Title Suppressiveness of steam-exploded biomass of *Miscanthus sinensis* var. *giganteus* against soil-borne plant pathogens

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Abstract

Commercial compost is a renewable resource widely used in horticulture as an organic amendment, though its suppression against soil-borne plant pathogens remains limited. Preliminary studies conducted on the disease suppression effect of the biomass waste obtained in a steam explosion plant demonstrated positive results. Steam-Exploded Biomass (SEB) of *Miscanthus sinensis* var. *giganteus*, a herbaceous perennial energy crop, is a multifunctional renewable energy resource, which could also be useful in crop protection to find valid alternative to the compost use in horticulture. The purpose of this work was to assess the suppressiveness of SEB against five plant pathogenic fungi that are important in many Italian horticultural cropping systems. Analyses of the microbial inhibitors (furfurals, organic acids and lignosulfonates) present in the SEB were performed by the High Performance Liquid Chromatography technique. Assessment of toxic effect of the furfurals present in the SEB (furfuraldehyde and 5-hydroxymethylfurfural), added to a growing medium at the different concentration ranges, was carried out *in vitro* on *Phytophthora nicotianae*, *Pythium ultimum*, *Fusarium oxysporum* f. sp. *lactucae*, *F. oxysporum* f. sp. *melonis* and *Rhizoctonia solani*. The suppressiveness of SEB, added to a potting soil used in horticulture at the different doses, was tested *in vivo* on tomato/*P. nicotianae*, cucumber/*P. ultimum*, lettuce/*F. oxysporum* f. sp. *lactucae*, melon/*F. oxysporum* f. sp. *melonis* and bean/*R. solani*. The results showed that furfuraldehyde, 5-hydroxymethylfurfural, lignosulfonates, acetic and formic acid were detected at a concentration of 2.93, 0.28, 4.12, 10.07 and 1.88 g/kg SEB, respectively. The *P. nicotianae*, *P. ultimum* and *R. solani* fungi were highly inhibited by the addition of 3.2 g/L furfuraldehyde and 0.48 g/L 5-hydroxymethylfurfural. Moreover, the inhibitory effect was found not adequate against *F. oxysporum* at the same concentrations. The SEB increased significantly the suppressiveness level of the peat substrate on *P. ultimum* in cucumber and *R. solani* in bean in all the trials. For *P. nicotianae* in tomato, the SEB addition showed a significant suppression at the 20 and 30% doses, but the change was not significant at the 10% dose. In case of *F. oxysporum* f. sp. *lactucae* in lettuce and *F. oxysporum* f. sp. *melonis* in melon, the SEB addition showed no suppressive effect with respect to compost in all the trials. In conclusion, the SEB could be used against some soil-borne fungal diseases in place of compost in the potting soil, and its suppressiveness could be related to the concentration of the microbial inhibitors produced during the processing of fresh biomass in the steam explosion plant.