

Water Management

Water management is an essential part of vegetable production. Plant growth and yield can potentially be optimum when a reasonable measure of water control is achieved in the soil. Too little or too much water can result in crop losses as natural conditions rarely satisfy crop needs. In some cases, water is also required for pest control or nutrient application. Water is used on the farm for post harvest market preparation. Water quality must be considered, as unsuitable water can impact vegetable yields, quality and marketability of the crop.

Drainage

Removing excess water in spring, fall and winter is usually necessary in South Coastal B.C. and, to a lesser degree, in some Interior areas. In the Interior, drainage is frequently required for reclamation and control of soil salinity and alkalinity. Many coastal floodplain areas can also benefit from drainage to reduce or remove saline salts. Drainage systems give the following benefits:

- increased trafficability;
- extended crop season;
- increased crop yields due to improved nutrient uptake;
- improved aeration of the root zone;
- warmer soil temperatures;
- crop protection from “drown-out” and certain seedling and root diseases;
- control of water erosion; and
- increased land values.

Drainage systems usually have a surface and a subsurface component. Both must be well-planned, installed and maintained to be effective. Subsurface drainage with a functioning outlet is the best way to control water on most soils. Lightweight, continuous, flexible, perforated plastic drain pipe is used. On sloping land, porous surface or blind inlets may be needed to lead water to the subsurface drains in order to reduce overland flow and erosion. On sandy soils, geotextile filters are needed around the perforated pipe to prevent sand from clogging the drain tube. Filters should not be used on organic soils.

Plastic drain pipe is quickly installed by drainage contractors using specialized equipment. Installation depth and spacing differs with fields and is mainly based on the climatic conditions and soil type. Pumps are sometimes needed in low lying areas that lack gravity outlets.

Drainage systems must be maintained. This includes periodic cleaning of drain pipes, outlets and ditches, and careful in-field soil management. Soil conservation and best management practices should be followed to reduce the need for ditch cleaning and avoid damage to soil tilth.

Agricultural ditches are often connected to channels and streams that contain fish and have good fish habitat. Producers must follow the “Agricultural Watercourse Maintenance Policy Guidelines” (Partnership Committee on Agriculture and the Environment) when conducting channel maintenance.

The “B.C. Agricultural Drainage Manual”, and BCAGRI factsheets (<http://www.agf.gov.bc.ca/resmgmt/publist/Water.htm#drainage>) provide more information and details on installing a subsurface drainage system.

Irrigation

In almost all parts of the province, the natural rainfall is not sufficient to replace water lost from the soil due to evaporation or crop usage, for at least part of the growing season. At these times, irrigation can result in higher yields and, in some cases, prevent crop failure. Irrigation is especially necessary in new plantings where plants have small and shallow root systems.

Irrigation systems include drainage systems used for subirrigation, trickle and drip and various forms of sprinkler irrigation. All have their own merits. The systems must be properly designed, installed and maintained to be effective. Efficient delivery and distribution systems conserve water and save on power and fertilizers. Applying too much water or having leaky pipes may lead to soil erosion, reduced production and higher operating costs. Over-application of water will also result in leaching of nutrients such as nitrogen and boron. Check and repair or replace pipes, pumps and sprinklers on a regular basis. The Irrigation Industry Association of B.C. (IIABC) certifies irrigation system designers and companies that can provide efficient plans and products to growers. The IIABC can be contacted at (604) 859-8222.

A water license is required to use irrigation water from surface water sources. Licenses can be obtained from B.C. Ministry of Environment. Groundwater is not licensed at the present time. For more information on irrigation system design, operation and maintenance, refer to BCAGRI factsheets (<http://www.agf.gov.bc.ca/resmgmt/publist/Water.htm#irrigation>) or the “BC Trickle Irrigation Manual” or the “BC Sprinkler Irrigation Manual” (available from IIABC: 604 859-8222). For information on irrigation system assessments, irrigation scheduling, water and energy conservation and other beneficial management practices, refer to the “BC Irrigation Management Guide”, also available from the IIABC.

Chemigation

Chemigation refers to the injection and application of pesticides or fertilizers (fertigation) through an irrigation system. Growers who have solid set sprinkler or trickle irrigation systems may use chemigation as a method of applying nutrients. However, pesticides must be registered for application through an irrigation system. Check the label to make sure this method can be used for applying the pesticide. Prior to injecting fertilizers or other chemicals into an irrigation system, proper safety procedures must be followed. The booklet “Chemigation Guidelines for British Columbia”, available from BCAGRI, provides information on injection rate calculations and safety considerations.

Water Quality for Irrigation

Irrigation water comes from surface or groundwater sources. In many areas, ditch water is used for irrigation. Ditch water may contain high levels of bacteria, salts, metals or organic compounds that can affect the performance or quality of crops. Some groundwater sources may also contain high levels of ions or nutrients that may impact crop performance.

Water quality should be checked at a laboratory before planting a crop. If the crop is established, check the water before using for crop production. Refer to your local Yellow Pages under “Laboratories - Analytical”, for a listing of laboratories which conduct water testing. Water tests should assess salt levels (both electrical conductivity [EC] and sodium adsorption ratio [SAR]), pH, metals, nutrients, possible toxic elements and coliforms (see Tables 2.1 and 2.2). Also check levels of bicarbonate (HCO_3), calcium and magnesium. High levels will cause precipitates to form on the crop or possibly plug a drip irrigation system. The “B.C. Sprinkler Irrigation Manual”, “B.C. Trickle Irrigation Manual” and the “BC Irrigation Management Guide” provide further information on irrigation water quality guidelines. The following table shows the acceptable levels of some chemical aspects of water.

Protecting Water Quality

Waste products generated during the planting, maintenance and harvesting periods in vegetable production may have negative impacts on water. Growers who operate at the highest environmental standards will be better able to protect themselves from possible challenges to their operations. Proper use and storage of pesticides, fertilizers, manure and woodwaste will help to protect water quality. Growers are reminded to use best soil management practices in the field and appropriate waste handling techniques during on-farm washing, grading or processing activities. Follow the recommendations in this guide and also

refer to the “Environmental Guidelines for Field Vegetable Producers in B.C.” available at BCAGRI offices. Growers are encouraged to take advantage of the Canada-BC Environmental Farm Plan Program. Farmers participating in this program will gain more detailed information on a range of environmental issues including water management. See following link (<http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning/index.htm>) for information on the Environmental Farm Planning Program.

The following table shows some of the characteristics used to evaluate water quality and their potential impact.

Table 2.1 Guidelines for Irrigation Water Quality

| Crop Test | Safe for all Vegetables | Safe for Most Vegetables | Injurious to Most Vegetables |
|---------------------------------|---------------------------------|--------------------------------------|----------------------------------|
| SAR | <6.0 | 6.0-9.0 | >9.0 |
| EC (Salinity) | <0.5 dS/m | 0.5-3.0 dS/m | >3.0 dS/m |
| PH | 6.0-8.5 | 5.0-6.0 or 8.5 – 10.0 | <5.0 or > 10.0 |
| Boron (B) | < 0.5 mg/L | 1.0-2.0 mg/L | >2.0 mg/L |
| Chlorine (Cl) | <50 mg/L | 50-350 mg/L | >350 mg/L |
| Total Dissolved Solids (TDS) | <500 mg/L | 500-800 mg/L | >800 mg/L |
| Iron (Fe) | 1.0 - 2.0 mg/L | 2.0 - 5.0 mg/L | >5.0 mg/L |
| Sodium (Na) | <115 mg/L | 115 - 460 mg/L | >460 mg/L |
| Fecal Coliforms | < 1 cfu/100 ml | <100 cfu / 100 ml | >100 cfu / 100 ml |
| Irrigation System Test | Low Probability of Precipitates | Moderate Probability of Precipitates | High Probability of Precipitates |
| Iron (Fe) Drip Systems | <0.2 mg/L | 0.2 – 1.5 mg/L | >1.5 mg/L |
| Calcium (Ca) | < 10 mg/L | 10 – 50 mg/L | > 50 mg/L |
| Magnesium (Mg) | | | |
| Bicarbonate (HCO ₃) | < 30 mg/L | 30-120 mg/L | >120 mg/L |

mg/L = ppm Source: Canadian Water Quality Guidelines, BC Trickle Irrigation Manual

Table 2.2 Water Quality Evaluation Characteristics

| Characteristic | Level that indicates contaminated water | Concern |
|---------------------------------|--|--|
| Biological Oxygen Demand (BOD) | > 40 for small streams > 60 for larger streams | Danger to fish stocks |
| Total Iron (Fe) | > 3 mg/L | Crop staining |
| Nitrate (NO ₃ -N) | > 5 mg/L | Danger to human health |
| Total Suspended Solids (TSS) | > 75 mg/L | Danger to fish stocks |
| Ammonia (NH ₄ -N) | > 10 – 15 mg/L (depends on pH and temperature) | Danger to fish stocks |
| Fecal Coliform | a) > 100 CFU/100 mL b) > 0 CFU/100 mL (CFU = coliform forming units) | a) Reduced crop quality b) Danger to human health See “Food Safety” chapter. |
| Tannin and Lignin (resin acids) | > 9 µg/L TRA or > 80 µg/L DHA (TRA = total resin acids) (DHA = dehydroabietic acid) | a) Danger to fish stocks b) Crop staining |

Source: *Canadian Water Quality Guidelines*