A New Substrate For Shiitake Producers

BY

Jerry D. Larson
International Trade Manager
Oregon Department of Agriculture

Oregon produced about 2.5 million dollars of shiitake during 1992 most of which was grown on substrate, rather than on oak or other comparable logs. The primary reason for the Oregon producers using substrate is that we can get into production within about 8 weeks of inoculation. The limitation of the substrate process is access to good quality, low priced products from which we produce the substrate. Oregon's hardwood mills do not produce enough sawdust to supply the needs of the mushroom growers and their other long time markets, so we either have to grind the existing oak and other hardwood varieties like alder and ash which really pushes up the price to the grower, or come up with a new growing media.

Can Shiitake Production Be Profitable?

BY

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Dr. Melvin J. Baughman, Extension Specialist—Forest Resources and
Associate Professor, University of Minnesota,
Department of Forest Resources,
St. Paul, MN 55108

INTRODUCTION

In the past ten years the science of producing shiitake in this country has improved dramatically. New strains and cultivation techniques adapted for our climate have enabled growers to improve their mushroom yields (Przybylowicz and Donoghue 1988.) But, shiitake production remains a risky alternative. Interested growers should carefully consider the potential financial risks and returns before entering the business.

This article describes a cash flow analysis of two hypothetical, family-sized shiitake production enterprises in the Upper Midwest: 1) an outdoor operation in which 4,000 logs are inoculated per year, and 2) an indoor operation in which 4,000 logs are inoculated per year. Shiitake production on sawdust logs in sterile environments is not included in this analysis.

METHODS

For both operations, the physical activities required to produce and market shiitake and the timing of each activity were determined. Major sources of information included published literature (Forest Resource Center 1984-1991, Harris 1986, Kerrigan 1982, Kozak and Krawczyk 1989, Kuo and Kuo 1983, Przybylowicz and Donoghue 1988), and personal interviews with shiitake growers and researchers (Deden and Gilbert 1989-91, Farris 1988-89, Mook 1988, and Schmidt 1988-89). Costs for most materials, supplies, and tools were obtained from retail outlets or from the Forest Resource Center, Lanesboro,
Table 1. Logs Fruiting and Mushrooms Produced.

<table>
<thead>
<tr>
<th>Year(s)</th>
<th>Logs at Start of Yr</th>
<th>Logs Fruiting</th>
<th>Total Pounds of mushrooms</th>
<th>Logs at Start of Yr</th>
<th>Logs Fruiting</th>
<th>Total Pounds of mushrooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4,000</td>
<td>0</td>
<td>0</td>
<td>4,000</td>
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<td>3,600</td>
<td>2,268</td>
<td>7,600</td>
<td>7,020</td>
<td>8,964</td>
</tr>
<tr>
<td>3</td>
<td>11,092</td>
<td>7,092</td>
<td>8,030</td>
<td>11,020</td>
<td>10,098</td>
<td>13,273</td>
</tr>
<tr>
<td>4-12</td>
<td>14,479</td>
<td>10,479</td>
<td>12,196</td>
<td>11,020</td>
<td>10,098</td>
<td>13,273</td>
</tr>
<tr>
<td>13</td>
<td>10,479</td>
<td>10,479</td>
<td>9,298</td>
<td>11,020</td>
<td>10,098</td>
<td>13,273</td>
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<tr>
<td>14</td>
<td>6,879</td>
<td>6,879</td>
<td>7,020</td>
<td>6,498</td>
<td>11,833</td>
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<tr>
<td>15</td>
<td>3,387</td>
<td>3,387</td>
<td>4,166</td>
<td>3,420</td>
<td>3,078</td>
<td>4,309</td>
</tr>
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</table>

Shiitake News is published three times each year (March, August, and November) by the Forest Resource Center, a private, non-profit, educational corporation. Dedicated to promoting the responsible use and renewal of our natural forest resources, the FRC is a forestry and environmental education learning center, located at R1, Box 156A, Lanesboro, MN 55949, U.S.A.

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The Forest Resource Center welcomes article submissions to Shiitake News.
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Log operations were assumed to be distributed evenly each week throughout the year, with each log fruiting a total of nine times over a three-year rotation.

In both operations it was hypothesized that some logs would be removed from production annually due to damage caused by competing fungi, weather, bark loss and handling (Kuo and Kuo 1983). Log losses in the outdoor operation were assumed to occur at the end of the year with 10 percent of the logs on site lost at the end of the first year, and 3 percent lost at the end of the second and third years. Due to the timing of the first fruiting, log losses in the indoor operation were assumed to occur at the beginning of the year. It was estimated that approximately 10 percent of the logs would be lost in the first year, 5 percent in the second year, and 10 percent in the third year.

It was assumed that each log in the outdoor operation would produce 3.51 pounds of mushrooms, compared to 4.0 pounds in the indoor operation. Mushroom yields per log were based upon the green weight of a red oak log (six-inch diameter by forty-inch length) (USDA Forest Service, 1974). It was estimated that each log would produce approximately 10 percent of its weight in fresh mushrooms over an entire
Table 4. Estimated hours of labor*

<table>
<thead>
<tr>
<th>Year(s)</th>
<th>Outdoor operation</th>
<th>Indoor operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>400</td>
<td>664</td>
</tr>
<tr>
<td>2</td>
<td>697</td>
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<td>3</td>
<td>1,445</td>
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<tr>
<td>4-12</td>
<td>2,034</td>
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<tr>
<td>13</td>
<td>1,854</td>
<td>2,135</td>
</tr>
<tr>
<td>14</td>
<td>1,447</td>
<td>1,721</td>
</tr>
<tr>
<td>15</td>
<td>696</td>
<td>793</td>
</tr>
</tbody>
</table>

*Does not include labor hired for log inoculation.

*The Internal Revenue Service may not allow the producer to deduct business expenses from income taxes until the operation shows a profit.

rotation (Deden and Gilbert 1989-91, Leatham 1982, and Pryzbylowicz and Donoghue 1988) or 4.0 pounds. It appeared feasible to grow 4.0 pounds of mushrooms in three years indoors, however, it was determined that a 5-year rotation would be needed in the outdoor operation to produce 4.0 pounds of mushrooms. When a financial analysis was performed in an outdoor operation involving a 5-year rotation, financial returns were lower than for a 4 year rotation. In the fifth year, low mushroom production and high management costs reduced profits. We, therefore, chose a 4-year rotation for the outdoor operation.

It was assumed that operators would be able to sell all mushrooms produced as fresh product. Mushrooms grown outdoors would be sold at $4.50 per pound; mushrooms grown indoors would be sold at $5.50 per pound. This price difference was based upon experiential evidence that indoor growers would be able to sell mushrooms at a higher price because their product could be marketed year-round instead of only in the spring and fall.

Cash flow tables were prepared for each scenario (Tables 2 and 3). To simplify calculations all expenses and revenues were assumed to occur at the beginning of the year. A 4.0 percent general rate of inflation was assumed in the analysis. After-cash flows account for federal income taxes only, and assume a 28 percent income tax bracket for the producer. Using a single tax bracket simplified the analysis but it was not entirely accurate since at low income levels the 15 percent bracket was more appropriate and at high income levels a 33 percent bracket is more appropriate. Capitol expenses were depreciated according to Internal Revenue Service schedules and operating expenses were deducted in the year in which they occurred.* (See Tables 2 & 3.)

In both operations it was assumed that growers would be able to borrow funds to cover all business expenses until profits were realized. Loans were handled as standard 10-year mortgages at 11.4 percent interest.

No costs were included for research and development. It was assumed that the producer was knowledgeable about all phases of shiitake cultivation and marketing. Land costs also were excluded from the analysis under the assumption that most producers own land and would continue to own land whether they produced shiitake or some other crop. However, property tax calculations do consider land values in order to reflect the possible increase in property values attributed to shiitake production. Property taxes were based on average land values and tax rates in southeastern Minnesota; property taxes on permanent structures (i.e., soak tank and building) were also included.

It was assumed that three part-time laborers would be hired to help inoculate logs. All other labor costs were excluded from the analysis under the assumption that shiitake producers would most likely be sole proprietors who would perform their own labor, and could not deduct their own labor from income for tax purposes. In both operations annual labor requirements were estimated to be equal to one person working full time (Table 4). However, during parts of the year, both operations would actually require two or more people.

Net present value (NPV), equivalent annual income (EAI), and internal rate of return (IRR) were calculated both before and after taxes. A sensitivity analysis was performed, including the estimation of break-even mushroom yields and prices, and different operation scales. The before-tax calculations of NPV and EAI were based on an 8.0 percent nominal rate of interest (or discount rate). A nominal interest (discount) rate of 5.76 percent was used for the after-tax calculation of NPV and EAI. IRR also was calculated both before and after financing. Financing (borrowing money from the bank) had a dramatic and potentially misleading effect in IRR. Furthermore, the calculation if IRR without financing provides investors who might provide their own start-up funds with a more accurate picture of their rate of return.
Table 5. Financial Indicators for inoculating 4,000 logs per year outdoors and indoors.

<table>
<thead>
<tr>
<th></th>
<th>NPV</th>
<th>EAI</th>
<th>IRR</th>
<th>IRR*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before taxes**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor operation</td>
<td>$241,696</td>
<td>$22,649</td>
<td>123.54%</td>
<td>42.80%</td>
</tr>
<tr>
<td>Indoor operation</td>
<td>$325,152</td>
<td>$30,470</td>
<td>116.32%</td>
<td>35.47%</td>
</tr>
<tr>
<td>After taxes***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor operation</td>
<td>$212,711</td>
<td>$17,192</td>
<td>3734.93%</td>
<td>41.92%</td>
</tr>
<tr>
<td>Indoor operation</td>
<td>$267,032</td>
<td>$23,199</td>
<td>351.11%</td>
<td>28.88%</td>
</tr>
</tbody>
</table>

*Calculated with financing removed from the cash flow table.
**NPV and EAI are based on an 8.0% discount rate.
***At the time the analysis was performed, long-term U.S. Savings Bonds were earning 8.0 percent interest.
**NPV and EAI are based on a 5.76% discount rate.

All financial calculations were performed using a computer program written specifically for this analysis, within the structure of the commercial spreadsheet program, WORKS (Microsoft Corp 1987-89). The model was validated using the CASH microcomputer program (Belli, Rose, Blinn, and Ho, 1988). CASH is rather simple to use and understand, however, the program did not handle loans and income tax data changes as quickly as the spreadsheet.

RESULTS

Cumulative net revenues shown in Tables 2 and 4 indicate there is a net loss after-taxes in both scenarios in the first year. If borrowed money were not included in the cash flow, both operations would exhibit after-tax cumulative net deficits in years 1 through 3. It also should be noted that the indoor operation requires almost twice as large an investment as the outdoor operation. Should the operation fail, indoor operators have more cash at risk.

Table 5 compares the scenarios by NPV, EAI, and IRR both before and after taxes. Since reliance on a before-tax analysis often leads to an over estimation of financial returns, the remainder of this article focuses on the after-tax analysis.

The indoor operation yields a higher NPV and EAI, but a lower IRR than the outdoor operation. Both scenarios appear to be good investments, but which is better? Here it may be helpful to bring labor back into the discussion. Cash flows for these scenarios assume no cost for labor, other than during inoculation, therefore, NPV, EAI, and IRR measure not only the financial returns that accrue to money invested in the projects, but also the financial returns that accrue due to the investment of labor.

If an individual were contributing only money to the project and not labor, the operation that yields the higher IRR with outside financing removed probably would appear to be the better investment, i.e., outdoor shiitake production. However, these individuals would still have to hire labor. Investors can approximate the maximum hourly wage payable for labor, while still achieving a 5.76 percent after-tax nominal interest rate, by dividing NPV by the total hours of labor required over 15 years (Table 4). Using this method, a person investing in the outdoor operation would be able to pay only $8.65 per hour for labor, while a person investing in the indoor operation could pay $10.18 per hour for labor.

Persons investing both labor and money into the project also should pay attention to the value of labor. Since NPV and EAI are measures of financial worth determined by discounting future cash flows at 5.76 percent, the discount rate could be thought of as the financial return for use of capital, and any positive values for NPV and EAI could be thought of as financial returns to labor. Based on this rationale, the indoor operation not only meets the 5.76 percent financial return, but it also yields a higher return to labor than outdoor production, as measured by NPV and EAI. This is further evident when future labor hours are discounted to the present at 5.76 percent and divided into NPV to calculate the average hourly income. Persons growing shiitake indoors could earn approximately $14.77 for each hour of labor invested compared to $12.56 for each hour of labor invested in outdoor production. Both for people investing money and people investing their own labor, growing shiitake indoors appears to be a better alternative than growing it outdoors.

SENSITIVITY ANALYSIS

Since shiitake cultivation is a relatively new industry in the United States and production processes, expenses, and revenues are not widely known or easily estimated, there is a high degree of uncertainty in determining cash flows. A sensitivity analysis helps identify which expense or revenue items deserve the greatest care in estimating, and which require close monitoring of the
project is expected. Table 6 shows how much NPV and EAI would change given a 10 percent shift in each separable expense and revenue items after taxes.

In both scenarios mushroom revenue was identified as the most sensitive item in the analysis. For this reason, the break-even mushroom yield per log, and the price per pound were calculated. To break even, an outdoor operation needs to sell shiitake at $2.18 per pound and to produce 1.27 pounds per log. An indoor operation needs to sell shiitake at $2.84 per pound and produce 1.71 pounds per log. Potential growers should look carefully at yields and prices and perhaps make conservative estimates to lessen the risk of a financial loss in the shiitake business.

For the operation NPV and EAI were most sensitive to changes in expenses for packaging and shipping, and logs. Log expenses include expenses for acquiring logs, shiitake spawn, wax, and identification tags.

For the indoor operation NPV and EAI were most sensitive to changes in expenses for the building, packaging and shipping, and logs. Persons who invest in indoor shiitake production should pay particular attention to building construction expenses. Growers that can modify existing barns or sheds may substantially reduce construction expenses and increase profits.

With the exception of building construction expenses in the indoor operation, NPV and EAI are not very sensitive to any expense item in either scenario. A 100 percent increase in any one expense item still would not drive NPV to zero.

We also analyzed the impact in NPV, EAI, and IRR from increasing the scale of both operations from 4,000 logs inoculated per year to 8,000 logs inoculated per year. All expense and revenue items for these larger scale operations; we did not simply double the expense and revenue figures figures. The before-tax nominal interest rate, inflation rate, and planning period remained the same as those used for the smaller scale operations, however, increased income at the larger scale

<table>
<thead>
<tr>
<th>Table 6. Sensitivity analysis*</th>
<th>Outdoor operation</th>
<th>Indoor operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>NPV</td>
<td>EAI</td>
</tr>
<tr>
<td>Expenses:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tools and Supplies</td>
<td>$1,348</td>
<td>$109</td>
</tr>
<tr>
<td>Maintenance/Operation</td>
<td>$677</td>
<td>$55</td>
</tr>
<tr>
<td>Utilities</td>
<td>$891</td>
<td>$72</td>
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<tr>
<td>Marketing/Advertising</td>
<td>$2,998</td>
<td>$242</td>
</tr>
<tr>
<td>Packaging/Shipping</td>
<td>$5,122</td>
<td>$414</td>
</tr>
<tr>
<td>Insurance</td>
<td>$1,338</td>
<td>$108</td>
</tr>
<tr>
<td>Property Taxes</td>
<td>$279</td>
<td>$22</td>
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<tr>
<td>Labor/Inoculation</td>
<td>$1,176</td>
<td>$95</td>
</tr>
<tr>
<td>Logs</td>
<td>$4,239</td>
<td>$342</td>
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<tr>
<td>Soak Tank</td>
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<td>$46</td>
</tr>
<tr>
<td>Tractor</td>
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<td>$31</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>$427</td>
<td>$34</td>
</tr>
<tr>
<td>Mushroom Scale</td>
<td>$110</td>
<td>$9</td>
</tr>
<tr>
<td>Laying Yard</td>
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<tr>
<td>Building</td>
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<td></td>
</tr>
<tr>
<td>Computer</td>
<td>$301</td>
<td>$24</td>
</tr>
<tr>
<td>Revenue:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mushroom sales</td>
<td>$41,774</td>
<td>$3,376</td>
</tr>
<tr>
<td>Break even mushroom price **</td>
<td>$2.18/lb</td>
<td></td>
</tr>
<tr>
<td>Break even mushroom yield/log**</td>
<td>1.27 lbs</td>
<td></td>
</tr>
</tbody>
</table>

*Based on 10% change in expenses and revenue, after-taxes.
**Based on a 5.76% discount rate, after-taxes.
Table 3. Cash flows: indoor operation.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
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<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tools &amp; supplies</td>
<td>(4,105)</td>
<td>(376)</td>
<td>(795)</td>
<td>(407)</td>
<td>(948)</td>
<td>(588)</td>
<td>(930)</td>
<td>(476)</td>
<td>(1,930)</td>
<td>(315)</td>
<td>(1,889)</td>
<td>(557)</td>
<td>(1,297)</td>
<td>(500)</td>
<td>(520)</td>
</tr>
<tr>
<td>Maintenance &amp; operation</td>
<td>(80)</td>
<td>(1,594)</td>
<td>(1,712)</td>
<td>(1,794)</td>
<td>(1,852)</td>
<td>(2,379)</td>
<td>(2,018)</td>
<td>(2,083)</td>
<td>(2,166)</td>
<td>(2,270)</td>
<td>(2,895)</td>
<td>(3,304)</td>
<td>(2,334)</td>
<td>(2,185)</td>
<td></td>
</tr>
<tr>
<td>Utilities</td>
<td>(1,800)</td>
<td>(1,872)</td>
<td>(1,947)</td>
<td>(2,025)</td>
<td>(2,106)</td>
<td>(2,190)</td>
<td>(2,278)</td>
<td>(2,369)</td>
<td>(2,463)</td>
<td>(2,562)</td>
<td>(2,664)</td>
<td>(2,771)</td>
<td>(2,882)</td>
<td>(2,997)</td>
<td>(3,117)</td>
</tr>
<tr>
<td>Packaging &amp; shipping</td>
<td>(792)</td>
<td>(5,127)</td>
<td>(7,896)</td>
<td>(8,212)</td>
<td>(8,540)</td>
<td>(8,882)</td>
<td>(9,237)</td>
<td>(9,606)</td>
<td>(9,991)</td>
<td>(10,390)</td>
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<td>(11,238)</td>
<td>(11,688)</td>
<td>(10,837)</td>
<td>(4,104)</td>
</tr>
<tr>
<td>Property taxes</td>
<td>(1,648)</td>
<td>(1,714)</td>
<td>(1,783)</td>
<td>(1,854)</td>
<td>(1,929)</td>
<td>(2,006)</td>
<td>(2,086)</td>
<td>(2,169)</td>
<td>(2,256)</td>
<td>(2,346)</td>
<td>(2,440)</td>
<td>(2,538)</td>
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<td>Labor</td>
<td>(1,440)</td>
<td>(1,498)</td>
<td>(1,558)</td>
<td>(1,620)</td>
<td>(1,685)</td>
<td>(1,752)</td>
<td>(1,822)</td>
<td>(1,895)</td>
<td>(1,971)</td>
<td>(2,050)</td>
<td>(2,132)</td>
<td>(2,217)</td>
<td>(2,305)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soak tank</td>
<td>(5,100)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tractor</td>
<td>(4,400)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td></td>
</tr>
<tr>
<td>Reformer</td>
<td>(3,850)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>Mushroom scale</td>
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<td>Laying yard</td>
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<td>Building</td>
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<tr>
<td><strong>Revenue</strong></td>
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<td>Mushroom sales</td>
<td>7,920</td>
<td>51,274</td>
<td>78,958</td>
<td>82,117</td>
<td>85,401</td>
<td>88,817</td>
<td>92,370</td>
<td>96,065</td>
<td>99,908</td>
<td>103,904</td>
<td>108,060</td>
<td>112,382</td>
<td>116,878</td>
<td>108,365</td>
<td>41,040</td>
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<td><strong>Financing</strong></td>
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<td>Loan receipts</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>Loan payments</td>
<td>(20,489)</td>
<td>(20,489)</td>
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<td>(20,489)</td>
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<tr>
<td><strong>BEFORE TAXES</strong></td>
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</tr>
<tr>
<td>Annual net revenue</td>
<td>(12,569)</td>
<td>5,755</td>
<td>28,525</td>
<td>34,046</td>
<td>35,717</td>
<td>37,910</td>
<td>40,383</td>
<td>43,324</td>
<td>41,706</td>
<td>48,515</td>
<td>69,210</td>
<td>74,652</td>
<td>76,921</td>
<td>80,699</td>
<td>20,657</td>
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<tr>
<td>Cumulative net revenue</td>
<td>(12,569)</td>
<td>(6,813)</td>
<td>21,711</td>
<td>55,757</td>
<td>91,474</td>
<td>129,384</td>
<td>169,767</td>
<td>213,091</td>
<td>254,797</td>
<td>303,311</td>
<td>372,522</td>
<td>447,174</td>
<td>524,695</td>
<td>604,794</td>
<td>625,451</td>
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<tr>
<td><strong>AFTER TAXES</strong></td>
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<tr>
<td>Annual net revenue</td>
<td>(2,674)</td>
<td>7,417</td>
<td>22,795</td>
<td>25,828</td>
<td>26,120</td>
<td>26,953</td>
<td>28,155</td>
<td>29,567</td>
<td>26,946</td>
<td>32,020</td>
<td>50,918</td>
<td>53,896</td>
<td>55,522</td>
<td>59,797</td>
<td>15,672</td>
</tr>
</tbody>
</table>

All Values are in dollars inflated at 4 percent to the beginning of the year of occurrence. Values in parenthesis are less than zero. Columns may not add up due to rounding error.
Not All Logs Are

There are Shiitake logs. And then there are Lambert Shiitake logs. Logs that are manufactured and cured by the finest team of shiitake mycologists and specialists. Logs that must meet the highest standards in terms of quality. Or they won’t make it out of our growing rooms and into yours.

A Lambert Shiitake log is formulated from a blend of supplemented sawdust inoculated with the finest Shiitake strain available for indoor cultivation. We adhere to strict quality control measures in all aspects of log manufacture—from strain maintenance to final product selection to shipment.

Our investment in people yields big results for you.

The main reason that Lambert should be your Shiitake log supplier is our people. A team of professionals who are involved in all aspects of producing Shiitake logs with a tireless emphasis on quality control and continuous improvement.

No one in the industry invests as much time as we do in research and development. We have four full time mycologists on staff who are involved in projects as diverse as our Shiitake breeding program and the development of alternative production technologies. Our scientific staff are also constantly exchanging ideas, information, and strains with other scientists and research teams worldwide. The benefits of which can be seen in logs that consistently produce high yields of the finest quality Shiitake mushrooms.
We don’t just sell logs. We sell a total support system.
What’s made Lambert the Shiitake log company is the total support package we offer growers. Our staff is available to answer your questions anytime of day (yes we even have a 24-hour “hotline”). Need technical support or advice on temperature control? Call us, we’re ready to respond. Unsure how long to soak your logs? No problem, give us a ring and we’ll give you the help you need. We pride ourselves on personal service and unsurpassed quality, so you get the yields and quality you’ll be happy with.

Lambert Spawn. A name you can trust.
Lambert Spawn is America’s oldest mushroom spawn company. We have more experience in the Shiitake industry than any other company. This is one reason why Lambert has become America’s number one supplier of quality shiitake logs.
Whether you’re in need of white or cured logs, Lambert Spawn has the product and the support system you’re looking for.
Our production is in limited supply, but we are currently expanding our capacity without sacrificing quality. If you’re interested in our services, we suggest you call Ralph McIntyre collect at (215) 384-5031 and try out our logs. They, like the people who create them, have no equal.

The Lambert Shiitake Team—Kristina Ellor, John Coliguri, Hilary Fox, Roberta Cheek, Joe Luna, Christine Smith

Great spawn is made by great people.
Coatesville, PA • (215) 384-5031 FAX (215) 384-0390
Western U.S. Representative: Greg Costa • California • (408) 842-3349 FAX (408) 842-6428
Western Canadian Distributor: Fraser Valley Mushroom Grower’s Co-operative Assoc. • (604) 882-0333
Table 7. Financial indicators for inoculating 8,000 logs per year outdoors and indoors.

<table>
<thead>
<tr>
<th></th>
<th>NPV</th>
<th>EAI</th>
<th>IRR*</th>
<th>Wage**</th>
</tr>
</thead>
<tbody>
<tr>
<td>After taxes***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outdoor</td>
<td>$432,755</td>
<td>$34,406</td>
<td>46.63%</td>
<td>$12.73</td>
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<tr>
<td>Indoor</td>
<td>$593,754</td>
<td>$47,206</td>
<td>33.08%</td>
<td>$15.44</td>
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</tbody>
</table>

*Calculated with financing removed from the cash
**Reported in dollars/hour.
***NPV and EAI are based on a 5.52% assumed discount rate.

pushed both operations into a 31 percent income tax bracket for the after-tax analysis. We, therefore made the simplifying assumption that all revenue would be taxed at 31 percent. This assumption reduced overall profits from what producers could actually earn. The after-tax nominal interest (discount) rate, therefore, also was changed to 5.52 percent. Table 7 reports the NPV, EAI, IRR and hourly wage for indoor and outdoor operations at the scale where 8,000 logs are inoculated per year.

When the financial indicators in Table 7 are compared to those in Table 5, it becomes apparent there is a very slight economy of scale when operation size is increased from 4,000 logs inoculated per year to 8,000 logs. In the outdoor operation, when the scale increases 2.0 times, NPV increases by 4.71 percent. In the indoor operation, when the scale increases 2.0 times, NPV increases 2.07 times and IRR increases by 4.2 percent. These differences may not be substantial enough for some producers to take the additional risks associated with larger production scales.

Prospective operators should be cautioned that this analysis assumes that all mushrooms produced would be sold as fresh product. When full production is reached at the 8,000 log inoculation level, approximately 24,392 pounds of shiitake would be produced annually outdoors and 26,546 pounds indoors. A strong market is needed to sell this much product. This is especially true for the outdoor operator whose product is on the market only 14 weeks out of the year. Operators at the higher scale may want to consider drying some mushrooms or selling their shiitake at a lower price per pound.

CONCLUSIONS

Based on assumptions in this analysis about production processes and cash flows. Small scale shiitake mushroom production involving the inoculation of 4,000 logs annually appears to be a reasonably good financial investment. It may be possible to earn after-tax rates of return exceeding 28 percent (with loans removed from the analysis). For persons investing both labor and capital, shiitake operators may produce a 5.76 percent after-tax rate of return plus after-tax equivalent annual incomes of $17,192 for outdoor production and $23,199 for indoor production. These financial returns require the input of approximately one person working year-round with additional labor hired for log inoculation. Financial returns are not very sensitive to changes in individual expense items, but are sensitive to changes in revenue. Increasing inoculation from 4,000 to 8,000 logs per year yields only a slight gain in financial efficiency.

Potential investors are cautioned that these scenarios assume the grower is very knowledgeable about shiitake production and is able to sell all mushrooms as fresh product. It is important that the magnitude of these assumption be clearly understood. Inexperienced growers commonly end up with an expensive pile of firewood in the first few years of production (Kozak and Krawczak 1989). Growers should conduct a financial analysis based upon their own level of experience and estimates of expenses and revenues and should not rely solely on this report as a basis for investing or not investing in shiitake cultivation. Cultivation is not easy. If it were, the financial aspects of this analysis indicate that more people would be growing shiitake for profit.

LITERATURE CITED


Dedem, J., and M. Gilbert. 1989-91. Personal communication. Forest Resource Center, Rt 2, Box 156A, Lanesboro, MN.

Farris, T. 1988-89. Personal communication. Carolina Agro-Tech Corp., Box 2196, Henderson, NC.


Kerrigan, R. 1982. Is Shiitake

[Continued on page 13]
Attention Mushroom Growers, Marketers, Suppliers and Scientists:

Daniel J. Royse
Professor of Plant Pathology and Chair,
Specialty Mushroom Workshop Planning Committee

You are cordially invited to attend the 4th Annual Specialty Mushroom Workshop (June 15-16, 1993) at The Pennsylvania State University, University Park, PA. The Workshop is designed to promote the exchange of ideas for research, production and merchandising of specialty mushrooms.

The planning committee has developed an outstanding program with an experienced group of speakers and panelists. Time has been set aside for questions following each presentation and for questions and discussions with panel members. This year, Dr. Erik Lee of Franklin Foods will discuss production of Shiitake, Pleurotus and Maitake in Connecticut. Dr. S. C. Jong of the American Type Culture Collection will describe production of specialty mushrooms in China and Taiwan while Dr. Daniel J. Royse will compare cultivation and consumption of specialty mushrooms in the USA and Japan. Year-round production of shiitake on natural logs in a continental climate will be the topic of Mr. Joe Krawczyk of Field and Forest Products, Peshtigo, Wisconsin. Ms. Tina Ellor, L. F. Lambert Spawn Co., will outline methods and practices used for breeding and selection of shiitake for production on substrate.

Marketing of mushrooms will receive special emphasis this year. Mr. Kevin Donovan of Phillips Mushroom Farm will discuss production and marketing of specialty mushrooms in Pennsylvania. Part of the afternoon of June 15 will be devoted to a joint session on marketing with the Agaricus group of the Mushroom Industry Short Course (June 14-16, 1992). This joint session will address such topics as the new marketing order, national and international trends and how marketing does and does not work.

The Workshop will be held in the newly renovated Penn State Nittany Lion Inn. For more information on either or both programs contact: Agricultural Short Courses and Conferences, 306 Agricultural Administration Building, The Pennsylvania State University, University Park, Pa 16802-2601. Phone: (814) 865-6301, Fax: (814) 865-7050.

Please mark your calendar and plan to register for these dates. We hope to see you at Penn State in June. The registration fee for either the Mushroom Short Course or the Specialty Mushroom Workshop is just $125. Please make your own housing arrangements. A list of local hotels and motels is available from the address above. A block of rooms has been reserved at the Nittany Lion Inn. The Nittany Lion Inn toll free number is (800)233-7505.

Specialty Mushroom Short Course Registration Form

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
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</table>

| Company or Organization |

| Street Address |

| City | State | Zip |

| Telephone (area code) | Fax Number (area code) |

Forest Resource Center
Shiitake Recipes

Chef Paul Prudhomme's Chicken Diane
Yield: 2 servings

1/2 pound shiitake mushrooms sliced
6 ounces unsalted butter or margarine
1 tablespoon, plus 2 teaspoons Cajun Magic Poultry Magic Seasoning
12 ounces boneless chicken breasts, skinned, cut into strips
1/4 green onion tops, minced
3 tablespoons fresh parsley, minced
1 teaspoon fresh garlic minced
1 cup chicken stock
6 oz pasta, dry

Cook pasta and set aside. Mash 1/3 of the butter or margarine and combine with seasoning and chicken. Heat a skillet over a high fire until it's hot (about 4 minutes). Add chicken pieces and brown them in about 2 minutes on the first side and about 1 minute on the other. Add mushrooms and cook 2 minutes. Add green onions, parsley, garlic, and stock. Cook 2 or more minutes or until the sauce is at a rolling boil. Add remaining butter or margarine (cut in pats), stirring and shaking the pan to incorporate. Cook for 3 minutes and add the cooked pasta. Stir and shake the pan to mix well. Serve immediately.

Shiitake Sweet and Sour Salad

1/2 cup fresh shiitake mushrooms
1/2 cup onion rings
1/4 cup herb salad dressing
1 minced garlic clove
2 cups mixed fresh greens

Combine onion rings, mushrooms, garlic, and dressing. Sauté until onion is tender. Toss mixture with greens and serve.

Baked Shiitake Omelet

1/2 pound fresh shiitake mushrooms
1/4 cup butter
8 eggs beaten
1 tsp salt
1/4 teaspoon pepper
1/4 teaspoon rosemary

Saute mushrooms in butter. Combine other ingredients. Bake in 7x11 dish at 325 degrees for 15 min. or until set.

Broccoli Shiitake Red Pepper Tart

Pepper Pie Crust
1 C. sifted all-purpose flour
1/2 tsp salt
1/2 tsp freshly ground pepper
1/4 c/ vegetable oil
2 tsp water

Filling
1 c. Shiitake mushrooms (about 2 oz.)
1/3 cup chopped red onion
2 tsp vegetable oil
1 c. steamed broccoli florets, cut into small pieces
1/2 c. each chopped red and yellow peppers
3/4 c. grated Monterey Jack Cheese
1 c. milk
2 eggs
1/2 tsp salt (optional)
1/2 tsp freshly ground pepper

Heat oven to 350 degrees

For pie crust: Mix flour, salt and pepper in bowl. Add oil and water; stir with fork until blended and dough holds together. Form into flat circle. Roll out dough between two squares of waxed paper until circle of dough touches edges of paper. Dampen working surface to prevent waxed paper from slipping as dough is rolled. Peel off top paper. Pick up rolled dough with bottom paper and turn onto pie or tart plate; paper side up. Carefully peel off paper and press dough into 8 inch tart or pie plate. Trim dough even with edge of plate.

For filling: In medium-sized pan, sauté mushrooms and onions in 2 tablespoons of oil. Arrange broccoli in bottom of pie or tart shell. Add peppers and top with mushrooms and onions. Sprinkle with grated cheese. In blender, combine milk, eggs, salt and pepper. Pour over vegetables in pie shell. Increase oven temperature to 375 degrees and bake for about 40 minutes or until center of pie is set. Cool slightly before cutting. Makes 6-8 servings or one 8 inch tart.
Continued from page 10

Farming for You? Far West Fungi, Watsonville, CA.


Microsoft Corp. 1987-89. Microsoft (R) Works (Version 2.000A). Redmont, WA.


Schmidt, E. 1988-89. Personal communication. University of Minnesota, Department of Forest Products, St. Paul, MN.


Free 1993 Garden Book Listing

The American Horticultural Society has assembled a descriptive listing of the latest releases in gardening and horticulture, and has combined that list with many essential reference works and classic garden selections. This useful guide to gardening titles is now available free of charge.

The AHS Garden Book Listing is updated every two months enabling participants to locate the very latest in new releases, as well as the most up-to-date editions of the many reference titles offered. From visiting Henry Mitchell's small city garden in Gardening With Friends to ordering Amaryllis bulbs from Gardening by Mail, the AHS Garden Book Listing has the book to get gardeners growing. In addition to offering many of the best garden books available, AHS has also discounted every title, making them affordable for every budget.

Copies of this free book listing are available by sending a business sized SASE to AHS Book List, 7931 East Boulevard Drive, Alexandria, VA 22308.

Forestry Camp for Teens

Today's forests are valuable source of wood products, wildlife habitat and recreational opportunities. They also protect our soil and renew our water resources. Producing these benefits requires generations of careful planning and management. Future forests depend on today's youth.

The University of Minnesota's Extension Service is planning a summer camp to provide young women and men ages 14-18 an opportunity to explore the forest ecosystems of Minnesota. The camp will be offered June 27 through July 2 at the Forest Resource Center near Lanesboro, MN. The week-long camp costs $170 per person and space is limited, so early registration is requested. A limited number of camp scholarships may be available.

Participants will be introduced to the basic principles of forest management including forest evolution, forest products, wildlife biology, soil and water protection and recreation planning. With a team of peers, they'll learn how to conduct a forest inventory and design a stewardship management plan for a 10 acre "adopted" forest. Camp programs also will include team building, a high ropes confidence course, a canoe trip, fisheries management, a cave tour, prairie management, bird banding and natural resource career exploration.

For more information contact the Forest Resource Center, 1991 Brightside Road, Rt 2, Box 156A, Lanesboro, MN 55949; telephone (507) 467-2437.

Additional Shiitake Information

Florida Mushroom Growers Association

Charlie Tarcan
3426 SW 75th Street, Gainesville, FL 32607

Carolina Shiitake Mushroom Association

Ellie Litts
Box 356
Hodges, SC 29653
Phone: (803) 874-7480

Forest Resource Center
Can a Shiitake a Day Really Keep The Doctor Away?

Like other shiitake growers in the United States, you are probably familiar with the claims originating mostly in Japan and China about the effectiveness of the shiitake in lowering cholesterol levels, inhibiting tumor growth and generally "beating up" the immune system, but you may not be aware that these "claims" are actually "facts" based in substantiated research - some of it done right here in this country. This research, in turn, has led to the National Institutes of Health (NIH) experimenting with the shiitake in its AIDS research program because of its natural interferon-like substance that inhibits viral growth.

If the shiitake raises possibilities for the treatment of illnesses related to the virus then what can it do for the common cold--the virus that we're most familiar with? Could research lead to some form of daily shiitake intake being as common in the 21st century as popping a Vitamin C tablet is today? Will the time come when a doctor prescribes a shiitake-based drug to minimize the effects of influenza and other viral "bugs" that attack our health?

In the private sector, health research activity in some instances has already proceeded into actual commercial production, reports medical researcher and physician, Andrew Weil, in his recent book, Natural Health, Natural Medicine. He states that right now there are large pharmaceutical companies in the United States developing drugs using medicinal mushroom extracts.

Some mushroom entrepreneurs are already on this bandwagon in a smaller way. In one health food store in the Washington D.C. area, I found the same mushroom powder that was on the shelf with seasonings and condiments also placed on the shelf with vitamins, cold remedies and nutritional supplements.

If you have a connection with a health food store or supplier you might want to consider drying your leftover fresh mushrooms and stems and marketing them in a powdered form. I wouldn't advertise it as a cold remedy just yet--you know how the FDA is about these things--but the shiitake is certainly viable as a nutritional booster.

All of this reminds me of a conversation my husband, AMG Board Member Mike Cook, had a few years ago with Paul Stamets, founder of the Fungi Perfecti company and author of The Mushroom Cultivator. In talking about the health potential of the shiitake, Stamets said he thought it was possible that one day production of the shiitake for medical purposes could surpass the amount grown for food consumption. It may be that we're on the threshold of seeing that prediction come true right now!

Appalachian Mushroom Growers Fall Newsletter, 1992, pgs 2-4.

"Growing Shiitake Mushrooms in a Continental Climate"
by Mary Ellen Kozak & Joe Krawczyk
Field & Forest Products, Inc.

Based on first-hand information from our commercial log-grown Shiitake operation, this book details the process - from selecting logs to the finer points of year-round cultivation (indoors and outdoors) in our challenging climate (and yours). This book is illustrated, easy to read, printed on recycled paper, and written to provide information pertinent to climates very different from Asia. A must for all serious growers. Available from Field and Forest Products at $7.95, post-paid.

"Recommendations and suggestions made in the book are based on practical experience, not theoretical notions ... an excellent book, suitable for growers who live in either dry, or moist, humid climates. Readers will not be disappointed."
- Steven Bratkovich - District Ext. Specialist
Ohio Cooperative Extension Service -

(Received for your Field & Forest Products catalogue, today! Our catalogue features our own Shiitake Spawn and mushroom growing equipment and supplies. The catalogue is $2, which can be applied towards spawn purchases).

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Pelishio,
Wisconsin.
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(715) 562-4997
VISA and MasterCard Accepted

WOODLAND OWNER'S GUIDE TO OAK MANAGEMENT NR-FO-5938
Provides information woodland owners should know about regenerating oaks and managing hardwood stands. Gives tips for improving stands, controlling pests, protecting soil and water, and managing for wildlife and aesthetics. For private woodland owners and individuals responsible for managing hardwood stands. Cost $1.50

Enclose a check or money order payable to the University of Minnesota and mail to: Minnesota Extension Service Distribution Center, 3 Coffey Hall, 1420 Echles Avenue, St. Paul, MN 55108-6064. Fax(612) 625-2207

Forest Resource Center Lanesboro, Minnesota
Ironwood Logs Available: Near Baraboo, WI, Contact: Ray Unrein, W8590, Blue Joint Road, Waterloo, WI 53594.

Ironwood Logs Available: Near Frederick, WI, Contact: Scott Badenoch, phone (612) 871-8431.

Exclusive Shiitake Pens/Pencils/Sets: Oak Wood. Beautiful swirling spalting lines. Really stunning! Uses Cross refills. Extraordinary gift for "best" customers, relatives, potential clients, etc. Laser engraving available. Promote your business! Pen - $22.00. $1.00 for information to: Shiitake Pens, P.O. Box 2303, Lufkin, TX 75901.

Shiitake Suppliers Wanted: Metropolitan Agribusiness, a major distributor of Shiitake and other fresh specialties foods to the New York Market, needs additional suppliers of all grades of shiitake; requirements up to a thousand pounds a week. We are also interested in supplies of cremini, portobello and other exotic or wild mushrooms. Interested growers please contact Patrick Ahern (212) 431-3504, Director of Purchasing, Metro Agribusiness.

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Paul Przybylowicz
John Donoghue

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* Methods for cultivation on sawdust.

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Consulting, Research, Seminars.
Shiitake Mushroom Spawn & Wax

Forest Resource Center

WON SHAN
Mushroom Farms Co.

Outdoor Shiitake Expert

Mr. Eung Sik Weon has been producing spawn and growing outdoor mushrooms for over 20 years. Won Shan Mushroom farm now is one of the largest outdoor productions in the United States. We only specialize in S-1 for summer strain and S-5 for winter strain for shiitake mushroom.

Over 20 years, we never had an off season using our spawn. Please call or write for a free brochure or any questions concerning outdoor production.

For a free brochure write to:

Won Shan Mushroom Farm
Rt. 1, Box 510
Catlett, VA 22029
A New Substrate For Growers  Continued from page 1

And that is exactly what has happened. Ray Young started a new company that produced products from the by product of the grass seed industry called Straw Products Inc. Oregon produces about 1,250,000 tons of this straw that is left after taking the grass seed off by combining. We sell 250,000 tons as livestock feed to the Japanese and have about 1,000,000 lbs. that has to be burned in the fields or otherwise disposed. The farmers give this product free to any one who wants to collect it so the base price of the product gives Mr. Young the opportunity to produce a product that gives the mushroom farmer a little better margin in their current wholesale price of between $4.50 to $5.50. Our retail price at the present time is about $10.00 per pound.

This substrate is produced as follows. The straw is bailed in the field and delivered to the processing site. It is put through a bale chopper to reduce it to about a two inch long product and is then put through a flail grinder which reduced the size to about the size of fine hardwood sawdust. The process continues by compacting it into a 2.5 inch by one half inch wafer. During this process the temperature is raised to up to about 265 degrees for about 12 minutes so all of this included fungi, bacterial disease or insects are disposed of. The product called mushroom starter is then bagged in 50 pound bags for shipment.

This new inoculation has gone through rather extensive trial for producing both Shiitake and Oyster mushrooms and has proven to be a very high producer per pound of product used. It issued as a direct replacement for other wood substrates. The grower uses 2# of the concentrated wafers adding water and any other material you might need for substrate production, inoculate the material and production begins in about 8 weeks.

For detailed information and samples please contact: Ray Young, Straw Products Inc., Ph: (503) 967-4676, Fax: (503) 967-4227.

Oregon's mushroom production for 1992 was, Shiitake at $2.5 million, Oyster at $1.0 million, Commercial agarics at $24 million and wild non-producible mushrooms at $40 million.