DETERMINATION OF DIMETHOATE AND DIMETHOXON ON GRAPES

ABSTRACT: The pesticide dimethoate and its oxygen analog dimethoxon were extracted from grape samples with methylene chloride. The extract was dried, suction filtered, and evaporated to dryness. The residue was taken up with residue quality acetone, and malathion was added as an internal standard. The sample was finally analyzed by gas chromatography using a flame photometric detector, and the amount of residue determined using calibration curves for the respective compounds.

PROCEDURE: Composite samples were prepared by pooling grapes from the various locations, with the specific sampling dates and rep numbers. A 500 g sample of the composite is chopped (while still frozen) in a Hogarth chopper, and stored in a freezer. Two 50 g sub-samples are taken and analyzed. Weigh each sample into an explosion proof Waring blender jar. To the sample add 100 mL of residue quality methylene chloride and blend at high speed for 5 minutes. Remove the sample from the blender assembly and add 60 g of anhydrous sodium sulfate; swirl vigorously. Let the mixture stand for 30 minutes, and swirl about every 5 minutes to ensure that the salt contacts any water droplets that may be floating on the surface. Next, add 4 g of activated charcoal, mix well, and allow the mixture to stand for 2 minutes. Then, suction filter the extract through a Millipore glass pad into a 250 mL filter flask. Wash the pulp with two 25 mL volumes of methylene chloride. Transfer the filtered solution to a 250 mL round bottom flask and evaporate to dryness using a rotary evaporator. The residue is taken up with 1 mL of residue quality acetone and to it is added 50 uL of 100 ppm malathion, as an internal standard.

Chromatographic analyses were carried out on a Hewlett-Packard 5880A gas chromatograph equipped with a flame photometric detector, operated in phosphorus mode, with the following conditions:

OVEN TEMPERATURE : 200°C
DETECTOR TEMPERATURE : 225°C
AUXILIARY TEMPERATURE : 225°C
NITROGEN FLOW RATE : 12 mL/min (carrier)
HYDROGEN FLOW RATE : 200 mL/min
OXYGEN FLOW RATE : 20 mL/min
AIR FLOW RATE : 60 mL/min
AUXILIARY GAS FLOW RATE : 20 mL/min

On column injection was used.

Chromatography was carried out on a MEGABORE DB-17 column, 15 m X 0.53 mm with 1 micron film thickness. The detector signal was integrated with a Hewlett-Packard 5880A Series GC Terminal (level two).

The calibration curves were constructed using solutions prepared from analytical standards of dimethoate and dimethoxon (Cyanamid Canada). From the standard solutions, ranging from 1 ppm to 50 ppm, a 1 mL aliquot is taken and to each is added 50 uL of 100 ppm malathion; as an internal standard. For all samples a 5 uL syringe with

a capillary needle was used. The syringe is washed with acetone and 1 uL is left in the syringe before any sample is drawn up. The syringe is wiped and the needle is placed into the sample solution and drawn back to a total volume of 3 uL (ie. 2 uL of sample is injected for all samples analyzed); being careful not to drawn up any air in the sample. Finally, the needle is inserted into the injection port and the plunger quickly depressed.

Efficiency of extraction was studied using 50 g samples of controls fortified with 1 mL of dimethoate and dimethoxon standards to yield the desired spike levels (ie. 1 mL of 50 ppm standard in 50 g of sample to yield a~1.0 ppm spike). The standard is added dropwise over the surface of the sample and excess solvent is evaporated by running a gentle stream of filtered air over the surface for about 30 seconds. The sample is mixed and allowed to stand for 5 minutes. Then, the methylene chloride is added and the same extraction and cleanup procedures, as described above, are carried out on the fortified sample.

RESULTS AND DISCUSSION : Table 1 shows that the total residues of dimethoate and dimethoxon are well below the acceptable value of 1.0 ppm. In fact, the highest total level is 0.102 ppm, found on the 60 days after treatment samples. Also note that the dimethoxon levels are much higher than those of the dimethoate; even then they are still well below acceptable levels. The simple reason for this is that dimethoxon is the oxygen analog of dimethoate and after 60 days most of the dimethoate that hasn't already degraded will have reacted with the oxygen in the air and formed dimethoxon. However, there are still trace amounts of dimethoate in the grape samples, some just above the method detection limit.

The method detection limit was found by recovery tests on fortified samples. The limit is specifically for dimethoate concentrations. Any attempts at lower levels (ie. 0.005 ppm) resulted in large discrepencies in recovery results. The most apparent reason for this is an interfering peak at 1.0 ± 0.05 min which would cause the dimethoate peak at 1.1 ± 0.1 min not to be detected every run. Attempts to increase detection by increasing attenuation resulted in increased interference by backround noise and very inaccurate results. Some of the same problems were evident in determining the detection limit for dimethoxon. However, it was not obscured by a conflicting peak, as was the case for dimethoate, and its detection limit may have been slightly lower. Unfortunately, the time limit did not allow for a detailed examination and 0.010 ppm was chosen as the method detection limit for both dimethoate and dimethoxon.

Table 2 shows the average recoveries for dimethoate and dimethoxon from the grape controls. Clearly, the dimethoate recoveries are better than the dimethoxon recoveries. Especially at the lower concentration. However, both are still very acceptable.

TABLE 1 : CONCENTRATION OF DIMETHOATE AND DIMETHOXON ON GRAPES

SAMPLE	BLOOM				60 DAYS			
	LOCATION	DIMETHOATE (ppm)	DIMETHOXON (ppm)	TOTAL (ppm)	LOCATION	DIMETHOATE (ppm)	DIMETHOXON (ppm)	TOTAL (ppm)
CONTROL	C	BDL	BDL	BDL	C,S,W	BDL	BDL	BDL
REP 1'S	C,S,W	0.011	0.010	0.021	S,W	0.020	0.082	0.102
REP 2'S	C,S,W	BDL	BDL	BDL	S,W	0.013	0.073	0.086
REP 3'S	C,S,W	0.011	0.015	0.026	S,W	BDL	0.056	0.056
REP 4'S	C,S,W	BDL	0.011	0.011	S,W	0.012	0.082	0.094
ALL REPS	C,S,W	BDL	BDL	BDL	S,W	0.015	0.037	0.052

NOTE:

BDL = BELOW DETECTION LIMIT (~0.010 ppm)
C = CASORSO LOCATION
S = SPERLING LOCATION
W = WIKENHEISER LOCATION

TABLE 2 : RECOVERY TEST

COMPOUND ADDED	FORTIFICATION LEVEL (ppm)	APPARENT RESIDUES (ppm)	AVERAGE RECOVERY (%)
DIMETHOATE	0.51	0.40	79.0
DIMETHOXON	0.50	0.37	73.6
DIMETHOATE	1.03	0.98	95.2
DIMETHOXON	0.99	0.92	92.8

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4075/94-95/E903-505
URMULE Submission Numbers: 94-110

February 21, 1995

Mr. Bill Collings
Association of B.C. Grape Growers
#5 - 1864 Spall Road
Kelowna, British Columbia
V1Y 1T0

Dear Mr. Collings:

This is in follow up to our Canadian Agri-Food Development Initiative (CAFDI) agreement with respect to your User Requested Minor Use Label Expansion (URMULE) project submission number: 94-110.

During a review of our files, it was noticed that your project will be completed on **February 28, 1995** and to date we have not received a claim for reimbursement of expenses for fiscal year 1994-95. Please be advised that any monies not claimed by March 31, 1995 will lapse and cannot be recovered at a later date. I am enclosing Claim for Reimbursement forms (part A and B). If you require any assistance in completing the forms, do not hesitate to contact me at **(613) 957-7078.** The forms should be returned to:

National Marketing Programs
Agriculture and Agri-Food Canada
2200 Walkley Road
Ottawa, Ontario
K1G4G8

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Canada

The reports on trials as outlined in Appendix A of your agreement should now be forwarded to the Minor Use Program Coordinator at the address in your agreement.

Yours sincerely,

Andy Archibald
Program Officer

Enclosure

c.c. Doug Rothwell
L.Larose
J. Vielvoye

Province of
British Columbia

Ministry of
Agriculture,
Fisheries and Food

Regional Office
Suite 200, 1690 Powick Road
Kelowna, British Columbia
V1X 7G5
Telephone: (604) 861-7211
Fax: (604) 861-7490

October 27, 1994

Mr. J. Douglas Rothwell
Minor Use Coordinator
Agriculture and Agri-Food Canada
Plant Industry Directorate
59 Camelot Drive
Nepean, Ontario K1A 0C5

Dear Mr. Rothwell:

Re: URMULE Submission 94-110
Your Letter to Mr. D. Sperling - Aug. 5/94

The Association of B.C. Grape Growers, with the cooperation of Mr. H. Philip and myself, conducted studies in 1995 to determine if Lagon 480 (dimethoate), PCP #16037, was phytotoxic to grapes.

Results of the trials confirm that Lagon 480 at 0.6 kg/ha does not cause phytotoxic effects on leaves or fruit of grapevines. This supports earlier work done by Dr. F. Banham s.22 , of Agriculture Canada Research Station, Summerland. Dr. Banham used Cygon (dimethoate) 480 EC; Sys-Tem (dimethoate 480 EC in his work for thrip control.

We would appreciate confirmation from you that these trials satisfy your requirements for additional data.

Fruit samples taken for residue analysis are presently in cold storage. Funding to do the analysis is not yet in place.

It is my understanding, from Rhoda Gowan, Senior Program Officer for CAFDI, that you provide the requirements for Appendix "A" of URMULE 94-110. Regarding requirement #2 in Appendix "A" of the Agreement (betweeen the Association and CAFDI, please note what is obviously an error. Item 2 requires publication of the results of this project in the "Expert Committee on Weeds - Research Report - 1993 - Western Section"; plus a report to yourself.

The report to yourself is attached to this covering letter. The reference to - "Expert Committee on Weeds - Research Report - 1993 - Western Section", should perhaps have been - "Pest Management Research Report 1994 - of the Expert Committee on Pest Management". However, since this trial did not deal with

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pest control, but rather with crop tolerance, the attached report would not be suitable for that "Expert Committee" either. I request, therefore, that the requirement to publish these results be waived, and that they simply be considered as additional data as you requested.

Yours truly,

John Vielvoye

John Vielvoye, P.Ag.
Provincial Grape Industry Specialist

cc: H. Philip
B. Collings

URMULE Submission 94 - 110

In support of minor use registration of Lagon 480 (dimethoate) PCP # 16037 on grapes for the control of Thrips (Flower, Western Flower and Grape)

Requirements
- Conduct crop tolerance trials, collect data
- Publish results
- Send report to Minor use coordinator

Crop Treated - Grape cv. Sovereign Coronation, Patricia, Bath

Pest - Thrips (Flower, Western Flower and Grape)

Title - Grape Tolerance to Lagon 480 (dimethoate), PCP#16037

Methods

Three geographically separate vineyards located in the Okanagan Valley of B.C. were selected for tolerance observations to sprays of Lagon 480 (dimethoate). Four replications of 4 vines each of the cv. Sovereign Coronation, Bath and Patricia were sprayed at 0.6 kg/ha June 10, 1994 (bloom), and July 15, 1994 (anticipated to be 60 days before harvest). Adjacent vines in rows of non sprayed vines were used as controls for observations of differences that may be present as a result of Lagon 480 applications. Observations for damage or injury were made 1 day and10 days after treatment and at harvest.

Results

There were no evidence of phytotoxicity to leaves or fruit any of the sprayed vines.

Conclusion

Lagon 480 (dimethoate) at 0.6 kg./ha is not phytotoxic to grapevines.

Crop Tolerance Observations Lagon 480 (dimethoate) 1994

Cultivar/ Location	Insecticide	Application Date	/ Rate	Days to Harvest	Injury Symptoms
D. Sperling					
Sov. Coronation	Lagon 480	June 10/94	0.6	92	nil
L.Wickenheiser					
Sov. Coronation	"	June 10/94	0.6	92	nil
Bath	"	June 10/94	0.6	92	nil
K.Casorso					
Sov. Coronation	"	June 10/94	0.6	92	nil
Patricia	"	June 10/94	0.6	92	nil

Cultivar/ Location	Insecticide	Application Date	/ Rate	Days to Harvest	Injury Symptoms
D. Sperling					
Sov. Coronation	Lagon 480	July 15/94	0.6	56	nil
L.Wickenheiser					
Sov. Coronation	"	July 15/94	0.6	56	nil
Bath	"	July 15/94	0.6	56	nil
K.Casorso					
Sov. Coronation	"	July 15/94	0.6	56	nil
Patricia	"	July 15/94	0.6	56	nil

Residue Samples - Lagon 480 (dimethoate) Trial -1994

The following data represents the samples taken for residue analysis.

- Sample size - 2 kg.
- Harvest date - Sept. 9, 1994
- Cultivar - Sovereign Coronation

Application date - June 10, 1994 (bloom) Rate 0.6 kg./ha
92 days from application to harvest

Location	Replication Number (Samples taken) Note: Duplicate set taken.				
	1	2	3	4	Control
D. Sperling	yes	yes	yes	yes	yes
L.Wikenheiser	yes	yes	yes	yes	yes
K.Casorso	yes	yes	yes	yes	yes

Application date - July 15, 1994 Rate 0.6 Kg./ha
56 days from application to harvest

Location	Replication Number (Sample Taken) Note: Duplicate set taken.				
	1	2	3	4	Control
D.Sperling	no	yes	yes	no	yes
L.Wikenheiser	yes	yes	yes	yes	yes
K.Casorso	no	no	no	no	yes

ASSOCIATION OF BRITISH COLUMBIA GRAPE GROWERS

#5 - 1864 SPALL ROAD, KELOWNA, B.C. V1Y 4R1 • 762-4652

April 27, 1994

Ms. Madeline Waring, P.Ag.
Minor Use of Pesticides Coordinator
B.C. Ministry of Agriculture, Fisheries and Food
17720 - 57th Avenue
Cloverdale, B.C.
V3S 4P9

Dear Ms. Waring,

Re: dimethoate for thrip control on grapes

Attached is a completed "Proposal For A User Requested Minor Use Label Expansion" form to register the use of Lagon 480 for the control of thrips on grapes. As sponsor of this application, the Association of B.C. Grape Growers (ABCGG) requests funding through the Canadian Agri-Food Development Initiative to support the collection of any additional data required for registration.

The Association is sponsoring this application because there are no products registered to control thrips on grapes. Thrips on table grapes causes economic losses due to down grading of fruit affected by the halo spots and the scarring on grape berries resulting from the feeding and ovipositing. Approximately 150 acres are devoted to table grape production in British Columbia. Most of this acreage suffers from thrip damage.

Mr. John Vielvoye P.Ag. Provincial Grape Industry Specialist and Mr. Hugh Philip Entomologist, both with BCMAFF, will work together on this project.

This proposal has the support of United Agri Products (Mr. Erwin Schmidt, Product Development and Registration). Copies of work done by Dr. F.L. Banham s.22 and Mr. L. Dale of Agriculture & Agri Food Canada at Summerland is attached. Also attached are the control recommendations for thrips on table grapes in California.

Please direct any questions concerning this application to John Vielvoye (861 7211). We look forward to your expeditious processing and favorable consideration of this application.

Your sincerely

Doug Sperling
Chairperson, Table Grape Committee
Association of British Columbia Grape Growers

Province of
British Columbia

Ministry of
Agriculture,
Fisheries and Food

Regional Office
Suite 200, 1690 Powick Road
Kelowna, British Columbia
V1X 7G5
Telephone: (604) 861-7211
Fax: (604) 861-7490

April 27, 1994

Mr. Erwin Schmidt
Product Development and Registration
United Agri-Products
RR 2, 789 Donnybrooke Dr.
Dorchester, Ontario N0L 1G5

Dear Mr. Schmidt:

Re: Lagon 480 - Minor Use Label Expansion

We appreciate your support to use your company's product, Lagon 480, in a proposal for a Minor Use Label Expansion for the control of thrips on grapes.

Local research conducted by Dr. Fred Banham s.22 , at the Agriculture & Agri Food-Research Station in Summerland, has shown that dimethoate will control grape thrips (Drepanorthrips reuteri Uzel). Recommended control measures for grape thrips and western flower thrips (Frankliniella occidentalis Pergande) in California, lists dimethoate as the only suitable control product.

There are three species of thrips found in vineyards in the Okanagan and Similkameen Valleys of British Columbia; i.e. the two previously mentioned, as well as flower thrips (Frankliniella tritici Finch). Western flower thrips damages fresh grapes by feeding under flower caps and ovipositing into the tissue of young berries. Halo spots and scarring of berries causes visible damage to the berries, resulting in misshapen fruit, scarred berries or halo spots, which cause a down-grading of the fruit from Canada Number 1 to Canada domestic grade.

Application time will be at the first sign of bloom. Suggested interval to harvest is 60 days. We suggest using a rate of 0.6 actual kg/ha.

Since we do not have land or vineyards of our own, the trial will be conducted on private land.

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We have requested that the Association of British Columbia Grape Growers submit a proposal for a User Requested Minor Use Label Expansion.

Mr. Hugh Philip P.Ag., our Entomologist, and I will work together on this project.

Yours Sincerely,

John Vielvoye

John Vielvoye, P.Ag.
Provincial Grape Industry Specialist

Encl.

cc: Hugh Philip, P.Ag.

Agriculture Canada

Market and Industry Services Branch
Direction générale des services
à l'industrie et aux marchés

National Marketing Programs/Programmes nationaux de commercialisation

Your file Votre référence

Our file Notre référence

4075/94-95/E903-505
URMULE Submission Number: 93-110

August 18, 1994

Mr. Bill Collings
Association of B.C. Grape Growers
#5, 1864 Spall Road
Kelowna, British Columbia
V1Y 4R1

Dear Mr. Collings:

Please find enclosed three copies of a Canadian Agri-Food Development Initiative (CAFDI) agreement with respect to your User Requested Minor Use Label Expansion (URMULE) project submission numbers: 94-110.

In a memorandum from the URMULE Coordinator, Doug Rothwell I was advised that the only eligible costs are those associated with obtaining efficacy. Health Canada has not and is not able to indicate what is required for the residue trials, therefore the costs submitted dealing with shipment of grapes to the laboratory and residue analysis are not eligible for consideration under this agreement.

Provided that you accept the terms and conditions of this agreement, the documents should be signed by two officers of your organization and returned by September 8, 1994. They will then be signed on behalf of the Minister and an original returned to you for your records.

The method of payment of the contribution is described in Appendix "B". You should be aware that 25% of each payment is withheld pending receipt of verification of expenditures for the fiscal year and a satisfactory project report as described in Appendix "A".

Canada

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I am enclosing Claim for Reimbursement of Expenditures forms, which should be signed by an authorized officer of your organization. All claims for payment should be submitted to my attention at:

National Marketing Programs
Market and Industry Services
Agriculture and Agri-Food Canada
2200 Walkley Road
1st Floor
Ottawa, Ontario
K1G 4G8

Please do not hesitate to contact me at (613) 957-7078 for additional information.

Yours sincerely,

Rhoda Gowan

Rhoda Gowan
Senior Program Officer

Enclosure

c.c. D. Rothwell
J.Vielvoye, P.Ag.

Agriculture Canada

Food Production and Inspection Branch | Direction générale. Production et inspection des aliments

Plant Industry Directorate
Nepean, Ontario,
K1A 0Y9
TEL: (613) 952-8192 x 4417
FAX: (613) 990-0605

Your file Votre référence

Our file Notre référence

Copy to Asst. Dep. also Agriculture Canada Biology Advisory Committee

Mr. Doug Sperling
Chairperson,
Assoc. British Columbia Grape Growers
#5 1864 Spall Road
Kelowna, BC
V1Y 4R1

August 5, 1994,

Dear Mr. Sperling

RE: **MINOR USE OF PESTICIDES PROGRAM**
URMULE 94-110

Dimethoate to control thrips on Grapes

The preliminary review of this submission is now complete.

Efficacy

The data submitted indicates that control of thrips was effective at the proposed rate. However, the registrant has noted that phytotoxicity may be a concern - specifically that in California they use the 25% WP formulation due to phyto concerns. As a result of this concern we will require an additional year of efficacy data or data gathered under different environmental conditions to determine of phyto is a concern under your conditions.

Residue Trials

Health Canada will require additional residue data for this new use. However, due to the fact that the toxicological database for this compound is incomplete, they will not be abe to provide Residue Trial Spec forms until a later date.

I would recommend that you proceed with the required efficacy trials so that the information will be on hand when Health is prepared to provide the Residue Trial forms.

Sincerely,

J.Douglas Rothwell,
Minor Use Coordinator,
Plant Industry Directorate.

Agriculture
Canada

1Market and Industry Services Branch
Direction générale des services
à l'industrie et aux marchés

National Marketing Programs/Programmes nationaux de commercialisation

Your file Votre référence
CAFDI #505
Our file Notre référence

June 28, 1994

Mr. Bill Collings
Association of B.C. Grape Growers
#5, 1864 Spall Road
Kelowna, British Columbia
V1Y 4R1

Dear Mr. Collings:

This is to acknowledge receipt of your application for financial assistance under the Canadian Agri-Food Development Initiative (CAFDI) for the project entitled "Minor Use Registration for dimethoats on grape for thrip control".

Following an initial review of your application, you may be asked to provide additional information which will assist us in undertaking an assessment of your project.

As indicated to Mr. John Vielvoye, your application for funding cannot be processed until a User Requested Minor Use Label Expansion (URMULE) submission number has been issued. Once this step is completed, I will advise you whether financial assistance can be offered for the project.

May I remind you that, in order to remain eligible for financial support, you should not commence your project prior to being advised whether or not your application has been approved. I have contacted Doug Rothwell, Food Production and Inspection Branch to enquire on the status of your submission.

Do not hesitate to contact me at (613)957-7078 for further information.

Yours sincerely,

Rhoda Gowan

Rhoda Gowan
Senior Program Officer

c.c. Doug Rothwell - Plant Industry Directorate
J. Vielvoye, P.Ag.

Canada

CANADIAN AGRI-FOOD DEVELOPMENT INITIATIVE

Project no: **4075/94-95/E903-505**

Canadian Department of Agriculture

THIS AGREEMENT BETWEEN

HER MAJESTY THE QUEEN in right of Canada herein represented by and acting through the Minister of Agriculture (hereinafter called the "Minister").

OF THE FIRST PART

AND **Association of B.C. Grape Growers**

(hereinafter called the "Recipient")

OF THE SECOND PART

WHEREAS the Recipient proposes to perform work, services and other matters which will facilitate economic development in the Canadian agricultural and food products industry,

AND WHEREAS the Recipient has applied to the Minister for financial assistance pursuant to the Canadian Agri-Food Development Initiative (CAFDI) in connection with the Project,

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the premises and the covenants and agreements hereinafter contained, the parties covenant and agree as follows:

1. The Recipient agrees to perform the work, services and other matters described in the Statement of Work attached hereto and marked as Appendix "A" together with all work, services and other matters incidental thereto all of which work, services and other matters are collectively hereinafter called the "Project".

2. This Agreement shall commence on **July 1, 1994**, and terminate on **February 28, 1995**, during which time the Recipient shall complete the Project.

3. The Recipient will not change or enlarge the general scope of the Project without prior written consent of the Minister.

4. Subject to Appendix "B", the Minister will contribute to the Recipient **50%** of the allowable costs paid by the Recipient in carrying out the Project, to a maximum contribution of **$2,614**. Allowable costs are limited to costs for which there is a cash outlay and which are directly incurred as a result of undertaking the Project.

5. The Recipient shall observe the conditions which appear in Appendix "C".

6. In accordance with Section 40 of the Financial Administration Act, this Agreement is subject to there being an appropriation for the fiscal year in which any contribution hereunder, as outlined in Appendix "B", would come due.

7. The Recipient shall keep proper books, accounts and records relating to the costs of the Project and during the performance of the Project and for a period of not less than three years after its completion shall preserve such books, accounts and records and keep them available for examination and audit by such person or persons as the Minister may, from time to time, designate. The reasonable and proper costs of the Project shall be determined in accordance with generally

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accepted accounting practices and, at the discretion of the Minister, shall be determined after and subject to an audit or audits by such person or persons as the Minister may, from time to time, designate.

8. If an audit of the Recipients' books, accounts and records discloses that any costs for which there was a federal contribution were not made in accordance with this agreement, the contribution made towards those costs shall be repaid to the Crown and until repaid will be considered a debt due to Her Majesty.

9. Any authorized representative of the Minister shall have access to the premises of the Recipient and premises where any part of the work is being carried on at all reasonable times, to inspect and assess the progress of the Project and the Recipient will render all reasonable assistance to any such authorized representative for the purpose aforesaid.

10. If, during the term of this Agreement the Recipient or the Minister determines on the basis of technical, marketing, financial or other considerations that the Project should not be proceeded with, or that it should be amended, or terminated earlier than the date provided for in Section 2, the Recipient and the Minister shall consult and the Agreement may be terminated or shortened.

11. If the Recipient is unable or unwilling to complete the Project, the Minister is under no obligation to contribute to the Recipient toward allowable costs incurred. However, if a portion of the Project has been satisfactorily completed, the Minister may, at his discretion, contribute to the Recipient toward some or all eligible costs incurred.

12. The Recipient shall obtain the express written consent of the Minister before entering into any arrangement for raising or obtaining other sources of government funds, where the total from the federal government may exceed 50% and where the total from all government sources may exceed 75% of the total Project costs.

13. It is an express condition of this Agreement that no member of the House of Commons or the Senate shall be admitted to any share or part of this Agreement or to any benefit to arise therefrom and that former public servants operating under Post-Employment Guidelines disclose their involvement in the Project.

14. The Recipient shall not assign this Agreement or sublet any of the work without the prior written consent of the Minister, unless it is customary in the carrying out of Projects of this nature. No assignment or subletting shall relieve the Recipient from any of its obligations under the Agreement or impose any liability on the Minister to an assignee or subcontractor.

15. This Agreement shall enure to the benefit of and shall be binding upon the successors and assigns of the Minister and of the Recipient respectively.

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16. Where the context herein requires or permits, the singular number shall be read as if the plural were expressed and the masculine gender as if the feminine or neuter, as the case may be, were expressed.

17. For the purpose of this Agreement, any notices, consents, or other communications, required to be given pursuant to it, shall be adequate if sent by prepaid registered post, telegram or facsimile to the Minister as follows:

Director General
Market and Industry Services Branch
Agriculture and Agri-Food Canada
200 Walkley Road
Ottawa, Ontario K1G 4G8
K1A 0C5
Facsimile: (613) 952-6526

and addressed to the Recipient as follows:

Mr. Bill Collings
Association of B.C. Grape Growers
#5, 1864 Spall Road
Kelowna, British Columbia
V1Y 4R1

and should either the Minister or the Recipient change his address, he shall provide the other party with written notice of such change immediately in the manner described herein.

18. This Agreement and Appendices "A", "B", and "C" constitute the entire Agreement between the parties hereto with respect to the subject matter hereof and supersede all previous negotiations and documents relating thereto.

This Agreement is duly executed on behalf of Her Majesty the Queen in right of Canada by the Minister of Agriculture and on behalf of the Recipient by its proper signing officers duly authorized.

EXECUTED FOR HER MAJESTY THE QUEEN
IN RIGHT OF CANADA BY:

Representative of Her Majesty the Queen	Signature of Representative	Date
Position of Officer of the Recipient Organization	Signature of Officer	Date
Position of Officer of the Recipient Organization	Signature of Officer	Date

Appendix "A"

Project

Dimethoate to control Thrips on Grapes.

(URMULE Submission 94-110)

The Recipient shall conduct crop tolerance trials in consultation with Mssrs. Hugh Philip and John Vielvoye, British Columbia Ministry of Agriculture and Food Canada.

A. In support of minor use registration of Lagon 480 (Dimethoate), PCP # 16037 on Grapes for the control of Trips (Flower, Western Flower and Grape)

1. Conduct crop tolerance trials, collecting data for trials as outlined by the Plant Industry Directorate.

2. Publish the results in the Expert Committee on Weeds -Research Report - 1993 - Western Section and submit a report to :

Minor Use Coordinator
Agriculture Canada
Plant Industry Directorate
59 Camelot Drive
Nepean, Ontario
K1A 0C5

The Recipient shall provide additional information as requested by the Project Coordinator or the Minister.

Contribution

1. A 50% contribution to a maximum of $2,614 may be made toward the following allowable costs to be incurred and claimed prior to March 31st of fiscal year 1994-95.

B.C. Grapes Growers
URMULE # 94-110

Eligible Items	Eligible Costs
Planning trial, search to locate sites (3), contact company, layout of plots (3 sites, 4 reps/site); apply insecticides (1 application)	
Time and travel	$ 500.00
Supplies and materials	$ 400.00
Crop Husbandary (prune, weed, irrigation, tie, fertilizer, other spray materials)	
Crop husbandry	$ 1,500.00
Freezer storage of sprayed and non-sprayed Fruit for residue analysis	
Fruit storage	$ 360.00
Crop loss due to spray applications	$ 1,350.00
Sample collection and preparation	$ 450.00
Administration	$ 667.00
TOTAL	$ 5,227.00

Maximum CAFDI contribution: 50% to a maximum of $2,513.50

2. The Recipient shall submit all claims for payment of allowable costs in a form approved by the Minister within two(2) months of the completion of the project but no later than March 31st, of the fiscal year in which the expenditures were incurred in accordance with Section 1 herein.

   The maximum allowable rate for travel, accommodation and meals shall be in accordance with Treasury Board of Canada rates and allowances (on average per person, $40 per day for meals and incidentals and $60 per day for accommodation).

3. Advance payments can be made in relation to the Recipient's cash requirements for the Project for a 90 day period. Advance payments are calculated as 75% of the Minister's share of eligible project costs for a 90 day period, less a 25% holdback. No further payments shall be made until it is verified, in a form approved by the Minister, that the work for which the advance was made has been completed and the associated costs have been paid.

4. Where an advance payment has been made, and the work for which the advance was made has not been completed, the Recipient must repay the advance to the Minister. The Minister may, at his discretion, allow a deduction of any or all costs incurred towards the uncompleted work from the amount to be repaid.

5. a) Any interim claim(s) shall include an itemized account of allowable costs paid by the recipient and shall be certified by a senior officer of the Recipient. Upon verification of a claim, the Minister shall pay to the Recipient, as soon as reasonably practicable, 75% of the contribution toward allowable costs paid by the Recipient less any amount which has been paid as an advance payment.

../2

b) The final 25% of the Minister's contribution shall be paid to the Recipient upon submission of:

i) an acceptable final claim which shall include an itemized account of total allowable costs paid by the Recipient and certified by a senior officer of the Recipient organization; and,

ii) a final Project report satisfactory to the Minister, as described in Appendix "A".

6. If any question arises as to the interpretation of this schedule, the percentage of contribution to be made, the time in relation to the making of a payment of the contribution or any other question related to the payment of the contribution, the Minister's decision shall be final and irrevocable.

7. For the purposes of this Agreement, fiscal year means April 1st of one year to March 31st of the following year.

Appendix "C"

General Terms and Conditions

1. All patents, copyrights and other intellectual property resulting from this Project shall be the property of the Minister, and shall be assigned, disposed of or disclosed in whatever fashion determined by the Minister.

2. If the Recipient, in the opinion of the Minister, deviates from this Agreement, or becomes bankrupt or insolvent or a receiving order is made against it (either under the Bankruptcy Act or otherwise) or makes an assignment for the benefit of creditors, or if an order is made or resolution passed for winding up of the Recipient, or if the Recipient takes the benefit of any statute of the time being in force relating to bankrupt or insolvent debtors, the Minister may, by giving notice in writing to the Recipient, exercise any or all of the following remedies:

   (a) terminate the obligation to contribute or continue to contribute to the allowable costs of the Project;

   (b) direct the Recipient to, at no cost to the Minister, transfer and deliver to the Minister, ownership and custody of all property including patents, copyrights and other intellectual property referred to in this Agreement;

   and

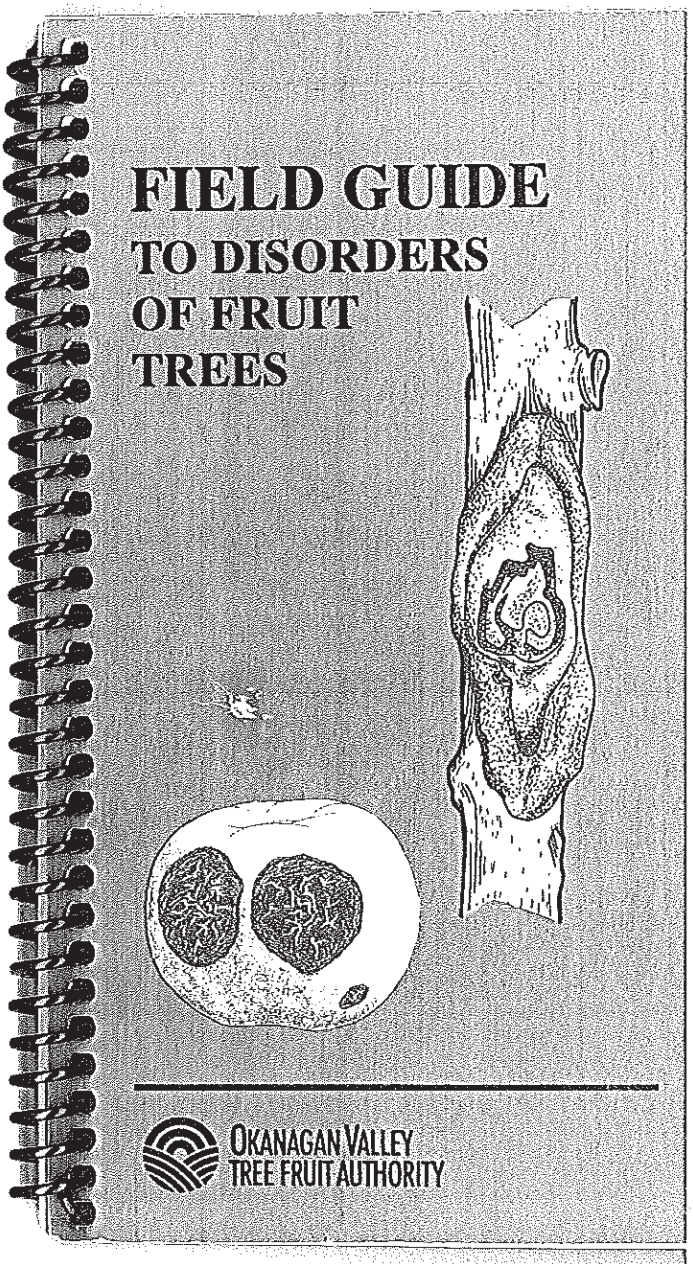
   (c) direct the Recipient to repay to the Minister all of the contribution to the costs of the Project made by the Minister hereunder.

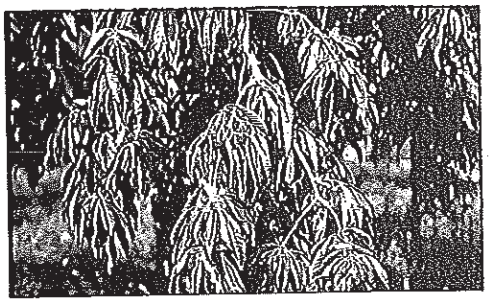
3. The Recipient shall ensure that all federal and provincial environmental assessment requirements and guidelines are met.

4. If the Recipient becomes aware of any environmental impacts of the Project not previously reported to the Minister, these impacts must be reported to the Minister, without delay, in care of National Programs Directorate. The project will then be subject to an environmental impact assessment and the agreement may be canceled or postponed, at the discretion of the Minister. Eligible costs that have been properly incurred to date will be reimbursed according to Appendix "B" of the Agreement.

5. All activities shall at all times indemnify and save harmless the Minister from and against all claims, demands, loss, damages, costs, actions, suits or other proceedings by whomsoever made, sustained, brought or prosecuted in any manner based upon, occasioned by or attributable to anything done, suffered or omitted to be done by The Recipient, its officers, agents, students, contractors, or licensees, or any, some, or all of them, in connection with the purpose of the agreement as described herein, and whether caused by the negligence of The Recipient, its officers, agents, students, contractors, licensees, or assignees.

6. Nothing in this agreement is to be construed as authorizing one party to contract or to incur any obligation on behalf of the other.


FIELD GUIDE
TO DISORDERS
OF FRUIT
TREES
OKANAGAN VALLEY
TREE FRUIT AUTHORITY

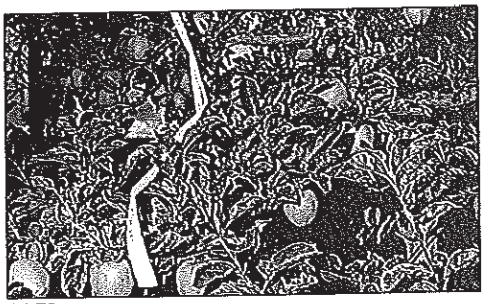


BCMAFF

Dimethoate (CYGON, LAGON)

- leaves turn brown, dry, and drop on susceptible varieties

Most susceptible fruit crop(s): cherry, especially Sam, Stella, and Lapins
Also susceptible: peach, apricot



AAFC

Calcium Chloride ($CaCl_2$): summer sprays

- widespread scorch on leaf margins from spray at too-high concentrations or high air temperature after spraying causing rapid drying

See also calcium chloride, p. 69.

BRITISH COLUMBIA

BC COPY

VANCOUVER 2010

November 18, 2004

D31 2004-3897
(Jan 24 ~~original~~ PMRA sent this #)

Doug Rothwell, Minor Use Coordinator
Pest Management Regulatory Agency
A.L. 6607D, 2720 Riverside Drive
Ottawa, Ontario, K1A 0K9

D32 2005-0486.

Dear Mr. Rothwell;

Here is a minor use label expansion package for suppression of Cherry Fruit Fly in sweet and and sour/tart cherries with Entrust 80 W Naturalyte Insect Control Product (spinosad), for national registration. Included is the application form, letters of support, draft label, USA label, rationale: description of the problem, crop production information, pest biology, and a USA efficacy report.

Cherry fruit fly is a critical limiting factor in cherry production, particularly for organic cherry production where there are no registered products to control this pest. Currently, management for organic production includes growing only early cherry varieties, and harvesting before fruit flies begin flying. Conventional growers have insecticides available to them, but some are phytotoxic, have questionable efficacy, or are not acceptable to use for export markets. Refer to the BC Cherry Crop Profile for more details on cherry production.

Entrust has been submitted and is under review at PMRA, and is registered for use in the USA. Since Entrust has been registered for use on cherries for cherry fruit fly, USA organic cherry production has increased dramatically; a testament for the efficacy of the product against this pest. Success 480 SC (another formulation of spinosad) is currently registered for control of leafrollers in stone fruit in Canada.

There are about 2154 ha of cherries grown in Canada (960 ha in BC, 1134 ha in Ontario, and 60 ha in Saskatchewan). I estimate that 50% of conventional acreage might be treated, and 100% of organic acreage will be treated. Currently organic acreage is about 68 ha, but will expand once Entrust is available. Developing cherries need to be protected from mid June through to harvest, which can be 3-6+ weeks depending on variety.

In this URMULE, we have proposed the leafroller rate of 87.4 g ai/ha. T. Smith's efficacy report (2003, attached) shows good control at 70 g ai/ha (lowest USA rate). However, a preliminary (unreplicated) study in an unmanaged BC cherry orchard with

Ministry of Agriculture, Food and Fisheries

Food Safety and Quality

Mailing Address:
1767 Angus Campbell Road
Abbotsford, British Columbia, V3G 2M3

Phone: (604) 556-3028
Facsimile: (604) 556-3117

Web Address: http://www.gov.bc.ca/agf/

very high fruit fly population showed only suppression at 87.5 and 105 g ai/ha (Success 480 was used). Considering the results of these trials, we ask for "suppression " of cherry fruit fly, and that the leafroller rate of 87.4 g ai/ha be registered, for a maximum of 4 applications per season. The current spinosad residue data supports this rate and number of applications (sub# 2004-1744 Entrust 80W, sub# 2002-0054 Spinosad Technical).

Please contact me or the sponsor, Ms. Linda Edwards, if you have any questions.

Sincerely,

Tracy Hueppelsheuser

Tracy Hueppelsheuser
Minor Use Pesticide Coordinator

OKANAGAN-KOOTENAY
CHERRY GROWERS ASSOCIATION

October 13, 2004

Dr. Doug Rothwell
Minor Use Coordinator
Pest Management Regulatory Agency
A.L. 6607D
2720 Riverside Drive
Ottawa, Ontario
K1A 0K9

Dear Dr. Rothwell:

The Okanagan-Kootaney Cherry Growers Association would like to express its support of the Minor Use application for the addition of cherry fruit fly to the Entrust label.

Our Association represents more than 90 cherry growers. Most of these are conventional producers. However, our membership also includes most of the organic cherry growers plus many members who would like to grow cherries organically if there was a viable control for cherry fruit fly that met those standards. This is not possible with the products currently available for this pest.

Conventional growers are interested in this product as well for a number of reasons. The major conventional insecticides for control of cherry fruit fly are organophophates (dimethoate, diazinon, malathion) which are phytotoxic to the new varieties of cherries often resulting in defoliation.

It would be optimal to be able to use Entrust instead, particularly in hot weather when the organophosphates are most damaging to the trees. This product could also be very useful in younger plantings where the phytotoxic effect of the organophosphates is worse and where cherry fruit fly populations are usually low.

There is also a desire to have a product such as this to use, which is less toxic to humans and generally more environmentally friendly.

Many conventional growers export worldwide, where there are additional requirements for pest management, including sanctioning the use of some pest control products and not others. Spinosad insecticides are acceptable in these specialty markets. The registration of Entrust will provide market opportunities for both conventional and organic growers.

1395 Gibson Rd., Kelowna, B.C., Canada, V1P 1B7
Phone: (250) 491-1030

Spinosad has a novel mode of action, so will be important as a resistance management tool for conventional growers.

Backyard and hobby farmer cherry trees are an on-going source of infestation for the commercial cherry growing areas. Currently, there is an understandable reluctance to use the organophosphate insecticides in such situations so usually nothing is done. The registration of spinosad for cherry fruit fly suppression will allow a safer product which has a relatively low application rate to be available for use in residential areas. With a commercial registration, only certified individuals will be able to purchase and apply it, which will ensure it will be used appropriately.

Finally, we are in on-going contact with our counterparts in the US where Entrust has been used for the past 2-3 years. We are encouraged that they have found they can rely on Entrust for control of cherry fruit fly.

Our Association has been funding Dr. Tim Smith of Washington State University to carry out trials in regard to the efficacy of spinosad. Dr. Smith has been in touch with the PMRA and has been carrying out research to Canadian standards. The results have been very impressive. Unofficially, we have been informed this year's trials were just as good. Data for past years is being submitted with this application. Results for this year's trials will be available soon and will be sent to you.

Sincerely,

Greg Norton
President

Per Graem Nelson, Secretary

Crop Profile for
Sweet Cherries
in British Columbia

Crop Group 12: Stone Fruits

Production Facts

(Annual BC Horticultural Statistics, 2003)

- BC produces about 86% of the cherries grown in Canada. (Fast Stats 04)
- In 2003, BC produced approximately 6,611 tonnes of sweet cherries worth $15.4 million
- 824 of 944 ha of sweet cherries were productive in 2001 (2001 Census of Agriculture)
- Cherry plantings are expanding due to strong market demand

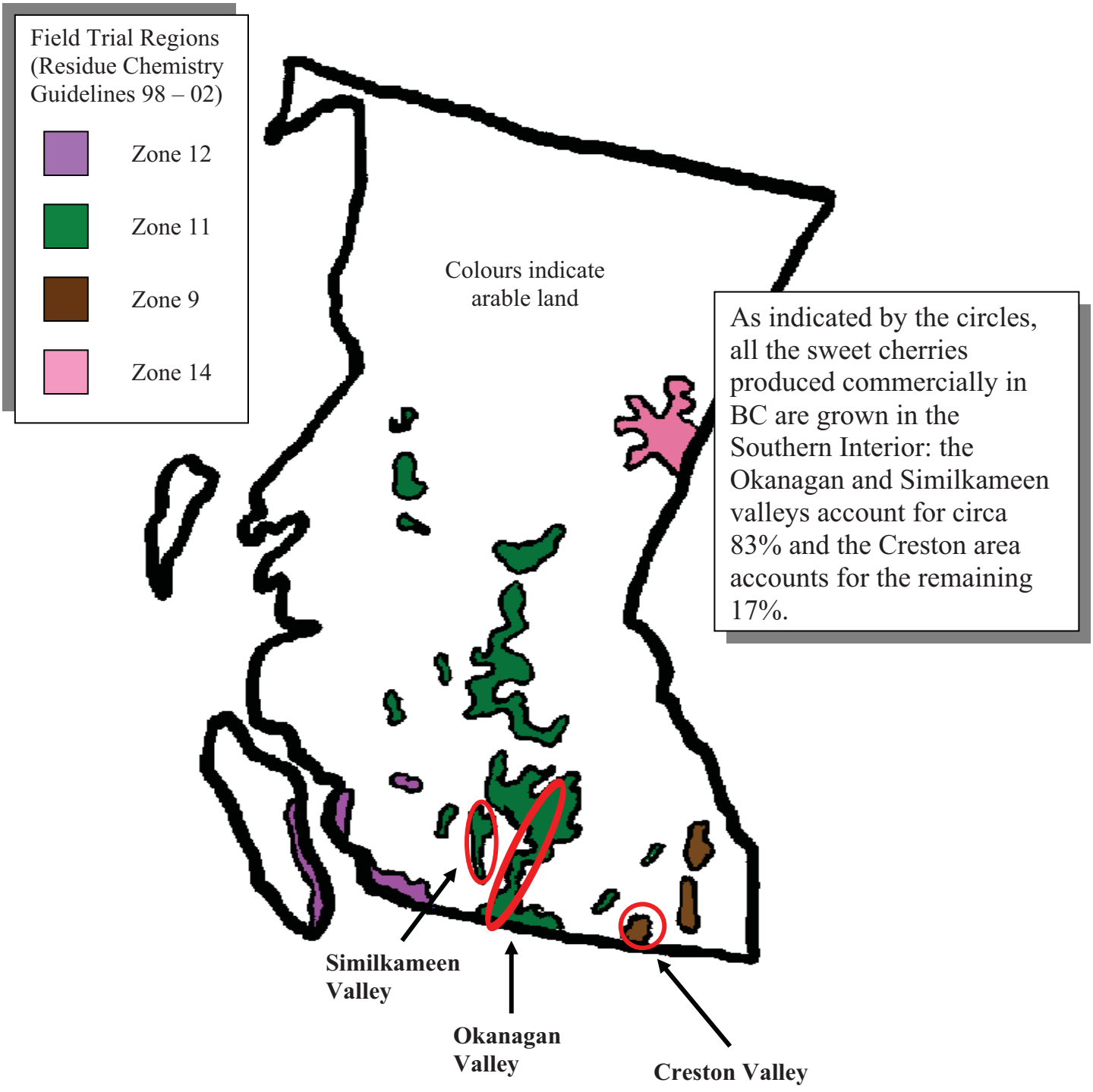
- Less than 7% of cherries produced in BC went into the processing market
- Cherries sold into the fresh market accounted for more than 93% with 75% sold wholesale and 18% sold directly to the consumer

August 2002
Last Updated: October 2005

BRITISH COLUMBIA
Ministry of Agriculture and Lands

Crop Profile: Cherries in British Columbia
Table of Contents

Regions of Sweet Cherry Production in British Columbia



Commodity Description

Background Information

Fresh BC cherries
Photo courtesy of BCMAL

Sweet cherries (*Prunus avium*), in the family of the *Rosaceae,* are a round, juicy, dark red (or occasionally yellow) stone fruit. Cherries can be blended for sauces or drinks, frozen, canned and used for jams, pie fillings and yogurt flavouring; however, the vast majority of cherries are used fresh. Cherries are a good source of vitamin C, the B vitamins and potassium.

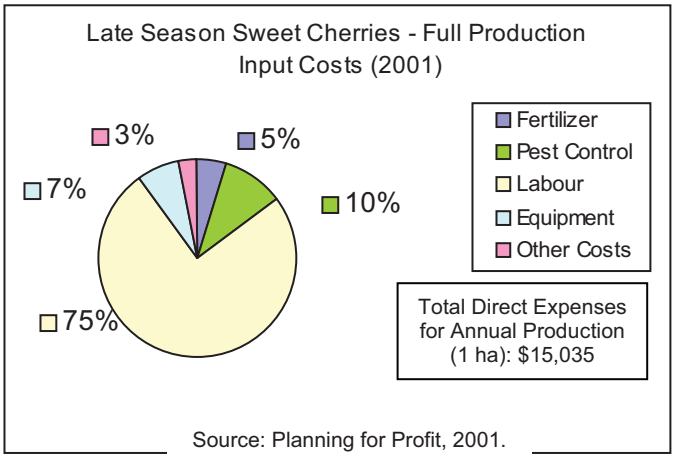
Cherry production in BC began more than 75 years ago and the industry has undergone significant evolution over the past 20 years, largely due to changes in marketing and handling. Cherry production in BC is a high risk, high reward business. In the past, growers depended on the highly competitive domestic markets, as well as sales to canneries and processors. Today, the development of export markets for premium quality cherries and an almost non-existent processing market define the cherry industry in BC. As this change has swept the BC market, the main market competition in Washington State has followed suit. There has been a switch in emphasis from high volume to high quality production, requiring a shift in horticultural, handling and marketing practices. The need for a high quality product has led to a trend toward the development of on-site packing with strict quality control although about 50% of BC cherries continue to be shipped to off-site packinghouses. These sites are also undergoing changes in their handling methods to ensure quality standards are met.

The importance of the export market produces some unique challenges for BC cherry growers. Countries that import BC cherries set their own standards for chemical use and quality. Chemicals which are accepted in one country may not be acceptable in another, which complicates the spray program used by growers. Additionally, Canada is considered a small market with respect to worldwide cherry production, and agricultural chemical companies may choose not to pursue registrations for certain products. This

puts Canadian growers at a disadvantage when compared to larger market countries such as the United States.

British Columbia exports cherries throughout the world, including the United States, Asia, the Far East and the European Union. Additionally, there are many new and expanding markets and emerging opportunities for growers producing a high quality fruit.

In BC, the majority of costs for cherry production are associated with labour (pruning, picking, and grading). Equipment costs include fuel, oil and lubrication of equipment, along with repair and maintenance. Pest control includes the cost of an IPM program, herbicides, insecticides and fungicides. Other costs include crop insurance and the rental of beehives.



BC Varieties

BC growers can choose from many varieties of cherries. Cherries can be categorized based on the harvest date: early season, mid season and late season. Aside from harvest date, varieties are chosen based on colour, texture, stem quality, flavour of fruit and market trends and acceptability.

Cristalina**,** Van and Santina are the main early cherry varieties planted in BC, though the planting trend for Van is declining. Mid-season varieties include Sylvia, Summit, Sonata, Lapins, Stella and Lambert; the latter two are declining. There is also a trend of increased Rainier plantings as a mid season variety. Late season varieties include Staccato, which is rapidly increasing in acreage, and Sweetheart. Additionally, there are a number of promising new varieties under trial. Due

Fresh Rainier cherries
Photo courtesy of BC Tree Fruits Ltd.

to the growth in the cherry industry in BC, new varieties are being bred at the Pacific Agriculture Research Center in Summerland (those varieties starting with "S", as well as Lapins, were bred in Summerland).

Production Systems

Cherry trees begin to bear fruit at 3 to 5 years of age, and remain productive for many years. The cherry production season, from bloom to harvest, lasts about 80 to 120 days. The trees are generally dormant from November through early March. The trees become active, buds break and the trees come into blossom from April through early May. Harvest starts in late June and continues into early September. All of these dates depend on the latitude, exposure (aspect) and altitude of the orchard. A summary of cherry production can be found on page 35.

A 21-weather-station network is operating in the Okanagan and Similkameen Valleys. The network combines the latest technologies in weather station instrumentation, communication and the Internet to provide farmers with real time weather information. This weather system uses radio telemetry in combination with climatic sensors to create a network that can be administrated from a single location. Collection of climatic data from these stations and packaging of the information is provided to orchards in order to improve application efficiencies using Evapotranspiration data to schedule irrigation systems. The expandable and flexible weather station network also allows growers to accurately calibrate their irrigation systems, and provides pest and disease management information to optimize the use of chemical and cultural control strategies.

Planting

The ideal site for an orchard is on a sloping hill, with a grade of 4% to 8% to allow for air drainage and good light exposure. The land is cultivated, limed (if needed based on soil test pH) and managed for weeds before planting.

Planting stock for BC cherry orchards generally comes from BC and Washington, or sometimes from California. New trees are planted as early as possible in the spring in order to increase growing time and achieve greater shoot growth. With large areas, mechanical planting may be used. Before planting, any crown or root galls are pruned off. If pre-plant soil tests indicated the need for soil amendments, they are applied prior to planting. New plantings are generally fenced to protect the trees and their fruit from ungulates such as deer.

There is a trend towards higher density plantings in BC. Older plantings averaged 120 trees per ha, while the newer high density plantings may have as many as 1,940 trees per ha. Cherry orchards in BC have an average of 1,125 to 1,250 trees per ha. The higher density plantings require careful management to maintain air circulation and thereby aid in the prevention of certain fungal diseases.

New trees are pruned shortly after planting; pruning encourages vegetative growth. Trees are pruned differently depending on the variety, stage of growth and training system. New cherry orchards in BC generally use a central leader (main stem) system.

Because vegetative growth is so important in the first year after planting, a fertilization program is needed. An application of phosphorus is made shortly after planting to stimulate growth and a feeding program with low levels of nitrogen is started soon after. Feeding is managed to establish a balance between encouraging tree growth and minimizing the susceptibility of the young trees to winter kill. Nutrients can be mixed with fungicides and applied as a foliar spray as a form of feeding the young trees; nutrients, including nitrogen, zinc and boron are often applied this way.

Growth and Care

Proper pollination is essential for good fruit production in a cherry orchard. Most of the older cherry varieties require cross-pollination (pollen from the anthers of the flowers of one cherry variety must be transferred to the stigmas of a different, compatible variety). Most varieties planted today, such as Santina, Lapins, Staccato, Sonata, Sweetheart and Skeena are self-fertile, but benefit from cross-pollination and therefore are not generally planted in large blocks of single varieties. Pollinizer trees are

interplanted at regular intervals throughout the orchard; cherries are harvested from both the main and the pollinizer varieties. The necessity of planting several varieties, and the resulting variation in maturity dates, complicates the spray program used in the orchard. Cherry orchardists rent honeybee hives in order to ensure enough insects are present for adequate pollination. Hives are placed in the orchard at the onset of bloom; a rate of 4 to 6 hives per ha is used.

Cherry trees must be pruned to maximize fruit production and quality. Trees are pruned each year when they are dormant in the winter or early spring. They may be pruned again in the summer if pruning is needed to reduce leaf area, in order to minimize vegetative growth and promote flower initiation in the following season.

Eliminating a portion of flowers during blossom can increase fruit size and increase the amount of bloom that will occur the following season. Cherries may be thinned up until pit hardening, (while the fruit is still green and has not yet started to swell with ripening). Thinning is time and labour intensive, and is not generally done.

Most growers apply gibberellic acid (GA) to their cherries during pit hardening, which is at least 3 weeks before harvest. Applying GA encourages the development of larger, firmer cherries.

Soil and Nutrient Requirements

Cherries grow well on a variety of well drained soils; they are highly susceptible to poor drainage. A soil test may be used to determine the soil pH, conductivity (level of soil salts) and the level of boron in mature cherry orchards. Soil analysis is a reliable guide for nutrient requirements in cherries; additionally leaf analysis may be used to determine nutrient needs. Leaf samples are taken in late June or July, from leaves not previously sprayed with the elements being tested. A leaf sample consists of 50 leaves taken from the middle third of terminal (current year's) growth. A separate sample is taken for each variety and age group, and separate samples for areas of concern or reduced vigour are often used.

Cherries nearing maturity
Photo courtesy of BCMAL

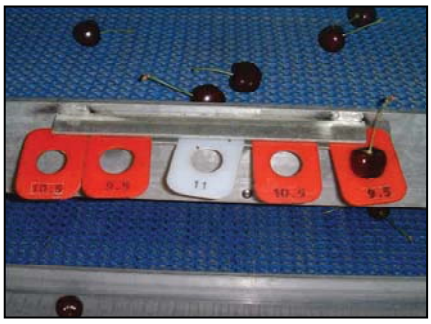
A pH of 6.0 to 6.5 is ideal for cherry orchards. Most native soils in BC's interior are neutral or alkaline, but the persistent applications of nitrogen fertilizers and irrigation favour the development of acidic soils. It is recommended that lime be broadcast evenly over the entire orchard; the soil may be lightly cultivated to aid in absorption.

Nitrogen is applied in the late fall or early spring. Caution is used in determining the correct amount of nitrogen to apply to the soil. Nitrogen can also be applied as a foliar spray. Generally, foliar analysis indicates low zinc levels in cherry orchards in BC's interior. Zinc sulphate is normally applied annually during the period from late dormant to early budswell (the second stage of cherry bud development), and again as soon as possible after harvest. Fruit trees grown in BC often require boron applications; but excess boron is toxic to cherries, so leaf and soil analyses are conducted before applying boron. If leaf analyses indicate a need, boron is applied to the soil once every 3 years on fine and medium textured soils, or annually on coarse soils. Manganese, iron, phosphorus and potassium levels are monitored in BC orchards. If deficiencies are determined through soil and/or leaf analyses, these nutrients are applied as foliar or soil treatments.

Water Requirements and Irrigation

Irrigation is critical for producing high quality cherries throughout the growing season (April through October); irrigation is generally reduced after harvest. The orchard receives a thorough watering prior to winter to prevent the trees from drying out.

In BC, cherry orchards use a variety of irrigation methods, including drip irrigation, and micro and conventional sprinklers. Orchardists desire modern, efficient systems geared towards water conservation and this has resulted in a trend towards increased technology and control over water delivery.



Cherry grading line, showing the sizing templates used to grade BC cherries. Photo courtesy of BCMAL

Harvest and Storage

Cherries are hand harvested when they mature (late June to early September). Cherries are picked from the tree with the stem attached. Harvesting

cherries requires the use of three-legged orchard ladders.

After harvest, the fruit is moved quickly to a cooler to preserve the quality. Cherries are cooled, graded and washed. Cherries are graded based on size, with larger cherries garnering the highest price. Cherries may be stored for up to 3 to 4 weeks in MAP (modified atmosphere packaging) bags at 0°C, but should be sold immediately for the best quality. To reduce moisture loss and improve storage life, polyliners are used in storage containers or boxes. Fruit should not be stored longer than 4 weeks, as a serious deterioration in quality results.

Worker Activities

Throughout the year, orchard owners, operators, contract workers and pest management professionals all spend time in the orchard. The amount of time spent in the orchard depends on the activity; an entire day may be spent pruning, while turning an irrigation system on and off takes only an hour. In addition, the level of contact with the trees varies from zero contact activities such as mowing weeds to high contact activities such as harvest. A complete schedule of worker activities can be found on page 35.

Pest Management

Pesticide Application

Pest management in BC tree fruit orchards is based on a wide variety of non chemical approaches, including sterile insect release, mating disruption and biological insecticides. The BC Fruit Growers' Association developed and implemented the BC Good Agricultural Practices (BCGAP) program to ensure that the BC tree fruit industry remains competitive. That is, to ensure the industry is able to satisfy market demands for verified production and food safety standards and food traceability. The program is based on Integrated Fruit Production (IFP), the economic production of quality fruit, giving high priority to horticultural and ecologically sound methods that minimize the use of agricultural chemicals. The current *Integrated Fruit Production Guide for Commercial Tree Fruit Growers in the Interior of British Columbia* contains a

description of the program, how to apply for BCGAP certification and the fruit production standards with which growers must comply in order to receive certification. Many growers in BC have achieved certification to the EURE GAP (European Certification Standards).

Many fungicides and insecticides are applied with air-blast sprayers that are designed specifically for use on fruit trees. Insecticides and fungicides are usually applied in concentrate sprays of 850-1170 L per ha (75-125 gallons per acre). Dormant oil and GA are generally applied using dilute sprays (about 2240 L per ha or 200 gallons per acre).

Diseases

The major fungal diseases of cherries are Brown Rot, *Botrytis*, Bacterial Canker, Cytospora Canker, Coryneum Blight, *Alternaria* and Powdery Mildew. Powdery Mildew is becoming more prevalent as the number of higher density plantings increases.

Two diseases of lower importance are Verticillium Wilt and Crown Rot Phytophthora. Verticcilium Wilt can be a problem when new trees are planted on previous vegetable fields; mainly in the South Okanagan. The incidence of Crown Rot Phytophthora is directly related to rootstock susceptibility.

Numerous viruses also affect cherries; Little Cherry Virus is of the greatest concern in BC. A summary of disease control products can be found starting on page 25.

Brown Rot *(Monilinia fructicola)*

Brown Rot is a fungal disease that causes serious damage to cherries and other stone fruits during wet seasons. This disease is of most concern for export markets, as it is a quarantine disease for some destinations, including the European Union. Brown Rot first appears as small, circular brown spots that rapidly increase in size. Early infections appear as blossom blight or twig canker. Grayish spores appear in tufts on rotted areas. Infected fruits eventually turn into shriveled, black mummies that may drop or remain attached to the tree through the winter. Spring infections arise from mummified fruit of the previous season that has remained attached to the tree or fallen to the ground. Brown

Rot can also spread after harvest; mature fruit can decay in 48 hours under warm conditions.

Two types of spores that can infect blossoms are produced in the spring. Conidia are produced on cankers and fruit mummies in the tree. Apothecia (small mushroom-like structures) form on mummies lying on the ground. The apothecia discharge ascospores during the bloom period, but do not contribute to fruit infection later in season. Fruit mummies hanging in the tree are thought to be the main source of inoculum in BC. Spores on blighted blossoms cause secondary infections. These infections spread to ripening fruit. Rotting fruit provide abundant inoculum that can infect additional healthy fruit. Fruit becomes increasingly susceptible as it ripens.

Cherry fruit affected by brown rot
Photo courtesy of Agriculture and Agri-Food Canada

Brown Rot causes more extensive damage during wet seasons. Prolonged wet weather during bloom may result in extensive blossom infection. The length of the wet periods required for blossom infection depends upon the temperature: as temperature increases, the length of time required for infection decreases. Regular sprays are required for control of Brown Rot. The number of sprays during the bloom period can vary from zero to 4, depending on the weather. Additional sprays are required to protect the fruit as it ripens.

There is no formal weather monitoring/modeling underway for Brown Rot with the weather network at the present. So far the weather network is used primarily for apple scab and fire blight infection prediction. However, some crop consultants do consider the information on wetness periods for Brown Rot blossom infection in their recommendations.

Harvest and storage are sites of disease spread; pickers avoid injuring or bruising fruit at harvest, pick only sound fruit and discard fruit with brown spots or rot. Culls and rotted fruit are buried promptly and fruit is pre-cooled and kept in cold storage until it reaches its destination. There are no fungicides registered in Canada for control of post harvest Brown Rot in cherries. There is a need for a post harvest fungicide dip in high

risk years. Detailed recommendations for chemical sprays are described in the *BC Integrated Fruit Production Guide for Commercial Growers – Interior Districts, 2004/2005 Edition*, and at http://www.al.gov.bc.ca/cropprot/tfipm/brownrot.htm as well as on page 25 in Table 1.

Botrytis Fruit Rot (*Botrytis cinera)*

Botrytis cinera is a common fungus that can cause fruit rot problems in the orchard and post-harvest. *Botrytis* infects the cherry blossoms following prolonged periods of wet, cool weather. When the wet weather persists, green fruit rot occurs; symptoms of the green fruit rot include blossom blight and smooth brown lesions on cherry fruit. In other cases, a latent flower infection develops into fruit rot as the fruit ripens. Botrytis rot of mature cherries may be mistaken for Brown Rot; the symptoms are very similar. Fruit develop a firm brown decay and become covered with light brown spores. Laboratory examination may be required to distinguish between Brown Rot and *Botrytis*. *Botrytis* is also an important cause of post harvest losses in cherries. It can develop at cold temperatures and has the ability to spread in storage.

Disease spread occurs at harvest and in storage. Pickers avoid injuring or bruising fruit at harvest, pick only sound fruit and discard fruit with brown spots or rot. Culls and rotted fruit are buried promptly and fruit is pre-cooled and kept in cold storage until it reaches its destination. There are no fungicides registered for *Botrytis* in cherries.

Bacterial Canker *(Pseudomonas syringae)*

Bacterial canker has been an increasing problem in the BC interior, particularly on young cherry trees. Cherries are very susceptible, but *Pseudomonas* also infects other stone fruit, pears, apple rootstocks and many species of ornamental trees. Young cherry trees, less than 10 years old, are more susceptible than established cherry trees, and trees under stress are much more susceptible than healthy trees with optimal growing conditions.

Bacterial canker infections are thought to take place mainly in the fall and winter during cool, wet weather. Trees are particularly susceptible during autumn leaf fall when fresh leaf scars may become infected. Cankers may not be obvious until the spring when

they start to expand rapidly. Frost damage in the spring may promote additional infections, and may be more important than previously recognized. The bacteria overwinter in canker margins, in healthy buds and also systemically in the vascular system. In the spring, bacteria are disseminated by rain to blossoms and young leaves. The bacteria can survive in an epiphytic phase on the surface of symptomless leaves and blossoms, and also on other plants or weeds in the orchard during the summer.

Symptoms on young cherry trees include elongated gummy cankers that are soft or spongy to the touch. Cankers may expand rapidly in the spring, causing girdling of the main trunk or branches. Bacterial canker can also kill buds and sometimes cause brown, circular lesions on leaves, which fall out to produce "shotholes". Fruit lesions are small brown spots, which may be slightly sunken on immature fruit. Leaf and fruit symptoms are not common in the Okanagan, but may be seen in areas with higher rainfall.

Bacterial canker gumming on cherry tree
Photo courtesy of Agriculture and Agri-Food Canada

Stresses on young or recently planted cherry trees can be minimized by providing adequate water to prevent drought stress, avoiding planting in areas with poor drainage or high frost potential, managing nutrients and pH carefully and controlling pests and diseases that may otherwise weaken trees.

Trees with minor gumming may be able to recover. Small cankers can be cut out with a disinfected pruning knife. Affected branches are pruned throughout the season. If the infection has spread significantly, the tree may not be able to recover and the only possible control is to remove the tree before it infects others. Before planting new cherry trees, the soil may be tested for nematodes, as the ring nematode is possibly associated with increased losses due to bacterial canker. Growers who source new cherry trees from arid production areas generally have fewer problems with bacterial cankers. No bactericides are registered for bacterial canker in sweet cherries.

Powdery Mildew *(Podosphaera clandestina)*

Powdery mildew is a significant concern for cherry growers in BC. Cherry foliage, fruit, and shoots are susceptible to powdery mildew. Fruit infection appears as a white powdery covering on the cherry as the fruit ripens, resulting in unmarketable fruit. Fruit is infected by conidia that are produced on the leaves. Immature fruit is much more susceptible than mature fruit and susceptibility decreases as sugar content increases. Outbreaks of powdery mildew are triggered by wet weather during fruit development.

Cultural controls include increasing air circulation by pruning and avoiding dense plantings, removing infected water sprouts, and keeping grass short beneath cherries with low-hanging branches. The trend towards higher density plantings and later-maturing varieties has lead to increased powdery mildew infections throughout BC cherry orchards.

Critical spray timings for fruit protection under conditions of light to moderate mildew pressure include fungicide applications at husk fall and about 7 to 10 days later to protect the susceptible green fruit. Where mildew problems have been severe, it is advisable to bring the foliar mildew problem under control early in the season. Mildew sprays begin no later than petal fall and continue at 7 to 14 day intervals until the pit hardening stage. In later varieties mildew protection may be required beyond this stage. Spray intervals can be adjusted depending on weather conditions and the products selected. More sprays are needed in wet years than dry years. Chemical spray recommendations can be found in the *BC Integrated Fruit Production Guide for Commercial Growers – Interior Districts, 2004-2005 Edition*, and at http://www.al.gov.bc.ca/cropprot/tfipm/mildew.htm, as well as on page 25 in Table 1.

Cytospora infection on tree trunk
Photo courtesy of Agriculture and Agri-Food Canada

Cytospora Canker *(Leucostoma cincta)*

This fungal disease is an important problem on all stone fruit trees, especially in the South Okanagan and Similkameen Valleys. The majority of infections are found on scaffold limbs or trunks of infected trees. The primary symptom is the presence of dead twigs or branches after the tree has leafed out in the spring.

Closer examination of dead limbs often reveals slightly sunken areas in the bark. Small, black, pimple-like fruiting bodies of the fungus often develop under the bark in these sunken areas. Later in the spring, hair-like masses of spores are extruded from these structures. Conidia (spores) are most abundant in the fall and spring. During rain or irrigation, spores are splashed and blown around the orchard. Infection occurs through injuries to the bark such as pruning wounds, leaf scars, winter injury and sunburn. After the fruiting bodies have been washed by rain, small white dots remain on top of the pimple-like structures and serve as useful indicators of the fungus.

Cultural controls are as follows: pruning is performed as late in the spring as possible to take advantage of the more rapid rate of wound healing which occurs at higher temperatures. To further encourage rapid healing-over, branches are cut just beyond the ridge of the thickened bark that connects them to larger limbs. Pruning stubs should never be left. Trees are trained so that wide crotch angles develop between the trunk and the branches. Sporulating infections on scaffold limbs or trees are removed immediately and burned, as they are a source of spores. Preventative measures are used to minimize winter injury, sunburn, rodent damage and insect damage. Trees are maintained in a vigorous state. No fungicides are registered for Cytospora canker, which is a significant concern for many cherry growers in BC.

Coryneum Blight *(Wilsonomyces carpophilus)*

Fruit symptoms of this fungal disease are most severe when there is frequent wet weather at husk fall. On cherry fruit, Coryneum blight causes small reddish-brown to purple spots, some of which appear scabby later in the season. Twig infections are not common, but shotholes in leaves are often found. The main cultural control is to prune out infected twigs during dormancy. No fungicides are registered for Coryneum blight in cherries.

Alternaria Fruit Rot (*Alternaria alternata*)

Alternaria causes a minor disease of cherry fruits. Early symptoms show on green fruit as red rings, approximately 2 mm in diameter; these rings are most prevalent just as the fruit begins to colour. As the cherries ripen, the centers of the rings become

brown and sunken. Under moist conditions, a grey to dark green mould grows on the surface of the spots. Alternaria rot may also occur on cracks and insect damaged areas of the fruit. In addition, this fungus causes a post harvest storage rot.

Little Cherry Disease

Little cherry disease is caused by the little cherry virus (mostly LChV-3), which is vectored by the apple mealybug. This virus is a serious disease of cherries in BC, though it has lately stabilized and newly infected trees are rarely found.

Cherries on affected trees are not fit for the fresh fruit market as they lack flavour, sweetness, size and colour. A regulation under the BC *Plant Protection Act* makes removal of infected trees mandatory. In spite of ongoing eradication programs, the disease remains established at low levels in Southern BC.

Cherries affected with little cherry virus (left) compared to healthy cherries (right).
Mass of apple mealybug eggs (white) in cluster
Photo courtesy of
Agriculture and Agri-Food Canada

Fruit symptoms are most pronounced in the Lambert variety, in which fruit can be as small as half the normal size. The fruit colour is dull red and its shape is pointed, usually with three flat sides tapering toward the blossom end. Fruits fail to develop normal sugar and acid levels, resulting in tasteless cherries lacking in sweetness and flavour. It is common for some fruits on a branch to be more severely affected than others. Other varieties have similar symptoms, but they are less severe and more variable. It is not always possible to tell whether a tree has the little cherry virus by visual inspection. PCR and ELISA tests have been developed to assist with the diagnosis of this virus.

Little cherry virus is spread from tree to tree by the apple mealybug (see page 21), but is also readily transmitted by all types of grafting. Transmission by pollen, seed, in the soil or by pruning tools has not been demonstrated. Ornamental flowering cherries are symptomless carriers of the disease and are prohibited in the Okanagan, Similkameen and Creston valleys. To control little cherry disease, growers purchase only certified

virus-free stock, when available. Infected trees are removed immediately and hosts (such as Japanese flowering cherry and wild bitter cherry) must be destroyed. An apple mealybug control program is essential in orchards where little cherry disease has been found.

Recent research has revealed that there is more than a single virus causing little cherry disease in BC. An unrelated virus (tentatively identified as LChV-1) has been detected in numerous orchards in the North and South Okanagan, and also in the Similkameen and Creston Valleys. The vector of LChV-1 is unknown. Additional research is needed to understand the epidemiology of this disease, which has symptoms similar to those caused by LChV-3.

Insects

The new weather station network also supports the use of insect development models that allow growers to better time their monitoring and control activities. Degree day models for insect management are available as computer programs from packinghouse field services. Currently they include Codling Moth, Fruittree Leafroller, Mullein Bug and Obliquebanded Leafroller. The development of a Western Cherry Fruitfly emergence model is underway.

The Western Cherry Fruitfly (*Rhagoletis indifferens*) is the most important insect pest of cherries. The Black Cherry Fruitfly (*Rhagoletis fausta*) and (the eastern form of) the Cherry Fruitfly (*Rhagoletis cingulata*) occasionally attack cherries. Leafrollers (fruittree, European, obliquebanded, threelined) are significant pests, as is the Peach Tree Borer and the Eye-spotted Budmoth. Growers in Creston are starting to be concerned about the Black Cherry Aphid *(Myzus cerasi),* only diazinon is registered against this pest. McDaniel mites (*Tetranychus mcdanieli*) and Two-spotted spider mites (*Tetranychus urticae*) seem to be an increasing problem. An emerging pest is the Pear Sawfly (*Caliroa cerasi,* aka 'Pear Slug'). Ambrosia Beetle *(Xyloborus dispar)* and Shot-hole Borer *(Scolytus rugulosus)*, as well as mites, are occasional pests. The Apple Mealybug (*Phenacoccus aceris)* is problematic as a vector of little cherry virus where the disease is present, but does not cause direct injury. A summary of insect and mite control products can be found on page 27.

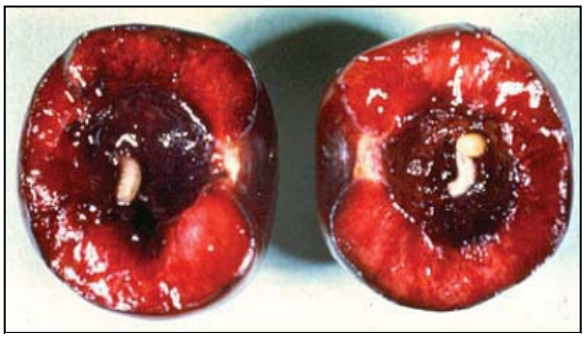
Cherry Fruit Flies *(Rhagoletis* spp.*)*

The Western Cherry Fruit Fly (*Rhagoletis indifferens)* and the Black Cherry Fruit Fly *(R. fausta*) live mainly in the Okanagan, while the Creston area can be home to both species, as well as the eastern Cherry Fruit Fly *(R. cingulata)*. For control purposes, the species do not need to be differentiated as their life-cycles are essentially the same.

The larvae of this fly burrow into the flesh of the cherry, rendering the cherry unmarketable. Larvae are undetectable from the exterior of the cherry, but are easily visible when the cherry is opened. This pest can render an entire crop unmarketable, as there is zero tolerance for this insect in most export markets.

The cherry fruit fly overwinters as a pupa in the soil under trees. Adults emerge from June through August. Adults are weak fliers, but disperse readily and are a constant threat throughout the summer. Approximately 5 to 9 days after emerging, female flies lay up to 250 eggs singly in cherries. Larvae feed for 1 to 2 weeks before cutting exit holes and dropping to the ground to pupate. Only 1 generation is produced per year. Due to the extended emergence period of this pest, fruit must be protected through to harvest. The presence of fruit flies in unmanaged orchards, backyard and wild trees pose a constant threat to nearby managed orchards.

Yellow sticky traps for the cherry fruit fly are available, but their use yields variable results. Many growers feel that the traps are not consistently reliable. If used, traps should be inspected daily until the first fly is caught, then again at weekly intervals. A control product must be applied within 6 days of first fly capture. Because the yellow traps cannot detect the flies when numbers are low, fruit is often protected even if no flies are captured. Insecticidal sprays are applied when the cherries begin to colour and continue until near harvest (depending on pre harvest intervals of the chosen control products). Growers are encouraged to apply a post harvest spray of a systemic product such as dimethoate or imidacloprid to control larvae in unharvested fruit.



Western cherry fruit fly larvae in cherry fruit
Photo courtesy of Agriculture and Agri-Food Canada

Although chemical sprays are essential for management of this pest, growers have access to only a few products. There is also a concern about the declining availability of effective controls due to market restrictions, loss of registrations due to re-evaluations and lack of MRLs in importing countries for products recently registered in Canada. Another threat to cherry growers is the potential increase in fruit fly pressure from nearby backyard cherry trees left unprotected due to the loss of domestic cherry fruit fly control products such as diazinon, carbaryl, and dimethoate. New products for cherry fruit fly control are needed for both domestic and commercial use. Also, diseased and split fruit left on the trees increase the risk of greater fruit fly pressure the following year if not treated for fruit flies post-harvest.

In 2005, an organic formulation of spinosad, Entrust™, has been registered for control of western cherry fruit fly and other tree fruit pests. Entrust™ will open the way for development of an organic cherry industry in Canada.

General spray recommendations can be found in the *BC Integrated Fruit Production Guide for Commercial Growers – Interior Districts, 2004-2005 Edition*, http://www.al.gov.bc.ca/cropprot/tfipm/fruitfly.htm and as well on page 27 in Table 2 of this document.

Leafrollers: Fruittree Leafroller *(Archips argyrospila)*, European Leafroller *(Archips rosana)*, Obliquebanded Leafroller *(Choristoneura rosaceana)* and Three-lined Leafroller *(Pandemis limitata)*

Leafroller larvae cause damage to buds (chewed petals and flower parts), blossoms (petals webbed together, often remaining attached through petal-fall; inner flower parts eaten), leaves (fed upon, rolled up and tied together with silk) and fruit (deep irregular holes in small fruit resulting in large russeted scars in mature fruit).

Fruittree leafroller larva
Photo courtesy of BCMAL

Fruittree and European leafrollers are present in most cherry growing areas in BC. Overwintering egg masses begin to hatch around the 15 mm green bud stage. Egg hatch may extend over several weeks if temperatures are cool. Larvae enter buds and feed

on flower parts, moving to the leaves after bloom. They feed on leaves and nearby fruit. Mature larvae pupate within leaf rolls. Adults emerge from June to August, mate and lay eggs that hatch the following spring. There is 1 generation per year.

In order to monitor for the fruittree leafroller, branches are checked for egg masses during pruning. Weekly hatches can be monitored to determine when peak hatch occurs. A small dark hole will appear in hatched eggs. Alternatively, a degree-day model is available to estimate the proportion of eggs hatched. Another monitoring technique is limb taps combined with examination of fruit bud and blossom clusters on a weekly basis to monitor for the presence of young larvae. A pheromone-baited trap is commercially available to monitor fruittree leafroller adults and identify the adult moth flight period, but no relationship between moth captures and subsequent larval abundance the following year has been established.

Trees are pruned to open up the canopy to allow sufficient penetration of control sprays, especially into the upper canopy, where leafrollers are most active. Where leafroller numbers are low to moderate, a single application of Btk (*Bacillus thuringiensis* var. *kurstaki*) after most of the larvae have hatched provides good control. However, temperature restrictions often limit the effectiveness of Bt in the spring, as it is sensitive to sunlight but is less efficient at temperatures lower than 15°C. Where larval numbers are high, a late bloom or petal fall spray followed by a second spray 10 days later is recommended. Growers may use spinosad for the second spray. Fruittree and European leafrollers in the Okanagan Valley are generally resistant to organophosphate insecticides such as diazinon and azinphos-methyl.

The obliquebanded and three-lined leafrollers are present throughout the Southern Interior. These 'two generation' leafrollers have 2 generations per year, each of which can cause significant damage. Young larvae overwinter in silken cocoons in bark crevices or under bark scales. Most of the overwintering larvae emerge around the 15 mm green bud stage and bore into fruit buds. They feed on flower parts, leaves and young fruit. Feeding of the first generation results in irregular shallow skin tunnels under a leaf tied to a fruit, or where two or more fruit are touching.

Mature larvae pupate within rolled leaves. Moths of the second generation emerge from late May to late July. Females lay egg masses on leaves and young larvae

feed first on terminal growth and later on leaves and fruit. The second generation creates small feeding holes in the fruit that can become infected with rot pathogens, causing losses in storage. Larvae can be present at harvest and contaminate harvested fruit which can adversely affect the marketability of the fruit.

Moths of the second generation are active from late August to October and lay eggs on leaves. Larvae hatching from these eggs feed briefly before seeking protected sites on trees in which to overwinter.

Orchards are monitored by checking fruit bud and blossom clusters for larvae in the spring. In the summer, terminals and leaves attached to fruit are checked for young larvae and feeding damage. Blossoms and fruit clusters can be shaken or tapped over a beating tray to detect the presence of larvae. Pheromone-baited traps for adults are available to establish the timing of sprays; but no relationship has been established between moth captures and subsequent larval abundance or damage.

Elimination or spraying of unmanaged host trees next to commercial host crops helps to reduce leafroller pressure. It is essential to control the overwintering generation of obliquebanded and threelined leafrollers in order to reduce the summer populations. The first summer generation is much more difficult to control because of increased canopy density, and because growers have access to a limited number of control products with short pre harvest intervals. Two new tools in the fight against leafrollers are Isomate CM-LR (PCP# 27776) and Entrust™ (PCP# 27825), which are both certified for use in organic production in cherry orchards. Control recommendations can be found on pages 6.8 to 6.12 in the current edition of the *BC Integrated Fruit Production Guide for Commercial Growers – Interior Districts,* as well as at http://www.al.gov.bc.ca/cropprot/tfipm/leafrollers.htm.

Greater Peach Tree Borer *(Synanthedon exitiosa*)

Larvae tunnel under the bark at or below the ground level, creating masses of gum mixed with sawdust and excreta near the soil line of the tree trunk. Young trees can be girdled and killed; older trees are weakened and become susceptible to attack by other insect pests. The larvae overwinter in their feeding tunnels or in the soil, becoming active in the spring. Pupation occurs in their feeding tunnels. Adults are active from late

June until September. Females lay their eggs on tree trunks, mainly near the soil line. Larvae bore into the tree after hatching and take up to 2 years to reach pupation.

Male moths are monitored using pheromone-baited traps. In mid June, traps are hung at a density of 1 trap per ha with a minimum of 2 traps per orchard. Traps are also placed along the edges of the planting to monitor moths entering from adjacent plantings. Traps are checked weekly and the traps and pheromone lures are replaced every 6 weeks. Tree bases are inspected for signs of larval attack (excreta mixed with jelly-like gum).

Attacked tree trunk displaying gummy resin ooze at base
Photo courtesy of BCMAL

Larvae can be killed in tunnels by probing with a wire or by opening tunnels to find and destroy them. One chemical treatment consists of dipping the tree roots and trunk in Thiodan (endosulfan) before planting. If trap catches indicate a need for control, established trees may be sprayed with Thiodan (the only registered product, aside from the mating disruption pheromone) twice in June and July for at least 2 consecutive years to obtain control. However, if the infestation occurs late in the season, Thiodan cannot be used due to the long pre harvest interval of 15 days. Additionally, Thiodan is on the red-list in the EU, and the product will no longer be used on export crops.

Isomate-P twist-tie on young cherry tree
Photo courtesy of BCMAL

In 2002, the mating disruption pheromone Isomate-P was registered in Canada as a control method for the Greater Peach Tree Borer and appears to be an effective control method. Control recommendations are described on page 6.17 in the current edition of the *BC Integrated Fruit Production Guide for Commercial Growers – Interior Districts,* as well as at: http://www.al.gov.bc.ca/cropprot/tfipm/peachborer.htm.

Apple Mealybug *(Phenacoccus aceris)*

This insect pest causes no direct damage, but is the primary vector of little cherry virus. Adult mealybugs appear as small white powdery patches in bark crevices, pruning

scars and in the crotches of small twigs. Apple mealybugs overwinter as nymphs on their host (fruit trees, ornamental trees and shrubs) and become active in May. Eggs are laid from June to July, and nymphs are present from July to October, when they overwinter. There is 1 generation per year.

Apple mealybug is likely prevented from developing noticeable populations because of a very effective biological control agent in combination with insecticidal sprays applied against other pests such as cherry fruit fly. No chemicals are registered for the pest on cherries or other fruit trees.

Eye-spotted Budmoth *(Spilonota ocellana)*

This pest is common north of Summerland in the Okanagan Valley and in the Creston Valley. Damage is rare elsewhere in the South Okanagan and Similkameen Valleys. Young larvae overwinter in silken cocoons in the crotches of twigs and branches. They emerge during bloom and construct nests of leaves and blossoms, feeding mainly on leaves. Larvae pupate in the nests and moths emerge in mid June to late July. After mating, females lay eggs singly on leaves. Summer larvae tie dead leaves to fruit and feed on the fruit surface. In September, larvae seek overwintering sites on the trees. There is 1 generation per year.

Monitoring takes place in the spring, when feeding damage to leaves and bud clusters can be found. In late July and August, the fruit is examined for surface feeding, usually in areas of red fruit where a leaf had been attached or where two adjacent fruits were touching. Pheromone-baited traps are commercially available to monitor adults; however, no relationship between moth captures and subsequent larval abundance has been established. It is important to control the spring generation of budmoth larvae in order to reduce the need to control the summer generation that causes the economic damage. Control recommendations are described on pages 6 and 7 of the current edition of the *BC Integrated Fruit Production Guide for Commercial Growers – Interior Districts,* as well as at http://www.al.gov.bc.ca/cropprot/tfipm/budmoth.htm.

Weeds

Weeds compete with cherry trees for nutrients and water. Cherry trees are affected by the insects and diseases harboured by weeds. Weeds around tree trunks can provide shelter for rodents. As these rodents may girdle trees by stripping the bark, weeds near the trees should be reduced. Ornamental and wild cherry trees are significant sources of the little cherry virus, which can easily spread to commercial orchards via the apple mealybug. These weed trees are prohibited in the commercial cherry growing areas of BC and must be destroyed when found.

Residual and non-residual herbicides are used to control orchard floor vegetation (Table 3). Hand weeding is practical only for small orchards and if the area is free of perennial weeds. Tillage is shallow to avoid pruning the tree roots. Mulches are sometimes used; mulch materials can be varied and adjusted to what is available and economical. Sawdust, wood shavings, grass clippings, weed-free hay and straw are all used to a small extent. Available controls are listed in Table 3 on page 30.

Other Issues

Cherry growers in BC face many challenges beyond insect and disease pests. Vertebrate pests damage young trees, inclement weather causes crop losses and the areas best suited for production border ever-growing urban centers.

Cherry orchards in BC are generally fenced at planting to protect the trees from ungulates such as deer and elk. The animals chew buds, spurs, shoots and leaves, and trees that are damaged when they are young may not develop into commercially productive plants. Woven wire fences of at least 2.4 m in height provide the best protection, but are expensive to install.

Birds such as starlings, robins and crows often attack cherries. Starlings, which cause the most severe damage, can cause serious crop loss. A combination of 2 or 3 control methods has yielded the most success in controlling bird populations. Noisemakers such as propane exploders and whistler shells are used to startle the birds; recorded starling distress calls are effective at repelling starlings. Plastic tape or streamers can be suspended throughout the orchard as a visual repellent, but work best in combination with noisemakers.

Field mice (also called voles; Genus *Microtus*) feed on trees when their summer food supply becomes scarce in the fall. Injury to the trees can begin in late summer and continue through the winter; severe damage such as complete girdling of the trunk or roots can kill the trees. The vegetation in and around the orchard is managed to discourage rodents and rodenticides are sometimes also used (Table 4).

The cherry growing areas of BC generally have mild winters, but the climate can be unpredictable. Winter damage to cherry trees increases the susceptibility to diseases and insects, particularly shot-hole borer and ambrosia beetle. Rain split can be very problematic during periods of heavy rain. Cherries absorb water and swell, eventually splitting. The wound serves as a point of entry for diseases, particularly brown rot and *Botrytis*. Trees can be sprayed with calcium in an attempt to reduce damage. Additionally, some growers use helicopters or air blast sprayers to dry the fruit off after a rain.

In BC, cherries are grown in the fertile Okanagan, Similkameen and Creston valleys. These areas are also popular tourist destinations and home to numerous golf courses, resort lakes and burgeoning cities. There is increased pressure on cherry orchards as cities and recreational users compete with growers for land and water. In addition, fruit trees kept for pleasure by neighbours serve as sources of disease inoculum and harbour insect pests, and noisemakers used to frighten birds may be disruptive in residential areas. Being located on the urban/rural interface presents challenges that cherry growers must face on a daily basis and which growers, industry and other user groups must work together to overcome.

Table 1. Chemical Control of Diseases*

Active Ingredient (Trade Name)	Disease	% Acreage Treated*	Est. # Apps.*	REI (hours)	PHI (days)	Application Method	Application Timing	Comments
Boscalid (Lance)	Brown Rot, *Monilinia* spp.	20-30	1-2	4 (once residue has dried)	0	Foliar spray	Begin applications at pink bud or prior to disease development.	Max. application rate is 1.85kg/ha per season. Can be phyto-toxic (leaf drop) to some varieties in the Okanagan. 80%-90% use in Creston area.
Captan (Maestro)	Brown rot	<10	1-2	48	2	Foliar spray	From bloom to prior to harvest	
Chlorothalonil (Bravo)	Brown rot	70-80	1	48	40	Foliar spray	Apply before husk-fall	Use of this product has increased in the past few years.
Fenbuconazole (Indar)	Brown Rot, Blossom Blight, Black Knot	80-90	1-2	12	1	Foliar Spray	For Brown Rot apply every 7 to 10 days starting 3 weeks before harvest	Do not use more than 7 applications/year. This product is overtaking Rovral in popularity.
Fenhexamid (Elevate)	Brown Rot, Shoot & twig Blight, Blossom Blight, (Monilinia *spp*.)	5-10	1	4	1	Foliar Spray	Depending on disease treated start application between pre-bloom and 2 weeks before harvest begins	Do not apply more than 4 times/year for all diseases; a seven-day interval must be allowed. Product is expensive. It helps to controls also Botrytis. 50%-60% use in the Creston area.
Ferbam	Brown rot	0	0	24	4	Foliar spray	From bloom to PHI	
Iprodione (Rovral)	Brown rot	90	2	24	1	Foliar spray	From bloom to PHI	
Myclobutanil (Nova)	Brown rot	30	1	24	1	Foliar spray	Bloom	70%-80% usage in Creston area. Preferred use against Powdery Mildew
Myclobutanil (Nova)	Powdery mildew	70	1-3				From bloom to PHI	Later varieties need more powdery mildew protection.

Table 1. Chemical Control of Diseases continued

Active Ingredient (Trade Name)	Disease	% Acreage Treated*	Est. # Apps.*	REI (hours)	PHI (days)	Application Method	Application Timing	Comments
Propiconazole (Topas)	Brown rot, Leaf Spot	50	1-2	72	3	Foliar spray	From bloom to PHI	80-90% usage and 2-3 applications in the Creston area against Brown Rot. Used at huskfall.
Pyraclostrobin (Cabrio)	Powdery mildew, Anthracnose	5-10	1	10 **DAYS**	10	Foliar Spray	Pink bud (or prior to disease development), every 7 to 14 days depending on disease pressure	Do not apply more than 2 consecutive treatments.
Sulphur (Kumulus)	Powdery mildew	50-70	1-4	24	1	Foliar spray	At husk fall, repeated as required	Highest application % in spring. Higher usage in the Creston area; up to 90%.
Thiophanate-methyl (Senator)	Brown rot	<5	1	24	1	Foliar spray	From bloom to PHI	
Triforine (Funginex)	Brown rot	<5	1	24	N/A	Foliar spray	Apply before husk-fall	Limited availability

Note: A maximum of 5 sprays for brown rot and 8 sprays for powdery mildew are applied. See Table 5.
*Estimates provided by BCMAL staff, TerraLink Horticulture Inc., Cherry Focus Goup 2005, and the Directors of the Okanagan-Kootenay Cherry Growers Association.

Table 2. Chemical and Biological Control of Insects and Mites

Active Ingredient (Trade Name)	Pest	% Acreage Treated*	Est. # Apps.*	REI (hours)	PHI (days)	Application Method	Application Timing	Comments
Azinphos-methyl (Guthion, APM, Sniper)	Eye-spotted budmoth, leafrollers, cherry fruit fly	30	1-2	+	15	Foliar spray	Pre-bloom, petal-fall, or summer	+ Depending on the activity, the re-entry interval ranges from 3 to 15 days. Product will be discontinued end of December 2007. Used for fruit fly only. Most fruittree and European leafrollers, as well as some Obliquebanded leafroller populations in the Okanagan Valley are resistant to this and other organophosphate products. This product lacks market acceptance. Phyto-toxic symptoms have been observed in some varieties. 75% to 90% use in the Creston area.
Bacillus thuringiensis var. *kurstaki* (DiPel, Foray, Bioprotec)	Leafrollers, Eye-spotted budmoth	80	1-2	24	0	Foliar spray	Bloom	
Carbaryl (Sevin)	Cherry fruit fly, Pear sawfly	50-70**	1-3	48	2	Foliar spray	Summer	** Higher usage in North Okanagan; depends on variety, harvest time and pest pressure. Mostly used for fruit fly. Use of this product may cause increased mite infestations. Note: This product is not recommended in the IFP guide.
Diazinon	Black cherry aphid, Eye-spotted budmoth, San Jose scale, leafrollers, Cherry fruit fly	60-70	1-2	48	10	Foliar spray	Pre-bloom to post-harvest, - depending on pest	Mostly used against Cherry fruit fly. Many Fruit tree- and European leafrollers, as well as some Obliquebanded leafroller populations in the Okanagan Valley are resistant to this and other organophosphate products.

Table 2. Chemical and Biological Control of Insects and Mites continued

Active Ingredient (Trade Name)	Pest	% Acreage Treated*	Est. # Apps.*	REI (hours)	PHI (days)	Application Method	Application Timing	Comments
Dicofol (Kelthane)	Twospotted spider mites, McDaniel mite	10	1	24	7	Foliar spray	Post-harvest	
Dimethoate (Cygon, Lagon)	Cherry fruit fly	10	1	48	21	Foliar spray	Summer, post-harvest	Dimethoate causes injury on newer varieties at label rates. Some markets will not accept dimethoate treated cherries.
Dormant oil	Black cherry aphid, San Jose scale, Apple mealybug	60	1	24	0	Foliar spray	Dormant or pre-bloom	Usage is higher in the South Okanagon and the Similkameen Valley.
Endosulfan (Thiodan)	Rust mite, Black cherry aphid, Greater peach tree borer	10-15	1	48	15	Foliar spray	Pre-bloom or summer	For peach tree borer, apply to tree trunks in summer, when first moths are caught in pheromone traps.
Imidacloprid (Admire)	Cherry fruit fly	10	1-2	48	10	Foliar spray	June to harvest	Registered in May 2002. Suitable replacement for dimethoate but alternate chemistry for pesticide resistance management is still needed. This product can cause an increase in mite populations. Not used on most export cherries due to lack of MRLs in importing countries.
Isomate-P Pheromone	Greater peach tree borer	<5	1	N/A	N/A	Dispenser	Prior to moth emergence, in spring	Peach tree borer is not a significant pest in bearing cherries. Used primarily on young trees.
Isomate CM-LR Pheromone	Leafrollers	0	0	N/A	N/A	Dispenser	Prior to pest emergence	

Table 2. Chemical and Biological Control of Insects and Mites continued

Active Ingredient (Trade Name)	Pest	% Acreage Treated*	Est. # Apps.*	REI (hours)	PHI (days)	Application Method	Application Timing	Comments
Malathion	Plum curculio, Mealy plum aphid, Black cherry aphid	20-25	1	24	3	Foliar spray	Summer	
Phosalone (Zolone)	Cherry fruit fly, Black cherry aphid	5-20	1	48	7	Foliar spray	Summer	Can have phyto-toxicity issues; mostly used in North Okanagan. Not used in Creston area.
Pyridaben (Pyramite)	European, McDaniel, Twospotted spider mites	0	1	24	7	Foliar spray	Post-bloom (generally within 4 weeks)	Registered for 1 application/year. Generally not used as mites are generally not a problem. Very expensive at recommended rates.
Spirodiclofen (Envidor)	Mites	+	1	12	7	Foliar spray	Post bloom	+ Registered in May 2005. No field use data available yet
Spinosad (Entrust)	Leafrollers, Eye-spotted budmoth, Cherry fruit fly	10	2	Once residue has dried	7	Foliar spray	Spring / Summer	Product acceptable for use by organically certified growers. Registered in June 2005.
Spinosad (Success)	Leafrollers, Eye-spotted Budmoth	30	2	Once residue has dried	7	Foliar spray (max. 3 times/year)	Spring / Summer	Apply when pest begin actively feeding. Not used on most export cherries due to lack of MRLs in importing countries.
3M MEC-LR Pheromone	Leafrollers	N/A	N/A	N/A	N/A	Foliar spray	Spring, summer	This product is registered for use on cherries but no longer produced by manufacture.

Note: A maximum of 6 sprays for cherry fruit fly, 1-3 sprays for leafroller, 1 spray for aphids, and 1 spray for peach tree borer are applied. See Table 6.
*Estimates provided by BCMAL staff, Cherry Focus Goup 2005, TerraLink Ltd. staff, and the Directors of the Okanagan-Kootenay Cherry Growers Association.

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Table 3. Chemical Control of Weeds

Active Ingredient (Trade Name)	Application Timing	Weed Type	Crop Stage	% Acreage Treated*	Est. # Apps.*	REI (hours)	PHI (days)	Comments
Bentazon (Basagran)	Spring	Post-emergence broadleaf weeds	Non-bearing	<1	2-3	24	N/A	Directed spray for newly planted trees.
Simazine (Simazine 80W)	Spring, after planting	Pre-emergence annual grasses and broadleaf weeds		<5	1	24	N/A	Used on 1st year trees
Paraquat (Gramoxone)	Throughout season, before vegetation is 10 cm high	Post-emergence annual grasses and broadleaf weeds	Non-bearing or bearing	10-30	1-3	48	N/A	Used mainly in young plantings.
Dichlobenil (Casoron)	November/ December	Pre-emergence annual and perennial weeds		1	1	24	N/A	
Fluazifop-p-butyl (Venture)	Throughout season	Post-emergence annual grasses		<1	1	24	N/A	1 application/year post harvest
Pendimethalin (Prowl)	Late winter or early spring	Pre-emergence annual grasses and broadleaf weeds		20	1	24	N/A	Used mainly on new plantings and in orchards with young trees.
Metolachlor (Dual Magnum)	Late winter or early spring	Pre-emergence annual and broadleaf weeds		5	1	24	N/A	Used mainly on young plantings. This product is cost prohibitive.
Sethoxydim (Poast Ultra)	Throughout season	Post-emergence annual grasses	Bearing	<1	1	24	30	
Glyphosate (Roundup, Touchdown)	Mid-spring	Annual and perennial grasses and broadleaf weeds		90	1-3	24	30	
2,4-D (2,4-D Amine 600)	Spring or Post-Harvest	Post-emergence broadleaf weeds		<10	1	24	80	
Metribuzin (Lexone)	Throughout season	Pre-emergence grasses and broadleaf weeds		0	0	24	30	

Table 3. Chemical Control of Weeds continued

Active Ingredient (Trade Name)	Application Timing	Weed Type	Crop Stage	% Acreage Treated*	Est. # Apps.*	REI (hours)	PHI (days)	Comments
Terbacil (Sinbar)	Spring	Pre-emergence for annual weeds	Bearing	<10	1	24	N/A	

*Estimates provided by the Directors of the Okanagan-Kootenay Cherry Growers Association, TerraLink Horticulture Inc., and PARC staff.

Table 4. Chemical and Biological Control of Vertebrates

Active Ingredient (Trade Name)	Pest	% Acreage Treated*	Est. # Apps.*	REI (hours)	PHI (days)	Application Method	Application Timing	Comments
Putrescent whole egg solids (Deer-Away)	Deer	0	0	0	N/A	Spray lateral branches to a height of 2 m	Before flowering or after harvest	For use on non-bearing trees only.
Diphacinone (Ramik Brown)	Mice	5	1	0	N/A	Place in bait stations or broadcast	Post-harvest to March 31st	This product is highly toxic to dogs.
Chlorophacinone (Ground Force, Rozol)	Mice	15	1	0	N/A	Place in bait stations or broadcast	Post-harvest	
Zinc phosphide (Rodent Pellets, Rodent Bait, ZP)	Mice, pocket gophers	10	1	0	N/A	Place in bait stations or broadcast	Post-harvest	
Strychnine (Elston Gopher Getter)	Pocket gophers	5	1	0	N/A	Use a hand-probe to insert product into burrows	Mid-April	Used mainly in young plantings and for perimeter control. Toxic to all forms of life.

Note: Approximately 35% of cherry orchards in BC use some form of rodent control.
*Estimates provided by the Directors of the Okanagan-Kootenay Cherry Growers Association and TerraLink Horticulture Inc.

Table 5. Estimated Fungicide Treatments per Year

Disease	Est. # of Apps.*	Comments
Brown rot	2-5	Except in Creston (6-8 sprays) where the weather is cooler and wetter. The number of sprays required is weather dependent. Applied from April 10 to May 15 and June 15 to August 15.
Powdery mildew	2-8	Later varieties must be protected for longer periods of time and generally require more sprays. Later varieties in certain areas may therefore require the upper range of applications.

*Estimates provided by the Directors of the Okanagan-Kootenay Cherry Growers Association and the Cherry Focus Group 2005.

Table 6. Estimated Insecticide Treatments per Year

Pest	Est. # of Apps.*	Comments
Cherry fruit fly	3-6	Later varieties must be protected for longer periods of time and therefore generally require more sprays.
Leafroller	1-3	Growers are encouraged to control leafrollers post-harvest to decrease pest pressure in adjacent pome fruit blocks and in the following year.
Aphids	0-1	May be controlled with cherry fruit fly sprays.
Peach tree borer	0-1	

*Estimates provided by the Directors of the Okanagan-Kootenay Cherry Growers Association

Table 7. Estimated Herbicide Treatments per Year

Pest	Est. # of Apps.*	Comments
Weeds	2-4	Residual plus Round-up

* Estimates provided by PARC Summerland and TerraLink Horticulture Inc. staff

Table 8. Relative Toxicity to Beneficial Insects, Aquatic Life and Bees*

Active Ingredient	Predatory Mites	Predatory Insects	Parasitoids	Aquatic Life	Bees
2,4-D	L	L	L	L	Non-toxic
Azinphos-methyl	H	H	H	H	Very toxic
Bacillus thuringiensis var. *kurstaki*	L	L	L	L	Non-toxic
Bentazon	?	?	?	L	Non-toxic
Boscalid	L	L	L	M	Non-toxic
Captan	L	L	L	H	Non-toxic
Carbaryl	M	H	H	M	Very toxic
Chlorothalonil	L	L	L	H	Non-toxic
Diazinon	M	H	H	M	Very toxic
Dichlobenil	L	L	L	L	Non-toxic
Dicofol	M	L	L	M	Non-toxic
Dimethoate	H	H	H	H	Very toxic
Endosulfan	M	H	M	M	Toxic
Fenbuconazole	L	L	?	H	Toxic
Fenhexamid	L	L	L	M	Non-toxic
Ferbam	L	L	L	M	Non-toxic
Fluazifop-p-butyl	L	L	L	H	Non-toxic
Glyphosate	L	L	L	L	Non-toxic
Imidacloprid	L	L	L	H	Toxic
Iprodione	L	L	L	M	Non-toxic
Malathion	H	H	H	H	Very toxic
Metolachlor	?	?	?	M	Non-toxic
Metribuzine	?	?	?	M	Non-toxic
Myclobutanil	L	L	L	M	Non-toxic
Paraquat	?	?	?	L	Non-toxic
Pendimethalin	?	?	?	H	Non-toxic
Phosalone	H	M	H	H	Non-toxic
Propiconazole	L	M-H	L-M	M	Non-toxic
Pyridaben	H	H	H	M	Very toxic
Pyraclostrobin	L	L	L	H	Non-toxic
Sethoxydim	L	L	L	L	Non-toxic
Spinosad	M	M	L	H	**
Sulphur	L	L	L	L	Non-toxic
Thiophanate-methyl	M	L	L	H	Non-toxic

Table 8. Relative Toxicity to Beneficial Insects, Aquatic Life and Bees continued*

Active Ingredient	Predatory Mites	Predatory Insects	Parasitoids	Aquatic Life	Bees
Triforine	M	L	L	L	Toxic

* L = low hazard, M = moderate hazard, H = high hazard.
Very toxic = Do not apply to flowering crops or weeds, Toxic = Apply only during late evening or early morning, Non-toxic = can be used with few precautions with minimum injury to bees.

** Very toxic if bees are sprayed directly, little residual effect once dry

Sources:

BC Tree Fruit Production Guide for Commercial Growers – Interior District, 2002-2003 Edition
BC Vegetable Production Guide for Commercial Growers, 2004/2005 Edition,
BC Berry Production Guide for Commercial Growers, 2005/2006 Edition
Meister *CropProtection Handbook 2005*
Koppert at http://www.koppert.nl/e0110.html (accessed June 2005)
Biobest Biological Systems at http://www.biobest.be/ (accessed June 2005)
The Pesticide Manual, 2000 (British edition)
PMRA website http://eddenet.pmra-arla.gc.ca/4.0/4.1.asp regarding various labels (accessed June 2005)

Cherry Production and Pest Management Schedule[1]

Time of Year	Action	Activity
December to early March Trees dormant	Plant Care	Prune trees
	Soil Care	Prepare sites of new plantings. Take soil samples in established sites for nutrient analysis.
	Disease Control	Remove shoots with bacterial, cytospora, and coryneum blight.
	Insect Control	Apply delayed dormant controls for aphids, mites, scales, apple mealybug, and other insects.
	Weed Control	Monitor for weeds, and apply controls if needed.
	Other	Monitor for vertebrate pests, and control as needed.
	Worker Activity Summary	Pruning of trees occurs from November 1 through March 30. Pruning is done mainly by the owner/operator of the orchard, and occasionally by contractors. Pruners spend about 8 hours per day in the field, but the trees have no leaves, and it has been 30 to 180 days since the last chemical application.
Late March to May Bud break and blossom	Plant Care	Plant and prune new trees. Irrigate as needed. Place beehives in the orchard when first blossoms open.
	Soil Care	Apply nitrogen to established orchards as needed and apply lime as needed.
	Disease Control	Monitor for powdery mildew and brown rot during and post bloom and apply controls if needed.
	Insect Control	Set out and monitor yellow sticky traps for cherry fruit flies. Monitor for leafrollers, fruitworms, budmoth, mites, aphids, apple mealybug, shot-hole borer, ambrosia beetles, and beneficial organism. Apply IPM-compatible controls if needed.
	Weed Control	Monitor for weeds, and apply controls if needed.
	Other	Monitor for vertebrate pests, and control as needed.

Late March to May Bud break and blossom	Worker Activity Summary	During the planting and pruning of new trees, workers are in close contact with the trees, but the young trees are small and haven't been recently treated with any pesticides. When beehives are placed in the field, no contact with the trees is made. Likewise, irrigation takes approximately 1 hour twice daily, but no contact with the trees is made. Monitoring for diseases and insects is done by pest management professionals, who visit each orchard about once per week. The scouts wear protective clothing, and are aware of the spray schedule in each orchard. The orchard may be mowed with a tractor to control weeds and the grass alley cover.
June to August Blossom, fruit development, and harvest of summer varieties (August)	Plant Care	Apply supplemental nutrient sprays as needed. Irrigate as needed. Thin cherries. Have leaf analyses performed. Harvest and market fruit.
	Soil Care	Apply boron if needed.
	Disease Control	Treat for brown rot as needed. Cut out wood with cankers and remove powdery mildew infected water sprouts. Monitor mature fruit for little cherry disease.
	Insect Control	Set out and monitor pheromone traps for peach tree borer. Continue monitoring cherry fruit flies, leafrollers, budmoth, mites, aphids, apple mealybug, shot-hole borer, ambrosia beetles, and beneficials. Begin monitoring for pear sawfly. Apply controls if needed.
	Weed Control	Monitor for weeds, and apply controls if needed.
	Other	Monitor bird pests and damage, and control as needed.
	Worker Activity Summary	If thinning is performed, it is completed prior to the bulk of the insecticide applications (mainly for cherry fruit fly). People walk through the orchard for bird control, but have no contact with trees. During harvest, all PHI are obeyed. Cherries are picked by hand from ladders. The average cherry picker works for about 3 weeks, for 5 to 6 hours in the mornings per day.
September to November Harvest and post-harvest care	Plant Care	Irrigate as needed after harvest. Remove dead, weak, and diseased trees. Begin dormant pruning.
	Soil Care	Take soil samples in established sites for nutrient analysis. Begin preparation at sites of new plantings.
	Insect Control	Apply post-harvest controls for cherry fruit flies, scales, mites, and apple mealybugs, if needed.

September to November Harvest and post-harvest care	Weed Control	Monitor for weeds, and apply controls if needed.
	Other	Monitor for vertebrate pests, and control if needed.
	Work Activity Summary	Pruning of trees occurs from November 1 through March 30. Pruning is done mainly by the owner/operator of the orchard, and occasionally by contractors. Pruners spend about 8 hours per day in the field, but the trees have no leaves, and it has been 30 to 180 days since the last chemical application.

[1]Adapted from *BC Tree Fruit Production Guide for Commercial Growers – Interior District, 2002-2003 Edition* and with the help of the Okanagan-Kootenay Cherry Growers Association.

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