ARIZONA ICEBERG LETTUCE RESEARCH COUNCIL

FINAL REPORT

Project title: Effective management of powdery mildew on lettuce.

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INTRODUCTION

The Arizona Iceberg Lettuce Research Council conducted a survey of Arizona iceberg lettuce producers to identify research priorities. Among 10 different areas of research, Disease Control and Management received the largest number of high priority votes. Within this area of research, powdery mildew received the largest number of high + medium priority votes among 13 different disease categories.

Powdery mildew on lettuce is caused by the fungus *Golovinomyces cichoracearum*. This pathogen is an obligate parasite, which means that it can only grow and reproduce on living plant tissue. *Golovinomyces cichoracearum* can cause powdery mildew on crisphead, romaine, and leaf lettuce types. The disease usually is first observed in late January as small discrete white colonies on the top or bottom of older leaves. These colonies continue to grow and can eventually merge together to cover the surface of infected leaves. Powdery mildew develops at first on the older leaves at the base of infected plants, followed by infections and growth on younger leaves. Yield loss is dependent on the degree of disease development at harvest as well as the portion of the plant that will actually be harvested. Powdery mildew is most likely to cause losses on lettuce harvested from February to the end of the harvest season, as environmental factors are usually most favorable for rapid disease development at this time.

Management of powdery mildew on lettuce and on other crops is reliant on fungicides and genetic resistance if available. The importance of powdery mildew to Arizona iceberg lettuce producers as identified by a research priority survey suggests that the currently available fungicides and genetic disease resistance are not satisfactory for widespread effective management of powdery mildew. The specific objectives of this research project were to 1) evaluate and compare existing and new fungicides in development for their efficacy in controlling powdery mildew on iceberg lettuce and 2) to evaluate some commercial varieties of iceberg lettuce planted for harvest from February to the end of the production season for their relative susceptibility to the disease.

MATERIALS AND METHODS

Fungicide evaluation. This study was conducted at the Yuma Valley Agricultural Center. The soil was a silty clay loam (7-56-37 sand-silt-clay, pH 7.2, O.M. 0.7%). Lettuce 'Winterhaven' was seeded, then sprinkler-irrigated to germinate seed on Nov 7, 2012 on double rows 12 in. apart on beds with 40 in. between bed centers. All other water was supplied by furrow irrigations or rainfall. Treatments were replicated five times in a randomized complete block design. Each replicate consisted of 25 ft of bed, which contained two 25 ft rows of lettuce. Plants were thinned Dec 6 at the 3-4 leaf stage to a 12 in. spacing. Treatment beds were separated by single nontreated beds. Treatments were applied with a tractor-mounted boom sprayer that delivered 50 gal/acre at 100 psi to flat-fan nozzles spaced 12 in. apart. Depending on the treatment, foliar applications of treatments were made Jan 23, 31, Feb 7 and 18, 2013. Powdery mildew (caused by *Golovinomyces cichoracearum*) was first observed in plots on Feb 7, when the third application of products was made. Maximum and minimum ranges (EF) of air temperature were

as follows: Dec, 2012, 60-84, 34-53; Jan, 2013, 50-79, 31-58; Feb, 60-81, 33-55. Maximum and minimum ranges (%) for relative humidity were as follows: Dec 2012, 62-98, 14-50; Jan 2013, 27-99, 8-77; Feb, 21-98, 7-28. Monthly rainfall in inches was as follows: Dec, 0.49; Jan, 0.92; Feb, 0.01. The severity of powdery mildew was determined Mar 1 by rating 10 plants within each of the five replicate plots per treatment using the following rating system: 0 = no powdery mildew present; 1 = powdery mildew present on bottom leaves of plant; 2 = powdery mildew present on bottom leaves and lower wrapper leaves; 3 = powdery mildew present on bottom leaves and all wrapper leaves; 4 = powdery mildew present on bottom leaves, wrapper leaves and cap leaf; 5 = powdery mildew present on entire head. Yield loss due to rejected lettuce heads would normally begin to occur on plants with a rating above 2.0.

Iceberg lettuce variety evaluation. A lettuce planting was established on Nov 6, 2013 consisting of plots of the same size and number of replicates as noted for the fungicide evaluation study. Iceberg varieties in this trial included Coyote, Eblin, Grizzly, Synergene 352, Top Billings, Vandenberg, Winter King, and Winterselect. Ten plants per replicate plot were rated for powdery mildew severity on Mar 5, 2014 using the same disease rating scale described above.

RESULTS AND DISCUSSION

Fungicide evaluation. The data in Table 1 illustrate the degree of control of powdery mildew obtained by applications of the various materials tested in this trial. All treatments significantly reduced powdery mildew compared to nontreated plants; however, some treatments were highly efficacious, reducing disease from 92 to 100%. No phytotoxicity symptoms were noted for any of the products.

Table 1. Effectiveness of tested products in controlling powdery mildew on lettuce

Treatment [y]	Rate of product per acre	Mean disease rating [z]
BAS 700	9.1 fl oz	0
IKF-309	4.0 fl oz	0
IKF-5411	10.0 fl oz	0
Merivon	6.0 fl oz	0
Microthiol Disperss	10.0 lb	0
Quintec	5.0 fl oz	0.1
Rally	5.0 oz	0.1
Torino	3.4 fl oz	0.2
Fontelis	16.0 fl oz	0.3
Fracture alternated with Quadris	24.4 fl oz /15.4 fl oz	1.2
CX-10440	3.75 fl oz	1.2
Quadris	15.4 fl oz	1.3
Fracture + Quadris	24.4 fl oz + 12.3 fl oz	2.1
Fracture	24.4 fl oz	2.1
Nontreated control	-------	3.9
LSD (Least Significant Difference, *P* = 0.05)		**0.2**

[y] All treatment except Torino were applied Jan 23, 31, Feb 7 and 18, 2013. Torino was applied Jan 23 and Feb 7.

[z] Mean disease rating for 10 plants from each of the five replicate plots per treatment. Treatments differing by the LSD value (0.2) are significantly different from each other.

Several fungicides provided excellent control of powdery mildew. Most of the tested products were conventional fungicides, many now registered and some in development for use on lettuce. Two tested materials, CX-10440 and Fracture, are biofungicides. The effective products represent some different modes of action, which when used in disease management programs will help reduce the development of resistance to these materials within populations of the lettuce powdery mildew pathogen.

Iceberg lettuce variety evaluation. There were no significant differences in the final severity of powdery mildew among tested iceberg lettuce varieties (Table 2). It is unfortunate that differences in susceptibility to powdery mildew were not detected. These results suggest that successful management of powdery mildew on lettuce is highly reliant on initiation of a fungicide application program before the disease gains a foothold in a lettuce planting.

Table 2. Powdery mildew severity on different iceberg lettuce varieties[z]

Lettuce variety	Mean disease rating
Vandenberg	4.0
Coyote	4.1
Winter King	4.2
Grizzly	4.2
Synergene 352	4.2
Eblin	4.2
Top Billings	4.2
Winterselect	4.3

[z] There was no significant difference in powdery mildew severity among tested lettuce varieties