The Shiitake Mushroom

By

Tracy V. Dunbar, Ph.D

A REPORT

Submitted to
The Arkansas Land and Farm Development Corporation

March 1998

Table of Contents

List of Tables

The Shiitake Mushroom

Introduction

Small limited-resource farmers are experiencing many economic and environmental problems including: **Financial difficulties**--increased costs of inputs and significant interest charges; **biophysical constraints**--constraints on soil, air and water resources; soil erosion; pest, weed and moisture control problems; increase in the rate at which farmers are going out business; and decreased support of institutions. The production of High Value Products (i.e. the Shiitake Mushroom) may be one means of bringing in additional revenue and ensuring economic sustainability.

The remainder of this document includes sections related to the following topics: The Requirements for Producing the Shiitake Mushroom, Speciality Crop Certification Standards, Shiitake Mushroom Production/Costs, Markets and Transportation/Packaging.

Requirements for Producing the Shiitake Mushroom

The Shirley Community Services and Development Corporation (CDC) published a document titled "Growing Shiitake: The Basics" that explains the procedures/requirements for producing the Shiitake Mushroom. These requirements including topics related to felling the trees, spawn selection, inoculation, spawn run, dormant periods, fruiting and harvesting are listed and discussed in the remainder of this section of the document. The Director of the Shirley CDC Mr. Tom E. Kimmons is considered to be a foremost expert on growing the Shiitake Mushroom in Arkansas.

Felling the Trees

Trees should be "felled" in the fall and winter. The logs should the be inoculated as soon as possible--no more than three weeks from felling. Contact should not be made between the logs and the ground (Shirley Community Service and Development Corporation) .

Generally, Oak logs are used in Shiitake mushroom production. However, many other hardwoods may be used to produce Shiitake mushrooms. Selection should include young, healthy trees--damaged bark should be avoided. The ideal diameter is 4". Cut logs 30" to 48" long (Shirley Community Service and Development Corporation).

Spawn Selection

There are three basic categories of Shiitake mushroom spawn. These categories include the following (Shirley Community Service and Development Corporation):

1) **Year-Round Fruiting (Wide-Range)**--for most intensive purposes, the year-round (wide-range) strains are the most favorable. These strains produce quickly and easily--logs turn over more rapidly and less growing area is needed.

2) **Spring to Fall (Warm-Range)**--generally grown for dried mushroom production and often require two to three summers after inoculation until the first flush of mushrooms.

3) **Fall, Winter, and Spring (Cold-Range)**--generally fruit in the fall following two summers after inoculation although some varieties will produce mushrooms the first fall after spring inoculation.

   Cold-weather strains are most likely to produce the highest grade.

Note: All strains need one full summer before they will produce. If environmental conditions are right, the more spawn put into a log, the sooner it will produce its first crop.

Inoculation

Spawn come in three forms including the following: 1) on wooden plugs (dowels), 2) in grain and 3) in sawdust. Sawdust spawn is used by either pre-drilling and using a special pressure inoculation tool, or by making a saw cut and packing it with spawn. The spawn is then covered with melted beeswax for protection (Shirley Community Service and Development Corporation) .

If inoculation is not used within ten (10) days spawn must be refrigerated. Spawn may be left at room temperature for a few days before inoculating. However, spawn must be exposed to sunlight or dirt. It is recommended that six holes at six to seven inch intervals be drilled across the lateral surface of the log. The next row of holes should be staggered about two inches away, making a diamond pattern. This is the traditional Japanese method for optimum distribution of the spawn (Shirley Community Services and Development Corporation).

Spawn Run (Growth Stage)

The growth stage will take 6-18 months before the log is completely colonized by the fungus. Freshly inoculated logs should be stacked tightly in square, criss-cross piles (crib-stack) or in a tight lean-to stack, in the shade, and covered with burlap or shade cloth for several months. To prevent growth of unwelcome fungi, uncover the logs after a rain and allow the bark to dry (Shirley Community Services and Development Corporation).

The spawn is not hurt by cold temperatures, however, the growth of the spawn will slow down at temperatures below forty-three (43) degrees F. Temperatures above one hundred (100) degrees F should be avoided (Shirley Community Services and Development Corporation).

As stated earlier, cribstack is one means of stacking the logs. Logs should be restacked in a "loose" crib-stack, 4-6 logs in a layer after cold weather ends. For logs that are close to the ground, air circulation is most significant. The appearance of mold indicates that the logs are too damp. In this instance, protective covering should be removed, however, the ends of the logs should not be reversed. When fuzzy white blotches appear on the log ends or mushrooms appear after a rainfall, the spawn run is nearly complete. Rotating spawn yards each year and moving logs to a permanent laying yard after Shiitake mushrooms appear will reduce contamination by wild fungi (Shirley Community Services and Development Corporation).

Dormant Periods

Stacks may be exposed all winter. Logs may also be placed in a greenhouse for winter production. Shelter from the drying effect of sun or wind may be reduced by using plastic sheeting or evergreen shade areas, lowering the angle of the log stack. Stacks may also be covered with burlap or shade cloth. Gravel may be placed in stack areas to minimize contamination from soil or forest microorganisms. Logs are not affected by snow cover (Shirley Community Services and Development Corporation).

Fruiting

In order to maximize production, about 1/7 of producing logs should be "cycled" each week in the following manner (Shirley Community Services and Development Corporation).

1. Depending on the age and temperatures of the logs, the logs should be soaked for 12-72 hours. A sprinkler system may be used to soak the logs. Alternatives include standing/soaking the logs in a gallon drum, tub or stock

tank. If the air is warm and the water is cool, the logs may be soaked from 12-24 hours. If the air and the water is cool, the logs need to be soaked longer. When bubbles not longer appear on the surface of the logs, they are totally saturated and should be removed from the water.

2. Mechanical vibrators, electric shock, or cold shock may be used to force fruiting.

3. "Pinning"--occurs when small bumps called "primordia" forms and pushes through the bark. Careful management during pinning may result in higher yields. Under optimal conditions logs are maintained between 75 and 85% moisture content and 55 to 65 degrees F.

4. Logs should be soaked again thirty (30) days after a harvest. This "rest period" is necessary to allow the mushroom mycelia to store more nutrients. A 10-12 week rest period if preferable.

Harvesting

Shiitake mushrooms should be harvested after the veil breaks while the caps still have curled edges and are less than 4 inches in diameter. Mushrooms may be left on the logs longer during cool days. During warm weather, mushrooms should be harvested early and often to minimize bug damage and discoloration from spore discharge (Shirley Community Services and Development Corporation).

Fresh mushrooms will keep for 2-3 weeks in the refrigerator, however, mushrooms should be marketed within 4 to 6 days of harvest. Mushrooms may be stored in cloth, paper bags or in perforated cardboard boxes (not plastic) (Shirley Community Services and Development Corporation).

Speciality Crop Certification Standards (Shiitake Mushrooms)

Small Shiitake Mushroom farms cannot compete with some of the larger farms. Therefore, small farmers should be encouraged to market their products cooperatively in Speciality Markets. In Speciality Markets, the emphasis is on quality versus quantity (Kimmons, 1998). Speciality Crop Certification Standards as stated by the Organic Crop Improvement Association (OCIA) are listed and discussed in the remainder of this section of the document. The remainder of this section includes standards for trees, spawn, insects and weed fungi, woodlot management, water and handling.

Trees

Only trees not treated with synthetic pesticides can be used in the cultivation of specialty mushrooms. Trees treated with Bacillus thuriengensis (BT) are acceptable as are trees or limbs of trees treated with any of the pesticide alternatives acceptable by OCIA. Supplements: All supplements as synthetic fertilizers or pesticides are prohibited. Log and spawn site coatings used to prevent moisture loss must be food grade paraffin, cheese wax, mineral oil or beeswax. Recycled wax can be used as long as its origin can be ascertained. Petroleum based tree coatings, latex and oil based paints are prohibited (Organic Crop Improvement Association, 1996).

Spawn

Choices of spawn and suppliers may be left to the discretion of the grower. Certified organic spawn should be used if available. **Note**: Purity of spawn is related to the success of the spawn producer and their customers. Cryogenic storage is essential in maintaining the genetic integrity of parent cultures. It is the same system that is used for semen storage in livestock

breeding programs (Organic Crop Improvement Association, 1996).

Insects and Weed Fungi

The use of synthetic pesticides is prohibited. The use of preventative management; sanitation, proper air flow and removal of affected blocks is required. Dilute chlorine bleach used as a disinfectant is acceptable. Use of mechanical controls (traps and physical barriers without addition of synthetic pesticides with the exception of pheromones or attractants), biological controls (natural predators and parasites), physical controls (sprays and dusts such as diatomaceous earth, insecticidal soaps and natural pesticides approved by OCIA) are acceptable pest controls (Organic Crop Improvement Association, 1996).

Woodlot Management

Woodlot Management for specialty mushrooms produced outdoors on natural logs: Woodlots directly adjoining agricultural fields should have a 100 foot buffer strip separating the mushrooms growing area from the field to avoid agricultural drift. The use of herbicides for understory control is prohibited (Organic Improvement Association, 1996).

Water

Well, stream and pond water used for soaking logs and blocks must be tested to determine if concentrations of nitrates and coliforms are acceptably low. Use of chlorinated water in urban areas is acceptable. Use of water known to be contaminated with toxic substances, byproducts of urban, industrial or waste treatment processes is prohibited (Organic Crop Improvement

Association, 1996).

Handling

Harvesting, storage and shipping procedures that ensure maxim freshness and nutritional quality are encouraged. Harvesting at proper maturity levels, chilling immediately through refrigeration, clean work areas for packing and clean bulk containers used for storage during chilling are highly encouraged (Organic Crop Improvement Association, 1996).

Shiitake Mushroom Production\Income and Costs

In general, forty-five (45) to sixty-five (65) pounds of mushrooms per week (at 0.25 to 0.33 lb/flush/log) can be produced on a one-person farm (fewer than five thousand (5,000) logs). About one-hundred ten (110) pounds of mushrooms per week can be produced on a two-person farm (5,000-10,000 logs). A four person farm (20,000-30,000 logs) can produce about 220 pounds of mushrooms per week. Stacking of the logs, harvesting the mushrooms, packaging and selling of the mushrooms requires extra labor. A small farm inoculating 4,000 logs per year, can generate about $20,000 to $30,000 gross annual income (Shirley Community Services and Development Corporation).

In order to produce, 110 pounds per week it is necessary to have space for a permanent laying yard, a temporary laying yard of about 200 square yards, tanks for soaking the logs, and one or more indoor fruiting areas in the winter and hottest summer months (Shirley Community Services and Development Corporation).

Forty to sixty batches per year may be cycled through a garage, barn or modified poultry

house. One square foot per log of space is required for growing indoors. The amount of light needed is about the level required for reading. Air flow and humidity must be controlled (Shirley Community Services and Development Corporation).

Costs and profit projections examples for Shiitake mushroom operations have been conducted by various researchers. These costs and profit projections may be used as a basis for making decisions about whether or not to enter the Shiitake Mushroom production business. Projections range from 1,000 to 12, 000 log operations. Baughman (1989) conducted an analysis based on both, outdoor an indoor operations in which 4,000 logs were inoculated each year. Both scenarios involved a 15-year planning period. An additional assumption is that the outdoor logs will fruit twice each year, in the spring and fall. The indoor logs will fruit four times per year. Sixteen percent (16%) shrinkage loss of the logs is expected over a four-year period. Four thousand (4,000) new logs will be added each year. There would be a maximum of 14,479 logs (outside) and 11,020 logs (inside). Outside logs would produce 3.06 pounds of mushrooms in each of four years and inside logs would produce 3.60 pounds of mushrooms in each of three years.

An additional assumption is that this is a one person operation with no hired labor. A partial reproduction of Baughman's analysis is documented below in Tables 1, 2, 3 and 4 (Source: M. J. Baughman, "Financial Analysis of Shiitake Mushroom Production", Proceeding From a National Symposium and Trade Show, 1989.

Table 1: Baughman's Example for Outdoor Shiitake Production
(first five years of a fifteen year scenario)

YEAR	1	2	3	4	5
COSTS					
Tools/Supply	$ 1,390	$ 1,017	$ 980	$ 1,508	$ 1,613
Utilities	560	1,107	1,680	2,280	2,371
Advertising	4,252	4,422	4,599	2,393	2,488
Shipping	0	1,516	5,656	8,969	9,327
Interest	2,474	4,013	2,657	0	0
Logs	5,920	6,157	6,403	6,659	6,926
Soak tank	3,145	0	0	0	0
Laying yard	1,726	0	1,367	0	0
Tractor	5,500	0	0	0	0
Refrigerator	0	6,850	0	0	0
Scale	0	619	0	0	0
REVENUE	0	9,098	33,934	53,808	55,960
Before Taxes*					
Period Net Revenue	-24,967	-11,604	10,092	31,999	33,235
Cum Net Revenue	-24,967	-41,571	-31,478	521	33,755
After Taxes**	-21,570	-13,390	7,7769	23,976	24,626
Period Net Revenue	-21,570	-13,390	7,769	23,976	24,626
Cum Net Rev	-21,570	-34,960	-27,191	-3,214	21,411

*All values are in dollars inflated at 4 percent to year of occurrence, before taxes. Columns may not add due to rounding error.

**All values are in dollars inflated at 4 percent to year of occurrence, before taxes. Columns may not add due to rounding error.

Table 2. Baughman's Example for Indoor Shiitake Production
(first five years of a fifteen year scenario)

YEAR	1	2	3	4	5
COST					
Tools	$ 1,394	$ 1,030	$ 989	$ 732	$ 1,315
Utilities	3,560	4,227	4,914	5,110	5,315
Advertising	4,778	4,969	5,168	2,687	2,795
Shipping	972	6,293	9,691	10,079	10,482
Property tax	1,750	1,820	1,893	1,969	2,047
Interest	10,142	8,070	3,395	0	0
Logs	5,920	6,157	6,403	6,659	6,926
Soak tank	1,430	0	0	0	0
Tractor	5,500	0	0	0	0
Refrigerator	3,430	0	0	0	0
Scale	595	0	0	0	0
Building	70,000	0	0	0	0
REVENUE	7,128	46,149	71,064	73,907	76,863
Before Taxes*					
Period Net	-102,343	13,583	38,612	46,671	47,984
Cum Net Revenue	-102,343	-88,760	-50,148	-3,477	44,507
After Taxes**					
Period Net Revenue	-94,221	15,169	31,956	36,788	36,917

Cum Net Revenue	-94,221	-79,052	-47,069	-10,308	26,609

*All values are in dollars inflated at 4 percent to year of occurrence, before taxes. Columns may not add due to rounding error.

**All values are in dollars inflated at 4 percent to year of occurrence, before taxes.

Table 3. Estimated Cost of Operations From Baughman

Operating Expenses

Log covers:

Plastic--.25 sq. Ft./log @ $0.018/sq.ft., 3 yr. Life.

Fabric--1 sq. Ft./log @ $0.10/sq. Ft., 4 yr. Life.

Tools/Supplies:

Sawdust spawn inoculation tool--1/4000 logs inoculated at $22 each.

Staple gun--1/12000 logs inoculated @ $20 each.

Log drilling stands--1/4000 logs inoculated @ $17 each.

Electric drill--1/6000 logs inoculated @210 each.

Drill bits--$36/4000 logs inoculated.

Electric extension cord--1/8000 logs inoculated @ $40 each.

Wax melting pot--1/8000 logs inoculated @ $18 each.

Wax baster--1/4000 logs inoculated @$34 each.

Water hose and sprinkler--1/4000 logs on site @ $35 each, 4 year life.

Scale for weighing logs-60# capacity milk scale @ $100. Picking and Storage baskets--$2/1000 lbs. Mushrooms

Laying yard maintenance materials--5% of original materials cost/yr.

Steel racks for carrying and soaking logs--1/25 logs soaked @ $4 each.

Office supplies--cost estimated for small tools, paper products, telephone service.

Tractor operation and maintenance--$0.02/log on site/yr.

Utilities:

Outdoor operation--water and electricity @ $0.14/log site/yr.

Indoor operation--water, electricity and building heat.

Advertising:

$0.30/lb of mushrooms with expenses weighted to beginning of project.

33% of total expense occurring in the first 3 years. Remaining expense spread evenly over next 12 years.

Shipping:

Packaging and labels--$0.25/lb of mushrooms

Transportation--$0.50/lb of mushrooms

Interest on borrowed money: 11%/year based on cumulative net loss.

Table 3. (Continued)

Capital Expenses

Logs:

Oak logs purchased @ $0.50 each, 6" diameter by 40" length.
Spawn @ $0.90/log
Wax @ $0.03?log
Aluminum identification tags and staple @ $0.05/log.

Soak tank:

Concrete vault, each log being soaked occupies 1.25 cubic ft., total capacity assumes logs to be fruited during one week are all soaked at the same time, double capacity provided in case extra logs must be fruited to satisfy short term needs.

Laying Yard: (for laying and fruiting outdoors)

.8 square ft ground space/log, shade cloth over top and on two sides @ $0.20/square ft, wooden poles @ $9 each and steel cables @$14/ft hold up shade cloth, poles 12 feet apart on perimeter and approximately 24 feet apart on interior, perimeter poles held down by cable and buried dead @ $3.00 each, cable clamps and thimbles @ $0.70/set ans screw eyes @ $0.30 each.
Fasten cables to poles and deadman, construction tools @ $100.

Tractor:

Used farm tractor with front end lift @ $5,000, 7-year life.
Trailer for transporting logs @ $500, 7 year life.

Refrigerator: .41 cubic ft/lb of mushrooms, holds all mushrooms fruited in one week.
Scale for weighing mushrooms for sale: Electronic, digital readout @ $595 each, 6 year life.
Building: (indoor operation only)
Building with steel skin, wooden pole supports, fiberglass insulation, plastic vapor barrier, electric lights, large doors, heating system, 12,500 square ft, @ $70,000. Assumed no salvage value at end of 15 years.

Revenue

Price: All mushrooms sold fresh.

$4.50/lb of mushrooms produced outdoors.
$5.50/lb of mushrooms produced indoors.

Mushroom yield/4000 logs

Source: M.J. Baughman, "Financial Analysis of Shiitake Mushroom Production", Proceedings From a National Symposium and Trade Show, 1989.

Another analysis of the profitability of Shiitake Mushrooms was conducted by Vic Ford (1987) (**See**: Table 4). Maintenance and cost of equipment (i.e. a tractor, a building and cooler, etc.) was not considered in this analysis. The assumption is that this an outside operation with minimum expenses. In addition Ford (1987) does not account for additions/shrinkage in his thirty-six (36) cord operation. Furthermore, augmentation or renewal costs are not stipulated.

Still another analysis of the profitability of Shiitake Mushrooms was conducted by Krawczyk and Kozak (1991) (**See**: Tables 5 and 6). Krawczyk and Kozak's analysis is based on two scenarios including: 1) One-thousand (1,000) log operation with minimal, but realistic expenditures and revenues. 2) An eight-thousand (8,000) log initial operation with four-thousand (4,000) logs inoculated yearly for replacement. The first scenario is equivalent to a part-time, supplemental operation. While, the second scenario means to generate enough income to support a small family. Interest on building loans was not figured into either of these scenarios.

Table 4. Shiitake Profitability Estimates

A. Production Costs:

1) Inoculation 36 Cords [150 logs per cord * 36 = 5,000 log operation]
   - $/Cord - $6.00*
   - Labor - 20 hrs./cord inoculation, $4.25 $/hr.
   - Spawn - $105.00 /Cord

TOTAL INOCULATION COSTS - $7,056.00 (Cost/Cord - $196.00)

2) Maintenance
   - Labor - 2000 hrs. $8,000.00 (@ $4.00 per hr.)
   - Supplies - $300.00
   - Equipment - $1,000.00
   - Interest - 0
   - Utilities - $100.00

Table 4. (Continued)

Fuel - $25.00
Telephone - $12.00
P. R. - $60.00
Misc. - $75.00

TOTAL MAINTENANCE - $9,572.00 (Cost/Cord - $265.89)

3) Total Production Costs $16,628.00 (Cost/Cord - $461.89)

B. Sliding Net Income Scale

Production (lbs/Cord)

$/lb	**50**	**100**	**150**	**200**	**250**	**300**
$1	-14,828	-13,028	-11,228	-9428	-7,628	-5,828
$2	-13,028	-9,428	-5,828	-2,228	1,372	4,972
$3	-11,228	-5,828	-428	4,972	10,372	15,772
$4	-9,428	-2,228	4,972	12,172	19,372	26,572
$5	-7,628	1,372	10,372	19,372	28,372	37,372
$6	-5,828	4,972	15,772	26,572	37,372	48,172
$7	-4,028	8,572	21,172	33,772	46,372	58,972
$8	-2,228	12,172	26,572	40,972	55,372	69,772
$9	-428	5,772	31,972	48,172	64,372	80,572
$10	1,372	19,372	37,372	55,372	73,372	91,372

Source: V. Ford, "Marketing Shiitake Mushrooms", Seminar presented at The Meadowcreek Project, Fox, AR, 1987.

Table 5. Krawczyk/Kozak-- 1,000 Log Operation

Fixed Costs

Beginning with a 26' * 36' * 8' garage with sand floor	
Remodeling	1923.00
(Insulation, plastic vapor barriers)	
Equipment	2199.00

Table 5. (Continued)

(Gravel floor, used furnace, carpentry, cooler, soak tanks, fruiting blankets)

Total Building and Equipment Costs	4,122.00
Variable Costs	
Log Variable Costs (per log) $1.85 * 1500	2,775.00
Other Variable Costs	
Utilities	600.00
Marketing Costs	180.00
Total Variable Cost	3,555.00

Tools - (shared with another grower)
a) ½ interest in high speed drill with a 4 yr. life span and drill Bits $31.25/year - $.04
b) ½ interest in 2 hand held in-inoculation tools @ $22.50 - $.01/log
Spawn - $13.50/bag @ 25 logs per bag - $.54
Wax 1 lb./10 logs - $.10/log
Labor $5.00/hr., 8 minutes/log - $.64/log
**Logs - Logs purchased at $50.00/cord, about 100 Logs/cord - $.50/log

	YEAR ONE	**YEAR TWO**
Operating Revenue	7,800.00	7,800.00
Mushroom Sales: 25 lbs. Per week @ $6.00 per lb.		
Total Operating Expenses	7,677.00	1,705.00
Fixed Costs:		
Building and Equipment	4,122.00	0
Variable Costs:		
Logs @ $1.85	2,775.00	925.00
Other	780.00	780.00
Income (loss)	123.00	6,095.00

Source: J. Krawczyk and M. E. Kozak, Year-Round Shiitake Cultivation in The North, 1991, Shiitake Growers Association of Wisconsin.

Table 6. Krawczyk/Kozak- 8,000 Log Operation

FIXED COSTS

Building Specs: 40' * 105' * 10' (h)	$30,000.00
Air Handling system:	1,125.00
Attic Ventilation:	1,100.00
Heating Plant:	7,800.00
Soaking Tank:	2,150.00
Log Handling System	4,930.00
Harvest and Cooling System	1,574.00
Total Fixed Costs	48,769.00

Variable Costs	
Logs - $1.94/@ * 12,000	$23,280.00
Labor/Part time @ $6.00 * 20 hr./wk	6,240.00
Utilities	625.00
Insurance	3,760.00
Marketing Costs	1,244.00
Total Variable Costs	$35,149.00

	Year 1	**Year 2**	**Year 3**	**Year 4**
Operating Revenue	41,600	41,600	41,600	41,600
Mushroom Sales: 200 lb. @ week sold fresh @ $4.00 per lb.				
Fixed Costs	48,679	0	0	0
Building				
Equipment				
Variable Costs	35,149	14,180	14,180	14,180
Includes 12,000 log start-up and 4,000 new logs per year				
Operating Expenses	83,828	14,180	14,180	14,180
Income/(Loss) From Operation	-42,228	27,420	27,420	27,420
(Loss) From Prior Yr.		-42,228	-14,808	
Total Income/(Loss) From Operation	-42,228	-14,808	12,612	27,420

Source: J. Krawczyk and M. E. Kozak, Year-Round Shiitake Cultivation in the North, 1991, Shiitake Growers Association of Wisconsin.

Markets

Again, small farms cannot compete with some of the larger farms. Therefore, small farmers should be encouraged to market their product cooperatively in Specialty Markets. In Speciality Markets, the emphasis is on quality versus quantity of products (Kimmons, 1998).

The Ozark Organic Growers Association (OOGA) will pay growers the going market price (at survey time, $29.50 per 5 lbs.) year around. However, there is a $200.00 OOGA membership fee, an organic certification fee, plus a 15% commission. In addition, OOGA pays a dry market price (at survey time $3.00 per oz.) less 15% commission. Some of the larger restaurants in Little Rock have been reported to pay as much as $7.00 per pound for mushrooms. Reportedly, brokers added $2.00 per pound, thus, the mushrooms sell for $9.00 per pound. These prices are several dollars higher during the holidays or low-supply periods. Some health food stores carry a limited supply of both dry and fresh Shiitake Mushrooms {(**See**: APPENDIX) for additional marketing information in Arkansas.}(Kimmons, 1993).

Regional markets include Boston, Chicago, New York, Philadelphia, Los Angeles and Oregon. The most significant market is in Philadelphia. Shiitake Mushrooms are sold in Asian Restaurants, Gourmet Deli's (Safeway, Krogers, etc.), Health Food Stores, Greek/Italian Restaurants (European Markets), Hotels (Five-Star), Specialty Stores (in CA and FL) (Scott, 1998).

Fruit and Vegetable Market News, Federal-State Market News Service, USDA (1998),

includes the following categories: 1) 3-lb cartons and 2) 5-lb cartons. The Terminal Market Prices are listed below for Philadelphia, New York, Miami, Atlanta, Boston, Dallas, Chicago and Los Angeles. Prices for 3-lb cartons range from $11.00 - $17.00 / carton while prices for 5-lb cartons range from $20.00 - $30.00 / carton.

Table 7. Terminal Market Prices

Film-Wrapped Trays

City	3-lb Cartons	5-lb Cartons
Philadelphia	$11.00-$12.50 PA Shiitake	
New York	$16.00-$17.00 PA Shiitake	$23.00-$25.00 FL Shiitake
Miami	$13-$14.00 FL Shiitake	
Atlanta	$13.50 Shiitake Large	$30.00 CA Shiitake
Boston	$13.00-13.50 CT Shiitake	
Chicago	$13.50 PA Shiitake	$20.00-$21.00 PA Shiitake
Dallas		$23.50-$26.00 PA Shiitake
		$26.00 TX Shiitake
Los Angeles	$5.25-$6.50/lb CA Shiitake	

Transportation/Packaging

Baughman (1989) estimates packaging/labels at .25/lb of mushrooms. Transportation costs are estimated at .50/lb of mushrooms (Baughman, 1989). Transportation costs are generally absorbed by the buyer. Transport is conducted by freight and air (i.e. United Postal Service (UPS) overnight-delivery). The Shirley Community Development (CDC) located in Shirley, AR sells 3 and 5 lb boxes for .85 / box. These boxes contains much needed breathing holes. A lid goes on the top of the box to cover the mushrooms. Shiitake mushrooms keep up to two weeks, properly refrigerated. Mushrooms keep longer in the winter months than in the summer months (Kimmons, 1998).

References

Baughman, M.J. 1989. "Financial Analysis of Shiitake Mushroom Production", Proceedings From A National Symposium and Trade Show.

Ford, V. 1987. "Marketing Shiitake Mushrooms", Seminar presented at The Meadowcreek Project, Fox, AR.

Fruit and Vegetable Market News, Federal Market News, USDA. 1998. Http://www.ams.usda.gov...mn_reports.

Kimmons, Tom E. 1998. A Telephone Interview. Director, Shirley Community Services and Development Corporation, Shirley, AR.

Kimmons, Tom E. 1993. "Growing a Grassroots Industry Based on Shiitake Mushrooms"In Proceedings of the National Shiitake Mushroom Symposium. Cooperative Extension Program, School of Agricultural and Environmental Sciences, Alabama A&M University, Huntsville, AL.

Kimmons, Tom E. 1992. Market Overview of an Emerging Agricultural Industry, Vol. II, Shirley Community Services and Development Corporation, Shirley, AR

Krawczyk, J. and M.E. Kozak. 1991. Year-Round Shiitake Cultivation In The North, Shiitake Growers Association of Wisconsin.

Organic Crop Improvement Association. 1996 International Certification Standards, Bellefontaine, Ohio.

Scott, Samuel. 1998. A Telephone Interview. Marketing Specialist, Alcorn State University, Lorman MS.

Shirley Community Services and Development Corporation. [Undated]. Growing Shiitake: The Basics, Shirley, AR.

Appendix

Marketing Information (Kimmons, 1993)

1. American Forest Foods Corporation
   Rt. 5, Box 84E
   Henderson, North Carolina 27536
   (919)-438-2674

   "Persons seeking a guaranteed stable income through a contract growing arrangement with our corporation, by cultivating "certified" Dried Imperial Brand Shiitake Mushrooms, should contact..."

2. Alan Frick
   Devalon Sales
   Los Angeles, CA
   (213)-623-2500

   A terminal market in the Los Angeles area. According to ATTRA in Fayetteville, AR, spokespersons from Devalon stated "[We are]...interested in buying any amount of fresh shiitake mushrooms for immediate deliver by air freight...could off $6.00 to $6.50 per pound for shiitake mushrooms at the beginning of January, 1990.

3. Hardscrabble Enterprises, Inc.
   c/o Mr. Paul Goland
   HC71 Box 42
   Circleville, WV 26804
   (304)-358-2921

   According to a September 1992 brochure, they will buy dried shiitake for $15.00 to $20.00 per pound, depending on quality.

4. Ozark Organic Growers Association
   c/o Marketing Director
   Fayetteville, AR
   (501)-521-0206

   They will purchase Shiitake from their members at wholesale price less 15% commission.