Preliminary Substrate Trial Report

Quincy Mushroom Farm – December 2025
Prepared for Plumas Wood Fiber

My name is Che Rubalcava-Cunan, a resident of Quincy, California, and the founder of Quincy Mushroom Farm (QMF), an operation that cultivates culinary and medicinal mushrooms using forest-restoration byproducts. Our mission is to expand and diversify the region's wood-utilization economy by creating a small-scale, community-rooted outlet for the excess woody biomass.

Executive Summary

As part of ongoing trials evaluating the viability of locally available waste wood for commercial mushroom cultivation, QMF has been comparing the performance of mushrooms grown on traditional hardwood-based substrates with those grown on softwood chips sourced from thinning projects on over-forested properties in Quincy. Most recently, QMF incorporated hammer-milled wood fiber from Plumas Wood Fiber into these trials as an additional locally sourced waste wood substrate. Its finer and more uniform particle structure distinguishes it from the coarse softwood chips we currently produce and may offer important functional advantages.

All substrate groups—hardwood fuel pellets, Douglas-fir chips, and Plumas Wood Fiber's engineered wood fiber—are processed into spawn and fruiting blocks using the same methods, inoculated with the same mushroom species, and cultivated under identical environmental conditions. Across all substrates, QMF is recording mycelial colonization rates, contamination rates, and final mushroom yields to directly compare performance.

Although several crop failures occurred across all substrate types due to cultivation errors that delayed data collection, early observations show that the Plumas Wood Fiber substrate consistently supports mycelial colonization, does not exhibit elevated contamination rates, and has successfully produced healthy mushrooms. These preliminary results justify continued testing and demonstrate that engineered wood fiber has meaningful potential as a sustainable, locally sourced substrate for mushroom cultivation.

Introduction

Quincy Mushroom Farm's primary goal is to create a financially feasible outlet for the excess woody biomass in local forests. Secondary benefits—producing fresh, high-quality ingredients for a rural community with limited access to them and generating nutrient-rich spent substrate that supports local agriculture—create the economic foundation that allows this forest-health mission to operate sustainably at a local scale.

The trials described in this report compare three forms of woody substrates:

- **Hardwood Fuel Pellets (Control Group)**

Hardwood fuel pellets were selected as the control because they represent the industry standard for small- and mid-scale gourmet mushroom cultivation. They are made from kiln-dried, resin-free hardwood sawdust that hydrates into a clean, consistent fine-particle substrate ideal for rapid colonization. Their stability and predictability provide a widely accepted baseline against which new substrate materials can be evaluated.

- **Douglas-fir Chips**

Douglas-fir chips were selected as a test substrate because they are the most readily available softwood byproduct on QMF's 14-acre forested property and are considered one of the more promising softwoods for mushroom cultivation. The chips are produced from limbs and treetops of freshly felled trees using an 8.5-horsepower chipper-shredder, which reflects the scale and equipment realistically available to the operation.

- **Plumas Wood Fiber Hammer-Milled Material**

Plumas Wood Fiber's substrate was included because it represents another locally available waste-wood resource produced by an organization with a mission similar to QMF's. Its smaller and more uniform particle size should allow mycelium to move through the substrate more quickly and evenly. Including this material in the trials helps determine whether the advantages of a finer particle size justify investing in equipment to process our own biomass more finely, or whether purchasing material from Plumas Wood Fiber would be a cost-effective and mission-aligned alternative to hardwood pellets.

Methods

QMF's cultivation process consists of three primary phases, each are performed using identical procedures across all substrate types—hardwood pellets, Douglas-fir chips, and Plumas Wood Fiber's hammer-milled material. These phases represent the standard workflow for small-scale gourmet mushroom production and allow for consistent comparison of how each substrate performs.

1. Spawn Generation

A 50:50 blend of woody substrate and grain is loaded into autoclavable bags and sterilized in a pressure sterilizer. Sterilization is necessary to kill off competing bacteria and mold to allow the desired species of fungus to colonize the substrate. Once cooled, these bags are inoculated with mycelium obtained from tissue inside mushrooms from previous crops of two species

cultivated at QMF. The bags are then incubated in a warm room, where the mycelium begins spreading through the sterilized substrate.

2. Fruiting Block Production

After the spawn is fully colonized, it is used to inoculate larger bags of sterilized woody substrate called fruiting blocks. As with spawn, sterilization ensures that the mushroom mycelium has a clean, uncontested environment for growth. The colonized spawn is mixed thoroughly into the fruiting substrate, and the bags are incubated until the mycelium has spread through the entire block.

3. Fruiting

Once fruiting blocks are fully colonized, holes are cut into the bags, and all test groups are transferred into the same fruiting chamber. This chamber provides high humidity, fresh air exchange, and lower temperatures, which are the environmental cues that trigger the formation of mushrooms. Fruiting blocks across all substrates are maintained under identical conditions to ensure fair comparison.

To evaluate how well each substrate performs, QMF is recording three primary metrics. Together, these measurements provide a full picture of substrate viability for commercial mushroom cultivation.

1. Mycelial Colonization Speed

Mycelial colonization speed is the rate at which mycelium spreads through both the spawn bags and fruiting blocks. Faster and more uniform colonization reduces the amount of time a crop takes to produce mushrooms, lowers the risk of contamination, and increases production efficiency. Substrates that support quick, even colonization are generally more reliable and cost-effective for growers.

2. Contamination Rates

Contamination occurs when unwanted microbes—typically mold or bacteria—appear in the spawn or fruiting blocks. This can ruin entire crops and cause significant material and labor loss. Substrates with naturally lower contamination rates, or those that sterilize more effectively, are more practical for commercial use. Tracking this metric helps determine whether certain substrates introduce more risk than others.

3. Mushroom Yields

These are measured as the total weight of mushrooms produced from each fruiting block. Yield ultimately determines whether a substrate is economically viable. Even if a material colonizes

quickly, it must also produce competitive harvest results to be considered a suitable replacement for industry-standard substrates.

Results & Preliminary Observations

Although controlled data collection is still underway and several early batches experienced crop failures across all substrate types due to cultivation errors, meaningful observations have been recorded:

- **Plumas Wood Fiber substrate colonizes rapidly and evenly** in both the spawn and fruiting block phases.
- **Contamination rates have been low**, comparable to or better than the other substrates tested.
- **Both mushroom species have successfully fruited** on the Plumas Wood Fiber substrate, producing healthy and well-formed mushrooms.

Because crop failures impacted multiple rounds, a full dataset of colonization times, contamination rates, and yields is not yet available. However, ongoing trials are now running more smoothly, and future reports will include quantitative comparisons across all three substrate types.

Conclusion and Next Steps

These preliminary findings indicate that substrate from Plumas Wood Fiber has strong potential as a locally sourced, sustainable substrate for mushroom cultivation. Its finer particle size potentially offers meaningful advantages over the coarse softwood chips currently produced on-farm, and further testing will help determine whether QMF should invest in finer-processing equipment or consider Plumas Wood Fiber as a long-term substrate supplier.

As data collection continues, QMF will generate comparative results on each metric previously discussed.

These metrics will allow a clear assessment of the viability of locally sourced softwood substrates relative to the industry standard hardwood pellet baseline.

QMF appreciates Plumas Wood Fiber’s partnership in these trials and looks forward to providing a more comprehensive report in the future.

Oyster mushrooms fruiting from Plumas Wood Fiber substrate.

Mycelial colonization of of Plumas Wood Fiber substrate.

Lion’s Main Mushroom fruiting on Plumas Wood Fiber substrate.