

Fungicide and Nematicide Update

RANDALL C. ROWE, Ohio Agricultural Research and Development Center, Wooster

Ridomil, Ronilan, and Rovral—New Tools for Vegetable Disease Control

In recent years many fungicides have been tested for vegetable disease control, but for a variety of reasons, most have never made it to commercial use. Three new fungicides, Ridomil, Ronilan, and Rovral, however, appear promising and a few labeled uses are becoming available. As these compounds become more widely labeled, they should expand the arsenal of tools available for vegetable disease control.

Ridomil (metalaxyl, Ciba-Geigy Corp.) is a systemic acylalanine with specific activity against *Pythium*, *Phytophthora*, *Peronospora*, and other pythiaceus fungi. The active ingredient is also marketed as Subdue for use on ornamentals and as Apron for use as a field crop seed treatment. Metalaxyl is highly water-soluble and is readily translocated from roots to aerial portions of most crops, but lateral translocation between leaves is only slight. Ridomil has been effective when applied as a postinfection curative treatment in many situations. Phytotoxicity has not been a problem at labeled rates. Ridomil is available in three formulations: a 2 lb/gal emulsifiable concentrate, a 5% granule, and a 10% wettable powder formulated with 48% mancozeb (Ridomil MZ-58). The granular formulation is, at present, for experimental use only.

Ronilan (vinclozolin, BASF Wyandotte Corp.) is a nonsystemic contact fungicide used primarily as a foliar spray. Ronilan effectively inhibits spore germination and germ tube growth but has only limited postinfection efficacy. It is available as a 50% wettable powder and has not been phytotoxic to a wide range of crops at suggested rates.

Rovral (iprodione, Rhone-Poulenc Chemical Co.) is a broad-spectrum contact fungicide. Like Ronilan, it is active against *Botrytis*, *Monilinia*, and *Sclerotinia* but also has efficacy against *Alternaria*, *Helminthosporium*, and *Rhizoctonia*. It inhibits both spore germination and mycelial growth but is not useful as a postinfection curative. The active ingredient, iprodione, is also marketed as Chipco 26019 for use on turf and ornamentals. Both products are available as 50% wettable powder formulations. Phytotoxicity has not been observed on a wide range of crops.

Widespread testing of these three fungicides on vegetable crops has occurred during the past 5 years. Ridomil has been tested as a foliar protectant or

curative on a wide range of vegetables for downy mildew control. It has been exhaustively tested for late blight (*Phytophthora infestans*) control on potatoes, and Ridomil MZ-58 was recently labeled for this use. This formulation was tested successfully in 1982 in New Jersey against downy mildew (*Pseudoperonospora cubensis*) of cucumber by foliar spray applications at 14-day intervals. It has been successfully tested as an eradicator of this pathogen on greenhouse cucumbers in Ohio. A weakness of Ridomil, pointed out in tests on potatoes and cucumbers, is its narrow spectrum of efficacy and thus its inability to control other such common diseases as potato early blight (*Alternaria solani*) and cucumber powdery mildew (*Erysiphe cichoracearum*). This necessitates the use of additional broad-spectrum fungicides to completely protect these crops.

Ridomil has been successful in controlling *Phytophthora* blight (*P. capsici*) of pepper. Tests in Brazil in 1982 achieved control with soil application at transplanting followed by foliar sprays at 14-day intervals. These workers mentioned another problem with Ridomil, i.e., the development of resistant strains of pathogenic fungi. They noted this in 1981 in *P. capsici* of pepper. Similar resistance problems in other pathogens, along with the narrow spectrum of efficacy of metalaxyl, were the primary reasons for the development of Ridomil MZ-58. Rotation or combination of Ridomil with other broad-spectrum fungicides may be necessary for its successful use in vegetable disease management systems.

In the last few years, research in Delaware has been successful in controlling potato tuber pink rot (*Phytophthora erythroseptica*) with soil- or foliar-applied Ridomil. In 1982, three foliar applications of Ridomil MZ-58 spaced 2 weeks apart gave excellent control. Ridomil is also quite useful in controlling *Pythium* damping-off. A 1982 New Jersey test showed excellent control by banding the fungicide over the row following planting of snap beans. Ohio tests in the last two seasons have shown effective use of Ridomil as a curative for *Pythium* damping-off in celery beds by drench application onto infected seedlings. No phytotoxicity was observed.

Since Rovral and Ronilan are contact fungicides with similar ranges of efficacy, many tests have included both compounds. Considerable testing has been done with beans. Excellent control of white mold

(*Sclerotinia sclerotiorum*) of dry beans has been shown for a number of years. Tests in 1982 in North Dakota and Idaho were highly successful with one or two sprays of Ronilan at bloom. Rovral was somewhat less effective. Interest in snap beans has been not only for white mold control but also for gray mold (*Botrytis cinerea*). Tests in New York and Oregon in 1982 indicated that both compounds were effective, but Ronilan again had a slight edge. In both cases, applications at early and full bloom were the most efficacious.

Control of *Botrytis* in greenhouse vegetables has become a serious problem since the widespread development of benomyl-resistant strains. In a test reported from Lebanon, weekly applications of Rovral to greenhouse cucumbers gave excellent *Botrytis* control and were superior to Ronilan. Tests in Ohio over the last 3 years on greenhouse tomatoes have also shown excellent control with weekly Rovral applications. Greenhouse studies in Ontario, Canada, have shown excellent control of gummy stem blight (*Didymella bryoniae*) of greenhouse cucumbers with weekly applications of Rovral. Acreage of greenhouse cucumbers has been increasing in both Canada and Ohio, and this disease, which is uncontrolled at present, is becoming a limiting factor in production.

Widespread testing of both fungicides against lettuce drop (*Sclerotinia sclerotiorum* and *S. minor*) has occurred in New Jersey, New York, and Ohio in recent years. Two or three applications of Ronilan following planting have given excellent control. A federal label for this use on head lettuce was approved for the 1983 season.

Of the three fungicides, Ridomil is at present the most widely labeled on vegetable crops. Ridomil 2E is labeled for soil application at seeding to control *Pythium* damping-off of tomatoes and as a preplant, broadcast spray to control *Pythium* damping-off of tomato, cucumber, and melon bedding plants. It can also be applied 6–8 weeks before harvest to reduce *Pythium* and *Phytophthora* fruit rots.

Ridomil 2E has FIFRA Section 18 labels in California for downy mildew control on broccoli, cauliflower, cabbage, brussels sprouts, lettuce, and spinach and in Washington for broccoli. A Section 18 label has also been obtained in California for *Phytophthora* control on asparagus. Ridomil MZ-58 is labeled as a foliar

spray for control of downy mildew on cucumbers, melons, and dry bulb and seed onions and for late blight (*Phytophthora infestans*) on potato and tomato. Further label expansion in the vegetable area is planned.

Vegetable growers using Ridomil must keep in mind certain restrictions on rotational crops. Any small grains planted during the fall after Ridomil applications must be plowed down the next spring and not used as food or feed. This could be troublesome to potato growers using wheat-potato rotations who normally seed winter wheat after potato harvest.

Ronilan 50W has only two federal food

crop labels at present. It is labeled for *Botrytis* fruit rot control in strawberries and for *Sclerotinia* "drop" in head lettuce. In lettuce, up to three applications 14 days apart can be made after seeding or transplanting. Thorough coverage of lower leaves, plant stems, and bed surfaces is required for control. State labels (FIFRA Section 18) have been granted in New Jersey and Ohio for application to leaf lettuce.

The first food crop labels for Rovral were approved in 1983. It now has a federal label for brown rot (*Monilinia* sp.) on stone fruit and FIFRA Section 18 labels for *Botrytis* control on grapes in California and Washington. The only

vegetable label is a Section 18 clearance for lettuce "drop" in Wisconsin. Federal labels for lettuce "drop" and *Botrytis* and *Sclerotinia* control on beans are anticipated. Chipco 26019, also containing iprodione, is widely labeled on turf and ornamentals.

Dr. Rowe is editor of the vegetable crops section of Fungicide and Nematicide Tests, David F. Ritchie, Editor, published annually by the New Fungicide and Nematicide Data Committee of The American Phytopathological Society. Copies of current and past volumes may be obtained from Richard E. Stuckey, Business Manager F & N Tests, Plant Pathology Department, University of Kentucky, Lexington 40546.