4 CROPS

INTRODUCTION

This chapter discusses crop management practices for protection of the environment. It contains introductory information on the relationship between crops and the environment. It also contains information on crop production environmental concerns, legislation and beneficial management practices related to:

- outdoor crops
- indoor and container nursery crops

CROPS AND THE ENVIRONMENT

The primary role of agricultural crops is to provide a food source for humans and livestock. Environmental concepts related to crops are listed in alphabetical order below.

Buffers

Buffers on farms are generally defined as specially managed areas used to separate farm activities from sensitive areas that may be impacted by those activities. The objective of a buffer is to intercept and retain contaminants, preventing them from reaching a sensitive area or to deliver other agricultural or environmental benefits. ➔ see Buffers, page 11-4

Carbon Sequestration

Plants and soil organic matter play an important role in removing carbon dioxide from the air and storing (sequestering) it. Carbon is the main component in plant material and soil organic matter. Any uptake of carbon dioxide from the air by plant material or soil reduces the effects of climate change.
➔ see Climate Change, page 12-1

Cover Crops

Cover cropping and relay cropping are practices that can aid in the management of pests, nutrients and soil tilth. Such practices also benefit wildlife and provide additional forage yield.

Cover crops include crops such as fall rye, barley or annual rye grass grown between plowdown and reseeding of perennial forage or hay crops or between plantings of annual crops. Cover crops are used to protect against soil erosion, to improve soil structure and soil fertility, to suppress some insect pests and weeds, and to promote higher populations of some beneficial insects. They accelerate the movement of rainwater into the soil and toward drainage systems, reducing the time free water remains on the field surface.

Excess Nutrients Impact on Crop Quality

Under certain soil and climatic conditions, crops can take up or transform nutrients in such a way that the plant tissue can be harmful to animals. For example, grasses will "luxury consume" potassium which can lead to grass tetany in dairy cattle. In addition, nitrate-nitrogen, the form taken up by plants, can, if the concentration in soil is high enough or if there are rapid changes in moisture or temperature, accumulate in plant tissue and cause nitrate toxicity to livestock and wildlife.

Grasses

Forage grasses offer a unique opportunity to producers for improved nutrient management and environmental protection. Healthy grass stands build soils with good tilth and help protect soil from erosion by wind and water by binding soil particles and covering the soil surface. If soil moisture conditions are appropriate grass can take up significant amounts of nutrients.

The timing of forage harvest and the cutting height of the grass also play a critical role in the capture and filtration of runoff. Leaving longer plant stands late in the season near watercourses will help to filter suspended solids from runoff.

Nutrient Cycle

Crops play an integral role in nutrient cycling. For example, some crops remove excess nutrients from the soil, some capture nutrients for soil recycling that would otherwise have been lost and others capture nitrogen from the air. The nutrient cycle provides valuable sources of food and energy to the soil biota (bacteria, fungi and insects), plants and animals.

Soil Erosion Control

Plant roots bind soil particles together by exerting pressure and releasing glue-like organic compounds, resulting in aggregates that are more resistant to soil erosion. Plants protect soil from the erosive impact of raindrops and wind as well as from the erosive effects of overland flow by reducing the velocity of water runoff.

Soil Structure

Good soil structure increases soil permeability, resulting in reduced runoff flow. The growth and decay of crop roots and organic residue enhance microbial activity and population growth of soil microbes. Microbial activity improves soil structure and organic matter content.

Runoff Filtration

Standing crops, or crop residue attached to the soil, will decrease water velocities, resulting in fewer suspended solids and dissolved chemicals being carried by runoff water to watercourses. Crops and crop residue allow water to infiltrate the soil more rapidly than bare soil, as well as reduce runoff and erosion. An added benefit is that water entering the soil is filtered by the soil and plant roots take up nutrients.

Wildlife Habitat

Crops can provide wildlife with feed and habitat. Some crops may be specifically planted as 'lure' or 'sacrifice' vegetation for migrating birds. In addition, shelterbelts or windbreaks may provide soil and water conservation benefits as well habitat for beneficial birds or insects. Riparian plantings offer such benefits in addition to enhancing fish habitat and improving water quality.

➔ see Riparian Areas, page 11-13

OUTDOOR CROPS

This section discusses outdoor crop practices common to these crops:

- berries
- bulbs
- Christmas trees
- fiber
- field grown flowers and nursery stock
- field vegetables
- forage seeds
- forages
- ginseng
- grains and oilseeds
- grapes
- medicinal and herb
- nuts
- pastures
- tree fruits
- sod
- other specialty crops

➔ see Indoor Crops and Container Nurseries, page 4-12, for outdoor container nurseries

OUTDOOR CROP ENVIRONMENTAL CONCERNS

Primary environmental concerns related to outdoor crop management are:

- harvesting annual crops that leave the soil bare for extended periods and results in soil erosion
- harvesting of crops that results in excessive soil removal
- under production and poor crop uniformity (yield and quality potential not being realized due to weeds, diseases, poor water management, drought, low plant density, etc.) that results in unutilized nutrients causing water pollution, or results in soil erosion causing air or water pollution
- leachate from stored crops (e.g., silage) that results in water pollution
- crop processing dust or crop residue burning that results in air pollution
- movement of invasive plants, exotic pests or infected plant material that results in biodiversity impacts and/or threats to other crops
- conversion of land to agricultural production (e.g., drainage of wetlands) that results in loss of critical habitat and release of greenhouse gas to the atmosphere

For detailed information on these concerns:

➔ see Impacts on Biodiversity and Habitat, page 7-8, and refer to Farm Activities and Impacts
➔ see Soil Quality Factors, page 8-2, refer to Compaction
➔ see Soil Loss by Harvest, page 8-14
➔ see Water Quality and Quantity Factors, page 9-2, refer to Contaminants
➔ see Air Quality Factors, page 10-1, refer to Dust and Particulates, to Odours, and to Open Burning
➔ see Farm Activities and Impacts, page 12-6, and refer to Land Clearing

OUTDOOR CROP LEGISLATION

The following is a brief outline of the main legislation that applies to outdoor crops.

➔ see page A-1 for a summary of these and other Acts and Regulations

Agricultural Land Commission Act

This Act requires agricultural land within the Agricultural Land Reserve not be used for non-farm use unless permitted by the Act. The removal of soil and placement of fill are deemed to be non-farm uses except as provided in *Agricultural Land Reserve Use, Subdivision and Procedures Regulation.*

- Section 4(1): allows for the removal of soil or placement of fill when operating a turf farm as long as the necessary notification requirements in the *Regulation* have been met

Drinking Water Protection Act

This Act and Regulations have requirements regarding the protection of drinking water quality and regulate domestic water systems (those serving **more** than one single-family residence).

- Section 23(1): subject to subsection (3), a person must not (a) introduce anything or cause or allow anything to be introduced into a domestic water system, a drinking water source, a well recharge zone or an area adjacent to a drinking water source, or (b) do or cause any other thing to be done or to occur if this will result or is likely to result in a drinking water health hazard in relation to a domestic water system

Environmental Management Act

The *Code* under the *Agricultural Waste Control Regulation* has specific requirements regarding agricultural wastes:

- Section 3: agricultural vegetation wastes must be collected, stored, handled, used and disposed of in a manner that prevents pollution
- Section 12: agricultural vegetation waste must be applied to land as a fertilizer or soil conditioner
- Section 30: agricultural products must be managed, used and stored in a manner that prevents the escape of agricultural waste that causes pollution

Plant Protection Act

Regulations under this Act provide for the prevention of the spread of designated pests (e.g., insect, plant or disease) destructive to specific plants.

This Act prohibits activities that may cause a health hazard:

- Section 15: a person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard

Public Health Act

The Act also has conditions under the *Public Health Act Transitional Regulation*:

- Section 18: separation distance from wells to be at least 30.5 m from any probable source of contamination (probable source of contamination could include leachate from stored crops)

Weed Control Act

This Act imposes a duty on all land occupiers to control designated noxious plants.

Wildlife Act

The provincial *Wildlife Act* protects wildlife designated under the Act from direct harm, except as allowed by regulation (e.g., hunting or trapping), or under

permit. Legal designation as Endangered or Threatened under the Act increases the penalties for harming a species. The Act also enables the protection of habitat in a Critical Wildlife Management Area.

Fisheries Act

This Act has three sections of importance to outdoor crop management:

- Section 35: prohibits harmful alteration, disruption or destruction of fish habitat unless authorized
- Section 36(3): prohibits the deposit of deleterious substances into watercourses (deleterious substance could include eroded soil)
- Section 38(4): requires reporting infractions of Sections 35 or 36

Plant Protection Act

This Act protects plant life by preventing the importation, exportation and transportation of pests.

Species at Risk Act

This Act has sections that protect listed species, their residence and critical habitat. It applies to federal lands, internal waters (i.e., all watercourses), territorial seas of Canada, and the air space above them.

The provisions of the Species at Risk Act (known as the 'safety net') could be invoked on BC crown and private lands using a federal order under the Act if provincial action is not sufficient to protect listed species.

OUTDOOR CROP BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable outdoor crop related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

Outdoor Crop Soil Management

Improper crop management practices can cause soil degradation. Bare soils are prone to erosion and compacted soils will contribute to reduced crop yield and quality. Both conditions carry a greater risk of runoff flows transporting sediments into watercourses. Follow the same beneficial management practices outlined under protecting soil quality when cultivating for crop production.
➔ see Chapter 8, Soil

Cover Crops

Cover cropping and relay cropping are practices that can aid in the management of pests, weeds, nutrients and soil tilth, while benefiting wildlife and providing additional forage yield. Implement the following practices:

- plant annual cover crops following crop harvest (e.g., oats after carrots)
- plant annual cover crops to fill gaps between perennial crop rows (e.g., barley between raspberry rows)
- plant perennial cover crops to fill gaps between perennial crop rows (e.g., grasses between orchard rows)
- if fall manure application is planned, plant cover crops early enough to ensure that sufficient growth has occurred to utilize nutrients (emergence by mid September is typically necessary)

Relay Crops. Relay cropping is a form of cover cropping used by forage producers (e.g., the use of Italian ryegrass between the rows of silage corn). Relay cropping is practiced to reduce weed growth during the growing season, to provide an active crop available for fall manure application after corn is

harvested, to protect soil from erosion, and to provide additional forage yield. Implement the following practice:

- plant a relay crop instead of a fall-planted cover crop if fall manure application is planned to ensure better nutrient uptake

Catch Crops. Catch crops are a specific type of cover crop. The primary goal of a catch crop is to utilize nutrients that would otherwise be leached from bare soil during the fall and winter. In spring, catch crop nutrients can be removed from the field as a livestock feed or recycled by cultivation into the soil for use by a subsequent crop. Implement the following practices:

- following crop harvest, test the soil for residual nutrient levels to determine the need for a catch crop
- plant a catch crop if there are unused nutrients in the soil

Plowdown of Cover Crops. When cover crops are plowed down, the decomposition of plants, shoots and roots releases a flush of nutrients, particularly nitrogen, into the soil. In high precipitation areas, spring is the preferred season for plowdown to reduce the risk of nitrogen leaching to watercourses or ground water.

Strip Cropping

On long sloping fields, crops grown in strips on the contour will minimize the effects of concentrated water flow. This will encourage water to infiltrate into the ground, reducing soil erosion.

Crop Rotation

Crop rotation refers to the practice of growing two or more crops with different growth habits on a given field during different time periods. For example, in the dairy industry a perennial grass or grass-legume mix can be grown for a period of time after which the crop is plowed down with an annual silage corn crop replacing it. The two crops have different rooting characteristics, and varying nutrient and cultivation requirements. Crop rotation crops can provide an environmental benefit by improving soil structure and nutrient management by reducing erosion and by allowing greater flexibility in the management of pests.

- practice crop rotation in order to ensure efficient nutrient use, to aid in maintaining soil tilth, and to provide good pest management

Buffers

Establish and maintain an adequate vegetative buffer between outdoor crop activities and sensitive areas to avoid noise, dust, and odours from causing a nuisance or pollution. ➔ see Buffers, page 11-4

Outdoor Crop Nutrient Management

The management of nutrients for crops is necessary to achieve a desired yield and uniformity.

Nutrient requirements for every crop will be different. Forage grasses, for example, are greater nitrogen users than silage corn. It is important to know the nutrient requirements of a given crop to prevent the waste of nutrients and to prevent pollution from excessive application. Nutrients that are not utilized by the crop have the potential to be leached into groundwater and/or transported by surface runoff.

Nutrient management refers to the balancing of nutrients removed by a crop during growth with the nutrients available to it from all sources in a manner that protects the environment. ➔ see Chapter 6, Soil Amendments

Planting Date. Planting dates will impact nutrient uptake. While crops are usually planted when climate, soil or market conditions are suitable, nutrients only become available in response to specific weather, soil conditions and to human activity. As a result, planting and growth do not always mirror optimum nutrient availability.

- choose crop variety and planting dates appropriate to the weather and soil conditions of the site to optimize nutrient availability

Outdoor Crop Water Management

Water management is critical to most crops. A high water table or drought conditions will reduce the yield of a crop, resulting in reduced utilization of applied nutrients. Where possible, manage water for optimum growing conditions.

➔ see Irrigation, page 9-18
➔ see Drainage, page 9-36

Invasive Pest Management

Invasive pests include insects, plant diseases, and weeds. Transfer is common in areas where farm equipment and farm products move back and forth between fields and farms. Bacteria, fungi or other organisms growing on the crop or in the soil are readily picked up by equipment. Plant disease and weed infestations can result in significant losses in crop quality and/or yield. Severe contamination may even reduce the range of crops that can be grown on a site.

➔ see Chapter 11, Biodiversity

To ensure that pests, diseases and weeds are not spread, implement the following practices:

- purchase certified plant material or seed, and visually inspect plant material for pests upon receipt and prior to planting
- when using equipment in fields with known disease or weed problems, thoroughly disinfect equipment before moving out of the field

➔ see Chapter 5, Pest Management

Outdoor Crop Management

Annual Crops. Production and harvesting of annual crops (e.g. carrots, sweet corn) can result in soil erosion when soil is left bare over winter. Harvesting of certain crops can result in significant soil loss. Crop residues from annual crops can generate leachate if they come in contact with water, resulting in a risk of pollution. ➔ see Soil Loss by Harvest, page 8-14

Cranberries. Water management for cranberries differs markedly from that of other berries and crops due to the variety of ways that water is used in cranberry production. Water is used for irrigation, disease and insect control, frost protection, and harvesting. Growers impound water near cranberry beds to address the crops' extensive water requirements.

The extensive use of water in cranberry production creates the potential to place fertilizers, pesticides, and other chemicals (such as woodwaste leachate) in solution or suspension and to carry them into adjacent waterways. Implement the following practices to prevent water pollution:

- recover and recycle flood water used in cranberry production
- after application of a pesticide, impound the effected runoff within the boundaries of the farm for the period of time specified on the pesticide label
  - when discharging water
  - screen debris from water used for harvesting prior to discharge

- if unsure about discharge water quality, test it prior to discharge to meet the water quality objectives of the watercourse
  http://www.env.gov.bc.ca/wat/wq/
- if the water quality is acceptable, release it from impoundment areas gradually to avoid excessive rise in the water table and/or flooding of downstream neighbours
- if the water quality is unacceptable, obtain authorization from MOE before discharge

Forage Areas Used by Livestock. Implement the following crop practices for fields that are grazed or used as livestock overwintering sites:

- leave sufficient plant cover to protect the soil from compaction and erosion
- this may require increased crop residue to be left in the fall on affected areas or reduced stocking rates to prevent excessive trampling
- account for the nutrient content of manure deposited by livestock to match the affected area's need for fertilizer

➔ see Outdoor Livestock Areas, page 3-7
➔ see Nutrient Application, page 6-8

Forage Grass. Potassium levels in forage grass grown on dairy farms have been increasing to cautionary levels in recent years. Potassium is the only major nutrient associated with the concept of 'luxury consumption'. Luxury consumption of potassium is strongly associated with the intensive production of grass forages and refers to the uptake of a nutrient well in excess of a plant's requirement for growth. Grass tetany may result from cows eating grass grown on high potassium soils.

Nitrate-nitrogen can, if the concentration in soil is high enough or if there are rapid changes in moisture or temperature, accumulate in plant tissue and cause nitrate toxicity to livestock.

Soil and forage testing are essential to monitor both potassium and nitrate levels on intensive operations. Potassium leaches very slowly with the result that it may build up in soils if application exceeds crop needs.

➔ see Nutrient Management Planning, page 6-11

Forage Plowdown. When perennial forage stands are plowed down, the decomposition of plants, shoots and roots releases a flush of nutrients, particularly nitrogen, into the soil. In high precipitation areas, spring is the preferred season for plowdown to reduce the risk of nitrogen leaching to watercourses or ground water.

Medicinal and Herb Crops. Do not cultivate invasive plants as a crop.

www.agf.gov.bc.ca/cropprot/nonnativepests.htm
http://www.invasiveplantcouncilbc.ca/

Nursery Stock - Field Grown. Implement the following practices to minimize soil loss:

- when planting container nursery stock into a field use the largest feasible pot size to reduce the amount of native soil lost during harvest

- practice root pruning for all ball and burlap plant material to minimize root ball size – keep root balls to industry standards to preserve soil
- after nursery crop harvest, rest the soil with a seeded cover crop for one year
  - work cover crop into the soil after it has grown to trap nutrients and provide more organic matter to the soil
- replace soil removed in the root ball by the addition of soil amendments such as compost ➔ see Chapter 6, Soil Amendments

  📖 **BC Landscape Standard 2008**

Sod. Implement the following practices to minimize soil loss:
- reduce harvest to once every 15 months (suggested)
- optimal harvest sod soil thickness is 1 cm (suggested)
- use netting material to reduce the volume of soil harvested
- apply organic and/or mineral material to the soil between harvests

Tree Fruit and Berry. If burning of prunings is practiced, follow the open burning regulations. ➔ see Open Burning, page 10-17

Crop Residue

Crop residue that is not managed properly can be an environmental concern. Implement the following practices for crop residue:
incorporate residue into the soil that is easily moved or transported by wind or water (e.g., can be washed or blown to watercourses)
leachate from residue piles must be managed to prevent water pollution
➔ see Leachate, page 9-48

Forage Seed Production. If burning of stubble is practiced, follow the open burning regulations. ➔ see Open Burning, page 10-17

New Crop Development

When developing new cropland, protect critical fish and wildlife habitat.
➔ see Wildlife and Wildlife Habitat Protection, page 7-21
➔ see Riparian Areas, page 11-13

Stewardship Crops

There are many crop and non-crop plantings that exist for land and/or stewardship purposes, including:
- lure or sacrifice crops grown to draw wildlife away from feeding on forage cash crops
- field margins and hedgerows dedicated to wildlife use or providing refuge for wildlife and domestic livestock during harvesting or inclement weather
- grass fields normally used for annual cropping but which have been set aside for the sole purpose of providing a benefit to soil biota and to enhance soil structure and fertility

Roadsides, field corners and riparian areas can also be planted with stewardship crops. Such areas can be managed for limited harvest as well as to provide cover for wildlife. Stewardship crops are increasingly being placed as buffers for overland water flow to capture nutrients and sediments.
➔ see Chapter 7 Stewardship Areas, page 11-1

Crop Handling

Harvested crops may be lost (spilled) in the field, during handling to and from storage, and while in storage. To prevent surface water or ground water contamination, implement the following practices:

- keep crops contained during transport to eliminate losses
- clean up spills before water sources are negatively impacted
- remove waste feed promptly to reduce odours and rodent activity

Crop Processing

For concerns related to disposal of crop wash water, crop drying (e.g., grain) and feed mills ➔ see On-Farm Processing and Sales, page 2-42

Livestock Feed. Contain raw materials and processed feeds. Uncontained feed has the potential to contaminate surface water or ground water. Select a site with good drainage, preferably elevated and easily accessible. Divert roof water and clean runoff away from the site. Clean up spilled feed as soon as possible to reduce odour, discourage rodent activity, and to prevent contamination of surface water. Collect, store and handle feed-contaminated surface water.
➔ see Runoff, page 9-42, ➔ see Leachate, page 9-48

Install dust collection or suppression equipment to prevent the dispersion of feed dusts. Establish and maintain an adequate buffer between feed processing areas and neighbours to mitigate noise and dust from causing nuisance or pollution.
➔ see Buffers, page 11-4, ➔ see Dust and Particulate, page 10-10

Crop Waste Disposal

Manage culled or spoiled unusable crops as soil amendments.
➔ see Chapter 6 for use of crop wastes as soil amendments. Water that contains crop waste must be handled as contaminated water.
➔ see Collecting, Storage and Use of Contaminated Water, page 9-44

Crop Storage

Crops must be stored properly to prevent contamination of water sources. Most contamination under forage and vegetable storage conditions is caused by nutrient rich leachate leaving crop material or water contacting the stored crop, creating leachate. Store crops on hard surfaces to more easily divert and contain leachate and cover to avoid precipitation contacting the stored crop.
➔ see Buildings and Roads, page 2-2, ➔ see Runoff, page 9-42
➔ see Leachate, page 9-48

Forage Crop Storage

The following comments on feed storages are separated based on whether such storages are located in high or low precipitation climates. High precipitation exceeds 600 mm total winter precipitation; low precipitation is less than 600 mm. ➔ see Appendix B.1, page B-2

Hay Storage: Low Precipitation. Implement the following practices:

- choose a well-drained site not subject to seasonal water flow or flooding
- lay out the site for convenient cleanup of spillage
- divert clean runoff away from the site ➔ see Runoff, page 9-42
- ensure any contaminated runoff leaving the site is controlled and collected
- consider covering hay with a tarp or structure to prevent leachate formation
- use gravel splash pads at the base of hay shed walls for roof stormwater erosion control

Hay Storage: High Precipitation. Implement the following practices **in addition** to those listed above for low precipitation areas:

- cover hay storages to reduce feed losses and to eliminate leachate
- use eavestroughs, downpipes and drain piping for roof stormwater control

Silage Storage: Low Precipitation. Silage leachate poses a great pollution concern. If silage leachate is produced, contain it to prevent entry into watercourses. In low precipitation areas, open pit storages are suitable. Implement the following practices:

- locate silage storage away from yard drain inlets, ditches and wells and 15 m or more from watercourses (suggested)
- choose a well-drained site not subject to seasonal water flow or flooding
- divert clean runoff away from the site
- since silage leachate is expected to be generated, have an impervious floor (e.g., concrete or other material) to contain the leachate
- construct silo floors to drain towards the open end to avoid the pooling of rainwater and silage leachate within the silo storage area itself
  - divert any potentially contaminated flows away from watercourses
  - direct contaminated flows onto adjacent fields to soak in if pollution will not occur or divert to a liquid storage facility such as a manure pit

Store silage in plastic bags on sites similar to those above with the following additional practices in place to prevent leachate escape:

- prepare the site base with fine compacted gravel, concrete, or asphalt to prevent bag puncture
- fence to deter livestock and wildlife in order to prevent bags from tearing
- keep free of ruts and weeds to discourage rodents
- where required, bait the site to control rodents

Silage bag handling can result in a large amount of waste plastic material which must be disposed of correctly. ➔ see Farm Refuse Disposal, page 2-15

Silage Storage: High Precipitation. Implement the following practices **in addition** to those listed above for low precipitation areas:

- cover storages to reduce silage leachate
- use eavestroughs, downpipes and drain piping for roof stormwater control

Indoor and Container Nursery Crops

This section discusses indoor crop practices common to these crops:

- ♦ button & specialty mushrooms
- ♦ container-grown nursery stock
- ♦ greenhouse-grown crops

Indoor and Container Nursery Crops Environmental Concerns

Primary environmental concerns related to indoor crops and container nursery production are:

- ♦ escape of leachate or spent nutrient solution from the production facility that results in nutrients causing water pollution
- ♦ increased water flow leaving the site due to the amount of impervious surface that results in soil and watercourse erosion and downstream flooding
- ♦ emissions from greenhouse boilers that result in air pollution
- ♦ inappropriate crop residue management that results in soil, water and air pollution
- ♦ movement of plant material infested with invasive plants or exotic pests or the invasive plants or exotic pests themselves that results in impacts to biodiversity
- ♦ mushroom media production that results in water or air pollution

For detailed information on these concerns:

➔ see Heat Production and Agricultural Boilers, 2-39
➔ see Impacts on Biodiversity and Habitat, page 7-8, and refer to Farm Activities and Impacts
➔ see Soil Quality Factors, page 8-2, refer to Contaminants
➔ see Water Quality and Quantity Factors, page 9-2, refer to Contaminants, and to Overland Flow
➔ see Air Quality Factors, page 10-1, refer to Contaminants, to Dust and Particulates, and to Odours

Indoor and Container Nursery Crops Legislation

The following is a brief outline of the main legislation that applies to indoor crops and container nurseries.

➔ see page A-1 for a summary of these and other Acts and Regulations

Local Bylaws

Many local governments have specific bylaws on mushroom media production, greenhouse coverage, heating fuel (emissions) and lighting.

Agricultural Land Commission Act

This Act requires agricultural land within the Agricultural Land Reserve not be used for non-farm use unless permitted by the Act or its regulations. The removal of soil and placement of fill are deemed to be non-farm uses except as provided in *Agricultural Land Reserve Use, Subdivision and Procedures Regulation.*

- Section 2(4): allows for the removal of soil or placement of fill necessary for a specific use as long as it does not:
  - cause danger on or to adjacent land, structures or rights of way
  - foul, obstruct or impede the flow of any waterway
- Section 4(1): allows for the removal of soil or placement of fill when constructing and operating a greenhouse or mushroom production facility that covers more than 2% of the area of the parcel as long as the necessary notification requirements in the Regulation have been met

Environmental Management Act

This Act and Regulations have requirements regarding the protection of drinking water quality and regulate domestic water systems (those serving **more** than one single-family residence).

- Section 23(1): subject to subsection (3), a person must not (a) introduce anything or cause or allow anything to be introduced into a domestic water system, a drinking water source, a well recharge zone or an area adjacent to a drinking water source, or (b) do or cause any other thing to be done or to occur if this will result or is likely to result in a drinking water health hazard in relation to a domestic water system

There are two regulations under the act that pertain generally to crops and specifically to mushroom media production.

The *Code* under the *Agricultural Waste Control Regulation*:

- Section 3: agricultural wastes must be collected, stored, handled, used and disposed of in accordance with all other provisions of the *Code* and in a manner that prevents pollution
- Section 16: composting of agricultural waste for the production of mushroom media on a farm is allowed if:
  - the mushroom media produced is used only on that farm
  - the composting site is located at least 15 m from any watercourse and at least 30 m from any source of water for domestic purposes
  - the compost is prepared in a manner that does not cause pollution
- Section 30: agricultural products must be managed, used and stored in a manner that prevents the escape of agricultural waste that causes pollution

Mushroom Composting Pollution Prevention Regulation applies when a farm is producing media that will be sold off-farm. It regulates air and water discharges by requiring an implemented pollution prevention plan. The specifications for the plan are identified in the Regulation.

Plant Protection Act

Regulations under this Act provide for the prevention of the spread of designated pests (e.g., insect, plant or disease) destructive to specific plants.

Public Health Act

This Act has conditions under the *Public Health Act Transitional Regulation*:

- Section 18: provides separation distance of wells to be at least 30.5 m from any probable source of contamination (probable source of contamination could include leachate from mushroom media, crop residues and woodwaste)

Weed Control Act This Act imposes a duty on all land occupiers to control designated noxious plants.

Fisheries Act This Act has four sections of importance to indoor and container nursery crop production:

- Section 35: prohibits harmful alteration, disruption or destruction of fish habitat unless authorized
- Section 36(3): prohibits the deposit of deleterious substances into watercourses (deleterious substances could include leachate from mushroom media, crop residues and woodwaste)
- Section 37: requires approval for any work that may impact fish
- Section 38(4): requires reporting infractions of Sections 35 or 36

Plant Protection Act This Act protects plant life by preventing the importation, exportation and transportation of pests.

INDOOR AND CONTAINER NURSERY CROPS BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable legislation, including the above, and where appropriate, use the following beneficial management practices to protect the environment.

Indoor Crops and Container Nursery Facilities

Implement the following practices for indoor crops and container nursery facilities:

- locate with proper setbacks from watercourses
  ➔ see Farm Building Siting, page 2-4
- locate where contaminated runoff or leachate can be controlled and collected
  - fine textured soils (soils with more than 20% clay content) are preferred as leachate does not move as quickly through clays and remain on the surface allowing them to be collected
- collect and manage roof water if roof area is more than 10% of a site area (suggested)
  - stormwater flow is increased as impervious roofing or yard areas are increased ➔ see Buildings and Roads Practices, page 2-9
- establish and maintain an adequate buffer between greenhouse, container nursery and mushroom facilities and neighbours to avoid noise, dust, and odours from causing a nuisance or pollution ➔ see Buffers, page 11-4

Nutrients Applied Through an Irrigation System (Fertigation)

When nutrients are applied through an irrigation system, implement the following practices:

- install an efficient and uniform application system
- match application rates and amounts to crop requirements to reduce over watering and excessive leaching (e.g., a computerized irrigation scheduler controlling a drip system is more efficient than an overhead system)
- for container crops, use drip irrigation when practical to apply water to the crop
  - avoid areas where crops are not grown to eliminate the need to capture any nutrient-rich water

Leachate. The degree of leaching required to maintain healthy container crops is strongly related to the tolerance such crops exhibit to accumulations of salts within the growing media. Manage salt levels in growing media to minimize the need for leaching and the subsequent discharge of nutrient-rich water. Leachate may account for 10% to 30% of total irrigation water applied. If leachate has nutrient or pesticide levels that could cause pollution the water must be captured and recirculated or retained until such time that it can be discharged without causing pollution. ➔ see Leachate, page 9-48

Implement the following practices to manage leachate:

- for impervious subsoil, recover irrigation waste water in field drains for storage
- for pervious subsoil, use concrete floors or polyethylene floor liners in greenhouses or nurseries to collect all leachate
- in greenhouse or nursery production, use water recirculation techniques to both reuse leachate as a nutrient source and to conserve water
  - due to disease transfer concerns, recirculation is not feasible on all operations

Spent Nutrient Solution. The concentration of nutrients in recirculated water can be reduced by decreasing the amount of fertilizer added at the end of a production cycle. Dispose of the spent nutrient solution at the end of the cycle by applying to other suitable agricultural crops.
➔ see Nutrient Application, page 6-8

Any effluent discharge into the environment, which is not being used as a fertilizer for crop production, requires a permit from MOE.

Invasive Pests

To ensure that neither diseases nor pests are spread, implement the following practices when purchasing propagative plant material:

- do not propagate invasive plants
- use certified pest-free plant material if available
  - monitor plants upon arrival to the farm
  - if possible, isolate new plant material for a period of time prior to moving into production areas
    ➔ see Chapter 5, Pest Management

Soilless Media

Storage of Media. Store raw materials as well as prepared and spent media in such a way as to prevent their release into the environment.

Use of Media. The choice of growing media in a greenhouse or nursery operation has a significant effect on overall water consumption. Watering efficiency can be increased through the choice of substrates with higher water holding capacity. However, such substrate use may be limited by an often higher potential for root rot.

Disposal of Media. Dispose of unused, spent or waste media in a manner that does not cause pollution. Reuse within the operation or use these materials as a soil conditioner. ➔ see Soil Conditioner Application page 6-29

Greenhouse

Roofs. Shade materials such as nettings or curtains are preferred over shading compounds that are sprayed on greenhouse roof or walls. Shading compounds used on the outside of greenhouse structures can contribute to stormwater contamination. Capture and appropriately deal with contaminated water that will cause pollution. ➔ see Runoff, page 9-42

Consider using rainwater collected from greenhouse roof systems as an alternative source of irrigation water.

Crop Residue. Other parts of this Guide address concerns associated with crop residue from greenhouses:

- crop prunings, plants and waste organic media application to soil ➔ see Soil Conditioner Application, page 6-29
- organic wastes for compost ➔ see Compost, page 2-32
- plastic clips, strings, pots, rockwool ➔ see Farm Waste, page 2-13

Building Drains. Greenhouses may be constructed with perimeter drains to divert clean roof water away from the roof and building foundation. If a greenhouse also has separate drains to collect spent irrigation water or contaminated floor water, implement the following practice:

- test drains to ensure they are not cross-connected by introducing a MOE-approved dye into the contaminated water drain system and checking that the dye does not show up in the perimeter drain discharge

Boiler Emissions. Greenhouse boilers may generate air emissions that contribute to climate change or particulates that could result in air pollution. ➔ see Heat Production and Agricultural Boilers, page 2-39

Light Emissions. Greenhouses may emit light that causes a nuisance to neighbours. Depending on the intensity of your lights and the light emission reduction desired, consider using the following:

- do not use supplemental lighting during the evening hours of 6 PM to midnight. (crops need a period of darkness; this will minimize impacts on your neighbours)
- control overhead light emissions (if crops will allow)
  - use light abatement material such as black-out curtains, light abatement screens or thermal curtains on side walls
- consider vegetation buffers for very close neighbours (an IPM program may be required to reduce potential insect problems resulting from the buffer)

Nursery

Woodwaste. The use of woodwaste products such as sawdust and hog fuel is regulated under the *Environmental Management Act* as leachate from this material can be toxic to fish. ➔ see Woodwaste, page 2-27

Crop Residue. Other parts of this Guide address concerns associated with crop residue from nurseries:

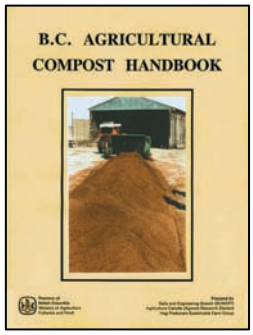
- prunings, plants and waste organic media application to soil ➔ see Soil Conditioner Application, page 6-29
- organic wastes for compost ➔ see Compost, page 2-32
- sheet plastic, pots, trays, fertilizer bags, pesticide containers ➔ see Farm Waste, page 2-13

Mushroom

Media Production. Beneficial practices specific to mushroom media production include those associated with both the storage of raw materials and with composting.

Organic materials, if not handled carefully, may create leachate, runoff and odour problems while undergoing decomposition in storage. Odour is a particular problem with wet straw-bedded horse manure or poultry litter. In addition, if raw materials are exposed to high rainfall, the runoff will be contaminated with organic compounds. Store all raw materials in a manner that prevents the escape of agricultural wastes that may cause pollution. Cover all manure-based raw materials to avoid runoff and odour problems. Locate media production sites to meet the *Public Health Act* and *Agricultural Waste Control Regulation* requirements.

The potential for leaching from compost piles is significant. Carry out all composting on a hard, impermeable surface designed to collect leachate. Use covered compost facilities in areas receiving high rainfall.



Compost Production Odour Reduction. Mushroom compost production produces odours and careful attention to site selection will help to minimize nuisance odour problems. Install scrubbers and biofilters to reduce odours on sites located close to neighbours.

➔ see Composting, page 2-32
➔ see Protection of Air Quality, page 3-4, and refer to Biofilters

📖 **BC Agricultural Composting Handbook (series of Factsheets)**
📖 **Mushroom Production Guide – Guide to Best Management Practices in British Columbia**

Fresh Media Storage. Mushroom media is typically stored on a concrete pad near the mushroom house while the beds are filled. During this time, the compost may be exposed to rain, creating leachate and contaminated runoff.

Implement the following practices:

- locate media storage (fresh and spent) away from yard drain inlets, ditches, wells and watercourses
  - at least 30.5 m from wells (*Public Health Act*)
  - 15 m or more from watercourses (suggested)
  - 30 m or more from water intake used for domestic purposes (suggested)
- minimize the amount of runoff
  - schedule compost deliveries to arrive as the compost is required
  - fill beds as soon as possible after the compost arrives, keeping it out of the rain
  - provide a covered storage area for fresh media in high precipitation areas such as the Lower Fraser Valley and Vancouver Island
  - clean up debris from receiving and filling areas frequently
  - divert runoff away from fresh media piles
  - collect all contaminated runoff that can pose a pollution risk
    ➔ see Runoff, page 9-42

Spent Media. Once mushrooms have been harvested, the compost is considered "spent media" and removed from the barn. Construct berms or other containment works to divert clean runoff away from spent media piles and to prevent any leachate or contaminated water flows from entering surface or ground water. Collect, store and treat or apply to the land any runoff that has contacted spent media. Spent media can be applied to soil as a soil conditioner.

➔ see Runoff, page 9-42
➔ see Soil Conditioner Application, page 6-29

Building Drains. Mushroom barns may be constructed with perimeter drains to divert clean roof water away from the roof and building foundation. If a mushroom barn also has separate drains to collect contaminated water, implement the following practice:

- test drains to ensure they are not cross-connected by introducing a MOE-approved dye into the contaminated water drain system and checking that the dye does not show up in the perimeter drain discharge

Crop Waste Disposal

Manage culled or spoiled unusable crops as soil amendments.

➔ see Chapter 6 for use of soil amendments. Water that contains crop waste must be handled as contaminated water.
➔ see Collecting, Storage and Use of Contaminated Water, page 9-44