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Mushrooms and water

To the Editors:

As a researcher who has been active for many years in the field of water relations of *Agaricus bisporus* I have to comment on the contribution of Kurtzman[4] in this journal. The basis of all of Kurtzman's conclusions is on top of p. 28: "We can calculate that 100 g CH_2O (substrate) + 96 g O_2 = 10 g CH_2O (mushrooms, dry wt.) + 54 g H_2O + 132 g CO_2". He assumes that 100 g substrate dry matter are needed to get 10 g mushroom dry matter. The ratio dry matter loss in the substrate/dry matter in the mushrooms would be 10. How he arrives at this ratio is his secret. This ratio is not based on experiments Kurtzman reports nor on data from the literature he refers to. This ratio and as a consequence Kurtzman's conclusions are as we shall see nonsense.

Let us look at data from experiments that show how dry matter loss in the substrate and dry matter in the harvested mushrooms are correlated. As an example I take data from experiments with *Agaricus bisporus*[2], the first break of cultures without watering of the casing soil (p. 280, Table 1). At spawning, 100 kg substrate/m^2 with 31.5% dry matter and 68.5% moisture contained 31.5 kg dry matter and 68.5 kg water. Day 20 after casing, 15.06 kg mushrooms/m^2 with 6.51% dry matter were harvested equal 0.98 kg dry matter and 14.08 kg water. After harvesting, there was 86.48 kg substrate/m^2 with 32.8% dry matter equal to 28.37 kg dry matter and 58.11 kg water. A dry matter loss of 3.13 kg in the substrate went with a dry matter gain of 0.98 kg in the mushrooms. The ratio dry matter loss in the substrate/dry matter in the mushrooms is 3.19 and not 10 as Kurtzman uses for his theory. The stoichiometric equation with real not fictitious data is 3.13 kg CH_2O (substrate) + 2.29 kg O_2 = 0.98 kg CH_2O (mushroom dry matter) + 1.29 kg H_2O + 3.15 kg CO_2. Only 1.29 kg metabolic water was formed. The 3.13 kg dry matter taken from the substrate held 6.81 kg water. 6.81 kg + 1.29 kg metabolic water = 8.1 kg water but the mushrooms contained 14.08 kg. The rest came from the casing soil and the substrate. For those interested in the casing soil's important contribution to the water supply of *Agaricus* fruit bodies read Kalberer[2,3]. The substrate moisture content decreased from 68.5% to 67.2%. If Kurtzman's theory were correct it would increase. To quote Kurtzman p. 28 "for *Agaricus*, we should have much more excess water".

Flegg[1] wrote on p. 243: "Metabolic water … contributed relatively little to the water balance. Dry matter losses in the compost from which metabolic water was calculated were on average about 16% of that present at casing". Data from Flegg's experiments: p. 239: crop yield 200-260 kg/t of compost, on p. 238 bottom: compost moisture content 65%, therefore, 1 t of

compost contained 350 kg of dry matter; the dry matter loss of 16% was 56 kg. On p. 245 bottom: mushroom dry matter was 10%; per t of substrate equal to 20-26 kg of mushroom dry matter. The ratio of dry matter loss in the substrate/dry matter in mushrooms was 56/23 = 2.4 which is far from Kurtzman's 10. In addition, Kurtzman neglected transpiration from fruit bodies and evaporation from substrate and casing. *Agaricus* cultivation is never done in an atmosphere of 100% humidity. Water losses by transpiration and evaporation are important.

An example with *Pleurotus* by R. Zhang *et al.*[5], p. 279, Table 1, Test 1: Substrate dry weight 173.9 g, substrate dry matter loss 32.3%, equal 56.2 g. Mushroom yield 158.6 g fruit bodies with 7.5% dry matter (p. 281), equal 11.9 g. Ratio dry matter loss substrate/dry matter mushrooms 56.2/11.9 = 4.7. This is still far from Kurtzman's 10. Like all other people in science Kurtzman should study the literature before he writes papers and he should do experiments to check his assumptions.

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