REPORT FOR MINI-GRANT
2006

INTEGRATED PEST MANAGEMENT FOR MASTER GARDENERS

Grant Recipients

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Thanksgiving Point Office

Original Grant

INTEGRATED PEST MANAGEMENT FOR MASTER GARDENERS

Project leader

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Cooperators

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Gretchen Campbell, Utah State University Advanced Master Gardener Coordinator
Jay McEntire, Utah State University Webmaster
Utah County Master Gardener Organization
Thanksgiving Point Advanced Master Gardeners
Tooele County Master Gardener Organization
Davis County Master Gardeners
Salt Lake County Advanced Master Gardeners
Cache County Master Gardeners

Situation Statement

Many Master Gardeners volunteer for Utah State University Extension Service each year. Many of these volunteer in diagnostic clinics and some are in counties without horticultural expertise. Many could and would do much more to help Extension programs but they lack diagnostic training.

Most of the Master Gardener classes have less than five hours of training and this is not sufficient training for most volunteers to fell comfortable diagnosing plant problems. There is a critical need to train these Master Gardener Volunteers in pest identification and in Integrated Pest Management.

Providing additional training would better help Master Gardeners to staff diagnostic clinics, do additional workshops and classes incorporating IPM techniques. It would also help them answer questions at Master Gardener booths at state and county fairs, home and garden shows and other venues.

Providing this training is essential to keep Master Gardeners up to date and to keep them excited and motivated to continue to help Utah State University Extension with disseminating horticultural information.

This information will be placed on the USU website but the CD format is very important because Master Gardeners often host clinics where they do not have internet access but computer access is usually available.

Objectives

- Develop diagnostic and IPM training materials to be utilized by Master Gardeners on a statewide basis.
- Provide an Integrated Pest Management and a diagnostic CD to each Master Gardener trained in Utah in 2006.
- Train 100 Utah State University Advanced Master Gardeners in pest identification and advanced IPM practices for trees and shrubs.
- Train 65 Utah State University beginning Master Gardeners in basic IPM practices and in techniques to share those with the public.
- Develop printed fact sheets that outline Integrated Pest Management for distribution by Master Gardeners at educational events.

Procedures

- Train 50 Utah State University Advanced Master Gardeners in advanced diagnostic and pest management techniques emphasizing IPM Practices at workshops to be held on a regional basis between May 15 and September 1, 2005.
- Train 65 Utah State University Extension Beginning Master Gardeners in basic IPM practices and sharing information with the public. Focus IPM technique training to change pesticide use practices and reduce pesticide impacts.
- Develop and implement concise IPM materials for inclusion in the Statewide Master Gardener manual to be used starting September 2005.
- Develop and implement concise, reproducible IPM fact sheets for inclusion in county and State events for 2006.
- Integrated Pest Management information will be disseminated in an article published in a statewide newspaper and two regional newspapers. Similar information will also be provided through the USU information office to all media outlets in the state.
- Offer IPM training on a statewide and regional basis through two radio programs. Include IPM information on web sites for KSL radio and television, and Utah Sate University.

Techniques

Develop at CD ROM Pest Control, Diagnostics and IPM manual for Horticultural Plants that will be distributed to all advanced Master Gardeners as a resource and as part of their training.

Train Fifty Utah State University Advanced Master Gardeners in advanced diagnostic and IPM techniques in Tooele, Salt Lake, Davis, Cache and Utah Counties. The training will be conducted by USU Extension Horticulture Agents, USU Paraprofessionals and appropriate USU Specialists.

- Classes and training will be done in two parts. They will include classroom sections and outdoor, hands-on clinics.
- The training will be evaluated by pre and post testing to determine the knowledge and skills gained by teaching integrated pest management techniques and diagnostic techniques Master Gardeners.

Budget

Audiovisual equipment, supplies, and materials to develop training aides	$	400.00
Travel	$	565.00
Workshop supplies and preparation	$	550.00
Preparation and reproduction of diagnostic and IPM CD	$	1,000.00
Contract help for preparing diagnostic CD and IPM materials	$	850.00
Total	**$**	**3,365.00**

FUNDING SOURCES

IPM Mini Grant	**$**	**1,650.00**

Other Sources

Funding provided by County Master Gardeners organizations	$	1,000.00
In-kind contributions from Master Gardeners and USU counties	$	665.00
Total	**$**	**3,365.00**

Training Workshops

As a part of the Integrated Pest Management Training for Master Gardeners, eight groups of Utah State University Extension Master Gardeners and one group of professional Pest Control Operators d were trained in plant pest diagnostics in courses in May, June, August and September.

Three classes were for basic Master Garden classes, three were for advanced classes and one was done as a statewide training. More than 200 master gardeners were trained in basic or advanced diagnostic skills.

The basic training courses were done for Master Gardener participants at Thanksgiving Point Gardens, Salt Lake County and in Tooele County. These workshops covered landscape insects and diseases, weeds, environmental problems and irrigations problems.

More than 100 beginning master gardeners received both classroom training on plant pathology, entomology and weed science. In addition, they received specific diagnostic training to help them understand and determine what pests they are dealing with. This is critical in determining the pest and implanting a successful IPM program.

Advanced Master Gardeners from Utah, Davis, Tooele, Summit, Weber, Morgan and Salt Lake Counties were trained in diagnosing pests and problems in a series of workshops held in May and June at the International Peace Gardens in Salt Lake City.

In this training, each participant learned how to identify the problem, look for problems, delineate time-development of damage patterns, determine causes of the plant damage whether living-pathogens, insects, mites or non-living-mechanical, physical or chemical causes. They then learned to make a diagnosis to determine the probable cause for the plant failure.

One important concept was teaching what is normal for a plant so that we could better understand if there truly is a problem or if it was a normal function of the plant. This separates real from perceived problems, which is a great help in a good IPM program because many individuals mistakenly apply a pesticide when there is no pest present.

The hands on workshops covered insect pests, pathogenic and non-pathogenic diseases and other genetic problems. The participants identified more than forty problems in the field and learned how to distinguish different causal organisms. More than 100 Advanced Master Gardeners received this training.

The final training was done as a day long statewide training. (See separate report) Participants were trained in the classroom and by onsite landscapes in the Thanksgiving Point Gardens.

These Master Gardeners are the first contact that many clients contact in the USU offices so it is important that they receive good training in diagnostics. Training included ornamental pests, vegetable pests, turfgrass pests and fruit pests. Each participant received diagnostic training

and will receive the Master Gardener diagnostic CD to help them in clinics and at the Extension offices.

Developed concise IPM materials for inclusion in the Master Gardener manual.

Integrated Pest Management information was disseminated in articles published in a statewide newspaper and regional newspapers. (See Supplemental Material)

Offer IPM training on a statewide and regional basis through radio programs. Include IPM information on web sites for KSL radio and television, and Utah Sate University. (See Supplemental Materials)

AGENDA for the

SECOND ANNUAL USU HORTICULTURE DIAGNOSTIC WORKSHOP

Thanksgiving Point Gardens - Lehi, Utah

9:00 a.m. - 12:00 p.m. DIAGNOSING PESTS in the LANDSCAPE – INSECT AND DISEASE TOUR of THANKSGIVING POINT GARDENS and SAMPLE DIAGNOSIS

Larry Sagers (USU Horticulture Specialist), Adrian Hinton (USU Extension Horticulturist) and Tony Latimer (Pest Control Specialist, Thanksgiving Point) - Tour Guides

12:00 - 1:00 p.m. LUNCH on YOUR OWN (see restaurant list)

1:00 p.m. CONTROLLING INSECTS in the VEGETABLE GARDEN

Erin Hodgson, USU Extension Entomology Specialist

2:00 p.m. QUARANTINE PEST PROBLEMS (INCLUDING THE NEWLY-DISCOVERED JAPANESE BEETLES)

Rich Riding, Utah Department of Food and Agriculture

3:00 P.M. ABIOTIC DISEASES in the LANDSCAPE

Loralie Cox, USU Extension Agent - Cache County

Questions and Answers

4:00 p.m. ADJOURN - ***HAVE A SAFE JOURNEY HOME!***

Master Gardener Diagnostic Training
Thanksgiving Point Gardens

The object of the diagnostic training was to train those Master Gardeners, paraprofessional extension service personnel and agents in the art and science of plant problem diagnosis.

These key individuals could then could go back to their respective counties and help assist the Extension Agents by diagnosing pests and plant problems and try to get clients to integrate Integrated Pest Management practices.

The participants were trained by the following individuals and in the following subjects.

Diagnostic Training Field Diagnosis on Ornamentals, Adrian Hinton, Tony Latimer, Pest Management Specialist for Thanksgiving Point Gardens and Larry A. Sagers

This training lab was conducted at Thanksgiving Point Gardens and participants toured the gardens while being instructed on Ornamental Plant Problems. Thanksgiving Point Gardens was a great place to conduct this workshop because of the many different kinds of plants available including trees, shrubs, vines, groundcovers as well as annuals and perennials in an excellent garden setting.

The field training is very valuable because even though seeing problems on a slide during a lecture is one thing but to see the problems, to touch and examine them is a much better learning experience.

This workshop covered the most common problems in Utah lawns. Potential problems included insect pests, pathogenic diseases and nonpathogenic problems of soil compaction, thatch and fertility. The tour covered several turf problems including fairy ring, snow mold, sod webworm and several others.

Flower problems included cold temperatures, soil fertility, salt, watering problems and transplant shock.

We also examined many different tree problems including the importance of good planting and care practices and how they affect the IPM practices. Crown gall, borers, nutrient deficiencies, transplant problems and different scale and aphid problems were also shown in the gardens.

The tour participants were instructed on the importance of improving the health of the lawn by good cultural practices so that pesticides could be eliminated or reduced for many problems. Well cared for turf will often withstand outbreaks of a pest without showing damage.

The workshop emphasized practices that reduce or prevent weed problems. Turf weeds are often controlled by good watering, mowing and fertilization. If herbicides are needed, the timing and

the application techniques are important to make them more effective and the best chemical treatment for each weed problem.

We also examined many different tree problems including the importance of good planting and care practices and how they affect the IPM practices. Crown gall, borers, nutrient deficiencies, transplant problems and different scale and aphid problems were also shown in the gardens.

Summary

This day long, statewide diagnostic clinic, trained 40 Master Gardeners, USU paraprofessionals, Extension Agents and professional nursery personnel in diagnostic identification and in correct IPM practices for several different crops and many ornamental plants.

They can now better serve the Extension Offices and agents by helping with diagnostic clinics in their own counties and help with training of other gardeners. Training Master Gardeners helps them teach the public correct information on how to identify pest problems. Teaching them good IPM practices helps them implement those, instead of the common mentality that spraying with chemicals is the best way to control any problem.

Erin Hodgson, USU Extension Entomologist helping with Master Gardener diagnostic tour.

Dallas Holmes and Janice Young USU Advanced Master Gardeners at Diagnostic clinic for Master Gardeners held at Thanksgiving Point Gardens

Larry Sagers, USU Horticulture Specialist discussing Integrated Pest Management of turfgrass on the Master Gardener Diagnostic workshop held at Thanksgiving Point Gardens

Professional Horticulture Diagnostic Workshop

Sponsored by the Utah State Pest Control and Lawn Care Association and Utah State University

***Thursday, September 21, Thanksgiving Point Gardens, Lehi, UT,**

9:00 a.m. - 3:15 p.m.

For: Pest Control operators to update all diagnostic skills on the latest insects, diseases and weed problems and their control.

AGENDA:

***8:45 a.m. Registration**
***9:00 a.m. - 12:00 p.m.* - Diagnosing Pests in the Landscape field tour – Thanksgiving Point Gardens, Larry Sagers, Utah State University Horticulture Specialist and Tony Latimar Pest Control Specialist Thanksgiving Point Gardens. (Pesticide Use)**

***12:00 p.m. - 1:15 p.m.* - _Lunch (Provided by the association), Safely Using Pesticides in the Landscape, Larry Sagers, Horticulture Specialist, USU Extension Service, (Pesticide Safety)**

***1:15 p.m. - 2:15 p.m.* Japanese Beetle Invasion inn Utah and Controlling Insects in the Landscape - Erin Hodgson, Entomology Specialist, Utah State University, (Pesticide Use)**

***2:15 p.m. - 3:15 p.m.* - Diseases in the Landscape and Turf Larry Sagers, Horticulture Specialist, USU Extension Service, (Pesticide Use)**

Tony Latimar, Pest control Specialist for Thanksgiving Point Gardens and USU Extension Advanced Master points out plant pests to the more 40 pest control operators in the IPM workshop held as a part of the grant requirements for the USU IPM grant.

This day long workshop trained more than forty professionals in turfgrass disease diagnosis, tree pests and flower pests. They have already requested we do a similar training program next season and do additional training at their annual convention next year.

Supplemental Materials Section

Examples of Mass Media IPM Materials Published or Broadcast During 2006

Materials for the Professional Pest Control Workshop Held August

A Systematic Approach to
DIAGNOSING PLANT DAMAGE

James L. Green, Extension Horticulture Specialist
Oregon State University
Corvallis, OR 97331 - 7304
Otis Maloy, Extension Plant Pathologist
Washington State Univerity
Pullman, WA 99164
Joe Capizzi, Extension Entomologist
Oregon State University
Corvallis, OR 97331

To determine what factors damaged a plant requires an inquisitive, investigative approach combined with careful observation and the ability to put all the pieces together to reconstruct the event(s) that produced the plant damage. Accurate diagnosis must be made before corrective action can be taken; even if no corrective measures are available, there is satisfaction in simply knowing what the problem is and what its future development might be.

INTRODUCTION

To determine what factors damaged a plant requires an inquisitive, investigative approach combined with careful observation and the ability to put all the pieces together to reconstruct the event(s) that produced the plant damage. Accurate diagnosis must be made before corrective action can be taken; even if no corrective measures are available, there is satisfaction in simply knowing what the problem is and what its future development might be.

Probability of correct diagnosis based on only one or two clues or symptoms is low. Similarities of symptoms produced on the same plant by completely different factors frequently make the use of symptoms alone inadequate.

In diagnosing plant damage a series of deductive steps can be followed to gather information and clues from the big, general situation down to the specific, individual plant or plant part. Through this systematic, diagnostic process of deduction and elimination, the most probable cause of the plant damage can be determined. Steps to follow in gathering diagnostic information are presented in **Table 1**. Each step will then be expanded and guidelines presented as we proceed through the diagnostic process. We will first identify the problem, then attempt to distinguish between living and nonliving damaging factors based on the observed damage patterns, development of the patterns with time, and other diagnostic signs.

Factors causing plant damage can be grouped into two major categories:

1. **Living factors**: living organisms such as *pathogens* (fungi bacteria, viruses, nematodes), and *pests* (insects, mites, mollusks, rodents...). With living factors, **"Something is missing, and something is gained."**
2. **Nonliving factors**: *mechanical factors* (i.e. breakage, abrasions, etc); *physical, environmental factors* (extremes of temperature, light, moisture, oxygen, lightning); and, *chemical factors* (chemical phytotoxicities, nutritional disorders, etc).

If we suspect that it is a **living damaging factor**, we will look for signs and symptoms to distinguish between pathogens and insects. If the accumulated evidence suggests that it is a pathogen, we will seek evidence to distinguish among fungal, bacterial, viral pathogens and nematodes. If the evidence indicates the damaging factor is an insect or other animal, we will seek further evidence to distinguish between sucking and chewing types.

If evidence indicates that the damage is being caused by **a nonliving factor**, we will seek further evidence as to whether the initial damage is occurring in the root or aerial environment. We will then attempt to determine if the damage results from MECHANICAL FACTORS, from extremes in PHYSICAL FACTORS (i.e. environmental factors such as extremes of temperature, light, moisture, oxygen), or from CHEMICAL FACTORS (i.e. phytotoxic chemicals or nutritional disorders). Once we have identified the plant and limited the range of probable causes of the damage, we can obtain further information to confirm our diagnosis from reference books, specialists such as plant pathologists, entomologists, horticulturists, and/or laboratory analyses.

Table 1. Flow Model for Diagnosing Plant Damage

I. DEFINE THE PROBLEM *(Determine that a "real" problem exists)*:

A. PLANT IDENTIFICATION and CHARACTERISTICS.
Establish what the "normal" plant would look like at this time of year. Describe the "abnormality": Symptoms & Signs.

B. EXAMINE THE ENTIRE PLANT AND ITS COMMUNITY.
Determine the primary problem and part of the plant where initial damage occurred.

II. LOOK FOR PATTERNS: On more than one plant? On more that one plant species?

A. NONUNIFORM DAMAGE PATTERN (scattered damage on one or only a few plant species) is indicative of *living factors* (pathogens, insects, etc).

B. UNIFORM DAMAGE PATTERN over a large area (i.e. damage patters on several plant species) and uniform pattern on the individual plant and plant parts indicates, *nonliving factors* (mechanical, physical, or chemical factors).

III. DELINEATE TIME-DEVELOPMENT OF DAMAGE PATTERN:

A. Progressive spread of the damage on a plant onto other plants, or over an area with time indicates damage caused by *living organisms*.

B. Damage occurs, does not spread to other plants or parts of the affected plant. Clear line of demarcation between damaged and undamaged tissues. These clues indicate *nonliving damaging factors*.

IV. DETERMINE CAUSES OF THE PLANT DAMAGE. Ask questions and gather information.

A. DISTINGUISH AMONG LIVING FACTORS.

1. Symptoms and signs of PATHOGENS.
2. Symptoms and signs of INSECTS, MITES, and OTHER ANIMALS.

B. DISTINGUISH AMONG NONLIVING FACTORS

1. MECHANICAL FACTORS
2. PHYSICAL FACTORS

a. Temperature extremes
b. Light extremes
c. Oxygen and moisture extremes

3. CHEMICAL FACTORS

a. Analyze damage patterns in fields and other plantings
b. Injury patterns on individual plants.
c. Pesticide-pollutant phyotoxicities - damage, patterns.
d. Nutritional disorders-key to nutritional disorders.

C. REFFRENCES (check reports of damaging factors on identified plant); may need LABOROTORY ANALYSES to narrow range of probable causes.

V. SYNTHESIS OF INFORMATION TO DETERMINE PROBABLE CAUSES.

I. DEFINE THE PROBLEM

PLANT IDENTIFICATION AND CHARACTERISTICS -GROWTH AND APPEARANCE OF THE "IDENTIFIED" PLANT -Normal? -Abnormal?

Determine that *real* problem exists. It is essential that the plant be identified (genus, species and cultivar or variety) so that the *normal* appearance of that plant can be established either by personal knowledge or by utilizing plant reference books. Many horticultural plants, or structures on those plants such as fruits, seeds, lenticels, etc. may appear to be abnormal to the person who is not familiar with the specific plant. For example, the 'Sunburst' honey locust might appear to be suffering from a nutrient deficiency because of its chlorotic yellow-green leaf color, but it was selected because of this genetic characteristic...IT IS NOT ABNORMAL FOR THIS PLANT. Therefore, it is not a problem.

Always compare the *typical* diseased plant with a healthy or normal plant, since normal plant parts or seasonal changes are sometimes mistakenly assumed to be evidence of disease. Examples are the brown, spore, producing bodies on the lower surface of leaves of ferns. These are the normal propagative organs of ferns. Also in this category are the small, brown, club like

tips that develop on arborvitae foliage in early spring. These are the male flowers, not deformed shoots. Small galls on the roots of legumes, such as beans and peas, are most likely nitrogen-fixing nodules essential to normal development and are not symptoms of rootknot nematode infection. The leaves of some plants, such as some rhododendron cultivars, are covered by conspicuous fuzz-like epidermal hairs. This is sometimes thought to be evidence of disease, but it is a normal part of the leaf. Varieties of some plants have variegated foliage that may resemble certain virus diseases. These examples illustrate the importance of knowing what the normal plant looks like before attributing some characteristic to disease.

In describing the plant "abnormality", distinguish between SYMPTOMS and SIGNS: **Symptoms** are changes in the growth or appearance of the plant in response to living or nonliving damaging factors. Many damaging factors can produce the same symptoms; symptoms are not definitive. **Signs** are evidence of the damaging factor (pest or pathogen life stages, secretions; mechanical damage; chemical residues; records of weather extremes or chemical applications; damage patterns). **PATTERNS OF DAMAGE ARE EXCELLENT SIGNS and are definitive diagnostic clues.**

EXAMINE THE ENTIRE PLANT AND ITS COMMUNITY.

In defining a plant problem, it is essential to determine the *real* primary problem. There are foliage symptoms that may occur due to root damage. The primary problem would be root damage, not chlorosis of the foliage -examine the roots. In general, if the entire top of the plant or entire branches are exhibiting abnormal characteristics, examine the plant downward to determine the location of the primary damage. Look for the factor causing the damage at the periphery of the plant damage.

Some pathogens and insects as well as nonliving factors are only damaging if the plant has been predisposed by other primary factors. For example, borers generally only attack trees that are already predisposed by moisture or other physical stress. Premature dropping of leaves by foliage plants (i.e. *Ficus benjamina*) and of needles by conifers frequently causes alarm. Evergreen plants normally retain their leaves for 3-6 years and lose the oldest gradually during each growing season. This normal leaf drop is not noticed. However, prolonged drought or other stress factors may cause the tree as a whole to take on a yellow color for a short period and may accelerate leaf loss. If the factors involved are not understood, this often causes alarm. The leaves that drop or turn yellow are actually the oldest leaves on the tree, and their dropping is a protective mechanism which results in reduced water loss from the plant as a whole.

II. LOOK FOR PATTERNS

Here is where we start making the distinction between living and nonliving factors that cause plant damage.

Nonuniform Damage Pattern *(living Factors)* vs Uniform Damage Pattern on Plant Community, Plant, Plant Part *(nonliving Factors).*

LIVING FACTORS: There is usually no discernable widespread pattern of damage. Living organisms generally produce no uniformly repeated pattern of damage on a planting. Damage produced by living organisms, such as pathogens or pests, generally results from their using the

plant as a food source. Living organisms are generally rather specific in their feeding habits and do not initially produce a wide-spread, discernable damage pattern. Plants become abnormal: Tissues are destroyed or removed, become deformed, or proliferate into galls.

Living organisms are specific, ie. damage may be greatest on or limited to one species of plant.

Living organisms multiply and grow with time, therefore they rarely afflict 100 percent of the host plants at one time. The damage is progressive with time. Likewise, the damage, generally, is initially limited to only one part of the plant and spreads from that initial point of attack with time.

Living organisms usually leave "signs", i.e. excrement cast skins, mycelium, eggs...

NONLIVING FACTORS: Damage patterns produced by nonliving factors such as frost or applications of toxic chemicals are generally recognizable and widespread: Damage will appear on all leaves of a certain age (for example on all the leaves forming the plant canopy at the time a toxic spray was applied) or exposure (i.e. all leaves not shaded by overlapping leaves on the southwest side of a plant may be damaged by high temperatures resulting from intense sunlight). Damage will likely appear on more than one type or species of plant (look for similar damage patterns on weeds, neighboring plants, etc) and over a relatively large area.

III. DELINEATE DEVELOPMENT

As already mentioned, another clue for distinguishing between living and nonliving factors causing plant damage is to observe the development of the pattern.

Living organisms generally multiply with time, produce an increasing spread of the damage over a plant or planting with time, are progressive.

Nonliving factors generally damage the plant at a given point in time, for example death of leaf tissue caused by a phytotoxic chemical is immediate and does not spread with time. There are exceptions. If a nonliving damaging factor is maintained over time, the damage will also continue to intensify with time: For example, if a toxic soil or air chemical is not removed, damage to plants within the contaminated area will continue to develop, but damage will not spread to plants in uncontaminated areas: NONLIVING FACTORS ARE NOT PROGRESSIVE. This again reemphasizes the necessity of piecing together multiple clues to identify the most probable factor causing plant damage.

IV. DETERMINE CAUSES

Patterns of damage distribution and time patterns in development of damage have been valuable in making the gross distinction between damage caused by living factors and damage caused by nonliving factors. Additional clues must be obtained to distinguish among factors within the living and nonliving categories.

DISTINGUISHING AMONG LIVING FACTORS:

If patterns of damage in the field planting and on the individual plant are uniform and repeated, this indicates that a nonliving factor is the probable cause of the damage.

DISTINGUISHING AMONG NONLIVING FACTORS

REFERENCES, LABORATORY ANALYSES

If you have identified the plant and have narrowed the probable cause down through the various categories, (i.e. distinguished between living and nonliving - then if living, distinguished between pathogens and animal factors - then if pathogen, distinguished between fungal and bacterial organisms), you will probably need assistance in identifying the specific responsible organism or nonliving factor. But, by now you know what specialist to contact (plant pathologist, entomologist, physiologist ...) and what specific reference book would provide further assistance in narrowing down the search for the specific factor causing the observed plant damage. Laboratory analyses and examination may be required to further narrow the range of probable causes.

SUMMARY

I. DEFINE THE PROBLEM (Determine that a "real" problem exists):

A. PLANT IDENTIFICATION and CHARACTERISTICS. Establish what the "normal" plant would look like at this time of year. Describe the "abnormality": Symptoms & Signs.

B. EXAMINE THE ENTIRE PLANT AND ITS COMMUNITY. Determine the primary problem and part of the plant where initial damage occurred.

II. LOOK FOR PATTERNS: On more than one plant? On more than one plant species?

A. NONUNIFORM DAMAGE PATTERN (Scattered damage on one or only a few plant species) is indicative of LIVING FACTORS (pathogens, insects, etc).

B. UNIFORM DAMAGE PATTERN over a large area (i.e. damage patterns on several plant species) and uniform pattern on the individual plant and plant parts indicates NONLIVING FACTORS (mechanical, physical, or chemical factors).

III. DELINEATE TIME-DEVELOPMENT OF DAMAGE PATTERN:

A. Progressive spread of the damage on a plant, onto other plants, or over an area with time indicates damage caused by LIVING ORGANISMS.

B. Damage occurs, does not spread to other plants or parts of the affected plant. Clear line of demarcation between damaged and undamaged tissues. These clues indicate NONLIVING DAMAGING FACTORS.

IV. DETERMINE CAUSES OF THE PLANT DAMAGE. Ask questions and gather information.

A. DISTINGUISH AMONG LIVING FACTORS

1. PATHOGENS - Symptoms and signs

2. INSECTS, MITES and OTHER ANIMALS - Symptoms and signs

B. DISTINGUISH AMONG NONLIVING FACTORS

1. MECHANICAL FACTORS

2. PHYSICAL FACTORS

a. Temperature extremes

b. Light extremes

c. Oxygen and moisture extremes

3. CHEMICAL FACTORS

a. Analyze damage patterns in fields and other plantings.

b. Injury patterns on individual plants.

c. Pesticide-pollutant phytotoxicities - damage patters.

d. Nutritional disorders - key to nutritional disorders.

C. REFERENCES (check reports of damaging factors on identified plant); may need LABORATORY ANALYSES to narrow range of probably causes.

V. SYNTHESIS OF INFORMATION TO DETERMINE PROBABLE CAUSES.

GENERAL DIAGNOSTIC REFERENCES: KEYS TO PLANT IDENTIFICATION AND DIAGNOSIS OF PLANT PROBLEMS

DISEASES OF TREES AND SHRUBS. 1987. Wayne A. Sinclair, Howard H. Lyon and Warren T. Johnson. This Comprehensive, up-to-date reference book has 576 pages, 247 color plates, 18 black-and-white illustrations in a 9 x 12 inch page-size format is priced at $49.95. An easily used, authoritative reference that is a reliable diagnostic aid that focuses on what can be seen with the unaided eye or with a hand lens. Includes diagnostic information on plant damage caused by both pathogen and nonliving factors such as environmental extremes, mechanical-physical damage, and chemical disorders. The book is available from: Cornell University Press, 124 Roberts Place, P.O. Box 250, Ithaca, NY 14851-0250.

WOODY ORNAMENTALS: PLANTS AND PROBLEMS. 1980. R. E. Partyka, J. W Rimelspach, B. G. Joyner, S. A. Carver. Produced, published and copyrighted by ChemLawn Corp, 450 West Wilson Bridge Road, Columbus, OH. Printed and distributed by Hammer Graphics, Inc., P. 0. Box 640, Piqua, Ohio, 45356. This hardback, 429-page book contains over 400 color pictures and over 400 black-and-white illustrations to assist the amateur as well as the professional in identifying plants, diagnosing plant disorders, and problem solving. It is well organized (and cross referenced), fairly complete in detail, and written in easy to understand language. This book can be purchased from: agAccess, P.O. Box 2008, Davis, CA 95617.

The major sections are: Plant identification characteristics (taxonomic key, plant illustrations and color photos); functions of plant parts; disease problems; insect problems and other animal pests; physiological disorders; chemical injury; trouble-shooting plant problems; ornamental plant problems key (diagnostic key with plants listed alphabetically by common names -latin genus and species and common name are cross referenced both ways in the Botanical Name Index and the Common Name Index in the back of the book) with color photo illustrations of common symptoms; and, avoiding and solving plant problems. There are two appendices: Appendix A, Plant Recommendations Based on Susceptibility to Problems; Appendix B, Plant Recommendations for Specific Problems.

The "Plant Problem Key" and accurate photographs of plant problems are very valuable diagnostic tools. This is one of the most useful books for assistance in diagnosing plant problems.

MANUAL OF WOODY LANDSCAPE PLANTS. (Their identification, ornamental characteristics, culture, propagation, and uses). Third edition, revised in 1983. Michael A. Dirr. Published by Stipes Publishing Company, 10- 12 Chester Street, Champaign, IL 61820. This book does exactly what the title indicates plus it indicates the more prevalent problems that might occur with each plant species and cultivar such as insect and pathogen problems, cultural requirements (i.e. pH, soil moisture, etc). It supplies valuable information on identifying characteristics of a range of cultivars of each species so the diagnostician can determine if the plant's appearance is normal for that cultivar.

HILLIER'S MANUAL OF TREES & SHRUBS, 5th edition, 1981. Harold G. Hillier. Van Nostrand Reinhold Company Inc, 135 West 50th St, New York, NY 10020. This reference provides descriptions and information on identifying characteristics of the significant cultivars of over 700 genera of landscape plants.

DIAGNOSIS OF PLANT DISEASES. Extension Bulletin 0751 (WSU Bulletin Department, Coop. Extn. Svc., Cooper Publications Bldg., Washington State University, Pullman, WA 99164-592, cost 25 cents/copy). Revised 1982. Otis C. Maloy.

DISEASES AND PESTS OF ORNAMENTAL PLANTS, 5th Edition. 1978. P. P. Pirone. John Wiley and Sons, Inc.

FOLIAGE PLANT PRODUCTION. 1981. Jasper N. Joiner, Editor. Published by Prentice-Hall, Inc. Englewood Cliffs, NJ 07632. This book includes chapters on prevention and diagnosis of foliage plant problems: pathogens, insects and mites, nutritional and environmental disorders.

FOLIAGE PLANT PROBLEMS, A PICTORIAL ATLAS OF. 1983. Richard W Henley, editor. Available for $5.00/copy from: Florida Foliage Association, P.O. Box Y, Apopka, FL 32703.

40-page manual with approximately 160 full-color illustrative photographs has seven major sections: physiological disorders, plant diseases, insect and mite injury, nematode injury, other pest damage, pesticide phytotoxicity, and other problems. In addition to the printed diagnostic information and symptom description of the major problems occurring on foliage plants, each is accompanied by a color photo further depicting the problem.

CHRISTMAS TREE PEST MANUAL. October 1983. Janine M. Benyus, Writer/Editor. United State Department of Agriculture, Forest Service, North Central Forest Experiment Station. 108 pages. $14.00/copy from U.S. Government Printing Office, Washington, D.C. 20402. Covers North Central and Northeastern U.S. and Southeastern Canada.

This manual is well written, beautifully designed, and well-indexed and cross-referenced for easy use. The color photographs are of high quality and clearly illustrate the diagnostic signs and symptoms.

REFERENCES REGARDING SPECIFIC FACTORS CAUSING PLANT PROBLEMS:

LIVING FACTORS - PROBLEM DIAGNOSIS

INSECT & MITE INJURY DIAGNOSIS

PACIFIC NORTHWEST INSECT CONTROL HANDBOOK. Revised and published annually. Available for $17.50 from: Publication Orders, Agricultural Communications, Oregon State University, Corvallis, OR 97331-2119.

WESTERN FOREST INSECTS. USDA Forest Service Miscellaneous Publication No. 1339. November 1977. R. L. Furniss and V M. Carolin. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock Number 001-000-03618-1). This is one of the most-used entomology reference books on my shelf. The extensive host index and general index to the information make it very easy and quick to locate needed information on a plant or pest. The clarity and completeness of the information on each pest including life cycles and photo-illustrations are invaluable in identifying and diagnosing pest problems on woody plants.

INSECTS THAT FEED ON TREES AND SHRUBS. 1991 (Second edition, revised). W T. Johnson and H. H. Lyon. Cornell University Press, 124 Roberts Place, P.O. Box 250, Ithaca, NY 14851-0250, $49.50 + $1.50 postage and handling. This 9 X 12, 560 page book has 241 color plates. This reference provides information about more than 950 species of insects, mites and other animals that injure woody ornamental plants in North America. It will enable the reader to diagnose plant disorders caused by pests and to identify the insect or mite responsible.

IDENTIFICATION OF INSECTS AND RELATED PESTS OF HORTICULTURAL PLANTS. A PICTORIAL GUIDE. 1991. Richard K. Lindquist. 43 pages. Ohio Florists' Association, 2130 Stella Court, Suite 200, Columbus, OH 43215-1033. Telephone 614-487-1117, FAX 614-487-1216.

PATHOGEN DIAGNOSIS

PACIFIC NORTHWEST PLANT DISEASE CONTROL HANDBOOK. Revised and published annually. Available for $17.25 from: Publication Orders, Agricultural Communications, Oregon State University, Corvallis, OR 97331-2119.

DISEASE CONTROL IN THE LANDSCAPE, Bulletin 614. 1985. Charles C. Powell, Jr. The Ohio State University Cooperative Extension Service Publications Office, 2120 Fyffe Rd., Columbus, OH 43210. $3.50/copy + 54 cents postage. This 25-page bulletin provides information on the common pathogenic diseases of landscape flowers, shrubs, vines, groundcovers and trees in Ohio.

DIAGNOSING ORNAMENTAL PLANT DISEASES, An Illustrated Handbook. 1988. Randolph Keim and Wesley A. Humphrey. Publication 21446, University of California

Cooperative Extension Service. Available from ANR Publications, Univ. CA., 6701 San Pablo Ave., Oakland, CA 94608-1239, $13/copy. This 36-page handbook contains 129 color photographs. It is divided into two sections: Section I describes general disease symptoms and steps in diagnosis; Section 11 is an alphabetical list of hosts for many diseases commonly found on ornamentals. This handbook is a guide, not a final answer.

THE DIAGNOSIS OF PLANT DISEASES, A Field and Laboratory Manual Emphasizing the Most Practical Methods for Rapid Identification. For Extension and Teaching Personnel and Those in Inspection Services and Commercial Agriculture. 1969. Rubert B. Streets, Sr. Cooperative Extension Service and Agricultural Experiment Station, The University of Arizona, Tbcson, AZ. 12 Chapters. Available from AgAcess, RO. Box 2008, Davis, CA 95617, telephone (916) 756-7177, $14.95/copy + $1.50 shipping charge.

COMPENDIUM OF ELM DISEASES. 1981. R. Jay Stipes and Richard J. Campana, editors. Available for $11.00/copy from: American Phytopathological Society Books, 3340 Pilot Knob Road, St. Paul, Minnesota 55121.

120 pages, 199 color illustrations, 103 black and white illustrations. This compendium compiles world-wide information on major and minor diseases of elm trees with emphasis on Dutch Elm Disease. It is written as a ready reference for nurserymen, landscapers, foresters, arborists. It is arranged for fast reference. Included is a guide to the identification of diseases and a glossary that translates scientific terms into understandable language. Disease control information is also included.

COMPENDIUM OF ROSE DISEASES. 1983. R. Kenneth Horst. Available for $17.00 from: American Phytopathological Society Books, 3340 Pilot Knob road, St. Paul, Minnesota 55121.

50 pages, 14 pages of color plants, 18 black and white photographs and illustrations. This is a practical reference.

DISEASES OF TURFGRASSES, Extension Bulletin 713, Washington State University Cooperative Extension Service. Charles J. Gould, Roy L. Goss and Ralph Byther. Available for $1.25 from: Bulletin Office, Cooper Publications Building, WSU, Pullman, WA 99164-5912 (Make check payable to: Cooperative Extension Publications).

This 40-page bulletin with color photographs of the various diseases contains diagnostic/control information within 6 major sections: Introduction, key to selected turfgrass diseases, major diseases, minor diseases, physiological and other miscellaneous problems, disease resistance and quality rating tables, chart showing prevalence of major turfgrass diseases during the year.

DISEASES OF TULIPS, Extension Bulletin 711, Washington State University. Charles J. Gould and Ralph S. Byther. Available for $1.50 from: Bulletin Office, Cooper Publications Building, WSU, Pullman, WA 99164-5912 (Make check payable to: Cooperative Extension Publications). 23-page bulletin with color photographs illustrating effects of many of the described diseases. Major sections are: major diseases, virus diseases, miscellaneous diseases, physiological diseases, and key to major tulip diseases. Under each disease, information on

symptoms, factors affecting, importance and host range, causal agent, control, and references for further reading.

DISEASES OF NARCISSUS, Extension Bulletin 709, Washington State University. Charles J. Gould and Ralph S. Byther. Available for $2.00 from: Bulletin Office, Cooper Publications Building, WSU, Pullman, WA 99164-5912 (Make check payable to: Cooperative Extension Publications). 27-page bulletin with color photographs illustrating the symptoms of many of the described diseases. Under each disease information on symptoms, factors affecting, importance, control and causal agent, and references are provided.

WESTCOTT'S PLANT DISEASE HANDBOOK. 1979. Fourth Edition, Revised by R. Kenneth Horst. 803 pp. This easily used reference has two main sections: Information on individual pathogens and control methods; and, an extensive listing by host plant of the pathogens, including viruses, that have been reported on that plant. The book is well indexed for fast location of information.

THE BALL FIELD GUIDE TO DISEASES OF GREENHOUSE ORNAMENTALS. 1992. Margery Daughtrey and A.R. Chase. $65.00. GrowerTalks, 1 North River Lane, Suite 206, P.O. Box 532, Geneva, IL 60134-0532, phone 708-208-9080, fax 708-208-9350.

NONLIVING FACTORS -PROBLEM DIAGNOSIS

HERBICIDE INJURY DIAGNOSIS

APPLIED WEED SCIENCE. 1985. Merrill A. Ross and Carole A. Lembi (Purdue University). 340 pp, hard cover. Burgess Publishing Company, Minneapolis, Minnesota. The authors' writing style is not stilted or heavy with technical jargon. The book is very well written: information is accurate, concise, clearly phrased and presented in a logical sequence. It is an interesting book that holds the reader's attention. The information is "applied" in the sense that the reader can readily relate the information to actual plant production and weed control situations. Chapter 14 on "Troubleshooting" is a useful guide to diagnosing the cause(s) of herbicide failure or injury problems. Interpretation of observed "patterns", information to collect when making an on-site investigation, identifying injury symptoms on individual plants, and interpreting findings are explained. The book is well indexed and cross-referenced so the reader can quickly find specific information. The "Glossary" provides quick definition of terms. *Available from AgAccess, Davis, C,4 95617.*

PACIFIC NORTHWEST WEED CONTROL HANDBOOK. Revised and published annually. Available for $17.25 from: Publication Orders, Agricultural Communications, Oregon State University, Corvallis, OR 97331-2119.

DIAGNOSIS AND PREVENTION OF HERBICIDE INJURY. Extension Bulletin E-809. Michigan State University.

DIAGNOSIS OF HERBICIDE DAMAGE TO CROPS. 1981. D. J. Eagle and D. J. Calerly. 70 pages. Chemical Publishing Company, 155 West 19th Street, Dept. 625, New York, NY 10011

HERBICIDE INJURY SYMPTOMS AND DIAGNOSIS. North Carolina State University.

FERTILIZERS: DEFICIENCIES & TOXICITIES

DIAGNOSTIC TECHNIQUES FOR SOILS AND CROPS. 1948. Published by the American Potash Institute, Washington, D.C.

WESTERN FERTILIZER HANDBOOK. Order from: The Interstate Printers and Publishers, Inc., Danville, Illinois 61832.

DIAGNOSTIC CRITERIA FOR PLANTS AND SOILS. 1966. Edited by Homer D. Chapman. Published by University of California Division of Agricultural Sciences. 793 pages. Includes function of the element in the plant, plant symptoms of deficiency and excess amounts of the element, diagnostic concentrations of the element in plant tissue and soil. Includes the major as well as trace elements and a chapter on organic soil toxins.

Home Grown Television Program broadcast worldwide several times in 2006 covering IPM on Fruit and mentioning USU's IPM website.

On this episode of HomeGrown our expert Larry Sagers will help you understand the basics and beyond of fruit tree growth and success. He will talk about what you need to know about watering, fertilizing, pruning, and pest control to have the best fruit crop ever.

Featured Expert:
Larry Sagers, our expert on this episode, is a Utah State University extension horticulture specialist, a radio host, and a newspaper columnist. Contact Larry at lsagers@ext.usu.edu

Click on a topic below to view additional information.

Planning and Selecting Your Fruit Trees

Selecting a Site for Your Fruit Trees

What to look for when you are buying a tree.

How to Plant Your Tree

Watering Recommendations & Fertilizing

Pruning

Pest Control

Television Program Script

This presentation of HomeGrown is made possible in part by a generous grant from Angel Partners. Angel Partners: Committed to the programs, services and technologies that support family values and lifelong learning.
>>Next on HomeGrown we'll learn how to grow fruit and nut trees. Whether you're an experienced fruit grower or just starting out, we'll explain all the basics on how to plant, prune, and harvest those fruit and nut trees. So stay tuned.
>>Welcome to HomeGrown. I'm Rebecca Cressman, and today we're talking about how to grow fruit and nut trees. With me today here at BYU's beautiful terrace garden is Larry Sager, a Utah State University Extension Horticulture Specialist, a radio host, and newspaper columnist. Thanks for being here with us. First of all, we're going to talk about fruit trees. What kind of decisions and criteria do we need to have at the top of our mind, when we decide what kind of trees to put in our yard?
>>Larry: Well we need to decide what's going to grow and grow well in your area. And you might think that's a fairly simple thing, but we're here in Provo, Utah, traditional fruit growing area for Utah but you go a few miles to the east of here and you could not grow the same kind of fruits. You can't grow any of the peaches or nectarines or anything else like we might grow here. So you need to find out what's going to grow and do well in your area. One of the problems is a lot of times the trees will grow, and they'll be perfectly hearty but we're growing these for fruits. Nut trees, for example, here in northern Utah, if we wanted to grow pecans, yes the trees will grow very well, but you probably will not get any pecans off of there. So you probably would want to select another tree that's going to grow and survive and produce a lot of nuts or fruit in your area.
>>Rebecca: Where do we go—resource wise—to find out what kind of trees we can actually grow, depending on the climate that we live in?
>>Larry: At first, check with your local extension service office. There's one of those in just about every county of every state in the nation. If that doesn't work, talk to your local friends and neighbors. See what they're growing. Look at some of the good local nurseries and find out what they have in stock and what people are buying and having good success with. And if you've got commercial growers in your area, stop by their fruit stands and taste some of their fruit and find out what varieties they're growing, because that's the ones you can likely grow in your yard and have success there also.
>>Rebecca: I like that kind of research. To test the fruit first!
>>Larry: Well fruit is a long-term commitment. In a vegetable garden, it can be in there. If we don't like it, we can put something in that's totally different next year. But you can't do that with fruit. Some fruit trees, it will take you cherries and things, it may take you 8-10 years to get that tree into good production, and you don't want to start over after you've decided "oh, I didn't really want that."
>>Rebecca: One other thing to think about is the heartiness zones. Let's talk a little bit about that. We'll see them in magazines, we see them in some of the catalogues. What exactly are heartiness zones?
>>Larry: Heartiness zones, cold heartiness zones are zones that are put together by the

USDA, and those are based on minimum winter temperatures. So, if you say you're a zone 5, that has a corresponding winter minimum temperature. So look at your heartiness zones, but realize there are microclimates and there are some other things that are going to affect whether or not you're going to be able to grow fruit trees in that area. But that's a good place to start.
>>Rebecca: You know, we've all heard of the tale, or many of us have heard of the folk tale of Johnny Appleseed. But in reality, we don't actually plant seeds anymore to get trees, and why is that?
>>Larry: You don't plant seeds, because if we look at these apples here, we've got a red delicious here. A golden delicious here. And we've got a granny smith here. If we took and cut this open, this is a palm fruit, so we cut it open and we look inside and there's going to be a number of different seeds in there. Actually, if we planted those, we may get a different kind of tree from each one of those seeds. And the reason is that this fruit—all of these fruits—are the product of cross-fertilization. This has two kinds of tissue. The vegetative tissue is what gives us the red color, and this red delicious taste that you're going to enjoy and you've eaten many, many times. But the reproductive tissue is in the seed, and that's a product of cross-fertilization. All of us are products of cross-fertilization. You might resemble your mother or father, but you're not an exact genetic duplicate. To get this to be an exact genetic duplicate, that tree has to be propagated, vegetatively, and that's done by budding and grafting. So no commercial growers grow their plants from seed and you shouldn't either. Because you don't know what you're going to get. Your chances of getting an apple that looks just like this with all the same characteristics are about a million to one.
>>Rebecca: Wow, that's a new idea for me. And each of these seeds could potentially create some other different type of harvest?
>>Larry: Some other kind of tree. And you know? The golden delicious, that was discovered by Paul Stark Sr. At least, he purchased the rights to it. A beautiful golden apple that was growing in the hills, and he bought the rights to that tree, I think he paid about $25,000 for the rights to that tree. But from that one apple tree have come every other golden delicious apple in the world. Granny Smith? This was granny smith's apple. Granny Smith.
>>Rebecca: There's an authentic granny?
>>Larry: Yes. And that's what everybody called it. And of course, that's one of the most popular apple varieties we'll want.
>>Rebecca: Especially for baking. How about deciding where to plant the tree in our yard?
>>Larry: You need to pay really close attention to that. And again, here in Utah, all of our really good orchards were established along the benchlands of the Old Lake Bonneville. So this area that was not quite up in the mountains but not down in the flat parts of the valleys. Now there are two reasons for that. Number one is climate. Fruit trees will freeze. Obviously, the most limiting factor that you have on whether or not you can grow a fruit tree or not in your yard is when are those spring frosts going to occur? And if they occur after your fruit tree is in bloom, you'll lose all your fruit. So the idea is to find a spot where those trees will warm up gradually, the fruit blossoms will come out, then they'll get pollinated without freezing. Because if they freeze, you've lost the crop. The cold air comes out of the mountains but it goes across the benchlands and collects in the coldest or the lowest spots in the valley. So right here, near Brigham Young

University, we're in a little bit more temperate zone here. There were orchards here before they had the University here. But you go down off the hill, and if you get down by Utah Lake here, it's much colder than it is right up here on campus.
>>Rebecca: I had experience with that when I moved a couple hours north and found that I was having a hard time getting anything growing there. We have lots of examples of plums here and you've got one that's actually gorgeous here too. This is a different type of fruit. You mentioned this is the…
>>Larry: Palm fruit.
>>Rebecca:…palm fruit?
>>Larry: Palm fruits will have—pears and apples are palm fruits, these are called "stone" fruits. And stone fruits will have a single pit or a "stone" in them. And so cherries, plums, nectarines, peaches, all of those have a single stone on the inside, so you open them up and there's one seed there, and that seed—of course—is what's going to reproduce a new tree. But again, we don't want to grow it from a seed, because it will not come true to type. We can plant that and we might get a hard, yellow plum that was not even tasty at all from planting that seed.
>>Rebecca: Okay, now in terms of getting ready to plant, we talked about maybe trying to find a site that gives us that just-the-right temperature and climate. What about the depth? How should we prepare the soil?
>>Larry: Well we need to look at the soil before you plant your trees. Because if you've got heavy clay soils that don't drain well, you're not going to have good success in growing your fruit trees. I tell people to dig a hole. Fill it up with water, let it all drain out, then fill it up again. And, of course, cover it up so a child doesn't fall in that or anything. But if you go out after 24 hours and there's still water in that hole, you've got some drainage issues that you've got to address. And if you don't fix that, you'll likely lose your trees to root rot. So another thing, you know, we tend to want to grow fruit trees in our lawn. Well we water our lawns too much and often times, people have sprinklers come on every day and things. That's not right for fruit trees. We want to have the fruit trees be watered deeply and infrequently. So put them in an area where you can keep them growing well without this frequent irrigation. Because there's root rot diseases, crown-rot diseases, and all kinds of other problems that come when fruit trees are watered too frequently.
>>Rebecca: Well, what about if we're…you know, we typically will buy a tree maybe with a bucket about this size. About how big of a hole do we need to dig? And I know you talked about "big enough that you have to watch with children" but what should we be planning on digging, size-wise?
>>Larry: Well it used to be that people said "don't plant a $10 tree in a $1 hole," but with inflation it's $100 tree and a $10 hole. But the thoughts now, as they've done more and more research, is to don't dig that hole real deep. Because if you plant that, and you've loosened the soil up underneath, that tree will settle, and then the water will collect around your tree. That will cause it to rot at the base or the collar, and you'll probably lose that tree and, of course, we want to keep these trees healthy. So plant it on undisturbed soil. In other words, dig it the same depth as the root bulb, but dig it much wider, three or four times the width of the root ball, loosen all that soil up so that those roots will spread out into the natural or native soil, and you'll get good growth on that tree.
>>Rebecca: And we have a pear tree right behind here. Let's bring that up. We'll move

this aside. And maybe give an example of what to look for when you're buying a fruit tree.
>>Larry: Of course, one of the things that we look for when we are buying a tree, we buy a grafted tree. And right here, it said you don't plant this from a seed. Now this part may be planted from a seed, or it may be done with a size-controlling root stock. This is what controls the size of the tree, is this little part right here.
>>Rebecca: That straight…
>>Larry: This little part right here, the root stock controls the size of the tree, and you can buy a dwarfing or a semi-dwarfing root stock, and that's what's going to make this difference between this tree being 40 feet tall or this tree being 12 feet tall is the underneath part. Now this part here is what's going to determine the kind of tree that you have. So if you want this kind of pear, then you have to go buy a tree with a tag that said is it a Bartlett pear? So actually all fruit trees are two different trees hooked together. Root stock on the bottom, size variety, or fruit variety, on the top.
>>Rebecca: I didn't know that. Now you talked about dwarf. Do you recommend that if we want to get a fruit harvest, that we actually buy dwarf versus the standard type of fruit tree?
>>Larry: For a homeowner, a full-size apple will get about 40 feet high. That's far bigger than you want. Because I tell people to always prune from the same ladder they pick their fruit from. And that way you're not going to have fruit up there 30 or 40 feet in the air that you can't get to. For your apples, you probably want either a dwarf or a semi-dwarf root stock. For things like peaches and things, they're not really big trees, and you prune them heavily, so you can get by with a standard root stock on your peaches. A lot of the cherries and things that are coming out with some new root stocks. But some of those are not as compatible and so you have to make a decision if you're worried a little bit about it, or you may just want to grow a great big tree just to hang the swing in and things, but you have to worry about pest control and other things that we'll talk about in a minute. Now, since this is the dwarfing part, and this is the fruiting part, we have to keep this graft union above ground. Because if we plant it to this point, not only might we rot this, and that would kill our tree, but this part will root, and remember this is a standard, full-size tree, so we will lose the advantage of your dwarfing and this would become a full-size tree. So you have to keep that grafting up out of the ground, three or four inches about like it is right here on the tree, and that way it won't root and you'll end up with a dwarf or whatever size tree you wanted.
>>Rebecca: Well one of the most intimidating parts I have is actually getting to the planting process. I like to pick out the fruit tree, but getting it in. You talked about testig the water, digging a hole, testing the water drainage of the area, making sure the hole is wide enough. What next to make sure that successfully getting it from here to your garden is actually going to be the healthiest way for your tree?
>>Larry: Well, if this is a well-established tree, we can actually just slip that out of the pot. Just lift that down, and that'll be all held together. Now in the spring you may not be able to do that. Because it might be a bare root tree. And there's nothing wrong with bear root trees, you just have to hammer them so that you take them, buy them at the store, take them home and get them planted. They can't sit around in a pot or sit around in their little plastic bag around their roots for more than just a few days.
>>Rebecca: I noticed that, they're really hard to kind of keep alive unless you get them in.

>>Larry: Dig your hole, go buy the tree, come home and plant it. Don't wait for a week.
>>Rebecca: What else? Once we get it in. You talked about the dirt level. Where should it be placed? Once we get it in that hole, we should place it so that the top of the root ball is below or above the rest of it?
>>Larry: You'll find where the roots come out here, and this is actually buried just a little bit too deep. But we've got some mulch there. We can just pull that away and where you start seeing these first roots, these lateral roots coming off, that's the base of the tree, that's where you want to plant it. Now, if you have poorly drained soils, and you mentioned your soils aren't real good in terms of drainage, you can actually burn those up or raise those up a few inches just so that the water slopes away, never so the water collects. We don't ever put saucers around our trees so that they collect water because that's what's going to cause the root crawler rock problems.
>>Rebecca: So when we get it here in the bucket, it actually might be deeper in here than we want once we've planted in our yard. Interesting.
>>Larry: See, this is just mulch on top. You can just scrape that off and just let it sit around the tree.
>>Rebecca: What are some of the signs of over-watering?
>>Larry: Over-watering, unfortunately, the signs for over-watering exactly the same as under-watering. Because if it's over-watered, what happens, again, oxygen is not getting down there because you've got water and no air getting down there, and so all of the little absorbing roots die. So, the tree looks like it needs water, and so our natural inclination—you know, we're getting a little scorched on the edges of some of these leaves and things, and we look at those and we say "Oops, getting a little too brown, we're getting problems here, I better give that tree more water." So we go out and put more water on. You know, this is the very best water gauge that you can have. Go out there, scrape off the topsoil, and then grab a handful of that soil and squeeze it. If that leaves a film of moisture on your hand, there's still water there that the plant can absorb. If that's not leaving a film of moisture, then it's dry and you need to give more water on there. That's particularly important when you plant a bare-root or a dormant tree in the spring. People want those leaves to come out really fast and so they'll water it 2-3 times a day. Big mistake! Particularly if you've got poorly drained soils.
>>Rebecca: Okay, let's also talk about fertilization. Because I remember hearing about root shock when you plant things, I don't know if that's said to be with trees. But what type of fertilizer should we be using from the beginning once we get it in the ground, and then maybe taking care of it for the first few months?
>>Larry: Actually, you can see a few little fertilizer pellets, the little green ones in here that they put on this tree. But for the most part, trees don't need a lot of fertilizer for the first 2-3 years. Sometimes you'll put a little bit of starter fertilizer on there and things. But the most important thing for that tree is to start a new root system so that it can start pulling up the nutrients and producing the fruit. But you don't need to worry a lot about fertilizers. If you put a little bit of fertilizer on, use a dilute fertilizer, transplant solution—much like you'd use on your vegetables or something like that. Don't ever mix dry powdered fertilizer in with your backfill, because fertilizers are salts and that can burn those new, developing roots.
>>Rebecca: Good to know. Also, speaking of the roots, I've been told that you actually want your trees to have roots as deep as possible. I don't know whether that's the way to go still with fruit trees. If it is, how do we do that?

>>Larry: Water them deeply and infrequently. But in reality, most of the absorbing roots have to be up near the soil surface. And so if you water them, that'll help the roots go down farther, develop a good, stable root system so it doesn't tip over in the wind or anything. But still, the absorbing roots. Those that are going to take in the water and the oxygen are probably going to be up near the surface.
>>Rebecca: Now, should we be watering, let's say we're targeting our watering. Should we be targeting it right around the base of the tree, or thinking about the roots and actually hitting a lot more wider in the circumference of the root system?
>>Larry: For the first couple of years, you have to make sure you soak up this root ball. But after that, you actually want that out around the drip line of the tree. So if your tree is 10 feet wide, that water out around the drip line 10 feet away is where you really need it.
>>Rebecca: Alright, let's put this down. Alright, so reviewing what you just said, what we want to do to make sure that we successfully plant those trees is go out into the yard, find a good site…
>>Larry: Find a good spot, and there's one other thing we need to talk about in terms of that. If you can keep those trees out of the wind and out of these frost pockets. Because remember, the cold air drains and if you've got a little pocket that's surrounded on three sides by a fence, that's just like liquid. That cold air flowing in there and it will actually fill up and then flow over the top of the fence. So avoid those little frost pockets. A lot of people want to plant them on the south side, thinking it's going to be warmer. That usually brings them out earlier, so it's actually more risky to put them right on the south side of your buildings.
>>Rebecca: So if you're looking at an ideal side of the house…?
>>Larry: Full sun, east, and it can be on the south side, just not right up against the building where it's going to heat up excessively.
>>Rebecca: Okay, let's go best-case scenario. We have successfully planted our tree. It is growing like a wildflower, well, like an apple tree. And producing well. What should we be doing in terms of pruning? And you hate to do that because you think you want all the fruit that the tree could give you, but there's a key to that.
>>Larry: You don't. Fruit trees actually will—on a peach tree—if you've got 10 percent of the blossoms to set, you'd have a full crop of really nice, good peaches. So they overproduce. Now these are hedge clippers. Forget them for fruit trees. They're to prune hedges. What you want is a good pair of lopping shears, something that's going to cut well, and probably a good pair of hand-shears. If you're going to prune large or older trees, you want to buy a good tree-pruning saw. And that would have very coarse teeth and it will have a wide set on those teeth. In other words, they're spread out a little bit farther so you can cut through green wood. They always cut on the pull stroke, not the push stroke, so never take your power saw out, never take your carpenter saw out and things and try it. Go buy a good pair of tools. And a good pair of tools will last you the rest of your life if you take care of them. Don't cut rocks and wire, and don't leave them out and get rusty.
>>Rebecca: You talked about 10 percent of the peach blossoms being our ideal harvest size for that peach tree. What is the idea behind pruning? Why is it so important that we go out and we glean and we trim the branches off?
>>Larry: Because you have to grow new wood to produce fruit. Peaches, and again, each tree bears on a different age of fruit. For example, peaches bear on the fruit that grows last year. So if you don't prune them heavily, you won't get a new crop of wood,

therefore the following year, you won't get a good crop of peaches. So you've got to come in and prune those trees heavily every single year. If you ignore it, it's going to affect your yield and it's also going to affect your quality. Pears and apples bear on 2-year-old wood. So you want to be sure that you have enough of that 2-year-old wood there that you are always having a little bit more new wood grow, but you're always having some wood left there that's going to produce your fruit.
>>Rebecca: Even though this is a young tree, let's bring it over and give us an example. It's often confusing. I've seen people do it kind of like a bowl-shape before. What do you recommend when we're pruning?
>>Larry: Okay, there's two kinds of shapes of trees that you would do. One would be called an open-center or a vase shape. And that's the bowl shape that you're talking about. That's very well-adapted to the plums, nectarines, peaches, apricots and—to a lesser extent—some of the cherries. Then we have what's called the central leader system where we actually keep a central trunk or a central leader going up and then have branches coming off in whirls, going out at about the four points of the compass. Now since this is a pear, I'm going to demonstrate a little bit about how we would do a central leader. Now we can't go into real detail pruning, but I want people to remember a couple of different ideas. Number 1 is to clean the tree up the second it's to let the light in. And that last one is very important, because if you've got a beautiful apple and it's hanging on the tree, (obviously this is a pear tree), but it's got to have some light to color up. If it's in deep shade, you're going to have a light-colored red delicious apple or a poorly colored yellow delicious apple. So you've got to have the light getting in where the fruit needs to be. So when we first plant our tree and I'm just going to turn this just a little bit so that people can see—we bought this tree here and there's a broken branch. Obviously that branch is never going to be good again, so that's part of the clean-up process. We're just going to come in and snip that off so that we can clean that up.
>>Rebecca: And just as close to the twig as you can?
>>Larry: As close as we can. We actually have what's called a collar there, but that one was broken clear back into the wood, so we cut that one as close as we can. Now our idea is that we want a branch going out about the four points of the compass. So if we look, we've got one going about to the east, about to the north, about to the west, and about to the south. So that's a pretty good tier here. Then we come up, but we talk about cleaning the tree up. We've got two leaders growing on this tree. And they're just both about the same height, they're both about the same diameter.
>>Rebecca: And name them Cain and Abel.
>>Larry: Well, which one are you going to take out?
>>Rebecca: Cain.
>>Larry: And in this case, I'm going to choose to take this one out right here. So I'm going to cut that one out. Now, once I've done that, that's the right branch. And I've taught thousands of people how to prune trees, but I don't teach any classes on putting them back. So once it's off, it's off. Don't even look back, say "That was the right branch!" And of course on this one, we would come up here and about 2-3 feet above that one, we would probably head this off again, develop a second tier of branches and maybe go to one more tree. So when this tree is fully-developed, it will look a little bit like a Christmas tree or a pyramidal shape, as opposed to the vase shape that we would do on our peaches.
>>Rebecca: Now is there a bit of a diagonal cut? We kind of kissed right up to the

branch, and then was it a diagonal cut, or just does it matter? Make sure to trim as close to the branch as you can?
>>Larry: We want to get that as close…and those pruners were just a little large. We could have just got slightly closer, but we don't want to be cutting into the trunk tissue. And if this were a peach tree, we would get, again, our branches going at about the four points of the compass, and then you'd cut this out right here. And that's when people pass out, when you cut about half the tree off and chuck it away. But that's what you have to do. You have to prune and you also have to thin. Again, 10 percent of the buds is all that's required to get you a full crop of fruit.
>>Rebecca: What is the difference between thinning and heading back?
>>Larry: Thinning is where you actually remove the fruits. You would go along and you want your peaches about six inches apart. If you're going to grow a three inch peach, and you have one side-by-side, they can't be any closer than six inches or they're going to be rubbing on one another. So if you're going to grow a great, big, beautiful peach like this, you can't have another one trying to grow right next to it.
>>Rebecca: So you pull the blossoms?
>>Larry: You actually thin them off after what we call a June drop. That's when we see which ones got pollinated, which ones the beads took care of for us, and then after that, some of them will drop naturally, and then you go back in and thin them. Don't wait until the end of the season, because if your fruit is big, you won't get any benefit from thinning at that point.
>>Rebecca: Alright, what about the different boars and the different pests that we need to watch for?
>>Larry: That's one of the main issues that I think people should look at before they start selecting which trees they're going to grow. It is becoming increasingly difficult to grow fruit, simply because of all the pests that we now have in the area. Cherries are a good example. Many of our viewers would—if they had grown up like I did. With a big cherry tree in the backyard, never sprayed it. We could climb up there anytime and eat our fill of cherries. Well, you can't do that anymore. Because in the early 1980's, the cherry fruit fly came to Utah and so now virtually 100% of our cherries will have worms in unless you start a very rigorous spray program. And in some cases you're talking about spraying twice a week, and you may start on memorial day and finish on labor day. Well, get a life. Nobody wants to spray that often, and so look for trees that you don't have to spray as much. And again, in the Utah County area, the peaches and the plums would take a lot less spraying than the apples and the pears and the cherries. And if you're not going to take care of the trees, don't plant them. Because it just becomes a breeding site which affects the commercial orchard industry and people's trees who are trying to keep the pests out of their trees.
>>Rebecca: And we can go back to the extension service and all the local counties and get some specific information from them as well, in terms of which type of trees need to be sprayed.
>>Larry: And actually, Utah State University has a great website that you can get on, and they'll actually email you a weekly update of what needs to be sprayed and when you need to spray it and things.
>>Rebecca: Thank you so much. So just to review, there are a few simple things we can do to ensure we cultivate our best fruit and our trees. First, be sure to select a tree that's right for you. Considering your climate, the fruit you like, and the amount of time and

money you want to invest in the tree. And next, be sure not to plant your fruit and nut trees in a frost pocket or in a windy area. You're warning us that will totally wipe it out.
>>Larry: If you're not going to get fruit, there's no point in growing that tree.
>>Rebecca: Also, remember to prune your fruit trees every year to let the light in and to get a better yield. And finally, if you like to start enjoying the fruit sooner than later, consider planting a dwarf plant tree.
>>Larry: A dwarf or a semi-dwarf.
>>Rebecca: I'm thinking of that apple tree right now. That's about all the time we have for today. For more information on this and other episodes of HomeGrown, or to order a copy of the series, be sure to log onto www.homegrown.byubroadcasting.org. Thanks to Larry and thanks for watching and remember, everything's better "HomeGrown." Goodbye.
>>On an upcoming episode of HomeGrown, we're going to learn how to grow vine vegetables and legumes. Whether you're an avid gardener or just starting out, we'll discuss everything you need to know about vine vegetables like zucchini and cucumber, and how to take those scrumptious and nutritious legumes from seed to your table. Be sure to tune in.
This presentation of HomeGrown is made possible in part by a generous grant from Angel Partners. Angel Partners: Committed to the programs, services and technologies that support family values and lifelong learning.

Japanese beetle can wreak havoc

Pest found in Utah County; problem could spread

By Larry A. Sagers
Deseret Morning News

Most gardeners have heard reports of the Japanese beetle appearing in Utah. But there are still questions about what can — or needs — to be done.

Erin Hodgson, who recently joined Utah State University Extension as an entomologist, has some answers.

Hodgson, a native to North Dakota, recently completed her doctorate degree at the University of Minnesota. In a baptism by fire — or at least by insects — she is helping monitor the pest and make recommendations for its control.

Larry Sagers
A Japanese beetle munches on a hibiscus plant. Damage caused by the pests can be severe.

The Japanese beetle — a federally quarantined pest — was first discovered in the eastern United States in 1916. From there it has spread south and west, threatening agriculture and horticulture plants. It feeds on more than 300 plant species, and the adults and the larvae can cause significant damage.

While it was thought that it was still thousands of miles from Utah, it was discovered by Meredith Seaver, a USU diagnostician working in the Utah County office. She noticed this pretty, colorful beetle feeding in her garden and decided to investigate further.

Hodgson describes the adult beetles as, "oval, metallic green with bronze-colored wings, and are about a half inch long." Males can be slightly smaller than females. Adults have six white tufts of hair along each side of the body. The grubs are creamy white, C-shaped and an inch long when fully grown. Adults are found clustered together on plants, and grubs can be clumped

under the soil of turfgrass.

"The adults and immature grubs feed on plants and can cause significant damage when in high numbers," Hodgson said. "Together, the adults and grubs feed on more than several hundred plant species. Some of the most susceptible plants are grown in Utah.

"Adult beetles feed on the upper leaf surface, removing the soft tissue of the leaf and releasing a strong aggregation pheromone that attracts additional beetles to a potential food source," she explained.

While visiting gardens in the East, I have witnessed the destruction these pests wreak. They almost seem to pile on top of each other in a feeding frenzy. They destroy flowers and leaves of many common plants and leave them full of holes or covered with skeletonized leaves.

The damage can be so severe that many vegetables never produce normal crops. Unless you are willing to handpick the adult beetles off your plants, controls almost seem useless.

Larry Sagers
Erin Hodgson

Hodgson has been working with the Utah Department of Agriculture and Food recommending management protocols for homeowners and others, especially those outside the Orem area. Some 500 beetles have been trapped in that area, "so they have been there for at least a year, if not logner," she said.

When asked what homeowners should do in their own garden, she explained that right now the problem is localized.

"If homeowners see a beetle that looks like the Japanese beetle, they can contact the UDAF. They can also contact (the department) if they want to set up a trap and monitor it next summer."

What they should not do is to spray right now to control any pests, she said. "The potential for any control right now is very minimal. The adults do a tremendous amount of damage to lawns and ornamentals, but they are very difficult to control," she explained.

If there is one bright spot, it is that the pest spends about 10 months of the year under the soil surface. While the grubs are feeding there, at least they are not destroying the flowers. Grubs often go unnoticed until September, when large patches of turf are destroyed. Damage shows as localized discolored patches that enlarge in just a few weeks.

Heavily damaged turf feels spongy and is easily pulled up like sod. The damage looks like the damage from other lawns grubs, but that damage usually shows up earlier in the season. Drought makes turfgrass injury worse than in a healthy lawn.

Japanese beetles produce one generation per year, and adults emerge from turf in late June and immediately begin feeding on low plants. Adults eventually move up on tree foliage to feed and mate. Mated females move back to turfgrass to lay egg masses in healthy, vigorous turfgrass.

Hodgson hopes that cooperative efforts can bring the pest under control, but it might be too

well established to eradicate. "It will probably spread throughout the Wasatch Front and our best hope is for suppression," she said.

Larry Sagers is the horticulture specialist, Utah State University Extension at Thanksgiving Point.

USU Master Gardener program begins

Written by Tooele Transcript

Thursday, 07 September 2006

The Master Gardener program trains volunteers to assist USU Extension horticulturists in an effective education program. In exchange for intensive training, volunteers donate time and talents teaching gardening presentations and answer garden questions via phone, diagnostic clinics, or garden shows. Past participants include college, high school and vocational horticulture instructors, nurserymen, landscapers, pest control operators, grounds maintenance and lawn service professionals, avid gardeners, and those who want to become avid gardeners. It also qualifies you to be a member of the Tooele Master Gardener Organization and network with other gardeners.

How much does the course cost?

A fee of $85 is required of each participant. The course charge covers many materials printed for Utah conditions.

How much volunteer time will I need to "payback"? You are required to volunteer 40 hours. You have a two year period after the beginning of the course to complete volunteer service. Those who do not complete the course and payback time are required to pay an additional $150 as this course would normally cost $235.

What activities qualify for volunteer time?

One of our most important needs is assistance in answering questions of thousands of gardeners who contact our office each year. Training qualifies you to answer questions with help and reference material, and be a gardening expert. Volunteering is a part of the training to solve horticulture problems. Demonstration gardens, landscapes, and many other activities are a fun and educational part of the training. Gardening seminars are also important training activities. Help at question and answer booths is needed during the early spring and fair time, and help in demonstrations gardens May through August. Other projects have included newsletters, neighborhood gardening advisors, scout and 4-H work, and many others.

Can I use this course for professional advancement?

Many graduates use this course as a stepping stone into the horticulture industry. Nurseries, lawn service companies, and pest control operators often hire Master Gardeners. If professionals volunteer their services to the Master Gardener Program, it is important that they identify themselves only as Master Gardeners during any volunteer service. This title is to be used duly by those individuals who are doing unpaid service in a University Extension sponsored program. Use of this title in any other way is prohibited.

Who instructs the course?

Horticulture Specialist, Larry Sagers, and County Ag Agent, Linden Greenhalgh, are the instructors and other Utah State University Extension Specialists assist instructing in their field of specialty. Other horticulturists assist in up-dating Master Gardeners in their area of expertise.

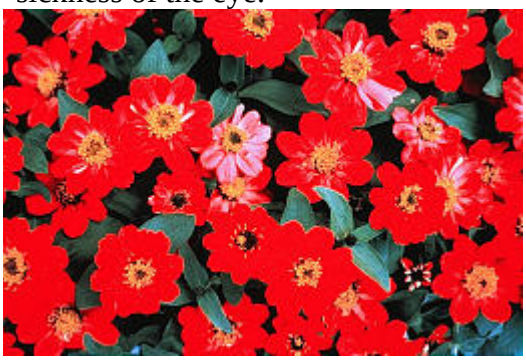
Enrollment is open until Sept. 25. Applications are available at the USU Extension Office at 151 North Main. Class size is limited, so respond quickly.
Last Updated (Thursday, 07 September 2006)

Some zinnias will resist mildew

By Larry A. Sagers
Deseret Morning News

Last week we covered flower bed problems, including powdery mildew on zinnias. This week, the focus is on disease-resistant zinnias that take the heat and avoid powdery mildew. Powdery mildew strikes zinnias worse than almost any other annual. Zinnias with the disease lose their bottom leaves, and their upper leaves are covered with gray powder, which is the mycelium of the fungi growing on the plant.

For centuries, zinnias have graced gardens and spread their glorious colors throughout flower beds and in vases, but they were not always as highly prized. When the Spanish first saw zinnia species in Mexico, they thought the flower was so unattractive they named it "mal de ojos," or "sickness of the eye."



Larry Sagers
Profusion Cherry zinnias were one of the first bred to resist mildew.

Although I have never shared their opinion, I admit that the gray mold covering the leaves does make a sick-looking flower.

If you want to grow zinnias, you have a few choices to make.

You can grow them and let the fungus take its course, but the zinnia beds will start looking bad about mid-August. As an alternative, you could buy expensive fungicides and spray your zinnias every couple of weeks to control the disease.

If neither of these has any appeal to you, there is another choice. Resistant varieties make a good integrated pest management tool for controlling diseases and insects. These varieties naturally resist pests and they require no sprays to keep them looking good.

While there are not resistant varieties for all pests, there are excellent choices for zinnias. Interestingly enough, many new varieties owe their resistance to older varieties from remote locations. Zinnia angustifolia is considered by some to be the original zinnia that the Aztecs grew in their gardens.

Zinnia angustifolia Orange Star (sold as Z. linearis), Star White and Old Mexico (Z.

haageana) have narrow (1/2- to 1-inch-wide) leaves with 1 1/2- to 2 1/2-inch-wide daisy-like flowers. These spreading plants are less formal-looking than the other zinnias, but all of the narrow-leafed varieties are considered disease resistant.

One of the first was Rose Pinwheel, a mildew-resistant zinnia released in 1988. It has 3 1/2-inch single dusty-rose flowers on tidy 12-inch-tall plants. The Pinwheel series was expanded to include gold, orange, pink-on-white and white flowers.

Larry Sagers

Yellow zinnia angustifolia has narrow leaves with 1 1/2- to 2 1/2-inch-wide daisylike flowers.

While most tall zinnia varieties flunk the powdery mildew test, the Blue Point series seems to buck this trend. These grow 40-50 inches in height and have large, double flowers that get 5-6 inches across. Look for apricot rose, lilac, orange, bright pink, dark pink, purple, dark red, dark red with pink, white and bright yellow colors. It also comes as Blue Point Formula Mix.

In 1999 this plant was voted the Cut Flower of the Year by the American Association of Specialty Cut Flower Growers for its mildew tolerance and long vase life. Look for the seed under Giant Dahlia Blue Points, Benary's Giant, and Park's Picks.

Interspecific crosses use these as parents. Growers breed them with other varieties to get even better mildew resistance. Many new low-maintenance zinnias have been introduced in recent years. These combine the flower colors from garden zinnias with the durability of spreading zinnias.

The best new mildew-resistant zinnias were introduced in 1999. Sakata Seed Corporation released the Profusion zinnias, Cherry and Orange, and won gold medals from All America Selections — the first in 10 years as a breakthrough in breeding for zinnias.

These interspecific crosses, which came from crossing Z. angustifolia and Z. elegans, are excellent flowers that take the best characteristics from both parents. They tolerate heat, humidity, mildew and are easy to maintain as they need no deadheading of spent blooms.

Since the introduction of the first two varieties, Sakata has added White, Double Cherry, Apricot, Deep Apricot, Fire and Double Pink. The seeds also come in a Five Color Mix and in an All America Mix.

If none of these mildew-resistant varieties appeal to you, there are still ways to defeat the disease. When you plant susceptible varieties, allow extra space between the plants. Good air circulation can discourage mildew. As with any disease, avoid getting the foliage wet as that increases disease problems.

Larry Sagers

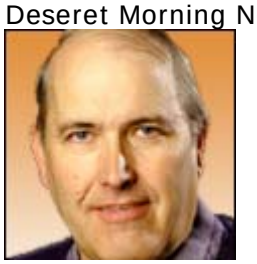
These spreading plants are less formal-looking than other zinnias but are disease-resistant.

My guess is that looking at dying, mildew-covered plants will be enough motivation for you to check out these resistant varieties.

Larry Sagers is the horticulture specialist, Utah State University Extension at Thanksgiving Point.

Too much water or too little? Hard to tell

By Larry A. Sagers
Deseret Morning News



Has the heat wave broken, and are your plants in for an easier spell?

Who knows? I certainly don't.

But I do know that plants that can withstand the heat are always welcome additions to any garden.

The August lull is the perfect time to grab a notebook and evaluate your flower beds. Are they still robust and blooming well? Or have they faded into plantings that show a striking resemblance to a limp dishrag? Award honors to those valiant flowers that are standing at their post and give demerits to those who have deserted your beds.

Larry Sagers
Powdery mildew on a zinnia. This mildew, which usually strikes hardest in August, is seldom fatal.

Heat problems can take on many forms in your flower garden. Certainly most would recognize the lack of water as one of the most common, but there are many others. As temperatures rise, many plant systems shut down, and many flowers stop growing and, consequently, stop blooming.

Almost all fungal diseases incubate and infect plants faster when the temperatures and the humidity are high. Sweltering heat and frequent rain or irrigation sets the stage for rampart disease outbreaks and a collapsing, unattractive flower bed.

As a further ignominious insult, heat also encourages the growth and development of many pests that vandalize and decimate our efforts.

Having just returned from visiting several beautiful gardens in the Midwest, I can say I am grateful for our climate. We miss most of the stem rots, leaf spots and fungal diseases that plague gardens in more humid areas.

The most serious problem Utah gardeners face is water. Is the bed getting too much or too little? Gardeners need to read the symptoms and check the soil. Overwatering is common on

heavy, clay soils. Underwatering is more common on well-drained, sandy soils.

If you are unsure, dig up a shovelful of dirt. Smell the soil. If it has a foul, stinky or rotten smell, you're overwatering. Underwatered soil has a dusty, powdery appearance.

The irony is that you cannot tell just by looking at the flowers which problem is affecting your beds. Overwatering drowns the plants, keeping oxygen from the roots, which causes the plant to die. Underwatered plants show the same symptoms.

Excess water also encourages growth of water mold fungi. While there are fungicides to control such pests, they are expensive and are not usually available to homeowners. And they only work if you change the plant-growing environment by increasing drainage, reducing the irrigation and amending clay soils with coarse organic matter.

Larry Sagers

Black root rot, caused by a fungus, is fairly common and affects a variety of plants.

Rust disease and fungal leaf spots are other symptoms of overwatering. These diseases usually require that the leaf stays continually wet for at least six hours. Our dry conditions usually prevent such problems unless the plants are watered too long or too frequently.

One disease that we never seem to escape is powdery mildew. This disease has adapted to desert climates and does not need moisture on the leaves to grow. While it appears on many plants throughout the season, as soon as the nights start to cool in August, it attacks with a vengeance.

Once it hits, make a decision. In most cases, the best solution is to cut back the plants or just ignore the problem. Powdery mildew, which covers the leaves with fine white mycelium, seldom kills plants, but it does distort their growth and makes them unattractive.

Again, spraying is an option, but flowers continue to grow and produce new leaves throughout the season. This requires that the leaves be recovered with a fungicide every two weeks throughout the season. In my mind, the expense and the time commitment make this prohibitively expensive.

The best option is always to use resistant varieties when they are available. Among the hardest hit annuals are the zinnias. While most zinnias are quickly destroyed, some new types are almost immune. Look for those in next week's column.

Larry Sagers is the horticulture specialist at Utah State University Extension, Thanksgiving Point.

Common gardening problems cropping up

Winterkill may affect trees, plants; pests make appearance

By Larry A. Sagers
Deseret Morning News

Judging from some of the questions I've been getting lately, it is time to address common gardening problems.

One of the most frequently asked questions is "Is this a normal year?" Second up is "When will conditions be right for my plants?" and "When are we going to have an average year again?"

Here are some observations: Normal means nothing when it comes to the weather; conditions are likely to be opposite for whatever plant you're trying to grow; and average years are simply mathematical calculations. That said, remember that millions of plants are able to thrive despite the weather.

Larry Sagers
Powdery mildew is rampant on some varieties of rose leaves.

So what's wrong with the plants in your garden? One answer is winterkill.

But it never got that cold this winter, you say. That's the problem.

Plants survive the winter best when temperatures cool gradually in the fall, stay cold and gradually warm up in the spring.

Think back and you will recall there were unseasonably warm spells followed by drops in the temperature well below freezing. The alternating cycles kept plants from hardening off, so winter damage was rampant.

Roses seem to be among the most affected. Hybrid tea roses are the least hardy, so they are showing the most damage. Many needed to be replaced, and those that did survive probably needed severe pruning.

In addition, many broad-leafed shrubs lost their foliage, but most have recovered without permanent damage. However, if they aren't showing good growth, cut back the dead wood.

The hot/cold temperature cycle during May took a toll on vegetable transplants as well. If plants are turning yellow, use a transplant fertilizer to perk them back up, but be careful not to apply too much nitrogen.

Excessive heat early in the season can be fairly destructive as the tender leaves haven't yet developed their cutin — or waxy layer — that keeps them from drying out. Keep your plants watered adequately, but do not drown them. Overwatering is the cause of many plant deaths as the small absorbing roots don't get enough oxygen.

If that wasn't enough, there are, of course, the usual diseases that are starting to affect plants.

Roses are showing rusty spots on the leaves, and powdery mildew is rampant on some rose varieties as well as Jonathan and other varieties of apples.

Larry Sagers

If your aspens have black spots, the infection occurred weeks ago. Don't spray now — get an early start on the problem next year.

Spraying for mildew on apples will not be effective because the leaves are already fully formed. Spraying should start as the buds first emerge.

If you are noticing black spots on your aspens, the infection occurred weeks ago. Spraying now is a waste of time and money. Keep the sprinklers from hitting the trees and remember to deal with the problem earlier next year.

Aphids are also cropping up. Wash off the backsides of the leaves with a strong stream of water and add some insecticidal soap if needed. Avoid spraying if possible, as that kills aphids' natural predators, which can make the problem worse.

Fruit insects are always troublesome. Because there are so many pests on so many kinds of fruit, keep updated by logging on to www.extension.usu.edu/cooperative/ipm/.

Larry Sagers is the horticulture specialist at Utah State University Extension Thanksgiving Point.

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Instructions For Controlling Peach Borer
July 1st, 2006 @ 7:33am

Peach Tree Borer is the most destructive insect pest of peach, cherry, plum, nectarine, apricot and other stone fruits. It also attacks the flowering forms of these trees. It feeds under the bark at the base of the tree and eventually kills the tree.

Unlike exotic fruit pests, this is a native insect and prior to the time peaches were introduced, it lived on wild cherries and plums. It causes severe injury by feeding on the cambium and inner bark of the trunk close to the soil line.

This pest is no respecter of age. Young trees are often completely girdled in one year and subsequently die. Older trees may be severely injured and succumb to fatal damage from other insects or diseases.

Symptoms of borer damage are wet spots or oozing, gummy, sap. Sawdust-like excrement often mixes with the sap giving it a dark color. Damage occurs at the base of the tree beneath the soil line.

Adult borers are clear-winged moths that resemble wasps. They are active now and fly during the day. They begin laying their eggs about July 1 and continue for about two months. Each female lays up to 400 eggs at the base of the trunk. The eggs hatch in about 10 days and larvae burrow into the trunk through cracks in the bark and start to feed.

The insects feed under the bark through the fall and spend the winter under the bark, as partially grown larvae, a few inches below the ground. In the spring, they resume feeding and pupate in late spring. Adult moths emerge from the pupae and start the life cycle again.

Once inside the tree they are protected from most treatments. Treat before they tunnel under the bark. Apply preventive sprays the first week in July and the first week in August. Spray more frequently if sprinklers hit the trunks regularly.

Check with local nurseries for registered products. Spray the trunk and let the spray puddle around the base. Use the amount of spray recommended on the label. Keep the spray off the fruit and leaves.

Organic controls include parasitic nematodes. Release them at the base of the tree after the larvae become active. Other types of controls including companion planting are not effective and are not reliable to successfully control this pest.

There is strong evidence that trees showing signs of stress or other damage are more susceptible to borer attack. Keep trees healthy by avoiding over watering and damage to the trunk by string trimmers and lawn mowers. Inspect trees carefully and apply the preventive controls as needed

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Hollyhocks: Beautiful and Easy To Grow
June 23rd, 2006 @ 6:13pm

As you continue your flower garden quest with iris from last week, add hollyhocks as another choice. Once again, these are easy-to-grow plants that are old favorites and are getting new attention as gardening trends evolve.

The resurgence in hollyhock popularity comes from several factors. Renewed interest cottage gardens, a desire for drought and heat tolerance in garden flowers and the introduction of many new varieties are all helping fuel their new popularity.

The old-fashioned hollyhocks we know likely came from Western Asia where they thrived on rocky sites and in dry grassy wastelands. For their size and flower displays, they are drought tolerant although they bloom better in moist soils.

I suspect many of your grandmothers had gardens like my grandmothers. They needed easy to care for flowers that did not require purchasing new plants each year and hollyhocks were popular choices. My memories of the tallest flowers in their gardens were the bottoms up view of the colorful spires of funnel-shaped flowers rising above huge clusters of leaves.

As the hollyhocks bloomed in their gardens, they were far more than just showy flowers. To the delight of granddaughters everywhere, these flowers made delightful hollyhock dolls using one blossom as the skirt and another for the bonnet.

The scientific name of the hollyhock is Alcea rosea, making it a member of the Malvaceae family which includes hibiscus, okra, lavatera and even cotton. All have funnel-shaped flowers and the older varieties have five petals with large floral parts in the center. Many new cultivars have double flowers.

The botanical classification is simple but the growing habit is not. Many books classify hollyhocks as perennials. In truth, most are biennials that appear to be perennials because their seeds germinate and grow in the same place.

A few hollyhocks are annuals that germinate and flower the first year from seed. During the first year, flowering is sparse, but the second year they show their glorious flowers from May until August.

Several perennial hollyhocks are available. Although these plants may live and flower for several years, these rarely flower as much as new plants started from seed. Fortunately, the seeds are easy to start and grow so you never need to be without these plants in your garden.

The plants are hardy form Zone 3 thru 8 so they thrive in all areas of Utah. They also are heat tolerant and bloom during the hottest part of the summer. Plant them where they are in full sun, as the plant dislikes shade of any kind.

The rainbow has serious competition from these lovely plants. The range starts with white and goes almost to true black. In between are pinks, reds, purples, yellows, coral and almost any other color except true blues.

The height range is just as amazing. Some of the newer dwarfs grow less than two feet high while some of the old-fashioned varieties will grow to nine feet or more in height. That makes them perfect background flowers in borders, along fences or walls.

The easiest way to establish hollyhocks is from seeds. All of the old-fashioned varieties produce viable seed that you can collect in the fall and plant in your garden or share with friends. Seeds germinate in 2-3 weeks at 60°F.

Try spring sowing or plant in August to produce flowering plants next year. If you have the right growing area, start seeds started indoors as bedding plants for bloom the following summer. Right now, look for them as plants in local nurseries.

Hollyhocks do best in moist, well-drained areas. They prefer a rich soil with abundant organic matter and in rural areas often bloom profusely in old, moist manure piles. Add fertilizer as needed in early spring to help the plants flourish.

Now that I have extolled their virtues, truth in journalism requires I bring up of the downsides of hollyhock growing. Like most plants, they do have a few insect and disease problems.

Hollyhock rust is the most common disease in Utah. The rust fungus first appears on the undersides of lower leaves as yellow to orange pustules that darken with age. Later the top of the leaf shows bright orange spots with red centers that may finally destroy large parts of the leaf.

Use good sanitation to control rust. Pick off infected leaves in the spring and destroy them. When plants stop flowering, cut them back to the base. Provide good air circulation and avoiding overhead watering to reduce the severity of the disease. Some varieties are rust resistant.

If sanitation does not control the disease, apply a fungicide such as chlorothalonil (Daconil), sulfur or copper in the spring as new growth starts. Several sprays may be necessary to keep new leaves protected against infection.

If your hollyhock leaves have holes chewed through their leaves, the pest is the hollyhock weevil. This small beetle eats holes in flower buds and seeds. The female weevil uses her long snout to chew holes in flower buds to lay eggs. The grub stage also feeds on the developing seeds. Apply insecticides as needed to control this pest.

Spider mites, caterpillars, slugs and snails also plague hollyhocks. Use insecticidal soap, Bt and baits respectfully to help reduce these pests to manageable levels.

In spite of your best efforts, pests often make the leaves unattractive even though the flowers still look good. Sometimes the best options include planting hollyhocks far enough away so you cannot see the leaves, or planting something in front of your hollyhocks to hide the leaves.

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Fruit Insect Advisory

CODLING MOTH: In much of Cache County and high-elevation sites elsewhere, the initial codling moth larval emergence most likely occurred last weekend (June 12th). The rest of northern Utah is experiencing peak egg-hatch, which is "rush hour" for codling moth larval emergence.

The bulk of the first generation eggs will hatch out during this time, and it usually lasts 2-3 weeks. Visit the codling moth phenology table to see current degree-day totals (check for your nearest location and then look in the column that says "DDs Since Biofix"): http://extension.usu.edu/cooperative/ipm/index.cfm/cid.645/tid.921/.

PEACH TWIG BORER: In the warmest sites (Salt Lake County), PTB populations are likely at or beyond 300 DDs. Most growers spray for PTB between 300 and 400 DDs. Most other sites in northern Utah have 4-10 days before they reach 300 DDs. Visit the PTB phenology table to check the projected developmental status of PTB in your area: http://extension.usu.edu/cooperative/ipm/index.cfm/cid.645/tid.924/. (Bear in mind that when the high temperature for a given day reaches the mid 80's and the nighttime low hits the mid-50's, you can expect 15-20 degree-days for the day.)

WESTERN CHERRY FRUIT FLY: As the cherries begin to yellow and take on a pink blush, they become soft enough for WCFF females to insert their eggs. Continue to keep trees protected, and be aware that rain events can shorten treatment intervals.

LYGUS AND OTHER CAT-FACERS: Keep an eye out for lygus bugs and stink bugs, particularly in orchards near open hillsides and alfalfa fields. Adult lygus bugs have been observed in peach canopies in Utah County. Their feeding damage causes cat-facing of peaches and apples. Sweeps of orchard groundcover or roadside vegetation will help determine if they're present. Most broad-spectrum insecticides work well for these insects.

Disease Advisory

FIRE BLIGHT: Fire blight infections have been observed in Utah Co. apples and Davis Co. pears. Pruning out these strikes will remove the infection and reduce subsequent shoot blight infections.

PEACH LEAF CURL: Despite its rarity in Utah, this fungal disease of peaches is showing up in a few isolated instances. Please visit the USU Extension Photo Gallery for images of peach leaf curl: http://eureka.ext.usu.edu/admin/plugin.cfm?id=2&img=405&gid=53 . Fall and/or early

spring applications of copper or chlorothalonil are good management approaches for this disease. Sanitation and cultural practices are ineffective.

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In order to understand and use any pesticide product, it is important to understand the products available to home gardeners. Because of the high numbers of questions we have had the past few weeks on plant diseases, we are providing this information on common fungicides for plant disease control.

Always practice good Integrated Pest Management practices that include using non-pesticide alternatives to chemical controls. Always read and follow all pesticide label information.

Home Garden Fungicides for Disease Control
Controlling plant diseases is often a confusing and difficult task. The recommendation to spray a fungicide often adds to the confusion because many registered fungicides are not readily available to home gardeners.

Several companies cater to the backyard grower. In Utah, these companies include Ortho, Lily Miller, Green Light, HiYield, Fertilome and Spectricide, Monterey and Cooke.
Fungicide names are confusing. Plant pathologists usually use the general or common name such as chlorothalonil.

Manufacturers and retailers use trade names. For example, chlorothalonil is packaged as Daconil or Ortho Multi-Purpose Fungicide for the home market and as Bravo for commercial markets.

There are differences in the formulation (such as a liquid or powder); for ingredient and in how it is used (as a spray or drench, for example). Some products have more than one type of chemical together. The ingredient list on the label will tell you what is in the product.

Triadimefon (Bayleton) An excellent curative and preventive fungus control for lawns but only available as granules.

Captan – An excellent general-purpose fungicide that controls many plant diseases. It is not effective on powdery mildews and rusts. Use it as a spray, dust, dip, or seed treatment. Captan is labeled for ornamentals, lawns, vegetables, and fruit but only when mixed with other pesticides. It controls leaf spots, blights, and fruit and vegetable rots.

Chlorothalonil (Daconil, Ortho Multi-Purpose Fungicide) - Another good, general-purpose fungicide for foliar fungal diseases as it breaks down rapidly in soil. It lasts well and is labeled for vegetables, fruits, and many ornamentals including shade trees. Allergic people may develop skin rashes.

Copper based compounds (Bordeaux mixture, Microcop) - There are many copper products, but copper sulfate is the most common. Bordeaux mixture, made by adding copper sulfate and

calcium hydroxide to water, was the first fungicide and was used extensively in France to control downy mildew on grapes.

It is a highly effective because it stays on the plant surface even after rain. It is often used as a dormant spray since it may burns tender plant tissues. Copper controls many fungal and bacterial diseases including cankers, galls, blights, and leaf spots. It is not effective against powdery mildews. It is widely recommended because it has no tolerance levels because it has low toxicity and insolubility in water.

Horticultural Oils (Neem Oils such as Rose Defense, Sunspray Ultra-Fine Year-Round Pesticidal Oil) – These include petroleum oils and plant oils. These are effective if powdery mildew is severe and they will eradicate the fungi if you thoroughly cover the plant surfaces. Do not use when plants are wet from rain, irrigation or dew.

Mancozeb (Green Light Broad Spectrum Mannose Fungicide) – A difficult fungicide to find in the stores but is effective on many fungal diseases. Registered for use on lawns, fruits, vegetables and ornamentals.

Myclobutanil (Immunox, Spectricide) - One of the most effective fungicides available to homeowners particularly against powdery mildew. It is also effective against rusts and many leaf spots. Apply to the plant foliage and rotate with other fungicides to prevent pest resistance.

PCNB (Hi-Yield Turf and Ornamental Fungicide) – Primarily for snow mold on turf and for bulbs.
Soaps (Safer's Insecticidal Soap) – Soaps help control powdery mildew and soft bodied insects. Thorough coverage of the plant surfaces is essential.

Sodium or Potassium Bicarbonates (Remedy) - Sodium bicarbonate is baking soda and potassium bicarbonates are used to prevent salt build up from the sodium form. Not as effective as other fungicides but better than nothing. Usually used with oils, which increase their effectiveness.

Sulfur (many formulations containing the word sulfur.) - Elemental sulfur is active against powdery mildews, some rusts, leaf blights, and fruit rots and is labeled for fruits, beans, and many ornamentals. Disadvantages are a short effective control time and specific temperature restrictions.

Sulfur is active as a vapor at higher temperatures but when the temperature is over 85 °F, some foliar burn is likely. At low temperatures, there is no fungicidal activity. 'Concord' grapes or apricots are sulfur sensitive and will burn at any temperature. Often leaves and objectionable residue on the plants and is caustic to skin.

Tebuconazole (Bayer Advanced Garden Disease Control for Roses, Flowers & Shrubs) cures, stops and prevents plant diseases. It is systemic and provides rainproof protection against most common plant diseases such as black spot, powdery mildew, rust and other diseases.

Thiophanate methyl (Green Light Systemic Fungicide, Halt) - A close relative to benomyl (Benlate) It is registered on ornamentals, lawns and some fruit trees.
Triforine (Funginex) - A locally systemic fungicide that controls powdery mildew, rusts, and some leaf spots or blights. It is labeled for use on several ornamental plants and is used to control important rose diseases.
The label is the legal document. No matter what anyone else says, always follow label directions. To do otherwise is against the law.