Bio-Intensive IPM Disease Management

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Traditional approaches of managing foliar diseases on potato in Wisconsin have focused on crop rotation, a balanced fertility program, careful irrigation and weekly application of fungicide sprays. The potato cultivars grown in Wisconsin are susceptible to both early and late blight so cultivar resistance to foliar pathogens provides little assistance in the overall management program. Twenty years ago many growers initiated their fungicide programs at emergence and continued to spray until vinekill. In the past twenty years we have seen large changes in how we manage disease. Beginning in 1979, growers began adopting pest management practices that fundamentally changed their approach to disease management. These changes included crop monitoring by professional IPM scouts, in-canopy monitoring of weather data for use in disease prediction software, the use of treatment thresholds (18 severity values for late blight and 300 P-Days for early blight) to initiate fungicide sprays and the use of computer software to adjust spray programs according to crop and weather conditions. Benefits of this approach included reductions in the number of fungicide sprays applied in most years, improved disease control with fewer fungicide inputs and cost savings. In recent years we have observed the arrival of new strains of the late blight fungus such as US#8 and changes in weather patterns that include prolonged wet and cool periods during the early season months of May, June and July. As a result and in response to changing weather and crop conditions, fungicide spraying now begins well before row close. The number of seasonal sprays has crept upwards and disease management costs have soared. These increased costs are justified in light of localized outbreaks of late blight and the associated risk to tuber quality and storability. Wisconsin is not alone in seeing disease control costs rise in recent years.

Increasing the intensity of fungicide treatments raises concerns about the amount of pesticides used in the production of this valuable and nutritious crop. Some would ask whether there are ways the industry could reduce the amount of fungicide inputs while maintaining an acceptable level of control. A large proportion of our research program is aimed at reducing the risk of diseases, improving control, reducing inputs and reducing the cost of disease management programs. The Food Quality Protection Act (FQPA) serves as a stimulus to reexamine our pest control recommendations and to move us toward the goal of replacing "high risk" recommendations with "lower or reduced risk" alternatives. The recent registrations of "reduced risk fungicides" such as azoxystrobin offer the potential for improved levels of disease control with greatly reduced amounts of fungicide active ingredients. Our positive statewide experience in 1998 with an Experimental Use Permit (EUP) for Quadris (azoxystrobin) fungicide paved the way for a national Section 3 label for Quadris in 1999. This new label allowed growers to achieve superior control of early blight and good control of late blight with substantially reduced use of fungicide ai.

During 1999, a major focus in our on-farm demonstration projects was to determine how the use of Quadris fungicide fit into "Bio-Intensive IPM Programs" within the settings of commercial production. The projects utilized four basic approaches to managing early and late blight. These included 1) intensive crop scouting from emergence to vinekill, 2) intensive monitoring of weather conditions within the plant canopy, 3) use of this weather information in disease forecasting models to initiate and schedule fungicide sprays, and 4) use of "reduced risk" fungicides compared with standard fungicides in a season-long program to control both early and late blight. At the conclusion of the growing season, samples were collected for yield and size grading and the effects of treatment on crop values were calculated.
Plot Design:

Each plot was designed as long replicated strips (40 rows wide - Wallendal Supply Inc. and 48 rows wide - Coloma Farms Inc.) through commercial fields. A minimum of three replications of each treatment was used at each field location. Treatments were initiated at either 18 severity values (mid-June) and continued weekly through vinekill. The arrangement of experimental plots is shown in Figure 1 and Figure 2. Disease severity data were collected weekly at each site and an area under the disease progress curve was calculated for each treatment at each location. Yield data were collected at harvest and subsamples were taken to the Hancock Agricultural Research Station for size grading.

Wallendal Supply Inc.

Field: Cline East (65 A)
Var. Snowden
No Admire

Field: Silver Valley North (65 A)
Var. Snowden
Admire

3 Treatments x 3 Reps = 9 Strips
40 rows / strip

1 = Reduced Risk Foliar (High fungicide)
   Insecticide: Spintor, permethrin, Fulfill
   Fungicide: Quadris/Bravo (High rates)

2 = Reduced Risk Foliar (Low fungicide)
   Insecticide: SpinTor, permethrin, Fulfill
   Fungicide: Quadris/3ravo (Low rates)

3 = Conventional Foliar
   Insecticide: Asana/Thiodan, Dimethoate, Monitor
   Fungicide: EBDC, Bravo

1 = Reduced Risk Systemic (High fungicide)
   Insecticide: Admire, permethrin, Fulfill
   Fungicide: Quadris/Bravo (High rates)

2 = Reduced Risk Systemic (Low fungicide)
   Insecticide: Admire, permethrin, Fulfill
   Fungicide: Quadris/Bravo (Low rates)

3 = Conventional Systemic
   Insecticide: Admire, Dimethoate, Monitor

Figure 1. Field design for Bio-Intensive trial at Wallendal Supply, Inc.
Figure 2. Field design for Bio-Intensive trial at Coloma Farms, Inc.

**Results and Discussion:** (See Figures 3 and 4)

**Wallendal Supply, Inc.**

**Snowden (Silver Valley)** - Early blight pressure in this field was light throughout the season and no late blight appeared. Control of early blight was adequate in all treatments although control was slightly better in strips treated with Quadris alternated with Bravo fungicide. The standard program of EBDC and Bravo provided acceptable control. Yield was highest in plots treated with the 12.4 fl oz of Quadris alternated weekly with Bravo fungicide.

**Snowden (Cline East)** - Early blight pressure was also low in this field throughout the season and no late blight appeared. Early blight severity at the end of the season was highest in plots treated with an EBDC and Bravo program. Disease severity was lowest in plots treated with Quadris alternated with Bravo fungicide and there were no differences in early blight control in plots treated with the 6.2 vs. 12.4 fl oz rate of Quadris alternated with Bravo fungicide. Yields were similar in all treated plots with a slight edge given to plots treated with the 6.2 fl oz rate of Quadris alternated with Bravo.
Coloma Farms, Inc.

Russet Burbank (Home Farm) - Early blight pressure was light through most of the growing season, but by the final rating, more early blight was observed in the grower standard program using EBDC and Super-Tin than in plots treated with Quadris fungicide. Control was best in plots treated with a strict alternation of Quadris (6.2 fl oz rate) with Bravo (Q/B/Q/B/…). Somewhat more disease was observed in plots treated with Quadris (6.2 fl oz/A) alternated with two sequential applications with Bravo fungicide (Q/B/B/Q/B/B/…). Yields were similar in plots treated with the Quadris and Bravo programs and slightly higher than in plots treated with the grower standard of EBDC and Super-Tin.

Russet Burbank (Kirschenlohr West) - Early blight pressure was substantially greater in this field than all of the test fields, especially in the strips treated with the grower standard consisting of Bravo, EBDC and Super-Tin. Minimal late blight appeared late in the season along irrigator tracks in this field, but differences in treatment efficacy were not observed. Control of early blight was excellent in all plots where Quadris was alternated with either Bravo or an EBDC fungicide. Yields were similar for all treatments in this field.

Results from these trials indicate that it is possible to achieve improved early blight control using Quadris fungicide at either 6.2 or 12.4 fl oz/A alternated with Bravo or an EBDC fungicide. The trials also help to answer the question of whether two sequential sprays with a protectant fungicide such as Bravo used between Quadris treatments can achieve a level of control similar to control observed in a strict alternating program using Bravo and Quadris.

These trials demonstrate that using a Bio-Intensive IPM program where a reduced risk fungicide is substituted for conventional fungicides such as Bravo, EBDC or Super-Tin material, substantial reductions in applied active ingredients can accrue over the course of a growing season. Additional information will be presented at these grower education meetings on the total amount of fungicide active ingredients, the impact of treatment on tuber size and the economics associated with each of these programs.

![Graphs showing early blight readings in field trials](image)

**Figure 3.** The final early blight readings in field trials comparing bio-intensive IPM programs with conventional disease management programs.
Figure 4. Yields in field trials comparing bio-intensive IPM programs with conventional disease management programs.