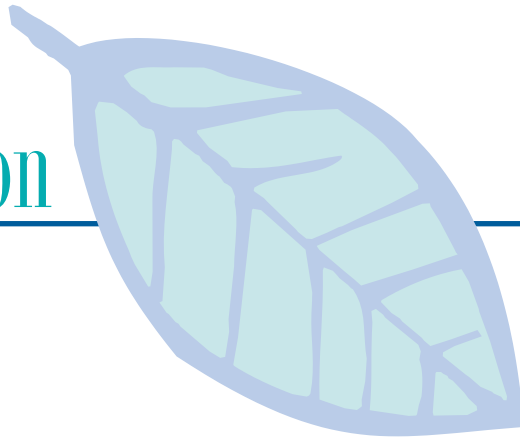


# Introduction



## SECTION 1

- Why Irrigation is Needed
- Maine's Irrigation Challenges
- History of Irrigation in Maine
- Future of Irrigation in Maine
- The Decision to Irrigate

The original concept of *The Users' Guide* was to provide Irrigation Best Management Practices (BMPs) for the state's agricultural industry. However, because of the diversity of Maine crop irrigation methods and regional water resources, the Maine Agricultural Water Management Advisory Committee (MAWMAC) decided in 2002 that the best first step was to develop a generic irrigation guide. The Maine Department of Agriculture, Food and Rural Resources (MDAFRR) had established MAWMAC to develop sustainable irrigation policy and action plans. The Committee's task was to create a guide that individual agricultural commodity groups in Maine could use as a basis for developing specific BMPs for their crops and region of the state. The Committee worked closely with the Central Aroostook Soil and Water Conservation District (CASWCD) to develop *The Users' Guide*.

The intent of *The Users' Guide to Crop Irrigation in Maine* is to provide Maine growers with an irrigation information clearinghouse. This guide is designed to serve the members of the State's agricultural community who are currently irrigating or are considering irrigation and seeks to help growers accomplish these goals:

- to gain information about irrigation that will contribute to the economic viability of their crop, and
- to manage and use water sources for irrigation in an efficient, cost-effective and environmentally responsible manner, keeping the environmental impact to a minimum.

Before growers make an investment in an irrigation system or an upgrade, they need answers to the following basic questions:

- who to contact for information, services and/or equipment,
- how much water is needed for their crop or field,
- how to assess and develop sufficient and sustainable water sources,
- how to keep on top of the regulations and permitting procedures that need to be followed when using or developing water sources,
- how to select the appropriate irrigation system for their crop or field, and
- how to schedule irrigation and conserve water.



Water-stressed blueberries.

This guide is a starting point for growers to establish irrigation systems and practices that will benefit their business as well as the public interest.



## Why Irrigation Is Needed

In Maine, irrigation is practiced primarily to provide crops with water to supplement deficiencies in precipitation. This provides two critically important economic benefits:

1. **Protection from crop loss or damage due to weather-related factors, with drought and frost being the primary risks.**

Irrigation can reduce the risks associated with drought to the maximum extent practicable and economically feasible for each individual grower. Natural rainfall can be unpredictable; water must be available in sufficient quantity, of desired quality and at the optimum times during the growing cycle. Drought episodes in the last part of the 1990s in Maine established drought as a higher risk than previously considered. Additionally, irrigation is useful for protection against frost, a major risk to many Maine crops.

2. **Protection in the marketplace, to help the grower stay competitive by meeting the increasing demands by consumers and processors for consistency, quality and quantity of the product.** Repeated years of low crop yield or reduced quality due to drought could result in the loss of long-term contracts with major processors.

Supplemental irrigation has many benefits for crop growth, yield, and quality, including:

- **Crop Establishment.** Recently transplanted or seeded crops require water for seedbed activation, root establishment and/or germination, especially broccoli, carrots, rutabaga, tree fruits and nuts, berry crops, grapes, nursery stock and other field vegetables.
- **Plant Growth and Vigor.** Plants require water for all phases of growth, including cell division, cell elongation, photosynthesis and transpiration during the growing season. It is the process of transpiration that provides a cooling effect to the crop as it grows.
- **Flower Setting and Fruit Development.** Adequate water supply enhances fruit and flower bud formation (feathering young trees), flowering, fruit set and fruit sizing.
- **Crop Quality.** The flavor, appearance and post-harvest attributes of certain fruits and vegetables can be improved with water-efficient irrigation. This is especially true for potatoes in Maine, where timing of irrigation will enhance development and postharvest storability. The major potato processors in Maine view favorably those growers with the ability to provide uniform quality. In some situations, some fruit and vegetable crops may not respond positively to irrigation water in terms of flavor or sugar development. (This may be cultivar- and soil type-specific.)

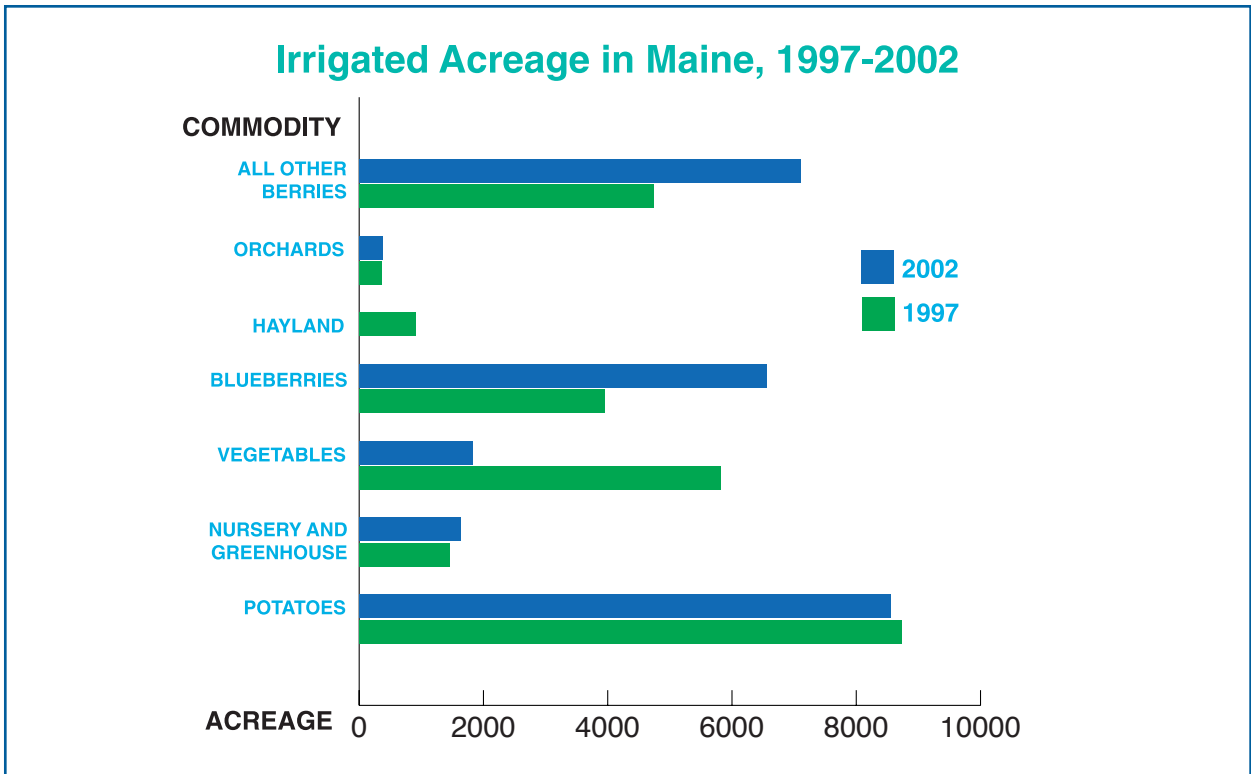


Other potentially high-value crops such as fruits, wild blueberries, sod, and nursery stock must be of top quality to win acceptance in the marketplace. Attaining quality requires timely management decisions—especially of crop production inputs.

## Maine's Irrigation Challenges

Wild blueberry growers in Maine's Downeast region, after investing two years in growing a crop, can face a 30 to 100 percent reduction in crop yield if drought occurs in either crop year. In Aroostook County, growers know that the quality and appearance of their potatoes can be improved with water-efficient irrigation during short-term drought. Major potato processing plants in Maine have high standards for quality, and growers have learned that supplemental irrigation helps their product to achieve a consistently uniform quality with good processing characteristics. In addition, the timing of irrigating potato fields can be crucial to post-harvest storability. Without supplemental irrigation, potato growers risk major losses in 3 out of 10 years of harvest due to drought. Other crops, such as strawberries and nursery crops, would be uneconomical to grow at all without an adequate source of water.

In surveys conducted by the Maine State Department of Agriculture in the late 1900s and early 2000s, growers ranked irrigation as one of the most important technologies needed to keep them in business in the next five years. Many growers interviewed believe the cost associated with installing an irrigation system is justified not only for increased quality and yield of crops, but to protect from partial or total crop failure.



Other growers stated they might go out of business in the next five years if they did not adopt irrigation. These facts are supported by Census of Agriculture data from the U.S. Department of Agriculture (USDA). For the period 1995-2000, growers who irrigated some or all of their cropland represented the net gain of farms in the state. The farms that were not irrigating represented the net loss. The irrigating farms reportedly increased the market value of products sold per farm by an average of \$8,318 per farm (USDA Census of Agriculture, Table 10).

Nearly every crop grown in Maine can benefit from irrigation to improve the quality and quantity of the product. As one farmer explained, “irrigation is as important to maintaining farms as snowmaking is to maintaining the ski industry.” (from *Growing Agriculture*, App. 2, MAWMAC, 2003). For many agricultural producers, the economic risks associated with a potential lack of water are substantial, and a lack of access to water can spell the difference between a profitable harvest and financial loss.

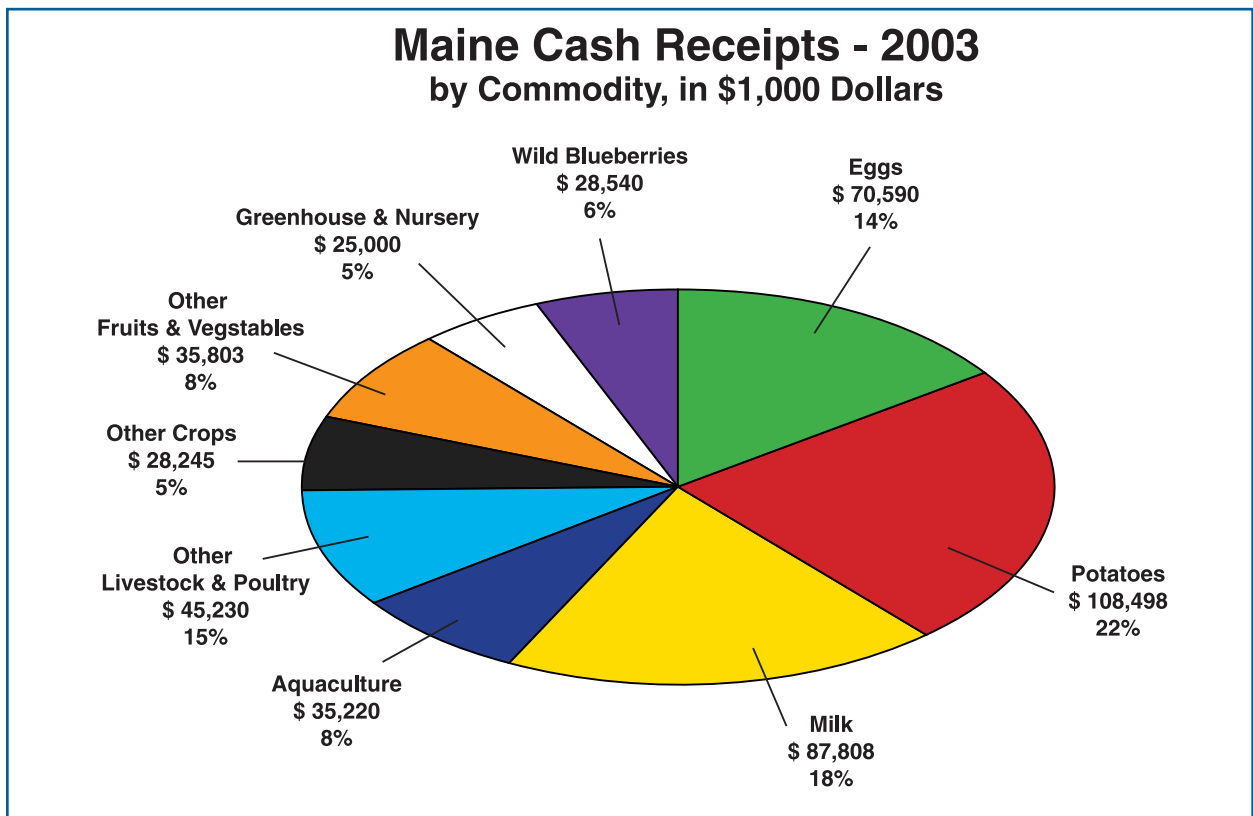
## History of Irrigation in Maine

Irrigation of agricultural crops in Maine dates back to the late 1950s and early 1960s with the wild blueberry industry in Washington County, but did not begin in earnest until the early 1990s. In Aroostook and Penobscot counties, irrigation technology began to be used on potato crops in the early 1970s. Irrigation of potatoes and broccoli became more widespread in Aroostook County in the 1980s. Irrigation is presently used on other vegetable and fruit crops elsewhere in the State.

The growth in irrigation correlates to irrigation research documenting its benefits. Some of the more notable research includes: University of Maine studies on irrigation benefits to fruit trees (1970s); U.S. Army Corps of Engineers, St. John River Basin Cropland Irrigation and Conservation Research/Demonstration Program Feasibility Report (1980s); University of Maine irrigation experiments at the agriculture and forestry experiment stations in Presque Isle at Aroostook Farm, and in Jonesboro at Blueberry Hill Farm (late 1980s and early 1990s); research by private growers and processors, such as irrigation trials conducted by McCain Food LTD. in the St. John Watershed, in neighboring New Brunswick, Canada; and recent plant demand research by growers in the Downeast region. Ongoing research throughout Maine continues to demonstrate the benefits of irrigation, while refining data on plant water demand, irrigation methods, irrigation management and crop benefits.

## Future of Irrigation In Maine

Statistics from the 1997 U.S. Census of Agriculture and 2002 MDAFRR Water Use Survey (MAWMAC, 2003) indicate that the practice of irrigation is on the rise in Maine. From 1992 to 1997, the number of acres irrigated rose from approximately 10,000 to 22,000 acres. The 2002 MDAFRR survey shows that growers were irrigating nearly 29,000 acres by 2002. Informal surveys conducted in the fall of 1999 at various agricultural forums and information developed from the Atlantic Salmon Conservation



NOTE: Additional information on the status and future of Maine irrigation may be found in *Growing Agriculture, Sustainable Water Source and Use Policy and Action Plan*, March 2003, produced by MDAFRR.

Water Use Plan (2000) support the results of the 2002 MDAFRR survey that in five years (by 2007), irrigation on farms could increase by an additional 22,000 acres. To meet this demand, water sources, above and beyond rivers, streams and lakes, will need to be developed to meet irrigation needs in an environmentally sustainable manner.

The results of irrigation studies previously mentioned point to the solid benefits of supplemental irrigation. Supplemental irrigation appears to be one of the most effective tools available to growers for warding off the risks faced by agriculture in the northeast, and at the same time providing the needed edge to remain competitive in the marketplace. The challenges that lie ahead for Maine's agricultural producers are to use and manage the state's natural resources to sustain this valuable sector of Maine's economy and way of life, while protecting and maintaining those natural resources for future generations.

## The Decision to Irrigate

Growers need to conduct their own assessment of what the costs and benefits of irrigation are for their specific situations. Irrigation does not suit every operation. Its benefits must outweigh its costs. Growers are advised to consider the factors in the following table before purchasing or modifying irrigation system components. A cost-benefit analysis can focus on the whole farm or on individual fields within the farm. The cost to develop an irrigation system is linked to several variables:

- crop type and acreage
- soil type
- climate
- water resources
- method of irrigation

A grower may choose not to irrigate because of increased costs that outweigh the potential benefits. For example, a strawberry grower may choose to go without an irrigation system because of soils with good moisture-holding capacity. If the operation is located in a climatically preferred region and on a good site, frost losses totaling a few thousand dollars in one out of four years may be acceptable compared to an investment of \$50,000 to \$100,000.



## *FACTORS TO CONSIDER BEFORE CHOOSING TO IRRIGATE*

GENERAL CONSIDERATIONS	DETAILS
WATER QUANTITY	<ul style="list-style-type: none"> <li>• Sufficient volumes must be available on demand.</li> <li>• Design should accommodate peak crop needs (for frost protection, design should be able to accommodate several consecutive nights' use).</li> <li>• Strategy should be in place to recharge limited volumes of water.</li> </ul>
WATER QUALITY	<ul style="list-style-type: none"> <li>• Irrigation water must be free of contamination from pesticides (herbicides), heavy metals, organic solids, salts, nematode and other parasitic organisms.</li> <li>• Water must be of desirable temperature and pH.</li> </ul>
REGULATIONS & LEGAL CONSIDERATIONS	<ul style="list-style-type: none"> <li>• These must be complied with before drawing water to irrigate.</li> <li>• See Permitting in Section 6.</li> </ul>
CAPITAL AND OPERATING COSTS	<ul style="list-style-type: none"> <li>• Capital investment and operating costs can vary dramatically, depending on system type, power sources, usage pattern, crop, field location and maintenance.</li> </ul>
LABOR & MANAGEMENT	<ul style="list-style-type: none"> <li>• Irrigation systems demand differing degrees of input.</li> </ul>
ENVIRONMENTAL IMPACT	<ul style="list-style-type: none"> <li>• Irrigation should not jeopardize the water cycle of a fragile ecosystem, nor interfere with quantity or quality of flowing water for downstream users and aquatic systems.</li> </ul>
SAFETY	<ul style="list-style-type: none"> <li>• An irrigation pond poses a potential hazard, especially in areas where there is easy access.</li> <li>• Fencing should be provided, with warning signs posted in high risk situations.</li> <li>• Certain irrigation systems may carry an inherently high risk while in use, because of high operating pressure or potentially dangerous electrical energy.</li> </ul>

*Source: Irrigation Management, Ontario (Canada) Ministry of Agriculture, Food and Rural Affairs, 1995.*

