MICROBIAL RHIZOSPHERE COLONIZERS OF STRAWBERRY AND THEIR EFFECT ON PLANT GROWTH

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The standard treatment for controlling root diseases in strawberry is broadcast fumigation with methyl bromide and chloropicrin prior to transplanting. With the loss of methyl bromide for fumigation looming at the end of the decade, a better understanding of specifically which pathogens are responsible for yield losses in the field will assist in developing effective control strategies. In addition, a more comprehensive understanding of the rhizosphere ecology of plants grown in fumigated compared to nonfumigated soils would be helpful not only for determining if deleterious rhizosphere colonizers contribute to yield reductions, but also for identification of beneficial rhizosphere microflora that might be capable of improving root health when plants are grown in nonfumigated soils.

Strawberry root pathogens

Aside from verticillium wilt, there are a number of other root pathogens that can contribute to reductions in strawberry plant growth and yield. A number of fungi described as pathogens of strawberry as well as other plants have been recovered from necrotic roots of strawberry plants grown in nonfumigated soils (with very few exceptions these fungi have not been recovered from plants grown in fumigated soil). The most common known pathogens recovered to date are in the genus *Pythium*. *Pythium ultimum* was the most prevalent species recovered, followed by an isolate that produces only spherical sporangia and approximately 10 other species that have yet to be classified to a species level. The isolates that produce spherical sporangia may be asexual isolates of P. *ultimum* or a heterothallic species such as P. *sylvaticum;* clarification of this is currently under evaluation using molecular markers and heterothallic tester isolates. Although members of this genus were most commonly isolated from necrotic feeder roots, significant numbers also have been recovered from structural roots. Additional fungi from the genus *Rhizoctonia, Fusarium,* and a number of other fungal genera have been recovered from necrotic roots as well. Greenhouse trials are in progress to evaluate isolate virulence and assess the influence of specific isolates (individually and in combination) on root health. Trials initially will be conducted with Selva, but subsequent evaluations with virulent isolates will be done with other cultivars as well to evaluate levels of plant resistance.

Rhizosphere microflora

Gaining an understanding of the population structure of rhizosphere colonizers and how they change throughout the season is imperative for development of strategies for controlling root diseases and improving root health. The current soil treatment with methyl bromide: chloropicrin can improve plant growth and yield even in the absence of known soilborne pathogens. One contributing factor in this may be alterations of specific rhizosphere microbial colonizers that influence root health. Dramatic differences are observed for fungal colonizers of healthy roots in

nonfumigated compared to fumigated soils. Not only are there differences in the diversity of fungal species recovered (roots from fumigated soils are colonized by a much smaller number of species compared to roots from plants grown in nonfumigated soils), but also the extent of colonization by specific fungal species varies. This is especially apparent for one particular fungal colonizer (a Trichoderma species); it is recovered in a low frequency on roots from nonfumigated soils in the Watsonville area but is found colonizing a high percentage of the root length of plants grown in fumigated soil (a qualitative assessment of approximately 60-70% root colonization). While this species also is present on roots of plants grown in fumigated soils in Santa Maria and Salinas, in these locations other fungal species are the predominant colonizers.

Distinct differences in the numbers and types of rhizosphere and rhizoplane bacterial and actinomycete colonizers also have been observed for roots recovered from plants grown in fumigated and nonfumigated soils. This includes not just fluorescent pseudomonads, (roots recovered from fumigated soil are colonized by a larger number of isolates compared to roots recovered from plants grown in nonfumigated soil) but also a number of other bacteria and actinomycetes. These populations are not static throughout the growing season, but rather vary as the season progresses.

Trial is in progress to evaluate the influence of specific rhizosphere/rhizoplane colonizers on root health, plant growth, and yield. Greenhouse/growth chamber evaluations are done using disease free plantlets inoculated with individual isolates after transplanting. Plants are grown for four weeks, after which plant growth parameters are assessed . Initial trials have identified several isolates that appear to have either beneficial or detrimental effects on plant growth (Table 1). Field trials to evaluate the effects of specific isolates on plant growth and yield are in progress, the results of which will be discussed.

Table 1. Effect of microbial inoculants on strawberry plant growth in autoclaved soil following 4 weeks incubation in a growth chamber set with diurnal temperature fluctuations of 20° and 10° C.

	% Difference from Control Treatment	
Isolate	TOD Growth	Root Growth
13	22.9*	46.1*
14	12.1	-2.4
15	8.2	-26.0*
16	25.5*	6.9
17	30.2*	8.2
18	41.0*	44.1*
19	39.1 *	40.6*

*Differences from the untreated control treatment are significant (P<0.05).