2004 Northeast IPM Project
Progress Report

A. Grant Data

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Title: **Validation and Implementation of a Weather-based Spray Advisory for Spinach**
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B. Non-technical Summary

Spinach (Spinacia oleracea L.) is an important crop grown for the fresh and processing markets in Maryland and Delaware, where acreage has increased in the past ten years. Together Maryland and Delaware constitute the fourth leading spinach producing area in the U.S., with 2700 acres produced in Maryland alone; New Jersey and Virginia also have large acreages. A spinach stakeholders meeting was held in Milford, Delaware on December 13, 2002. White rust (Albugo occidentalis G. W. Wils.) was cited as the most prevalent, and difficult to control, disease. There was near unanimous interest in adaptation of a weather-based fungicide application model for management of spinach white rust.
A fungicide-application model based on the relationship between the environment and white rust on spinach was developed in Oklahoma. Our goal is to test this model and adapt it for use in the mid-Atlantic region. The overall objective of this project is to assist growers in adopting a weather-based fungicide application model for spinach through an improved understanding of i) presence and extent of over-wintering oopsore inoculum, ii) identification of the optimum time to initiate fungicide applications, and iii) identification of fungicides or bio-fungicides that can be successfully used with a weather-based fungicide application model.

C. Introduction

Spinach is an important crop grown for the fresh and processing markets in Maryland and Delaware. White rust is consistently identified as a priority concern of growers in Maryland and Delaware and throughout the mid-Atlantic region. Growers have repeatedly requested the development of a white rust prediction system.

Crop rotation is used on most of the spinach acreage in the U.S.; however, rotation alone is not adequate to control white rust. Recently cultivars that have moderate levels of resistance to white rust, and with fair agronomic characteristics, have been developed. A cultivar with moderate resistance to white rust “Vancouver” is now grown on limited acreage in Maryland and Delaware, and other moderately resistant cultivars are currently in University trials. However, Vancouver has “semi-savoy” leaf type, which limits how much can be used for the processing market. In addition, fungicide applications are necessary on moderately resistant cultivars to limit the incidence of white rust lesions that reduce leaf quality. Despite widespread crop rotation and limited use of host resistance, fungicide usage is very high on spinach in order to control white rust. Azoxystrobin, copper, mefenoxam and fosetyl-Al are used to control foliar diseases on U.S. acreage. Recently registered fungicides such as acibenzolar-S-methyl and pyraclostrobin may be highly effective, reduced-risk alternatives. Losses due to white rust persist due to poor timing of fungicide applications and newly registered fungicides need to be evaluated under different application timing.

Fungicide applications may be reduced without incurring yield or quality loss in some environments and on some cultivars. As the acreage of cultivars with moderate resistance increases, fungicide usage may be further reduced. The ability to schedule fungicide applications to coincide with periods of environmental conditions conducive to disease, would reduce application frequency and/or increase the efficacy of each application. A fungicide-application model based on the relationship between the environment and white rust on spinach was developed in Oklahoma (Sullivan, et al. Plant Disease 87:923-928). Temperature during periods of leaf wetness were used to time fungicide applications. This model was adapted and preliminary tests were conducted in the mid-Atlantic. Preliminary results indicate that the model may improve timing of fungicides and that the model would improve economic return for Maryland, Delaware, New Jersey and Virginia growers through reductions in disease incidence and therefore quality loss.

However, despite preliminary success with the model, we concluded that initiation of the model through scouting was not adequate to effectively manage white rust. Control of white rust is also impeded because little information exits on the importance of oospores as initial inoculum, and the optimum time to initiate fungicide applications. Our preliminary trials examining the model have clearly demonstrated that, although the model may result in better fungicide timing, delaying initial applications until disease is observed often results in unacceptable losses due to presumed oospore infections.

D. Objectives

Objective 1) Survey fields for the presence of oospores and determine their role as initial inoculum in epidemics. Oospores are not commonly observed in the mid-Atlantic region. Understanding when oopspores occur would assist in development of biologically based disease management strategies for white rust throughout the region.

Objective 2) Determine optimum time to initiate weather-based fungicide application model for management of white rust of spinach. Preliminary trials of the weather-based fungicide application model initiated at first sign of disease did not adequately manage white rust. Here we will test the initiation of the model prior to disease onset.

Objective 3) Evaluate reduced risk fungicides and biofungicides for management of white rust on spinach when scheduled according to the weather-based fungicide application model. Several products have recently been registered or are undergoing research or registration through the IR-4 program.

E. Approach

An experiment was conducted to examine the optimum time to initiate fungicide applications on fields where no, low, or a high rate of mefenoxam was applied. The main factor in the factorial experiment was mefenoxam rate (none, 1 pt/A or 2 pt/A). The subplots received one of four fungicide schedules (weekly applications initiated at first sign of disease, applications according to the model initiated at first sign of disease, weekly applications initiated three weeks after emergence, or applications initiated and applied according to the model). A second experiment evaluated seven reduced-risk fungicides or biofungicides, a grower standard treatment, and no treatment. The treatments were arranged in a randomized complete block design with four replicates.

F. Progress

Spinach was planted at University of Maryland's Lower Eastern Shore Research and Education Center (UM-LESREC), Salisbury, on 7 Sep 2004. Spinach also was planted at the UM-Wye Research and Education Center (UM-WREC), Queenstown, on 8 Sep 2004. Emergence and stand development were good at both locations. White rust disease development was low at UM-LESREC and no white rust developed at UM-WREC. Phytotoxicity occurred in treatments that included copper hydroxide. The experiments are being repeated at the same locations in fall 2005.