



## BASIC GUIDELINES FOR OYSTER MUSHROOM PACK PRODUCTION USING JUNCAO TECHNOLOGY IN KWAZULU-NATAL

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Although not well known in South Africa oyster mushrooms are a nutritious high protein (35% dry weight basis) meat substitute with medicinal properties, including a natural occurring source of lovastatin (an anti-cholesterol agent).

Oyster mushrooms possess lignocellulosic enzymes which enable them to grow successfully on wood and leaves in their natural state. They nevertheless still require access to a source of nitrogen and the usual inorganic compounds. Traditionally therefore, they have always been produced on wooden logs or sawdust in one form or another.

Technology developed by Professor Lin and his team of the Juncao Institute in Fuzhou, China - and now patented - seeks to replace this source of lignin and cellulose through the use of selected grass species and other suitable, surplus, inedible herbage.

This technology was introduced by Prof Lin to the Department of Agriculture, Environmental Affairs & Rural Development, KwaZulu-Natal in January 2005. It has since been evaluated and adapted for use within the province as a means to support efforts to facilitate food security and sustainable job creation. This article will therefore address the *modus operandi* which we apply in the production of the mushroom packs distributed to our direct beneficiaries involved in the Juncao Mushroom program within KZN province. It should be pointed out that this procedure is merely one of a number which can be applied to the production of mushroom packs for oyster mushroom production.

### Raw materials

In keeping with the application of Juncao Technology, we at Cedara make use of the following raw materials for mushroom pack production: sugarcane bagasse or napier fodder, hominy chop, wheaten bran, weathered sawdust, calcitic lime and hydrated lime.



**Figure 1:** Raw materials – Napier fodder

Currently our 'standard' substrate formula for use with our specific strain of oyster mushrooms is as follows:

- 40% air-dry, sugar cane bagasse or napier fodder passed through a hammer-mill fitted with a 6.0mm sieve
- 30% hominy chop
- 15% wheaten bran
- 10% weathered, pine-tree sawdust
- 2.5% agricultural lime
- 2.5% calcium hydroxide (hydrated) lime

### Mixing of raw materials

It is important that the raw materials are thoroughly mixed before the addition of clean water. This can be achieved by hand, or by means of a small cement mixer – or even a purpose-built 'ribbon' mixer.

The volume and frequency of mixing will dictate what method should be applied. Once the raw materials are mixed – an equivalent amount of water should be added. Experience has indicated that a convenient, manageable amount at any one time is that of 100kg of dry material to which 100 litres of water is added before bagging.



**Figure 2:** *Mixing raw materials in a ribbon- mixer*

### Bagging

The mixed raw materials must then be bagged into convenient and manageable sized packs. The material used for the bags must not be porous to air and moisture, and must also be heat resistant. It is also preferable that a clear or translucent material is used.

Depending on the volume of substrate being handled, bagging can be done by hand or machine.

At Cedara we make use of a purpose-built bagging machine. Irrespective of the bagging method used, the density of a filled pack should be such that 1.0kg of the moist substrate mixture should be compressed into a cylinder 150mm in diameter to no more than 300mm in length. The raw material within the pack is therefore firmly compressed – to the level that, when carefully handled, ‘fingerprint indentations’ are not left on the packs. Once the packs are adequately compressed, they are sealed or capped using a purpose-made plastic neck and cap.



**Figure 3:** *Bagging machine making mushroom packs*

### Pasteurisation

The sealed packs are then placed into purpose-made, stackable steel crates measuring roughly 450mm long 50mm wide and 300mm deep. Twelve (12) packs are placed in each crate.

The crates are then stacked (4 high, 6 wide and 11 long) and covered by a heavy duty plastic tarpaulin. Steam is generated and passed through a steel piping manifold between the crates to achieve and maintain a temperature of at least 90 degrees centigrade for 14 hours within the individual packs.



**Figure 4:** *Pasteurising mushroom packs with steam*

### Cooling

Once the desired time and temperatures have been achieved with the steaming, the packs are allowed to cool slowly overnight to revert to room temperature – without removing the tarpaulin cover.

### Inoculation

- **Selection of oyster mushroom strain.**

While oyster mushroom substrate requirements may be similar, within the different strains there may be varying levels of substrate requirements for these strains. For instance – some may be better suited to utilise sawdust within the mixture, while others may be better suited to utilising Napier Fodder within the mixture for optimal levels of production. The supplier of the spawn should offer appropriate guidance in this matter. However, it remains necessary to continually monitor and ‘refine’ the formula – as experience and confidence is gained with a specific strain of mushroom.

- It is absolutely essential that the inoculation procedure is carried out under completely sterile conditions. Disinfection of anything exposed to the air (hands, clothing sleeves, instruments, the outside of the mushroom packs) is therefore necessary.



- Use can be made of home made 'glove boxes' – essentially an airtight wooden box with a glass-fronted entrance hatch and 'portholes' through which work can be undertaken once the inside of the box and contents have been sterilised. The box should be large enough to accommodate at least 50 individual packs at any one time.



**Figure 5:** Inoculating mushroom packs

- The recommended sterilising agent for hands and instruments is 70% alcohol. Success has been achieved using 10% hydrogen peroxide (atomised through a hand spray) for the sterilisation of the inside of the box and packs prior to inoculation. Use can also be made of a 0.5% solution of chlorine dioxide (Tecsachlor) liquid for the same purpose. At least 20 minutes must be allowed to lapse between spraying and the commencement of the inoculation procedure.
- Inoculation involves the transfer of spawn to cooled pasteurized packs. A ratio of 1:20 is suggested for quick colonisation of the inoculated pack. The packs are then placed into plastic crates and transferred to a location where colonisation of the pack (spawn run) can take place.



**Figure 6:** Inoculating mushroom packs

## Spawn run

Colonization rooms should be dry, dark with the temperature maintained at *circa* 25 °C. The free flow of oxygen should be maintained to ensure that no carbon dioxide accumulation takes place.

The spawn run should be completed within 6 to 8 weeks.



**Figure 7:** Spawn run in mycelium growth room

Once the mycelium has colonised the entire pack, it is then ready to be transported to the location where the fresh mushrooms are produced.

It is important to note that exposure of the packs to direct sunlight should always be kept at the minimum possible levels. Should any information be required in terms of the fruiting management of the mushroom packs, this can be obtained from Agri Update 2010/8



**Figure 8:** Delivery of mushroom packs to beneficiaries



**Figure 9:** Communal activity: processing fresh mushrooms





**Figure 10:** *Good, wholesome food.....!*

**For further information:**

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