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Water Control Structures

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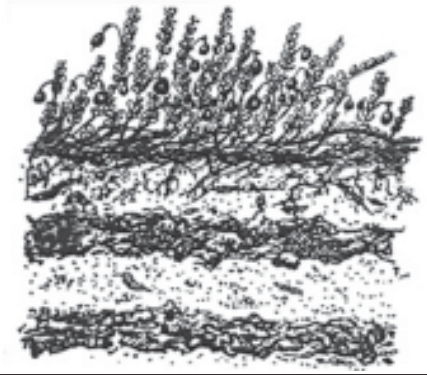

BEST MANAGEMENT PRACTICES GUIDE FOR MASSACHUSETTS CRANBERRY PRODUCTION

Water Control Structures

Commercial cranberry management requires the ability to manipulate water during the course of the season. Activities that rely on diking systems and water control structures include flooding the beds, impounding water, manipulation of the water table in the bed, and drainage functions. Dikes are used to separate the cranberry beds into manageable units for flood harvest.

Recommended Practices

Flumes

Flumes are water control structures, usually constructed of steel, aluminum, or concrete, which are installed in a dike to convey water, control the direction of flow, or maintain a required water surface elevation.

In cranberry systems, the primary purpose of the flume is to control discharge, distribution, delivery, or direction of water flow in open channels (ditches, canals) or on the cranberry beds. They are also used for water quality control, holding back sediment and impounding water following pesticide applications.

- **Flumes should be designed to meet site-specific needs.**

  Structures should be designed to meet the needs of the individual site and use (applicable NRCS designs may be adapted). A Conservation Farm Plan is critical if major changes to or construction of water control systems is planned. The plan will include design (location, grade, dimension, materials) and maintenance plans for the flume.

- **When planning flume design, consider water quantity requirements.**

  When designing flumes for controlling water movement onto cranberry beds, plan structure elevation so that a foot deep flood can be maintained on the bed and so that the water table can be lowered to an adequate depth for proper rooting during the growing season. See the Irrigation Management BMP for information on water table depths.

  Design flume size to accommodate the proper volume of water. This will determine how quickly a bed can be flooded or drained. For example, an undersized outlet flume may lead to poor drainage, particularly in the early spring after the winter flood and during the spring frost-protection season.

- **Flumes should be installed and maintained so that erosion during and after installation is minimized.**

  Flumes should be fitted with antiseep collars. Fill and compact around the culvert to prevent erosion and undermining -- packing with bentonite or other dense materials may be helpful. Placement of concrete blocks or turf sods around the flume may also help. When conditions permit, stabilize disturbed soil surfaces by seeding or with the placement of sods (see further information below in dike section).

  The size of the outlet pipe is important. If it is too small, the culvert may wash out. Size is determined based on the amount of water to be discharged. Consult an engineer or NRCS for this calculation.

  Water should be discharged into a stable ditch or channel.

  As part of normal maintenance, inspect flumes on a regular basis. Look for leakage, erosion, or undermining. NRCS will inspect existing flumes as part of the Conservation Farm Planning process.

- **Consider aquatic life when planning water control structures.**

  Design and use the flume properly so that fish are protected. If watercourse fisheries are important, special precautions or design features (e. g. 'fish ladders') may be needed to insure continuation of fish migrations.

  Exercise caution when discharging warm, oxygen poor waters as these may adversely impact fish and other aquatic species.

Dikes

Dikes are embankments constructed of earth or other suitable materials to protect land against overflow or to regulate or contain water. In cranberry management, perimeter and interior dikes are used to temporarily impound water for harvest, trash (leaf litter) removal, pest control, and winter protection. Dikes are also used to impound water for the preservation of water quality, limiting the discharge of sediments and segregating waters following the application of pesticides. Dikes allow the control of water levels to maintain the depth from rooting zone to water table for optimum cranberry growth and productivity (see flumes section). Dikes surrounding tailwater or other irrigation ponds facilitate water storage.

- **Dikes should be designed so that settling and slumping are minimized.**

  Minimum top width of the dike should be 4 feet. Embankments should be built no steeper than 1:1. Site the shallower slope on the outside of the dike to minimize off-site erosion. The dike should be built and compacted in layers using fill materials containing no sod, brush, roots, or stumps. Core materials in the dike should be the most pervious materials available. In Southeastern Massachusetts, this will often be compacted glacial till. Dikes should be constructed to a height 1 foot above the normal *flood elevation*. In order to establish vegetation on dikes or embankments, surface soil must have the capacity to hold adequate water to support plant growth.

- **Adding a dike within a bog area presents unique challenges. Seek expert planning assistance.**

  It may be beneficial to add an interior dike within a cranberry bed that is severely out of grade to facilitate flooding activities. Generally, these would be older bogs built on peat. Stabilizing interior dikes on such beds can be difficult as peat tends to compress under the weight of the dike. Consult NRCS for planning assistance, including mapping of underlying peat using ground penetrating radar, prior to beginning any such project.

- **Dikes should be stabilized to prevent erosion.**

  Stabilize dikes and other disturbed areas by seeding, mulching, or placing soil stabilization fabric (geotextile, netting, burlap). Mulch should be anchored with mesh. Grade 2-3 turf sods have been used successfully for this purpose. Pay particular attention to dike edges, they remain prone to erosion during rainstorms until stabilized.

  Curlex, a cornstarch netting entwined with aspen excelsior fibers, has been successfully used to stabilize bankings and on-bed ditch edges. Ditches stabilized with Curlex required 60% less cleaning than those left untreated. Erosion blankets are preferable to loose mulch on the bog side of a dike, as mulch may contain weed seeds that will end up in the bed. Curlex is biodegradable, decomposing in 6-8 months. The material must be in good contact with the underlying soil or erosion can occur under the blanket.

  Grass is best planted in spring or fall and may benefit from a layer of mulch or netting and periodic watering during establishment. Top dress dikes with 3-4 inches of topsoil prior to seeding. Hydroseeding or gel seeding can be used. Erosion control 'blankets', such as Curlex, have been successful in conjunction with grass planting. Choose non-weedy species for seeding dikes. Recommended examples include clovers, fescues, and perennial ryegrass. Mixtures of species in the seed mix are preferable to a single species. Fertilize and lime grasses as needed during establishment.

- **Consider protective measures to prevent animal damage to newly-constructed dikes.**

  Chain-link or galvanized wire fencing (chicken wire) may be laid out on the dike surface prior to seeding or sodding to prevent muskrats or other pest animals from burrowing into the dike.

- **Maintain dikes at designed shape and height.**

  Initial height should be at least 5% higher than the desired working height to allow for settling (see previous page).

  All efforts should be made to avoid the formation of deep tire channels on the top of the dike.

  Maintenance should include periodic removal of any woody vegetation that becomes established on the embankment as roots of these species can destabilize the dike.

  Embankments should be mowed as needed to prevent the spread of seeds onto the bogs and to facilitate removal of berries during flood harvest.

For further information:

Dike standard. 1980. Natural Resources Conservation Service Conservation Practice Standard #356. NRCS-NHCP. Amherst, MA.

Structure for water control standard. 1977. Natural Resources Conservation Service Conservation Practice Standard #587. NRCS-NHCP. Amherst, MA.

Erosion and Sediment Control and **Water Resource Protection and Enhancement** BMPs in this series.

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