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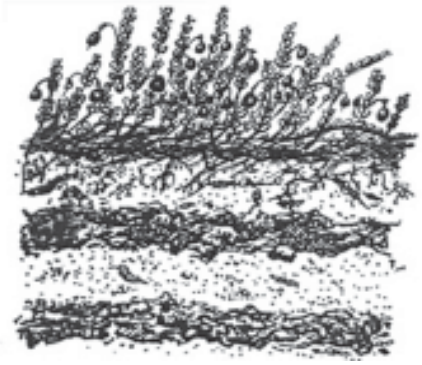
Water Resource Protection and Enhancement

Carolyn DeMoranville
Cranberry Station, carolynd@umext.umass.edu

Hilary A. Sandler
Cranberry Station, hsandler@umass.edu



BEST MANAGEMENT PRACTICES GUIDE FOR MASSACHUSETTS CRANBERRY PRODUCTION

Water Resource Protection and Enhancement

Cranberry growers manage water on bogs to ensure sufficient moisture and adequate drainage for optimum plant growth. Water management practices on cranberry bogs differ from those used for other forms of agriculture because of the variety of ways that water is used in cranberry culture. Water is used for disease and insect control, frost and heat protection, sanding, harvesting, and protection from winter desiccation and cold injury. Because of the periodic need for sizable amounts of water, impoundment of water adjacent to the bogs is a normal farming practice in cranberry production. In addition to storage ponds and sumps, components of a typical water management system for a cranberry bog include irrigation systems, wells, flood gates and flumes, lift pumps, and drainage ditches and pipes.

Water can be used and re-used within a cranberry bog because its irrigation system and water storage reservoir are often interconnected. In some instances, water can also be recycled among growers. Therefore, water uses on cranberry bogs are not always consumptive. Newly established bogs, however, do require more irrigation to satisfy the needs of growing vines. Because cranberry culture typically is carried out in moist areas such as wetlands and marshes, irrigation needs are limited and comparatively small (averaging between 0.4 and 1.5 inches per week from rainfall and irrigation combined, during the growing season).

Important environmental considerations directly related to water management include:

1) conservation of fresh water supplies;
2) prevention of contamination of surface and groundwater by pesticides, fertilizers, or sediments;
3) optimizing plant growth, yield, and resistance to pests and diseases.

Recommended Practices

- **Make sure that your water supply is adequate for cranberry production needs.**

  Generally, older bogs will require as much as 10 acre feet of water per acre per season to meet all production, harvesting, and flooding needs. The actual figure will vary depending on the rate of recharge of your water supply and your ability to recapture and reuse water. With the implementation of appropriate BMPs, water needs may be reduced substantially.

- **Use tailwater recovery and holding ponds to conserve water.**

  Install tailwater recovery systems where possible so that water can be recycled within the bog system. Design systems so that gravity is used to move the water onto or off of the bog, requiring pumping only in one direction. For maximum water conservation, the tailwater recovery and associated holding pond should be designed to hold, at minimum, enough water to flood the bog. This will allow for the storage of the winter flood water for reuse during other irrigation and flooding events, including the flood-harvest. The existence of the holding pond will also mitigate against heavy instantaneous water withdrawals that might impact sensitive water bodies or aquifers. A benefit of this practice is the ability to store water during periods of high flow so that during low-flow periods, stored water can be used, thus avoiding impacts of instantaneous heavy water withdrawals from shared sources. When designing such a system, it is recommended that a Conservation Farm Plan be in place and that NRCS staff be consulted for assistance in design specifications.

- **Implement all feasible water conservation measures.**

  Laser-level new and renovated beds to minimize the volume of water needed for flooding. However, beds should be slightly crested to promote drainage.

  Implement efficient irrigation designs with maximized uniformity. This will minimize that volume required to achieve the optimum 0.1 inch/ hour dispersal rate at the poorest head. Refer to the Irrigation BMP and NRCS specifications for design suggestions.

  Water control structures and dikes should be adequate to maintain floods. These structures should be well-maintained to avoid seepage losses and catastrophic failures. Flume boards should be tight to facilitate required water impounding following pesticide applications.

  Cranberry bogs should be designed with a perched water table. This creates a barrier between the bed and ground water which serves to protect ground water resources, allow for flood retention in the bog, and facilitate efficient irrigation management. See the Mineral Soil Bog Construction and Irrigation BMPs for further information on designing and managing a perched water table.

  Monitor soil moisture. Apply irrigation only when required based on plant needs and soil moisture status. Moisture may be monitored using tensiometers or water level floats. See the Irrigation BMP for information on the use of these devices.

- **In closed bog systems, where water can be held for extended periods of time, make sure that water control structures (i.e. flumes, bulkheads, etc.) are water-tight.**

  Water-tight flumes are essential to prevent the escape of ditch water containing fertilizer or pesticide residues and suspended sediment, and to prevent loss of flood water during harvest. Worn or damaged flume or bulkhead boards should be replaced regularly. Keep the boards free of debris and consider the use of rubber gasket strips on the channel guides or a tension activated tiedown system to decrease leakage. Information on suppliers and detailed construction drawings are available from the Cape Cod Cranberry Growers Association.

  Application of sawdust to ditch water on the upgradient side of the ditch can sometimes be effective in reducing water flow through worn or imperfectly-fitted flume boards. A locking mechanism to prevent unwarranted tampering with the flume boards should be considered in areas prone to vandalism.

- **In flow-through bog systems, those containing a permanently flowing stream or constant water discharge, consider some strategy or method to segregate or isolate the stream flow from ditch water and protect external water bodies.**

  Prior to initiating these practices, seek technical assistance. You should, at minimum, have an NRCS Conservation Farm Plan in hand.

  Installation of auxiliary flumes at the intersection of perimeter ditches and interior ditches is one way of segregating the stream from the bog ditches. Installation of perforated drainage pipe in the interior ditches and backfilling of interior ditches with gravel may be an alternative solution.

  Construction of a by-pass canal to reroute water during fertilizer or pesticide applications may be an additional option. Alternatively, tailwater recovery systems may be used. Activated carbon filters have been shown to be an effective method of discharge water filtration under certain conditions. Carbon loading rates and filter efficacy are dependent on water flow rates.

  If bogs have adequate soil drainage, consider leaving some actively growing aquatic vegetation in the ditches during the growing season. The vegetation can be effective in removing nutrients and residues from the water. Take full advantage of aquatic vegetation's potential for nutrient removal by delaying cleaning or removal until later in the growing season, preferably after harvest.

  Studies of constructed wetlands have shown them to be effective in filtering water flowing from agricultural land. Experience with constructed wetlands in cranberry systems is limited. It should be noted that a constructed wetland may be subject to the same regulations that pertain to natural wetlands.

- **Reduce the level of water in ditches as much as possible before application of fertilizers and pesticides. Take steps to minimize direct input of fertilizers and pesticides into surface water.**

  Minimizing direct application of fertilizers and pesticides to streams and ditch water is the single most important step in reducing the potential for off-site movement of these potential contaminants.

  Lowering the water level in ditches dries out the soil and reduces the amount of water runoff that occurs. Also, lowering the water level in ditches before a fertilizer or pesticide application will allow for adsorption of nutrients and pesticides onto sediment and vegetation in the ditches and increases the water holding time even in flow-through bog systems. However, monitor soil moisture to avoid drought stress during this practice.

  Based on research studies, other practices that may reduce deposition of materials in ditch water include:

  - ✓ Installation of sprinkler guards - wire mesh was shown to be more effective than plastic mesh;
  - ✓ Use of part-circle ('half-head') sprinkler heads (most effective when used with sprinkler guards);
  - ✓ Move heads in from ditch edges;
  - ✓ Irrigation system shutoffs;
  - ✓ Substituting subsurface drainage for interior ditches;
  - ✓ Covering internal ditches.

- **Hold harvest water to allow sediment to settle prior to release from the bog system.**

  During harvest, sediments are suspended into the flood water. Discharge of sediment into wetlands and waterways is not permitted. Sediments should be allowed to settle and flood water should be discharged over the top flume boards gradually to avoid sediment discharge to surface water.

  A novel practice of holding the harvest flood for up to 4 weeks is under investigation by scientists at the Cranberry Station and a team of growers. This practice may have additional benefits in pest and weed control. Refer to the Harvest and Postharvest Management BMP.

- **Hold water after pesticide applications for as long as practical and no less than the required holding time indicated on pesticide labels.**

  Impounding water is a key means to reduce the potential for adverse environmental impacts and is required for certain materials (see labels). If you have the capacity, hold water longer than the required label specified holding time to further reduce the likelihood of adverse environmental impact.

- **Incorporate weather forecasts into your water management plan.**

  Rainfall, especially downpours from severe thunderstorms, can wash fertilizer nitrogen and pesticides off the target area into nearby waterbodies. Follow weather forecasts and postpone fertilizer and pesticide applications when rainstorms are forecast.

  Heavy rainfalls during water impoundment periods may lead to bog flooding. Monitor bogs carefully during such periods. A short summer flood can have adverse effects on fruit quality; longer floods may kill blossoms or newly formed fruit by suffocation.

- **When feasible, take additional steps to protect surface water bodies.**

  Use of part-circle ('half-head') sprinklers and sprinkler guards can be effective in keeping pesticides out of surface water and off dikes and travel lanes. Research has shown that wire mesh guards are more effective than plastic mesh guards.

  Consider installing secondary containment for liquid fuels stored adjacent to open water. Consult local and state fire marshall regulations for specifications.

  Impound water for at least 7 days following barge sanding.

  Follow the BMPs for Pesticide Storage and Pesticide Mixing and Loading.

- **Protect public drinking water supplies.**

  Growers should be aware of and strictly comply with all state regulations for the protection of public drinking water supplies, including wellheads and surface water supplies. These rules are designed to prevent contamination of these supplies and their recharge areas. Public water supplies are any sources that provide water to 25 or more people for 60 or more days per year.

  Specific regulations exist for the protection of public drinking supplies and require specific management restrictions in Zone II and Zone B and C areas. Zone II wellhead protection areas are defined as the area of an aquifer which contributes water to a public water supply well under the most severe recharge and pumping conditions. Zones B and C are areas that feed surface water sources used as public drinking supplies. Zone B is the half mile area abutting the surface water source and Zone C is the area in the watershed that feeds the source. Zone II, B, and C areas are delineated by the MA-DEP. Maps showing the delineated areas are available from Mass GIS (State Executive Office of Environmental Affairs). Information can be ordered or downloaded via their web page at www.state.ma.us/mgis/massgis.htm.

  Any grower whose bogs lie within a Zone II, B, or C should have a Farm Conservation Plan. If you do not have such a plan, contact the Plymouth County Conservation District. They are part of a partnership with NRCS and the Cape Cod Cranberry Growers Association formed to provide funding and resources for cranberry farm planning.

  For additional information, the Cape Cod Cranberry Growers Association assists its members in defining the locations of Zone II, B, and C areas in relation to their farms.

- **Protect private wellheads.**

  When siting a non-public well on your farm, certain precautions should be taken. Wells should be located away from areas subject to uncontrolled surface runoff or flooding. If a well is in such a location, measures should be taken to protect the well. Construction of a protective berm or landscaping and contouring of the site so that water flow is diverted away from the well should be sufficient to protect the wellhead. Wellheads should be covered and the soil around the casing tightly packed to prevent surface water and shallow groundwater from entering the well. Wells should be sited at least 400 feet away from potential sources of contamination such as storage and preparation areas for fertilizers, pesticides, and petroleum products. It is recommended that wells should be sited at least 150 feet from bog edges.

- **Make sure the bog has adequate drainage. Maintain proper ditch drainage function.**

  Proper soil drainage results in healthy vines that reduce the incidence of diseases such as root rot

For further information:

DeMoranville, C. J. “Peat-based cranberry bogs - water relations”. in Sandler, H. A., ed. **Cranberry Production: A Guide for Massachusetts**. UMass Extension Publication SP-127. December 1997. Second printing February 1998. pp.23-24.

LaFleur, J. “Sign-posting and description of Zone 2 regulations”. in Sandler, H. A., ed. **Cranberry Production: A Guide for Massachusetts**. UMass Extension Publication SP-127. December 1997. Second printing February 1998. pp.91.

Water Control Structures and **Flood management** BMPs in this series.

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