AHDB
HORTICULTURE

Grower Summary

M 060

Developing alternatives to peat in casing materials for mushroom production

Final 2015

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Project title	Developing alternatives to peat in casing materials for mushroom production
Project number:	M 60
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Location of project:	East Malling Research, Pershore Centre and grower sites
Project coordinator:	Mr James Rothwell
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GROWER SUMMARY

Headline

- Addition of 12.5% of bark fines or 6.3% each of bark fines and mature green waste compost (GWC), with water, to peat casing was either beneficial or neutral to mushroom yield
- Recycled cooked-out casing used at 25% had no overall effect on mushroom yield. A MushComb casing separator machine is a possible option in recycling spent casing in the shelf system. The recycled casing could be added to fresh casing in the conveyor to a head-end filler of shelves
- Positive Taqman PCR test results for *P. tolaasii* and large increases in *Pseudomonas* sp. populations in the casing from application to after the second flush generally corresponded with the occurrence of moderate or severe bacterial blotch

Background and expected deliverables

Previous research has shown that the most promising peat substitutes in mushroom casing are composted bark fines, mature GWC, coir, recycled casing, recycled granulated waste rockwool slabs and filter cake clays. Coir was incorporated into some commercial blends for several years but it is no longer used due to the increased demand and cost of the raw material, particularly for uses such as strawberry substrate production. However, spent coir is a significant disposal problem for the soft fruit industry. In this project, the effect of using the above materials individually and in combinations of materials was investigated. The specific objectives of the project were:

1. To update and summarise any recent information on peat alternatives in casing published since HDC project M 53
2. To produce data that meets the requirements of the Environment Agency's low risk waste status and/or food safety regulations
3. To undertake commercial farm trials with the five most promising alternative materials identified from small-scale experiments in M 38 and M 53
4. To test how experimental physical, chemical and microbial standards for casing materials relate to mushroom yield, quality and blotch incidence on commercial farms
5. To electronically monitor crop water management and casing water status, and determine how these interact with the performance of casing materials and the occurrence of blotch
6. To communicate and disseminate results to industry
7. To monitor industry uptake of peat substitute casing materials.

Summary of the project and main conclusions

Discussions with several European casing manufacturers suggest that decreasing availability of wet dug peat for mushroom casing is a problem not only in Britain but also in the Netherlands and Belgium. Other types of peat and peat production by-products are available in Britain in sufficient quantities to supply the mushroom industry. A review of potential alternatives to wet dug peat has shown that the most promising materials were composted bark fines, granulated recycled rockwool slabs, recycled casing, spent coir from strawberry grow bags, PAS 100 Green Waste Compost (GWC), and filter cake clays.

The following casing materials were used as peat substitute materials in the experiments: (a) pine bark fines (b) mature GWC (c) used granulated rockwool slabs (d) cooked-out separated spent mushroom casing (e) clay from sand quarries (f) spent coir from strawberry grow bags. The materials were used as individual peat substitutes and in two- and three- way mixes in some of the trials. Peat substitute materials were tested in four peat-based casing materials: three were commercial products containing wet dug peat and sugar beet lime (SBL) (Harte, Sterckx and Topterra) and a fourth casing (Everris) consisted of blocking peat, milled peat fines and SBL or ground chalk.

The main conclusions from the review and mushroom cropping trials conducted at five farms were:

1. The supply of wet dug peat has substantially reduced in Britain and dwindling supplies in Germany are also of concern to casing manufacturers in the Netherlands and Belgium.
2. The most commonly used casing in Britain is Harte (Ireland) with smaller quantities from Scotland, Belgium and the Netherlands.
3. Other types of peat and peat production by-products are available in Britain in sufficient quantities to supply the mushroom industry.
4. A review showed that the most promising alternatives to peat were composted bark fines, granulated recycled rockwool slabs, spent coir from grow bags, PAS 100 GWC, and filter cake clays.
5. Mushroom yields and quality from an Everris casing prepared from partially dried blocking peat and milled peat fines were similar to Harte and Topterra casings prepared from wet dug peats; however, the casing needed wetting during pre-mixing and the crop needed more frequent irrigation events of shorter duration than with wet dug peat casing.
6. The effects of adding 12.5 to 25% bark fines on mushroom yield were inconsistent between farms.
7. GWC was unsuitable at an inclusion rate of 25% but at 12.5% had no overall effect. It was best used at 6.3% in conjunction with a similar volume of bark when the effect was either

beneficial or neutral to mushroom yield; this blend would also be cheaper than using 12.5% bark.

8. The effect of addition of 25% recycled rockwool at all three farms where it was tested and in three types of casing was not significant compared with the respective peat control casings.
9. Recycling spent casing at 25% had no overall effect on mushroom yield. Casing with salt or disinfectant must be avoided for use in recycling in casing. A MushComb casing separator machine is an option for in recycling spent casing in shelves.
10. Filter cake clay at 20% reduced mushroom yield but the effect of 12.5% clay was not significant. However, the material was difficult to mix evenly through the casing.
11. Spent coir was unsuitable for casing because it encouraged green mould.
12. Casing materials with a volumetric water retention at saturation of at least 67% were more suitable than materials with a lower water retention when saturated
13. Maintaining a casing volumetric water content of at least 61% during cropping produced a better yield than maintaining a lower water volume in the casing.
14. Casing water tensions were consistently greater in the second flush than in the first across all the farms in spite of second flush yields being similar or lower than first flush yields; this indicates that more water needs to be applied after the first flush, without excessive draining into the compost.
15. The occurrence of bacterial blotch was not primarily related to the initial population of *Pseudomonas* sp. in casing materials; blotch was mainly associated with one farm which may have had environmental conditions conducive to the disease.
16. The occurrence of blotch generally corresponded with positive results obtained with a Taqman PCR test for *P. tolaasii* on casing samples taken after the second flush, although blotched mushrooms were obtained from casing treatments that tested negative and *vice versa*.
17. Large increases in *Pseudomonas* sp. populations in the casing from application to after the second flush generally corresponded with the occurrence of bacterial blotch or severe blotch.

Financial and environmental benefits

Recycling of spent casing is a viable option if the casing is cooked out, not treated with disinfectant or large amounts of salt, and a method for removing the casing layer from the compost is available. This work has shown that the MushComb casing separator is a possible option in the shelf system. The recycled casing can be added with fresh casing in the hopper of the head-end filling machine. Table A1 shows the potential benefits and costs of recycling casing. This assumes that crops are cooked-out and there is no mushroom yield difference between fresh casing and casing containing 25% recycled casing; this work has shown that there may be a yield benefit in recycling casing if it is rewetted before reuse. Alternatively, it may be possible to recycle a greater proportion of casing (30 - 50%) without a mushroom yield penalty, but this requires further investigation.

Table A1. Benefits and costs of recycling casing

Benefits	**Costs**
Saving in casing cost (25%)	Casing separating machine and trailer for collecting separated casing
Separated compost with increased fertiliser value (lower pH, higher plant nutrient content) or for reuse in Phase I compost	Removal of salt patches from casing after cook-out
Reduced cost of SMC disposal (12%)	Hopper and conveyor for feeding recycled casing into head-end casing hopper

HDC project M43 showed that 33% of spent compost (with casing layer removed) can be reused in Phase I compost with no effect on mushroom yield compared with non-amended Phase I compost. There is therefore a potential to save on straw and other compost ingredients, if composting is conducted in the vicinity of mushroom production.

Casing prepared from dried blocking peat and milled peat fines, and rewetted before use, can produce comparable mushroom yields and quality to casing prepared from wet dug peat. This could reduce dependency of the British mushroom industry on imports of wet dug peat. However, the casing needs to be wetted in a casing mixer and requires more frequent and smaller waterings. The cost of the casing materials would be similar to that of casing prepared from wet-dug peat and sugar beet lime, but there would additional costs in blending the casing ingredients.

The addition of bark and/or GWC at inclusion rates of 6.3-12.5% v/v, together with additional water, to peat casing may give yield benefits on some farms. These ingredients can be added to the casing hopper. The cost of the casing would therefore be similar to non-amended casing.

The Taqman PCR test for *P. tolaasii* and the measurement of *Pseudomonas* sp. in casing should help to identify conditions that are conducive to bacterial blotch.

Action points for growers and casing producers

- Investigate removal and re-use of cooked out casing – disinfectants or large amounts of salt must not be applied to the casing before reuse, and salt patches must be removed from casing after cook-out.
- The cooked-out casing needs to be rewetted before reuse; the wetted material can be added to the hopper of the head-end filling machine in shelves.
- Addition of small (6.3 – 12.5%) amounts of bark and GWC, together with additional water, to peat casing may give yield benefits on some farms.
- Water tension in the casing is much greater in the second flush than in the first flush, indicating that more water needs to be applied after the first flush, without excessively draining into the compost. Volumetric water content of the casing should be kept at least 61% during cropping.
- In the event of a blotch problem, testing of casing during the cropping period using the Taqman PCR test for *P. tolaasii,* and for the total population of *Pseudomonas* sp. may identify where conditions are favourable for the disease.