Nature and Use of Spent Mushroom Substrate

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Annual production of mushrooms is estimated to be over 4.1 million tons worldwide. Mushrooms are produced by solid state, aerobic conversion of a wide range of pretreated lignocellulosic wastes and manures. One pretreatment of major importance is composting which has been practiced by mushroom growers since the 18th century.

Spent mushroom substrate (SMS) is mushroom compost pasteurized with steam after the mushroom harvest is finished. Mushroom compost is made from: wheat straw, gypsum, poultry litter, and water, or wheat straw bedded horse manure, or a combination of mixed hay , corn cobs or cottonseed hulls and cocoa bean hulls. During its three week outside windrow processing, it is turned and watered every few days for a total of eight to turnings. Mushroom compost is steam pasteurized and deammonified before it is suitable for mushroom growing. A second steam pasteurization, at the end of cropping , kills all weed seeds and is performed routinely as part of mushroom farm sanitation programs.

In the case of the Champignon (Agaricus bisporus), an average of 0.5 ton SMS is produced from one ton of spawned mushroom compost. In terms of a compost feedstock, SMS can be evaluated as a food processing residual with relatively few harmful constituents and several potential applications .

Only a few scientists throughout the world have studied SMS, yet the mushroom farm industries of many nations need information about SMS in this age of environmental consciousness. Because of this need and the paucity of information in the professional literature, it was decided to convene an international symposium by the College of Agricultural Sciences, The Pennsylvania State University : MIGAL, Galilee Technological Center and the Hebre University of Jerusalem.

The objectives of the SMS symposium, held in Philadelphia, Pennsylvania, March 11-14, 1994, were to identify potential environmental problems associated with SMS, as well as to propose environmentally sound uses for spent mushroom substrate on a year-round basis. Topics included the enumeration of potential environmental concerns , mostly chlorides, that may leak and enter surface or ground water. Neither nitrates nor phosphates appear to be of any concern with land applied SMS, and heavy metals levels are no higher for SMS than for the plant materials used in making mushroom substrate through composting.

A wide range of beneficial uses for SMS are demonstrated including: as a peat moss substitute for ornamental plants; as a soil ameliorant- organic fertilizer used to grow horticultural and agronomic crops; as a primary component for constructed wetlands used to remediate water downgraded by acid mine drainage; as a stabilizing agent and regrowth medium for severely disturbed sites (i.e., abandoned stripmine culm banks, pipeline construction sites, urban multiuse green space); as a matrix for bioremediation of volatile organic pollutants, including pesticides: as a feed for ruminant

animals; and as the source of yet to be identified agents for control of plant diseases.

Mushroom production is one of the more sophisticated and complex forms of indoor farming. The unique and specific nature of research on the crop and its growing systems has allowed for the evolution of extensive intercontinental information sharing and technology transfer through networks, personal contacts, conferences and commercial, technical support. Reflective of this international sharing are reports included in the Proceedings authored by individuals from USA, Canada, Ireland, Scotland, Netherlands, Hong Kong and Israel.

The symposium could not have occurred without the moral and financial support of many groups and individuals. Acknowledgments and appreciation for financial support are extended to: American Mushroom Institute; College of Agricultural Sciences, Office for Research and Department of Plant Pathology, The Pennsylvania State University; Fertl-Soil Company; Giorgio Mushroom Co.; Guizzetti Farms; International Society for Mushroom Science; Modern Mushroom Farms Inc.; Ostrom Mushroom Farm; and Terry Farms, Inc. An advisory committee provided inputs regarding program development and speakers, and the following individuals are recognized for their contributions: D.M. Beyer, T. Brosius, D. Carroll, K.M. Lomax, M.L. Morris, L.R. Stark and J. Yeatman.

One output from the SMS symposium and its Proceedings will be a more comprehensive understanding of the problems, potential treatments and utilization options available for SMS worldwide. Those dealings with composted materials other than SMS may learn of options not heretofore considered, using the SMS experience as a model for different substrates.

There are potential benefits to sharing experiences between those who make highly controlled, specialized compost for mushroom farming and other composters, mushroom compost must be specialized, pasteurized and nutritious or it will not support the growth of mushroom crops. Since mushroom compost is the original material from which SMS is derived, SMS also is a specialized product. **MN**