

**GUIDELINES
FOR THE
CONTROL OF PLANT DISEASES
IN
WESTERN CANADA**

Prepared by

The Western Committee on Plant Diseases

for the use of

Alberta Agriculture, Food & Rural Development
British Columbia Ministry of Agriculture, Fisheries & Food
Manitoba Department of Agriculture and Food
Saskatchewan Department of Agriculture and Food

in preparing

Provincial Disease Control Recommendations

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PREFACE

The Western Committee on Plant Diseases (WCPD) has compiled the "Guidelines for Plant Disease Control in Western Canada" to provide ready access to up-to-date information on the management of plant diseases for those groups involved in developing disease control recommendations for commercial and non-commercial producers in each of the four western provinces.

The information contained in these Guidelines is to be used at the discretion of each provincial body or individual responsible for formulating and dispensing disease control recommendations. Their recommendations, including the reproduction of the guidelines in part or *in toto*, are to be issued in their official capacity under the auspices of their own departments and not under that of the WCPD.

The control measures listed are, in the opinion of the WCPD, the best recommendations currently available. The pesticides listed for the control of a particular host-disease combination may not include all that are registered for this use. These recommendations are not a substitute for, nor do they supersede, the instructions on the label of a pesticide. LABEL DIRECTIONS MUST BE FOLLOWED CAREFULLY WHENEVER PESTICIDES ARE USED.

The production of the "Guidelines for the Control of Plant Diseases in Western Canada" is possible only because of the active participation by personnel from the governments of the four western provinces, the federal government, the Universities of Alberta, Manitoba, Saskatchewan and Simon Fraser University, and the agricultural industry, particularly seed and pesticide companies.

The WCPD reviews these Guidelines annually to ensure that information is up-to-date and pertinent to the major infectious and non-infectious plant diseases likely to be encountered on the major and minor crops and cultivated plants in Western Canada. We ask **all** users of this publication to draw to the attention of the WCPD any errors it contains and any information on disease control that would improve its usefulness. Comments should be forwarded to the Editors of these Guidelines or to the Chairman of the Subcommittee responsible for the chapter in question.

Since the 2001 edition of the Guidelines was published, many suggestions have been received for their improvement. Most of these have been incorporated into the 2002 edition by the dedicated work of our 13 commodity subcommittees. All disease control recommendations have been reviewed critically and, where required, modified to keep these Guidelines as current as possible. Important changes have been made to most pages of these Guidelines and page numbers have been changed. **The 2001 and earlier issues are now outdated and should be destroyed.**

October, 2002 - M. Desjardins and T.C. Shinnars-Carnelley, Editors

GENERAL INTRODUCTION

F. R. Harper and R.J. Howard

The Western Committee on Plant Disease Control (WCPDC) was organized in 1976 to function as an advisory body to provincial government advisory committees of the four western provinces and to other agencies concerned with plant disease control within the region. Its objective is to promote the development and adoption of sound measures for the management of plant diseases of regional concern in the four western provinces. The WCPDC was renamed the Western Committee on Plant Diseases (WCPD) in 1990. It is a member of the Western Forum on Pest Management and meets each October with other member committees of this organization.

The "Guidelines for the Control of Plant Diseases in Western Canada" is the result of an initial undertaking to compile a set of well-documented measures for the control of regionally important plant diseases to serve as a basis for provincial recommendations. The WCPD, through its thirteen subcommittees, reviews these recommendations annually and revises them as new resistant cultivars, disease control products, and other control measures are developed and proven effective.

A standardized format is used to simplify the recording, documenting and compiling of the best information available on disease control measures. This format, which treats the control of each disease under three categories-- cultural, resistant cultivars, and chemical, was chosen to provide the user with concise and current information on each major disease listed. We urge each user of the Guidelines to contribute his or her practical and experimental findings to the advancement or improvement of the information contained therein.

Diagnosis and Control

Disease control in plants must be preceded by accurate diagnosis of the causal agent. A diagnostician familiar with the diseases of a crop can often recognize the exact cause by symptoms alone. However, factors such as weather, the cultivar being grown, cultural practices and soil conditions, can influence symptom expression. Therefore, it is frequently necessary to isolate and identify the causal agent or to carefully examine the diseased tissue under a microscope to diagnose the cause(s) of an infectious disease. It may even be necessary to utilize more specialized techniques, such as immunoassays, electron or scanning microscopy, biochemical testing or analysis of genetic material, to identify a pathogen. Diagnosing the causes of non-infectious or abiotic diseases can also take considerable time and effort and may require detailed examination of environmental conditions, crop production records, and the influence of insects and mite pests, weeds and infectious diseases.

Once a disease is diagnosed, preventative or curative treatments can be prescribed. This may require the application of a pesticide, physical treatment of the seed, foliage or soil, destruction of affected plants, a change in cropping sequence, or the use of a different crop cultivar. These measures usually fall into the categories of exclusion, eradication, host resistance or protection. To be successful, treatments must not only be effective, but also practical for the specific situation. These Guidelines therefore presume an accurate diagnosis of the disease in question and, in addition, rely on the user to select the management procedure(s) that will be most appropriate for the particular problem at hand. Remember, it is often impossible or impractical to cure or eliminate a plant disease once it has appeared. Therefore, some management strategies may have to be applied to the succeeding crop.

Organization of the Guidelines

The disease control recommendations in this volume are organized into thirteen chapters, each representing a crop or group of crops. The crops treated in each chapter are arranged alphabetically by common name. The important diseases of a crop are in alphabetical sequence by disease name. This is followed by a section titled "Other Diseases" that lists those problems

for which no control is known or that are important elsewhere but of little economic importance in Western Canada. A third section, titled "Quarantine Diseases", appears, where appropriate, to alert readers to diseases that do not occur or are of limited distribution in Canada and are under quarantine regulations.

Disease and Pathogen Names

The names used for diseases and pathogens in these Guidelines are those accepted by most plant pathologists and diagnosticians in Canada. Alternative names, in parentheses, follow the accepted one in those instances where this second name is also widely used. Sub-specific designations for pathogens have generally been omitted for the sake of brevity.

Resistant Cultivars

Only those cultivars that are suitable for production in Western Canada are listed. Under this heading, "None" denotes that the commonly grown cultivars have been evaluated and none have been found to be resistant, and "--" designates that the resistance of the commonly grown cultivars has not been adequately evaluated. Two subheadings are used to provide additional information on cultivar reactions. **Intermediate** denotes cultivars that may develop the disease under favourable conditions, but normally do not require protection, and **Susceptible** denotes cultivars that require protection or should be avoided where the disease is a problem.

Pesticide Names

The common names of active ingredients, as accepted by the Canadian Standards Association, are adopted for use throughout the Guidelines. When no common name has been accepted, the name used by Pest Management Regulatory Agency of Health Canada is employed to identify the active ingredient. A glossary cross-referencing certain alternative designations and the common name and code used in Canada appears at the back of this volume. Several chapters have appendices which lists registered products by Pest Control Products Act (PCP) registration number or trade name.

Use-Designation for Pesticides

Each pesticide listed in the chemical control section of the individual disease control reports is followed by a three-letter code in parentheses. The designations used are:

DOM - indicates a fungicide registered for domestic use by home gardeners and available in small quantities.

COM - indicates a product registered for commercial use by persons experienced and equipped to apply pesticides, such as licensed pest control operators, farmers, greenhouse operators and nurserymen. Pesticides designated COM are not sold in small quantities.

RES - indicates a pesticide registered for certain restricted purposes. A permit must be obtained from the appropriate provincial regulatory agency for the use of a pesticide designated RES.

In British Columbia, Alberta, Saskatchewan and Manitoba, plant disease control products are available only from outlets specially licensed for the sale of pesticides.

Pesticide Formulations

A formulation code is also given for each pesticide listed in the chemical control sections of the disease control recommendations. These codes are:

DF - dry flowable	SG - soluble granule
DU - dust	SN - solution
EC - emulsifiable concentrate	SO - solid
EM - emulsion	SP - soluble powder
GR - granular	SU - suspension
LI - liquid	TA - tablet
PA - paste	WG - water-dispersible or wettable granule
PO - powder	WP - wettable powder
PS - pressurized spray	

Pesticide Application Rates

Application rates have normally been omitted since the user should follow the rate listed on the product label. Rates may be listed where a **Minor Use** is involved because the information may not be printed on the product label, and also where a specific rate is recommended. **Where rates are listed, they are in terms of active ingredient (AI) stated in SI units.** The equation :

$$\frac{100 \times \text{application rate ai}}{\text{Percent ai in the product}} = \text{application rate of formulated product}$$

can be used to convert the active ingredient rate to the product rate.

Limitations

Only those limitations that are particularly important in the use of a pesticide for control of the disease in question, e.g., preharvest interval (PHI), are listed. The label should be consulted for other limitations.

Resistance to Pesticides

Resistance to pesticides has become an increasingly serious problem in plant disease control with the marketing of products that are more selective in their action. Research studies have documented many instances where resistance has resulted in loss of efficacy by fungicides and bactericides that originally provided excellent disease control. The following is a guide to avoiding the problem.

Detection: A decrease in the effectiveness of disease control in part of a field or over a larger area following repeated use of a particular product may indicate the development of a resistant strain of the pathogen. Further confirmation can be made by laboratory tests to determine the sensitivity of spores of the pathogen to the pesticide. Plant health diagnostic facilities or provincial plant pathologists in Alberta, British Columbia, Manitoba and Saskatchewan should be contacted if resistance to a disease control product is suspected.

Development of resistance: Resistant strains occur at very low levels in wild populations of most plant pathogens. They are usually not detectable until repeated use of a pesticide drastically reduces the number of sensitive strains in the population and allows the resistant strain to attack the host plant and reproduce. Once a resistant strain has become dominant, it will usually remain so even if use of the pesticide is discontinued. In some instances, another form of resistance may develop by a non-genetic adaptation of the original population to the presence of the pesticide. When this occurs, the pathogen again becomes sensitive to the pesticide several months after its use is discontinued. This type of resistance is rarely found in the field.

Resistance by a pathogen to a particular pesticide usually means that the pathogen will also be resistant to other pesticides with a similar chemical structure. For example, if a pathogen becomes resistant to benomyl, it may also be resistant to other fungicides of the benzimidazole group such as thiabendazole, but not to fungicides such as captan or carbathiin, which belong to different structural groups.

The rate at which different pathogens develop resistance to a particular fungicide appears to be a property of the pathogen. Fruit rotting *Monilinia* spp. developed resistance to benomyl much more rapidly than did *Botrytis cinerea*. Throughout much of Europe and the United States, the late blight fungus *Phytophthora infestans* became resistant to metalaxyl in a single season when the fungicide was applied as a single component, whereas no resistance to metalaxyl has been detected after six years of field tests when it, alone, was used to control *Pythium* spp. causing seedling rot in peas.

Coping with resistance in the field: The use of a mixture of two fungicides with different modes of action can sometimes prevent development of resistant strains. For maximum effectiveness both fungicides should be effective against the pathogen and each should be used at the registered rate.

Alternating the fungicides used for control of a disease may also prevent the development of resistant strains of a pathogen. This method should be considered where more than one effective fungicide is available and several applications are needed in a season.

Limiting the use of fungicides is another important means for discouraging the development of resistance in pathogens. This can be done by improved timing of application, use of cultural control methods such as crop rotation, destruction of contaminated crop debris, and planting of resistant cultivars.

Monitoring for pesticide resistance: Programs for monitoring tree fruit pathogens are operated by the Vineland Research Station in Ontario and the Pacific Agri-Food Research Centre in Summerland, British Columbia. These programs monitor the major pathogens to determine changes in the incidence of spores that are resistant to the currently registered fungicides. Results are used to advise growers and extension personnel on the suitability of different fungicides for disease control in different parts of the fruit growing areas they serve. Similar programs would be useful with vegetable, greenhouse and certain field crops, especially where fungicides are applied several times a season to control important diseases.

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