Soil Management

Good soil management begins before planting. Assess the soil conditions of each field and understand the potential problems as a first step to planting a berry crop. Land may be inadequately drained, have shallow topsoil, have impermeable subsoil or be too steeply sloped for successful cropping.

Resources

Use the following resources to help identify potential problems:

- soil survey reports and maps (are available for reviewing from **BCMAL** offices or public libraries),
- **BCMAL** publications: "Soil Management Handbook for the Lower Fraser Valley" and "Soil Management Handbook for the Okanagan and Similkameen Valleys",
- specific berry sections in this guide, and
- professional soil management consultants.

The handbooks discuss general soil management topics including: identification of soil texture and structure, tillage, recognition and reversal of soil compaction, and issues surrounding soil conservation practices. Recommendations in all manuals—including this production guide—are general guidelines only. Qualified soil management consultants are available on a fee-for-service basis to give recommendations specific to each farm. Growers planning to plant a new parcel of land should consult with a professional for recommendations on soil suitability and management. Management includes advice on nutrient management, irrigation and drainage.

Soil Management Problems

Soil management problems are generally related to:

- soil texture,
- soil structure,
- drainage; and
- erosion.

Soil Texture

The mineral materials in soils are simply small fragments of rock or mineral materials derived from rock, but which were altered by water and chemical reactions in the soil. Soil particles are grouped into four particle sizes: gravel, sand silt and clay. In describing soil, "texture" refers to the relative percentages of sand, silt and clay sized particles in the soil material. Soil texture is a permanent characteristic. Texture will not change unless a large quantity of soil material of another texture is added to it, such as might occur during land clearing or very deep plowing into a subsoil of a different texture.

Problems related to soil texture are common. Stony soils may reduce the suitability for some berry crops such as strawberries. Stones can interfere with tillage and reduce the overall nutrient and water storage capacity when they cover greater than 50% of the surface area or make up more than 75% of the soil volume.

Soil Structure

In soil, individual sand, silt and clay particles become more closely packed and bonded together to form larger particles called aggregates. "Soil structure" refers to the type and arrangement of aggregates found in soils. Aggregates occur in almost all soils, but their strength, size and shape varies considerably among soil types. Some of these aggregates are in stable forms which are not easily broken down by water or physical forces. In addition to the soil texture, the organic matter content can play a significant role in the development of good soil structure.

Revised: March 2012

The formation of soil structure results from many different processes, including the growth of plant roots, activities of soil organisms, wetting and drying, freezing and thawing, and tillage. Plant roots excrete sugars and resins which bind aggregates or create pores in the soil when they die. Soil organisms also bind aggregates with "glues" or, in the case of earthworms, create channels that improve drainage and aeration.

Soil structure also affects the internal drainage of the soil, water holding capacity, temperature and the growth of plant roots. In soils under cultivation, most aggregates at the surface tend to break down under the forces of rainfall, irrigation, tillage and traffic. When soils are left exposed to rainfall or are excessively cultivated under less than ideal moisture conditions, the result is the degradation of soil structure. Structure degradation leads to crusting or puddling of the soil surface, or compaction deeper within or below the rootzone. This can lead to poor crop growth, poor drainage and soil erosion.

Maintaining Soil Structure

Soil structure is the most important soil characteristic to consider when managing soils as it is most affected by farming practices. It also is one of the most important factors in crop growth, along with water and nutrients. The main objective in soil management is to promote and maintain good soil structure which will be favorable to crop growth.

Soil structure degradation can be reversed by carefully using these cultural practices:

- Adding organic matter from manure or compost,
- Using appropriate and timely tillage, and
- Protecting the soil surface by using cover crops.

Adding Organic Matter. Soil organic matter has a significant influence on soil structure. Other benefits are holding soil moisture and improving nutrient levels. Careful use of manure or compost can increase soil organic matter levels. However, the nutrient content of these materials must be the first consideration for their use. Added nutrients from manure or compost must match the crop's nutritional requirements. Organic matter levels can also be increased by growing and tilling under cover crops.

Refer also to "Nutrient Management" for information on added manure or compost.

Appropriate and Timely Tillage. When a tillage operation is carried out, ask the following questions:

1. What is the purpose of the tillage operation?
2. Is the timing of the tillage operation best for the soil moisture and weather conditions?
3. Is the tillage implement the best for the intended purpose?

Tillage is used to:

- prepare a suitable planting bed,
- bury or incorporate crop residues, fertilizers, lime, manure or other soil amendments,
- kill weeds, and
- form raised planting beds.

There are two groups of tillage implements. **Primary tillage** implements, such as plows, discs, subsoilers and rotary spaders, are used to break soil, reverse compaction and incorporate residues. **Secondary tillage** implements such as cultivators, harrows and rotovators are used to prepare planting beds and incorporate soil amendments. Secondary implements can have a large impact on soil structure by breaking soil aggregates.

Using cover crops. Cover crops have many benefits in addition to improving soil structure. Refer to "Cover Crops" below.

Drainage

Berry crops require moderately to well drained soils with at least 0.5 m unrestricted rooting depth for successful cropping. Many lowland soils in BC have poor natural drainage with a high water table during the fall, winter and spring. These soils often need a subsurface and regional drainage system to remove excess water from the rooting zone for berry production.

Soil in upland areas may have a subsoil hardpan within 0.5 m of the surface. In most cases, this hardpan will not allow the soils to drain during the fall, winter and spring. Such soils require a subsurface drainage system to remove excess water from the rooting zone. Hardpan soils may also require deep tillage with a subsoiling implement.

Refer to the section, "Water Management" for more information on drainage.

Revised: March 2012

Erosion

In the coastal region, all soils are susceptible to water erosion when cultivated and left bare over the winter. Water erosion damage is most severe on long or steep slopes (over 5 to 10%) where the crop rows run up and down the slope or where cropping practices leave the soil surface exposed to rainfall impact. It can also occur on sites where soil becomes saturated. Valuable topsoil is washed away from the upper slopes and can bury plants on the lower slopes.

Wind erosion is most serious on light sandy soils that are left bare over the winter.

Erosion Control

Where possible, use the following practices to minimize the loss of soil by water or wind erosion. Although any of the listed practices will help control erosion, the best control is achieved by using as many of the practices together that are appropriate.

Water erosion:

- drainage systems (refer to "Water Management"),
- contour planting (across the slope),
- winter cover cropping; and
- permanent cover cropping on field roads, field margins and water runs.

Wind erosion (these slow the wind speed at the crop or soil surface):

- windbreaks (e.g. tree rows, snow fences or hedges),
- crop residue (it should be anchored to the soil); and
- cover cropping.

Cover Crops

Cover crops are grown to protect against soil erosion, to improve soil structure and soil fertility, to suppress some insect pests and weeds, and promote some beneficial insects. They are not usually grown for harvest or forage. They are planted when portions of the field, or the entire field, are left bare. Cover crops are also called green manure, living or dead mulches, plow down, companion, relay, double or catch crops depending on their specific use.

Before planting a cover crop, it is important to know the soil problem that needs to be addressed. For example, cover crops will not prevent flooding, but if a field is drained they can help to improve the movement of rain water into the soil so it can get to the drains without staying on the soil surface.

Choosing a Cover Crop

Specific comments on cover crops can be found in each berry crop section. Spring cereals sown in the fall are usually winter-killed leaving a protective mat on the soil. Winter cereals will usually grow slowly over the winter, producing the majority of their growth in the spring. Winter cereals require a spring management program. Grasses or white clover are recommended for permanent covers. Some varieties of cover crops have been reported to suppress pests or increase the population of beneficial insects. Others may be useful for specialized conditions such as organic berry production or specific soil management concerns. Table 4, lists the best types, seeding rates and planting date for cover crops used in berry production.

Spring Management of Cover Crops

For spring cereal crops, crop residues can be disced, or disced and plowed, depending on the amount of residue. Chop heavy residues first to prevent an undecomposed mat from forming.

Winter cereal crops or cover crops that survive the winter should be mowed or killed with Roundup (glyphosate) or Gramoxone ☠ (paraquat) before plowing down. If large amounts of plant material are to be turned under, apply a light application of manure or 20-30 kg/ha of fertilizer nitrogen to speed decomposition. Chop and incorporate the crop residue with a disc prior to plowing.

Mulches

Strawberries and blueberries are the two berry crops that most likely benefit from the use of mulches. In blueberries, woodwaste (shavings or sawdust) is used as a soil amendment to improve the tilth of raised planting beds on mineral soils and as a mulch around established plants for improved weed, and soil moisture and temperature control. In strawberries, straw or wood chips can be used between crop rows to control weeds, reduce moisture loss by evaporation and protect from winter injury (Interior locations). In U-pick strawberry operations, wood chips or sawdust mulch can help in soil management and in keeping picker's feet clean.

Revised: March 2012

Woodwaste

"Woodwaste (as defined under the "Code of Agricultural Practice for Waste Management") includes hog fuel, mill ends, wood chips, bark and sawdust, but does not include demolition waste, construction waste, tree stumps, branches, logs or log ends." Under the Code woodwaste can be used for plant mulch, soil conditioner, ground cover, on-farm access ways and berms for cranberry beds as long as the storage on use of the woodwaste does not cause pollution. This means that any leachate or particulate matter from the woodwaste must not enter a watercourse. Woodwaste must not be used as landfill or on sites within 30 m of any source of water used for domestic purposes. For more information on accepted woodwaste use refer to the BCMAL Factsheet "Guidelines for Farm Practices involving Fill".

Managing Coastal Peat and Muck Soils

Organic soils can be divided into two groups. The first group, the peat soils, are slightly to partially decomposed organic materials generally found in lowland or flood plain areas. The second group, the muck soils, are mainly highly decomposed organic materials and may contain significant portions of mineral soil. In the Cloverdale area, muck soils are the predominant soil type although some peat soils are present. There are also some "highly organic" mineral soils in the area that are the result of cultivation and mixing of the peat or muck with underlying or exposed mineral soils.

Peat and muck soils undergo a natural process of decomposition and subsidence when they are drained and cultivated. Subsidence may also occur from erosion and compaction of the organic matter.

Maintaining high water tables and flooding reduces subsidence but these practices can be harmful in berry production. Saturated soils are susceptible to damage from traffic and tillage. Further, soil structure is degraded by the lack of free movement of air and water in saturated soils. Flooding leaves the soil surface susceptible to structural degradation, thin layer compaction and sealing. It also damages the roots of berry crops, sometimes causing plant death.

To reduce the rate of subsidence and decomposition:

- avoid excessive tillage,
- increase organic matter inputs,
- cover crop during the growing season and winter; and
- use good water management practices.

These practices will improve soil structure in both organic and mineral soils.

Tillage contributes to the decomposition of peat by increasing the exposure of the soil particles to air. Excessive tillage with any implement and particularly rotary cultivators, such as rotovators, increases the breakdown of these soils. Also, the fine soil particles may become compacted by traffic, tillage, rainfall, or irrigation. Compaction leads to reduced air and water movement, and eventually restricted workability of the soil. The use of minimum tillage equipment or practices is suggested as one means of reducing compaction and subsidence.

Table 4. Cover Crops for Berry Production

Types	Seeding Rate	Recommended Seeding Date
Spring cereals (barley or oats)	80 - 150 kg/ha (30 - 60 kg/acre)	• Before September 10.
Winter cereals (winter wheat or fall rye)	80 - 150 kg/ha (30 - 60 kg/acre)	• After August 15 and before September 30. • Fall rye better for late seeding.
White clover	10 - 15 kg/ha (4 - 6 kg/acre)	• Generally recommended for spring seeding or when soil moisture is available in late summer.
Grass mixes (containing creeping red fescue, sheep's fescue, hard fescue or perennial ryegrass)	20 - 40 kg/ha (8 - 16 kg/acre)	• Generally recommended for spring seeding or when soil moisture is available in late summer. • Use as permanent cover in blueberries.

Revised: March 2012