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Floral Notes Newsletter

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In This Issue

Greenhouse Management & Systems

Geothermal Heat for Greenhouses

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Soil and water below ground contains a vast reservoir of thermal energy. Geothermal heating systems recover this energy and convert it to heat that can be utilized in greenhouses and other buildings. Geothermal heat can be classified into three categories.

Low temperature (50°F)

The soil temperature at the surface varies considerably over the year and closely follows the air temperature. At the 10-12' depth it is more uniform averaging about 50°F with a variation of about 6°F above and below this level. There is also a lag time of about 8 weeks between the maximum surface temperature and the maximum soil temperature at the 12' level which is helpful in winter heating and summer cooling. For the greenhouse production of perennials, herbs, nursery stock and some vegetables that require a temperature from 32-45°F this low grade soil heated air or water can be used directly. For heating the greenhouse to a higher temperature, a heat pump is necessary. These are available as air to air, air to water, water to water or water to air systems.

Medium temperature (140-300°F)

Thermal wells and springs in some parts of the world including the west coast of the U.S. Washington that are heated by geothermal energy. The heated water that comes from the ground is distributed through fin radiation or root zone heating.

High temperature (>300°)

The steam from geysers in California, Nevada and Utah is being tapped for power generation. Currently there are about 20 sites in operation with several more under construction. These produce power for 5-8 cents/kW hr.

Greenhouse heating systems

In New England, the only choice that we have for geothermal heating is with low temperature heat. There are several systems that appear to be feasible that have a reasonable payback. Before considering the installation of one of these systems, it is important to address energy conservation. Reducing infiltration, installing energy curtains, insulating sidewalls and the foundation perimeter, making good use of growing space and installing electronic controls should be done first. This will save considerable heat and reduce the size of the heating system needed.

Air systems

Earth tubes are piping that is buried 6' to 12' below the soil surface. The simplest and least expensive systems gather heat during the winter by drawing air through corrugated plastic tubes and direct it into the space to be heated. The air passing through the tubes is warmed by the soil that has a higher temperature than the air. During the summer the system can be used to cool building space by drawing the heated air in the greenhouse through the buried tubes and then returning it to

provide hot water that can be used directly for heat. There are currently over 40 greenhouse operations in Oregon, California and

the building. The heat is absorbed by the cooler earth.

In the above system the air can be warmed or cooled to near the soil temperature. For example, the average soil temperature 8' below the surface in central Massachusetts varies between 60°F in early Fall to 46°F in early March. To increase the temperature to 80°F - 90°F for air heating for ornamentals or bedding plants, an air to air heat pump could be employed. This process is similar to what happens in a refrigeration system.

Water systems

Liquid systems utilize either the soil heat to warm a liquid, such as water or antifreeze or directly use water from ponds or well and extract the heat. There are several systems that have been used successfully.

Closed-loop systems circulate water or an antifreeze solution through loops of small diameter underground pipes. In cold weather this solution absorbs heat from the ground and carries it to a heat exchanger that extracts it. In may also go to a heat pump that amplifies it so that the temperature is warmer.

Horizontal loops may be used where adequate land is available. Pipes are placed in trenches in lengths to 400'. Multiple loops are used to capture the amount of heat needed to heat the greenhouse. Vertical loops are an alternative were land area is limited. Well drilling equipment is used to bore small diameter holes from 75' to 500'; deep. The hole may be filled with a grout to transfer the soil heat to the pipes.

Pond or lake loops are economical to install

when a body of water is nearby. This system eliminates the excavation cost. Water or antifreeze is circulated through coils of pipe that are placed in the bottom of the pond or lake. A depth of at least 12' is needed to avoid the influence of the freezing that occurs on the surface during the winter.

An open loop system utilizes ground water directly. Water is usually pumped from one well and returned to a second, adjacent well. The distance between wells has to be far enough so that the return water doesn't influence the intake water. The water may also be pumped out of a pond or lake at one location and returned a distance away. Open loop systems can be economical if the source of water is located nearby.

Conclusions

The use of ground heat is becoming more popular for residential and commercial applications. Due to the high temperature needed for conventional greenhouse heating, a heat pump is needed. Today's equipment is more reliable at a lower cost than a few years ago. Where low temperature heat is needed, such as maintaining an air temperature just above freezing, direct use of the heat is possible.

As the cost of fossil fuels increases, the payback for alternative heating systems shortens. For most geothermal systems the payback is in less than ten years with energy prices at $25/MBtu. (#2 fuel oil = $2.50/gal).

Additional information is available at: www.mass.gov/agr/programs/agroenviro/gralltreportoioneergardens.htm.

2009-2010 New England Greenhouse Floriculture Guide

Greenhouse growers throughout New England rely on the *New England Greenhouse Floriculture Guide* as an unbiased source of detailed crop-specific production recommendations. This compendium of up-to-date information about products that manage insects, mites, diseases, weeds and algae, and regulate plant growth, is a must-have manual for professional growers. Since the last edition, several new products have become available and have been incorporated into the 2009-2010 publication.

All of the *Guide's* chemical recommendations are presented within the framework of sustainability. The insect/mite section, for example, presents a practical approach to establishing a comprehensive integrated pest management program, beginning with detailed information about pest identification and step-by-step guidelines for implementing an effective scouting program. Practical guidelines for instituting a biological control program, including use of banker plants and alternative pest control materials, are provided. The plant growth regulator (PGR) section not only provides details of which PGRs to use and how to apply those products to specific crops, but also explains how to manage crop growth environmentally.

The *Guide* is updated every two years by floriculture faculty and staff from the six New England State Universities, and is published by New England Floriculture, Inc.

The 2009-2010 edition of the *Guide* will be available to attendees of the New England Greenhouse Conference at a special conference price of $15 per copy. After the conference, it will be available for $25 per copy via the New England Greenhouse Conference web site (www.negreenhouse.org).

Transitioning to Renewable Energy for Greenhouse Heat

Sturbridge Host Hotel and Conference Center, Sturbridge, MA
Thursday, December 4, 2008, 8:30 AM – 3:30 PM

Sponsored by: UMass Extension Vegetable and Floriculture Programs, New England Vegetable and Berry Growers Association, and Massachusetts Flower Growers Association

8:00	**Registration, Complimentary Coffee**
8:30-9:00	**Case Studies: Transitioning to Alternative Fuels** *Vern Grubinger, University of Vermont*
9:00-9:45	**Case Study: How We Switched To Corn To Heat Our Greenhouses For Spring Crops** *Mike Kosinski, Kosinski Farm, Westfield, MA*
9:45-10:00	**Break**
10:00-10:45	**Sources of Funding for Alternative Fuels** *Gerry Palano, Mass Department of Agricultural Resources*
10:45-11:30	**Greenhouse Energy Audits and Conservation** *John Bartok, Extension Professor Emeritus, University of Connecticut*
11:30-12:00	**New! Massachusetts Energy Audit Program** *Darlene Monds, Resource Conservation & Development*
12:00-1:00	**Buffet Lunch**
1:00-1:30	**Where We Are Going With Biofuels?** *Steve Herbert, University of Massachusetts*

1:30-3:30 PM **Concurrent Sessions**

Session A **Grain Corn Production for Fuel**

Growing Grain Corn: Varieties, Scheduling, Nutrition

Grower Panel: Harvesting, Storage, Drying

Session B **Wood for Fuel**

Things to Think About When Burning Wood *John Howell, New England Vegetable and Berry Growers Association*

Options for Greenhouse Furnaces and Fuels *John Bartok, Extension Professor Emeritus, University of Connecticut*

Grower Panel: Using Wood for Fuel

For more information contact: *Contact Tina Smith, 413-545-5306,* tsmith@umext.umass.edu, *Paul Lopes, 508-295-2212 ext. 24,* lopes@umext.umass.edu *University of Massachusetts Extension.*

Alternative Greenhouse and High Tunnel Crops

Sturbridge Host Hotel and Conference Center

Friday, December 12, 2008, 9:00 AM - 3:30 PM

Sponsored by: University of Massachusetts Extension Floriculture and Vegetable Programs, University of Connecticut Extension and Northeast SARE

8:30 **Registration , Complimentary Coffee**

9:00-9:45 **Growing in Greenhouses and High Tunnels** Vern Grubinger, Univ. of Vermont

9:45-10:30 **Growing Winter Sprouting Broccoli in Unheated High Tunnels for Fresh Market** Becky Grube, University of New Hampshire

10:30-10:45 **Break**

10:45-12:15 **Growing Fresh Cut Herbs and Edible Flowers** Sandie Shores, Herb's Herb & Such, Millville, MN

12:15-1:15 **Buffet Lunch**

1:15-2:15 **Growing Greens** Pete Johnson, Pete's Greens, Craftsbury, Vermont

Pete's Greens is a four-season organic vegetable farm with an emphasis on growing baby greens, heirloom tomatoes and root crops.

2:15-2:30 **Break**

2:30-3:30 **What we are growing and how we are doing it. Salad Greens for High Tunnel Production** Dave Zemelsky, Starlight Gardens, Durham, Connecticut

Starlight Gardens is a certified organic farm that grows tomatoes, microgreens, vegetable and herb seedling in greenhouses and high tunnels.

Growing and Marketing Ginger Root Missy Bahret and Casey Steinberg, Old Friends Farm, Amherst, MA

Old Friends Farm is an 8 acre certified organic farm specializing in cut flower, salad greens and specialty crops. They have been growing ginger for three years.

Financial support for this program is being provided with a grant from Northeast SARE.

For more information contact: Tina Smith, (413)545-5306, tsmith@umext.umass.edu or Paul Lopes, University of Massachusetts Extension Floriculture Program, (508)295-2212 ext. 24, lopes@umext.umass.edu

Biological Control in Greenhouses: Preparing For Spring Crops

Tina Smith
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Amherst

Currently there is a lot of interest in using biological control to manage pests. We recently held the program, "Biological Control in Greenhouses" which was attended by 70+ growers. The New England Greenhouse Conference will have sessions and the 2009-2010 New England Recommendation Guide has a new updated section on using biological control. The information below is intended to help get you started.

If you are planning to use biological control for spring crops, then plan to take some important steps now. The success of any biological control program relies on patience and a commitment to detail such as sanitation, scouting and record-keeping.

Sanitation and Disinfecting

Greenhouse sanitation and disinfecting are steps that growers can take now to prepare for the spring growing season. Clean as early as possible to eliminate over-wintering sites for pests to reduce their populations prior to the growing season. Greenhouse pests will over-winter in weeds and protected areas in unheated greenhouses and especially during years with unseasonably warm temperatures. Remember that pests are much easier to prevent than to cure.

Floors. Begin by thoroughly cleaning the floor of soil, organic matter and weeds. Pay particular attention to areas around furnaces or along side walls where small weeds may exist. Install physical weed mat barriers if floors are bare dirt or gravel and repair existing ones. Weed barriers not only prevent weeds, but also make it easier to manage algae. Avoid using stone on top of the weed mat that will trap soil and moisture, creating an ideal environment for weeds, diseases, insects and algae. Fix any low spots or poorly drained areas in the greenhouse that allow water to accumulate.

Benches, hose nozzles, media mixing area. Benches, preferably made of wire, should be disinfected and pots, flats and trays should be either new or disinfected. Bench tops and work tables should be made of a non-porous surface such as a laminate that can be easily disinfected. Avoid using bare wood for these tasks. Disinfect hose nozzles, hang hoses to keep ends off the floor and provide a clean and covered area for growing media. Avoid holding plant material and contaminated pots, media or debris in the media mixing area.

Disinfectants. Disinfect the growing and plant handling areas, and irrigation system. There are several different types of disinfectants that are currently used in the greenhouse for plant pathogen and algae control. They are quaternary ammonium compounds (Green-Shield®, Physan 20®, and Triathlon®), hydrogen dioxide (ZeroTol®, Oxidate®) and chlorine dioxide (Selectrocide™). All these products have different properties, so read and follow label directions. Chlorine bleach may be used for pots or flats, but is not approved for application to walls, benches or flooring. Alcohol is flammable and therefore not used as a general disinfectant. However, it is useful as a dip or swipe treatment to disinfect propagation tools. If possible, disinfectants should be used on a routine basis both as part of a pre-crop clean-up program and during the cropping cycle.

Organic options. Organic growers have fewer options for disinfectants. Oxidate® is the only material mentioned above that is currently listed by the Organic Material Review Institute (OMRI), see www.omri.org. Ethyl or isopropyl alcohol is also allowed under the organic standards. Organic growers should always check with their certifying organization before using any material new to their growing practices.

Outside weeds. Check weeds around the greenhouse perimeter for aphids and other pests. When weather permits, use horticultural oil on weeds outside, around the greenhouse perimeter to smother over-wintering pests such as aphids. Then clean up the weeds this fall to prevent pests next spring.

Fallow greenhouses. Finally, pest population will be reduced significantly with a fallow period of four weeks, but having an empty greenhouse for even two weeks can help. Before placing plants in a greenhouse this winter, place yellow sticky cards throughout the greenhouse and on the floor after watering benches and the floor to detect over-wintered thrips (emerging from pupae), fungus gnats, whiteflies or other insects, Close up the greenhouse and turn on the heat to break dormancy. Observe cards after a few days. Also place a few sticky traps on the outside perimeter of the greenhouse, especially under vents to detect pests. When treating inside the greenhouse (prior to releasing biologicals) use low residual materials such as insecticidal soap and horticultural oil.

To learn more about cleaning and disinfecting see the fact sheet Cleaning and Disinfecting the Greenhouse which can be found at: www.umass.edu/umext/floriculture/fact_sheets/greenhouse_management/ghsanitz.html

Pesticide Use

If planning to use biological control, it is important to phase out the use of pest control materials in the organophosphate, carbamate, and pyrethroid chemical classes prior to releasing natural enemies since many materials in these chemical classes can persist for up to four months in the greenhouse. For more information on the compatibility of pest control materials with natural enemies refer to on-line databases, such as Koppert, Inc., (www.koppert.com) or Biobest (www.biobest.be). Check under “Side Effects.” Research is continuing on the compatibility of pest control materials with natural enemies.

Monitoring

In addition to sanitation and phasing out the use of residual pesticides, a good monitoring program must be in place. Detecting problems early is essential, since beneficials are introduced at the first sign of an infestation. It is also important to monitor weekly throughout the crop cycle to help decide future releases and to know what is working or not. A 10X hand lens will help to identify pests and beneficials. Knowing the major insects, mites and diseases prone to the crop and how to recognize beneficials is essential.

Other considerations include establishing a supplier in advance, having someone available when shipments arrive and checking shipments for viability (remember they are living organisms).

If this will be the first time using biological control, it is recommended to try it in a small isolated greenhouse, in propagation houses, or in a greenhouse where edible crops such as herbs are being grown. This will allow you to obtain experience and then have the opportunity to expand into other production areas.

Partial List of Suppliers

1. Green Spot, 93 Priest Road, Nottingham, NH 03290-6204. Phone: 603-942-8925; Email: info@greenmethods.com

2. IPM Laboratories, PO Box 300, Locke, NY 13092-0300. Phone: 315-497-2063; Email: ipminfo@Ipmlabs.com

3. Koppert Inc., Romulus, MI. Phone: 734-641-3763; Email: info@koppertline.com

4. Syngenta Bioline, Oxnard, CA. Phone: 805-986-8255; Email: info@syngentabioline.com

5. BioBest Biological Systems. Email: info@biobest.ca or www.biobest.be

For information on additional suppliers of natural enemies refer to the publication, "Suppliers of Beneficial Organisms in North America by Charles Hunter. This booklet is available from the California Environmental Protection Agency, Department of Pesticide Regulation, Environmental Monitoring and Pest Management at www.cdpr.ca.gov or 916-324-4100.

Suggested Resources

Ball Guide to Identification of Greenhouse Pests and Beneficials by Stanton Gill and John Sanderson. ISBN-10: 1-883052-17-3, 256 pages.

Knowing and Recognizing: The Biology of Glasshouse Pests and Their Natural Enemies, Second Edition by M. H. Malais and W.J. Ravensberg.

2009-2010 New England Greenhouse Floriculture Guide. A Management Guide for Insects, Diseases, Weeds and Growth Regulators. From New England Floriculture Inc. (see the top of page 9).

Websites

Pesticide Side Effects www.biobest.be

Biological Control: A Guide to Natural Enemies in North America www.nysaes.cornell.edu/ent/biocontrol/

Green Methods http://greenmethods.com/site/

Koppert Biological Systems, also Pesticide Side Effects Database www.koppert/com

Biological Control of Insects and Other Pests of Greenhouse Crops, University of Wisconsin (108 page book)

http://learningstore.uwex.edu/pdf/ncr581.pdf

Greenhouse IPM Manual with an Emphasis on Biocontrol, Penn State (108 page book) http://paipm.cas.psu.edu/63.htm

Buglady Consulting (Handout from Biological Control Program) Suzanne Wainwright-Evens spoke at the Sept. program. http://www.bugladyconsulting.com/

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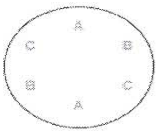

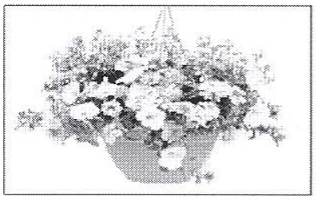

A Safari® White
Nemesia
Qty: 2

B Supertunia® Mini White
Petunia
Qty: 2

C Tukana® White
Verbena
Qty: 2

Combination Details	
Season	Spring
Exposure	Sun
Container Size	12 inches
Color Scheme	Monochromatic
Container Style	Hanging Basket

Your Combination List

Combination	Qty
Bridal Shower *Season:* Spring *Container Style:* Hanging Basket *Exposure:* Sun	125
Little Boy Blue *Season:* Spring,Summer *Container Style:* Hanging Basket *Exposure:* Sun	150

Your Liner Order

Variety	Combination(s)	Liners Required	Tray Size	Liner Trays Required	Liners Leftover
Safari® White *Nemesia*	Bridal Shower	250	84	3	2
Supertunia® Mini Blue Veined *Petunia*	Little Boy Blue	300	84	4	36
Supertunia® Mini White *Petunia*	• Bridal Shower • Little Boy Blue	550	84	7	38
Superbena® Purple *Verbena*	Little Boy Blue	300	84	4	36
Tukana® White *Verbena*	Bridal Shower	250	84	3	2
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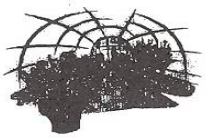

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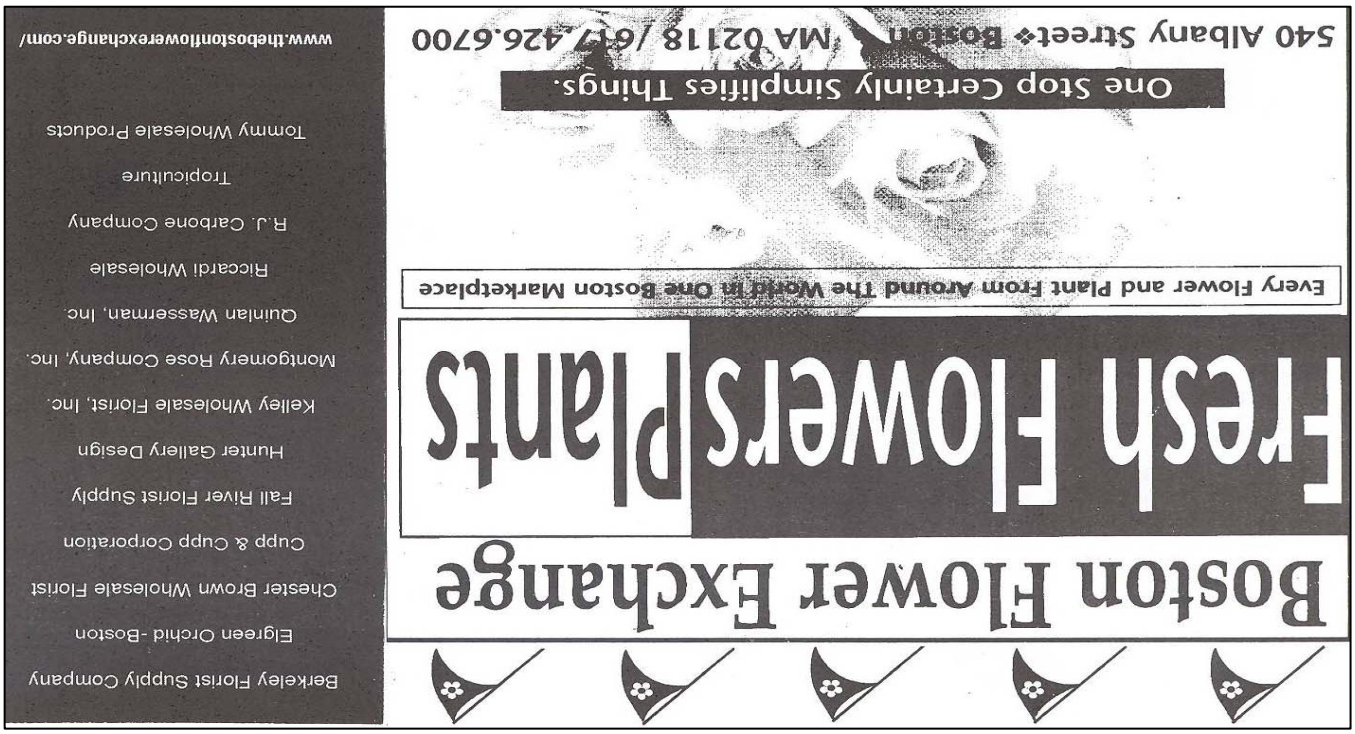

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