Abstract: Soil contains significant populations of microorganisms with the ability to attack or suppress plant pathogenic fungi (1, 2). Fungistasis has been shown to be strongest in soils with high organic matter content and microbial activity, and soil bacteria have been implicated as the major cause of such fungistasis (2). Disease suppressive soils capable of controlling plant pathogens have been reported for a number of crops (1, 3, 4, 5) but this aspect of natural biocontrol has not yet been investigated in viticulture. Soil microbial communities with high population and diversity are likely to have a larger number of candidates with the ability to compete with pathogens and to be disease suppressive (1). This study investigated the effect of mulch and organic matter from herbicide treated weeds (6) on the populations of vineyard soil bacteria and actinomycetes able to suppress grapevine fungal root pathogens \textit{in vitro}.

Author Address: mweckert@csu.edu.au

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IN VITRO INHIBITION OF GRAPEVINE ROOT PATHOGENS BY VINEYARD SOIL BACTERIA AND ACTINOMYCETES

M. A. Whitelaw-Weckert

National Wine and Grape Industry Centre, Charles Sturt University, Locked Bag 588, Wagga Wagga, NSW, 2678

INTRODUCTION

Soil contains significant populations of microorganisms with the ability to attack or suppress plant pathogenic fungi (1, 2). Fungistasis has been shown to be strongest in soils with high organic matter content and microbial activity, and soil bacteria have been implicated as the major cause of such fungistasis (2). Disease suppressive soils capable of controlling plant pathogens have been reported for a number of crops (1, 3, 4, 5) but this aspect of natural biocontrol has not yet been investigated in viticulture.

Soil microbial communities with high population and diversity are likely to have a larger number of candidates with the ability to compete with pathogens and to be disease suppressive (1). This study investigated the effect of mulch and organic matter from herbicide treated weeds (6) on the populations of vineyard soil bacteria and actinomycetes able to suppress grapevine fungal root pathogens in vitro.

MATERIALS AND METHODS

Vineyard field trial The trial site was located within the Charles Sturt University vineyard (Vitis vinifera cv. Chardonnay) at Wagga Wagga, NSW. There were four replicates of three treatments simulating three different approaches to floor management: herbicide spray under-vine only; herbicide both under-vine and inter-row; and slash only (no herbicides applied). Soil cores (60mm diameter) were collected from the undervine region (30cm from vine trunk) and inter-row region (50cm from trunk) from the upper 10cm of soil in February 2002, seven months after the first herbicide application (post-emergent ‘knockdown’ herbicide glufosinate ammonium). In order to isolate only microorganisms resilient to dessication (7) the samples were maintained as intact soil cores in tissue culture tubes (height 15cm, diameter 6cm), air dried at 35°C for 11 days and then rewetted. After 46 days, representative soil cores were obtained. These soil samples were vortex mixed for 10s, sonicated at 260W/cm² for 15 s and orbitally shaken for 15 min and then obtained. These soil samples were vortex mixed for 10s, sonicated at 260W/cm² for 15 s and orbitally shaken for 15 min.

Soil microbial communities with high population and diversity are likely to have a larger number of candidates with the ability to compete with pathogens and to be disease suppressive (1). This study investigated the effect of mulch and organic matter from herbicide treated weeds (6) on the populations of vineyard soil bacteria and actinomycetes able to suppress grapevine fungal root pathogens in vitro.

RESULTS AND DISCUSSION

70% of the bacteria and actinomycetes from the herbicideed inter-row treatment were inhibitory to Cylindrocarpon destructans, whilst only 11% of the isolates from the other treatments were inhibitory. From the 0.01NA-B soil dilution plate counts, it was estimated that the culturable soil population able to inhibit C. destructans was around 7 times higher (P < 0.001) for the inter-row treatment that had received herbicide than for the other treatments (Figure 1). This may have been due to the action of the herbicide on the developed weed coverage, resulting in a mulch of plant residue to protect the soil surface and to serve as a readily degradable carbon source (6).

There was also a trend (non-statistically significant) towards a higher population of microbes suppressive towards Fusarium oxysporum (250% increase, P = 0.996) but not towards Pythium irregulare (P = 0.922).

The C. destructans data (Figure 1) indicate that fluctuations in soil organic matter may result in changes to the populations of bacteria and actinomycetes able to produce antibiotics with activity against some root pathogens. However, there are risks in extrapolating from in vitro antibiotic production to the ability to suppress pathogens in soil (2). Future work will investigate the ability of these microbes to suppress a number of grapevine root diseases in pot and field trials. The effect of both mulch and organic carbon will also be investigated more fully.

**Figure 1:** Soil bacteria and actinomycetes able to inhibit *Cylindrocarpon destructans in vitro*. Error bars = 1 SE
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