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Resilience of soil microbial and nematode communities after biofumigant treatment with defatted seed meals

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The use of alternative biocidal compounds to replace chemical pesticides after the Directive 2009/128/EC has raised renewed interest in the biofumigation technique. In particular, the defatted seed meals (DSM) derived from brassicaceae plant tissues with high glucosinolate content represent an efficient practice to control soil-born plant pathogens and pests that can be applied in synergy to catch crop green manures. For a wider and safer application of this technique, the impacts on non-target soil microorganisms and free-living nematodes have to be investigated in more depth. In this pot-scale experiment a naturally nematode-infected soil was amended with a glucosinolate-containing DSM from Brassica carinata (CAR), a non-glucosinolate-containing DSM from sunflower (SUN) and the metham-sodium fumigant (VAP). Tomato plants were transplanted and checked for the presence of pests and/or pathogens and plant vigour. The response of soil microbial communities was assessed through 454-pyrosequencing analysis of bacterial 16S rRNA and fungal 18S rRNA genes, whereas nematode indices were applied to assess their community structure 0, 10, 32 and 62 days after the treatments. Significant shifts were observed among both bacterial and fungal communities, whereas various changes of nematode communities occurred depending on the nematode family. Similar changes initially occurred in both bacterial and fungal community structure in response to DSM and VAP amendments, but after 62 days fungal communities were more strongly shaped by VAP fumigation than bacteria. The non-biofumigant SUN treatment added organic matter into the soil inducing significant changes in microbial communities, but it was not effective against M. incognita root infestation. Although the free-living nematode structure was negatively influenced by all treatments, B. carinata DMS proved the best compromise between efficiency to control M. incognita and environmental impact. These results confirmed the interesting potential of biofumigant DSM amendments as alternatives to chemical fumigants for a more environment-friendly control of some soil-borne diseases.