

Summary

The present investigation was designed to study the possibility of utilising a designated agro-waste after commercial mushroom cultivation (spent mushroom substrate – SMS) as a potential peat substitute in soilless strawberry production in an unheated plastic tunnel. The experiment was carried out for three years (2018-2020), studying the feasibility of fresh SMS's, i.e. A-SMS (white button mushroom – *Agaricus bisporus*), L-SMS (shiitake – *Lentinus edodes*) and P-SMS (oyster mushroom – *Pleurotus ostreatus*) as growing media substitutes in various combinations with peat. The selected chemical parameters of SMS based substrate combinations, and strawberry morphological, pomological, yield as well as selected physiological parameters among different substrate combinations (S2-S7) in comparison with peat (S1) were examined. During experiment 1 (2018) A-SMS was substituted to peat in 10 and 20% (v/v), while L-SMS and P-SMS were substituted in 25 and 50%. During the experiment 2 (2019) and 3 (2020) all SMS's, i.e. A-SMS, P-SMS and L-SMS were substituted to peat in 15 and 25%.

The results of chemical analysis over the period of the study (2018-2020) revealed that SMS's in whole (100%) did not exhibit ideal substrate characteristics, particularly concerning pH, EC and nutrient concentration values which in turn restricts their immediate use as a soilless substrate. Whereas, the prepared substrate combinations (S2-S7) based on A-SMS:Peat, L-SMS:Peat and P-SMS:Peat in various combinations during experiment 1 (2018), 2 (2019) and 3 (2020) revealed favourable chemical properties, exhibiting ideal substrate characteristics concerning pH, EC and nutrient concentrations. These results strongly demonstrated the possibilities of potential utilisation of fresh SMS as peat substitutes in lower concentrations (10-25%) for strawberry soilless production.

The strawberry performances concerning morphological, pomological and yield parameters among the studied substrate combinations (S2-S7) were observed to be superior and/or equal to the commercial peat (S1). The cv. 'Elsanta' was found to perform better when compared to cv. 'Honeoye'. Further, the measured Performance Indices (F_0 , F_m , F_v/F_0 and F_v/F_m) during the experiment 2 (2019) and 3 (2020) revealed that the strawberry plant photosynthetic performances were not altered and were not under abiotic stress influenced by varying chemical properties (pH, EC and nutrient concentrations) exhibited by prepared substrate combinations (S2-S7). These findings were also supported by Vegetation Indices (NDVI, PRI and MCARI) indicating normal and/or healthy vegetation of strawberry plants cultivated on SMS based substrate combinations (S2-S7).

Overall, the outcomes from the present investigation revealed potential possibilities of utilising fresh SMS as a sustainable and eco-friendly peat substitute in soilless culture, contributing towards peat/reduced and/or peat-free horticulture. Such easy, immediate and effective utilisation of a designated agro-waste (SMS) from mushroom enterprises can help to overcome disposal and environmental issues associated with improper handling of fresh SMS. At the same time, substituting peat with fresh SMS can partially reduce the dependency on an expensive and non-renewable natural resource such as peat and can decrease the production costs in soilless culture.

Potential use of agro-industrial and/or agro-wastes such as SMS can help to achieve a zero-waste crop cycle, to create sustainability and a transition to the circular economy.

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