Oyster Mushrooms
Turn Your Trash into Cash!

University of Guam, Guam Cooperative Extension
November 1993, Bulletin CRD —2

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cnowledgments
The author wishes to express appreciation to all who contributed to or assisted in some way with publication.
Special thanks go to the CALS Media staff, Dr. Lawrence F. Kasperbauer, CDI Director and Jeff Barcinas, GCE Associate Dean.

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pportunities for ushroom Production

Guam is experiencing rapid growth and development, especially in the itor industry. In 1992, nearly one million tourists chose Guam as their :ation destination. This influx, along with local population growth, has ısed the generation of waste to mount. Public agencies which deal with ste removal and management are hard pressed to keep pace.

Here, as in the mainland United States, paper comprises more than half ıll solid waste sent to local landfills. Apart from being a terrible fire hazard, s paper waste can shorten the life span of the Ordot Landfill and other ınd refuse areas.

Many island residents are working to find alternate ways to manage am's growing trash problem. Some proposals include village composting as and a waste incineration plant. However, environmentalists have sed concern on possible side effects these will have on sanitation and the ⁄ironment.

One educational tool which the University of Guam's Cooperative tension employs is the use of paper and other organic wastes to produce ırmet mushrooms. The technique has been proven to be cost-effective d safe. The simple technique can be used by island residents as a hobby, generate extra income, or as a business venture.

What are Mushrooms?

Mushrooms are molds (fungi) and are classified in the class *Basidiomycetes*, order *Agaricales*. Some of their common characteristics are:

- Presence of gills under an umbrella-shaped cap or pileus;
- Most have stalks;
- Size, texture, shape and color of fruiting bodies vary according to the genus or species.

Some mushrooms like to grow in cool weather, while others thrive in warm places. Some flourish on logs; others develop on composted substrates. They commonly emerge during rainy season because of their requirement for high moisture and relative humidity.

Life for the mushroom begins with the seeds called spores. These spores are very small, often microscopic, which helps their dispersal through the environment via air currents.

Upon contact with a suitable substrate, spores germinate and develop mycelia. When conditions are favorable, the mycelia grow, branch out through the substrate, absorb food and produce the fruiting bodies which we know as mushrooms.

In the natural environment, mushrooms exist as part of the organic life cycle. They work to break down or decompose dead organic matter, particularly cellulose. Since plants are mostly made up of cellulose, mushrooms are found growing on dead branches or stems, or on forest litter which has a light organic matter content.

There are no signs, such as rings, that distinguish edible mushrooms from poisonous ones. Due to the extreme danger of eating wild mushrooms, species have to be properly examined, identified and tested in the laboratory to determine if they are safe to eat. Subsequently, attempts are made to grow the edible species in artificial culture. Their cultivation is aided by using various forms of organic waste. Best among these are solid wastes from cities and farms such as waste paper, grass, straws, wood chips, animal manure and lawn clippings.

As consumers interest in healthy living and healthy food has increased over the years, so has the cultivation of mushrooms. Mushrooms have become an important part of our diet, and rightly so. They are good sources of protein, Vitamin B complex and minerals. They are also low in cholesterol and sodium and contain retene, a substance that may have antagonistic effects on some tumors.

The tasty oyster mushroom is easy to cultivate on organic solid waste, ›ecially waste paper. Due to the abundance of this type of waste on Guam, Community Development Institute under the Guam Cooperative Exten- n of the College of Agriculture and Life Sciences at the University of Guam ›erimented with the growing of this type of mushroom on waste paper. It s a success!

This pamphlet will guide you step by step through the cultivation of ;ter mushrooms. By raising this type of mushroom, you will help lessen amount of waste now heading to island landfills, provide a source of trients for a healthier diet for you and your family, and generate a little ra income!

asic Biological Requirements

Similar to the fruits of plants, mushrooms are the reproductive bodies ungi. For a fungus to reach this stage quickly, it is important that the ;etative stage be vigorous and active. To attain this, the fungus has to be ›plied with its basic food and environmental needs. Another requirement hat the fungus be given the chance of attaining maturity at the earliest ssible time. This is accomplished by eliminating or suppressing competi- s through the sterilization or pasteurization of the substrate.

The above characteristics and growth requirements are essential to ıshrooms. It is important to provide these in order to successfully induce growth and fruiting of mushrooms in artificial culture.

Introduction

For a beginner, a room or carport, measuring 5 x 5 meters (16.4 x 16.4 feet) would be sufficient. A 10 x 15 meter (32.8 x 49.2 foot) building, preferably made of concrete, would be adequate for the commercial production of oyster mushrooms. Within this building, a room measuring at least 3 x 3 meters (9.8 x 9.8 feet) can be used for inoculating, another 4 x 4 meter (13.1 x 13.1 feet) room for incubating, and a 5 x 5 meter (16.4 x 16.4 feet) area for other laboratory activities, such as preparation of cultural media. The rest of the building can be used as a growing chamber for mushrooms and for storage.

Apparatus:

The following is a list of basic equipment and supplies needed for a modest spawn laboratory, including the sterile room:

- autoclaves or pressure cookers — 12 1/4 to 15 1/4 inches inside diameter by 10 to 17 1/2 inches inside height
- refrigerators or incubators — 1 1/2 x 1 1/2 feet or larger
- transfer chamber or laminar flow cabinet — 24 x 18 x 18 inches
- exhaust fan for cooling incubation room — 16 inches diameter
- humidifier — six gallons per day capacity
- iron casserole or drum steamer — 50 gallon capacity
- gas or electric stove — two-ring burner
- wood fuel stove for steaming
- double boiler — 12 inches or more in height
- work table — 4 x 2 x 2 1/2 feet
- shelves in the incubation rooms — 1 x 1 x 3 feet
- shelves for chemicals — 1 x 1 x 3 feet
- test tubes — 125 x 20 mm
- petri dishes — 4 inches x 3/4 inch
- flask — 500 ml
- weighing scale — 2000 g capacity
- pH meter — 0-14 range
- thermometer — 20-220° F
- hygrometer — 10 to 99 percent range
- alcohol lamp

- wire loop — 6 inch handle with 2.75 inch wire loop
- scalpel — 5 1/2 inches
- graduated cylinder — 500 ml with 5 ml graduation
- cotton balls
- PVC plastic necks — 3/4 to 1 inch inside diameter x 1 inch length
- plastic storage pails — 12 x 14 inch
- polypropylene bags — 7 x 14 inch
- flat or round bottles — 8 x 3 inch
- matches
- rubber bands — size 64 (3.5 x 1/32 x 1/4 inch)
- felt-tipped permanent marker pens
- test tube labels
- aluminum foil — 66 2/3 yards x 12 inch
- test tube racks — for 20 mm test tubes
- test tube brush — 9 inches long with 3 inch bristles

emicals:

- Dextrose or white cane sugar
- Agar (powder or bar)
- Alcohol, ethyl and denatured - 80 percent
- Bleach containing Chlorine
- Lactic acid
- Formaldehyde

(to lessen the expense, white cane sugar can be substituted for dextrose; agar bars can be used instead of powdered agar.)

awn Substrate:

- Waste paper (cardboard, carton, newspaper, bond and/or computer paper)
- Grain (i.e., corn, wheat or rice)
- Fertilizer (16-16-16)
- Limestone

Preparation of Cultural Media

PDA (Potato Dextrose Agar)

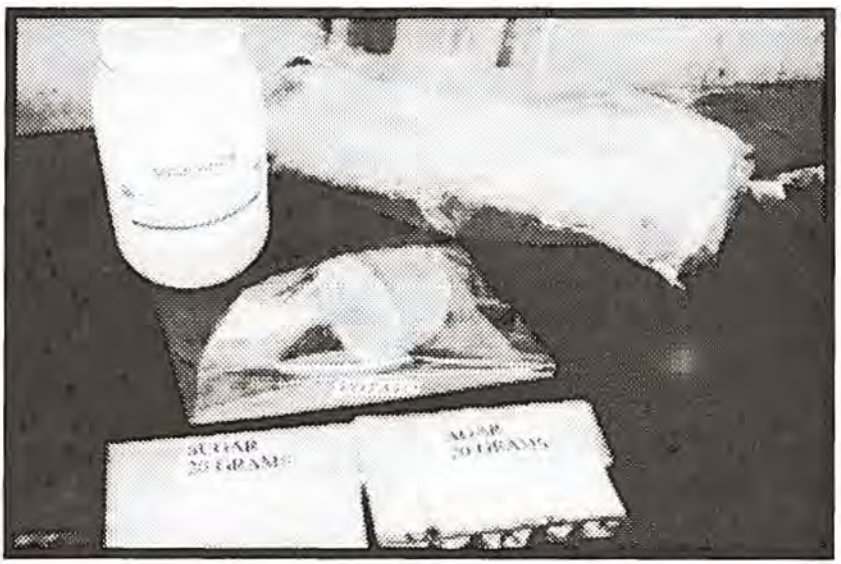
Ingredients:		
	Diced potato	200 g
	Dextrose or white cane sugar	20 g
	Powdered agar or agar bars	20 g (2.5 bars)
	Distilled water (or rain water)	1 liter

Procedure:

Peel, wash, weigh and cut potato into cubes. Boil in a casserole with one liter of water for 15 minutes. Remove the potato then add water to make one liter of potato broth. Add the dextrose and agar. Heat and stir broth until the agar is melted. Pour the solution into flasks (1/3 full) or into test tubes (2.5 cm from the bottom). Cover the mouth of the flasks with aluminum foil or screw the caps on the test tubes.

The flasks and test tubes are sterilized either by pressure or non-pressure steaming. Sterilization by pressure steaming requires the use of a pressure cooker. Sterilization is set at 15 psi for 15-30 minutes. Sterilization by non-pressure steaming requires two to three hours of steaming inside a large casserole or similar type steamer.

After sterilization is completed, allow the pressure to go down to zero. Take the test tubes out and place **in a slanting position on a flat surface** to cool and solidify. These are the agar slants that are used for the growing of the oyster mushroom in pure culture. These, together with the flasks, are stored in the refrigerator to lessen the possibility of contamination.



her media used in the culture of mushroom

)Y (Potato Dextrose Yeast)

Procedure:

Boil 300 g potato in one liter of water for 15 minutes.
Remove potato;
Add 10 g dextrose, 2 g yeast and 20 g agar.
Heat mixture until agar is melted.
Pour into flask and test tubes.
Sterilize.

EA (Malt Extract Agar)

Procedure:

Boil 40 g of MEA in one liter of water;
Pour into flask and test tubes.
Sterilize.

Obtaining a Pure Culture

NOTE: This step may be omitted if a pure culture of the oyster mushroom (*Pleurotus sajor-caju*) is available.

Take out the flask containing the sterilized PDA from the refrigerator. Once it has adjusted to room temperature, melt by heating it in boiling water. After the agar has melted, pour into petri dishes that have been previously sterilized in the oven at 390° F for three hours. Allow the PDA to cool and solidify.

The pure culture is obtained from a tissue of the fungus' fruiting body, a process that is known as tissue culture. Mushrooms used in this process should be fresh, preferably one to two days old. Any part of the mushroom may be used, although the cap is considered the best because the tissue can be easily dissected.

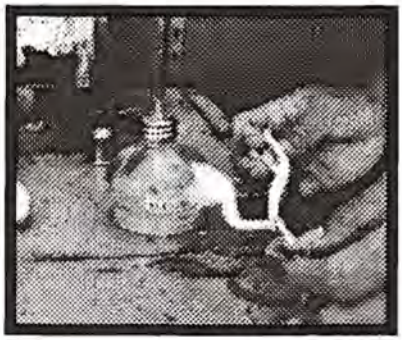
The mushroom is thoroughly pre-washed in sterile water. A scalpel is dipped in alcohol and held over a flame, such as an alcohol lamp or Bunsen burner, until red hot, then cooled for 10 seconds. This is used to cut the mushroom lengthwise, from the cap downward. You can also break the mushroom lengthwise with your fingers. A small slice of the internal tissue (1/8 inch square) is removed with the use of a scalpel and transferred to the surface of the solidified PDA in the petri dish.

The petri dish is incubated at room temperature. After two to three days, white fungal mycelial growth will be visibly radiating from the tissue. A piece of agar with the mycelia from the edge of this radical growth is lifted with the use of a wire loop or scalpel.

This piece of agar is transferred to an agar slant. After two to three days, mycelia will be observed growing from this piece of agar. Provided there is no contamination, this is a pure culture.

Making Sub-Cultures

The pure culture can be used as a source for producing sub-cultures. This is done by transferring a piece of the agar with some mycelium from the pure culture into sterilized test tubes with the solidified PDA slants.



Spawn Preparation

Containers: Mason or wide-mouthed glass jars
Polypropylene bags

Substrate:

Paper	80 percent
Corn grits	17 percent
Sugar	1 percent
Lime	1 percent
Fertilizer (16-16-16)	1 percent

Procedure:

Various types of waste paper can be used to prepare the mushroom spawn substrate. The paper is cut into appropriate sizes which is easily placed inside polypropylene (PP) bags. A space is provided at the center of the bag where the mixture of corn grits , sugar, fertilizer and lime is added. Water is added to saturate the substrate. Excess water is drained off 24 hours after soaking.

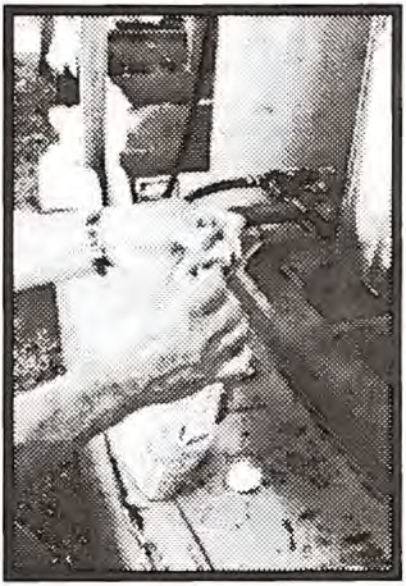
When placing the paper inside the PP bag, leave enough space at the top portion of the bag so it can be easily rolled and inserted through a pre-cut PVC pipe neck. After insertion, the top is folded over to provide an opening for the transfer of the pure culture. This opening is plugged with a cotton ball, then with a piece of paper that is held in place by a rubber band.

Several PP bags can be piled inside a pressure cooker. The bags are sterilized at 15 psi for one hour. Pasteurization can also be used instead of sterilization. This is accomplished by steaming the PP bags with a drum steamer for three to four hours.

If glass jars are used, the paper, corn, fertilizer and lime can be mixed together. The mixture is then placed inside the jars (aluminum foil is a good cover for the jars). Follow the soaking and sterilization guidelines as was done with the PP bags.

Inoculation and Spawning

After sterilization, the PP bags are cooled to room temperature. The bags are placed inside the transfer chamber to lessen the possibility of contaminants getting into the substrate during inoculation. The rubber band and paper are removed. The cotton is unplugged to provide an opening to the bag. Into this opening, a piece of agar from the pure culture or from the subculture is aseptically transferred from the test tube to the substrate with the use of a wire loop. Once this is accomplished, the bag is immediately closed.



Incubation

The PP bags are kept in a cool dark room or inside a cabinet. The mycelia from the transferred agar will start to grow and move downward. Within 20 to 30 days, the PP bags will be fully covered with mycelia. Subsequently, white pustules or primordia will start to form. This is an indication that it is time to open the bags for these are the fruiting bodies that will develop once the bag is opened and transferred to the growing chamber.

The PP bag is opened by removing the cotton plug and the PVC pipe neck, then rolling down the upper portion of the bag. Another way is to cut the upper portion of the bag with a knife. After this, the bag is placed inside the growing room or chamber to induce fruiting.

Fruiting and Harvesting

Fruiting requires the right temperature (20 to 28° C or 68 to 82.4° F), ventilation, little light, enough moisture and high humidity (85 to 92%). To maintain the required moisture, the growing chamber has to be misted daily. Misting should not be directed at the open portion of the bags as the entry of water may induce rotting of the substrate.

If the temperature inside the room or chamber is more than 30° C (86° F), it is best to spray every three hours from 9 a.m. to 3 p.m. in order to lower the temperature. Doors and windows may be opened at night to let the cool air in.

Three to four days after transferring the bags to the growth chamber, mushrooms will start to form. These will be ready for harvest in another two or more days. To harvest, grasp the stalk of the mushroom and gently pull it out. Remove any part of the stalk that breaks off and is still attached to the substrate to lessen the growth of contaminants that may be present in the chamber.

Yield

Established yield ranges from 100 percent to 200 percent of the substrate's dry weight. The total harvest depends on the combination of materials in the substrate, as well as the way in which the bags were managed during the fruiting stage. To increase the yield, the most common supplement used is urea or orchid fertilizer at the rate of 100 g in 100 liters water. This solution is sprayed on the substrate immediately before the fruiting with the use of a plastic mist sprayer.

ses for Spent Mushroom Compost

Pleurotus is one genus of edible mushroom widely studied for its ability legrade and break down organic materials, especially straw.

Male (1981) demonstrated that the yield of certain vegetables, such as bage, beans, celery and cauliflower, increased when mushroom compost s incorporated to the soil. He concluded that spent mushroom compost be used as an alternative to poultry manure in vegetable production.

In Puerto Rico, *Pleurotus* spent compost obtained from sugarcane **asse** is now accepted by local nursery growers as a good substitute for mmercial fertilizer. The spent compost is covered with plastic and is her decomposed for four to eight additional weeks before it is dried, ged, and sold to nursery owners (Mignucci, 1988).

Feeding trials in poultry showed that spent compost, when fed to ilers, resulted in greater weight gains when compared to commercially cessed feeds (Quimio, unpublished). Ongoing research at the Hebrew iversity in Jerusalem included the production of a highly digestible ritious feed for cattle from *Pleurotus* straw compost (Laire, 1988).

Quimio (1988) showed that spent compost from *Volvariella* beds can be d for growing *Pleurotus*. The yields obtain rose significantly when the mpost was supplemented with starch, peptone and wheat bran.

conomics of Production

Worldwide, oyster mushroom sales in 1991 topped 149 million pounds ued around $398 million or $2.67 per pound.

In the continental United States, dried oyster mushrooms sell for $24 per nd. Shiitake sells for $6 retail and $5 wholesale in its fresh form. Dried itake fetches $15 to $24 per pound.

The market for fresh, dried and canned mushrooms already exists on am, especially among restaurants and hotels. However, the mushrooms w used are all imported and expensive. Guam supermarkets sell imported ter mushrooms for $7.42 per pound. With the local production of fresh ter mushrooms, additional markets can be created among the gourmet d health food establishments.

Additional Techniques and Explanations in the Cultivation of *Pleurotus*

1. Grain or sawdust spawn can also be used. To prepare grain spawn, wash the seeds (wheat, rye, sorghum or rice) thoroughly and soak overnight. The next day, wash the seeds again, remove dead and floating seeds, then boil in water for 10 to 15 minutes until slightly expanded. Drain, cool and pack loosely in bottles that can withstand heat. Fill 2/3 full, then plug with cotton. Sterilize bottles in a pressure cooker for one hour at 15 psi pressure. Allow to cool before inoculating with the pure culture.

Once the mycelia penetrates all the grains, refrigerate the bottles. This prevents formation of profuse white mycelia which will make it difficult for the grains to be separated during spawning. Spawning is done by shaking the bottle or aseptically stirring with a long flat-end wire. After removing the plug and flaming the mouth of the bottle, transfer some of the grain to the bag. Re-plug the bag and proceed to the next bag. For better distribution of the grain, tilt the bag around. One bottle of spawn can inoculate 50 to 60 bags.

2. If no white growth appears five days after transfer, the pure culture may already be dead. Another cause may be that the substrate is too dry or is contaminated with other fungal species.

If the contaminating fungi (usually with black or green spores) appears on the surface, contamination probably occurred during inoculation. If the contaminants are all over the surface, the substrate may not have been properly sterilized.

3. Add 1 percent urea to the spawn substrate.

4. Use 10 percent tangantangan leaves as an additive to the substrate.

5. A mushroom house may be made of wood or concrete. There should be air vents in the upper walls to facilitate aeration which is needed for the developing fruiting bodies.

6. The walls of the growing house may be covered with plastic or foam sheets to increase the relative humidity from 80 to 95 percent.

7. Shelves, made of bamboo or wood, are set up on both sides with a central aisle. The shelves, one on top of the other, are spaced about 45 cm (18 in.) apart.

8. To disinfect the room or chamber, spray thoroughly with 10 percent bleach solution before bringing in the bags for spawning and fruiting.

ips on Growing *Pleurotus*

1. The different species of *Pleurotus* can be grown within a temperature ıge of 15 to 30° C (ca. 59 to 85° F).

2. Regular misting, done once or twice daily, is needed until fruiting lies are 30 to 40 percent of harvest size. After this period, watering can done as needed to prevent caps from cracking.

3. Steaming at 100°C is more practical since the cost is lower. The amer may be an ordinary large-capacity casserole or a drum. The ɔstrate is steamed for two to three hours, depending on the volume and size of the bags. Substrates thus steamed are less susceptible to ıtamination.

4. When grown in jars, *Pleurotus* fruits from exposed surface at the uth of jars.

5. Sufficient light for fruiting body initiation and maturation in most *urotus* species is provided by 'cool white' fluorescent bulbs for two to four ırs a day.

Without leaves, without buds, without flowers;
Yet, they form fruit.
As a food, as a tonic, as a medicine;
The entire creation is precious.

he Culinary Aspects of Mushrooms

ɔw to cook oyster mushrooms

The best way to eat these mushrooms is by thoroughly cooking them in ɾe oil for 10 to 15 minutes until most of the water has evaporated and they n light brown in color. A medium-high temperature is recommended. e mushrooms can be served with rice, added to white sauce, or used as arnish on steaks or chicken.

A small amount of butter, soy sauce, chopped onions and a touch of ite wine can be added. Or try adding garlic, shrimp, tofu and bean sprouts a culinary treat. This is best done in a wok.

Mushrooms are wonderful simply sautéed in butter and served as a side h or atop your favorite meat or fish. Mushrooms add special flavor to any -fry dish and can be used in combination with all of your favorite ɡetables, from baked potatoes to broccoli.

Oyster mushrooms can be added to the following dishes:

- Shrimp
- Peas and carrots
- Soups
- Any vegetable dish
- Any meat dish
- Salads
- Omelettes

Hot dong go

1 lb. mushroom, finely chopped

4 tbs. vegetable oil

1 tbs. lemon juice

16 oz. sour cream

4 tbs. chopped parsley

2 tbs. minced onion

2 tbs. mince jalapeno pepper

2 tbs. nutritional yeast

In a medium saucepan, warm oil then add mushrooms and lemon juice and simmer 10 minutes. Add remaining ingredients and mix well.

Simmer for another 10 minutes. Can be served as a dip, hot or cold.

Elaine's Mushroom Quiche

Pie crust

18 eggs (beaten)

1 cup Carnation milk

3 cups mushrooms, chopped

4 cups shredded mozzarella cheese

2 heads broccoli, chopped

1 onion, chopped

Salt and pepper to taste

In a bowl, mix the broccoli, mushrooms, salt and pepper. Add 2 cups of the shredded cheese. In a separate bowl, beat the eggs. Add milk, salt and pepper.

Place pie crust in a 10 x 13 inch Pyrex pan. Layer on top of this the broccoli and mushroom mixture. Spread evenly the egg and milk mixture over this layer. Spread 2 cups of cheese on top.

Bake at 350° F for 1 1/2 hours or until cheese is melted. Take out of the oven, cool and serve.

gered Carrot Rice with Oyster Mushrooms

2 tbs. butter
2 tbs. minced shallots
1 tsp. minced fresh ginger
1 clove garlic, minced
1 cup long grained rice
2 cups water
1/4 cup sliced green onions
2 carrots, peeled and grated
1/2 tsp. pepper
4 oz. mushrooms, coarsely chopped

In a large saucepan, sauté the shallots, ginger and garlic in butter until
Add rice and stir until all the grains are coated with butter. Add the
er, carrots, salt and pepper and stir to mix. Cover, bring to boil and
ner for 12 minutes. Add the mushrooms evenly over the rice. Do not
Cover and continue to cook for 5-7 minutes or until the rice is just
ler. Stir in the green onions and serve.

ecial Oyster Mushroom Dip

4 oz. mushrooms, sliced
1 large egg
1 tsp. white wine vinegar
1 1/2 tsp. minced shallot
1/2 tsp. salt
1/8 tsp. pepper
1/4 cup olive oil
2 tsp. fresh tarragon (1/2 tsp. dried)

Place the mushrooms on an uncovered plate. Microwave on high power
5-10 minutes until the mushrooms are slightly dry and shriveled. The
e will vary according to the size and age of the mushrooms. Let cool.
Combine the mushrooms with the remaining ingredients, except the oil
tarragon, in a food processor or blender. Blend together. With the motor
ning, slowly add the oil. Stir in the tarragon and refrigerate.
Makes 3/4 cup.

Lentin de Chene Turnovers

1/2 lb. fresh mushrooms, sliced

2 oz. fresh tofu, diced finely

3 tbs. vegetable oil

1 large onion, finely chopped

2 tbs. dry sherry

Pinch of thyme

Pinch of oregano

1/4 tsp, salt

1/4 cup sour cream

1 tsp. soy sauce

Freshly ground pepper, to taste

In skillet, warm oil, add onion and cook until limp. Add mushrooms, tofu, and sherry and simmer for 3 minutes, stirring often. Mix seasonings and flour and sprinkle on simmering mushrooms. Stir about 1 minute to brown flour, then add sour cream and soy sauce, reduce heat and simmer until thickened.

Crust:

8 oz. cream cheese, softened to room temperature

1/2 cup vegetable oil

1 1/2 cups flour

1 tbs. nutritional yeast

Blend ingredients with pastry blender until smooth and uniform. Chill for 30 minutes.

Bake:

Preheat oven to 450° F. Roll pastry 1/8 thick and cut into 3-inch rounds. Place 1 tsp. filling on each round and fold over in half. Press sides together with fork and prick top crust. Bake for about 15 minutes or until lightly browned.

eam of Oyster Mushroom Soup

2 tbs. butter

1 medium onion, chopped

1 lb. mushrooms, thinly sliced (7-8 cups)

1 tbs. all purpose white flour

4 1/4 cups defatted reduced-sodium chicken stock

3/4 cup milk

1/3 cup heavy cream

Pinch of freshly grated nutmeg

Salt and freshly ground black pepper to taste

3 tbs. chopped fresh parsley or green onions

Melt butter in a large saucepan over medium heat. Add onions and shrooms and cook for 10 minutes until softened, stirring occasionally. i flour and cook, stirring for 1 minute. Add chicken stock and bring to ɔil. Reduce heat to low, simmer uncovered for 10 minutes until vegetables tender.

Puree soup in batches in a food processor or blender. Return to the ıcepan. Stir in milk, cream and nutmeg and season with salt and pepper. ıeat gently until hot. Serve garnished with parsley or green onions. Serves 6.

Chicken Breasts with Garden Vegetables & Oyster Mushrooms

1 clove garlic, crushed

1/4 cup minced onion

4 oz. mushrooms, sliced

2 tbs. butter

4 chicken breasts, boned and skinned

1/2 cup julienned green zucchini

1/2 cup julienned yellow squash

16 thin strips red bell pepper

2 tbs. chilled butter, sliced very thin

Salt and pepper

Sauté the garlic, onion and mushrooms in 2 tbs. butter for 3 minutes. Let cool.

Place the chicken breasts on a large piece of tin foil and sprinkle with salt and pepper. Top with the mushrooms, then the green zucchini, yellow squash and red pepper. Light salt and pepper the vegetables and lay the butter pats over the vegetable topped chicken. Tightly fold the tin foil to ensure that the juices will not run out. Place on a baking sheet and bake at 425° F for 20-25 minutes.

Serves 4.

ld Rice Pilaf with Oyster Mushrooms

2 tbs. vegetable oil

1 medium onion, finely chopped

1 cup wild rice (6 oz.)

2 cups defatted reduced-sodium chicken stock

1/2 cup pecan pieces

4 oz. oyster mushrooms, sliced

Grated zest of 1 lemon (about 2 tsp.)

Salt and freshly ground black pepper to taste

In a heavy-bottomed pot with a tight fitting lid, heat 1 tbs. oil over lium heat. Add onions and cook, stirring for about 15 minutes or until nslucent. Add rice and stir briefly. Add chicken stock and bring to a boil. 'er, reduce heat and simmer over low heat for about 1 hour or until rice ender.

Meanwhile, preheat oven to 350° F. Spread pecans on a plate or baking et and toast in oven for 5 to 10 minutes, stirring occasionally until lightly wned and fragrant. Set aside to cool.

When rice is almost done, heat remaining 1 tbs. oil in a small skillet over lium heat. Add mushrooms and sauté for about 5 minutes, or until der. Set aside.

When rice is cooked, remove from heat and stir in mushrooms. Cover l let sit for 5 minutes, then stir in lemon zest and pecans. Season with and pepper. Serve immediately.

Serves 6.

Spicy Oriental Noodles with Oyster Mushrooms

3 tbs. butter

2 cloves garlic, crushed

1 tsp. minced ginger

4 oz. mushrooms, sliced

3 tbs. dry sherry

1/4 cup smooth peanut butter

1 1/4 cup chicken stock

3/4 tsp. lemon juice

2 tsp. soy sauce

3/4 tsp. oriental chili paste (or to taste)

1 tbs. sesame oil

1 cup cooked asparagus, cut into 1" diagonal pieces

1/4 cup thinly sliced green onions

2 tbs. toasted sesame seeds

8 oz. Oriental noodles, or your favorite pasta

Sauté the garlic and ginger in butter. Add the oyster mushrooms and cook for 3 minutes over medium high heat. Remove the mushrooms and set aside. Over high heat, add the sherry and let come to a boil. Combine the peanut butter, chicken stock, lemon juice, soy sauce, chili paste and sesame oil and add to the pan. Let boil for 3-4 minutes, stirring occasionally until the sauce thickens just slightly. Add the mushrooms and asparagus and heat thoroughly.

Cook the noodles, drain and toss with the sauce. Garnish with green onions and sesame seeds. Serve immediately.

Serves 4.

shroom Salad

4 oz. mushrooms, sliced
1 1/2 tbs. olive oil
1 tbs. sherry vinegar
1 clove garlic, crushed
1/4 tsp. salt
3 tbs. olive oil
3 tbs. chopped toasted walnuts
4 cups mixed greens, such as curly endive or bibb lettuce
1/2 cup green beans, cut in thin strips, blanched
1/2 cup carrots, cut in thin strips, blanched
1/3 cup red bell pepper, cut in thin strips
Freshly ground black pepper

Sauté the mushrooms in 1 1/2 tbs. olive oil over medium high heat until tly browned. Set aside to cool.
To make the dressing, combine the sherry vinegar, garlic, salt and per and slowly add the olive oil. Toss the lettuce, beans, carrots and red per with just enough dressing to coat. Place on individual plates or a ter and arrange mushrooms on top. Sprinkle with walnuts and serve. Serves 4.

Oyster Mushroom Sauce with Marsala

4 tbs. butter

2 tbs. minced shallots

4 oz. mushrooms, sliced

1/2 cup dry Marsala wine

1/2 cup chicken stock

3/4 cup whipping cream

Salt and pepper

In a large skillet, sauté the shallots in butter for 1 minute. Add the mushrooms and cook over medium high heat for 2 minutes. Remove the mushrooms from the pan and set aside. Add the Marsala to the pan and cook over high heat for 1 minute. Add the chicken stock and cook until it is reduced by half. Add the cream and cook over high heat for 3 minutes or until the sauce is of a creamy consistency. Return the mushrooms to the pan, sprinkle salt and pepper to taste and serve.

Serves 4.

ter Mushrooms and Broccoli with Garlic & Lemon

l head broccoli, cut into small florets (5 cups)

2 tbs. olive oil

l clove garlic, crushed

3 oz. oyster mushrooms, sliced (4 cups)

l tbs. fresh lemon juice

Salt

Freshly ground black pepper to taste

Blanch broccoli in a large pot of boiling salt water for 1 1/2 minutes, or l tender-crisp. Refresh under cold water and set aside.
Heat oil in a large skillet over medium heat. Add garlic and cook, stirring, ne minute. Add mushrooms and cook, stirring for 3 to 4 minutes or until hrooms are tender. Add reserved broccoli and cook for one minute or l heated throughout. Remove from heat, toss with lemon juice and on with salt and pepper. Serve immediately.
Serves 4.

Sources of Materials

Telephone and written inquiries were made regarding the availability of materials needed in the culture of the oyster mushroom. On the basis of the responses that were obtained from various commercial establishments, the materials are available at the following firms:

Agar bars

Price:	$2.19
Contents:	4 bars weighing 40 grams

Source:

Bunny Market
Barrigada, Guam
Tel. 734-2344/3353/4977

Polypropylene bags

Size (inches):	Price per 1000 pieces:
4 x 7	$11.00
5 x 8	$15.00
6 x 10	$27.50

Source:

Fidelity Enterprises Ltd.
Harmon Industrial Park #1D
P.O. Box 9850
Tamuning, Guam 96911
Tel. 646-1080/8018
Fax. 646-1996

Chemicals

Malt extract agar (MEA)	1/2 lb.	$16.00
Agar-agar (powder)	1/2 lb.	$28.00
Peptone	1/2 lb.	$16.00

;truments and equipment

Wire loop	$ 5.00
Scalpel	$ 8.00
Alcohol lamp	$ 9.00
Petri dish	$ 3.50
Test tube	$ 1.65
Flask (500 ml)	$16.95
Graduated cylinder (500 ml)	$19.00
Plastic pipette (10 ml)	$14.00
Non-absorbent cotton (1 lb.)	$24.95
Wash bottle	$ 4.00

Pressure cooker

All American Electric Steroclave	$350.00
Other types range from	$129.95 - $395.00

Humidity hydro-thermometer $39.95

Yellow Insect 'Sticky' sheets $29.95

Source:

Fungi Perfecti
P.O. Box 7634
Olympia, WA 98507
Tel. (206) 426-9292
Fax. (206) 426-9377

Pressure canner (21 quart capacity) $144.95

Source:

BURPEE
300 Park Avenue
Warminster, PA 18991-0001
Tel. 1-800-888-1447
Fax. (215) 674-4170

Additional Sources of Information

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Ramsbottom, John. 1989. Mushrooms and Toadstools. Bloomsbury Books, 42 Bloomsbury St., London WC1B 3QJ.

Stamets, P. and J. S. Chilton. 1983. The mushroom cultivator. Agarikon Press, Olympia Washington. 415 p.

Metric Conversion Table

1 meter	=	3.2808 feet
1 gram	=	0.0353 ounce
1 liter	=	1.0567 quarts
1 cm.	=	0.3937 inches

Temperature conversion from Centigrade to Fahrenheit

9/5 (C) + 32 = F

sclaimer

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Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, and tember 30, 1977, in cooperation with the U.S. Department of Agriculture. Chin-Tian Lee, Dean, lege of Agriculture and Life Sciences, Guam Cooperative Extension, University of Guam, U.O.G. tion, Mangilao, Guam 96923

Created by CALS Media, November 1993