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Mushroom Cultivation Utilizing Off-Season Vegetable Growth Chamber

Soggy Bottom Mushroom Farm, 210 West Lykers Road, Canajoharie, NY 13317
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With the farm expanding and space for produce being a factor, there was (and still is) a need to use existing spaces and materials in different ways. We had proposed to use our vegetable growth chamber (also known as a growth cabinet, seedling cabinet, etc.), not in seasonal use, to aid in the expansion of produce, in this case to cultivate mushrooms. Only small climate equipment modifications were used that did not affect the in-season vegetable use.

School Hill Farm is a full time dairy farm and a part time vegetable farm that tries to coexist during the vegetable season. With limited space and resources, the farm had diversified to meet the needs of each area of operation. Soggy Bottom Mushroom Farm was established in 2009 due to lack of farmland and space that was needed by School Hill Farm.

The project began with Lee Pratt, Schoharie County Marketing Specialist, as our advisor, but shortly after Mr. Pratt left the position and was replaced by Michelle Strobeck. Unfortunately, Ms. Strobeck wasn't familiar with mushrooms. I went to the Cornell Cooperative Extension Schoharie County and met David Cox, Agriculture Program Leader. David helped me with the community outreach by getting a booth at the Schoharie County Sunshine Fair, moving the complete growth chamber operation, publicity, and printing important information packets that were distributed to local farmers, agriculture school teachers, and the general public.

The project began as proposed by sterilizing hay with a pressure cooker and inoculating mini hay bales (3"x 5"x 8") with about ½ cup of inoculated mushroom spawn. The project took a turn when I had difficulty pushing wet hay-bales through the mini hay bale machine. I found out that this was not a plausible way to produce mushrooms, but was a good way to sell table top mushroom "farms" where the mini hay bales would be bought and placed on a table top so the customer would enjoy watching mushrooms grow. After realizing that the mushroom vessel needed to change for easier production and knowing that the new vessel needed to be biodegradable or reusable, I switched to clear plastic totes. I continued to pressure cook the hay and then laid the wet hay and spawn in layers in the totes until I reached 50 lb. in each tote. The amount of spawn to hay is supposed to be 5 lb. of spawn to 200 lb. of wet hay. I had never done this scale before so I added about 5 lb. of pawn to 100 lb. of wet hay to insure good inoculation. Any left over spawn and hay was packed into plastic burlap bags. So, in the end, I had 50 lb. of inoculated mushroom mini hay bales, 200 lb. of inoculated mushroom totes, and 100 lb. of inoculated mushroom plastic burlap bags.

As the mycelium slowly colonized the hay, I watched for invading molds and pests, by removing molds and hanging a fly strip to remove unwelcomed insect pests. I tried to keep the right conditions for optimal Gray Dove Oyster Mushroom growth to about 75%

humidity and 65-70 degrees by measuring humidity and temperature and making adjustments to the humidistat and heater. The control was left alone in the farm cellar where temperature and humidity constantly varied from around 58% - 65% humidity and 56 - 68 degrees outside the plastic tote. When the mycelium fully colonized in the totes and bags, I cut and drilled holes in a diamond pattern around 8" apart. When the mushroom clusters pinned, I observed the rate of growth, what insects were on the mushrooms, and kept track of what the competing molds were doing. After the mushrooms finally started growing, I sold them at the local farmers market by weight using a (borrowed) USDA certified scale.

As I expected, it was much easier to inoculate the totes then the mini hay bales and easier to handle as well. As soon as the Grey Dove Oyster mycelium appeared in the growth chamber (Day 4-5), so did competing green mold and lipstick mold. As the mycelium continued to grow, patches of green mold became very visible (Day 14) and did not allow any of the Grey Dove Oyster mycelium to grow in that area. I removed any competing mold that I could access until the mycelium was too colonized. I also drilled 7/8" holes (in all totes) in the sides making 8"x 8" diamond patterns (Day 14). In the controlled area the mycelium was taking twice as long to colonize, but had only a fraction of the green mold. Both the control and growth chamber mini hay bales were colonized with green mold because of human error by not cleaning the mini hay bale maker well enough before the mini hay bale process. Only the growth chamber mini hay bales could spread into the totes. I had come to the realization that the growth chamber totes had been opened, allowing condensation to drip down from the mini hay bales and infect parts of the totes. Because I used more spawn than prescribed, the mycelium over took the green mold and lipstick mold also allowing Grey Dove mycelium growth. Neither areas saw extreme pest problems; the worst was the chamber where the fruit flies could not escape.

Everything went smoothly until after I brought the "portable" growth chamber (and climate control machines) to the Schoharie County Sunshine Fair. Transportation and set up went fine; I left the fair for the night with all system operations up and running. Two hours later I had a nagging feeling to check on the growth chamber, so I stopped in and discovered the Fair had turned off the power to the whole building. When I checked on the chamber, the temperature was 81 degrees on the inside and I had no clue what the core temperater of the totes was but I knew that if the core reached 85 degrees, aerobic activity would start to stop eventually and kill the mycelium. When the totes went to the Fair, there were signs of mushroom pinning. After two hours with no electricity and 90 degree weather, the top one inch of mycelium and hay had dried out. Further investigation the next morning revealed that all mushroom pins were dead. I knew that this was a setback for the chamber, but did not know how long it would take to for the mycelium to re-colonize. All my efforts were validated 8/16/09 (34 days later) when the mushrooms in the growth chamber pinned again. The pinning filled the drilled 7/8" holes and on 8/21 and 8/22, I harvested the mushrooms. I weighed the mushroom clusters making sure that the scale was certified for weighing vegetables, and sold the mushrooms at the local farmers market in Cobleskill. The control pinned two weeks later on 8/30. I also had discovered through dried-out mushroom clusters that all totes needed some kind of a rehydration and wait period that lasted one week and/or two weeks at most. During

this time, I watered the tote until water flowed out of the mushroom holes and placed them back in the proper places. Every other week I brought mushrooms to the farmers market.

What I had observed in this experiment was that the growth chamber advanced the mushroom growth by two weeks even after the problem from the Fair. Having kept the chamber at a perfect temperature and humidity made optimum mushroom growth. The control was at the whim of the constant fluctuating temperatures and humidity. Even though the climate of the control had subtle variations it was enough to affect mushroom growth in this experiment.

The eight weights from the first pinning were from 10 oz. to 3 oz., making our stand at the market $23.25 enough to pay off one bag of spawn. The influx of customers who wanted to see the mushrooms stayed to buy other produce, which was exactly what I had hoped for. The mushrooms sparked costumer curiosity. Even if they did not buy mushrooms, they still came over and bought other farm produce. Two weeks after the control started to produce mushrooms, the weights were almost identical. Sales were at $18.50 and not much different from those from the totes. The weeks that followed resulted in massive mushroom clumps that topped off at 14.7 oz from the growth chamber and 12.3 oz. from the control. There were not as many clumps at once, but were more spread out. The average was five clumps for each farmers' market instead of eight, but we had mushrooms at almost every Saturday market resulting in a total of $92.25. Unfortunately the bales and bags did not yield any mushrooms, so there was a loss of 150 lb. of inoculated hay.

After the growth and sales of these wonderful fungi, I have many "adjustments" that I would have made to the project. I would have placed the lids on the tote to prevent the contamination of molds and to help regulate, and changed the whole process to using totes. The totes were supper effective, easy to use, clean, handle, inoculate, and, most of all, grow mushrooms. If I had used a proper spawn-to-hay ratio, I could have doubled my sales. I still would have brought the project to the Fair, but would have made sure that the power was going to be on! Bringing the project to the Fair let the visiting farmers, ag teachers, and ag enthusiasts see the project first hand. The biggest adjustment I would have made would have been making a larger project. Even though the project was successful there were variables that affected the project. If the project was larger, then there would have been more data to compare and better readings would have been made. So, many variables such as heat, humidity, and pest problems might have been different (better or worse) if the project had been larger. As for this particular experiment, the size and effects were related to the outcomes, but have limited data. The next step would be to have a larger project focused around the growth chamber; everything else the same, just more of it.

I would most definitely repeat the process for adding diversification to my farms produce. The project did what it was suppose to do by using an off-season vegetable growth chamber to produce mushrooms. I believe that the project resulted in a good foundation for farmers/producers to cultivate their own mushroom and tweak the project as needed.

I definitely will grow mushrooms in the growth chamber again. The project fits into the vegetable season and adds more variety to our farm stand and farmers' market.

My outreach included farmer-to-farmer conversations with those selling produce at the Cobleskill Farmers' Market and a display at the local Schoharie County Sunshine Fair with help from Cornell Cooperative Extension Schoharie County. I felt that this was a great place to educate farmers and the public being the biggest ag event in Schoharie County and agriculture being the county's largest business. I spent seven days at the fair talking about the project for a total of 28 hours (4 hours/day) to anyone that wanted to listen. My audiences were school teachers, local and visiting farmers, homesteaders, and part-time farmers. I explained what drove me to think up this project, its potential, and how it could apply to their agricultural/business needs. The greatest conversation I had was with an ag school teacher who was trying to teach students the fundamentals of mushrooms. He had a project similar to mine with little success. I explained cost saving actions such as making the substrate myself and using recycled materials and climate controlled equipment. The outcome was the school teacher taking the mushroom pamphlets, grant proposal paper, spawn venders, and project overview, and a renewed spirit to try the project again from what he learned from my project.

I also had conversations with SUNY Cobleskill students and professors in which I explained what happened after the growing mushrooms and what effect it had on our farmers' market. The more current public conversation about the project was on February 19, 2010 at a Fonda-Fultonville Central School accelerated science class in which we inoculated toilet paper rolls and created a mini growth chamber. I taught the students some of the problems farms are facing, farms' effects on their environments, and what mushroom cultivations could do for financially suffering farms. I wanted to teach the students about mushrooms as a business. Montgomery County also is an agricultural county with students who represent the future of agriculture.

The purpose of this project was to use a vegetable growth chamber to grow mushrooms and help farmers expand profitability and viability. I used an off-season vegetable growth chamber and added climate control equipment that could be used to increase mushroom growth. I kept the project ecologically sound using reusable and biodegradable substrate vessels, and kept track of climate and invasive species that may or may not have had an effect on mushroom growth. I measured growth, did what was needed to continue to grow mushrooms, and measured the final weight and sale of the mature mushrooms. The final results showed income from the mushrooms and that the mushroom chamber was the best of the growing methods used. The project sparked interests in farmers, teachers, numerous fairgoers, and costumers at the farmers' market. For me this project was a success. I produced and sold mushrooms, and I understand the best course of action for the next season from the knowledge I gained.

Respectfully submitted,

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