CHECKLIST
BMPs for VEGETABLE PRODUCTION
ENERGY EFFICIENCY AND CONSERVATION

√ The greenhouse is the biggest potential source of energy savings:

- Reduce air leaks. Install weather stripping. Lubricate louvers to ensure that they close tightly.
- Insulate sidewalls and endwalls. Install double covering to reduce heat loss.
- Insulate foundation and sidewalls to bench height.
- Install thermal blanket.
- Install windbreaks or locate greenhouses in sheltered areas.
- Increase space utilization with moveable benches.
- Ensure efficient heating system by boiler maintenance. Install electronic thermostats with 1° F accuracy.
- Consider alternate energy heat sources like wood or corn pellets. See http://www.umass.edu/umext/floriculture/fact_sheets/energy.html.
- Install horizontal air flow fans to regulate temperature uniformity. Use the smallest fan motor and largest fan diameter available.
- Use shading to reduce the need for cooling. Install roll up sides or open air vents.
- Conserve electricity by installing low wattage fluorescent or HID bulbs. Add motion detector to security lights to reduce their use.
- Lower nighttime temperature. Delay opening greenhouse for a week or more by using a germination chamber.
- Have wiring system checked for efficiency.

√ Energy savings in the field are related to nutrient management, equipment maintenance, and employee education.

- Keep engines on all equipment properly tuned. Ensure proper tire inflation.
- Avoid idling. Keep equipment in proper gear for load.
- Train employees in proper operation of equipment.
- Consider used oil as equipment fuel. Waste oil can be filtered and used as in a diesel solution. Consider vegetable oils (soybean or cottonseed oil).
- Practice sound nutrient management practices. Start with a soil test. Consider alternate sources of nitrogen like animal manures. Calibrate equipment to ensure uniform application.
- Keep irrigation system components serviced and well tuned. Keep motors, valves, control panels, and switches clean of dirt, insects, bird's nests, and debris.
- Time irrigation to maximize energy and water use efficiency.
- See http://www.berkshirepioneerrcd.org/mfep/energy/php for energy programs for Massachusetts farmers.

ENERGY PROGRAMS

Massachusetts Farm Energy Program
http://www.berkshirepioneerrcd.org/mfep/energy/php

Massachusetts Farm Energy Discount Program of MDAR
http://www.mass.gov/agr/admin/farmenergy.htm

USDA REAP Rural Energy for America Program
http://www.rurdev.usda.gov/rbs/farmbill/index/html

Mass Technology Collaborative Energy Programs

- MTC Commonwealth Solar http://www.masstech.org/solar
- Large Onsite Renewables Initiative (LORI)
  http://www.masstech.org/renewables/large

Rural Development Value-Added Producer Grant Program
http://www.rurdev.usda.gov/rbs/coops/vadg.htm

Massachusetts Farm Energy Program Audits and Incentives Program
http://www.berkshirepioneerrcd.org/mfep/energy/php

Agricultural Environmental Enhancement Program (AEEP) of MDAR
http://www.mass.gov/programs/aeep/index.htm

Massachusetts
Farm Energy Program
Conservation • Efficiency • Renewables

Energy Audits & Incentives Now Available For Farmers

The MFEP seeks applications from farmers across Massachusetts interested in participating in this program.

The Mass Farm Energy Program (MFEP) has funding available to help farmers pay for energy audits and renewable energy assessments, and to implement the recommendations of the audits. MFEP will pay 75% of the cost of an audit, assessment, or consultation with the farmer responsible for the remaining 25%. MFEP will also pay incentives of up to $7,500, based on energy savings, to implement the recommendations.

The MFEP will

- refer farmers to existing audit and incentive programs
- assist with locating other energy funding sources to "leverage" additional funds
- provide "targeted" energy audits and/or renewable energy assessments by MFEP contractors
- provide financial incentives for implementation of audit recommendations, based on energy savings of:

$0.15 incentive per kWh electricity
$2.50 incentive per therm natural gas
$2.75 incentive per gallon propane
$3.00 incentive per gallon fuel oil

The MFEP seeks applications from farmers across Massachusetts interested in participating in the program. Higher priority will be given to farmers with less access to other audits and incentives programs, especially those on municipal power, and those not eligible for USDA-Rural Energy for America Program (REAP) and/or MA Technology Collaborative (MTC) funding.

The goal of the Audits and Incentives Program is to encourage farmers to implement at least 50% of the recommended measures, including those recommended by public utility programs.

Go to http://www.berkshirepioneerrcd.org/mfep/energy.php for complete information and to apply.

The Massachusetts Farm Energy Program is a two-year statewide pilot program that receives funding and technical support from the Massachusetts Department of Agricultural Resources and USDA-Natural Resources Conservation Service. The program is administered by the Berkshire-Pioneer Resource Conservation and Development Area, Inc. and the Patriot Resource Conservation and Development Council, Inc.

Berkshire-Pioneer RC&D • MA Farm Energy Program • 433 West St. Amherst MA 01002
413.256.1607 • www.berkshirepioneerrcd.org/mfep/index.php
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CHECKLIST
BMPs for VEGETABLE PRODUCTION
ORGANIC WASTE MANAGEMENT-COMPOSTING

- √ Contact the Massachusetts Department of Agricultural Resources Composting Program for information on state and local regulations regarding composting (http://www.mass.gov/agr/programs/compost/index.htm).
- √ Most organic materials generated by vegetable production can be composted. Do not compost diseased plant material unless the compost will be thoroughly heated and mixed.
- √ Site compost piles distant and downwind from sensitive neighbors and residential property.
- √ Compost piles should be protected from surface water and storm runoff.
- √ Successful composting requires attention to carbon to nitrogen ratio (C: N) of material being composted. Balance materials with a high C: N ratio with materials with a low C: N.
- √ Air is needed for composting, both from turning and from passive flow through the pile. Structure the pile to allow for air flow. Turn the pile frequently to mix nutrients and maintain pile structure.
- √ The compost process requires adequate moisture. If the moisture level is too low, active composting ceases. If the moisture level is too high, anaerobic digestion and resulting offensive odors will occur.
- √ Finished compost requires several cycles of heating and cooling, followed by a period of slow curing.
- √ Consider the potential for odors when turning, watering, or opening compost piles.
- √ Control dust when turning or grinding piles. Avoid operations during periods of high winds.
- √ Odor problems can be avoided by proper composting procedures. Keep piles aerobic, porous, well aerated, and well mixed.
- √ Do not compost plant material treated with herbicides, especially grass clippings.

ORGANIC WASTE MANAGEMENT_COMPOSTING

Breakdown of organic material through composting is an excellent means of handling organic waste. The composting process involves microorganisms which decompose the organic material. These microorganisms require both air (oxygen) and water. Organic matter in an unmanaged pile will eventually decompose but it may require a long time and generate offensive odors. Composting generates heat which kills pathogens and weed seeds and results in a soil-like material which contains nutrients, humus, and beneficial microorganisms. Finished compost is a stable, organic material which is useful as a soil conditioner or nutrient source.

Compost must be monitored to ensure appropriate air and moisture content and temperature. Active composting takes place between 105 and 145° F; the microorganisms that decompose organic matter generate heat. A new compost pile will quickly heat up to about 130° F. A compost pile will settle as decomposition proceeds; turning the pile regularly will re-establish pile structure and mix the nutrients. Compost cures at a lower temperature, around 100° F; curing allows the compost to stabilize.

Regulations
Agricultural waste composting is regulated by the Massachusetts Department of Agricultural Resources (MDAR). Agricultural composting operations are registered if the compost operation is located on a farm, the applicant has submitted an application and agrees to a site visit, and the applicant demonstrates the knowledge and capacity to conduct proper composting. A composting operation for agricultural waste is defined in M.G.L. c.128, & 1A. The following materials may also be composted:

- Leaf and yard waste
- Wood waste
- Clean cardboard or newspaper
- Thin shells and bones
- Animal manures and animal bedding materials
- Less than 20 cubic yards (10 tons) per day of vegetative material
- Less than 10 cubic yards (5 tons) per day of food material

The Composting Process
Pre-compost preparation may be needed. Materials may need to be ground or shredded to increase surface area and allow more rapid decomposition. Bulking amendments may be needed to add structure to a pile and improve its porosity. Finished composts may require grinding or screening before their use.
Mixing of compost components should be thorough and the pile should be turned on a frequent basis. Proportions of nitrogenous waste and those high in carbon is critical to successful composting. The exact recipe for each compost pile will vary with the materials available for composting.
Pile construction is dependent on the types of materials to be composted, the turning method, and the site where composting will take place. In general, piles should have a broad base, flat tops, and sloping sides. Several small piles may be preferred to one large

one. Piles that are too large or have poor structure can become anaerobic and generate offensive odors.

Monitoring of the moisture, oxygen content, and temperature during active composting and the curing process is critical. Effective composting requires good air flow and proper temperatures.

Moisture content can be adjusted during turning. Without adequate moisture, the active composting process ceases.

Turning of piles ensures good aeration and moisture distribution. Turning allows the entire mass of the pile to reach the high temperatures needed for complete decomposition and killing of pathogens and weed seeds. Frequency of turning is determined by the pile structure, the types of materials being composted, and whether the pile is exposed to the elements. Piles should be turned as often as practical once temperatures reach 100° F.

Curing is the final step in the composting process and allows the compost to stabilize. Curing takes place at lower temperatures than active composting. Compost sites should be selected that have enough space to allow proper curing of compost. Finished compost should be tested for the following characteristics: moisture content, pH, C:N ratio, soluble salts, total nitrogen (ammonium and nitrate), extractable heavy metals, and extractable major and minor nutrients (phosphorous, potassium, calcium, magnesium, zinc, boron, iron, and copper).

Water quality must be protected during the composting process, curing, and storage. Composting can produce leachate with high levels of water contaminants like nitrogen. Piles should be protected from surface water and storm water runoff. They may need to be protected from rain to prevent them from becoming anaerobic. Saturated piles will have to be rebuilt and remixed. Any runoff from compost piles should be collected and not allowed to leave the site.

CHECKLIST
BMPs for VEGETABLE PRODUCTION
INORGANIC WASTE MANAGEMENT

√ Pesticides that are too old or illegal to use are hazardous waste.
√ Triple rinse pesticide containers before disposal. Always wear personal protective equipment when conducting rinsing operations. Add rinse water to sprayer to be applied as a pesticide.
√ Prevent re-use of pesticide containers by puncturing containers. Follow the product's label for proper disposal.
√ The Massachusetts Department of Agricultural Resources or individual communities sponsor hazardous waste collection. See http://www.mass.gov/agr/pesticides/waste/index.htm.
√ Contact a licensed commercial hazardous waste hauler:

- Clean Harbors
- Enviro-Safe Corporation
- Medical Waste Disposal Company
- Triumvirate Environmental Services
- Stericycle, Inc.
- Veolia Environmental Services Technical Solutions.

√ Agricultural plastics include mulch film, pesticide containers, nursery containers and flats, row covers, and woven tarps.
√ The Massachusetts Department of Environmental Protection prohibits the burning of agricultural plastics. Burning plastic can release toxic chemicals into the air, soil, or water.
√ Plastic to be recycled must be separated into different types of plastic, washed to remove contaminants, and chopped.
√ Contact local municipal recycling center or a plastic recycling company.
√ Plastic can be disposed of by a commercial waste hauler.