Downy Mildew of Broccoli - Promising New Fungicides for Disease Control

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ABSTRACT

Downy mildew of broccoli, caused by the fungus Peronospora parasitica, is a perennial disease problem affecting winter broccoli production in Arizona. During 1985-87, potential systemic fungicides were evaluated in the field for disease control. In the 1985-86 season, a period of high disease incidence, lesion development was significantly reduced by fosetyl-Al (44%), phosphorous acid (42%), oxadixyl + mancozeb (35%), chlorothalonil (33%), metalaxyl + mancozeb (30%) and metalaxyl + chlorothalonil (28%). During the 1986-87 growing season, disease incidence was low and lesion development was significantly reduced by phosphorous acid (82%), fosetyl-Al or oxadixyl + chlorothalonil (77%), metalaxyl + chlorothalonil (68%) and chlorothalonil (54%). Fosetyl-Al, phosphorous acid and oxadixyl were as effective as currently available fungicides (metalaxyl and chlorothalonil) for control of downy mildew of broccoli in Arizona.

INTRODUCTION

Downy mildew of broccoli, caused by the fungus Peronospora parasitica, is a yearly disease problem affecting winter broccoli production in Arizona. Disease incidence and severity is greatly influenced by environmental conditions. Cool damp weather with high humidity and air movement favor sporulation, dissemination and infection by this fungal pathogen.

The systemic fungicide metalaxyl (Ridomil) is highly effective in controlling downy mildew of broccoli (2). However, constant use of this material for disease control could result in the development of resistance to metalaxyl by Peronospora parasitica. The purpose of this research is to evaluate new systemic fungicides for control of downy mildew. The more fungicides available for disease control, the less dependent growers become upon the success or failure of a single compound.

MATERIALS AND METHODS

During 1985-87, test plots were established at the Yuma Valley Agricultural Center. The broccoli cultivar 'Emperor' was used in all tests, as it is known to be susceptible to P. parasitica (1). Fungicide treatments included metalaxyl + mancozeb, metalaxyl + chlorothalonil, fosetyl-Al (Aliette), oxadixyl + mancozeb, oxadixl + chlorothalonil, phosphorous acid (H_3PO_3) and chlorothalonil (Bravo). Foliar sprays of each fungicide were applied at 14-21 day intervals. Disease severity was determined by counting downy mildew lesions on one leaf from each of 40 randomly selected plants within each treatment. All leaves collected were of similar age.

RESULTS AND DISCUSSION

The results of these field tests are summarized in Tables 1 and 2. The percent inhibition of lesion development on leaves was determined by comparing the lesion count on leaves treated with fungicides to the lesion count on the untreated leaves.

Table 1. Effect of fungicide treatments on development of downy mildew on broccoli (1985-86 field trial)

Treatment	Rate of product per acre	Percent inhibition of lesion development on leaves
Untreated	--	0 a[z]
Metalaxyl + mancozeb	2.0 lb	30 bc
Metalaxyl + chlorothalonil	2.0 lb	28 bc
Fosetyl-Al	2.0 lb	39 c
Fosetyl-Al	4.0 lb	44 c
Oxadixyl + mancozeb	2.5 lb	35 c
Chlorothalonil	2.25 pints	33 c
Phosphorous acid	2.1 lb	42 c

[z] Values followed by the same letter are not significantly different at the 5% probability level according to Duncan's Multiple Range Test.

Table 2. Effect of fungicide treatments on development of downy mildew on broccoli (1986-87 field trial)

Treatment	Rate of product per acre	Percent inhibition of lesion development on leaves
Untreated	--	0 a[z]
Metalaxyl + chlorothalonil	2.0 lb	68 b
Chlorothalonil	2.25 pints	54 b
Oxadixyl + chlorothalonil	2.0 lb	77 b
Fosetyl-Al	2.5 lb	68 b
Fosetyl-Al	5.0 lb	77 b
Phosphorous acid	2.1 lb	82 c

[z] Values followed by the same letter are not significantly different at the 5% probability level according to Duncan's Multiple Range Test.

In both trials, all test fungicides significantly reduced disease levels. The 1985-86 season was a period of high disease incidence, while 1986-87 was a time of low disease levels. This fluctuation in severity of downy mildew results from differences in the duration of cool, wet periods encountered from year to year.

During the period of high disease pressure (1985-86), the levels of disease control were much lower than those achieved during the period of low disease incidence (1986-87). This is caused in part by our experimental design, where untreated border rows surround each treatment block. High levels of disease in the untreated border rows subject the treatment blocks to tremendous quantities of spores. If the entire field was treated, the actual level of disease control would be substantially higher.

Significant differences in yield were not detected in these tests, as downy mildew appeared late in the season. If young broccoli plants become infected, yield could be adversely affected.

The equivalent activity of fosetyl-Al and phosphorous acid is consistent with research suggesting that fosetyl-Al is degraded to phosphorous acid in plant tissue (3). Protectant fungicides, such as mancozeb and chlorothalonil, are applied along with the systemic material to reduce the development of resistance to the systemic fungicide by P. parasitica.

The results of these tests show that fosetyl-Al, phosphorous acid and oxadixyl were as effective as currently available materials (metalaxyl and chlorothalonil) for control of downy mildew of broccoli in Arizona.

REFERENCES

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