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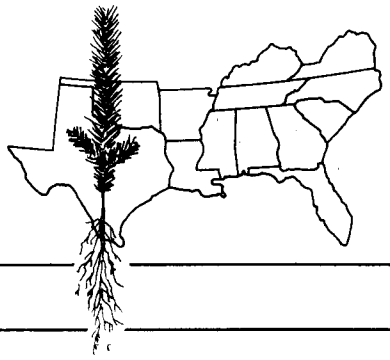

RESEARCH REPORT 96-4

Efficacy of soluble silicon against the foliar pathogen *Cronartium quercum* f.sp. *fusiforme*

by
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INTRODUCTION

Although silica is one of the most abundant elements on the surface of the earth, little is known concerning its affect on plant growth. For some plant species silica appears to be a minor element used in the formation of cell walls while for some species, silica is not required for growth. Studies have reported that nutrient solutions amended with as little as 100 PPM of SiO_2 resulted in Si-treated cucumber and rose remaining free of powdery-mildew (*Sphaerotheca fuliginea*) and root rots caused by the fungi *Pythium aphanidermatum* and *Fusarium oxysporum*. Interestingly, extracts from the common horsetail (*Equisetum arvense* L.), a species with over 15% of its dry weight composed of silica, have been applied as a drench to protect crops against plant pathogens by gardeners for centuries. This research seeks to determine if the use of soluble silicon can reduce infection by *Cronartium quercuum* f.sp. *fusiforme*. If effective against rust, nursery managers may have another method to minimize the losses due to this disease.

METHODOLOGY

Loblolly pine seeds were sown in containers in a defined potting media. Various levels (0-4000 PPM) of soluble silicon were applied to seedlings as a foliar application four weeks after sowing and 14 and 7 days prior to inoculation. After treating the seedings, they were delivered to the USDA Forest Service fusiform rust screening center in Asheville, North Carolina, where the seedlings were exposed to the fungal pathogen under uniform disease inducing conditions. Included in the silicon treatments was the standard fungicide treatment (Bayleton®) as a control. The effectiveness of silicon treatments against fusiform rust was determined by counting the number of galls formed on seedling stems 6 months after inoculation. Seedling dry weights were also determined to determine if treatments had any affect on seedling growth.

RESULTS

Based on these trials, the use of silicon as a protectant against fusiform rust is not as effective as Bayleton. The percent infection ranged from the lowest at 18% on the Bayleton® treated seedlings to 40% on those seedlings receiving no silicon treatment (0 ppm) Table 1. While a few silicon treatments had infection levels near that of the Bayleton® (50 ppm @ 23%), the amount of infection was not significantly less than those seedlings that received no silicon (0 ppm).

Table 1. Percent of loblolly seedlings with infection (galls), healthy (no galls), mortality and seedling dry weights 6 months after inoculation with *Cronartium quercuum* f.sp. *fusiforme*

Treatment	Infection (%)	Healthy (%)	Mortality (%)	Dry weights (g)
Bayleton®	18.1	79.9	2.0	39.7
0 ppm	40.4	58.6	1.0	44.0
50 ppm	23.3	75.7	1.0	39.4
100 ppm	37.0	63.0	0.0	41.9
200 ppm	25.0	75.0	0.0	39.7
400 ppm	40.1	58.9	1.0	42.2
500 ppm	38.7	59.3	2.0	43.1
1000 ppm	31.6	66.4	2.0	38.8
2000 ppm	37.7	59.3	3.0	44.9
4000 ppm	34.4	64.6	1.0	45.8

There is some indication in other studies that soluble silicon acts as a "fertilizer" and thus increases plant growth. However, there was no affect of the treatments on seedling growth as measured by dry weights. These ranged from 38-45 grams per seedling and approximately 20-25 cm in height. Overall the total seedling dry weights were larger than would be expected in the containers that held them. This was attributed to "extra special" care by the USDA Rust Screening personal who maintained the seedlings over the summer.

MANAGEMENT IMPLICATIONS

Although soluble silicon has been shown to be a cost effective alternative to insecticides on some plant species, we were not able to duplicate this effectiveness for rust control on Loblolly pine seedlings. The experiment will be repeated a second time to obtain a second year's data. Nurserymen cannot look to soluble silica as a substitute for insecticides at this point.