

CLIMATE ADAPTATION RESOURCES FOR NORTHERN NEW ENGLAND FARMERS: IRRIGATION

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OVERVIEW

Use of irrigation can prevent crop losses due to drought, support consistent crop yield and quality, and allow production of a greater variety of crops. Even in areas where crops have historically been produced without supplemental irrigation (e.g., the Northeast United States), there is growing evidence for the economic benefits of irrigation. As climate change and variability increases the frequency and severity of extreme weather patterns, such as heat and drought interspersed with heavy precipitation events, the need for and benefits of irrigation are likely to increase for Northeastern U.S. farmers.

There are a variety of irrigation systems that farmers may consider installing. Two options suitable for small and medium New England farms are drip and solid set sprinkler irrigation systems. This brief presents these irrigation systems generally and does not address their use in specific contexts such as high-tunnels or greenhouses. Farmers interested in more information about technical and financial support for the implementation of these systems should consult with local extension agents. Potential irrigation water sources include an on-farm pond fed by runoff from surrounding areas, on-site well, or nearby streams and lakes. The quantity and quality of water are site-specific but are of significant importance. A rough estimate of the irrigation water (pumping rate) need for the region is about 10-15 gallons per minute per acre for irrigation events lasting about 8 hours a day.

Drip Irrigation

Drip irrigation brings water to crop root zones through low pressure devices, such as drip emitters, micro spray, sprays, and bubblers, that are operated just above or directly on the ground, or just under the soil surface. This option works well in orchards and vineyards and in vegetable and flower production. While drip irrigation is easy to install, highly efficient, effective on sloping and oddly shaped fields, and largely unaffected by wind, it has high management and maintenance needs, including those related to issues such as clogging and bacterial and algal growth.



Irrigation from University of Vermont Extension Workshops.
Photo Credit: Jennifer Brown

SOLID SET SPRINKLER IRRIGATION

Solid set irrigation is a sprinkler system that uses higher pressure and water volume than drip irrigation. It is frequently used on small and medium farms due to its adaptability to a variety of soil and field conditions, the ability to easily automate it, versatility offered by the option to make



Irrigation from University of Vermont Extension Workshops.
Photo Credit: Jennifer Brown

it portable, and for its additional use for frost prevention. Furthermore, sprinklers can be beneficial when plants are in early growth stages with shallow root systems since sprinklers wet the entire field area and ensure that the entire crop has access to water. Due to the high flow, a substantial water supply, such as that from a pond or large well, is required to support this sprinkler system. Weed control around the sprinkler risers is also needed to maintain their visibility and prevent accidental damage from farm equipment operated nearby. Solid set sprinkler systems may also require close management, ensuring that the rate of application does not exceed the rate of soil absorption to prevent overwatering and subsequent runoff and erosion. Since uniform application of water can be a challenge with sprinklers (e.g., windy days), attention should be given to all sprinkler irrigated areas to avoid under- and over-watering.

IRRIGATION ADOPTION COSTS AND BENEFITS

POTENTIAL BENEFITS

Improves crop quality, consistency, and yield

Supports production of a greater variety of crops

Prevents crop losses due to intermittent drought

Drip irrigation is easy to install, efficient, effective on sloping fields, and unaffected by wind

Solid set sprinkler irrigation is adaptable to a variety of field and soil conditions, can be used for frost prevention, and is easily automated

POTENTIAL COSTS

Adequate and reliable water source is required, yet specific to unique farm settings and locations

Upfront investment required to install irrigation system

Ongoing maintenance and labor costs

Drip irrigation is susceptible to clogging and bacterial and algal growth

Solid set sprinkler systems require a substantial water supply, weed control around the risers, and management to prevent overwatering

Uniform water application can be a challenge with solid set sprinklers, as application rate may exceed intake rate in fine textured soils

AERIAL VIEW OF A DRIP IRRIGATION SYSTEM ON A NEW ENGLAND VEGETABLE FARM



Farm before pond or irrigation lines.



Addition of farm pond for irrigation water supply.



Diagram of pump and irrigation system installed.

VISUALIZATIONS

These visualizations are designed to help the viewer picture how irrigation appears in the context of a real New England farm. These images depict the different stages of practice implementation and help the viewer anticipate how the implementation of this practice will appear over time and what implications it may have for the farm. To use these images, please request permission from Stephanie Hurley (stephanie.hurley@uvm.edu).

PERSPECTIVE VIEW OF A DRIP AND SPRINKLER IRRIGATION SYSTEM ON A NEW ENGLAND VEGETABLE FARM



Existing farm with vegetable crops.



New irrigation pond, pump and pipes established as water source.



Aerial sprayers added to create combined drip and sprinkler irrigation system.



Crops grown with pond-irrigation system.

ADDITIONAL RESOURCES

Interested in irrigation? Visit our website at nefarmclimate.com for more information and to explore our economic tool to determine potential costs and revenue. Check out these additional resources for more information:

GUIDES AND TOOLS

- Selecting an Irrigation System: Small Scale Solutions for Your Farm (USDA Natural Resources Conservation Service, January 2009) www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1167474.pdf
- Small Acreage Irrigation Guide (USDA Natural Resources Conservation Service and Colorado State University Extension, Boyd Byelich, Jennifer Cook, Chayla Rowley, Updated February 2019) sam.extension.colostate.edu/wp-content/uploads/sites/2/2017/04/sam-iri-guide.pdf
- Getting started with drip irrigation: components and costs (University of Vermont Extension, Rachel Schattman and Chloe Boutelle, Updated November 2018) www.uvm.edu/climatefarming/sites/default/files/files/uvm_dripirrigation.pdf
- NRCS Irrigation Economic Tools (USDA Natural Resources Conservation Service) www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/econ/tools/#Irrigation0

CASE STUDY

- Irrigation pays in protecting crop revenues (USDA Northeast Climate Hub) www.climatehubs.usda.gov/hubs/northeast/topic/irrigation-pays-protecting-crop-revenues

OTHER TOOLS AND RESOURCES:

- Drought.gov (National Integrated Drought Information System and National Oceanic and Atmospheric Administration) www.drought.gov
- Climate Smart Farming Water Deficit Calculator (Cornell University, Cornell Institute for Climate Smart Solutions, 2021) climatesmartfarming.org/tools/csf-water-deficit-calculator/
- Potential Evapotranspiration for Selected Locations (Northeast Regional Climate Center) www.nrcc.cornell.edu/wxstation/pet/pet.html

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