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Effect of four types of compost on strawberry plant health and productivity

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INTRODUCTION

California produces more than 86% of all fresh strawberries in the United States. Important to this success has been pre-plant fumigation with methyl bromide and chloropicrin for pest management, growth benefits and risk mitigation. As regulatory restrictions have limited availability of methyl bromide, soilborne diseases have become increasingly severe in all California production regions. Consequently, new strategies are urgently needed to provide more effective management of soilborne diseases.

Disease suppressive soils reduce the risk of disease by inhibiting the activity of plant pathogens. Disease suppression has been associated with a microbial community that differs in composition and abundance from what is found in a conducive soil. An objective of our research is to determine the extent to which the various types of compost available to strawberry growers may effect quantitative and qualitative changes in the soil microbiota, and contribute to disease suppression and/or growth benefits to strawberries.

COMPOST

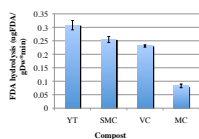
Compost is used by both conventional and organic strawberry growers, providing a source of nutrients, organic matter, and enhancing microbial diversity. Previous work demonstrates that amending soil with compost can contribute to disease suppression, but factors that influence the efficacy of compost have not been well characterized. We selected four commercial composts to evaluate for effects on plant health and disease suppression.



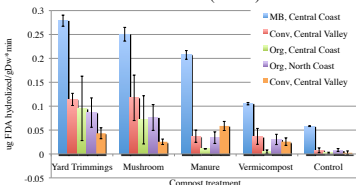
Material Name	Description of source material
Yard Trimmings Compost (YT)	100% Yard trimmings
Manure Compost (MC)	20% steer manure; 30-40% green waste fines 35-45% mix of waste and straw animal bedding
Vermicompost (VC)	100% Composted dairy manure + rice hull bedding fed to worms
Spent Mushroom Compost (SMC)	Composted horse manure + straw, amended with gypsum and peat post-decomposition



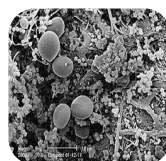
MICROBIAL ACTIVITY



High microbial activity is often associated with general disease suppression due to competition at the root for exudates and colonization sites. Microbial activity was quantified, based on hydrolysis of fluorescein diacetate, in 100% compost (left) and compost-amended field soil (below).



Microbial activity of four composts two weeks after incorporation into commercial strawberry field soil at 30T/A at five field locations (left). All composts increased microbial activity and the effect was consistent across field sites. MB, methyl bromide fumigated field; Conv, conventional production; Org, organic production.



COMPOST EVALUATIONS

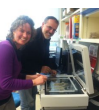


MICROBIAL DIVERSITY

Disease suppression and soil health are often related to both general and specific members of the soil microbial community. We will be evaluating the effect of four composts on the bacterial diversity and abundance in a commercial organic field and a methyl bromide fumigated field. Evaluations will be performed using bulk soil two weeks after compost incorporation and rhizosphere soil six months after incorporation.

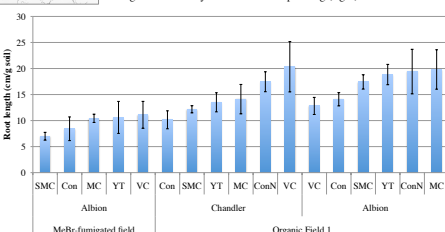


ROOT DEVELOPMENT



Plant productivity is strongly influenced by root and soil health. In non-fumigated soils, uneven growth and reduced productivity of a strawberry crop is associated with discolored roots. Compost is well-known for its contribution to soil health, but little is known about its effect on root development. Accordingly, it is an objective of our research to determine how different composts affect root health.

Preparing roots to be scanned (above, left) and resulting image of scanned roots (below, left). Range of strawberry crowns used for planting (right).



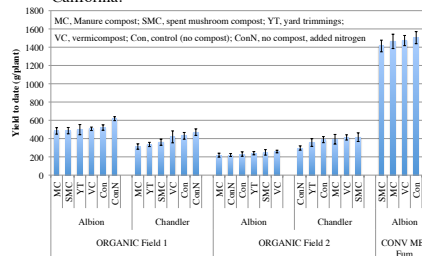
Total root length of strawberry cultivars Albion and Chandler at 7 months in methyl bromide fumigated and organic commercial fields amended with different composts (left).

YT-Yard trimmings, MC-Manure compost, SMC-Spent mushroom compost, VC-Vermicompost, ConN-No compost, added nitrogen, Con-No compost

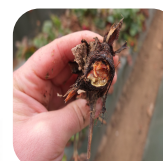
PLANT PRODUCTIVITY



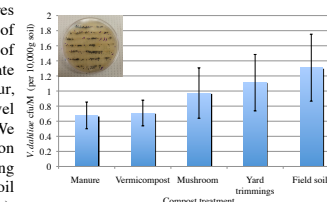
Results to date show that yield is affected by compost, but differently at each location. Vermicompost consistently produces a higher mean yield than other composts, although differences may not be significant. The yield of short-day variety Chandler is more affected by compost type than the day-neutral variety Albion, which is the most widely grown cultivar in California.



VERTICILLIUM DAHLIAE SUPPRESSION



An essential first step in development of *Verticillium* wilt, caused by *Verticillium dahliae*, is an infection of the root cortex. Most cortical infections fail to become systemic and therefore, measures that reduce the frequency of infection will reduce the risk of disease. In effect, lowering the rate at which cortical infections occur, increases the inoculum level required to cause disease. We evaluated the effect of compost on root infections by growing strawberries in infested potting soil amended with 20% compost (v/v), and quantifying the number of infections per unit root length.



Frequency of *V. dahliae* root infection in strawberries grown in soil amended with compost (above), determined by plating individual roots and counting infection sites (photo).

PYTHIUM ULTIMUM SUPPRESSION



Pythium ultimum is a contributor to the disease complex known as 'black root rot'. Black root rot is common in non-fumigated and organic fields, where it significantly reduces yields. Compost is well documented to have the capacity to suppress *P. ultimum*, yet effectiveness differs by compost type. We are evaluating the suppressive potential of four composts based on emergence and height of cucumber seedlings in *P. ultimum*-infested potting mix.

Potting soil amended with 20% compost sown with cucumber seeds after 7 days (photo). From left to right: vermicompost, control (potting mix only), yard trimming, manure and spent mushroom compost.

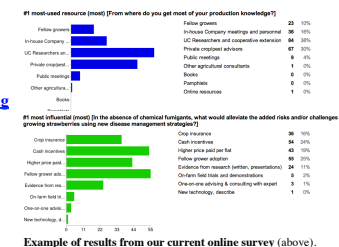
OUTREACH



The industry-wide shift in strawberry production generates a tremendous need for knowledge transfer and grower support. Accordingly, as a complement to the biological research, we are conducting a social network analysis and grower-identified needs assessment, to identify pathways of knowledge transfer among strawberry growers and to better understand grower perceptions of their goals, needs and management styles to best develop methyl bromide-alternative outreach.

Please visit our website
www.gordonlab.net/composting

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THANK YOU FOR YOUR INTEREST!