Tile Drain Best Management Practices

Drainage is critical in cranberry production. While cranberry is a wetland crop, continuous soil saturation during the growing season can result in poor rooting, increased susceptibility to Phytophthora root rot, poor fruit retention (and thus lower yield) and poor fruit quality (increased fruit rot). In saturated conditions, plants take up nutrients poorly. Historically, drainage in cranberry beds was accomplished with open peripheral and interior ditches. In more recent times, tile drain (perforated pipe) has been used for this purpose. Here we present the current knowledge regarding best practices to maximize the benefits of tile drains. Since the current standard in Massachusetts is to use 4-inch diameter perforated plastic pipe, these recommendations are based on that tile type. Much of this information came from NE SARE project LNE 12-316, in which the research team at the Cranberry Station and a team of grower partners collaborated to learn more about this practice.

Recommended Practices

Tile drainage system design

The layout of drain tiles should maximize the ability to drain the bed adequately but not excessively. Spacing should be designed to accommodate sprinkler mains and laterals. Tiles should not be installed into fine-grained material that promotes clogging.

- **Tiles should be spaced at least 20 feet apart (horizontal spacing).**

Replicated research at sites with differential spacing found that 15-foot tile spacing was associated with lower yield compared to spacing of 20, 25, or 30 feet. Since there was no yield or fruit quality differences among the 3 wider spacings, growers can choose among them based on logistical and financial considerations. Many find that a 20-foot spacing works well with a 40 x 50 sprinkler layout. Thus, this is the most commonly chosen spacing.

- **Tile depth should be tailored to the hydrology and geology of each site.**

Tile should be placed deeply enough to enhance drainage but not so deeply that drainage is restricted by the water level in the ditches or by fine-grained sub-layers that can clog the tile or impede water movement. As a general rule, the outlet of the tile should be higher than the water level in the ditch. Subsurface tiles and open ditches work in concert to lower the water table, and shallow or vegetative ditches may reduce the effectiveness of tile drainage. Tile depth must be adjusted to suit site conditions at any given bog, including the texture (coarseness) of the sand as well as the depth and composition of the subgrade. Realistically, in Massachusetts bogs, this will probably be between 8 and 16 inches deep.

In a research study of two tile depths (8 and 12 inches), the deeper tiles provided better drainage (the soil was drier based on tensiometer readings over the season) and the areas with the deeper tiles had improved yield (1 of 2 years) and less fruit rot (both years).

For a new planting, a 12-inch depth to tile *bottom* is commonly chosen. However, in a renovation or retro-fit (putting tile into an existing bed) situation, it is critical that the bottom of the tile is in the sandy layer of the bed, not in the underlying peat or muck. Depending on the subgrade and depth of the overlying sand layer in a bed a shallower tile depth may be needed.

Some growers have used a 'keyhole' design if, when renovating, the sand layer on the bed will not be 12 inches deep. Trenches (the keyholes) are dug into the subgrade and filled with sand, then the tile is placed on the keyhole prior to adding the final sand layer to the bed. Thus, even if the tile is in the subgrade, it is surrounded by sand. Some growers surround tile with gravel.

The bottom line: place tile as deeply as possible but avoid placement in underlying peat or fine-grained subsoil and keep tile placement above the bottom of perimeter ditches.

- **Consider retro-fitting tile into existing beds.**

Growers were asked about their experiences with drainage tiles that were retro-fitted into existing beds. In addition to improvements in drainage and soil moisture, 70% reported observing increased yield and reduced fruit rot. This supports the science and observations that saturated soils lead to reduced yield and quality. If your site has saturated conditions, tile installation may help to improve yield and quality.

Tile drainage use in sub-irrigation

In addition to drainage, tile can also be used for crop irrigation - a practice known as sub-irrigation. While this practice is currently not common, some growers are using it during establishment of new or renovated beds.

- **On newly planted beds, raise the water table using tiles to supply moisture in the root zone, but avoid saturation.**

Some growers use tiles for sub-irrigation during plant establishment in renovated beds. This allows them to keep a shallow water table as the cuttings root and then gradually lower the water table to encourage deeper root growth. However, care must be take to avoid saturation in the root zone.

- **Use sub-irrigation on established beds in concert with overhead irrigation.**

The ability to incorporate sub-irrigation into the management of an established bed will depend on the depth of the drains and properties of the soil and the subgrade. Freely draining coarse sands are good candidates - you can raise the water level then lower it and minimize the time when the soil is saturated. If the soil drains slowly, that same action could lead to extended periods of saturated conditions, not ideal. If the subgrade layer does not allow the formation of a perched water table when flooding the tiles, then sub-irrigation will be less successful.

Depending on the distance between tiles and soil characteristics in the bed, the areas between tiles may not get sufficient water via sub-irrigation. In an established bed, sub-irrigation should be used in concert with overhead irrigation, taking care to avoid soil saturation. The fact sheet by Bruce Lampinen, detailing the use of water level floats (Constructing Water Level Floats: http://ag.umass.edu/cranberry/fact-sheets), has a good discussion of how sub-irrigation (in his example using ditches) and overhead irrigation work together.

In any irrigation or drainage protocol it is critical that you monitor soil moisture. Maintaining soil conditions that are too wet *or* too dry can negatively impact crop.

Tile drains and pest management

The foremost pest management benefit of good drainage using tile is in disease management.

- **Improve soil drainage to manage and prevent Phytophthora root rot.**

This disease requires wet conditions. Once established, it is almost impossible to eliminate Phytophthora unless drainage is improved. Many growers pull in lengths of tile from the affected area to the nearest ditch for this purpose.

- **Improve drainage to improve fruit quality.**

Avoiding soil saturation and wet vine canopies by properly integrating irrigation and drainage with soil moisture monitoring is essential in the production of high quality fruit.

Good drainage in concert with proper irrigation can lessen the incidence of fruit rot. With proper water management, the potential to decrease fungicide use is real. Consult the Extension Plant Pathologist for individual advice on fungicide recommendations pertaining to your bog and fruit quality goals.

For further information:

DeMoranville, C., C. Kennedy, P. Jeranyama, H, Sandler, and E. Saalau Rojas. 2016. Use of Tile Drainage in Massachusetts Cranberry Production. Fact Sheet. May be found at: http://ag.umass.edu/cranberry/fact-sheets

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