COMMERCIAL CULTIVATION OF *AGARICUS BISPORUS* ON SUBSTRATE CONTAINING OLIVE MILL RESIDUES

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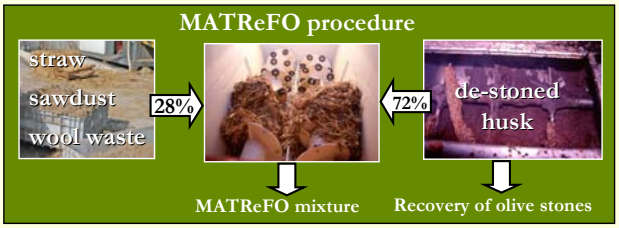
Introduction

The increasing growth in olive oil production worldwide poses ecological challenges for the disposal of the Olive Mill Waste (OMW), recalcitrant to degradation. The CNR-ISAFoM recently developed a new technology, called MATReFO (WO/2005/082814), able to convert raw OMW into a non-leaching and non-odorous organic matter useful for agronomic applications. Such type of substrate contains sugars, tannins, lignin, polyphenols, polyalcohols, pectins, lipids and proteins, which serve as potential carbon, nitrogen and energy sources for growth of mushrooms.



The aim of this work is to determine whether MATReFO mixture can be used as an ingredient alternative to chicken manure, in the preparation of substrate for the cultivation of *Agaricus bisporus* on a commercial scale.

Material and methods

Preparation of substrate and cultivation of *A. bisporus* were conducted at the Valfungo mushroom farm, Sansepolcro, Arezzo, Italy. The procedure comprises:
- Phase 1 (aerobic substrate preparation);
- Phase 2 (pasteurization and stabilization of the substrate);
- Phase 3 (inoculation of the substrate with mushroom starter culture, the spawn, and incubation of the inoculated substrate).

The cultivation trial was carried out over 66 days starting from preparation of substrate to the completion of mushroom harvest, comprising of two flushes.
The experiment was carried out using a standard mushroom substrate (control) and compared with an experimental substrate (ES) containing MATReFO mixture.
Both spawn-run substrates were transferred, when ready, to five 500 m^2 cropping room, using the Dutch shelf system.

Phase 3: inoculation of substrate (a) and successive pinning in the cropping room (b)

Total microbial counts CFU (x10^8) g^{-1} in control and experimental substrates after pasteurization during phase 1

Time of incubation	Control substrate TSA[a]	Control substrate AIA[b]	Experimental substrate TSA[a]	Experimental substrate AIA[b]
2 days	110	1.3	200	1.7
7 days	580	340	1800	950

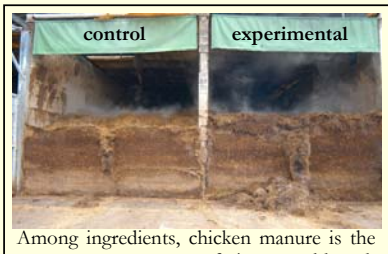
[a]Triptic Soy Agar [b]*Actinomycete* Isolation Agar

The selectivity of the ES and control substrates for *A. bisporus* cultivation was assessed by evaluating microbial growth, with particular reference to *Actinomycetes* in samples collected after pasteurization.

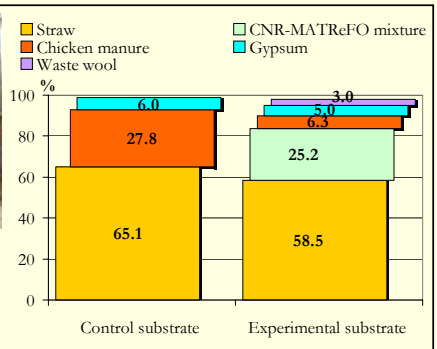
Evolution of organic matter, total and organic nitrogen in the control and experimental substrates during phases 1 of substrate preparation and phase 3 spawn-run substrate

	dry matter	organic matter	total nitrogen	organic nitrogen	organic matter	total nitrogen	organic nitrogen
	Tons				%		
Control substrate							
Start of substrate preparation	56.3	44.4	0.96	0.63	100.0	100.0	100.0
Pasteurization (phase 1)	39.4	30.6	0.56	0.40	64.4	58.5	63.2
Spawn run substrate (phase 3)	31.4	22.5	0.61	0.61	47.5	63.6	96.6
Experimental substrate							
Start of substrate preparation	59.6	52.5	0.97	0.56	100.0	100.0	100.0
Pasteurization (phase 1)	41.6	34.4	0.87	0.59	65.6	89.8	104.6
Spawn run substrate (phase 3)	28.3	21.2	0.79	0.79	40.4	81.4	141.1

At the end of trial the residue of cultivation (Spent Mushroom Compost, SMC) from ES showed 2.4 times total nitrogen content than control



Among ingredients, chicken manure is the most common source of nitrogen, although mushroom growers are concerned about hygienic and smell problems. Hence, increasing attention has been devoting to find out different by-products



Results and discussion

The control and ES substrates had a starting total nitrogen 1.70 and 1.63, total carbon 42.5 and 44.3, C:N 25.0 and 27.2, respectively, and were 71-73 % saturated.

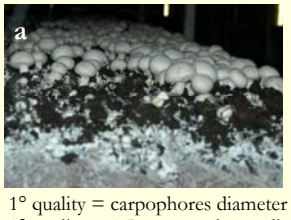
Total yield of *Agaricus bisporus* from two flushes

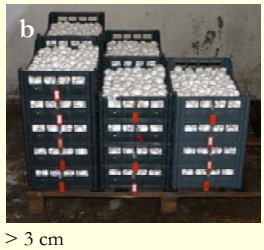
	Cropping area m^2	Fresh SS tons	Dry SS tons	Total yield tons	Yield Kg m^{-2}	Yield Kg tons^{-1} fresh SS	BE* %
C	1333	118.40	30.12	28.27	21.3 A	242.0 A	93.8 A
ES	1167	96.90	27.53	27.94	23.8 B	293.6 B	100.5 B

*BE = Biological Efficiency (sporophores fresh weight / SS dry weight) x 100; C=Control substrate; ES=Experimental substrate, SS=spawned substrate. Data flanked by the same letter are not significantly different according to SNK test for P < 0.05.

Although the total weight of ES spawned compost was lower than control, on dry and fresh weight basis, the total yields were comparable, thus signifying a higher BE (100.5 %) than control (93.8 %). This trend is also true when mean yields, expressed in square meter or weight of fresh spawned compost, is considered.

First flush (a) and yield recording (b)





1° quality = carpophores diameter > 3 cm
2° quality = 1.5 < carpophores diameter < 3 cm
3° quality = open veil and/or visible spot

Total yield of *A. bisporus* from first and second flushes and assessment of market quality

ES showed a better distribution of yield among flushes with reasonable commercial advantages for a farm such as Valfungo concentrating on fresh market sales. ES produced a higher prime quality fresh mushrooms (29.2 %) than the control substrate (21.5 %) and a lower amount of third quality mushrooms (41.8 %) than control (45.0 %).
Production of prime quality mushrooms reduces time and consequent cost of manual harvesting.
No differences were observed in the composition of fruit bodies grown on both ES and control substrates.

Conclusions

- ✓The suitability of the use of OMW in the preparation of growth media for *Agaricus bisporus* (Lange) Sing. has been demonstrated in a commercial-scale cultivation trial (2500 m^2)
- ✓The presence of OMW enhanced *Actinomycetes* during the pasteurization phase thus improving compost selectivity and subsequent protection against competitors
- ✓ES substrate showed a higher biological efficiency (100.5%) than control (93.8%)
- ✓Both SMC derived from the trial showed good physical-chemical and biological properties for agronomic applications, but the higher N-content (2.54%), found in the ES SMC, increases its recycling value as a potential slow-releasing fertilizer and/or in the re-cultivation of mushrooms
- ✓The conversion of OMW (a liability) into value-added mushroom substrate (an asset) is an effective waste management tool in oleaculture