Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01948, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01948
EGU General Assembly 2008

Chemical and biological changes occurring during prolonged curing of compost and their effect on suppressiveness against plant diseases.

S. Zmora-Nahum (1) M. Danon (2), Y. Hadar (2), **Y. Chen** (1)

(1) Dept of Soil and Water, Faculty of Agricultural, Food and Environmental Quality Sciences, Hebrew University of Jerusalem, Israel, (2) Dept of Plant Pathology and Microbiology, Faculty of Agricultural, Food and Environmental Quality Sciences, Hebrew University of Jerusalem, Israel

The suppression of soil-borne plant diseases by compost amendment of plant growth media (potting soil) has been extensively reported since the 1970's. A limited number of investigations have focused on the chemical properties of the compost or growth medium which support disease suppression, either directly, or by supporting the suppressive microbial population. Yet, the phenomenon of suppressive potting media has remained incidental, and the ability to predict the suppressiveness of a compost against a specific disease is still limited.

The aim of this study was to identify chemical properties which may serve as predictors of composts suppressiveness against plant disease, and, if possible, to tie these properties to the suppression mechanism. This research focused mainly on properties of the water soluble extract since the soluble phase is the most available to both the pathogen and its microbial antagonists. Therefore all interactions are mediated through these extracts.

Three types of commercial compost were collected and chemically characterized during their curing, and their suppressiveness against *Pythium aphanidermatum* in cucumber and *Sclerotium rolfsii* in beans was assessed. The composts were: (i) biosolids (BS) consisting of 1:1 v/v sewage sludge and yard waste; (ii) wheat straw and manure at a 1:2 v/v ratio (SM); and (iii) citrus peels and manure at a 1:1 ratio (PM).

To achieve our goals the curing process of the three compost types was monitored. It was found that the process was mainly reflected in the properties of the compost water extracts. As curing progressed, all composts exhibited a decrease in pH, in dissolved organic carbon (DOC) and ammonium concentration, and an increase in nitrate. Initial specific UV absorbances (ratio of absorbance at 254 nm : DOC) were lower than final ratios in each series. The most extreme changes were observed for the biosolids compost.

All three composts from all sampling dates exhibited suppression against *Pythium* when disease pressure was low. At high disease pressure the BS, SM and PM composts were more suppressive before curing than after. Due to high disease suppression and little differences between compost samples, no correlations could be established between suppression and chemical properties.

Sclerotia of *S. rolfsii* did not germinate and lost their viability on the three compost types, on samples from the beginning of the curing process. As curing progressed, the percentage of germinating sclerotia rose, as did their total viability. When examined for each compost separately, correlations were found between sclerotia germination and viability and the following traits: compost extract pH, ammonium, nitrate and DOC concentration, the amount and relative concentration of soluble sugars in the extract, and basal respiration. When data from the three series were analyzed together, correlations were much weaker. The highest correlation maintained was between ammonium and viability.

The Ascomycetes population in the biosolids compost, analyzed by DGGE, changed during curing, similarly to the changes in the chemical properties and suppression. The microbial population on the sclerotia which had been incubated on suppressive compost was not similar to the population in the bulk compost. An apparent enhancement of certain populations was observed on the surface of sclerotia which were placed on suppressive compost. In order to decouple the biological activity of the compost from its chemical activity, the direct effects of sterile compost extracts was examined.

Sclerotia placed on sterile compost extract from the first months of curing did not germinate. Their germination increased as curing progressed, from day 67 onwards. Germination was examined on buffered solutions mimicking the compost extracts. Germination was dependant on the combined effect of pH, buffer capacity and ammonium concentration in the solutions. A threshold ammonia concentration could be defined above which germination was totally inhibited. It is likely these factors affect germination in the compost bulk as well.

Sclerotia were inoculated with spores of antagonistic fungi and were incubated on compost extract. When challenged by opportunistic antagonists, with low colonization

ability, a higher percentage of sclerotia were attacked on extract which was inhibitory to sclerotia germination. Primary antagonists, on the other hand, colonized sclerotia even when the extract was not inhibitory to germination.

In summary, in order to benefit from the suppressiveness of composts, growers must find the time frame in which the compost is no longer phytotoxic, yet still potent in terms of suppressiveness. The effect of the compost may be direct, by changing the chemical conditions in the growth media in detriment of the pathogen, or by creating beneficial conditions for antagonist activity in the growth media. Where specific antagonists are involved in disease suppression, their interactions with the compost environment at different curing stages needs to be further investigated.