The Shift Out of Methyl Bromide and Pre-plant Fumigation: The Strawberry Case

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Background

Pre-plant fumigation with methyl bromide (MeBr) has provided essentially pathogen-free soil for strawberry production over the last four decades. Increasingly, growers are required to grow without MeBr because of the 1993 Montreal Protocol requiring 100% MeBr phase-out by 2005. Alternative fumigants are facing tightening restrictions in California as seen with township caps on application of Telone, VOC regulations, barrier film requirements, and expanding buffer zones within which no fumigants can be applied. Already, trends from 2011 describe heightened incidence of soilborne diseases affecting strawberry production.

The Pathogen: *Verticillium dahliae* The Disease: Verticillium Wilt

Description of Verticillium wilt on Strawberry

Early in disease development, the wilting leaves often occur only on one side of the plant. Without exception, the dead and dying foliage is restricted to the outer, older parts of crowns and the inner younger leaves remain symptomless.

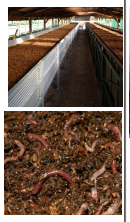
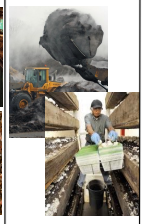
The internal crown tissue is likewise healthy in appearance and not discolored. In affected fields, symptomatic plants are randomly scattered throughout large sections of the planting.

Obj 1 Compost Explore disease-suppressive effects of compost

Can compost induce disease suppressive soil conditions?

Disease suppressive soil is a well-known phenomenon in which soilborne diseases fail to develop in spite of high infestation levels. Qualitative and quantitative changes in the soil microflora are generally regarded as the key suppressive mechanism. Some soils are naturally suppressive, however, suppressiveness can be induced by the addition of soil amendments such as compost. Previous work shows promise for managing Verticillium wilt with compost.

CHARACTERIZATION OF COMPOSTS

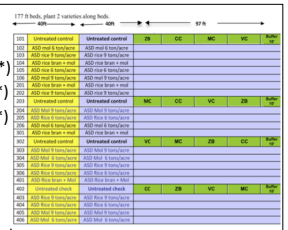
	Central Coast Compost *Gonzales, CA*	Sonoma Valley Worm Farm (Vermicompost) *Sonoma, CA*	Monterey Mushroom *Morgan Hill & Arroyo Grande, CA*	Z-Best *Gilroy, CA*
				
	20% steer manure 30-40% green waste fines 35-45% mix of: -Feed waste fr/ dairy cows -Straw bedding fr/ dairy stalls <5% vegetable waste	100% Composted dairy manure+ rice hull bedding fed to worms	Composted horse manure + straw Amended with gypsum and peat post-decomposition	100% Yard Trimmings
Nitrate-N* (mg/kg)	234	380	120	6.6
pH*	8.1	7.0	7.3	7.6
EC* (dS/m)	28	7.1	4.8	4.5
C:N*	12:1	13:1	14:1	17:1
Cost	$5/T	$500/YD	$3-5/T	$21/T
Application method	Broadcast	Apply to rootzone •In planting hole •In trench	Broadcast	Broadcast
OMRI approved	OMRI Listed	OMRI Listed	OMRI Listed	OMRI Listed

*Averages based on soil tests from a minimum of two batches

FIELD TRIAL, CENTRAL COAST, CA: Experimental Design

TREATMENTS	
Control (UTC)	10T/A Z-Best*
Central Coast Compos, CC	50T/A (+10T/A Z-Best*)
Z-best, ZB	50T/A (+10T/A Z-Best*)
Mushroom compost, MC	50T/A (+10T/A Z-Best*)
Vermicompost,VC	1cup in planting hole (+10T/A Z-Best*)

*All beds were amended with 10T/A of ZB compost
50T/A adds ¼" or less of material when broadcast applied



FIELD TRIAL, CENTRAL COAST, CA: Initial Yield Results

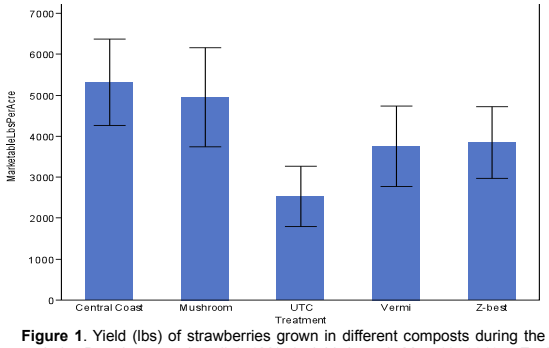


Figure 1. Yield (lbs) of strawberries grown in different composts during the early harvest period. Proprietary variety # 273M171 yield through May 11, 2013. Each error bar is constructed using 1 standard error from the mean. See above for treatment explanations.

FIELD TRIAL, CENTRAL COAST, CA: Initial Root Assays

Stunted

Healthy

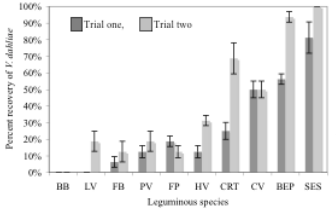
	Result
Phytophthora spp.	(-)
Pythium spp.	(+)
Rhizoctonia spp.	(-)

Pythium spp. were isolated from several plant roots.

Figure 2. Roots assayed from stunted plants

Obj 2 Rotation crops Establish host suitability of rotation crops

To what extent are rotation crops contributing to soil inoculum?
To which isolates of V. dahliae are these crops susceptible?



Fava bean
Bell bean
Purple vetch
Lana vetch
Hairy vetch
Common vetch
Field pea
Sesbania
Black-eyed pea
Crotalaria

Figure 3. Recovery of *Verticillium dahliae* from stems of ten leguminous crops grown in microsclerotia-infested potting mix, at low (A) and high (B) inoculum densities.

Rye, wheat, oats, triticale

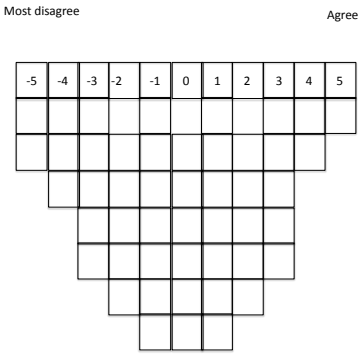
Other rotation crops

Radicchio, arugula, others?

Obj 3 Technology transfer Identify the priorities that motivate strawberry grower decisions, in order to focus technology development and design outreach that will lead to higher adoption rates.

The industry-wide shift in strawberry production generates a tremendous need for knowledge transfer and grower support. A social network analysis and grower-identified needs assessment will be employed 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 MB-alternative outreach.

Example of a Q-sort board used in Q-methodology.



Designed to study subjectivity, Q-method collects opinions from growers in response to broad questions that are summarized into a small set of statements, composing the Q-sort board. Next, 30-40 growers are asked to rank the set of statements on the board, forcing individuals to rank statements in relationship to each other.