

COMPOST SUBSTRATE ALTERNATIVES BEING CONSIDERED

To anyone outside the industry, mushroom growers would appear to be “drought-proof” enjoying the luxury of growing indoors, with no real care about the weather. But the severe drought gripping southern Australia has exposed the reality, with the decreased availability of wheaten straw placing real pressure on growers to consider the feasibility of compost substrate alternatives.

With this problem posing a clear and immediate priority for the industry, a Hort Innovation project - *Feasibility of compost substrate alternatives for mushroom production [MU17007]* - has been established to consider the issue.

Project manager, Dr Julia Jasonsmith from Murrang Earth Sciences has partnered with Dr Kevin Wilkinson from Frontier Ag and Environment to work through the options and come back to the industry with recommendations.

She explained that the priority for the project was to find alternative substrates for wheaten straw for use in the mushroom composting industry.

“The industry knows that there is currently a decreasing supply of wheaten straw, with a combination of drought conditions and increasing competition from the livestock industry reducing availability. Farming practices designed to increase the carbon content of soils are also playing a part, with many producers moving toward increased stubble retention.”

“With wheaten straw being the major substrate for mushroom compost, this decreased supply looms as a serious concern for the industry over the longer term.”

Dr Jasonsmith said the first step in the project was to examine the scientific literature and determine which alternative substrates could potentially be viable for use by the industry.

These alternatives range from spent mushroom compost, corn cobs, chicken litter, different manures and even non-composted substrates like coffee grounds, lignocellulosic waste or dry plant matter such as sugarcane bagasse or sawdust waste.

The list of potential alternatives was

considered and subsequently culled to those that were more strongly supported by the literature.

The team is now looking carefully at each option, taking into account both the physicochemical properties and the cost and feasibility of obtaining the materials.

At a physicochemical level, the analysis will take into account the physical side of things like how the substrate affects porosity, and chemical properties like carbon and lignin content, and how they compare to wheaten straw. The study will consider the impact on the compost and whether the materials could potentially promote the right kind of microbes, the correct type of fungi and the right type of bacteria to grow on the substrate.

The cost and feasibility of procurement will also be considered. Dr Jasonsmith said this aspect was particularly important to determine the practicality of the options.

“As an example, canola could be used as a substrate, but at the cost of \$400 a tonne and with prices changing every day, it is effectively





ruled out as a practical option.”

“There are also options like cotton trash which is pretty much free, provided you have the transport and machinery to go to the cotton-growing areas and load it. Again, this is potentially not feasible because the sourcing and transport are too much of a challenge.”

Dr Jasonsmith said this initial stage of the project is almost completed and the team was talking to a lot of different people in the industry to get their ideas about some of these substrates and whether they have been used previously.

“From our perspective, it is important to get a sense of what industry would be prepared to consider as practical alternatives and of what their experiences with these alternatives are. As an example, we have both done work around the use of green waste, but the feedback from mushroom growers is that they would be worried about the irregular quality, and many are not interested.”

Dr Wilkinson said his examination of the literature had revealed quite a few papers examining substrate

alternatives.

“The interesting thing is that while they may look reasonable from the studies when you talk to industry and gain insights on the practical implications, they simply are not feasible.”

“After taking everything into account, the reduced availability of wheaten straw is a growing concern, particularly as there are no easy alternatives in terms of consistency, price and ease of access. Some of the early feedback from industry highlights the real challenge when they say – if there were easy solutions, we would have found them!”

The team is focused on carefully analysing the chemical and physical properties of alternatives and presenting potential options for the industry to consider.

Dr Wilkinson said the work would encompass an initial screen and suggested there was likely to be additional research required to determine the productivity of any new substrates.

“What we have found is that industry has already been very curious and

experimental in trying different substrates and introducing portions of alternatives into the mix. Potentially this project builds on this and puts forward options for blending with various materials.”

He outlined that some waste streams may need a pre-treatment process. He said the industry could potentially access a stream of clean wood waste; however, a pre-treatment process of grinding the materials and screening to achieve the right particle size would be required.

Dr Jasonsmith said the drought was not the sole issue likely to affect longer-term access to wheaten straw.

“What we are seeing is that growers are increasingly retaining crop stubble to increase both the moisture content and the level of carbon in the soil. Access is not just a drought-related issue, and with projected climate change, there is a real sense this will become an ongoing problem.”



She said the project team's interactions with industry highlighted a level of innovation in examining alternatives and had revealed interest in whether there were options in the scientific literature that had not previously been considered.

The project team is practical about its chances of finding something as a direct replacement for wheat straw.

Dr Wilkinson said while the chances of a direct replacement were quite small, work undertaken by the project has highlighted the potential for changes to include new materials in the preparation of the substrate.

"The analysis of the literature highlights the technical feasibility of growing mushrooms with different approaches. The question to be considered is why some of these different options have not been commercially adopted, suggesting some limitations in the approach."

"Spent mushroom substrate is one example where the literature suggests growers can achieve good yields by blending the material in with their starting compost. However, if you talk to industry, the feedback is that there can be problems with salt levels and a subsequent impact on yield."

The project team considers a key aspect is to find a substrate that is not competing with the feedstock industry.

Dr Jasonsmith said while there was potential to use items such as cottonseed hulls, or brewery grain, the reality is that these materials were currently being used as drought fodder by the livestock industry.

"At a practical level a lot of these other substrates are not viable because of the feedstock industry, so it is finding something that is available and accessible in commercial quantities and is not in competition with livestock producers. Even if drought conditions ease, such competition will be a problem in the future, one way or another."

"For that reason, we are looking at products that are available and not being used for other commercial purposes. Even if they are not ideal, there may be ways of treating the product to deliver the right properties for the compost industry. The bottom line is that a process of pre-treatment may be cheaper than trying to compete with the feedstock or other industries for access to a particular product."

The project team sees itself as essentially providing a fresh set of eyes to a known problem.

While many compost makers have looked at options, they have not necessarily dived deeply into the detail, which is what we can provide through this process, they said.

The project will deliver a map of where to access alternative materials throughout Australia.

Dr Jasonsmith said the information would be made available in a consolidated form, with tables highlighting relevant information including pricing, climate risks, physical and chemical data, all in the one document.

"While farms have considered their options previously, this will provide a handy reference for anyone needing to consider the availability and potential costs of alternatives," she said.

The project concludes in November 2019, and an updated report on the outcomes will appear in the Australian Mushrooms Journal [Edition 4 – 2019].

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