 set	35.000	35.000
	Ember (Bucket/pail)	2 pcs	3.000	6.000
	Spatulla	3 pcs	10.000	30.000
	Timbangan (Balance)	1 set	75.000	75.000
	Gayung (Water dipper)	1 pc	3.000	3.000
	Cincin paralon (Paralon ring)	10.000 pcs	100	1.000.000
	Karung plastik (Plastic sack)	20 pcs	1.000	20.000
			5.994.000	
B	Variable cost			
	Serbuk gergaji (Sawdust)	6 ton	30.000	180.000
	Dedak (Rice bran)	800 kg	800	640.000
	Gips (Gypsum)	30 kg	3.500	105.000
	Kapur (Lime)	120 kg	300	36.000
	Biji-bijian atau tepungnya (Grain or its powder)	200 kg	5.000	1.000.000
	Alcohol	2 litre	20.000	40.000
	Kantong plastik PVC (PVC Plastic bag)	80 kg	8.500	680.000
	Bibit jamur (Mushroom spawn)	400 bottle	5.000	2.000.000
	Minyak tanah (Kerosene)	400 litre	1.200	480.000
	Karet gelang (Ring rubber)	1 kg	15.000	15.000
	Limbah kapas (Cotton waste)	10 kg	1.000	10.000
			5.186.000	
C	Tenaga kerja (Man power)			
	Pengemasan media (Bagging the media)	70 wmd	10.000	700.000
	Pembibitan/inokulasi (Spawning or inoculation)	30 wmd	10.000	300.000
	Pemeliharaan dan pemanenan (Maintenance and harvesting)	11 months	150.000	1.650.000
			2.650.000	
			13.830.000	

Keterangan (Remarks) : wmd = work-man day

e. Berdasarkan pengalaman, usia pakai rumah jamur adalah 3 tahun, hal ini berarti media jamur dapat diperbaharui secara periodik setiap tahun. Sehingga ada kesempatan berusaha jamur tahap kedua dan ketiga sesuai dengan usia pakai rumah jamur. Peluang penerimaan pada 12 bulan tahap kedua dan setiap tahap berikutnya sampai sekitar tiga tahun, yaitu:

Total produksi dikurangi biaya produksi (Bahan baku dan Tenaga Kerja) = Rp 20.000.000,- - 5.994.000,- = Rp 14.006.000,-

f. Keuntungan berupa barang

Pada 12 bulan tahap pertama selain diperoleh keuntungan pendapatan berupa uang, sebenarnya juga diperoleh keuntungan berupa barang yaitu bangunan dan rak yang berumur pakai 3 tahun (36 bulan) setelah dikurangi penyusutan yaitu senilai $5/6 \times (\text{Rp } 2.160.000 + \text{Rp } 2.000.000) = \text{Rp } 3.466.670,-$

g. Sisa media

Sisa atau bekas media jamur yang tidak dikonsumsi oleh jamur juga dapat memberikan penambahan income. Sisa media tersebut dapat digunakan untuk pupuk tanaman dan penggembur tanah.



Gambar 18. Pemanfaatan bekas media untuk pupuk (Figure 18. Utilization of spent compost for fertilizer)

price $\times 1/(1+0.0167)^{12}] = \text{Rp } 16,395,177.13$ (note x= multiplied by). Under the assumption that the bank interest was 20 percent per year, the real value of the revenue in the upcoming 12 month would be Rp 16,395,177.13.

e. Corresponding to the previous experience, the life service or usable duration of mushroom huts was about three years. This means that mushroom media can be renewed every twelve months period. Afterwards, there will come-up a second stage of mushroom farm for another period. Similarly, a third stage operations will appears again for another twelve months after renewal. This expectedly will proceed on and on continuously until reaching three years duration in accordance with the service life of the mushroom hut. The chance of acquiring revenue (net benefit) in the second stage of mushroom operations, and in the following stages until about three year duration ia as follows production total is subtracted by variable cost and taking into account the man power. In this regard, the chance of acquiring the net benefit for every 10,000 bags of media in the second stage of such mushroom endeavor would be Rp 20,000,000 - Rp 5,994,000 = Rp 14,006,000.

f. Benefit as materials

In the first 12-months stage, beside acquiring benefit in the form of currency, other benefits as material, e.g. building and shelves with their service life 3 years (36 months) after being substrated by depreciation that corresponds to $5/6 \times (\text{Rp } 2,160,000 + \text{Rp } 2,000,000) = \text{Rp } 3,466,670$

g. Spent medium

The spent medium or the medium that still left or not consumed by the mushroom as by-product (Figure 17 and 18) can also bring in additional income for mushroom business, since it can be used as fertilizer and softening of soil texture.

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SHIITAKE (*Lentinula edodes*)