

Microclimate Improvement for Reishi Mushroom Cultivation

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Introduction

Recently, AVN Consulting established a research plot for the development of new technology in growing Reishi mushrooms on oak logs and in growing bags. The company made a breakthrough in developing the cultivation technology of Reishi, which is described here. If the farmers and entrepreneurs utilize our technological innovations, they can take up the production of medicinal mushrooms and rich dividends.

In this article we introduce some thoughts and experience on creating the suitable environment for Reishi mushrooms cultivation in greenhouse with high content of biologically active carbohydrates such as polysaccharides and triterpenes.

Background

Reishi mushroom is a medicinal mushroom that is used to produce herb food supplements for people to use in powder, tea, tincture, capsules, liquid extract and etc. It has been used as a health tonic in Asia for many centuries. In Japan, it's called "Lingzhi", in China - "Reishi" or "the mushroom of immortality". Reishi mushroom species continue to be a popular traditional medicine in Asia and their use is growing throughout the world (Lindequist, 2005; Wachtel-Galor, 2004).

The literature review of Reishi is reported of very significant medicinal values - cholesterol lowering, nephroprotective, hypoglycemic anticancer, anti-HIV, anti-heart attack, anti-angiogenic, anti-diabetes, antioxidants etc. (Benzie, 2009; Borchers, 2008; Boh, 2007; Chen, 2004; Chang, 1999; Furusawa, 1992).

Many authors describe the beneficial effects of several mushrooms with a reference to the medicinal mushroom *Ganoderma lucidum* (Zhu, 1998; Upton 2000; Sanodiya, 2009).

In Chinese and Japanese systems of medicine Reishi is almost a panacea (Evans, 2009; Gao, 2005; Fang, 2002; Furusawa, 1992).

Biologically active components

In a study of the nonvolatile components of *G. lucidum*, it was found that Reishi mushrooms hold 1.8% ash, 26–28% carbohydrate, 3–5% crude fat, 59% crude fiber, and 7–8% crude protein (Mau, Lin, and Chen, 2001). In addition to these, mushrooms contain a wide variety of bioactive molecules, such as terpenoids, steroids, phenols, nucleotides and their derivatives, glycoproteins, and polysaccharides (Chang and Buswell 1996; Borchers et al. 1999; Sanodiya et al. 2009).

Reishi mushrooms are valuable herbs because they contain water-soluble polysaccharides and triterpenes that are considered as major bioactive components in medicinal types of mushrooms like Reishi (*Ganoderma lucidum*), they possess high level of polysaccharides and triterpenes that are studied by many scientists and published as the most commonly mentioned active compounds in plants and fungi (Boh et al. 2007; Zhou et al. 2007).

Recent medical science has indicated that the primary active ingredient in the Reishi mushroom is water-soluble polysaccharides that can help regulate the immune system and internal organ function. Reishi mushrooms are grown primarily for medicinal use, and are easily dried for use in extracts, teas and tinctures.

The other active ingredient in Reishi mushrooms - triterpenes, or ganoderic acids - are bitter in taste, and can help inhibit histamine release, and alleviate many allergy symptoms. Triterpenes have also been shown to improve oxygen utilization and liver function.

According to some studies, it was found that the polysaccharide content varied from 1.1–5.8%” and the triterpene content fluctuated from imperceptible to 7.8% (Chang and Buswell, 2008).

AVN Technology allows to obtain higher than average content of polysaccharides and triterpenes. According to the independent lab analysis in Philadelphia, PA we produce Reishi mushrooms at Greenhouse in Florida that contain 1-2% of polysaccharides and 3-4% of triterpenes.

Reishi mushroom cultivation

Reishi mushrooms can be easily cultivated outdoors on hardwood logs, or indoors using sterilized sawdust substrate.

Reishi can be grown by the farmers seasonally in the low-cost growing rooms preferably poly-houses or greenhouses and also in the environmentally controlled cropping rooms by the industrialists.

It's native to southern climates and grows especially well outdoors in the Southern US. Depending on light, temperature, humidity and carbon dioxide levels during fruiting Reishi will take one of two forms - a seashell like shape that forms when light levels, airflow and humidity are high, or a branched shape that resembles a set of antlers that forms in lower levels of light and airflow.

AVN technology provides different conditions for different growing stages of Reishi mushrooms. We set higher content of carbadoxes and humidity with 80% reduced light to produce mushroom antlers and at the stage of forming caps we increase light, pull fresh air and decrease relative humidity inside our greenhouse. Usually we harvest Reishi mushrooms within 6-7 months on logs and 1.5-2 months in growing bags (blocks).

Desired microclimate

The Lingzhi or Reishi is a relatively slow growing mushroom that prefers a temperature around 75-85 degrees Fahrenheit, and a high humidity (75-85% relative humidity).

Traditionally incubation of mycelium is done at 28-35 °C in the closed rooms (high carbon dioxide) and darkness. After the complete spawn run, which takes about 25 days. We believe that during the incubation it is not necessary to increase carbon dioxide artificially, so that we put logs in to the black plastic bags. For cultivation in growing bags we reduce light and inside the bags there is enough CO₂ and moisture.

In our greenhouse when the pins have grown up enough to form the cap which is indicated by the flattening of the whitish top of the pinhead, humidity is reduced to 78-80% relative humidity and more fresh air is introduced to logs and bags. Once the cap is fully formed, which is indicated by yellowing of the cap margin, temperature is lowered to 75-80 °F and relative humidity is more reduced to 60-65% for cap thickening, reddening and maturation of the fruitbodies of the cap margins.

Marketing

Marketing of Reishi is the most challenging part of the process. It refers to activities undertaken by a company to promote the selling of the product or service. Marketing includes advertising, selling, and delivering products to consumers or other businesses. Reishi is used as medicine and not as food because it is bitter and corky hard. Any one growing it has to find the market which is basically herbal medicine and food supplement (nutraceuticals) sector. Manufacturers of herbal medicines and food supplements can process, pack and trade it in various forms capsules, tablets, liquid extracts or even Reishi.

Conclusion

The United States is one of the largest producers of the medicinal mushrooms in the world. The US is also the largest exporter of mushrooms. The global market size has increased by 8% year-on-year, and the demand is most likely will double in 2023 compared to last year.

To maximize efficiency while maintaining high-quality fungi, they must be grown in modified climatic conditions that could be provided artificially in green or growing houses. Based on our experience we develop new technology to provide that conditions by regulating temperature, relative humidity, lights and carbon dioxide content at different growing stages.

In order to be able to increase knowledge sharing, the AVN Consulting company will continue updating and improvement of the technology to grow Reishi mushrooms in order to decrease the duration of cultivation and increase quality in terms of high content of biologically active carbohydrates such as polysaccharides and triterpenes.

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