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Floral Notes NEWSLETTER

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Recent Progress on the New UMass Greenhouses

Now that spring is here much outdoor progress has occurred on the construction of the new Umass Greenhouses. The picture taken May 1 shows that the frame of the greenhouse is nearly complete and ready to be covered. The headhouse is still the main center of construction activity with most of the complex mechanical systems installed while the labs, office, classroom, and other rooms are being finished. The new construction is set to be "done" by July 1 and then the renovation of the old greenhouse will begin. We have reasonable expectations that the complex will be ready for use by September when the students return.

Using Natural Fertilizers in Ground Beds in Greenhouses: Converting Chemical Fertilizer Recommendations to Organic Fertilizers

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Granular organic fertilizers and compost are becoming increasingly popular for fertilizing cut flowers, vegetables, and other crops grown in the field or in ground beds in greenhouses and high tunnels. Many growers report excellent results with these materials. Generally, organic fertilizers release nutrients slowly providing more timely nutrient release for the plants and potentially less nutrient leaching than chemical fertilizers.

When using natural fertilizers for plant nutrition, careful management of the structure and chemistry of the soil is essential. Soil pH between 6.2 and 6.8 is generally considered optimum for most crops growing in soil. A soil test will indicate whether or not the acidity should be changed. Fine ground limestone is used to raise the pH of acid soils; sulfur is used to lower the pH of alkaline soils.

It is equally important to maintain a high level of organic matter in the soil each year to maintain good soil structure - preferably at least 5% (at least 1 lb. per 1 sq. ft.). A soil organic matter test can estimate the required level to add. In greenhouses, there is a continual loss of organic matter due to cultivation, warm soil temperatures, frequent watering, and crop harvests. Animal manure-based composts should be avoided due to high nitrogen content which can lead to ammonium toxicity and high soluble salts.

An annual routine field or garden soil will provide information on what nutrients are adequate or limiting and provide a fertilizer recommendation. Visit the University of Massachusetts website for information on soil sampling and testing http://www.umass.edu/soiltest/. Once a soil test and fertilizer recommendation is received, the following steps and charts can be used to calculate the amounts of organic fertilizers to use for greenhouse crops grown in soil in ground beds.

If the soil test results recommend a commercial fertilizer such as 5-10-5 expressed as pounds per 100 or per 1000 sq. ft, then the first step is to convert the soil test recommendation to the number of pounds of nitrogen (N) to apply. Even though many fertilizers supply phosphorus and potassium also, N is the element most likely to be the deficient.

Step 1. Test soil and obtain fertilizer recommendation. Example: apply 30 lbs. 5-10-5 per 1000 sq. feet. The fertilizer analysis translates to 5% N (or 0.05) (The fertilizer also contains 10% phosphorus expressed as P_2O_5 and 5% potassium expressed as K_2O).

To convert the soil test recommendation to the quantity of organic fertilizer to use, the number of pounds of N is needed (Step 2).

Step 2. Determine the number of pounds of N that is needed by multiplying the %N by the recommended rate. Example: 0.05 x 30 lbs. (recommended rate) = 1.5 lbs. nitrogen per 1000 sq. feet. (In other words 5% of 30 lbs. of 5-10-5 is 1.5 lbs. of N).

Step 3. Using Chart 1, choose the organic fertilizer you want to use instead of chemical 5-10-5 to supply the required amount of N. For example, you decide on dried blood which has an analysis of 12-0-0.

Step 4. Use Chart 2 to determine the lbs. of the organic fertilizer to apply. Look at the lbs. of nutrients desired (determined in Step 2) on the top of the chart. Follow the column down until you find the percent analysis of the natural fertilizer. Example: 1.5 lbs. N is recommended Find 1.5 at top of chart (pounds of nutrient desired) and then find 12% (percent N in dried blood) in the left column. The chart indicates 12.5 lbs of dried blood would provide 1.5 lbs of N. So, 12.5 lbs of dried blood would be applied to 1,000 sq. ft. based on the recommendation.

Chart 1. Common Organic Fertilizers

Fertilizer	Analysis $N-P_2O_5-K_2O$	Nutrient availability	Comments
Dried Blood	12-0-0	High	
Bone Meal	2-20-0.2	Moderate	May attract pests
Rock Phosphate	0-20-0	Low	Must be ground to fine mesh (200) powder
Fish Emulsion	4-1-1	Moderate	May attract pests
Fish Meal	10-4-0	Moderate	May attract pests
Leaf Mold	1-1-1	Moderate	
Seaweed	1.5-0.7-5	Moderate	
Cottonseed Meal	7-2.5-2	High	May contain pesticide residue
Wood Ashes	0-2-5	High	Hardwood ash preferred
Fresh garden compost	1-1-1	Moderate	Quality depends on ingredients
Composted manure (not dehydrated) Cow Horse Rabbits Hen Hog Sheep	 0.5-0.25- 0.5 0.7-0.5-0.6 4-3-1 1.8-1-0.5 0.3-0.3-0.45 1-0.35-0.5	 Moderate Moderate Moderate Moderate Moderate Moderate	
Sludge	4-2.5-1	Moderate	Contains toxic metals
Granite Dust	0-1-6	Low (Nearly insoluble)	

Fertilizers in Chart 1 rated “moderate” for availability should be applied at **double** the amount needed; those rated “low” should be applied at **4 times** the amount needed. Do not use cat, dog, or human waste as a manure to prevent the spread of disease. Also, nowadays many feel that it is safer to use composted rather than fresh farm animal manure.

Note: One full bushel of compost, manure or seaweed will weigh about 40 lbs.

Chart 2. Amount of Fertilizer Needed Based on % Nutrient in Fertilizer and Number of lbs. of Nutrient Desired

	Pounds of Nutrient Recommended or Desired										
% Nutrient in Fertilizer	**0.5**	**1**	**1.5**	**2**	**2.5**	**3**	**4**	**5**	**6**	**8**	**10**
0.2	250	500	750	1000	1250	1500	2000	2500	3000	4000	5000
0.25	200	400	700	800	1000	1200	1600	2000	2400	3200	4000
0.4	125	250	375	500	625	750	1000	1250	1500	2000	2500
0.5	100	200	300	400	500	600	800	1000	1200	1600	2000
1.0	50	100	150	200	250	300	400	500	600	800	100
1.5	33	66	100	133	166	200	250	330	400	500	660
2.0	25	50	75	100	125	150	200	250	300	400	500
2.5	20	40	60	80	100	120	160	200	240	320	400
3.0	17	33	50	66	83	100	133	165	200	266	330
4.0	12	25	37	50	73	75	100	125	150	200	300
5.0	10	20	30	40	50	60	80	100	120	160	200
6.0	8	16	25	33	40	50	66	83	100	132	166
7.0	7	14	20	28	35	40	55	70	80	110	140
10.0	5	10	15	20	25	30	40	50	60	80	100
12.0	4	8	13	17	20	25	33	42	50	66	82
15.0	3	7	10	13	17	20	25	33	40	50	66
20.0	2	5	8	10	13	15	20	25	30	40	50

Most often, fertilizer recommendations are based on the amount of N to apply. However, the information in Chart 2 and the earlier four step calculations can be used for any element. For example, a soil test might recommend an application of P, but not N and K. In this case the choice of rock phosphate would be best and so the procedure outlined here and Chart 2 would be used for P rather than N.

[z]Adapted from: Morehouse C. and A. Barker. 1980. Natural Fertilizers in the Home Vegetable Garden. Cooperative Extension Service, University of Massachusetts.

Daylily Streak and Daylily Rust

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Daylilies *(Hemerocallis* spp.) are planted extensively throughout the United States and thousands of varieties have been developed. Once established in a landscape, daylilies require little maintenance, are drought tolerant, have no special pH or fertilization requirements, and are generally disease and insect free. Recently, however two diseases, Daylily Streak and Daylily Rust, have emerged that threaten the daylily industry. Daylily Rust caused by *Puccinia hemerocallidis* and Daylily Streak caused by *Aureobasidium microstictum* are easily confused. A quick diagnostic test is to run your finger along the underside of leaf lesions; an orange, powdery residue will result from the spores of Daylily Rust.

Daylily Streak *Aureobasidium microsnctum*

Initial symptoms of Day lily Streak are a central, yellow streak along the leaf midrib that often starts at the leaf tips and progresses downward. This initial streak is followed by necrosis both in the surrounding green tissue and the yellow streak itself. Small reddish brown flecks and oval, elongated necrotic lesions develop on infected foliage. Diseased foliage may wither and die completely. Daylily streak can be avoided by purchasing disease-free stock plants and propagating only from healthy plants. Cultivars differ in their susceptibility to this disease; proper selection of varieties can potentially limit this disease. Daylily Streak is primarily spread by water splash; proper plant spacing and minimizing overhead irrigation can slow disease development. The pathogen can also be disseminated by workers and tools, especially when leaves are wet. Leaf streak fails to develop when temperatures are above 90° F. Isolate infected plant material from healthy day lilies. Fungicides may be applied to protect susceptible new foliage and effective materials include: thiophanate methyl (Cleary's 3336, FungoFlo), myclobutanil (Eagle), chlorothalonil (Daconil, Echo 90DF), and azoxystrobin (Heritage).

Daylily Rust *Puccinia hemerocallidis*

Daylily Rust was first found in Georgia and Florida in 2000 and has since spread to 30 other states, including Massachusetts. The pathogen is native to Asia and is thought to have entered the United States on infected plant material from Central America. *P. hemerocallidis* first appears on the leaves as small, water soaked spots which expand and become raised to form pustules on both upper and lower leaf surfaces. Yellow-orange to orange-red spores are released from these pustules and can be carried by wind, water, workers, and tools. Although different cultivars react differently, most often infected leaves yellow, turn necrotic, and dry up. It is not known whether infection of tubers occurs. *P. hemerocallidis* requires two distinct hosts to complete its life cycle (heteroecious rust). The alternate host is the perennial *Patrinia* ; six species of this genus are grown and old as ornamentals. However, on Daylily *P. hemerocallidis* produces polycyclic or repeating stage spores (urediospores) and does not require the alternate host for disease development. Once a Daylily plant produces spores the disease can spread rapidly to other Daylily plants. Following inoculation of leaves, infections can appear in as little as two to three days. Not only does the rust have a short incubation period, but it also spreads fairly quickly in nurseries.

Daylily varieties differ in susceptibility to the rust. In Massachusetts daylily rust was diagnosed on the "Twice as Nice" daylily collection. The cultivars 'Raspberry Candy' and 'All Fired Up' are the two cultivars in this line that have shown the worst symptoms, with other cultivars, such as 'Moonlight Masquerade', showing less severe symptoms. There are fourteen cultivars in this product line. Varieties in other states which have been reported to be affected since 2000 include:

Attribution, Gertrude Condon, Crystal Tide, Colonel Scarborough, Starstruck, Joan Senior, Imperial Guard, Double Buttercup and Stella De Oro. Symptoms range from bright yellow spots to streaks.

Suspect Daylilies should be confIrmed by a Diagnostic Lab. Contact M. Bess Dicklow at the UMass Extension Plant Diagnostic Lab at (413)545-3209, mbdicklo@umext.urnass.edu.

Sanitation is very important in managing this disease. Remove and destroy all infected plants. Purchase disease-free plants from reputable growers and propagate only from clean plant material. Minimize periods of leaf wetness by avoiding overhead watering and proper plant spacing. Protect uninfected plants with azoxystrobin (Heritage), propiconazole (Banner Maxx), myclobufanil (Eagle), chlorothalonil (Daconil), thiophanate-methyl (Cleary's 3336), triadimefon (Strike), or triflumizole (Terraguard). Check labels for broad crop clearance before applying fungicides.

More information and photos of daylily rust are available from the following websites:

Daylily Rust - Massachusetts Introduced Pests Outreach Project
http://jmassnrc.org/pests/pestFAQsheets/daylilyrust.html

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Free Late Blight Posters Available

Garden retailers can help prevent the spread of late blight in gardens and on farms this growing season and provide customers with the facts about this disease (see article, next page). Grow your own transplants from seed or purchase locally grown plants. Late blight is not seedborne in tomatoes (however, it is tuber-borne in potato), so tomato plants started from seed locally would be free of the disease. To help with this educational effort free colored posters are available.

"Disease-Free Vegetable transplants - Buy Locally Grown" small, colored posters with photos of late blight on tomatoes are available to garden retailers. To receive your FREE poster, contact Rob Wick, UMass Extension, email: rwick@pltpath.umass.edu or call (413)545-1045.

Surface Water for Irrigation

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Rivers, streams and ponds are an alternate source of irrigation water to wells or a municipal system. They can be less expensive to develop but generally have more problems in water quality and quantity.

Quantity of water

Surface water sources are dependant on runoff from adjacent land or from ground water springs. These are dependant on rainfall rates that vary from year to year. Rainfall rates are highest during the rainy season which in New England is usually in the spring. During the late spring, summer and early fall when irrigation needs are the greatest the rainfall rate is usually lower.

If available, check water flow rates, flooding and maximum height for a river or stream to see if it will supply the quantity of water needed. If this is not available, a check with the local NRCS office or town officials may give some indication of what water is available. Water supply from a pond is more difficult to assess as it is subject to runoff from adjacent land or springs as well as evaporation and leakage. A common method of determining the flow of water from a stream or outlet from a pond is to multiply the average speed of flow (ft/min) x the cross-sectional area (sq ft) x 7.48 gal/cu ft = gallons/minute. For example: a brook with an average stream flow rate of 50 ft/min and 2 sq ft of cross-section will have a flow of 748 gpm (50 fpm x 2 sq ft x 7.48 gal/cu ft = 748 gpm). A weir could be used to more accurately determine cross-section area.

Water use rates are related to transpiration and evaporation. For most sections of the U.S. a maximum rate is about 0.4"/day on the warmest days. This translates into about 0.25 gallons/sq ft/day of growing area. In greenhouses, use rates can exceed this at times dependant on air movement, container size and color and temperature that the greenhouse is operated.

Water Quality

Surface water is subject to contamination from a number of sources such as sediment, chemicals and plant growth. These may need to be removed to make the water usable in an irrigation system. Tests for total suspended solids, volatile suspended solids, total dissolved solids, pH, conductivity and some of the key elements should be the first step in evaluating a source of surface water.

Sediment. Suspended particles such as, soil, clay and sand from runoff from adjacent agricultural land, construction sites and bank erosion can affect the operation of pumps, piping and nozzles. High levels of particles can reduce the life of pumps and clog sprinklers. Water samples taken at different times of the year and after a heavy rainfall can help to determine the concentration of suspended solids.

The type and size of filters will vary with the size and amount of the particles and the type of irrigation nozzles used. Multiple filters may be required. A common filter for dirty water is self flushing. When the pressure difference between the intake and exit is above a certain level, the filter will be flushed and water dumped.

Algae and bacteria. High light levels and temperature along with carbon dioxide, nitrogen, phosphorus and trace elements influence the development of algae. A pump or compressor aerator that circulates the water and introduces oxygen may be needed. Recently wind and solar powered aerators have become available. Slime caused by the presence of bacteria can clog irrigation systems. Development of these may be from hydrogen sulfides, iron bacteria or manganese present in the water.

Animal organisms. Protozoans, zooplanktons, small crustacean and fish can create blockages in irrigation pipes and nozzles. Water fleas and water mites are also present at certain times in the year. Filtration is needed.

Chemical sediments. **S**urface water is likely to have the presence of chemicals from runoff of adjacent fields or from illegal industrial waste. It is also possible to have harmful quantities of chemicals such as chlorine, boron and other salts that are found naturally in the soil. One of the most common pollutants found in New England streams is high nitrate levels from manure application and fertilizer used on dairy farms. It is also possible to have water that has a harmful level of herbicides from agricultural fields near the stream.

Location of the water source

The distance and elevation of the water source in relation to the greenhouse should be considered. The amount of trenching needed and the location of the pump can add to the cost of the installation. You should know the total cost of pumping water before you decide if the source is viable.

Maintenance of the equipment and water source also adds to the cost. Fencing may be needed to keep animals and children out. The dam on a pond will require mowing and cleaning of overflow pipes. A buffer may have to be installed to filter out sediment and pollutants.

Water diversion regulations

Water right laws have been passed in many states that limit the amount of water that can be use. For example, in Connecticut daily consumption of 50,000 gallons or more requires a permit from the Department of Environmental Protection. Digging a pond does not require a State permit but taking more than 50,000 gallons/day out does. A pond with a dam below grade does not require a permit but an above ground one does. An application for a diversion is expensive and may take up to a year to obtain. Annual reports of water usage are required.

Discharges of water from garden center, nursery or greenhouse operations of more than 5 acres of impervious surface require a non-storm water discharge permit.

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