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Proprietary research to determine feasibility of commercializing the Pink Oyster Mushroom

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ABSTRACT

This project serves as a feasibility experiment to bring the Pink Oyster mushroom (*Pleurotus flabellatus*) into constant domestic cultivation for the purposes of commercialization. Important data acquired from growth trials were growth timelines and yields. This information was used to generate interactive spreadsheets with which one can determine possible cost and profit in a variety of scenarios. The first portion of the experiment involved constructing a growth chamber, which can achieve and maintain stable environmental conditions. This portion was successful. Secondly, the numbers obtained from the experimental growth trials were used to determine future projections from the perspective of a small business start up. According to the data, investment in production is expected to be highly lucrative, with a projected net profit margin range of 300-2000%

INTRODUCTION AND LITERATURE REVIEW

P. flabellatus is a species of the edible higher fungi and supposedly originates from Malaysia. It is aggressive, saprophytic and thrives in tropical climates. Due to its aggressive nature, the fungus is an excellent candidate for processing a wide variety of substrates[i] into a healthy, edible food product. Additionally, the processed substrate makes nutritious fodder for ruminant livestock and can be used as a horticultural and agricultural additive for improving nutrient availability and quality in soils. Other uses for the *Pleurotus* fungus include bioremediation[ii,iii], replacing foam in packaging, car parts, etc…[iv], and includes, but is not limited to, potential relevance to the medical industry[v].

Pleurotus mushrooms in general are highly nutritious (Table 4, "nutrition information", obtained from Nutritiondata.self.com[vi]). The fruit body produced by the *P. flabellatus* fungus is referred to as the "Pink Oyster Mushroom" and is widely desired by culinary artists and everyday consumers alike. The pink oyster mushroom carries a strong flavor, which compliments red meats and seafood nicely. Additionally, it is not readily available in Nebraska, nor surrounding areas, as it cannot persist in sub-tropical climates outside of domestic cultivation. The goal of this project became an experiment in feasibility to bring the pink oyster mushroom into regular, constant production for sale in southeast Nebraska and surrounding areas.

Commercial mushroom cultivation is a big industry using age-old techniques, which have proven effective time and time again. Simply explained, substrate (in this case, wheat straw hay) is hydrated and pasteurized, then inoculated with spawn (in this case, colonized sorghum grain). This is followed by an incubation/colonization period, and lastly fruiting/harvest. Of course, techniques differ among types and strains[vii,viii,ix].

Most commercial operations take place in a somewhat sterile, climate-controlled environment. *Pleurotus* mushrooms are no different. While some types of mushrooms use stacked trays and pasteurized soil or logs in the cultivation protocol, *Pleurotus* mushrooms are often cultivated in hanging plastic bags packed full of spawn and substrate, which vary in size and orientation.

PROJECT GOALS

1. Design and build a self-contained environment to cultivate (tropical) mushrooms with minimal maintenance which mimics a scaled-down commercial facility
2. Determine feasibility, cost, and returns associated with expansion for continuous production and sale using information obtained from the constructed environment

MATERIALS

- Incubation unit
    - 22.5 cu foot refrigerator with top mounted freezer
    - Zoomed Hygrotherm
    - Zoomed ultrasonic humidifier
    - Schedule 80 PVC, 2”, 8 ft
    - 10 ft furnace tape
    - Plastic/acrylic sheet (condensation leakage preventer)
    - Sheet metal (3ftx3ft)
    - Self-tapping screws (10)
    - 12 feet rope lights
    - Light switch (2)

    - 30 gallon aquarium pump
    - Aquarium tubing, 2 feet
- Sorghum grain (one bag, 50 lb)
- Wheat straw hay (one bale, 75 lb)
- Plastic bags
- Half-gallon size mason jars (1 package)
- Fiber-fill pillow stuffing (1 bag)
- Fungus tissue culture
    - *Pleurotus flabellatus*
- Sterilization equipment
    - University autoclave

METHODS

- Fungal tissue culture purchased from commercial distributor
    - Propagated to agar ('complete media')
        - Culture maintenance
    - Propagated to grain spawn, 1-2 cc/jar
    - **One 4-inch petri plate can be overtaken in 4-8 days**
- Spawn jars
    - One quart, half-gallon mason jars
    - 3/4" diameter hole drilled into lid
    - Pack in wad of fiber-fill (filter)
- Grain spawn
    - Hydrated, sterilized sorghum grain
        - Soaked for four to ten hours, rinsed
        - Boiled for ~ten minutes to burst testa
        - Drained, cooled
        - Fill to spawn jars 2/3 full
        - Sterilize: autoclave on "gravity" setting for 90 minutes
- Incubate grain spawn until fully colonized

  - Set incubator temperature to 82 degrees F
  - Set incubator relative humidity to 95%
  - **Colonization of grain spawn takes 6-11 days**
- Wheat straw hay preparation
  - Chop straw to 4-8”, hydrate overnight.
  - Fill straw into large stock pot with water
  - Bring water to boil
  - Remove heat, leave covered until cool.
  - Let water drain
- Create “straw logs”
  - Transfer colonized grain spawn and hydrated, pasteurized wheat straw hay (substrate) to plastic bag (mix spawn through whole substrate)
  - Use about 1 quart jar for 1.5 cu ft of hydrated straw, packed into bag
  - Poke ~1/4” holes all around bag, approx 6” grid
- Incubate straw logs
  - Set incubator temperature to 85 degrees F
  - Set incubator relative humidity to 95%
  - **Colonization takes approximately 8-10 days**
- Initiate fruiting conditions
  - Turn on lights
  - Set incubator temperature to 75 degrees F
  - Set incubator relative humidity to 85%
  - Make sure CO_2 pump is operational
  - **Fruiting takes 5-8 days for mushrooms to grow and mature**

Data analysis is performed through spreadsheet tables. Under “Results and Discussion” are the tables with explanations of how to read and use them, and the equations used to populate many of the fields.

RESULTS

The first goal was to design a self-contained environment to cultivate (tropical) mushrooms with minimal maintenance. The grow unit is suitable for nearly all domesticated mushrooms, but specifically designed to accommodate tropical species. This portion of my project was successful. The grow unit (referred to as the "incubator") holds temperature at +/- 3 degrees F of the set parameter and relative humidity at +/- 3% of the set parameter. Climactic factors can be and are adjusted throughout the grow cycle. Lights can be turned on or off externally. Additionally, there is a setting for day and night cycles if necessary. Interior design of the incubator accommodates a wide variety of cultivation techniques. A cost sheet for the incubator and supplies can be found as "Table 1".

<u>Trials yielded a weight range of approximately 1.5-2.5 lbs of fresh mushrooms in a 4-week time period from micro propagation to fruit harvest, within 10 cubic feet of used space.</u>

The second goal was to use the growth data to determine a timeline for consistent production and sale from a small business start-up perspective.

To determine cost and profit, the researcher has designed multiple spreadsheet tables which are successively linked. Therefore, with just a few changes to specific fields (red cells and cells bordered in red), numbers are generated across all tables. First to be observed is **Table X, "Incubator" definition**. This is the first table to be populated. This table defines factored parameters of the variable "Incubator". It is based in part on the **Linked References Table** shown after, which is shown populated with numbers from the feasibility project. It should be noted that the numbers could easily be re-worked to change the definition of the variable "Incubator".

Based on the number of incubation units used, amt.needed/cycle is generated. These numbers are linked through the rest of the tables. Color-coding is used to illustrate which table portions are linked. Expansion and crop scenarios using the following tables can be found in the "discussion and analysis" section.

Table X, "Incubator" Definition				
				"Incubator" cost
Total number incubators:	10			$100.00
Item	**One Incubator**	**Total incubators**	**Amt. needed/cycle**	**Units**
cu ft usable space	**10**	100	-	cu ft space
length of HDPE tube	**10**	100	0.036	rolls
(lbs) dry hay per cycle	10	100	0.1	bales
(lbs) dry grain per cycle	5	50	1	bag
grain jars per cycle	5	50	5.56	pkgs
pillow stuffing	5	50	0.5	pkgs

Equations

- Incubator cost: cost of one incubator
- Total Incubators: (One incubator)*(Number of incubators)
- Amt. Needed HDPE tube/cycle: (Total incubators)/(usable ft tubing)
- Amt. Needed hay bales/cycle: (Total incubators)/(Weight of hay bale)
- Amt. Dry grain/cycle: (Total incubators)/(Weight 1 bag grain)
- Grain jars/cycle: (Total incubators)/(Grain jars in package)
- Pillow stuffing: (Total incubators)/(Jars per bag stuffing)

Second is the linked reference table. It contains values linked to calculations in the rest of the analysis tables:

Linked Reference Table		
Item	**Variable**	**Cost**
number incubators owned	0	-$100.00
incubator unit	1	$100.00
weight 1 hay bale (lbs)	1600	$75.00
weight 1 bag grain (lbs)	50	$16.00
2 mil HDPE tubing, 3000 ft, 12" dia. (usable:)	2800	$113.00
heat sealer	1	$60.00
grain jars in pkg	9	$9.00
jars/bag stuffing	100	$8.00
weeks per cycle	4	☺
growing weeks per year	48	☺
est. overhead cost/incubator/cycle	☺	$1.00
Yield, lbs/incubator	2.1	☺
value/lb (1)	☺	$10.00
value/lb (2)	☺	$12.00
value/lb (3)	☺	$15.00
value/lb (4)	☺	$20.00

Equations

- None are used, but “est. overhead cost/incubator/cycle” is linked to the **total (cycle)** on the Overhead Sheet, seen below and color coded appropriately. Labor and other costs are not figured at this point, but can easily be populated into the overhead sheet

overhead sheet		
	cost/cycle	**cost/year**
electricity	$1.00	$16.00
-		
-		
total	$1.00	$16.00

Next is the expansion scenario calculator. As color-coding will indicate, it is directly linked to and mostly populated by the previous tables to generate a supplies cost, which populates fields showing cycles and timelines until the materials are theoretically paid for.

Expansion scenario calculator

Item	Cost per	Multiplier	Total		
incubation space owned	-$100.00	0	$ -		
incubation space expansion final	$100.00	10	$ 1,000.00	AKA Facilities purchase cost or purchase cost per (10) cubic feet of used grow space	
grain jars 0.5 gal	$1.00	50	$ 50.00		
pillow stuffing	$8.00	1	$ 8.00		
sorghum grain, bag	$16.00	1	$ 16.00		
wheat straw hay, bale	$75.00	0.1	$ 4.69		
overhead/ incubator/ cycle	$1.00	10.00	$ 10.00		
2 mil HDPE tubing, 3000 ft, 12" dia.	$113.00	1	$ 113.00		
		total 1	$ 1,261.69		

yield/incubator (lbs)	value/lb	crop value, total	cycles to profit	weeks to profit	months to profit
2.1	$10.00	$210.00	6.0	24.0	6.0
	$12.00	$252.00	5.0	20.0	5.0
	$15.00	$315.00	4.0	16.0	4.0
	$20.00	$420.00	3.0	12.0	3.0

Equations

- Cost per grain jar: (Cost of grain jar package)/(Number of jars in package)
- Total 1: sum of product input costs
  - May be figured with the addition of price of heat sealer
- Cycles to profit: (Total 1)/(Crop value, total)
- Weeks to profit: (Cycles to profit)*(Weeks per cycle)
- Months to profit: (Cycles to profit)*(Weeks per cycle/4)

Next is the crop cost and profit calculator (1). This calculator is somewhat less dependent on other tables, specifically the expansion scenario, but still linked. This table is to be referenced after the expansion scenario, and once all reusable supplies are paid for. Reusable equipment totals are for reference only; they are not referenced by any other calculation. They are not figured in due to inconsistent longevity.

Crop cost and profit calculator (1)

number incubators:	10

non-reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost /cycle	actual cost/cycle	actual cost/year
cu ft usable space	**10**	**100**	100	cu ft space	-	-	-
length HDPE tube/cycle	**10**	100	0.036	rolls	$ 113.00	$ 4.04	$ 48.43
(lbs) dry hay per cycle	10	100	0.1	bales	$ 75.00	$ 4.69	$ 56.25
(lbs) dry grain per cycle	5	50	1	bag	$ 16.00	$ 16.00	$ 192.00
overhead/incubator	$1.00	$ 10.00	$ 10.00	-	$ 10.00	$ 10.00	$ 120.00
				cost/cycle	$ 214.00	$ 34.72	$ 416.68

reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost /cycle	actual cost/cycle
grain jars per cycle	5	50	5.56	pkgs	$ 54.00	$ 5.56
pillow stuffing	5	50	0.5	pkgs	$ 8.00	$ 4.00
				cost	$ 62.00	$ 9.56

	weeks/cycle	weeks/yr	cycles/year
cycles per year	4	48	12.0

actual product cost/year	$ 416.68

Yield, (lbs)/incubator
2.1

Yield, lbs/incubator	value $/lb	crop value	profit/cycle w/ bulk cost)	net profit/cycle	gross production value/year	net profit/year	profit percentage
2.1	$10.00	$ 210.00	$ (4.00)	$ 175.28	$ 2,520.00	$ 1,686.64	404.78%
	$12.00	$ 252.00	$ 38.00	$ 217.28	$ 3,024.00	$ 2,190.64	525.74%
	$15.00	$ 315.00	$ 101.00	$ 280.28	$ 3,780.00	$ 2,946.64	707.17%
	$20.00	$ 420.00	$ 206.00	$ 385.28	$ 5,040.00	$ 4,206.64	1009.57%

Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator
2.1	21.0	252.0

cyclic materials cost per cu ft	$ 0.35
yearly materials cost per cu ft	$ 4.17

Yield, lbs/incubator	value $/lb	crop value	yearly crop weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	gross profit/cu ft /year	net profit/cu ft/year
2.1	$10.00	$ 210.00	252	$ 2.10	$ 1.75	$ 25.20	$ 21.03
	$12.00	$ 252.00	252	$ 2.52	$ 2.17	$ 30.24	$ 26.07
	$15.00	$ 315.00	252	$ 3.15	$ 2.80	$ 37.80	$ 33.63
	$20.00	$ 420.00	252	$ 4.20	$ 3.85	$ 50.40	$ 46.23

Equations

- Cycles per year: (Weeks per year)/(Weeks per cycle)
    - Weeks per year is total number of weeks in a year used to grow ("Growing weeks per year" in the linked reference table.
- Actual product cost per year: (Actual cost/cycle)*(Cycles/ year)
- Profit/cycle w/ bulk cost: (Crop value)-(Bulk cost/cycle)
- Net profit per cycle: (Crop value/lb)-(Actual cost/cycle)
- Gross production value/year: (Crop value)*(Cycles per year)
- Net Profit/year: [(Net profit/cycle)*(Cycles per year)]-(Actual product cost/year)
- Profit percentage: [(Net profit per year)/(Actual product cost per year)] x100%
- Total yield/cycle: (Yield/incubator (lbs)*(Number incubators)
- Total yield/year (lbs): (Total yield/cycle)*(Number cycles per year)

- Cyclic materials cost per cu ft: (Actual cost/cycle)/(Cu ft usable space)
- Yearly materials cost per cu ft: (Cyclic cost per cu ft)*(Cycles/year)
- Crop value per cu ft: (Crop value)/(Cu ft usable space)
- Net profit per cu ft per cycle: (Net profit/cycle)/(Cu ft usable space)
- Gross profit per cu ft/year: (Crop value per cu ft)*(Cycles/year)
- Net profit per cu ft/year: (Net profit/cu ft/cycle)*(Cycles/year)

Lastly, we have the data output table. This is a condensed summary of some key factors generated through the tables for easy analysis:

DATA OUTPUT SUMMARY	
Yield/10 cu ft (lbs)	2
cu ft 1 incubator	10
Value ($/lb)	$20.00
Weeks per cycle	3
Weeks per year	50
Cycles per year	16.7
=	
Investment cost	$ 8,459.99
Total Crop Weight (lbs)	1,933.33
Cycles until profit	4.0
Months to profit	6.0
Net profit/year	$ 35,986.93
Purchasable space (incubators) w/ recycled profits	3599

To look at expansion scenarios, we use the Expansion scenario calculator. It is designed similarly to the above cost and profit calculator (1), with a few modifications:

cost/turnaround calculator

Table X, "Incubator" Definition

				"incubator" cost
total number incubators:	10	"=x10 cu ft space"		$125.00
item	**one incubator**	**all incubators**	**amt. needed/cycle**	**units**
cu ft usable space	10	100	-	cu ft space
length of HDPE tube	10	100	0.036	rolls
(lbs) dry hay per cycle	10	100	0.1	bales
(lbs) dry grain per cycle	5	50	1	bag
grain jars per cycle	5	50	5.56	pkgs
pillow stuffing	5	50	0.5	pkgs

linked reference table

item	variable	cost
number incubators owned	1	-$125.00
incubator unit	1	$125.00
weight 1 hay bale (lbs)	1600	$100.00
weight 1 bag grain (lbs)	50	$16.00
2 mil HDPE tubing, 3000 ft, 12" dia.	2800	$113.00
heat sealer	1	$60.00
grain jars in pkg	9	$9.00
jars/bag stuffing	100	$8.00
weeks per cycle	3	☺
growing weeks per year	48	☺
est. overhead cost/10 cu ft useable space/cycle	☺	$1.00
Yield, lbs/10 cu ft/cycle	1.5	☺
value/ (lb)	1	$12.00

Scenario values

year #	recycled profit %
1	100.00%
2	100.00%
3	100.00%
4	75.00%
5	75.00%
6	50.00%
7	50.00%
8	50.00%
9	50.00%
10	0.00%

Equations

- All equations used are the same as the cost and profit calculator (1)

The major difference to be noted at this point is the table labeled "Scenario Values". This table is where values for recycled profits (for the purpose of purchasing more usable grow space) are figured for the year's end (next year's beginning).

Following, we see the expansion scenario calculator. This table is to be used in conjunction with the Table X, definition of Incubator. These numbers are fed in to the Expansion Scenario calculator, which we have seen before:

Timeline:	Begin Year #	1	Below

Expansion scenario calculator

item	cost per	multiplier	total	
incubation space owned	-$125.00	1	$ (125.00)	
incubation space expansion final	$125.00	10	$ 1,250.00	AKA Facilities purchase cost or purchase cost per (10) cubic feet of used grow space
grain jars 0.5 gal	$1.00	50	$ 50.00	
pillow stuffing	$8.00	1	$ 8.00	
sorghum grain, bag	$16.00	1	$ 16.00	
wheat straw hay, bale	$100.00	0.1	$ 6.25	
overhead/ 10 cu ft/cycle	$1.00	10.00	$ 10.00	
2 mil HDPE tubing, 3000 ft, 12" dia.	$113.00	1	$ 113.00	
		total 1	$ 1,388.25	

yield/incubator (lbs)	value/lb	crop value, total	cycles to profit	weeks to profit	months to profit
1.5	$12.00	$180.00	7.7	23.1	5.8

cycles until profit	8
profitable cycles per year	8
crop sale value /year	$ 1,440.00
recycled profits @ (%)	100.00%
recycled profits @ ($)	$ -
allows for purchase of (x10 cu ft uable grow space)	0
totalling (x 10 cu ft grow space) to begin the next year	10
"= #10 ft logs"	10

Total Crop Weight (lbs)
240

What we have not seen before, however, is the output table towards the bottom. This table shows (most importantly) cycles to profit and profitable cycles per year. Using this information, combined with the recycled profit percentage, populates the next set of tables.

Equations

- Cycles until profit: (Cycles to profit), rounded up to the nearest whole number
- Profitable cycles per year: (Growing cycles per year)-(Cycles until profit)
- Crop sale profit value per year: (Profitable cycles/year)*(Crop value, Total)
- Recycled profits @ %: linked to the Scenario Values table
- Recycled profits @ $: (Crop sale profit value per year)*(Recycled profit %)
- Purchasable grow space: (Recycled profit @ $)/(Incubator cost), rounded down to nearest whole number
- # Incubators to begin the next year: (Purchasable incubators)+(Total incubators from previous year)
- =10 ft logs: **assuming one incubator equates to 10 cu ft grow space**: (Total incubators to begin next year)*(1)

Lastly, we have the Cost/Profit scenarios for the next 9 years (10 in total):

				Timeline:	Begin Year #	2	Below
	Cost/Profit				**Year#**	**2**	
number incubators:	21	"=x10 cu ft space"					
non-reusable equipment							
item	**one incubator**	**total incubation space**	**amt. needed/cycle**	**units**	**bulk cost**	**actual cost/cycle**	**actual cost/year**
CU FT USABLE SPACE	10	**210**	210	cu ft space	-	-	-
length HDPE tube/cycle	10	210	0.075	rolls	$ 113.00	$ 8.48	$ 135.60
(lbs) dry hay per cycle	10	210	0.1	bales	$ 100.00	$ 13.13	$ 210.00
(lbs) dry grain per cycle	5	105	2.1	bag	$ 48.00	$ 33.60	$ 537.60
overhead/10 cu ft usable space	$ 1.00	$ 21.00	$ 21.00	-	$ 21.00	$ 21.00	$ 336.00
				cost/cycle	$ 282.00	$ 76.20	$ 1,219.20
reusable equipment							
grain jars per cycle	5	105	11.67	pkgs	$ 108.00	$ 11.67	
pillow stuffing	5	105	1.05	pkgs	$ 16.00	$ 8.40	
				cost	$ 124.00	$ 20.07	
	weeks/cycle	**weeks/yr**	**cycles/year**				
cycles per year	3	48	16.0		**total product cost**		$ 1,219.20
Yield, (lbs)/incubator							
1.5							
Yield, lbs/incubator	**value $/lb**	**crop value/cycle**	**profit/cycle w/ bulk cost)**	**net profit/cycle**	**gross production value**	**total net profit**	**profit percentage**
1.5	$12.00	$ 378.00	$ 96.00	$ 301.80	$ 6,048.00	$ 4,828.80	396.06%
Yield, lbs/incubator	**total yield/cycle (lbs)/incubator**	**total yield/year (lbs)/incubator**		**cyclic materials cost per cu ft**	$ 0.36		
1.5	31.5	504.0		**yearly materials cost per cu ft**	$ 5.81		
Yield, lbs/incubator	**value $/lb**	**crop value**	**Total Crop Weight (lbs)**	**crop value per cu ft**	**net profit /cu ft/cycle**	**total crop value/cu ft**	**total net profit/cu ft**
1.5	$12.00	$ 378.00	504	$ 1.80	$ 1.44	$ 28.80	$ 22.99
Profitable Cycles per Year	16.0						
Net Profit per Year	$ 4,828.80						
Recycled Profits @ (%)	100.00%						
Recycled profits @ ($)	$ 4,828.80						
Allows for Purchase of (x10 cu ft grow space)	38						
Totalling (x 10 cu ft grow space) to Begin the Next Year	59						
"= # 10-ft logs"/cycle	**59**						

This table (and those which follow after) look similar (and they are) with one slight difference, in that (profitable cycles per year) is directly linked to (Cycles/year). This scenario calculator assumes no down time for production space expansion and no product loss due to unforeseen circumstances. Since all expansion is paid for with previous year's profits, there is no need to adjust the number of profitable cycles per year. Expansion scenarios can be generated for up to ten years, though more may be added.

The information obtained from the expansion scenarios is compiled into a summary table for easy reference:

Expansion Summary table							
Year	Yearly overhead	Net product cost/year	Total Recycled Investment, Year End	Net Profit/Year	Net Profit/Year - Recycled Investment	Yearly profit margin	Total Production /Year (lbs)
1	$ 1,616.00	$ 11,035.50	$ 24,750.00	$ 24,750.00	$ -		2,400
2	$ 5,552.00	$ 20,145.83	$104,774.17	$ 104,774.17	$ -	520.08%	8,328
3	$ 22,304.00	$ 80,931.66	$420,908.34	$ 420,908.34	$ -	520.08%	33,456
4	$ 89,648.00	$325,294.17	$ -	$1,691,785.83	$1,691,785.83	520.08%	134,472
5	$ 89,648.00	$325,294.17	$ -	$1,691,785.83	$1,691,785.83	520.08%	134,472
6	$ 89,648.00	$325,294.17	$ -	$1,691,785.83	$1,691,785.83	520.08%	134,472
7	$ 89,648.00	$325,294.17	$ -	$1,691,785.83	$1,691,785.83	520.08%	134,472
8	$ 89,648.00	$325,294.17	$ -	$1,691,785.83	$1,691,785.83	520.08%	134,472
9	$ 89,648.00	$325,294.17	$ -	$1,691,785.83	$1,691,785.83	520.08%	134,472
10	$ 89,648.00	$325,294.17	$ -	$1,691,785.83	$1,691,785.83	520.08%	134,472

*numbers displayed in above table examples are inconsistent with one another and should not be considered for any purposes of analysis. They are strictly for reference example.

DATA, TABLES, PICTURES

Table 1 thesis cost sheet			
INCUBATOR			
item	**cost per**	**multiplier**	**total**
refrigerator	$30.00	1	$30.00
hygrotherm	$75.00	1	$75.00
ultrasonic humidifier	$45.00	1	$45.00
PVC piping	$10.00	1	$10.00
furnace tape	$7.00	1	$7.00
plastic sheeting*		no cost	
sheet metal drip tray	$55.00	1	$55.00
rope lights	$10.00	1	$10.00
light switch	$10.00	1	$10.00
30 gal aquarium pump	$18.00	1	$18.00
		Incubator Cost	$260.00
OTHER SUPPLIES			
item	**cost per**	**multiplier**	**total**
75 lb wheat straw hay	$7.00	2	$14.00
50 lb sorghum grain	$16.00	2	$32.00
plastic bagging	$0.00	0	$0.00
1qt mason jar	$1.50	18	$27.00
0.5gal mason jar	$2.00	6	$12.00
synthetic pillow stuffing	$8.00	1	$8.00
tissue culture	$12.00	1	$12.00
		Supplies Cost	$105.00
		GRAND TOTAL	$365.00

Table 1 outlines the total cost for the thesis research project itself. Cost of the incubator and cost of "other supplies" were figured separately for use in other tables.

TABLE 2 yields (pounds) and projected value per cycle, thesis					
	# incubators				
	1	2	5	10	20
yield (lbs)/incubator					
1.5					
crop yield	1.5	3	7.5	15	30
projected value ($/lb)					
$10.00	$15.00	$30.00	$75.00	$150.00	$300.00
$12.00	$18.00	$36.00	$90.00	$180.00	$360.00
$15.00	$22.50	$45.00	$112.50	$225.00	$450.00
$17.00	$25.50	$51.00	$127.50	$255.00	$510.00
$20.00	$30.00	$60.00	$150.00	$300.00	$600.00
$23.00	$34.50	$69.00	$172.50	$345.00	$690.00
$25.00	$37.50	$75.00	$187.50	$375.00	$750.00
yield (lbs)/incubator					
2					
crop yield	2	4	10	20	40
projected value ($/lb)					
$10.00	$20.00	$40.00	$100.00	$200.00	$400.00
$12.00	$24.00	$48.00	$120.00	$240.00	$480.00
$15.00	$30.00	$60.00	$150.00	$300.00	$600.00
$17.00	$34.00	$68.00	$170.00	$340.00	$680.00
$20.00	$40.00	$80.00	$200.00	$400.00	$800.00
$23.00	$46.00	$92.00	$230.00	$460.00	$920.00
$25.00	$50.00	$100.00	$250.00	$500.00	$1,000.00
yield (lbs)/incubator					
2.5					
crop yield	2.5	5	12.5	25	50
projected value ($/lb)					
$10.00	$25.00	$50.00	$125.00	$250.00	$500.00
$12.00	$30.00	$60.00	$150.00	$300.00	$600.00
$15.00	$37.50	$75.00	$187.50	$375.00	$750.00
$17.00	$42.50	$85.00	$212.50	$425.00	$850.00
$20.00	$50.00	$100.00	$250.00	$500.00	$1,000.00
$23.00	$57.50	$115.00	$287.50	$575.00	$1,150.00
$25.00	$62.50	$125.00	$312.50	$625.00	$1,250.00

Table 2 shows crop yield and value across 1, 2, 5, 10, and 20 incubators in one 4-week cycle, based on 1.5, 2.0, and 2.5 pounds of wet mushrooms per crop. This does not factor in supplies cost. This is essentially a projected possible gross profit sheet.

Table 3, investment/turnaround, thesis					
est. cost per incubator	$260.00				
non-reusable supplies	$7.81				
number of incubators	**1**	**2**	**5**	**10**	**20**
incubator cost	$260.00	$520.00	$1,300.00	$2,600.00	$5,200.00
other supplies cost	$7.81	$15.62	$39.05	$78.10	$156.20
total cost	$267.81	$535.62	$1,339.05	$2,678.10	$5,356.20
profit, 1.5lb, 10$/lb	$15.00	$30.00	$75.00	$150.00	$300.00
# months until profit	17.3	17.3	17.3	17.3	17.9
profit, 1.5lb, 25$/lb	$37.50	$75.00	$187.50	$375.00	$750.00
# months until profit	6.9	6.9	6.9	6.9	7.1
profit, 2lb, 10$/lb	$20.00	$40.00	$100.00	$200.00	$400.00
# months until profit	13	13	13	13	13.4
profit, 2lb, 25$/lb	$50.00	$100.00	$250.00	$500.00	$1,000.00
# months until profit	5.2	5.2	5.2	5.2	5.4
profit, 2.5lb, 10$/lb	$25.00	$50.00	$125.00	$250.00	$500.00
# months until profit	10.4	10.4	10.4	10.4	10.7
profit, 2.5lb, 25$/lb	$62.50	$125.00	$312.50	$625.00	$1,250.00
# months until profit	4.16	4.16	4.16	4.16	4.3

Table 3 is based on the projected profit range from Table 2 at 1.5, 2.0, and 2.5 lb of yield per crop per incubator with (figuring) for supplies costs based on the "crop cost/profit calculator." "Number of months until profit" indicates the number of months until the reusable grow equipment is paid for through crop sales.

Table 4, nutrition information

NUTRITION INFORMATION

Amounts per 1 large (148g)

Calorie Information

Amounts Per Selected Serving		%DV
Calories	63.6 (266 kJ)	3%
From Carbohydrate	38.6 (162 kJ)	
From Fat	5.5 (23.0 kJ)	
From Protein	19.6 (82.1 kJ)	
From Alcohol	0.0 (0.0 kJ)	

Carbohydrates

Amounts Per Selected Serving		%DV
Total Carbohydrate	9.6 g	3%
Dietary Fiber	3.4 g	14%
Starch	0.0 g	
Sugars	1.6 g	

More details

Fats & Fatty Acids

Amounts Per Selected Serving		%DV
Total Fat	0.6 g	1%
Saturated Fat	0.0 g	0%
Monounsaturated Fat	0.0 g	
Polyunsaturated Fat	0.1 g	
Total trans fatty acids	~	
Total trans-monoenoic fatty acids	~	
Total trans-polyenoic fatty acids	~	
Total Omega-3 fatty acids	~	
Total Omega-6 fatty acids	59.2 mg	

Learn more about these fatty acids and their equivalent names

More details

Protein & Amino Acids

Amounts Per Selected Serving		%DV
Protein	4.9 g	10%

More details

Vitamins

Amounts Per Selected Serving		%DV
Vitamin A	71.0 IU	1%
Vitamin C	0.0 mg	0%
Vitamin D	~	~
Vitamin E (Alpha Tocopherol)	0.0 mg	0%
Vitamin K	0.0 mcg	0%
Thiamin	0.2 mg	12%
Riboflavin	0.5 mg	30%
Niacin	7.3 mg	37%
Vitamin B6	0.2 mg	8%
Folate	40.0 mcg	10%
Vitamin B12	0.0 mcg	0%
Pantothenic Acid	1.9 mg	19%
Choline	72.1 mg	
Betaine	17.9 mg	

More details

Minerals

Amounts Per Selected Serving		%DV
Calcium	4.4 mg	0%
Iron	2.0 mg	11%
Magnesium	26.6 mg	7%
Phosphorus	178 mg	18%
Potassium	622 mg	18%
Sodium	26.6 mg	1%
Zinc	1.1 mg	8%
Copper	0.4 mg	18%
Manganese	0.2 mg	8%
Selenium	3.8 mcg	5%
Fluoride	~	

The experimental incubation unit

Colonizing grain spawn

Fruit bodies 3 days to harvest

Freshly harvested mushroom, still slightly immature

Mushrooms on uncased straw log

Freshly harvested mushrooms, ~1 cu ft used grow space

Fully mature mushroom, past harvest window

ANALYSIS AND DISCUSSION

For the purposes of analysis, input costs, crop cycles, recycled profits, and crop values are changed for the scenario at hand and do not use numbers exactly as derived from the initial feasibility project.

Scenario 1: immediate expansion from one to five incubators; 50 cubic feet of grow space used

Using small-scale parameters and an initial investment of $1,264.33, we see the numbers below:

cost/turnaround calculator

Table X, "Incubator" Definition

total number incubators:	5	"=x10 cu ft space"		**"incubator" cost** $260.00

item	one incubator	all incubators	amt. needed/cycle	units
cu ft usable space	10	50	-	cu ft space
length of HDPE tube	10	50	0.018	rolls
(lbs) dry hay per cycle	10	50	0.7	bales
(lbs) dry grain per cycle	5	25	0.5	bag
grain jars per cycle	5	25	2.78	pkgs
pillow stuffing	5	25	0.25	pkgs

linked reference table

item	variable	cost
number incubators owned	1	-$260.00
incubator unit	1	$260.00
weight 1 hay bale (lbs)	75	$8.00
weight 1 bag grain (lbs)	50	$16.00
2 mil HDPE tubing, 3000 ft, 12" dia.	2800	$113.00
heat sealer	1	$60.00
grain jars in pkg	9	$9.00
jars/bag stuffing	100	$8.00
weeks per cycle	3	☺
growing weeks per year	48	☺
est. overhead cost/10 cu ft useable space/cycle	☺	$1.00
Yield, lbs/10 cu ft/cycle	1.5	☺
value/ (lb)	1	$20.00

Scenario values

year #	recycled profit %
1	100.00%
2	100.00%
3	100.00%
4	
5	
6	
7	
8	
9	
10	

Timeline: Begin Year # 1 Below

Expansion scenario calculator

item	cost per	multiplier	total	
incubation space owned	-$260.00	1	$ (260.00)	
incubation space expansion final	$260.00	5	$ 1,300.00	**AKA Facilities purchase cost or purchase cost per (10) cubic feet of used grow space**
grain jars 0.5 gal	$1.00	25	$ 25.00	
pillow stuffing	$8.00	1	$ 8.00	
sorghum grain, bag	$16.00	0.5	$ 8.00	
wheat straw hay, bale	$8.00	0.7	$ 5.33	
overhead/ 10 cu ft/cycle	$1.00	5.00	$ 5.00	
2 mil HDPE tubing, 3000 ft, 12" dia.	$113.00	1	$ 113.00	
		total 1	$ 1,264.33	

yield/incubator (lbs)	value/lb	crop value, total	cycles to profit	weeks to profit	months to profit
1.5	$20.00	$150.00	8.4	25.3	6.3

cycles until profit	9		**Total Crop Weight (lbs)** 120
profitable cycles per year	7		
crop sale profit value /year	$ 1,050.00		
recycled profits @ (%)	100.00%		
recycled profits @ ($)	$ 1,050.00		
allows for purchase of (x10 cu ft uable grow space)	4		
totalling (# incubators) to begin the next year	9		
"= #10 ft logs"	9		

Timeline: Begin Year # 2 Below

Cost/Profit — Year# 2

number incubators:	9	"=x10 cu ft space"

non-reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle	actual cost/year
CU FT USABLE SPACE	10	**90**	90	cu ft space	-	-	-
length HDPE tube/cycle	10	90	0.032	rolls	$ 113.00	$ 3.63	$ 58.11
(lbs) dry hay per cycle	10	90	1.2	bales	$ 16.00	$ 9.60	$ 153.60
(lbs) dry grain per cycle	5	45	0.9	bag	$ 16.00	$ 14.40	$ 230.40
overhead/10 cu ft usable space	$ 1.00	$ 9.00	$ 9.00	-	$ 9.00	$ 9.00	$ 144.00
				cost/cycle	$ 154.00	$ 36.63	$ 586.11

reusable equipment

grain jars per cycle	5	45	5.00	pkgs	$ 45.00	$ 5.00
pillow stuffing	5	45	0.45	pkgs	$ 8.00	$ 3.60
				cost	$ 53.00	$ 8.60

	weeks/cycle	weeks/yr	cycles/year		
cycles per year	3	48	16.0	**total product cost**	$ 586.11

Yield, (lbs)/incubator
1.5

Yield, lbs/incubator	value $/lb	crop value/cycle	profit/cycle w/ bulk cost)	net profit/cycle	gross production value	total net profit	profit percentage
1.5	$20.00	$ 270.00	$ 116.00	$ 233.37	$ 4,320.00	$ 3,733.89	637.06%

Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator		
			cyclic materials cost per cu ft	$ 0.41
1.5	13.5	216.0	**yearly materials cost per cu ft**	$ 6.51

Yield, lbs/incubator	value $/lb	crop value	Total Crop Weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	total crop value/cu ft	total net profit/cu ft
1.5	$20.00	$ 270.00	216	$ 3.00	$ 2.59	$ 48.00	$ 41.49

Profitable Cycles per Year	16.0
Net Profit per Year	$ 3,733.89
Recycled Profits @ (%)	100.00%
Recycled profits @ ($)	$ 3,733.89
Allows for Purchase of (x10 cu ft grow space)	14
Totalling (x 10 cu ft grow space) to Begin the Next Year	23
"= # 10-ft logs"/cycle	**23**

Timeline:	Begin Year #	3	Below

Cost/Profit

Year# 3

number incubators:	23	"=x10 cu ft space"

non-reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle	actual cost/year
CU FT USABLE SPACE	10	230	230	cu ft space	-	-	-
length HDPE tube/cycle	10	230	0.082	rolls	$ 113.00	$ 9.28	$ 148.51
(lbs) dry hay per cycle	10	230	3.1	bales	$ 32.00	$ 24.53	$ 392.53
(lbs) dry grain per cycle	5	115	2.3	bag	$ 48.00	$ 36.80	$ 588.80
overhead/10 cu ft usable space	$ 1.00	$ 23.00	$ 23.00	-	$ 23.00	$ 23.00	$ 368.00
				cost/cycle	$ 216.00	$ 93.62	$ 1,497.85

reusable equipment

grain jars per cycle	5	45	5.00	pkgs	$ 45.00	$ 5.00
pillow stuffing	5	115	1.15	pkgs	$ 16.00	$ 9.20
				cost	$ 61.00	$ 14.20

	weeks/cycle	weeks/yr	cycles/year		
cycles per year	3	48	16.0	Total product cost	$ 1,497.85

Yield, (lbs)/incubator
1.5

Yield, lbs/incubator	value $/lb	crop value/cycle	profit/cycle w/ bulk cost)	net profit/cycle	gross production value	total net profit	profit percentage
1.5	$20.00	$ 690.00	$ 474.00	$ 596.38	$ 11,040.00	$ 9,542.15	637.06%

Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator		
			cyclic materials cost per cu ft	$ 0.41
1.5	13.5	216.0	yearly materials cost per cu ft	$ 6.51

Yield, lbs/incubator	value $/lb	crop value	Total Crop Weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	crop value/cu ft /year	net profit/cu ft/year
1.5	$20.00	$ 690.00	552	$ 3.00	$ 2.59	$ 48.00	$ 41.49

Profitable Cycles per Year	16.0
Net Profit per Year	$ 9,542.15
Recycled Profits @ (%)	100.00%
Recycled profits @ ($)	$ 9,542.15
Allows for Purchase of (x10 cu ft grow space)	36
Totalling (x 10 cu ft grow space) to Begin the Next Year	59
"= # 10-ft logs"/cycle	59

Timeline:	Begin Year #	4	Below

Cost/Profit

Year# 4

number incubators:	59	"=x10 cu ft space"

non-reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle	actual cost/year
CU FT USABLE SPACE	10	590	590	cu ft space	-	-	-
length HDPE tube/cycle	10	590	0.211	rolls	$ 113.00	$ 23.81	$ 380.97
(lbs) dry hay per cycle	10	590	7.9	bales	$ 64.00	$ 62.93	$ 1,006.93
(lbs) dry grain per cycle	5	295	5.9	bag	$ 96.00	$ 94.40	$ 1,510.40
overhead/10 cu ft usable space	$ 1.00	$ 59.00	$ 59.00	-	$ 59.00	$ 59.00	$ 944.00
				cost/cycle	$ 332.00	$ 240.14	$ 3,842.30

reusable equipment

grain jars per cycle	5	45	5.00	pkgs	$ 45.00	$ 5.00
pillow stuffing	5	295	2.95	pkgs	$ 24.00	$ 23.60
				cost	$ 69.00	$ 28.60

	weeks/cycle	weeks/yr	cycles/year		
cycles per year	3	48	16.0	Total product cost	$ 3,842.30

Yield, (lbs)/incubator
1.5

Yield, lbs/incubator	value $/lb	crop value/cycle	profit/cycle w/ bulk cost)	net profit/cycle	gross production value	total net profit	profit percentage
1.5	$20.00	$ 1,770.00	$ 1,438.00	$ 1,529.86	$ 28,320.00	$ 24,477.70	637.06%

Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator		
			cyclic materials cost per cu ft	$ 0.41
1.5	13.5	216.0	yearly materials cost per cu ft	$ 6.51

Yield, lbs/incubator	value $/lb	crop value	Total Crop Weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	crop value/cu ft /year	net profit/cu ft/year
1.5	$20.00	$ 1,770.00	1,416	$ 3.00	$ 2.59	$ 48.00	$ 41.49

Profitable Cycles per Year	16.0
Net Profit per Year	$ 24,477.70
Recycled Profits @ (%)	0.00%
Recycled profits @ ($)	$ -
Allows for Purchase of (x10 cu ft grow space)	0
Totalling (x 10 cu ft grow space) to Begin the Next Year	59
"= # 10-ft logs"/cycle	59

At the end of year four, we see projected profits of $24,000 per year.

Scenario 2: immediate expansion to 20 incubators, 200 cu ft of grow space used

Using again small-scale parameters and with an initial calculated investment of $5,294.00, we see the following numbers:

cost/turnaround calculator

Table X, "Incubator" Definition

total number incubators:	20	"=x10 cu ft space"		"incubator" cost
				$260.00

item	one incubator	all incubators	amt. needed/cycle	units
cu ft usable space	10	200	-	cu ft space
length of HDPE tube	10	200	0.071	rolls
(lbs) dry hay per cycle	10	200	2.7	bales
(lbs) dry grain per cycle	5	100	2	bag
grain jars per cycle	5	100	11.11	pkgs
pillow stuffing	5	100	1	pkgs

linked reference table

item	variable	cost
number incubators owned	1	-$260.00
incubator unit	1	$260.00
weight 1 hay bale (lbs)	75	$8.00
weight 1 bag grain (lbs)	50	$16.00
2 mil HDPE tubing, 3000 ft, 12" dia.	2800	$113.00
heat sealer	1	$60.00
grain jars in pkg	9	$9.00
jars/bag stuffing	100	$8.00
weeks per cycle	3	☺
growing weeks per year	48	☺
est. overhead cost/10 cu ft useable space/cycle	☺	$1.00
Yield, lbs/10 cu ft/cycle	1.5	☺
value/ (lb)	1	$20.00

Scenario values

year #	recycled profit %
1	100.00%
2	100.00%
3	100.00%
4	
5	
6	
7	
8	
9	
10	

Timeline:	Begin Year #	1	Below

Expansion scenario calculator

item	cost per	multiplier	total	
incubation space owned	-$260.00	1	$ (260.00)	
incubation space expansion final	$260.00	20	$ 5,200.00	AKA Facilities purchase cost or purchase cost per (10) cubic feet of used grow space
grain jars 0.5 gal	$1.00	100	$ 100.00	
pillow stuffing	$8.00	1	$ 8.00	
sorghum grain, bag	$16.00	2	$ 32.00	
wheat straw hay, bale	$8.00	2.7	$ 21.33	
overhead/ 10 cu ft/cycle	$1.00	20.00	$ 20.00	
2 mil HDPE tubing, 3000 ft, 12" dia.	$113.00	1	$ 113.00	
		total 1	$ 5,294.33	

yield/incubator (lbs)	value/lb	crop value, total	cycles to profit	weeks to profit	months to profit
1.5	$20.00	$600.00	8.8	26.5	6.6

cycles until profit	9
profitable cycles per year	7
crop sale profit value /year	$ 4,200.00
recycled profits @ (%)	100.00%
recycled profits @ ($)	$ 4,200.00
allows for purchase of (x10 cu ft uable grow space)	16
totalling (# incubators) to begin the next year	36
"= #10 ft logs"	36

Total Crop Weight (lbs)
480

Timeline:	Begin Year #	2	Below

Cost/Profit

Year# 2

number incubators:	36	"=x10 cu ft space"

non-reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle	actual cost/year
CU FT USABLE SPACE	10	360	360	cu ft space	-	-	-
length HDPE tube/cycle	10	360	0.129	rolls	$ 113.00	$ 14.53	$ 232.46
(lbs) dry hay per cycle	10	360	4.8	bales	$ 40.00	$ 38.40	$ 614.40
(lbs) dry grain per cycle	5	180	3.6	bag	$ 64.00	$ 57.60	$ 921.60
overhead/10 cu ft usable space	$ 1.00	$ 36.00	$ 36.00	-	$ 36.00	$ 36.00	$ 576.00
				cost/cycle	$ 253.00	$ 146.53	$ 2,344.46

reusable equipment

grain jars per cycle	5	180	20.00	pkgs	$ 180.00	$ 20.00
pillow stuffing	5	180	1.8	pkgs	$ 16.00	$ 14.40
				cost	$ 196.00	$ 34.40

	weeks/cycle	weeks/yr	cycles/year
cycles per year	3	48	16.0

total product cost	$ 2,344.46

Yield, (lbs)/incubator
1.5

Yield, lbs/incubator	value $/lb	crop value/cycle	profit/cycle w/ bulk cost)	net profit/cycle	gross production value	total net profit	profit percentage
1.5	$20.00	$ 1,080.00	$ 827.00	$ 933.47	$ 17,280.00	$ 14,935.54	637.06%

Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator
1.5	54.0	864.0

cyclic materials cost per cu ft	$ 0.41
yearly materials cost per cu ft	$ 6.51

Yield, lbs/incubator	value $/lb	crop value	Total Crop Weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	total crop value/cu ft	total net profit/cu ft
1.5	$20.00	$ 1,080.00	864	$ 3.00	$ 2.59	$ 48.00	$ 41.49

Profitable Cycles per Year	16.0
Net Profit per Year	$ 14,935.54
Recycled Profits @ (%)	100.00%
Recycled profits @ ($)	$ 14,935.54
Allows for Purchase of (x10 cu ft grow space)	57
Totalling (x 10 cu ft grow space) to Begin the Next Year	93
"= # 10-ft logs"/cycle	93

				Timeline:	Begin Year #	3	Below
	Cost/Profit				Year#	3	

number incubators:	93	"=x10 cu ft space"

non-reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle	actual cost/year
CU FT USABLE SPACE	10	**930**	930	cu ft space	-	-	-
length HDPE tube/cycle	10	930	0.332	rolls	$ 113.00	$ 37.53	$ 600.51
(lbs) dry hay per cycle	10	930	12.4	bales	$ 104.00	$ 99.20	$ 1,587.20
(lbs) dry grain per cycle	5	465	9.3	bag	$ 160.00	$ 148.80	$ 2,380.80
overhead/10 cu ft usable space	$ 1.00	$ 93.00	$ 93.00	-	$ 93.00	$ 93.00	$ 1,488.00
				cost/cycle	$ 470.00	$ 378.53	$ 6,056.51

reusable equipment

grain jars per cycle	5	180	20.00	pkgs	$ 180.00	$ 20.00
pillow stuffing	5	465	4.65	pkgs	$ 40.00	$ 37.20
				cost	$ 220.00	$ 57.20

	weeks/cycle	weeks/yr	cycles/year		
cycles per year	3	48	16.0	**Total product cost**	$ 6,056.51

Yield, (lbs)/incubator
1.5

Yield, lbs/incubator	value $/lb	crop value/cycle	profit/cycle w/ bulk cost)	net profit/cycle	gross production value	total net profit	profit percentage
1.5	$20.00	$ 2,790.00	$ 2,320.00	$ 2,411.47	$ 44,640.00	$ 38,583.49	637.06%

Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator		
			cyclic materials cost per cu ft	$ 0.41
1.5	54.0	864.0	yearly materials cost per cu ft	$ 6.51

Yield, lbs/incubator	value $/lb	crop value	Total Crop Weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	crop value/cu ft /year	net profit/cu ft/year
1.5	$20.00	$ 2,790.00	2,232	$ 3.00	$ 2.59	$ 48.00	$ 41.49

Profitable Cycles per Year	16.0
Net Profit per Year	$ 38,583.49
Recycled Profits @ (%)	100.00%
Recycled profits @ ($)	$ 38,583.49
Allows for Purchase of (x10 cu ft grow space)	148
Totalling (x 10 cu ft grow space) to Begin the Next Year	241
"= # 10-ft logs"/cycle	**241**

				Timeline:	Begin Year #	4	Below
	Cost/Profit				Year#	4	

number incubators:	241	"=x10 cu ft space"

non-reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle	actual cost/year
CU FT USABLE SPACE	10	**2410**	2410	cu ft space	-	-	-
length HDPE tube/cycle	10	2410	0.861	rolls	$ 113.00	$ 97.26	$ 1,556.17
(lbs) dry hay per cycle	10	2410	32.1	bales	$ 264.00	$ 257.07	$ 4,113.07
(lbs) dry grain per cycle	5	1205	24.1	bag	$ 400.00	$ 385.60	$ 6,169.60
overhead/10 cu ft usable space	$ 1.00	$ 241.00	$ 241.00	-	$ 241.00	$ 241.00	$ 3,856.00
				cost/cycle	$ 1,018.00	$ 980.93	$ 15,694.84

reusable equipment

grain jars per cycle	5	180	20.00	pkgs	$ 180.00	$ 20.00
pillow stuffing	5	1205	12.05	pkgs	$ 104.00	$ 96.40
				cost	$ 284.00	$ 116.40

	weeks/cycle	weeks/yr	cycles/year		
cycles per year	3	48	16.0	**Total product cost**	$ 15,694.84

Yield, (lbs)/incubator
1.5

Yield, lbs/incubator	value $/lb	crop value/cycle	profit/cycle w/ bulk cost)	net profit/cycle	gross production value	total net profit	profit percentage
1.5	$20.00	$ 7,230.00	$ 6,212.00	$ 6,249.07	$ 115,680.00	$ 99,985.16	637.06%

Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator		
			cyclic materials cost per cu ft	$ 0.41
1.5	54.0	864.0	yearly materials cost per cu ft	$ 6.51

Yield, lbs/incubator	value $/lb	crop value	Total Crop Weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	crop value/cu ft /year	net profit/cu ft/year
1.5	$20.00	$ 7,230.00	5,784	$ 3.00	$ 2.59	$ 48.00	$ 41.49

Profitable Cycles per Year	16.0
Net Profit per Year	$ 99,985.16
Recycled Profits @ (%)	0.00%
Recycled profits @ ($)	$ -
Allows for Purchase of (x10 cu ft grow space)	0
Totalling (x 10 cu ft grow space) to Begin the Next Year	241
"= # 10-ft logs"/cycle	**241**

At the end of year four, we see a projected profit of $99,985.16 per year.

<u>Scenario 3: immediate expansion to medium-scale production, 1000 cu ft (100 x 10 ft "logs")</u>

The following scenario takes on a significant change to the input cost side of things and uses large-scale parameters; a 1600 lb round bale of hay costs approximately $100, instead of a 75lb square bale costing $8.00. Purchasing hay in this quantity is appropriate and cost effective for production at this scale. Incubation unit cost is changed from $26.00/cu ft to $10.00 per cubic foot, or, for the purposes of these tables, $100.00 per incubator. The researcher feels this is a more relevant cost estimation from the scale perspective . At this scale, cultivation would take place in a larger, cheaper, less mobile, scaled-up version of the modified refrigeration unit. Sale prices is figured as wholesale at $12.00/lb

With an initial calculated investment of $11,000, we see the following numbers:

cost/turnaround calculator

Table X, "Incubator" Definition

total number incubators:	100	"=x10 cu ft space"		**"incubator" cost** $100.00
item	**one incubator**	**all incubators**	**amt. needed/cycle**	**units**
cu ft usable space	10	1000	-	cu ft space
length of HDPE tube	10	1000	0.357	rolls
(lbs) dry hay per cycle	10	1000	0.6	bales
(lbs) dry grain per cycle	5	500	10	bag
grain jars per cycle	5	500	55.56	pkgs
pillow stuffing	5	500	5	pkgs

linked reference table

item	variable	cost
number incubators owned	0	-$100.00
incubator unit	1	$100.00
weight 1 hay bale (lbs)	1600	$100.00
weight 1 bag grain (lbs)	50	$16.00
2 mil HDPE tubing, 3000 ft, 12" dia.	2800	$113.00
heat sealer	1	$60.00
grain jars in pkg	9	$9.00
jars/bag stuffing	100	$8.00
weeks per cycle	3	☺
growing weeks per year	48	☺
est. overhead cost/10 cu ft useable space/cycle	☺	$1.00
Yield, lbs/10 cu ft/cycle	1.5	☺
value/ (lb)	1	$12.00

Scenario values

year #	recycled profit %
1	100.00%
2	100.00%
3	100.00%
4	
5	
6	
7	
8	
9	
10	

Timeline: Begin Year # 1 Below

Expansion scenario calculator

item	cost per	multiplier	total	
incubation space owned	-$100.00	0	$ -	
incubation space expansion final	$100.00	100	$ 10,000.00	**AKA Facilities purchase cost or purchase cost per (10) cubic feet of used grow space**
grain jars 0.5 gal	$1.00	500	$ 500.00	
pillow stuffing	$8.00	5	$ 40.00	
sorghum grain, bag	$16.00	10	$ 160.00	
wheat straw hay, bale	$100.00	0.6	$ 62.50	
overhead/ 10 cu ft/cycle	$1.00	100.00	$ 100.00	
2 mil HDPE tubing, 3000 ft, 12" dia.	$113.00	1	$ 113.00	
		total 1	$ 11,035.50	

yield/incubator (lbs)	value/lb	crop value, total	cycles to profit	weeks to profit	months to profit
1.5	$12.00	$1,800.00	6.1	18.4	4.6

cycles until profit	7
profitable cycles per year	9
crop sale profit value /year	$ 16,200.00
recycled profits @ (%)	100.00%
recycled profits @ ($)	$ 16,200.00
allows for purchase of (x10 cu ft uable grow space)	162
totalling (# incubators) to begin the next year	262
"= #10 ft logs"	262

Total Crop Weight (lbs)
2,400

Timeline: Begin Year # 2 Below

Cost/Profit — Year# 2

number incubators:	262	"=x10 cu ft space"

non-reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle	actual cost/year
CU FT USABLE SPACE	10	**2620**	2620	cu ft space	-	-	-
length HDPE tube/cycle	10	2620	0.936	rolls	$ 113.00	$ 105.74	$ 1,691.77
(lbs) dry hay per cycle	10	2620	1.6	bales	$ 200.00	$ 163.75	$ 2,620.00
(lbs) dry grain per cycle	5	1310	26.2	bag	$ 432.00	$ 419.20	$ 6,707.20
overhead/10 cu ft usable space	$ 1.00	$ 262.00	$ 262.00	-	$ 262.00	$ 262.00	$ 4,192.00
				cost/cycle	$ 1,007.00	$ 950.69	$ 15,210.97

reusable equipment

item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle
grain jars per cycle	5	1310	145.56	pkgs	$ 1,314.00	$ 145.56
pillow stuffing	5	1310	13.1	pkgs	$ 112.00	$ 104.80
				cost	$ 1,426.00	$ 250.36

	weeks/cycle	weeks/yr	cycles/year		
cycles per year	3	48	16.0	**total product cost**	$ 15,210.97

Yield, (lbs)/incubator
1.5

Yield, lbs/incubator	value $/lb	crop value/cycle	profit/cycle w/ bulk cost)	net profit/cycle	gross production value	total net profit	profit percentage
1.5	$12.00	$ 4,716.00	$ 3,709.00	$ 3,765.31	$ 75,456.00	$ 60,245.03	396.06%

Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator			
1.5	393.0	6288.0		cyclic materials cost per cu ft	$ 0.36
				yearly materials cost per cu ft	$ 5.81

Yield, lbs/incubator	value $/lb	crop value	Total Crop Weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	total crop value/cu ft	total net profit/cu ft
1.5	$12.00	$ 4,716.00	6,288	$ 1.80	$ 1.44	$ 28.80	$ 22.99

Profitable Cycles per Year	16.0
Net Profit per Year	$ 60,245.03
Recycled Profits @ (%)	100.00%
Recycled profits @ ($)	$ 60,245.03
Allows for Purchase of (x10 cu ft grow space)	602
Totalling (x 10 cu ft grow space) to Begin the Next Year	864
"= # 10-ft logs"/cycle	**864**

				Timeline:	Begin Year #	3	Below
	Cost/Profit				Year#	3	
number incubators:	864	"=x10 cu ft space"					
non-reusable equipment							
item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle	actual cost/year
CU FT USABLE SPACE	10	8640	8640	cu ft space	-	-	-
length HDPE tube/cycle	10	8640	3.086	rolls	$ 452.00	$ 348.69	$ 5,578.97
(lbs) dry hay per cycle	10	8640	5.4	bales	$ 600.00	$ 540.00	$ 8,640.00
(lbs) dry grain per cycle	5	4320	86.4	bag	$ 1,392.00	$ 1,382.40	$ 22,118.40
overhead/10 cu ft usable space	$ 1.00	$ 864.00	$ 864.00	-	$ 864.00	$ 864.00	$ 13,824.00
				cost/cycle	$ 3,308.00	$ 3,135.09	$ 50,161.37
reusable equipment							
grain jars per cycle	5	1310	145.56	pkgs	$ 1,314.00	$ 145.56	
pillow stuffing	5	4320	43.2	pkgs	$ 352.00	$ 345.60	
				cost	$ 1,666.00	$ 491.16	
	weeks/cycle	weeks/yr	cycles/year				
cycles per year	3	48	16.0		Total product cost		$ 50,161.37
Yield, (lbs)/incubator							
1.5							
Yield, lbs/incubator	value $/lb	crop value/cycle	profit/cycle w/ bulk cost)	net profit/cycle	gross production value	total net profit	profit percentage
1.5	$12.00	$ 15,552.00	$ 12,244.00	$ 12,416.91	$ 248,832.00	$ 198,670.63	396.06%
Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator		cyclic materials cost per cu ft	$ 0.36		
1.5	393.0	6288.0		yearly materials cost per cu ft	$ 5.81		
Yield, lbs/incubator	value $/lb	crop value	Total Crop Weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	crop value/cu ft /year	net profit/cu ft/year
1.5	$12.00	$ 15,552.00	20,736	$ 1.80	$ 1.44	$ 28.80	$ 22.99
Profitable Cycles per Year	16.0						
Net Profit per Year	$ 198,670.63						
Recycled Profits @ (%)	100.00%						
Recycled profits @ ($)	$ 198,670.63						
Allows for Purchase of (x10 cu ft grow space)	1986						
Totalling (x 10 cu ft grow space) to Begin the Next Year	2850						
"= # 10-ft logs"/cycle	2850						

				Timeline:	Begin Year #	4	Below
	Cost/Profit				Year#	4	
number incubators:	2850	"=x10 cu ft space"					
non-reusable equipment							
item	one incubator	total incubation space	amt. needed/cycle	units	bulk cost	actual cost/cycle	actual cost/year
CU FT USABLE SPACE	10	28500	28500	cu ft space	-	-	-
length HDPE tube/cycle	10	28500	10.179	rolls	$ 1,243.00	$ 1,150.18	$ 18,402.86
(lbs) dry hay per cycle	10	28500	17.8	bales	$ 1,800.00	$ 1,781.25	$ 28,500.00
(lbs) dry grain per cycle	5	14250	285	bag	$ 4,560.00	$ 4,560.00	$ 72,960.00
overhead/10 cu ft usable space	$ 1.00	$ 2,850.00	$ 2,850.00	-	$ 2,850.00	$ 2,850.00	$ 45,600.00
				cost/cycle	$ 10,453.00	$ 10,341.43	$ 165,462.86
reusable equipment							
grain jars per cycle	5	1310	145.56	pkgs	$ 1,314.00	$ 145.56	
pillow stuffing	5	14250	142.5	pkgs	$ 1,144.00	$ 1,140.00	
				cost	$ 2,458.00	$ 1,285.56	
	weeks/cycle	weeks/yr	cycles/year				
cycles per year	3	48	16.0		Total product cost		$ 165,462.86
Yield, (lbs)/incubator							
1.5							
Yield, lbs/incubator	value $/lb	crop value/cycle	profit/cycle w/ bulk cost)	net profit/cycle	gross production value	total net profit	profit percentage
1.5	$12.00	$ 51,300.00	$ 40,847.00	$ 40,958.57	$ 820,800.00	$ 655,337.14	396.06%
Yield, lbs/incubator	total yield/cycle (lbs)/incubator	total yield/year (lbs)/incubator		cyclic materials cost per cu ft	$ 0.36		
1.5	393.0	6288.0		yearly materials cost per cu ft	$ 5.81		
Yield, lbs/incubator	value $/lb	crop value	Total Crop Weight (lbs)	crop value per cu ft	net profit /cu ft/cycle	crop value/cu ft /year	net profit/cu ft/year
1.5	$12.00	$ 51,300.00	68,400	$ 1.80	$ 1.44	$ 28.80	$ 22.99
Profitable Cycles per Year	16.0						
Net Profit per Year	$ 655,337.14						
Recycled Profits @ (%)	0.00%						
Recycled profits @ ($)	$ -						
Allows for Purchase of (x10 cu ft grow space)	0						
Totalling (x 10 cu ft grow space) to Begin the Next Year	2850						
"= # 10-ft logs"/cycle	2850						

At the end of year four, we see projected profits of $655,337.14 per year.

FUTURE RESEARCH

- Rehydration tests[x]
    - Rehydration of spent colonies in nutrient solution
    - Analysis: growth notes
- Alternative bulk substrate
    - Alfalfa hay, soybean meal
    - Analysis: nutrition profile analysis of mushroom tissue vs. nutrient content of substrate(s)
- Over-insertion of genes responsible for enzymes capable of breaking down Bakelite (polyphenolic resin) plastics
    - Analysis: possible?

CONCLUSIONS

The proprietary research generated numbers that showed more profit and shorter crop times than originally expected. The researcher feels the information obtained is substantial and reliable enough to seek investment and move forward with implementing the business plan. Additionally, the researcher plans to use knowledge and skills obtained through this research and apply it to future research projects and likely profitable economic ventures.

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