INFOSHEET #18

# HORTICULTURAL PRODUCTION

## How to address concerns identified in Environmental Farm Plan Worksheet #18

environmental farm plan
sustainably farmed

Based on Environmental Farm Plan Workbook, 4th ed. 2013

This infosheet outlines options to address concerns identified in your Environmental Farm Plan (EFP) as they relate to horticultural production.

For horticultural production that is located in a Source Water Protection Zone, the risk management measures needed to address the risk will be determined through the Source Water Protection process in your particular area. The measures may be the same as or more than required by EFP due to the proximity to a municipal drinking water supply. For more information, contact your local municipality or check their website under Source Water Protection Planning.

All options in this infosheet are classed as **Actions** or **Compensating Factors.**

- **Actions** address the identified concern, and will change the EFP rating to (3) or Best (4).
- **Compensating Factors** are alternatives that will adequately address the concern, but will not change the rating in the EFP worksheet.

In most cases, you'll need more information before choosing and implementing options. Sources for more information are noted at the end of this infosheet.

For help with technical terms, please see the full glossary in your EFP Workbook.

Growing Forward 2
Ontario Farm Environmental Coalition
Ontario
Canada

# GREENHOUSE CROPS

## 18–1. Biosecurity

### BACKGROUND

Diseases and pests can thrive in greenhouses and cost growers millions.

Threats can be managed with preventative and control measures – including IPM, eradication and sanitation. These measures are the foundation of biosecurity.

Develop a biosecurity plan to limit the risk of infestation of your operation, and ensure all visitors (e.g. suppliers, service personnel) to your greenhouse business and all staff adhere to biosecurity procedures.

### WHAT CAN YOU DO?

**OPTION 1 – ACTION**

**Control visitor access to your greenhouses:**

- lock all doors to prevent unwanted entry
- install security cameras.

**Establish a disinfection procedure/process for all visitors:**

- install a double entrance at the entry point that is screened and vented outside of greenhouse complex
- ensure visitors and staff undergo disinfection procedures before entering.


**A biosecurity plan will help to counter pest and disease threats to your business. Strict adherence by all visitors is essential.**

## 18–2. Monitoring for pest management

### BACKGROUND

A monitoring program involves regular scouting for evidence of pests, familiarity with their life cycles, and gauging the stage and severity of infestation.

Careful monitoring provides reliable information to guide your IPM program and help you make most effective and efficient use of control strategies.

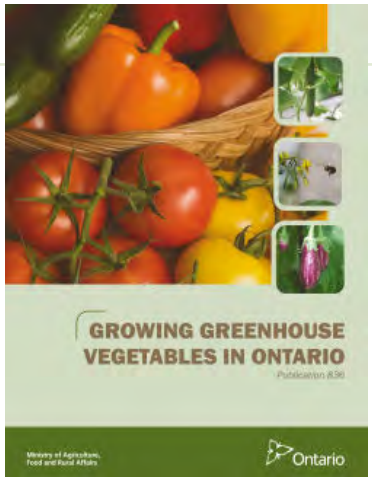
### WHAT CAN YOU DO?

**OPTION 1 – ACTION**

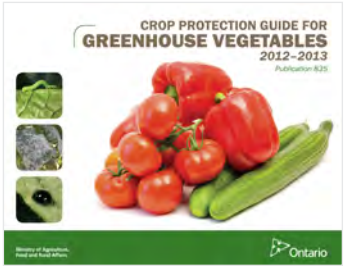
**Establish a regular pest monitoring program:**

- monitor/scout inside and outside greenhouses
- be familiar with pest life cycles and threshold levels that trigger control measures
- keep records – you will have reliable data on which to fine-tune management decisions.

**Pest monitoring is site-specific. Scout inside and outside the greenhouse regularly.**




**OMAFRA's *Growing Greenhouse Vegetables in Ontario*, Publication 836 is a comprehensive guide to the production of major greenhouse vegetables in Ontario, including information on greenhouse climate management and plant nutrition. It describes the major pests and diseases and IPM strategies, including biological control options. *Crop Protection Guide for Greenhouse Vegetables*, Publication 835 is a companion publication with a focus on pest control. Together, these two publications are an excellent reference package for greenhouse vegetables growers.**

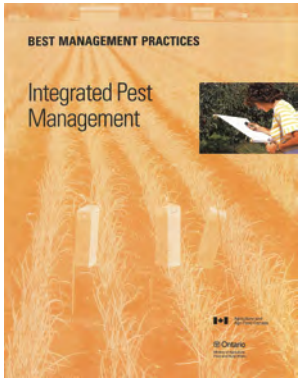


## 18–3. Integrated Pest Management (IPM)

### BACKGROUND

Consider using non-chemical control agents, including management techniques and biological controls.

Chemical control options are still allowed, but require extra attention to detail during their use in order to not harm the biological controls, e.g. parasites.




**This BMP booklet introduces the basics of IPM, such as pest monitoring, identification, thresholds, and an array of control strategies.**

### WHAT CAN YOU DO?

#### OPTION 1 – ACTION

**Incorporate IPM techniques.**

**Greenhouse climate management –** Pests will thrive in certain climatic conditions and be less successful in others. Know the preferences of the targeted pest and adjust the climate accordingly, while still meeting the needs of the growing crop.

**Exclusion –** If the pest can be denied access to the greenhouse in a cost-effective manner, management efforts can focus on other areas of improving production instead of reacting when the pest becomes a problem.

**Biocontrol agents –** These are living organisms, and their ability to control pest populations depends on their condition. All biocontrol agents should be inspected on delivery. Packages arriving during winter should be checked to ensure that they have not been frozen. Packages received during summer should be cool inside: otherwise, the biocontrol agents may be damaged.

**Intensive scouting/monitoring –** Early detection is critical for a successful IPM program. Thorough scouting is time well-invested. Always make notes of observations for later reference.

**Timely introduction of control management strategies –** When scouting reveals a pest issue, then decisions need to be made on how to best control the pest. At certain stages of the pest's life cycle, it will be easier to control and implementing a control strategy at this time will improve the chances of keeping the population at manageable levels.

**Biological control agents are living organisms, and their ability to control pest populations depends on their fitness – upon arrival and onsite.**

## 18–4. Disposal of prunings, culls, used growing media, and other material

### BACKGROUND

Plant debris is one of the primary sources of solid wastes from greenhouses. Improperly managed, decomposing plant debris will produce odours and nutrient-rich runoff. In addition, cull plant materials can be a host to greenhouse crop pests.

Organic wastes such as prunings and crop residues from greenhouse production should be properly handled on the farm to reduce environmental impact from stockpiling.

### WHAT CAN YOU DO?

#### OPTION 1 – ACTION

**Spread organic material on cropland and incorporate:**

- recycle inorganic material when possible
- take non-recyclables and unusable materials to the landfill
- keep woody waste from greenhouse vegetables out of the compost mix – use only vines and cull fruit material.

#### OPTION 2 – ACTION

**Compost organic wastes:**

- set up a properly managed compost pile and turn materials at regular intervals
- spread finished compost on cropland and incorporate
- recycle inorganic materials when possible
- take non-recyclables and unusable materials to the landfill.

**Plant material from greenhouse production should be properly handled (e.g. composted) on the farm to reduce environmental impact from stockpiling.**

# GREENHOUSE SYSTEMS (refers to issues unique to greenhouse production methods)

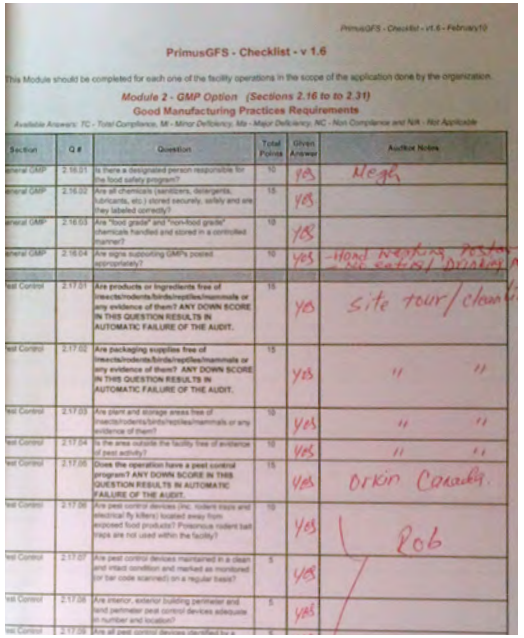
## 18–5. On-farm food safety

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Increasingly, retailers are demanding a full food safety program as a business requirement and for market access. Additionally, the traceability component of an on-farm food safety program may improve inventory control, resulting in a reduction of lost product and improved margins.<br><br>Food safety requires a comprehensive management strategy that includes not only best management activities but also the recording or documentation of these activities. Good records verify good management, and provide reference points for continuous improvement. | **OPTION 1 – ACTION**<br><br>**Establish an on-farm food safety program:**<br>• implement a record-keeping system to document food safety activities that were carried out.<br><br>**OPTION 2 – ACTION**<br><br>**Implement a third-party audit of existing food safety program:**<br>• audit to include a review of documented food safety activities that were carried out. |

## 18–6. Food traceability

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Traceability plays a significant role in helping businesses be competitive in the domestic and global marketplace. The ability to trace a product through all stages of production, processing, distribution, transport and retail to the end point (or consumer) is becoming a standard business practice for everyone involved in today's food supply chain.<br><br>Without an effective traceability system, you may be shut out of lucrative new markets or lose your existing markets to businesses that can demonstrate the value of their traceability system.<br><br>Recent outbreaks of food illness show the financial devastation to businesses and whole sectors when their reputation for providing safe food is put into question and effective traceability programs are not in place. | **OPTION 1 – ACTION**<br><br>**Establish a system of information exchange with electronic records for all participants:**<br>• set up a third-party audit system with complete records.<br><br>**OPTION 2 – ACTION**<br><br>**Set up a food traceability system with paper records.** |

For food safety information, see:
• www.ontario.ca/foodsafety


PrimusGFS - Checklist - v 1.6

Module 2 - GMP Option (Sections 2.16 to 2.31)
Good Manufacturing Practices Requirements

**Records and information-sharing will provide the basis for traceability by a neutral third party.**

## 18–7. Maintenance of heating system

**(includes air furnaces, unit heaters, boilers, heat distribution lines)**

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Proper maintenance of heating systems helps reduce energy and repair costs. | **OPTION 1 – ACTION**<br>**Schedule regular maintenance and inspections within a defined calendar period.**<br>Regular maintenance may include:<br>• changing air and fuel filters<br>• checking wear and tension on fan belts<br>• lubricating bearings on fan motors<br>• insulating distribution pipes and vents. |

**Regular boiler maintenance enhances heating efficiency.**

## 18–8. Control of heating system

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Up-to-date computerized control of heating systems helps increase energy efficiency while providing the best conditions for plant growth.<br>Proper environmental conditions also reduce disease pressure on the crop. | **OPTION 1 – ACTION**<br>**Install a computer-controlled system to regulate heating/cooling.**<br>**OPTION 2 – ACTION**<br>**Install a thermostatically controlled system:**<br>• set maximum/minimum thermometers<br>• record temperatures three times daily. |

**Using computerized controls in greenhouses can mean significant savings in energy consumption and costs.**

## 18–9. Energy management

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| A comprehensive energy audit shows energy usage in the various stages of crop production. This information can be used to target areas for improvement, analyze costs of improvement versus energy savings, and compare energy use to industry benchmarks. | **OPTION 1 – ACTION**<br>**Conduct an energy audit at least every five years.**<br>A professional audit may involve:<br>• performing an inventory of costs and consumption in time periods<br>• measuring efficiencies and effectiveness of on-farm systems and technologies<br>• benchmarking with industry standards<br>• identifying opportunities<br>• analyzing options. |

**Servomotors are designed to use electricity more efficiently than a standard electric motor.**

## 18–10. Electric motor efficiency

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| A servomotor allows for precise control of angular position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. Servomotors can perform specific mechanical tasks and reduce energy consumption. | **OPTION 1 – ACTION**<br>**Use energy-efficient motors:**<br>• when replacing a motor, consider a servo electric motor. |

## 18–11. Energy efficiency

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Heat and carbon dioxide can be lost from the premises through the flue. Energy-efficient heating systems reduce this kind of heat loss.<br>Flue gas condensors with hot water storage tanks will increase energy use efficiency and provide the necessary carbon dioxide ($CO_2$) for optimal crop performance. | **OPTION 1 – ACTION**<br>**Use energy-efficient controls with flue gas $CO_2$ and hot water tanks.** |

**Capturing heat and $CO_2$ from flue gas allows for the recycling of energy that would otherwise be wasted.**

## 18–12. Greenhouse construction (energy saving) – all greenhouses

### BACKGROUND

As energy costs continue to increase, so do the benefits from timely maintenance of buildings. Tightly glazed, gutter-connected, well-maintained greenhouses are more energy-efficient.

### WHAT CAN YOU DO?

**OPTION 1 – ACTION**

**Maintain and repair existing structures:**

- repair foundation and add sufficient insulation to the foundation and heat-transfer pipes
- maintain/repair glass to ensure that glazing is tightly sealed, and replace broken panes
- install and maintain gaskets on vents to prevent air escaping.

**OPTION 2 – ACTION**

**Replace old greenhouses or free-standing cold frames with gutter-connected range houses.**

**Energy-efficient structures are a major factor in achieving a competitive cost of production for greenhouse crops.**

## 18–13. Greenhouse construction – plastic greenhouses

### BACKGROUND

Polyethylene-covered greenhouses are less expensive than glass structures. They are more energy-efficient than glass greenhouses if two layers are used.

Many newer production areas have inflated double-layer 6 mil polyethylene as the greenhouse roof covering, in part because of initial investment costs.

### WHAT CAN YOU DO?

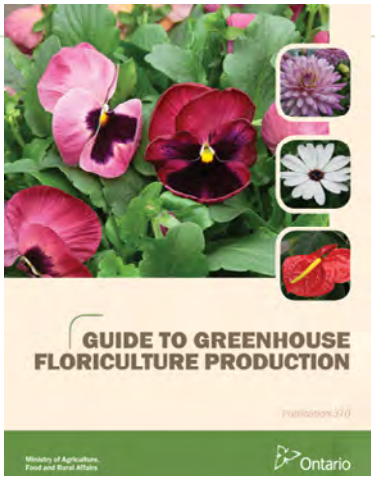
**OPTION 1 – ACTION**

**Inspect both layers of a double-layer plastic greenhouse covering to ensure there are no leaks.**

**OPTION 2 – ACTION**

**Install a thermal energy curtain to reduce heat loss in single-layer plastic greenhouse.**

**When constructing a plastic-covered greenhouse, consider how to make it as energy-efficient as possible.**




***Guide to Greenhouse Floriculture*, Publication 370 covers pesticide use, nutrition, pests and diseases, control strategies, and growth regulators. It is available online at OMAFRA's website or by CD:**

**www.omafra.gov.on.ca/english/crops/pub370/p370order.htm**

## 18–14. Greenhouse construction – glass greenhouses

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Renewed interest in glass construction has occurred for two reasons:<br>• a lifespan of 20+ years<br>• higher light levels – critical to crop quality and production during winter. | **OPTION 1 – ACTION**<br>**Install at least one energy curtain for increased energy conservation.** |

**When constructing a glass-covered greenhouse, consider how to make it as energy-efficient as possible.**

## 18–15. Greenhouse plastic coverings disposal

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Greenhouse plastic coverings can be economical and effective, but have a limited lifespan.<br>When the time comes to replace the covering, having it recycled is the preferred option. Often greenhouse poly covering can be washed, baled, pelletized, and sent for recycling.<br>When this is not possible, the covering should be taken to a licensed landfill. However, disposal of the poly, which must be replaced every three or four years, has become increasingly difficult as many municipal landfills no longer accept it as a waste. | **OPTION 1 – ACTION**<br>**Recycle or reuse plastic coverings:**<br>• buy plastic materials that can be used for at least two or more years before replacing<br>• utilize available recycling programs<br>• consider reuse in another aspect of production or another type of farm operation.<br>**Properly dispose of plastic coverings at an approved landfill if recycling is unavailable.** |

**Greenhouse coverings should last at least three to four years. Annual replacement generates more waste and increases labour and material costs.**

See also this OMAFRA factsheet:
• *Recycling Farm Plastic Films,* Order no. 95-019

## 18–16. Noise

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Neighbours in close proximity to greenhouses may make noise complaints. Taking steps to minimize fan noise is encouraged. | **OPTION 1 – ACTION**<br>**Reduce noise potential:**<br>• maintain fans and equipment regularly, according to a calendar schedule<br>• develop policy that tractor-trailer rigs must be shut off during loading and unloading<br>• replace forced-air ventilated greenhouses with top and/or side naturally ventilated greenhouses<br>• direct any fans away from residences.<br>**OPTION 2 – ACTION**<br>**Create noise barriers or screens (e.g. landscape screens, baffles) to reduce noise to nearby residences.** |

**Modern well-maintained equipment, noise barriers and separation distances will all help to reduce offsite noise impact.**

## 18–17. Lighting impact offsite

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Banks of lights shining all night in greenhouses can be disturbing to nearby neighbours. | **OPTION 1 – ACTION**<br>**Reduce offsite impact of greenhouse lighting:**<br>• install black-out screening above lights to eliminate offsite impact<br>• locate supplemental lighting so that it minimizes offsite impact. |

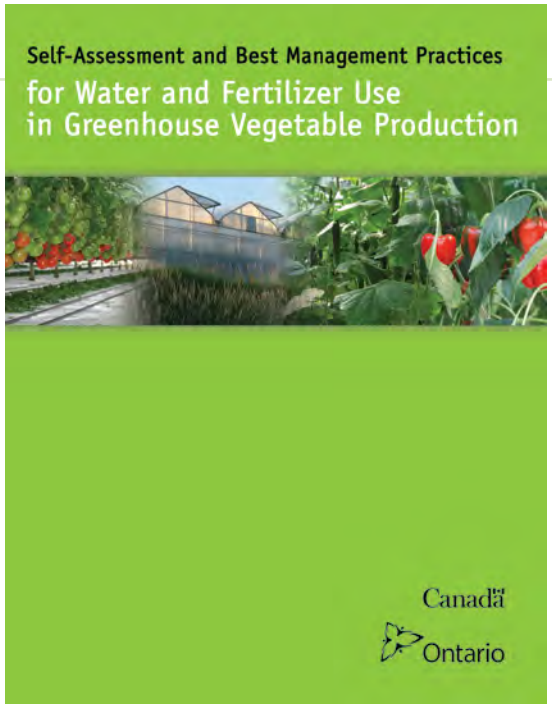
**Black-out screening will reduce the offsite impact of night-time lighting.**

## 18–18. Media testing

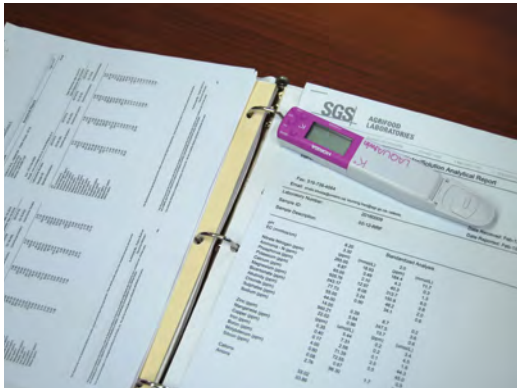
| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| The chemistry of growth media changes as nutrients and water are applied. Testing for salts (EC) and pH will provide feedback on nutrient and water efficiency.<br><br>Media testing throughout crop growth ensures that accurate and not excessive amounts of fertilizers are used. | **OPTION 1 – ACTION**<br><br>**Implement regular media testing:**<br>• include media testing on a definite schedule as part of management of the crop<br>• purchase equipment to do in-house testing of EC and pH<br>• designate and train staff to do in-house media testing on a definite schedule<br>• conduct monthly monitoring of N and K levels, as well as leaf tissue testing. |

## 18–19. Record-keeping and fertility program adjustment

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Keeping good fertility records for each crop and adjusting fertilizer applications to match the crop requirements will help prevent excess fertilizer use and reduce input costs. | **OPTION 1 – ACTION**<br><br>**Maintain a regularly updated record-keeping system for water and nutrient inputs for each crop.**<br><br>**Adjust fertility program based on past performance and crop needs.** |




***Self-Assessment and Best Management Practices for Greenhouse Vegetable Production*** **shows how to assess an operation's water and fertilizer management practices, and describes key BMPs to improve outcomes.**




**Regular media and nutrient solution testing will help you achieve optimum production and limit purchases of fertilizers to what is actually required.**

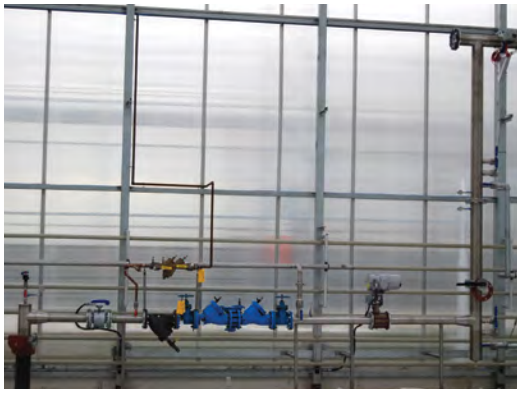
## 18–20. Management of fertigation equipment

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Fertilizer is an important component of any agricultural operation. However, rising raw material costs have put all crop inputs under close scrutiny.<br><br>Fertigation systems boost fertilizer use efficiency, allowing growers to tailor fertilizer applications to both crop growth and environmental impacts. | **OPTION 1 – ACTION**<br><br>**Calibrate fertigation equipment whenever the fertility program is changed.**<br><br>**Have a certified technican test backflow prevention equipment annually.** |

## 18–21. Fertigation initiation

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Excessive or insufficient fertigation can cause production, economic and environmental concerns. Properly managed, a variety of devices can ensure timely fertigation of water and nutrients. | **OPTION 1 – ACTION**<br><br>**Use technology to determine when to start fertigation, e.g. weigh scales, start tray and tension meters.** |

**For best results, use and monitor devices such as weigh scales that detect when fertigation should start.**



**Whenever fertigation equipment is used, always check that anti-backflow devices are installed and operating properly to prevent any backflow contamination of the water system.**

## 18–22. Precision irrigation management

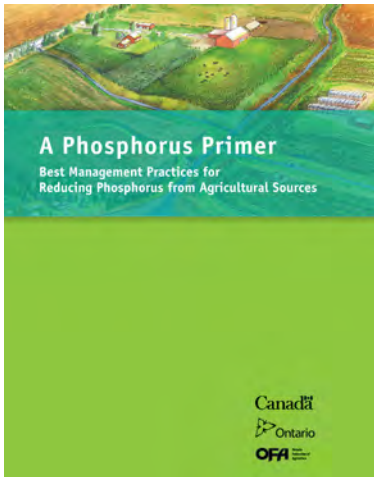
| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| One of the challenges with irrigation is providing the right rate, at the right place, when the crop requires it. Application rates, evapotranspiration and moisture content can be monitored and the information used to schedule irrigation events.<br><br>Water use efficiency is improved by the use of a monitoring system and automated feedback equipment. | **OPTION 1 – ACTION**<br><br>**Monitor water use by setting up an automated feedback and monitoring system:**<br>• this will help you meet the specific water needs of plants – supplying the right amount of water for efficient plant production. |


**Monitoring water use is essential to meeting plant needs and achieving a high level of water use efficiency.**

## 18–23. Fertilizer application

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Applying nutrients at the right times in their growth cycles improves water and fertilizer use efficiency. It also helps address environmental concerns regarding nutrients in wastewater. | **OPTION 1 – ACTION**<br><br>**Use controlled-release fertilizers to reduce amount of nutrient runoff.**<br><br>**OPTION 2 – ACTION**<br><br>**Use water-soluble fertilizers in closed irrigation systems.**<br><br>**OPTION 3 – ACTION**<br><br>**Install low-volume irrigation emitters.** |

**Fertilizer application can be improved through the use of water-soluble fertilizers in closed irrigation systems.**




**Unless properly managed, phosphorus can move from irrigation water and nutrient-enriched water to surface water – harming fish habitat and water quality.**

**This introductory BMP booklet explains what happens to phosphorus in soil and water, and shows how it can travel in runoff, leaks and drainpipes. BMPs for containment and reduction in a farm operation are presented.**

## 18–24. Fertilizer solutions reuses

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Fertilizer leachate can pose an environmental hazard to surface water due to nutrient loading of streams and ponds.<br><br>It must be collected and not allowed to escape. | **OPTION 1 – ACTION**<br><br>**Install a closed recirculating system to retain and reuse the fertilizer solutions.**<br><br>**OPTION 2 – ACTION**<br><br>**Collect and reuse fertilizer solution and leachate:**<br>• install a cistern and pond to collect all rainwater and irrigation water<br>• apply to other crops (e.g. turf, orchards) based on crop requirements.<br><br>Note: the disposal or land application of nutrient feedwater must be managed in accordance with applicable legislation such as the *Ontario Water Resources Act, Environmental Protection Act,* and *Nutrient Management Act*. |

**Collection of leachate is necessary to avoid nutrient loading of surface waters.**

## 18–25. Nutrient solution treatment

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Proper treatment allows for safe recycling of nutrient solutions. This practice helps to improve water and nutrient use efficiency.<br><br>Be aware that the nutrient solution should be disinfected prior to reuse to avoid the risk of spreading water-borne pathogens and organisms to crops. | **OPTION 1 – ACTION**<br><br>**Disinfect reused nutrient solution before application by:**<br>• heat pasteurization<br>• ultraviolet treatment<br>• ozonation. |

**Disinfecting the nutrient solution before reusing will reduce the risk of spreading diseases among crops.**

For more about water disinfection, see this online article in *Greenhouse Product News* (2006):

• www.gpnmag.com/grower-101-water-disinfection

## 18–26. Nutrient solution discharge

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Offsite movement of water and nutrients poses an environmental risk to surface water. Eliminating discharge water is important for the greenhouse sector's sustainability.<br><br>Treatment technology is available to reuse water, which means the need to discharge any water or solution from the greenhouse can be significantly reduced or eliminated altogether. | **OPTION 1 – ACTION**<br><br>**Install a treatment system so that all greenhouse water is reused, and discharge from the greenhouse is eliminated.**<br><br>**OPTION 2 – ACTION**<br><br>**Construct a storage vessel to contain nutrient solution. Apply solution to cropland during growing season at appropriate rates.**<br><br>Note: the disposal or land application of nutrient feedwater must be managed in accordance with applicable legislation such as the *Ontario Water Resources Act, Environmental Protection Act,* and *Nutrient Management Act*. |

## 18–27. Location and type of stock tank containing the nutrient solution

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| If a spill or leak occurs, large quantities of concentrated fertilizer solutions could put surface and ground water quality at risk.<br><br>Stock tanks located in high-traffic areas would be more susceptible to damage or puncture due to work activities and should have special protection from traffic contact. | **OPTION 1 – ACTION**<br><br>**Construct a separate, secured room for stock tanks.**<br><br>**Use non-corrosive tanks (e.g. plastic, fibreglass).**<br><br>**OPTION 2 – ACTION**<br><br>**Improve safety of tank location:**<br>• protect tanks from accidental vehicle impact (e.g. install bollards, concrete or metal barriers)<br>• use non-corrosive tanks (e.g. plastic, fibreglass). |

**Locate stock tanks in areas with minimal or no traffic, and protect them from accidental impact.**

## 18–28. Spill containment for stock tank

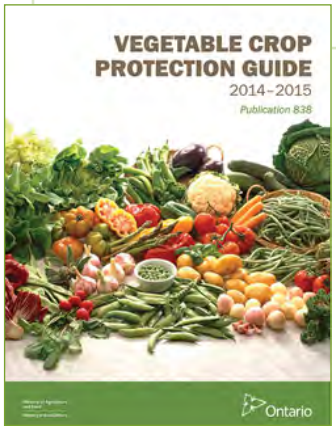
| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Greenhouse fertilizer storage areas contain concentrated nutrients that must be stored and managed properly.<br><br>Secondary containment of stock fertilizer solutions will prevent spills from reaching ground or surface water. | **OPTION 1 – ACTION**<br><br>**Construct an impermeable secondary containment system that will contain 110% of storage volume.**<br><br>**OPTION 2 – ACTION**<br><br>**Construct a clay-lined secondary containment system that will contain 110% of storage volume.** |

# FIELD-GROWN HORTICULTURAL CROPS

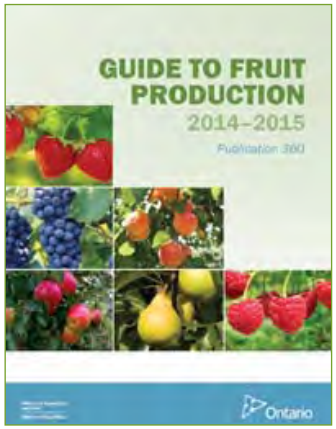
## 18–29. Need and timing for pesticide applications

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Properly done, scouting of crops can reduce pesticide use or at least ensure that pesticides are applied at the determined pest threshold for the greatest control and economic effectiveness.<br><br>See the chapter on field scouting in this OMAFRA publication:<br>• *Agronomy Guide for Field Crops*, Publication 811 | **OPTION 1 – ACTION**<br><br>**Take training in scouting techniques, pest identification and biology of the pest:**<br>• scout the crop, using the recommended scouting pattern and frequency to determine pest numbers<br>• make use of established pest thresholds to determine economic application of control treatments.<br><br>**OPTION 2 – ACTION**<br><br>**Hire a trained scout or a consultant.** |

**Scouting of pests provides site-specific information to help make decisions on the need and timing of pesticide application.**




**The *Vegetable Crop Protection Guide,* Publication 838 is the source of pest control information for a variety of field vegetable crops in Ontario. Publication 838 is a companion to *Ontario Field Vegetable Guide,* Publication 839, which will contain more comprehensive information on crop production and pest management (due 2014).**




***Guide to Fruit Production,* Publication 360 presents the latest pest management information for the commercial production of fruit crops in Ontario. This comprehensive, ready-reference manual also covers resistance management, organic and biopesticide products, nematode management, soil and crop nutrition, and much more.**

## 18–30. Organic wastes: disposal of prunings, culls, and other waste material

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Organic wastes such as prunings and crop residues from greenhouse production should be properly handled on the farm. This will reduce environmental impacts from burning or stockpiling, and help maintain biosecurity. | **OPTION 1 – ACTION**<br>**Consider rental or purchase of chippers and shredders for wood waste.**<br>**Spread waste material and incorporate it promptly into the soil.**<br>**Send diseased prunings to a landfill site.**<br>**OPTION 2 – ACTION**<br>**Temporarily pile and compost organic wastes. Manage the pile appropriately.**<br>**Ensure that any organic wastes spread on land are incorporated promptly and thoroughly.** |

See this OMAFRA factsheet:
- *Agricultural Composting Basics,* Order no. 05-23

**Organic wastes can be composted and applied to fields based on crop fertility needs.**

## 18–31. On-farm food safety

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| A food safety and traceability program is a formalized process that enables the food industry to follow products through all stages of the agri-food chain – from production to retail.<br>Benefits to growers include:<br>• helping you meet your market requirements and access new market opportunities<br>• effective product recall<br>• confidence in your products<br>• protection of your business and your customers. | **OPTION 1 – ACTION**<br>**Implement a traceability system.**<br>Types of traceability systems range from simple paper-based record-keeping to more sophisticated information management that uses automated and computerized components for efficient data capture and secure access to information. Regardless of the format, a traceability system will:<br>• document activities<br>• have an inspection schedule in place<br>• maintain records of inspections<br>• show that regular audits are planned. |

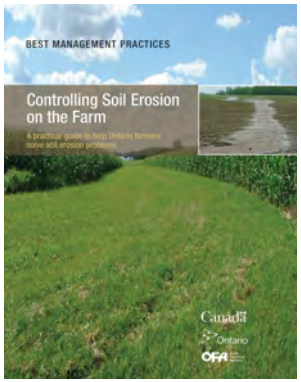
For food safety information, see:
- www.ontario.ca/foodsafety

## 18–32. Potential for wind erosion

### BACKGROUND

Some soil types are naturally more susceptible to the erosive action of wind, especially when they are dry, bare and unprotected.

There are three main wind erosion prevention strategies: keep it rough, keep it covered, and reduce the "fetch" of the wind (break up the length of field).




**For help with identifying the types of erosion problems and the best strategies to resolve them, see *Controlling Soil Erosion on the Farm*, a BMP publication.**

### WHAT CAN YOU DO?

**OPTION 1 – COMPENSATING FACTOR**

**Use reduced tillage practices:**

- reduce tillage to leave more surface residue cover
- choose tillage system that will leave a rough soil surface.

**OPTION 2 – COMPENSATING FACTOR**

**Plant cover crops:**

- plant cover crops immediately after crop harvest
- use cover crops (permanent or annual) for laneways, harvest alleys and spray rows.

**Windbreaks are an effective way to reduce the soil-eroding action of wind.**

**OPTION 3 – COMPENSATING FACTOR**

**Create windbreaks:**

- plant tree or grass windbreaks to reduce the wind speed
- erect snow fence or other wind barrier materials
- interseed a cereal grain as a cover crop into slow-emerging vegetables like carrots to stabilize soil and prevent soil movement before crop canopy development.

## 18–33. Effects of harvesting on potential for soil compaction

### BACKGROUND

Harvesting with heavy equipment can increase the incidence of soil compaction, especially in wet field conditions when there is a narrow window for harvest.

**Subsurface drainage will help to reduce the impact of rain on harvesting conditions.**

### WHAT CAN YOU DO?

**OPTION 1 – ACTION**

**Reduce equipment weight:**

- reduce axle weight and tire pressure
- partially fill dump carts and other harvest aids to reduce weight.

**OPTION 2 – ACTION**

**Reduce weather influences on harvesting conditions:**

- install tile drainage to poorly drained land – for those crops with narrow harvest dates, use best drained land
- take fields with chronic water problems out of production.

**OPTION 3 – ACTION**

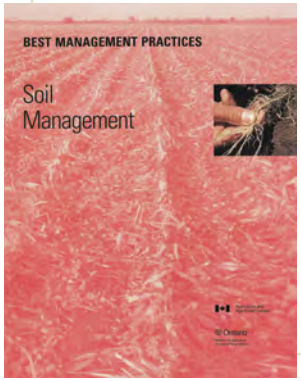
**Reduce the impact of harvesting operations:**

- use temporary or permanent grass cover crops between the rows in orchards, nurseries, and small fruit plantings
- designate in-field locations as roadways to concentrate compaction in known areas, or use controlled traffic system.

## 18–34. Crop rotations and cover crops

### BACKGROUND

Crop rotation and the use of cover crops help reduce soil erosion, build soil structure, and increase the organic matter of soils to improve the productivity of the soil.




***Soil Management* is an excellent reference to help you solve cropland soil problems and build back soil health. This BMP book explains soil properties, diagnostics for soil problems, and BMPs to prevent and correct problem soil conditions.**

### WHAT CAN YOU DO?

**OPTION 1 – ACTION**

**Use a good crop rotation:**

- rotate crop families, preferably on a four-year basis (or longer)
- include soil-building crops like cereals and forages in the rotation.

**OPTION 2 – ACTION**

**Plant cover crops and green manure crops:**

- plant green manure and/or soil-building cover crops after harvest of early season vegetable crops
- use a drill (no-till if necessary) to establish cover crops immediately after harvest
- plant temporary or permanent grass cover crops in the row middles of orchards, nurseries and small fruit plantings.

**Rotation of crop families will help to build soil structure.**

For more information about cover crops, see OMAFRA's website:

- www.omafra.gov.on.ca/english/crops/facts/cover_crops01/cover.htm

## 18–35. Manure or compost application

### BACKGROUND

Manure and compost can supply nutrients and organic matter to the soil. Care must be taken to prevent nutrient over-application and loss. The material must be handled and applied carefully to avoid food safety concerns.

**Make the most of this important on-farm nutrient. This BMP book explains what's in manure, how to mitigate concerns re: storage, odours and runoff, and how best to plan, set up and time its application.**


### WHAT CAN YOU DO?

**OPTION 1 – ACTION**

**Apply manure or compost according to crop recommendations and incorporate immediately:**

- based on manure and soil testing, adjust manure and fertilizer applications according to crop recommendations
- apply manure or compost under dry soil conditions to reduce the potential for compaction
- follow food safety guidelines at harvest time and at the time of manure and compost application.

**OPTION 2 – ACTION**

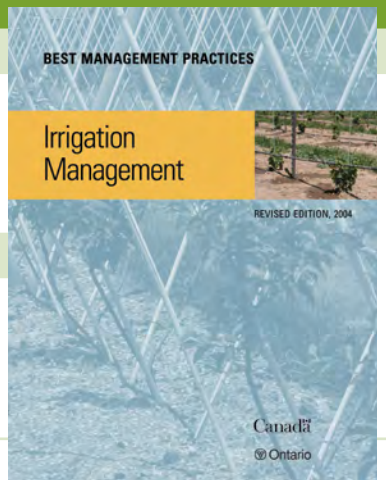
**Complete a Nutrient Management Plan (NMP) to ensure that the crop nutrient needs are matched with the nutrients applied through manure or compost application.**

**Follow food safety guidelines at harvest time and at the time of manure and compost application.**

**Manure applications should be based on laboratory analysis and crop nutrient needs.**

## 18–36. Management of fertigation

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| With fertigation, irrigation water and soluble nutrients are being supplied at the same time. If irrigation frequency increases in response to demand (higher evapotranspiration), a correspondingly lower rate of fertilizer should be injected into the irrigation system. If the nutrient content of the fertilizer is increased, less fertilizer is needed.<br><br>In both cases, the system needs to be calibrated to ensure that exact quantities of nutrients are applied with confidence.<br><br>Before using fertigation equipment, always check that anti-backflow devices are installed and operating properly to prevent any backflow into the water system. | **OPTION 1 – ACTION**<br><br>**Calibrate fertigation equipment each time the fertility program is changed.**<br><br>**Have backflow prevention equipment tested annually by a certified technician.**<br><br>**OPTION 2 – ACTION**<br><br>**Recalibrate fertigation equipment at the beginning of each season.**<br><br>**Have a Double Check Valve Assembly (DCVA) or a Reduced Pressure Principle Device (RPPD) in place.** |




**This comprehensive BMP book presents the latest on scheduling strategies, the pros and cons of sprinkler, drip and sub-irrigation systems, water-saving tips, and special applications. Extensive crop-specific charts are included.**

## 18–37. Equipment noise

| BACKGROUND | WHAT CAN YOU DO? |
|---|---|
| Some equipment such as harvesters, sprayers and bird scarers may cause noise issues with nearby neighbours. Demonstrating some effort to reduce the impact will go a long way towards good neighbourly relations. | **OPTION 1 – ACTION**<br><br>**Use practices to reduce noise levels:**<br>• change the location and timing of noise if possible (e.g. move bird scarers)<br>• conduct regular maintenance of machinery to reduce noise, and use only when necessary<br>• operate loud bird-scaring equipment only between sunrise and sunset.<br><br>**OPTION 2 – ACTION**<br><br>**Use netting and other low-noise alternative bird control methods.** |

**Experimental methods of on-farm bird control such as raptors have been tried with reasonable success.**

For more information, see this OMAFRA factsheet:

- *Understanding and Reducing Noise Nuisance from Stationary Farm Equipment,* Order no. 12-029

# FOR MORE INFORMATION

## Ontario Ministry of Agriculture, Food and Rural Affairs

Many sources of supplementary information are available. Below are some suggestions to get you started. Most can be found online at **ontario.ca/omafra** or ordered through ServiceOntario.

### FACTSHEETS

*Agricultural Composting Basics*, Order no. 05-23

*Recycling Farm Plastic Films,* Order no. 95-019

*Understanding and Reducing Noise Nuisance from Stationary Farm Equipment,* Order no. 12-029

### PUBLICATIONS

*Agronomy Guide for Field Crops,* Publication 811

*Crop Protection Guide for Greenhouse Vegetables,* Publication 835

*Growing Greenhouse Vegetables in Ontario,* Publication 836

*Guide to Fruit Production,* Publication 360

*Guide to Greenhouse Floriculture Production,* Publication 370 (online only)

*Ontario Field Vegetable Guide,* Publication 839

*Vegetable Crop Protection Guide,* Publication 838

### BEST MANAGEMENT PRACTICES

BMP publications are excellent sources to better understand on-farm environmental issues and discover a range of proven, practical options to address them. They are available at no charge to Ontario farmers. Below are a few suggestions.

*Controlling Soil Erosion on the Farm*

*Cropland Drainage*

*Field Crop Production*

*Integrated Pest Management*

*No-Till: Making it Work*

*Nutrient Management Planning*

*Self-Assessment and Best Management Practices for Water and Nutrient Use in Greenhouse Vegetable Production*

*Soil Management*

*Water Management*

### Inquiries to the Ontario Ministry of Agriculture, Food and Rural Affairs

Agricultural Information Contact Centre

Ph: 1-877-424-1300

Email: ag.info.omafra@ontario.ca

Web: **www.ontario.ca/omafra**

## Resources can be ordered through Service Ontario

**Online** at ServiceOntario Publications – **www.ontario.ca/publications**

**By phone** through the ServiceOntario Contact Centre

Monday–Friday, 8:30 am–5:00 pm

416-326-5300

416-325-3408 TTY

1-800-668-9938 Toll-free across Ontario

1-800-268-7095 TTY Toll-free across Ontario

# ACKNOWLEDGEMENTS

At the request of the Ontario Farm Environmental Coalition, consisting of Farm & Food Care Ontario, the Ontario Federation of Agriculture, and the Christian Farmers' Federation of Ontario, the following organizations and people contributed to the development of this infosheet:

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**Best Management Practices publications present in-depth explanations, tips and advice for Ontario farmers.**