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Storage of Tender Bulbs

Many of the ornamental plants that adorn our landscape form storage bulbs or roots as a means of survival from one growing season to the next in their native habitat. Since many of these species are not winter hardy at our latitude these storage structures should be dug and stored soon after the tops are killed by freezing temperatures. Examples of such garden plants include (tuberous) begonia, caladium, canna, elephant ear, gladiolus, dahlia and others.

Proper storage is important to make sure these bulbs will survive the winter months and make a glorious display of color in our garden the following growing season. Temperature and moisture are two important storage conditions that influence greatly the ability to store successfully any bulb or root.

Tuberous begonias should be dug immediately after the first killing frost. Allow the tops of the plant to remain on the tubers and spread them in a warm, dry location to dry thoroughly. After about 14 days remove the tops of the plants from the tubers and store the latter in peat moss, vermiculite or sawdust that is slightly moist. Begonia tubers should be stored at temperatures between 40 and 50 degrees F.

Cannas should be cut to the ground after the tops have frozen back and before the storage tubers are dug. Turn the tubers upside down after digging and allow them to dry outdoors for several hours. This will allow cut surface to begin to heal. Next move the tubers into a well-ventilated room to dry (cure) for several more days but not to the point that the tubers begin to shrivel. Place the tubers in dry peat moss, vermiculite or sand to keep them from drying out during the winter and store in a cool location but above freezing. A temperature of 40 degrees F is considered ideal. Do not be concerned if a bit of soil adheres to the tubers; it will not be harmful unless it contains pathogens.

Dahlia roots tend to be a bit more challenging to store than other tuberous roots because they have a thin skin that causes them to dry excessively unless protected. When digging dahlia roots take care not to damage the narrow neck between the crown of the plant and the thicker storage root. Allow the roots to dry for several days in a warm, dry location that is well-ventilated. Pack them in boxes filled with moistened peat moss or vermiculite and store them at a temperature close to 40 degrees F. A single dahlia plant often forms two or more healthy storage roots in one season of growth. Unless storage conditions are ideal it is best to wait until the following spring to divide these roots.

Gladiolus should be dug and allowed to dry in a room that is warm, dry and well ventilated. The storage organ of a gladiolus is a short, thick underground portion of the stem called a "corm". New corms form immediately above the corm planted the previous spring. After the tops have dried they can be removed from the new corm along with the old corm and any "cormels". Clean the corms and store in open boxes or hang them in mesh bags at temperatures between 40 and 50 degrees F.

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Fall 2008 Diagnostic Clinic Report

We do not receive as many samples in the fall, however many of the fall samples we received in October this year were impacted by the weather we had during the growing season, especially the excessively wet weather this year. Saturated soils and leaf wetness are very conducive to disease development.

Some of our samples recently have come from trees, and a variety of fungal leaf spots have been submitted. These were discussed in October, but in particular, we have continued to receive some oak samples with Tubakia leaf spot. See <http://agebb.missouri.edu/pdc/diagnosticreports/leafspot01.htm>.

We have also received a number of samples from declining trees. In some cases, this appears to be dieback that may have initially occurred during the unprecedented Easter freeze of 2007. Recent silver maple samples fall into this category. It is important to remember that the event caused severe stress to the trees and recovery is a lengthy process. See <http://ppp.missouri.edu/newsletters/meg/archives/v14n3/a2.pdf> or <http://extension.missouri.edu/explore/reports/xr0001.htm>.



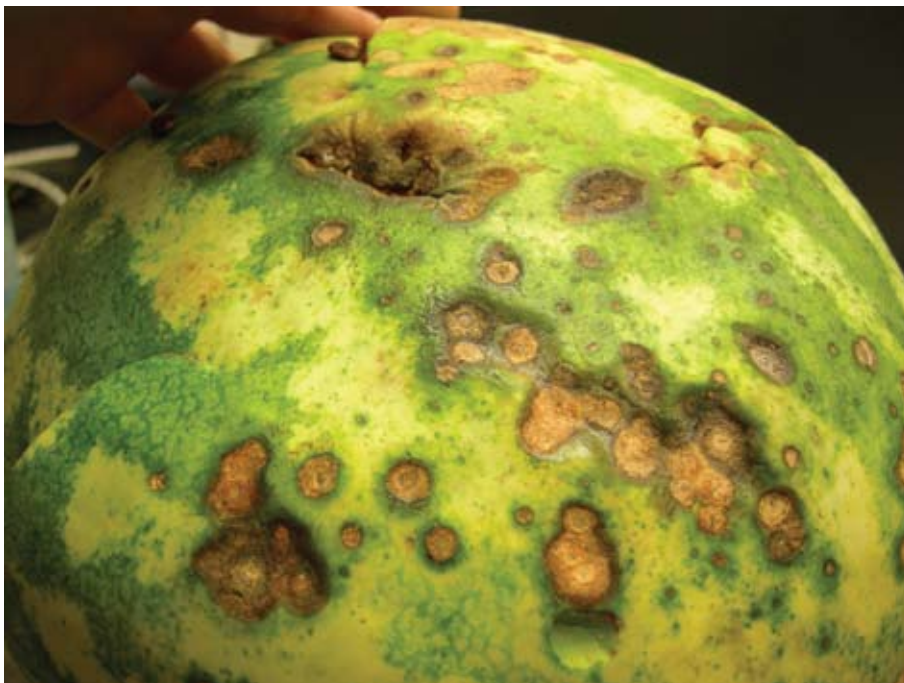
Leaf Mold, Fulvia fulva, on tomato leaf underside.

Declining white pine is frequently submitted to the plant diagnostic clinic. These samples may have been stressed by many different events, but this year waterlogged soils in areas with poor drainage or heavy clay soils would be an additional possibility. Our recent samples have had needles slowly or

rapidly turning yellow and brown. Some have had extensive insect infestations as well, mostly bark beetles on trees that were likely already severely stressed. None of the white pine samples we have recently received have been positive for pine wilt nematode, although we have had a few positives in the past. See <http://www.ppdl.purdue.edu/ppdl/weeklyphics/8-16-04.html>.

A recent juniper sample was displaying dieback within the interior of the tree as well as some of the lower branches. We were able to find *Cercospora* needle blight (*Cercospora sequoiae* var. *juniperi*) as well as spruce spider mites. We have not frequently found *Cercospora* needle blight on juniper samples submitted to the diagnostic clinic, and wet weather this year may have played an important role in disease development. More frequently we see *Phomopsis* tip blight during the growing season and *Kabatina* tip blight in late winter and early spring. See <http://www.oznet.ksu.edu/library/plant2/c711.pdf>.

We have had a few fruit and vegetable submissions this fall. Recently we received tomato samples with leaf



Anthracnose lesions on watermelon fruit.

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mold (*Fulvia fulva*) from greenhouse and high tunnel growers. High levels of humidity and poor air movement as these structures are closed up during cold weather may increase the potential for significant infection. See http://web.aces.uiuc.edu/vista/pdf_pubs/941.pdf <http://ohioline.osu.edu/~vegnet/news/currentvn15-07.htm>.

We have had several cucurbit samples this year with extensive anthracnose (*Colletotrichum obiculare*) infection. An additional late watermelon sample was recently submitted. As with many diseases this year, the wet weather probably contributed to severe symptoms development, but it will also be important to keep the disease in mind for next year when growing these crops in areas where the disease has been a problem. Crop rotation and destruction of this year's plant residues will be especially important. See <http://www.oznet.ksu.edu/path-ext/factSheets/Cucumber/>

[Anthracnose%20of%20Cucurbits.asp](#) for more information.

A recent strawberry sample had a lot of foliar insect injury. The leaves were completely riddled with small holes. It can be challenging to identify the insect responsible without seeing the insect, however small holes throughout the leaves are consistent with strawberry rootworm (*Paria fragariae*) feeding by the adult beetles. We receive a few of these samples each year. Because the adults feed at night, by going out with a flashlight and checking the plants, it may be possible to catch the culprit in action. See http://www.ipm.uiuc.edu/fruits/insects/strawberry_rootworm/index.html for more information.

Finally, we had some fall bedding plant samples as well. Wet weather played a role here as well, with an annual vinca submission with a Rhizoctonia blight and a geranium sample with a Pythium root and stem rot. While infection may have occurred earlier

in the year for both these samples, we would normally expect the Rhizoctonia blight to occur on bedding plants like vinca during hot, wet, "steamy" summer weather, and it appeared that much of the infection had occurred earlier in the summer. See <http://www.aces.edu/pubs/docs/A/ANR-1023/ANR-1023.pdf> and <http://floriculture.osu.edu/archive/sep00/bleggr.html>.

Sample submission can provide you with an accurate diagnosis to allow you to manage your plant problems, as well as allow us to provide comprehensive updates in the newsletter. Please refer to the sample submission section of our website <http://soilplantlab.missouri.edu/plant/index.htm> or contact us for more information on sample submission.

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Caladium and elephant ear are tropical plants grown for their showy foliage. Since they are tropical in nature they must be stored at warmer temperatures. After digging, remove excess soil from bulbs or tubers but do not wash them. Allow them to dry in a warm, dry location with good air circulation for 7 to 10 days. After drying, pull off the foliage of the

caladiums but cut off the foliage of the elephant ear about two to three inches above the bulb. Place the dried bulbs or tubers in dry peat moss or vermiculite and store at about 60 degree F.

In all cases, it is a good idea to check stored material periodically during the winter months and remove any that might be diseased. At the same time, check moisture status of the bulbs

stored in moist media such as peat moss or vermiculite. As a general rule, it is better to error on the dry side rather than the wet. Excess moisture in storage can be very damaging.

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**COMMERCIAL
PESTICIDE
APPLICATOR
TRAINING**

COMING JANUARY 2009

Pesticide applicator training helps reduce the harmful effects of improper pesticide use. The University of Missouri Extension Commercial Pesticide Program provides educational outreach for individuals who wish to become licensed commercial pesticide applicators. Licensed applicators must pass an exam and participate in continuing education courses on environmentally sound uses of pesticides.

For more information on training dates and registration, visit us at <http://ppp.missouri.edu/pat>

Safeguarding Missouri's Citizens and Agriculture through PAT

The safe and responsible use of pesticides is of up-most importance to Missouri's agricultural sector and its citizens. All pesticides used in the U.S. must be registered (licensed) by the Environmental Protection Agency (EPA). Registration of pesticides assures they will be properly labeled and if used in accordance with specifications, will not cause unreasonable harm to the environment.

During the decade that made up the nineteen-sixties, there arose a new awareness of ecology and the environmental resulting in an outcry of public concern over all types of environmental contamination from smoking, belching chimneys and smog; foul water, rivers and streams, as well as pollution from pesticides. Up until that time the old adage of "if a little works, a lot will work better!" was the major premise for applying chemicals to address pest problems on the farm and around the home.

As a result of this public outcry, the EPA and Congress enacted a "new" pesticide law, *the Federal Insecticide, Fungicide, Rodenticide Act* (FIFRA) in the early 1970s that provided the impetus to establish a national program of federal/state certification of pesticide applicators. The primary focus of this new law was to provide federal control of pesticide distribution, sales, and use. Under FIFRA, the EPA was given authority not only to study the consequences of pesticide usage but also to require users to register when purchasing restricted use pesticides. One of the goals of this program would be to provide the quantity and quality of information needed for various levels of persons using pesticides, ranging from structural pest control specialist to farm laborers.

Because of continuing public concerns over potential effects of pesticides on human health and the environment, new laws and regulations that govern pesticides and their use make an intensive training program essential. For example, there were several changes in the recently implemented Worker Protection Standard. Additional new legislation which provides training opportunities

for this program includes the Endangered Species Program and the Federal Record keeping Requirement.

The University of Missouri along with the Missouri Department of Agriculture provides certification and recertification for this diverse sector of individuals involved in the pesticide industry. Since the inception of Missouri's pesticide training program, over 6,000 commercial pesticide applicators have received at least initial training. Every three years, these applicators must be recertified by training programs conducted by University Extension as mandated by the Missouri Department of Agriculture's Bureau of Pesticide Control.

The University of Missouri Extension Pesticide Program provides educational outreach for individuals aspiring to become licensed commercial pesticide applicators as well as private applicators. If you engage in the application of a restricted-use pesticide for hire you are considered a commercial applicator. If you engage in pesticide application for the purposes of producing an agricultural commodity on property you or your employer owns, or rent without compensation other than trading of personal services between producers of agricultural commodities you are considered a private applicator. Private pesticide applicator training is available at the local level through your regional extension offices. It requires no exam to be certified or recertified.

The commercial applicator program involves two areas of instruction: a core training session in which all trainees attend and the specialty category section in which the attendees conduct their business activities. The core training session provides basic pesticide knowledge which impacts all pesticide applicators. The instruction is provided by persons representing several agencies including the Missouri Department of Agriculture, Missouri Department of Natural Resources and University Extension.

Missourians wishing to become licensed commercial applicators must pass a core exam, as well as a category exam tailored to the specific area in which

they wish to become certified. There are 11 different specialty categories within the commercial PAT program (category 1 has two sections: 1A: Agricultural Plant, and 1B: Ag. Animal Pest Control and category 7 has three sections: 7A: General Structural Pest; 7B: Termite; and 7C: Fumigation Pest Control).

Applicators can certify in one or more of the following categories depending on which area of expertise you are qualifying for.

Commercial Pesticide Applicator Categories:

- Category 1A: Agricultural Plant Pest Control
- Category 1B: Agricultural Animal Pest Control
- Category 2: Forest Pest Control
- Category 3: Ornamental and Turf Pest Control
- Category 4: Seed Treatment Pest Control
- Category 5: Aquatic Pest Control
- Category 6: Right-of-Way Pest Control
- Category 7A: General Structural Pest Control
- Category 7B: Termite Pest Control
- Category 7C: Fumigation Pest Control
- Category 8: Public Health Pest Control
- Category 9: Regulatory Pest Control
- Category 10: Demonstration and Research Pest Control
- Category 11a: Wood Products Pest Control

Training programs are conducted every January in Springfield, Kansas City, Cape Girardeau, St. Louis and Columbia. For dates and locations check out the Plant Protection Programs web site at: <http://ppp.missouri.edu/pat/training.htm>.

(Information used in this article came in part from MU Extension publications and Purdue Extension)

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Pesticide Recertification & Missouri Green industry Conference

The Missouri Turf & Ornamental Council will be offering pesticide recertification for those licensed in Category 3 (Ornamental & Turf). The Missouri Green Industry Conference (Sponsored by MoTOC) will be held December 3-4 at the St. Charles Convention Center in St. Charles, Missouri. Information and online registration is available at <http://www.motoc.org/index>. If you wish to be recertified and attend other educational seminars in your area of expertise, this is the conference for you.

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December Gardening Calendar

Houseplants

- **Weeks 1-4:** Water houseplants with tepid water. Cold tap water may shock plants
- **Weeks 1-4:** Be sure newly purchased indoor plants are well protected for the trip home. Exposure to icy temperatures for even a few moments may cause injury.
- **Weeks 1-4:** Overwintering geraniums like bright light and cool temperatures. Keep soils on the dry side
- **Weeks 1-4:** On cold nights, move houseplants back from icy windows to prevent chilling injury.
- **Weeks 3-4:** Mulch flower and bulb beds after the ground freezes, to prevent injury to plants from frost heaving.
- **Weeks 2-4:** Holiday Poinsettia basics: Sun for at least half of the day. Keep away from drafts, registers and radiators. Night temperatures in 50's or low 60's, days at 70 degrees. The soil should dry only slightly between thorough waterings. Discard the drainage. Be sure to punch holes in the decorative foil wraps to prevent soggy soil conditions.

Ornamentals

- **Weeks 1-4:** Hairspray works well to keep seed heads and dried flowers intact on wreaths and arrangements.
- **Weeks 1-4:** Living Christmas tree basics: - dig the planting hole before the ground freezes. - mulch and cover the backfill soil and the planting hole to keep them dry and unfrozen. - don't allow the tree's roots to become dry. - spray with an anti-transpirant to reduce needle moisture loss. - store the tree outdoors in a cool, shady, windless area until the last minute. Mulch the roots to prevent cold injury. - set the tree up in your coolest room. - don't keep the tree indoors for more than one week. Plant outdoors promptly.
- **Weeks 1-4:** Be sure the root zones of azaleas and rhododendrons are thoroughly mulched. Any organic material will do, but mulches made from oak leaves, shredded oak bark, or pine needles are preferred.
- **Weeks 1-3:** Christmas trees hold needles longer if you make a clean, fresh cut at the base and always keep the trunk standing in water.
- **Weeks 1-3:** Only female holly trees bear the colorful berries. There must be a male tree growing nearby for pollination, if fruits are desired.
- **Weeks 1-3:** Hollies may be trimmed now and the prunings used in holiday decorations.

Miscellaneous

- **Week 1:** If you feed rabbits corn or alfalfa, they may leave fruit tree bark unharmed.
- **Week 1:** Apply mulches to bulbs, perennials and other small plants once the ground freezes.
- **Week 1:** All power equipment should be winterized before storage. Change the oil and lubricate moving parts. Either drain fuel systems or mix a gas stabilizing additive into the tank.
- **Week 1:** Clean and oil all garden hand tools before storing for winter.