Appendices

Appendix A. Insect-Monitoring Equipment Supply Companies

Note: Inclusion in this list does not imply any endorsement or recommendation by the Ontario Ministry of Agriculture, Food and Rural Affairs.

BioQuip Products
2321 E Gladwick St.
Rancho Dominguez, CA
U.S. 90220
Tel: 310-667-8800
Fax: 310-667-8808
www.bioquip.com

Distributions Solida Inc.
Tel: 418-826-0900
Fax: 418-826-0901
www.solida.ca

Gempler's Inc.
1125 Deming Way
P.O. Box 449132
Madison, WI 53744
Tel: 1-800-382-8473
Fax: 1-800-551-1128
www.gemplers.com

Great Lakes IPM
10220 Crystal Road, NE
Vestaburg, MI
U.S. 48891
Tel: 989-268-5693
Fax: 989-268-5911
www.greatlakesipm.com

Quebec Insectes
3, rue du Coteau
P.O. Box 953
Pont-Rouge, Quebec
Canada G3H 2E1
Tel/fax: 418-873-2984

Appendix B. Corn Nitrogen Rate Worksheet (Imperial) With Detailed Explanation

Following 5 (unnumbered) tables go in the "Corn Nitrogen Rate Worksheet."

A. Base N Requirement (choose from Table A)	_____
B. Yield Adjustment (Yield (bu/acre) _____ x 0.77) =	+ _____
C. Heat Unit Adjustment Your CHU-M1s = _____ Less – 2,800 Total =_____ x 0.037 =	+ _____
D. Previous Crop Adjustment (Choose from Table D)	– _____
E. Price Ratio (PR) Adjustment for Nitrogen Relative to Corn Price (Choose from Table E)	– _____
F. Suggested Total N (A+B+C–D–E)	= _____
G. Deduct Starter N	– _____
H. Deduct Manure N Credits[1]	– _____
I. Preplant Additional N (F–G–H)	= _____
OR	
J. Sidedress Additional N (If additional N is applied side-dress, multiply value I by the appropriate value in Table J.)	_____

[1] Manure N Credits can be found in Chapter 9, *Soil Fertility and Nutrient Use*.

Table A. Base N requirement (kg/ha)

Soil Texture	Base N Requirement	
	Southwestern and Central Ontario	Eastern Ontario*
Clay, heavy clay	47	1
Clay loam	36	1
Loam	28	1
Loamy sand	41	17
Sandy loam	34	17
Sand	46	17
Sandy clay, sandy clay loam	38	17
Silt loam	18	1
Silty clay loam	32	1
Silty clay	44	1

* Eastern Ontario includes Frontenac, Renfrew and counties to the east of them.

Table D. Previous crop adjustments

Previous Crop	Adjustment
Grain Corn	0
Silage Corn	12
Cereals	11
Soybeans	27
Dry edible beans	27
Clover cover crop (plowed)	73
Clover cover crop (no-till)	60
Perennial Forages	
Less than one-third legume	0
One-third-to-half legume	49
Over half legume	98

Table E. Price Ratio (PR) Adjustment for Nitrogen Relative to Corn Price

Corn Price	Nitrogen Price $/lb N					
	$0.54	$0.68	$0.75	$0.82	$0.89	$0.96
$2.60/bu	40	58	67	76	*	*
$2.90/bu	33	49	57	65	73	*
$3.20/bu	27	41	49	56	64	71
$3.50/bu	22	35	42	49	55	62
$3.70/bu	19	32	38	45	51	57
$4.00/bu	15	27	33	39	45	51
$4.30/bu	12	23	29	34	40	45
$4.60/bu	9	20	25	30	35	40
$4.90/bu	7	17	21	26	31	36
$5.20/bu	5	14	18	23	28	32
$5.50/bu	3	12	16	20	24	29
$5.80/bu	1	9	13	18	22	26

* Adjustments for these price ratios have not been assessed.

Table J. Additional N at Sidedress — Timing Adjustment (Southwestern and Central Ontario only)

Soil Texture	Adjustment
Clay, clay loam, loam, silt loam, silty clay, silty clay loam	0.8
Sandy clay, sandy clay loam, sandy loam	0.9
Sand, loamy sand	1.0

Explanation of Factors in Worksheet

A. Base N Requirement
In most of the province, the medium-textured soils (silt loams and loams) provided the greatest amount of nitrogen to the corn crop, as indicated by the lower "Base N Requirement" (Table A). In both coarser and finer textured soils, the nitrogen requirements are higher.

The data showed a significantly lower requirement for nitrogen in the Ottawa Valley than in the rest of the province, although the reasons for this are not completely clear. This appears to apply in all of the counties east of the Frontenac Axis.

Since these values are derived from the average responses on a wide range of sites, they will represent the expected requirements for soils with "average" characteristics. Any soil that varies from the average (e.g., higher or lower organic matter (OM) content) may differ in the optimum N rates.

B. Yield Adjustment
There is a weak but consistent relationship between fields with higher yields at optimum N rates and higher nitrogen requirements. The yield factor derived from the N response data (0.77 lb N per bushel of yield) is almost exactly equal to the N removal from the field in the grain portion of the crop.

Use average yields for the previous 5 years to estimate the productive capacity of the field. Entering an inflated yield goal into this adjustment will not increase the productivity of the field, will cost money for wasted N and may result in environmental harm. To convert silage yield to an estimate of grain yield, divide the silage yield by 5 for grain yield in tonnes/hectare or tons/acre, or multiply tons per acre by 7 to estimate bushels per acre.

C. Heat Unit Adjustment
Research shows that corn in the long-season areas of the province requires more nitrogen. This may be due to greater moisture stress on the crop in areas with higher average temperatures, which would decrease N use efficiency, or it could be related to differences in soil OM content.

D. Previous Crop Adjustment
The crop that was grown immediately prior to planting corn has a significant impact on the nitrogen requirements. Crops such as grain corn immobilize a significant quantity of mineral N from the soil as the high carbon residue decomposes, and this is reflected in higher N requirements. Forage legume crops fix nitrogen out of the air, which is released to the corn crop as the residue breaks down, resulting in reduced N requirements.

E. Price Ratio Adjustment
The optimum N rate is the point where the yield increase from the last pound of added nitrogen just pays for the extra N. As the cost of nitrogen fertilizer goes up or the value of the corn crop goes down, the amount of yield required to pay for a pound of nitrogen increases. This means that the nitrogen rate that provides the maximum return to added fertilizer is reduced. The amount of reduction in N rates for various combinations of corn and nitrogen price is found in Table E. For prices outside of the ranges provided, calculate the adjustment to fertilizer rates by following these steps:

- Determine the price of a kilogram of nitrogen. Divide the price per tonne of fertilizer by the number of kilograms of nitrogen in each tonne (the %N multiplied by 10). Calculate the price per pound by multiplying the price per kilogram by 0.45. For example, urea (46% N) at $865 per tonne will have an N price per kilogram of $865/460 kg = $1.88/kg N, or $0.85/lb N.
- Estimate the value of a kilogram (or pound) of corn for the year following harvest (unless the corn has been pre-sold at a fixed price), including all stabilization payments, minus costs for drying, trucking and elevation. Price the value of corn to be fed on-farm at the replacement cost for the corn if it had to be purchased from off farm. The price for a kilogram of corn is the expected price per tonne, divided by 1,000. The price for a pound of corn is the expected net price per bushel divided by 56.
- Calculate the N:corn price ratio, by dividing the price of a kilogram (or pound) of nitrogen into the value of a kilogram (or pound) of corn.
- Subtract 5 from the price ratio, because the N recommendations were developed for a price ratio of 5.
- Multiply the resulting figure by 6.7 (6 for Imperial calculations), and enter this figure into the price ratio adjustment.

F. Total N Recommendation
This figure, calculated by adding values A through E, represents the total N requirements for the crop. This is normally supplied by a combination of starter fertilizer, broadcast or side-dressed fertilizer, and manure.

G. Deduct Starter N
Include any N that is supplied at planting here.

H. Deduct Manure N Credits
Include available nitrogen from manure (or biosolids) on this line. Available N from manure, based on accurate application rates and manure analysis will give more reliable N credits. For estimates of available nitrogen from manure, see Table 9–10, *Typical amounts of available nitrogen, phosphate and potash from different types of organic nutrient sources.*

I. Preplant Additional N
The difference between the Total N recommendation, and the credits for starter and manure N, is the amount of nitrogen to be included in a pre-plant application.

OR

J. Sidedress Additional N
Nitrogen that is applied just before the crop needs it is utilized more efficiently than N applied preplant (less opportunity for loss through denitrification or leaching). This difference is most pronounced in the heavier-textured soils. Sandy soils do not normally show a benefit to side-dress N applications.
NOTE: This adjustment does not apply in Eastern Ontario, where the N recommendations are already relatively low.

Appendix C. Accredited Soil-Testing Laboratories in Ontario

The following labs are accredited to perform soil tests for pH, buffer pH, P, K, Mg and Nitrate-N on Ontario soils.

Laboratory Name	Address	Telephone/Fax/E-mail
A & L Canada Laboratories Inc. www.alcanada.com	2136 Jetstream Rd. London, ON N5V 3P5	Tel: 519-457-2575 Fax: 519-457-2664 E-mail: aginfo@alcanada.com
Activation Laboratories Ltd. www.actlabsag.com	41 Bittern St. Ancaster, ON L9G 4V5	Tel: 905-648-9611 1-888-228-5227 Fax: 905-648-9613 E-mail: victoriapechorina@actlabs.com
Brookside Laboratories, Inc. www.blinc.com	200 White Mountain Dr. New Bremen, OH 45869	Tel: 419-977-2766 Fax: 419-977-2767 E-mail: jbrackman@blinc.com
Exova Canada Inc. (Ottawa) www.exova.com	8-146 Colonnade Rd. Ottawa, ON K2E 7Y1	Tel: 613-727-5692 Fax: 613-727-5222
SGS Agrifood Laboratories www.agtest.com	503 Imperial Rd. Unit #1 Guelph, ON N1H 6T9	Tel: 519-837-1600 1-800-265-7175 Fax: 519-837-1242 E-mail: ca.agri.guelph.lab@sgs.com
Stratford Agri-Analysis www.stratfordagri.ca	1131 Erie St., Box 760 Stratford, ON N5A 6W1	Tel: 519-273-4411 1-800-323-9089 Fax: 519-273-2163 E-mail: info@stratfordagri.ca
University of Guelph, Laboratory Services www.guelphlabservices.com	University of Guelph P.O. Box 3650 95 Stone Rd. W. Guelph, ON N1H 8J7	Tel: 519-767-6299 Fax: 519-767-6240 E-mail: aflinfo@uoguelph.ca

There is no official accreditation in Ontario for tissue analysis or manure analysis, but all the accredited soil-testing labs are monitored for proficiency on tissue and manure analyses. For an up-to-date list, visit the OMAFRA website at ontario.ca/crops.

Appendix D. Feed-, Mould- and Mycotoxin-Testing Laboratories

For an updated list, please visit the OMAFRA website at ontario.ca/crops.

A & L Canada Laboratories Inc.
2136 Jetstream Rd.
London, ON
N5V 3P5
Tel: 519-457-2575
Fax: 519-457-2664
www.alcanada.com

Actlabs Agriculture
41 Bittern St.
Ancaster, ON
L9G 4V5
Tel: 905-648-9611
www.actlabsag.com

Agribrands Purina
Strathroy Central Laboratory
127 Zimmerman St. S.
Strathroy, ON
N7G 3W3
Tel: 519-245-9600

Laboratory Services
University of Guelph
95 Stone Rd. W.
Guelph, ON
N1H 8J7
Tel: 519-767-6299
www.guelphlabservices.com/ahl/

SGS-Agri-Food Laboratories
503 Imperial Rd., Unit #1
Guelph, ON
N1H 6T9
Tel: 519-837-1600 or 1-800-265-7175
Fax: 519-837-1242
www.agtest.com

Intertek Testing Services
960 C Alloy Dr.
Thunder Bay, ON
P7B 6A4
Tel: 1-807-345-5392

Shur-Gain
R.R. 4, 600 James St. S.
St. Marys, ON
N4X 1C7
Tel: 519-349-2152
www.shurgain.com

Stratford Agri-Analysis
P.O. Box 760
1131 Erie St.
Stratford, ON
N5A 6W1
Tel: 519-273-4411 or 1-800-323-9089
Fax: 519-273-4411
www.stratfordagri.ca

Appendix E. Soybean Cyst Nematode-Testing Laboratories

Contact these labs for current prices and nematode handling and shipping procedures.

A & L Labs Canada East Inc.
2136 Jetstream Rd.
London, ON
N5V 3P5
Tel: 519-457-2575
Fax: 519-457-2664
www.alcanada.com

SGS-Agri-Food Laboratories
503 Imperial Rd., Unit #1
Guelph, ON
N1H 6T9
Tel: 519-837-1600 or 1-800-265-7175
Fax: 519-837-1242
www.agtest.com

Pest Diagnostic Clinic
Laboratory Services Division
University of Guelph
95 Stone Rd. W.
Guelph, ON
N1H 8J7
Tel: 519-767-6299
Fax: 519-767-6240
www.guelphlabservices.com

Appendix F. Ontario Laboratories Offering Custom Seed Germination Testing

Laboratories are accredited by the Canadian Food Inspection Agency.

Canadian Seed Laboratories Ltd.
P.O. Box 217
208 St. David St.
Lindsay, ON
K9V 5Z4
Tel: 705-328-1648
Fax: 705-324-2550

Laboratory is also accredited to test for seed purity.

Canadian Seed Laboratories Ltd. is also accredited to do some seed disease testing.
Other labs are accredited by CFIA but only accept in-house samples.

Dow AgroSciences Quality Lab
50 Industrial Ave.
Blenheim, ON
N0P 1A0
Tel: 519-676-1863, ext. 330

Kent Agri Laboratory
R.R. #2
Tupperville, ON
N0P 2M0
Tel: 519-627-3737
Fax: 519-627-3737

Laboratory is also accredited to test for seed purity.

Lang Germination Lab
6 Clarinda St.
P.O. Box 419
Teeswater, ON
N0G 2S0
Tel: 519-392-8203
Fax: 519-392-8203

Livingstone Seed Laboratory
P.O. Box 27050
Postal Outlet
500 Rexdale Blvd.
Etobicoke, ON
M9W 6L0
Tel: 416-743-7191
Fax: 416-743-7191

Laboratory is also accredited to test for seed purity.

Miller Seed Farm
R.R. #2
Bath, ON
K0H 1G0
Tel: 613-352-7453
Fax: 613-352-7453

Perth Seed Laboratory
RR #5
Mitchell, ON
N0K 1N0
Tel: 519-348-9057
Fax: 519-348-8165

Laboratory is also accredited to test for seed purity.

Appendix G. Neonicotinoid Regulations in Ontario

For up-to-date information, visit ontario.ca/neonics.

Ontario is taking action to strengthen pollinator health to ensure healthy ecosystems, a productive agricultural sector and a strong economy.

The Pollinator Health Strategy is multi-faceted, including:

- financial programs to assist beekeepers experiencing high levels of bee hive losses
- regulation limiting the use of neonicotinoid-treated corn and soybean seed
- the development of a comprehensive Pollinator Health Action Plan to address multiple stressors on pollinators

It builds on work already taken to improve pollinator health and sets out aspirational targets:

- an 80% reduction in the number of acres planted with neonicotinoid-treated corn and soybean seed by 2017
- an over-winter honeybee mortality rate of 15% by 2020

As part of the broader strategy to protect pollinators, the regulation under *Ontario Pesticides Act, 1990* has been amended to require corn and soybean farmers and custom planters to demonstrate that they need to use Class 12 pesticides on a farm property before they can purchase and use them. The new regulation came into effect on July 1, 2015.

Class 12 Pesticides

The provincial government is responsible for classifying pesticides and regulating their sale, use, transportation, storage and disposal.

Treated seeds are seeds that have been coated with a pesticide. The new regulatory requirements create a new class of pesticides — Class 12 — for corn and soybean seeds treated with the following neonicotinoid insecticides:

- imidacloprid
- thiamethoxam
- clothianidin

This new class of pesticides applies to corn seed grown for grain or silage and soybean seed.

The regulation does not apply to popping corn, sweet corn or corn used for the production of seed. Nor does it apply to soybean seed planted for the purpose of producing a soybean seed crop of certified status under contract. Corn seed and soybean seed treated only with fungicide are not classified as Class 12 pesticides under the regulation.

Farmers who will not be planting neonicotinoid-treated corn or soybean seed will not be subject to any new requirements under this regulation.

Farmers can only buy and use neonicotinoid-treated seeds that vendors have put on the "Class 12 Pesticides List." The list will be posted by August of each year at: ontario.ca/page/class-12-pesticides.

The regulation does not include requirements for the transport and storage of Class 12 pesticides.

Farmers must use Class 12 pesticides in accordance with the directions set out on the label or tag by the federal government.

Certain requirements of the regulation to reduce the use of neonicotinoid-treated corn and soybean seed are being phased in over time.

Important Regulation Timelines

On or after August 31, 2016, in preparation for the 2017 planting season, if farmers want to buy and use any amount of neonicotinoid-treated corn and soybean seeds (Class 12 pesticides), they will be required to:

- complete the new integrated pest management (IPM) training
- complete a pest assessment report
- sign a declaration called an IPM Written Declaration Form stating that they have considered IPM principles

Farmers will need to submit these pieces of information, along with their IPM training certificate number, to the sales representative or seed vendor, including direct-to-farm seed vendors, from whom they purchased the seeds or to the custom seed treater used for treating seeds with neonicotinoids.

Class 12 pesticides can only be planted in the application area (or areas) on the farm property(ies) identified in the pest assessment report.

Integrated Pest Management Training

Integrated pest management (IPM) is an approach to managing pests that is environmentally and economically sustainable. IPM promotes the use of different methods to prevent and reduce the risk of pests and encourage beneficial insects, including pollinators. Under IPM, pesticides are used as a last resort to control pest problems.

Starting on August 31, 2016, successful completion of a new IPM training course will be required in order to purchase and plant neonicotinoid-treated corn and soybean seed. Farmers will need to provide proof that they have completed this training by submitting their certificate number to a sales representative, vendor or custom seed treater. Certification is valid for 5 years (i.e., farmers will only need to take the course once every 5 years).

Farmers are able to take training in a classroom at various locations or online through the University of Guelph, Ridgetown Campus, at www.ipmcertified.ca. To encourage participation, IPM training will be offered **free of charge** until April 30, 2017.

Farmers do not need to take IPM training if they are a farm owner who hires people to purchase and plant Class 12 pesticides. In this case, the person they hire (e.g., farm manager or supervisor) will need to take IPM training.

An IPM trained person can supervise up to seven people who are planting Class 12 pesticides on the farm. Farmers who do not intend to buy and plant neonicotinoid-treated seeds are not required to take IPM training. Un-treated seed or fungicide-only treated corn and soybean seed, for example, are not Class 12 pesticides.

Pest Assessment Report

A pest assessment report is documented proof that there is a pest problem that requires the use of neonicotinoid-treated seed to control the pests. In order to purchase Class 12 pesticides, a person (i.e., farmer) must provide a pest assessment report to a vendor, sales representative or custom seed treater.

Pest assessments must be done according to the Conducting a Pest Assessment for Use of Class 12 Pesticides guideline (commonly referred to as the pest assessment guideline). The pest assessment guideline outlines how assessments are to be conducted, sets out the minimum thresholds and explains

Appendix G. Neonicotinoid Regulations in Ontario (continued)

how to calculate the application area where the Class 12 pesticides are to be planted at the farm property.

There are two kinds of pest assessments: inspection of soil and inspection of a crop.

Inspection of Soil

Soil pest assessment is a method that confirms the presence of an average of two or more grubs or one wireworm in soil at a farm property (see the pest assessment guideline at: ontario.ca/document/pest-assessment-guide for more information on scouting requirements and pest thresholds). A report must verify that pest thresholds have been met or exceeded.

A farmer can choose when to do soil pest scouting. The best time is in the spring or fall.

Starting August 31, 2016 until August, 31, 2017, farmers will be able to perform a pest assessment and prepare a report if they have a certificate number from completion of the new integrated pest management (IPM) training.

Starting on August 31, 2017, a requirement that a professional pest advisor conduct a soil pest assessment and prepare a report will begin to be phased in.

For the inspection of soil, an Inspection of Soil — Pest Assessment Report form will need to be completed and signed. The Inspection of Soil — Pest Assessment Report form can be found on the Ontario Central Forms Repository at: ontario.ca/forms.

Phased-In Professional Pest Advisor — Inspection of Soil

An Inspection of Soil — Pest Assessment Report is required each year. You can use the Pest Assessment Report for the purchase and use of Class 12 pesticides anytime within the 12 months from the date of the inspection for the application areas listed on the form. The requirement to have a professional pest advisor perform a soil pest assessment is being phased in over time on a geographic basis. See Table Appendix G–1 for the phase-in schedule.

Once the professional pest advisor requirement is phased in, a professional pest advisor will need to perform or supervise the assessment and complete a report at least once every 3 years. The IPM certified farmer can continue to conduct pest assessments in those years that the PPA is not required.

Farmers will need to refer to the schedule below of the counties and regions of Ontario to know when professional pest advisors are required for their area.

The table below gives the implementation date for when a Professional Pest Advisor must first conduct or supervise the soil inspection in the assigned geographic areas of Ontario, called Schedules. After the phase-in date, a Professional Pest Advisor is required to conduct a soil inspection at least once every 3 years.

Table Appendix G–1. Professional Pest Advisor Requirement Phase-In

Date	Schedule	Counties or Regions
Aug 31, 2017	Schedule 1	Dufferin, Frontenac, Halton, Lambton, Middlesex, Muskoka, Prince Edward, Stormont, Dundas, Glengarry, Toronto, Wellington
Aug 31, 2018	Schedule 2	Bruce, Elgin, Grey, Haldimand, Hamilton, Huron, Nipissing, Norfolk, Ottawa, Oxford, Peel, Sudbury, Waterloo
Aug 31, 2019	Schedule 3	Algoma, Brant, Chatham-Kent, Cochrane, Durham, Essex, Haliburton, Hastings, Kawartha Lakes, Kenora, Lanark, Leeds and Grenville, Lennox and Addington, Manitoulin, Niagara, Northumberland, Parry Sound, Perth, Peterborough, Prescott and Russell, Rainy River, Renfrew, Simcoe, Thunder Bay, Timiskaming, York

Inspection of a Crop

This method determines if the percentage of stand loss caused by specific pests is:

- at least 15% in corn caused by wireworms, grubs, seedcorn maggot or corn rootworm
- at least 30% in soybean caused by wireworms, grubs, seedcorn maggot or bean leaf beetle

If a farmer believes they have experienced crop damage from pests, they can choose to have a crop damage assessment conducted. A professional pest advisor will be required to conduct this assessment as this method requires specialized knowledge of pests and crop damage.

For the crop damage pest assessment method, an Inspection of a Crop — Pest Assessment Report form will need to be completed and signed by a professional pest advisor. The Inspection of Crop — Pest Assessment Report form can be found on the Ontario Central Forms Repository at: ontario.ca/forms.

Submitting a Completed Pest Assessment Report

Farmers will need to provide the completed pest assessment report form to the vendor and/or the treated seed sales representative from whom they purchase their neonicotinoid-treated seeds or to a custom seed treater to have seed treated with neonicotinoid insecticides. Farmers must also keep a copy of the report at their farm for at least 2 years.

The vendor or custom seed treater will then submit the report to the Ontario Ministry of Agriculture, Food and Rural Affairs.

For more information, contact:

Ministry of the Environment and Climate Change Public Information Centre
Tel: 416-325-4000 or toll free: 1-800-565-4923
E-mail: picemail.moe@ontario.ca

Ontario Ministry of Agriculture, Food and Rural Affairs
Tel: 1-877-424-1300 or TTY 1-855-696-2811
E-mail: ag.info.omafra@ontario.ca

Appendix H. European Corn Borer Economic Threshold Calculations

Use these calculations to estimate if it is economical to treat a non-Bt field with an insecticide. See *European corn borer*.

Univoltine Strain (for areas where there is one generation of ECB per year)

A. % shot-holed plants _____ = plants with shot-holes ÷ total plants checked
   Unfurl one of the shot-holed plants from each location and look for larvae.

B. Larvae per plant _____ = number of live larvae per unfurled plant x (A)% shot-holed plants ÷ 100
   Example: 25 shot-holed plants and 1.5 larvae per unfurled plant.
   larvae per plant is 0.38 = 1.5 x 25 ÷ 100
   A yield loss of 5% per live larvae is estimated.[1] Therefore:

C. Potential % yield loss _____ = (B) x 5 ÷ 100

D. Potential $ loss _____ = (C) potential % yield loss x expected yield t/ha (bu/acre) x value $/t ($/bu)
   A 75% effectiveness of a pesticide treatment is estimated.[1] Therefore:

E. $ preventable loss _____ = (D) potential $ loss x % effectiveness of pesticide treatment

F. Treatment cost _____ = pesticide cost + application cost

G. Gain (+) or loss (–) if treatment is applied _____ = (E) – (F)

[1] Use another estimated value if desired.

Bivoltine Strain (for areas where there are two generations of ECB per year)

A. Larvae per plant (cumulative counts taken 7 days apart) _____ = number of egg masses/plant x 2 borer/egg mass
   (Assumes a survival rate of 2 larvae per egg mass. This may vary with weather and egg mass size.)

B. % yield loss _____ = (A) larvae/plant x 4% yield loss per larvae/plant
   (Use a 3% loss per borer per plant if infestation occurs after silks are brown. The economic benefit of treatment declines rapidly if infestations occur after the blister stage.)

C. Yield loss t/ha (bu/acre) _____ = % yield loss x expected yield t/ha (bu/acre)

D. $ loss/ha (acre) _____ = (C) yield loss t/ha (or bu/acre) x expected value $/t ($/bu)

E. Preventable loss per ha (acre) _____ = (D) $ loss per ha (or acre) x 75% control
   (75% is an average. Use another estimated value if desired.)

F. Treatment Cost _____ = pesticide cost + application cost

G. Gain (+) or loss (–) if treatment is applied _____ = (E) – (F)

Appendix I. Other Contacts

University of Guelph

Main Campus
Guelph, ON N1G 2W1
Tel: 519-824-4120
www.uoguelph.ca

Ridgetown College
Ridgetown, ON N0P 2C0
Tel: 519-674-1500
www.ridgetownc.uoguelph.ca

Department of Plant Agriculture
www.plant.uoguelph.ca

Department of Plant Agriculture, Guelph
50 Stone Rd. W., Guelph, ON N1G 2W1
Tel: 519-824-4120, ext 56083

Department of Plant Agriculture, Simcoe
1283 Blue Line Rd. Box 587
Simcoe, ON N3Y 4N5
Tel: 519-426-7127

Department of Plant Agriculture, Vineland
Box 7000, 4890 Victoria Ave. N.
Vineland Station, ON L0R 2E0
Tel: 905-562-4141
Fax: 905-562-3413

Vineland Research and Innovation Centre
4890 Victoria Ave. N.
Vineland Station, ON L0R 2E0
Tel: 905-562-0320
Fax: 905-562-0084
www.vinelandontario.ca

Lab Services Division
www.uoguelph.ca/labserv

Trace Organic and Pesticide Contaminants
95 Stone Road West
Guelph, ON N1H 8J7
Tel: 519-823-1268

Pest Diagnostic Clinic
95 Stone Road West
Guelph, ON N1H 8J7
Tel: 519-767-6256

Agriculture & Agri-Food Canada Research Centres

Eastern Cereals and Oilseeds Research Centre
960 Carling Ave.
Ottawa, ON K1A 0C6
Tel: 613-759-1952
www.agr.gc.ca/eng/science-and-innovation

Harrow Research and Development Centre
2585 County Road 50
Harrow, ON N0R 1G0
Tel: 519-738-2251

Southern Crop Protection and Food Research Centre
1391 Sandford St.
London, ON N5V 4T3
Tel: 519-457-1470

Vineland Research Farm
4902 Victoria Ave. N
Vineland, ON L0R 2E0
Tel: 905-562-4113

Canadian Food Inspection Agency
www.inspection.gc.ca

Regional Offices (Plant Protection)

Belleville
345 College St. E.
Belleville, ON K8N 5S7
Tel: 613-969-3333

Hamilton
709 Main St. W. 101
Hamilton, ON L8S 1A2
Tel: 905-572-2201

London
1200 Commisioners Rd. E., Unit 19
London, ON N6A 3E3
Tel: 519-691-1306

Niagara Falls
350 Ontario St. Unit 13
Box 9
St Catherines, ON N2R 5L8

Brantford
Federal Building, Dalhousie & Queen St.
P.O. Box 637
Brantford, ON N3T 5P9

Ottawa District
3 Observatory Cres., Bldg., #3 Central
Experimental Farm, Ottawa, ON K1A 0C9
Tel: 613-274-7374, ext 221

Toronto Office
1124 Finch Ave. W., Unit 2
Downsview, ON M3J 2C6
Tel: 416-665-5055

Windsor
2000 Continental Ave.
Windsor, ON N9E 3P1
Tel: 519-969-2522

Appendix J. Row Length for a Partial Acre

Row Width	Row Length for 1/1,000 acre[1,2]
18 cm (7 in.)	22.8 m (74 ft 8 in.)
38 cm (15 in.)	10.62 m (34 ft 10 in.)
51 cm (20 in.)	7.97 m (26 ft 2 in.)
56 cm (22 in.)	7.24 m (23 ft 9 in.)
71 cm (28 in.)	5.69 m (18 ft 8 in.)
76 cm (30 in.)	5.31 m (17 ft 5 in.)
91 cm (36 in.)	4.43 m (14 ft 6 in.)

[1] To obtain the number of plants per one-thousandth hectare, multiply the number of plants in the length of row for the specific row width by a factor of 2.47.
[2] Multiply the number of plants counted in the length of row above by 1,000 to determine the number of plants/acre.

Appendix K. Hula Hoop Method for Determining Plant and Pest Populations

Count the number of plants found within the hoop or square and multiply that number by the pre-determined factor listed to determine plant population per hectare or acre.

Inside Dimensions	Area	Factor by Which to Multiply the Number of Plants Within the Hoop to Equal:	
		Plants per Hectare	Plants per Acre
Inside diameter of hoop			
91 cm (36 in.)	0.66 m^2 (7.1 ft^2)	15,228	6,162
84 cm (33 in.)	0.55 m^2 (5.9 ft^2)	18,122	7,334
76 cm (30 in.)	0.46 m^2 (4.9 ft^2)	21,928	8,874
71.8 cm (28.25 in.)	0.37 m^2 (4.36 ft^2)	24,711	10,000
61 cm (24 in.)	0.29 m^2 (3.1 ft^2)	34,263	13,866
Inside dimensions of square frame			
63.6 x 63.6 cm (25 x 25 in.)	0.405 m^2 (4.36 ft^2)	24,712	10,000
100 x 100 cm (40 x 40 in.)	1.00 m^2 (11.1 ft^2)	10,000	3,920

Appendix L. Commercial Grain Seeding Rates, Test Weights and Moisture Contents

Crop	Seeding Rate	Seed Weight[1]	Moisture
Wheat (winter & spring)	100–130 kg/ha	74.8 kg/hL (60 lb/bu) (365 g/0.5 L)	14.0%
Oats	60–110 kg/ha	42.4 kg/hL (34 lb/bu) (192 g/0.5 L)	13.5%
Barley (winter & spring)	80–160 kg/ha	59.9 kg/hL (48 lb/bu) (288 g/0.5 L)	14.8%
Rye	70–95 kg/ha	69.9 kg/hL (56 lb/bu) (339 g/0.5 L)	14.0%
Triticale	75–100 kg/ha	65 kg/hL (52 lb/bu)	—
Corn (field)	11–22 kg/ha	69.9 kg/hL (56 lb/bu) (353 g/0.5 L)	15.5%
White Beans (70 cm rows)	40–45 kg/ha	75 kg/hL (60 lb/bu)	—
Soybeans	65–155 kg/ha	74.8 kg/hL (60 lb/bu) (382 g/0.5 L)	13.0%
Peas (field)	130–200 kg/ha	75 kg/hL (60 lb/bu)	—
Buckwheat	55 kg/ha	59.8 kg/hL (48 lb/bu) (294 g/0.5 L)	45.6%
Flax seed	40 kg/ha	69.9 kg/hL (56 lb/bu) (331 g/0.5 L)	10.0%
Canola (spring & winter)	45 kg/ha	62 kg/hL (50 lb/bu)	10.5%
Millet (proso)	40 kg/ha	70 kg/hL (56 lb/bu)	—
Sunflower oilseed	4 kg/ha	33.6 kg/hL (27 lb/bu) (162 g/0.5 L)	9.5%
Sunflower stripes (confectionary)	6 kg/ha	39.9 kg/hL (24 lb/bu) (149 g/0.5 L)	9.5%
Mustard (yellow)	8–11 kg/ha	70 kg/hL (56 lb/bu)	—
Sudangrass	14 kg/ha	50 kg/hL (40 lb/bu)	—
Sorghum	14 kg/ha	70 kg/hL (56 lb/bu)	—
Annual canarygrass	35 kg/ha	62 kg/hL (50 lb/bu)	—
Lupins	150–180 kg/ha	75 kg/hL (60 lb/bu)	—

Source: Canadian Grain Commission

[1] Bushel weights in this table are the same as those used by the USDA.

— no data available

Appendix M. The Metric System

Metric units

Linear measures (length)

10 millimetres (mm) = 1 centimetre (cm)

100 centimetres (cm) = 1 metre (m)

1,000 metres = 1 kilometre (km)

Square measures (area)

100 m × 100 m = 10,000 m^2 = 1 hectare (ha)

100 ha = 1 square kilometre (km^2)

Cubic measures (volume)

Dry measure

1,000 cubic millimetres (mm^3) = 1 cubic centimetre (cm^3)

1,000,000 cm^3 = 1 cubic metre (m^3)

Liquid measure

1,000 millilitres (mL) = 1 litre (L)

100 L = 1 hectolitre (hL)

Weight-volume equivalents (for water)

(1.00 kg) 1,000 grams = 1 litre (1.00 L)

(0.50 kg) 500 g = 500 mL (0.50 L)

(0.10 kg) 100 g = 100 mL (0.10 L)

(0.01 kg) 10 g = 10 mL (0.01 L)

(0.001 kg) 1 g = 1 mL (0.001 L)

Weight measures

1,000 milligrams (mg) = 1 gram (g)

1,000 g = 1 kilogram (kg)

1,000 kg = 1 tonne (t)

1 mg/kg = 1 part per million (ppm)

Dry–liquid equivalents

1 cm^3 = 1 mL

1 m^3 = 1,000 L

Metric conversions (approximate)

5 mL = 1 tsp

15 mL = 1 tbsp

28.5 mL = 1 fl. oz.

Handy metric conversion factor (approximate)

litres per hectare × 0.4 = litres per acre

kilograms per hectare × 0.4 = kilograms per acre

Application rate conversions

Metric to Imperial or U.S. (approximate)

litres per hectare × 0.09 = Imp. gallons per acre

litres per hectare × 0.11 = U.S. gallons per acre

litres per hectare × 0.36 = Imp. quarts per acre

litres per hectare × 0.43 = U.S. quarts per acre

litres per hectare × 0.71 = Imp. pints per acre

litres per hectare × 0.86 = U.S. pints per acre

millilitres per hectare × 0.014 = U.S. fluid ounces per acre

grams per hectare × 0.015 = ounces per acre

kilograms per hectare × 0.89 = pounds per acre

tonnes per hectare × 0.45 = tons per acre

Imperial or U.S. to metric (approximate)

Imp. gallons per acre × 11.23 = litres per hectare (L/ha)

U.S. gallons per acre × 9.35 = litres per hectare (L/ha)

Imp. quarts per acre × 2.8 = litres per hectare (L/ha)

U.S. quarts per acre × 2.34 = litres per hectare (L/ha)

Imp. pints per acre × 1.4 = litres per hectare (L/ha)

U.S. pints per acre × 1.17 = litres per hectare (L/ha)

Imp. fluid ounces per acre × 70 = millilitres per hectare (mL/ha)

U.S. fluid ounces per acre × 73 = millilitres per hectare (mL/ha)

tons per acre × 2.24 = tonnes per hectare (t/ha)

pounds per acre × 1.12 = kilograms per hectare (kg/ha)

pounds per acre × 0.45 = kilograms per acre (kg/acre)

ounces per acre × 70 = grams per hectare (g/ha)

Dry weight conversions (approximate)

Metric	Imperial
grams or kilograms/hectare	**ounces or pounds/acre**
100 g/ha	1½ oz/acre
200 g/ha	3 oz/acre
300 g/ha	4¼ oz/acre
500 g/ha	7 oz/acre
700 g/ha	10 oz/acre
1.10 kg/ha	1 lb/acre
1.50 kg/ha	1¼ lb/acre
2.00 kg/ha	1¾ lb/acre
2.50 kg/ha	2¼ lb/acre
3.25 kg/ha	3 lb/acre
4.00 kg/ha	3½ lb/acre
5.00 kg/ha	4½ lb/acre
6.00 kg/ha	5¼ lb/acre
7.50 kg/ha	6¾ lb/acre
9.00 kg/ha	8 lb/acre
11.00 kg/ha	10 lb/acre
13.00 kg/ha	11½ lb/acre
15.00 kg/ha	13½ lb/acre

Appendix M. The Metric System (continued)

Conversion tables – metric to imperial (approximate)

Length
1 millimetre (mm) = 0.04 inches
1 centimetre (cm) = 0.40 inches
1 metre (m) = 39.40 inches
1 metre (m) = 3.28 feet
1 metre (m) = 1.09 yards
1 kilometre (km) = 0.62 miles
Area
1 square centimetre (cm^2) = 0.16 square inches
1 square metre (m^2) = 10.77 square feet
1 square metre (m^2) = 1.20 square yards
1 square kilometre (km^2) = 0.39 square miles
1 hectare (ha) = 107,636 square feet
1 hectare (ha) = 2.5 acres
Volume (dry)
1 cubic centimetre (cm^3) = 0.061 cubic inches
1 cubic metre (m^3) = 1.31 cubic yards
1 cubic metre (m^3) = 35.31 cubic feet
1,000 cubic metres (m^3) = 0.81 acre-feet
1 hectolitre (hL) = 2.8 bushels
Volume (liquid)
1 millilitre (mL) = 0.035 fluid ounces (Imp.)
1 litre (L) = 1.76 pints (Imp.)
1 litre (L) = 0.88 quarts (Imp.)
1 litre (L) = 0.22 gallons (Imp.)
1 litre (L) = 0.26 gallons (U.S.)
Weight
1 gram (g) = 0.035 ounces
1 kilogram (kg) = 2.21 pounds
1 tonne (t) = 1.10 short tons
1 tonne (t) = 2,205 pounds
Pressure
1 kilopascal (kPa) = 0.15 pounds/$in.^2$
Speed
1 metre per second = 3.28 feet per second
1 metre per second = 2.24 miles per hour
1 kilometre per hour = 0.62 miles per hour
Temperature
°F = (°C × 9/5) + 32

Conversion tables – imperial to metric (approximate)

Length
1 inch = 2.54 cm
1 foot = 0.30 m
1 yard = 0.91 m
1 mile = 1.61 km
Area
1 square foot = 0.09 m^2
1 square yard = 0.84 m^2
1 acre = 0.40 ha
Volume (dry)
1 cubic yard = 0.76 m^3
1 bushel = 36.37 L
Volume (liquid)
1 fluid ounce (Imp.) = 28.41 mL
1 pint (Imp.) = 0.57 L
1 gallon (Imp.) = 4.55 L
1 gallon (U.S.) = 3.79 L
Weight
1 ounce = 28.35 g
1 pound = 453.6 g
1 ton = 0.91 tonne
Pressure
1 pound per square inch = 6.90 kPa
Temperature
°C = (°F – 32) × 5/9

Abbreviations

%	= per cent	km/h	= kilometres per hour
ai	= active ingredient	kPa	= kilopascal
cm	= centimetre	L	= litre
cm^2	= square centimetre	m	= metre
EC	= electrical conductivity	m^3	= cubic metre
e.g.	= for example	mL	= millilitre
g	= gram	mm	= millimetre
ha	= hectare	m/s	= metres per second
kg	= kilogram	t	= tonne

Fertilizer Conversions

K_2O x 0.83 = K (elemental)
P_2O_5 x 0.44 = P (elemental)
Phosphorus (P) x 2.29 = P_2O_5
Potash (K_2O) x 0.83 = Potassium (K)
Potassium (K) x 1.2 = Potash (K_2O)

Appendix N. Field Scouting Report

Farm:_____ Scout: _____ Date:_____ Time:_____

Field:_____ Acreage: _____ Crop:_____ Plant Population:_____

Crop Growth Stage, Height and Condition: _____

_____

_____

_____

Soil Condition:_____

Weeds	**Growth Stage**	**Pressure/Density**

Insects	**Stage**	**Pressure/Density**

Diseases	**Stage**	**Pressure/Density**

Appendix N. Field Scouting Report (continued)

Field Map: Use the blank area below to sketch in the location of weeds, insects, disease patches, crop condition, including GPS coordinates.

Field Scout's Comments: _____

Action Recommended: _____

Appendix O. Diagnostic Services

Samples for disease diagnosis, insect or weed identification, nematode counts and verticillium testing can be sent to:

Pest Diagnostic Clinic
Laboratory Services Division
University of Guelph
95 Stone Rd. W.
Guelph, ON N1H 8J7

Tel: 519-767-6256
Fax: 519-767-6240
pdc@lsd.uoguelph.ca

Payment must accompany samples at the time of submission. Submission forms are available at www.labservices.uoguelph.ca/units/pdc/.

Fee Schedule
To obtain information on the fee schedule, refer to www.labservices.uoguelph.ca/units/pdc/ or phone the Pest Diagnostic Clinic.

How to Sample for Nematodes

Soil

When to sample
Soil and root samples can be taken at any time of the year that the soil is not frozen. In Ontario, nematode soil population levels are generally at their highest in May and June and again in September and October.

How to sample soil
Use a soil sampling tube, trowel or narrow-bladed shovel to take samples. Sample soil to a depth of 20–25 cm (8–10 in.). If the soil is bare, remove the top 2 cm (1 in.) prior to sampling. A sample should consist of 10 or more subsamples combined. Mix well. Then take a sample of 0.5–1 L (1 pint–1 quart) from this. No one sample should represent more than 2.5 ha (6.25 acre). Mix subsamples in a clean pail or plastic bag.

Sampling pattern
If living crop plants are present in the sample area, take samples within the row and from the area of the feeder root zone (with trees, this is the drip line).

Number of subsamples
Based on the total area sampled:

500 m^2 (5,400 ft^2)	10 subsamples
500 m^2–0.5 ha (5,400 ft^2–1.25 acre)	25 subsamples
0.5 ha–2.5 ha (1.25–6.25 acres)	50 subsamples

Roots
From small plants, sample the entire root system plus adhering soil. For large plants, 10–20 g (up to 1 oz.), dig fresh weight from the feeder root zone and submit.

Problem areas
Take soil and root samples from the margins of the problem area where the plants are still living. If possible, also take samples from healthy areas in the same field. If possible, take both soil and root samples from problem and healthy areas in the same field.

Sample Handling

Soil samples
Place in plastic bags as soon as possible after collecting.

Root samples
Place in plastic bags and cover with moist soil from the sample area.

Storage
Store samples at 5°C–10°C and do not expose them to direct sunlight or extreme heat or cold (freezing). Only living nematodes can be counted. Accurate counts depend on proper handling of samples.

Submitting Plant for Disease Diagnosis or Identification

Sample submission forms
Forms can be obtained from your local Ontario Ministry of Agriculture, Food and Rural Affairs office. Carefully fill in all of the categories on the form. In the space provided, draw the most obvious symptom and the pattern of the disease in the field. It is important to include the cropping history of the area for the past three years and this year's pesticide use records.

Choose a complete, representative sample showing early symptoms. Submit as much of the plant as is practical, including the root system or several plants showing a range of symptoms. If symptoms are general, collect the sample from an area where they are of intermediate severity. Completely dead material is usually inadequate for diagnosis.

With plant specimens submitted for identification, include at least a 20–25 cm (8–10 in.) sample of the top portion of the stem with lateral buds, leaves, flowers or fruits in identifiable condition. Wrap plants in newspaper and put in a plastic bag. Tie the root system off in a separate plastic bag to avoid drying out and contamination of the leaves by soil. Do not add moisture, as this encourages decay in transit. Cushion specimens and pack in a sturdy box to avoid damage during shipping. Avoid leaving specimens to bake or freeze in a vehicle or in a location where they could deteriorate.

Delivery
Deliver to the Pest Diagnostic Clinic as soon as possible by first class mail or by courier at the beginning of the week.

Submitting Insect Specimens for Identification

Collecting samples
Place dead, hard-bodied insects in vials or boxes and cushion with tissues or cotton. Place soft-bodied insects and caterpillars in vials containing alcohol. Do not use water, as this results in rot. Do not tape insects to paper or send them loose in an envelope.

Place live insects in a container with enough plant "food" to support them during transit. Be sure to write "live" on the outside of the container.