

AGRIBUSINESS AREA TORINO FORUM 2010

Project: Bioconversion of Agrowastes by Lentinula Edodes (Shiitake Mushrooms): A great potential to use viticulture residues.

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This Agribusiness project presents to the Torino Forum attendants a technological package that allows the use of viticulture agrowastes in the production of high priced edible mushrooms.

The proposal is supported on the research made by (Gaitán-Hernández y Esqueda , 2005) where results shows a strong potential to efficiently produce Shiitake Mushrooms (*Lentinula Edodes*) on a substrate from viticulture agrowastes and not from hard wood logs as is done traditionally.

The research phase is finished and its ready to be transferred to potential investors that are willing to exploit this new knowledge to create a rewarding business.

Introduction

According to (Gaitán-Hernández y Esqueda , 2005) "Fungi are primary causative agents of organic matter disintegration. Many fungi are important for their role in the decomposition of plant residues, releasing available nutrients and carbon dioxide for the plants. Basidiomycetes are key organisms in the degradation of the plant's primary cell wall and have been used biotechnologically to obtain protein-rich biomass for human and animal consumption as well for bioremediation processes (Abdullan and Iqbal-Zafar 1999). *Lentinula edodes* (Berk.) Pegler, known as shiitake, produces hydrolytic and oxidative enzymes that are responsible for the selective degradation of organic substrates. The production of enzymes is specifically related to and dependent on substrate composition and environmental factors such as temperature and moisture. The bioconversion of agricultural residues produces a strong environmental impact by avoiding waste accumulation.

Due to this biodegradable characteristic, *L. edodes* has been traditionally cultivated on hardwood logs, mainly oak, to obtain fruiting bodies for human consumption (Kozak and Krawczyk 1993; Sobata and Nall 1994). However, this cultivation system represents a limiting factor and potential danger to the environment due to the slow growth rate and the overuse of the oak, jeopardizing the population of this important forest element. Thus, efforts to develop a more efficient, faster, and more reliable production system have focused on the use of an enriched sawdust substrate (Przybylowicz and Donoghue 1990).

Shiitake is the most important mushroom among the species industrially cultivated. In 1997, the production worldwide was more than 1,564,000 tons, with China, Japan, Taiwan, and Korea being the main producing countries (Chang and Miles 2004; Lin et al. 2000; Savoie et al. 2000). Currently, in addition to having a wide market for direct consumption, it contains bioactive compounds that are important for the pharmacology, food, and cosmetology industries (Kües and Liu 2000).

Experimental cultivation of shiitake has been developed using shavings, e.g., *Carpinus*, *Bursera*, *Alnus*, and *Eliocarpus* (Mata et al. 1990; Morales and Martínez-Carrera 1991; Morales et al. 1991), and even coffee pulp and sugar cane bagasse (Mata and Gaitán-Hernández 1992, 1994; Salmones

et al. 1999) in Mexico. Although the availability of some of these substrates is limited, there are other lignocellulosic residues such as straw of different cereals and vineyard pruning (VP). There are 26,000 ha cultivated with grapes, producing approximately 250,000 tons of pruned material per year in Mexico. On the other hand, barley and wheat crops cover 383,000 and 560,000 ha, generating approximately 0.7 and 2.7 million tons of straw residue, respectively (FAO 2004), which are widely used in the cultivation of *Agaricus bisporus* (Lange) Imbach and *Pleurotus* spp. In contrast, VP, which has great potential for mushroom production (Sánchez et al. 2002), is practically never used.

Mexico is a leader in the production of *A. bisporus* and *Pleurotus* spp. mushrooms in Latin America, with a reported production of approximately 40,000 tons for the year 2002. In contrast, only 30 tons of *L. edodes* is generated per year (Lahman and Rinker 2004). The aim of the present study is to evaluate the efficiency of the bioconversion of some abundant lignocellulosic byproducts for shiitake cultivation."

Benefits Form the Use of This Technology Includes

- The use of abundant agro waste in regions were viticulture in present.
- The production of high quality - high price product based on an almost free substrate.
- The possibility to produce a high growth demand food with international markets already developed.

- The control over the production rates and volumes by controlling humidity and temperature.
- Generate an environmentally friendly product by not using logs and recycling agrowastes.
- The possibility to harvest a new crop to diversify local farming activities.
- The creation of new ventures that are well tuned to global trends like the development of technology based companies, the production of healthy foods, the recycling of wastes and the environmentally friendly production methods.

The Market for Shiitake Mushrooms

According to several research papers and surveys, it's been found that:

- Total commercial mushroom production has increased 21-fold in the last 30 years.
- Mushrooms are considered to be a highly popular healthy food.
- Annual production growth in the US averaged 20% for the last 10 years.
- 85% of Shiitake distributors in the US indicate that sales have grown in the last year.
- Shiitake is offered in menus of 39% of Full Service Restaurants in the US.
- 58% of fresh vegetables wholesalers that offer mushrooms offer Shiitakes in the US.

Project Needs

This proposal has finished the research stage with promising results, still to complete a sound business proposal, some efforts are needed to complete the following:

- The engineering to design a production plant.
- Determine production costs for a full scale production facility.
- A complete business plan that includes a deeper analysis of market, financial and operating issues.
- A strategy to develop a market for this product either local or international.