Product Labels
and
Safety Data Sheets

Product Labeling

- Label: Information printed on or attached to the pesticide container
- Labeling: Includes the label itself and information you receive from the manufacturer
- Contains basic information that helps users to clearly identify the product
- Contains instructions on how to use the product safely and correctly
- Pesticide users are required by law to comply with all the instructions and directions for use in pesticide labeling

Brand Name

- Each manufacturer has a brand name or trade name for each of its products
- The brand name must be located on the front panel of the label
- Different manufacturers may use different brand names for the same pesticide active ingredient















Ingredient Statement

- Active ingredients and the amount
- Common name of active ingredient(s)
- Common name may be followed by the chemical name in the list of active ingredients
  - Chemical name is a complex name that identifies the chemical components and structure

Active Ingredient: Orthoboric Acid.....5%
Other Ingredients.....95%
Total.....100%

ACTIVE INGREDIENT:
Imidacloprid, 1-[(6-Chloro-3-pyridinyl) methyl]-*N*-nitro-2-imidazolidinimine..... 21.0%
β- Cyfluthrin, Cyano(4-fluoro-3-phenoxyphenyl)methyl 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylate 10.5%
OTHER INGREDIENTS: 68.5%
TOTAL 100.0%

Active Ingredient:	
Lambda-cyhalothrin[1] [1α(*S**),3α(*Z*)]-(±)-cyano-(3-phenoxyphenyl)methyl-3-(2-chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropanecarboxylate	0.045%
Other Ingredients:	99.955%
Total:	**100.000%**

EPA Registration and Establishment Numbers

- An EPA registration number indicates that the pesticide label has been approved by EPA
- Needed by the pesticide handler in case of poisoning, claims of misuse, or liability claims
- The establishment number appears on either the pesticide label or container
- Identifies the facility where the product was made



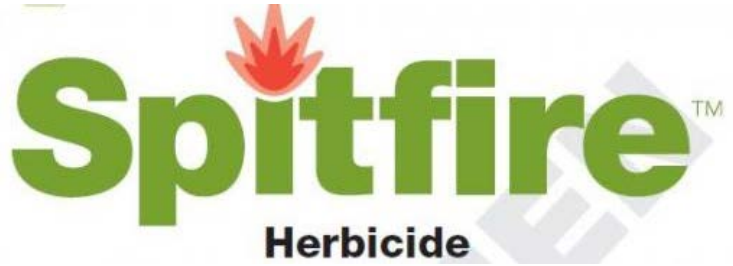


Other Identifying Information

- Name and address of manufacturer
- Net contents
- Type of Pesticide
  - Indicates in general terms what the product will control
- Type of formulation
  - May show up as abbreviation such as WP for wettable powder, D for dust, or EC for emulsifiable concentrate









Restricted Use Pesticide

- A statement describing the reason for the restricted-use classification will be present
- Will describe the category of certified applicator who can purchase and use the product

RESTRICTED USE PESTICIDE
DUE TO HIGH ACUTE INHALATION TOXICITY OF PHOSPHINE GAS
FOR RETAIL SALE TO DEALERS AND CERTIFIED APPLICATORS ONLY. FOR USE BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION, AND ONLY FOR THOSE USES COVERED BY THE CERTIFIED APPLICATOR'S CERTIFICATION. REFER TO THE DIRECTIONS IN THIS APPLICATOR'S MANUAL FOR REQUIREMENTS OF THE PHYSICAL PRESENCE OF A CERTIFIED APPLICATOR.

RESTRICTED USE PESTICIDE

DUE TO ACUTE ORAL TOXICITY and TO GROUND WATER CONTAMINATION

For retail sale to and use only by Certified Applicators or persons under the direct supervision of a Certified Applicator, and only for those uses covered by the Certified Applicator's certification.

Toxicity of Substances

- LD_{50} – Lethal Dose 50
  - The amount of hazardous material that kills 50% of a test population
  - Expressed in mg of toxicant per kg of body weight (mg/kg)
- Example:
  - Oral LD_{50} of a material is 832
  - 200 rats each weigh 1kg each are fed 832 mg
  - 100 will die
- Which substance is more toxic?
  - Substance A: LD_{50} = 200
  - Substance B: LD_{50} = 2000

Why is this substance more toxic?

LD_{50} of Common Pesticides & Everyday Items

- Chlordane 457
- Dursban 300-940
- Termidor SC >2000
- Boractin 3,450
- Nyguard IGR >5,100
- Intice Granular >5,000
- Gasoline 50
- Vinegar 22,000
- Nicotine 50
- Caffeine 370
- Aspirin 1,000
- Acetaminophen 2,400
- Table Salt 3,000
- Botulism 0.000005
- Ant or roach bait gels >5000
- Phantom >5000

The lower the LD_{50}, the more toxic the material is

Precautionary Statement

- Statement of practical treatment/First Aid
  - instructions on how to respond to an emergency exposure involving that product
  - instructions to seek medical help
- Signal words and symbols
  - DANGER ($LD_{50} \leq 50$)
  - WARNING ($LD_{50} = 50\text{-}500$)
  - CAUTION ($LD_{50} = 500\text{-}5000$)
- Use the signal word to help you decide what precautionary measures are needed for yourself, your workers and other persons (or animals) that may be exposed

FIRST AID	
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
If swallowed	• Call a poison control center or doctor immediately for treatment advice. • Do not give **any** liquid to the person. • Do not induce vomiting unless told to do so by the poison control center or doctor. • Do not give anything by mouth to an unconscious person.
If Inhaled	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. • Call a poison control center or doctor for further treatment advice.
Have the product container or label with you when calling a poison control center or doctor, or going for treatment.	
HOT LINE NUMBER For 24-Hour Medical Emergency Assistance (Human or Animal) or Chemical Emergency Assistance (Spill, Leak, Fire, or Accident), Call **1-800-888-8372**	

PRECAUTIONARY STATEMENTS

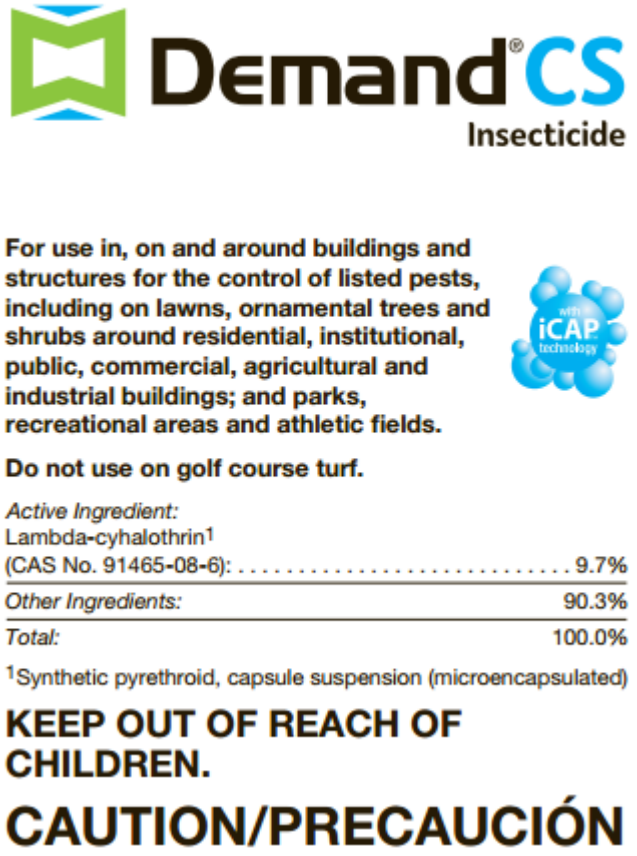
Hazards to Humans and Domestic Animals

CAUTION/PRECAUCIÓN

Harmful if absorbed through skin. Avoid breathing spray mist or vapor. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling, and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove contaminated clothing and wash before reuse. Prolonged or frequently repeated skin contact may cause allergic skin reactions in some individuals.

Signal Words

- Must appear in large letters on the front panel of the pesticide label
- This indicates how acutely toxic the product is to humans
- It reflects the hazard of any active ingredients, carriers, solvents, or inert ingredients
- The signal word is immediately below the statement, “Keep out of reach of children,” which also must appear on every label



Signal Words

- Danger
  - Signals that the product is highly toxic
- Warning
  - Signals that the product is moderately toxic
- Caution
  - Signals that the product is slightly toxic or relatively nontoxic
  - The skin or eye irritation it would cause, if any, is likely to be slight







Precautionary Statement

- Environmental Hazards
  - Indicates precautions for protecting the environment when you use the pesticide
  - Will contain specific precautionary statements if the pesticide poses a specific hazard to the environment
  - It may warn you that the product is highly toxic to bees, fish, or other wildlife
- Physical and Chemical Hazards
  - Alerts user to application hazards associated with using the product
    - Fire
    - Shock
    - Explosion

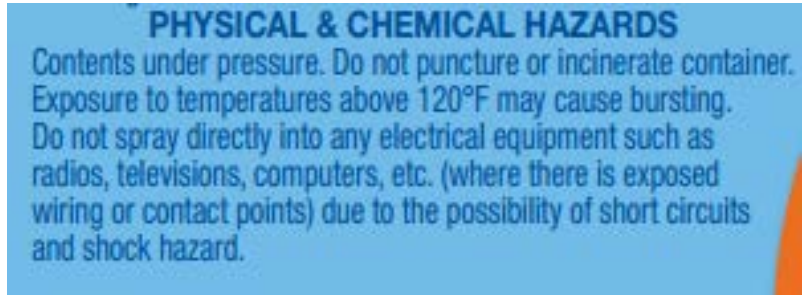
Environmental Hazards

This product is extremely toxic to fish and aquatic invertebrates. To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters, or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help to ensure that wind or rain does not blow or wash pesticide off the treatment area. Rinsing application equipment over the treated area will help avoid run-off to water bodies or drainage systems. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Apply this product only as specified on this label. When making applications, care should be used to avoid household pets, particularly fish and reptile pets.

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

Physical and Chemical Hazards

Do not use this product in or on electrical equipment due to the possibility of shock hazard.



THE NEW EPA BEE ADVISORY BOX

On EPA's new and strengthened pesticide label to protect pollinators



PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

This product can kill bees and other insect pollinators.

Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at:
http://pesticidestewardship.org/pollinatorprotection/Pages/default.aspx

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state/tribe, go to: www.aapco.org. Pesticide incidents can also be reported to the National Pesticide Information Center at: www.npic.orst.edu or directly to EPA at: beekill@epa.gov

Alerts users to separate restrictions on the label. These prohibit certain pesticide use when bees are present.

The new bee icon helps signal the pesticide's potential hazard to bees.

Makes clear that pesticide products can kill bees and pollinators.

Bees are often present and foraging when plants and trees flower. EPA's new label makes it clear that pesticides cannot be applied until all petals have fallen.

Warns users that direct contact and ingestion could harm pollinators. EPA is working with beekeepers, growers, pesticide companies, and others to advance pesticide management practices.

Highlights the importance of avoiding drift. Sometimes, wind can cause pesticides to drift to new areas and can cause bee kills.

The science says that there are many causes for a decline in pollinator health, including pesticide exposure. EPA's new label will help protect pollinators.

EPA

Read EPA's new and strengthened label requirements: http://go.usa.gov/jHH4

Other Precautionary Statements

- Acute effects statements
  - Indicate which route of entry (mouth, skin, eyes or lungs) you must protect and the specific action to take to avoid acute effects from exposure
- Delayed effects statements
  - Indicates the product has been shown to cause problems such as tumors or reproductive problems in laboratory animals
- Allergic effects statements
  - Indicate that the pesticide has a potential to cause allergic effects, such as skin irritation or asthma
- Personal protective equipment statements
  - Indicates the minimum personal protective equipment that you must wear when using the pesticide

PERSONAL PROTECTIVE EQUIPMENT (PPE)

All pesticide handlers (mixers, loaders, and applicators) must wear long-sleeved shirt and long pants, socks, shoes, and chemical-resistant gloves. All pesticide handlers must wear a dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C) when working in a non-ventilated space, including but not limited to crawl-spaces and basements. All pesticide handlers must wear protective eyewear (goggles, a faceshield, or safety glasses with front, brow, and temple protection) when working in a non-ventilated space, including but not limited to crawl-spaces and basements or when applying termiticide by rodding or sub-slab injection.

Directions for Use

- **NOT advice or suggestions, they are REQUIREMENTS**
- Instructions on
  - Handling
  - Mixing
    - Application Rate
  - Application
    - Target Pest
    - Target Site
  - Use Restrictions
  - Entry Statement
  - Storage
  - Disposal

MIXING INSTRUCTIONS

To prepare 1 gallon of a 0.06% spray dilution, add 0.8 fl oz of **Termidor SC** to the treatment tank already 1/4 - 1/3 filled with water. Filling hose must be equipped with an anti-backflow device or water flow must include an air gap to protect against back siphoning. While agitating add more water to make 1 gallon of finished dilution.

To make treatment, continue agitation and apply a coarse spray using a low-pressure sprayer.

USE RESTRICTIONS

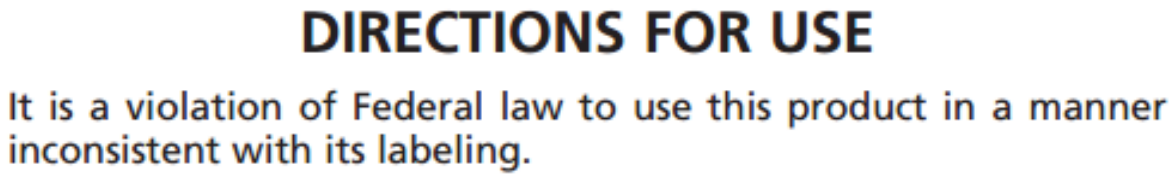
- Only protected applicators wearing personal protective equipment as required by this product label may be in the area during application.
- **DO NOT** treat within a distance of one foot out from the drip line of edible plants.
- **DO NOT** contaminate public and private water supplies.
- **DO NOT** contaminate water, food or feed. Cover or remove all exposed food, feed and drinking water.
- **DO NOT** apply to wasp or hornet nests if they are not attached to the structure exterior or inside wall voids.
- **DO NOT** make treatments while precipitation is occurring.

Use **Termidor® SC termiticide/insecticide** to kill and provide residual control of the following pests:
ants (acrobat, Argentine, big-headed, carpenter, crazy, odorous, pavement, pharaoh, thief)

Directions for Use

- On every pesticide product label is the following statement:

  "It is a violation of Federal Law to use this product in a manner inconsistent with its labeling."
- Pesticide may be used only on the plants, animals or sites named in the directions for use
- You can not use higher dosages, higher concentrations, or more frequent applications
- You must follow all directions for use, including directions concerning safety, mixing, diluting, storage and disposal



Storage and Disposal

- Entry statement
  - This statement tells you how much time must pass before people can enter a treated area except under special circumstances
- Storage and disposal
  - Contains some instructions for storing the pesticide
  - Pesticide labeling also contains some general information about how to dispose of excess pesticide and the pesticide containers in ways that are acceptable under Federal regulations
  - State and local laws vary, however, so the labeling usually does not give exact disposal instructions

Do not allow residents and pets into the immediate area during application and do not contact treated areas until sprays have dried.

STORAGE AND DISPOSAL

DO NOT contaminate water, food, or feed by storage or disposal.

STORAGE

Store unused product in original container only, out of reach of children and animals.

PESTICIDE DISPOSAL

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide is a violation of federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER HANDLING

Nonrefillable Container. DO NOT reuse or refill this container. Triple rinse or pressure rinse container (or equivalent) promptly after emptying; then offer for recycling, if available, or reconditioning, if appropriate, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures approved by state and local authorities.

Safety Data Sheets (SDS)

- Formally known as Material Safety Data Sheets (MSDS)
- Contains data regarding the properties of a particular substance
- Intended to provide workers and emergency personnel with procedures for handling or working with a substance in a safe manner

<u>Specific Sections that must be included in a product's SDS</u>

Section 1: Identification of Substance and Supplier
Section 2: Hazards Identification
Section 3: Composition/Ingredient information
Section 4: First Aid Measures
Section 5: Fire Fighting Measures
Section 6: Accidental Release Measures (Spill Containment)
Section 7: Handling and Storage
Section 8: Exposure Controls/Personal Protection
Section 9: Physical and Chemical Properties
Section 10: Stability and Reactivity
Section 11: Toxicological Information
Section 12: Ecological Information
Section 13: Disposal Considerations
Section 14: Transport Information
Section 15: Regulatory Information
Section 16: Other information not listed elsewhere

Safety Data Sheets (SDS)

The Global Harmonization System for Chemicals

now mandates

Hazard Communication Symbols called **Pictograms** be printed when applicable on all SDSs:

Health Hazard	**Flame**	**Exclamation Mark**
		
• Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	• Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	• Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non Mandatory)
Gas Cylinder	**Corrosion**	**Exploding Bomb**
		
• Gases under Pressure	• Skin Corrosion/ burns • Eye Damage • Corrosive to Metals	• Explosives • Self-Reactives • Organic Peroxides
Flame over Circle	**Environment *(Non Mandatory)**	**Skull and Crossbones**
		
• Oxidizers	• Aquatic Toxicity	• Acute Toxicity (fatal or toxic)

WEEKLY TRAINING SESSION

Basic Plant Physiology

Topic Category: Lawn

Recordable Verifiable Training Hours: 0.5

Objectives: This lesson is designed to teach Basic Plant Physiology.

Length of lesson: Approx 30 minutes.

Materials needed:

- Training Guideline
- Training Document – Basic Plant Physiology found in G:\Shared\GreenUp Reference Materials\Training Documents\Presentations\General Lawn or Shrub Topics.
- Pre- and Post- tests.

Training Guidelines:

- Make copies of the tests and training materials for all Team Members attending.
- Set up the training area in an area of the office that will minimize disruptions.
- Begin the meeting by defining the training topic and handing out the Pre-test
    - Allow a few minutes for Team Members to complete the Pre-test.
    - Collect the pre-test and hand out the Verifiable Training Record Form (VTRF)
- Distribute and review the training materials on Basic Plant Physiology
- Use the Training outline as a guide for key points.
    - Encourage active participation from all Team Members
    - Ask probing questions to develop key points
    - Encourage group reading
- After reading and reviewing all materials, ask questions to verify the lesson has been understood.
- Hand out the Post-tests. When complete, grade the tests and record the score on the VTRF.
- Collect tests and place with the verifiable materials in the Service Center Verifiable Training File.
- Make copies of the VTRF and place in each Team Member's training file.
- Complete all Weekly VTM's through Massey University.

WEEKLY TRAINING SESSION

Basic Plant Physiology

PRE & POST TEST

Name _____ Date _____

1. T or F Monocots are typically grass type plants
2. T or F Dicots are typically plants with woody trunks and stems.
3. T or F Palms are more closely related to grasses than to trees.
4. T or F Plants convert sunlight into proteins through the process of photosynthesis.
5. T or F Carbohydrates are transported from the leaves to the roots through the Xylem layer.
6. T or F Water is transported from the roots to the leaves through the Phloem layer.
7. T or F In Dicots, the Phloem layer is the inner layer of what we would commonly call bark.
8. T or F In Dicots, the Xylem layer is the first few growth rings of white wood.
9. T or F In Monocots, the xylem and phloem are scattered throughout the trunk in tube-like bundles.
10. T or F The primary root system of established trees and palms is typically in the top 18 inches of soil and extends well beyond the drip line of the plant.
11. T or F The primary factor the determines the depth of rooting is the availability of water.
12. T or F Planting a shrub or tree with the root ball slightly above the soil grade is much preferred to planting with the root ball slightly below the soil grade.

WEEKLY TRAINING SESSION

Basic Plant Physiology

PRE & POST TEST ANSWER KEY

1. (T) or F Monocots are typically grass type plants

2. (T) or F Dicots are typically plants with woody trunks and stems.

3. (T) or F Palms are more closely related to grasses than to trees.

4. T or (F) Plants convert sunlight into proteins through the process of photosynthesis.

5. T or (F) Carbohydrates are transported from the leaves to the roots through the Xylem layer.

6. T or (F) Water is transported from the roots to the leaves through the Phloem layer.

7. (T) or F In Dicots, the Phloem layer is the inner layer of what we would commonly call bark.

8. (T) or F In Dicots, the Xylem layer is the first few growth rings of white wood.

9. (T) or F In Monocots, the scattered throughout the trunk in tube-like bundles.

10. (T) or F The primary root system of established trees and palms is typically in the top 18 inches of soil and extends well beyond the drip line of the plant.

11. T or (F) The primary factor the determines the depth of rooting is the availability of water.

12. (T) or F Planting a shrub or tree with the root ball slightly above the soil grade is much preferred to planting with the root ball slightly below the soil grade.

Basic Plant Physiology

Basic Plant Physiology

- To understand how certain problems effect trees and palms, you first need to know the internal functions of the plant and some basic terms.

Monocots and Dicots

- "Flowering" plants can be placed into two groups – Monocots and Dicots.
- Monocots are typically grass type plants.
- They are referred to as monocots because they have one leaf that emerges from the seed.
- Dicots are typically plants with "woody" trunks and stems.
- They are referred to as Dicots because they have two leaves that emerge from the seed.

Monocots and Dicots

- Palms are Monocots and are more closely related to grasses than trees.
- Trees such as Oaks, Maples and Sycamores are Dicots

Food and Water Transportation

- A plant produces food for it's root system by gathering sunlight through the leaves and through the process of photosynthesis converts the sunlight into carbohydrates.
- Carbohydrates are transported to the down to the roots through the Phloem layer.
- Water is transported from the roots to the leaves through the Xylem layer.

Monocots and Dicots – Cross Section of Stem



Monocot



Dicot

Food and Water Transportation

- In Dicot type plants, the phloem layer is the inner layer of what we would commonly call the bark.
- The Xylem layer is the first few growth rings of white wood.

Food and Water Transportation in Dicots

- Outer Bark
- Phloem
  - Moves "food" from the leaves to the roots
- Xylem
  - Moves water from the roots to the leaves
- Cambium
  - Separates the xylem from the phloem.
  - Cambium cells produce phloem on one side and xylem on the other.



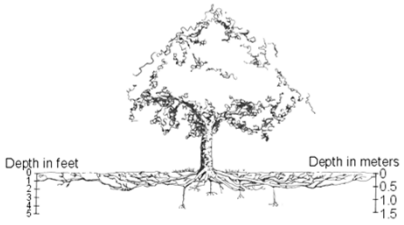
Food and Water Transportation in Monocots

- Palms do not have separated areas of Xylem and Phloem in the same manner as “trees”.
- The xylem and phloem are scattered in tube-like bundles throughout the trunk.



Root System

- The primary root system of shrubs, trees and palms is in the top 18 inches of soil.
- Most of the functional roots extend well beyond the drip line of the plant.



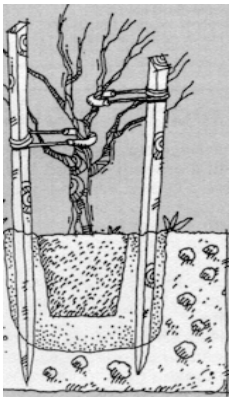
Root System

- The primary factor that determines the depth of rooting is oxygen.
- Roots need oxygen to survive and function properly.



Proper Planting Depth

- Shrubs and trees should be planted at the same depth they were growing before they were planted.
- Planting with the root ball slightly out of the ground is much preferred over planting too deep.



Planting Depth

- Trees planted at the correct depth will show exposed root flares.



WEEKLY TRAINING SESSION

Ganoderma Butt Rot

Topic Category: Lawn

Recordable Verifiable Training Hours: 0.5

Objectives: This lesson is designed to teach the identification of Ganoderma Butt Rot of palms.

Length of lesson: Approx 30 minutes.

Materials needed:

- Training Guideline
- Ganoderma Butt Rot Training Document G:Drive\Shared\GreenUp Reference Materials\Training Documents\Palm Info\Palm Diseases
- Collect samples of Ganoderma mushroom conks from the field, if available.
- Pre- and Post- tests.

Training Guidelines:

- Make copies of the tests and training materials for all Team Members attending.
- Set up the training area in an area of the office that will minimize disruptions.
- Begin the meeting by defining the training topic and handing out the Pre-test
    - Allow a few minutes for Team Members to complete the Pre-test.
    - Collect the pre-test and hand out the Verifiable Training Record Form (VTRF)
- Distribute and review the training materials on Ganoderma Butt Rot of Palms.
- Use the Training outline as a guide for key points.
    - Encourage active participation from all Team Members
    - Ask probing questions to develop key points
    - Encourage group reading
- After reading and reviewing all materials, ask questions to verify the lesson has been understood.
- Hand out the Post-tests. When complete, grade the tests and record the score on the VTRF.
- Collect tests and place with the verifiable materials in the Service Center Verifiable Training File.
- Make copies of the VTRF and place in each Team Member's training file.
- Complete all Weekly VTM's through Massey University.

FL/LA

WEEKLY TRAINING SESSION

Ganoderma Butt Rot

Name _____ Date _____

PRE & POST TEST

1. T or F Ganoderma butt rot only affects Canary Island Date Palms.
2. T or F Ganoderma butt rot is a lethal disease of palms.
3. T or F Ganoderma butt rot can be prevented or controlled with the use of fungicides.
4. T or F A palm cannot be diagnosed with Ganoderma butt rot until the mushroom conk forms on the trunk or the internal rotting of the trunk is observed after the palm is cut down.
5. T or F Ganoderma butt rot is spread by spores, which are produced and released from the mushroom conk.
6. T or F A palm showing the evidence of Ganoderma butt rot should be removed as soon as possible.
7. T or F Because Ganoderma butt rot survives in the soil, planting another palm in the same location is not recommended.
8. T or F If a palm is found that exhibits evidence of Ganoderma butt rot, it will surely die.

FL/LA

WEEKLY TRAINING SESSION

Ganoderma Butt Rot

PRE & POST TEST ANSWER KEY

1. T or F (F) Ganoderma butt rot only affects Canary Island Date Palms.
2. (T) or F Ganoderma butt rot is a lethal disease of palms.
3. T or F (F) Ganoderma butt rot can be prevented or controlled with the use of fungicides.
4. (T) or F A palm cannot be diagnosed with Ganoderma butt rot until the mushroom conk forms on the trunk or the internal rotting of the trunk is observed after the palm is cut down.
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7. (T) or F Because Ganoderma butt rot survives in the soil, planting another palm in the same location is not recommended.
8. (T) or F If a palm is found that exhibits evidence of Ganoderma butt rot, it will surely die.

FL/LA

PP-54

UF UNIVERSITY of FLORIDA
IFAS Extension

Ganoderma Butt Rot of Palms[1]

Monica L. Elliott and Timothy K. Broschat[2]

Summary

- Ganoderma butt rot is caused by the fungus *Ganoderma zonatum*. This fungus degrades or rots the lower 4-5 feet of the trunk.
- All palms are considered hosts of this fungus. This fungus is not a primary pathogen of any other plant species.
- Symptoms may include wilting (mild to severe) or a general decline. The disease is confirmed by observing the basidiocarp (conk) on the trunk. This is a hard, shelf-like structure that will be attached to the lower 4-5 feet of the palm trunk. However, not all diseased palms produce conks prior to death.
- A palm cannot be diagnosed with Ganoderma butt rot until the basidiocarp (conk) forms on the trunk, or the internal rotting of the trunk is observed after the palm is cut down.
- The fungus is spread by spores, which are produced and released from the basidiocarp (conk).
- Conditions that are conducive for disease development are unknown.
- There are currently no cultural or chemical controls for preventing the disease or for curing the disease once the palm is infected.
- A palm should be removed as soon as possible after the conks appear on the trunk. Remove as much of the stump and root system as possible when the palm is removed.
- Because the fungus survives in the soil, planting another palm back in that same location is not recommended.

Introduction

Ganoderma butt rot is a lethal disease of palms, both in the landscape and natural settings. While the disease is more prevalent in the southern half of the state, where palms are in greatest abundance, it is certainly not restricted to that area. The fungus that causes the disease is distributed throughout Florida, from Key West to Jacksonville to Pennsacola. It is also known to occur in Georgia and South Carolina.

1. This document is Fact Sheet PP-54, one of a series of the Plant Pathology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date November 2000. Revised May 2009. Visit the EDIS Web sSite at http://edis.ifas.ufl.edu.

2. Monica L. Elliott, professor, Plant Pathology Department, and Timothy K. Broschat, professor, Environmental Horticulture Department, Fort Lauderdale Research and Education Center--Fort Lauderdale, FL; Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL.

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Pathogen and Hosts

The fungal genus *Ganoderma* is a group of wood-decaying fungi that are found throughout the world on all types of wood — gymnosperms, woody dicots, and palms. There are many different species of this fungus in Florida, but only one is a pathogen of palms. That fungus is G*anoderma zonatum*. Another fungal name that was associated with this disease in the first half of the 20th century was *Ganoderma sulcatum*. Recently, these two species have been grouped together as one, *G. zonatum*.

While there are a few reports of *G. zonatum* on non-palm hosts, these reports are very limited. Therefore, palms are considered the primary hosts of this fungus. In general, if you observe a basidiocarp (conk) on a palm trunk, especially if it is still living, it is probably safe to assume it is *G. zonatum* and not some other *Ganoderma* species. Likewise, the *Ganoderma* species often observed on hard-wood trees, such as oak, are rarely observed on living palms. These other *Ganoderma* species may occur on dead palm trunks and stumps, but they are present simply as saprobes (fungi that live off dead plant material).

All palms are assumed to be susceptible to this disease. While not all palms growing in Florida have been documented with Ganoderma butt rot, at least 65 species of palms have. Those not documented with this disease are not commonly grown and have thus far escaped. The only possible exceptions would be palm species that do not form woody trunks — e.g., *Sabal minor* and some *Chamaedorea* spp. Since *G. zonatum* kills by degrading wood, these palm species may not have any suitable tissue to serve as a substrate for the fungus.

Symptoms, Signs and Diagnosis

Ganoderma zonatum is a white rot fungus that produces numerous enzymes that allow it to degrade (rot) woody tissue, primarily lignin and cellulose. As the fungus destroys the palm wood internally, the xylem (water-conducting tissue) will eventually be affected. Therefore, the primary symptom that may be observed is a wilting, mild to severe, of all leaves but the spear leaf (Figures 1 and 2). Other symptoms can best be described as a general decline – slower growth and off-color foliage. However, these symptoms alone should not be used for diagnosis of Ganoderma butt rot, since other disorders or diseases may also cause these symptoms.



Figure 1. *Sabal palmetto* (sabal palm) with wilted and dessicated leaves due to *Ganoderma zonatum* infection. Credits: M. L. Elliott

The basidiocarp or conk is the most easily identifiable structure associated with the fungus. The conk originates from fungal growth *inside* the palm trunk. Figure 3 illustrates different stages in the development of the conk. When the conk first starts to form on the side of a palm trunk or palm stump, it is a solid white mass that is relatively soft when touched. It will have an irregular to circular shape and is relatively flat on the trunk or stump.

As the conk matures, a small shelf or bracket will start to form as the basidiocarp begins to extend or protrude from the trunk. It will still be white, both on the top and bottom surfaces. Eventually, it will form a very distinct shelf-like structure that is quite hard with a glazed reddish-brown top surface and a white undersurface (Figure 4). A mature conk will have distinct zones, hence the name *G. zonatum*. The conk will have a half-moon shape with the relatively "straight" side directly attached to the trunk.



Figure 2. *Syagrus romanzoffiana* (queen palm) dying from *Ganoderma zonatum*. Only the spear and one other leaf remain green. Credits: M. L. Elliott



Figure 3. Three phases of basidiocarp (conk) development of *Ganoderma zonatum*. The white "button" near the top of the picture is the beginning stage of the conk. The lower-right structure is a mature conk. The lower-left structure is also a mature conk, but it is an old one; the underside of this conk is no longer white. Credits: M. L. Elliott

If a conk is present on the trunk at the same time the wilt or decline symptoms appear, then it is safe to diagnose Ganoderma butt rot. However, it is not uncommon for conks not to appear prior to severe decline and death of a palm. In that situation, the only way to determine if Ganoderma butt rot is the cause is to cut cross-sections through the lower 4 feet of the trunk after the palm is cut down (Figures 5 and 6). Conks may form on the palm stump after the diseased palm is removed.



Figure 4. Basidiocarp (conk) of *Ganoderma zonatum*. Note glazed reddish-brown top surface and white undersurface. The "straight" side of the conk is directly attached to the trunk. There is no "stem" or "stalk" that attaches the conk to the trunk. Credits: M. L. Elliott



Figure 5. Cross-sections of lower trunk of *Syagrus romanzoffiana* infested with *Ganoderma zonatum.* Top-left section is bottom section (section 1) and remaining sections progress up the trunk. Note darkening of wood due to fungal degradation (rot). Credits: M.L. Elliott



Figure 6. Comparison of pygmy date palm sections that are either healthy (right) or diseased (left) with *Ganoderma zonatum*. Credits: M.L. Elliott

Conks of *G. zonatum* can be up to 8 inches at their widest point and 2 inches thick. However, conks will take on the shape and size of the area in which they are growing (Figure 7). Microscopic

basidiospores are produced in the "pores" present on the underside of the conk. When basidiospores are dropped en mass on a white surface, they will appear brownish-red in color (Figure 8). Objects immediately around a conk that has dropped its spores may appear to be covered with a rusty colored dust. One conk can produce 3 cups of spores.



Figure 7. Cut palm stump with numerous basidiocarps (conks) of *Ganoderma zonatum* forming on it. The conks in the palm stump's center are crowding each other and thus are forming into shapes different from those on the outer edges of the stump. Credits: M. L. Elliott



Figure 8. Spore release from mature conks (same stump as Figure 7) has resulted in reddish-brown appearance of conks and surrounding area. Credits: M. L. Elliott

Disease and Fungus Life Cycle

The fungus is spread primarily by the spores produced in the basidiocarp (conk). The spores become incorporated into the soil, germinate and the hyphae (fungal threads) then grow over the palm roots. The fungus does not rot the palm roots, it simply uses the roots as a means of moving to the woody trunk tissue (Figure 9). Once a palm is infected with *G. zonatum*, the fungus will move with that palm to the location in which it is transplanted. It is also possible that soil associated with transplanted palms is infested with the fungus.



Figure 9. Longitudinal section through *Phoenix roebelenii* trunk and root system. The trunk is darkened due to infection with *Ganoderma zonatum*. The fungus is not rotting the roots but was isolated from the roots. Credits: M. L. Elliott

We do not know exactly how many months or years pass between initial infection of a palm and development of the conk. There is *no* method that can determine if a palm is infected with *G. zonatum*. Until the conk forms, there can be no confirmation of this disease. Therefore, it is not possible to guarantee that a palm is free of *Ganoderma* when first planted in the landscape.

Figures 5 and 10 are examples of the wood rotting and disease progression pattern observed. The fungus colonizes and degrades the palm trunk tissue closest to the soil line first, expands in diameter at the base and moves up the center or near-center of the trunk. Therefore, the disease progression pattern within the trunk is best described as cone-shaped, widest at the soil line and narrowing to a pinpoint.

The location of the conk is where the fungus is *emerging* from the trunk. This means the degradation is occurring internally as the fungus moves from the lower center of the palm to the outside. Therefore, wounds are *not* a likely factor in disease initiation. Other external environmental factors associated with the trunk are probably not associated with disease development either, such as too much mulch around



Figure 10. Sections 5 and 6 of Figure 5 (bottom row, middle sections) after incubation in a moist chamber for 4 days. White growth is hyphae of *Ganoderma zonatum* and corresponded with the discolored area of the cross-sections. Credits: M. L. Elliott

the trunk, irrigation heads striking the trunk, flowers or shrubs too close to the trunk, or painting the trunk.

Disease Management

No environmental conditions or landscape management practices have been observed that favor the development of Ganoderma butt rot. The disease occurs in natural settings (palms never transplanted) and in highly-maintained, transplanted landscapes. It occurs on palms that have been maintained very well nutritionally (no nutrient deficiencies) and on palms that were severely stressed by deficiencies. The disease occurs in well-drained settings and in swamps. The fungus has killed trees that had no apparent mechanical injuries and those that had been severely damaged by, for example, weed trimmers. Soil type appears to have no relationship with disease either, as diseased palms have been observed on deep sands (both silica and calcareous), muck (peat), and limestone rock. There has been no discernible pattern to provide clues as to why some palms become infected and die from *G. zonatum*, and others do not.

In general, the fungus will be located in the lower 4-5 feet of trunk. This has three implications. First, this means the fungus is not spread with pruning tools since the fungus is not associated with leaves. Second, this means that only the lower trunk portion should *not* be chipped and used for mulch. If possible, the diseased section should be placed in a landfill or incinerated. The remaining, fungus-free portion of the palm trunk could be chipped and used for mulch in the landscape.

Third, only the lower 4-5 feet of trunk will need to be protected from the fungus. However, typical xylem-limited, systemic fungicides will not be effective unless they are capable of spreading beyond the vascular tissue and protecting *all* the wood in the lower portion of the trunk. We know of no fungicide with these capabilities. Also, no fungicide will be effective once the conks have formed, since a large percentage of the trunk cross-sectional area has already been destroyed. Since we have no means of predicting or determining which palms are infected with *G. zonatum*, this effectively eliminates the use of fungicides as a control method, either preventively or curatively, for the present time. Therefore, there are no fungicide recommendations for this disease.

Since basidiospores from the basidiocarps (conks) are probably the primary method of spreading the fungus, palms should be monitored closely, especially after a palm has died or been removed *for any reason*. The fungus will readily colonize and degrade palm stumps (See Figures 7 and 8). Once the fungus becomes established in this dead wood, it will normally produce conks with millions of basidiospores that are easily moved by wind and water.

Therefore, monitor palms and palm stumps for the conks. Remove the conk and place in a trash receptacle that will be incinerated or delivered to a landfill. Do not place in trash that will be recycled in the landscape. The earlier the conk is removed (i.e., before it becomes a distinct shelf-like structure), the less likely that spores will be released into the environment. If you have never observed Ganoderma butt rot on the property, monitoring the palms once every six months will be adequate. Once you have observed the conks on palms or have a palm cut or fall down for any reason, monitor your palms at least once a month. Also, monitor the entire neighborhood, not just your yard. These spores blow with the wind, so it should be a community effort to reduce the spread of the spores of this lethal fungus.

Once a conk is observed on a palm, the palm should be removed – primarily for safety reasons. This is especially important during the hurricane season. As indicated before, if conks are being produced on a live palm, it means that a significant

portion of the trunk is already rotted. These palms are likely to be the first blown down in heavy winds. As much as you may want to keep the palm, it is probably best not to do so. When you remove the palm, remove as much of the stump and root system as possible. Alternatively, if you cannot remove the stump, then grind-up the stump. This will allow the infected stump material to degrade more quickly. By removing the stump or grinding the stump into smaller pieces, this will help to limit conk formation on any palm trunk material left behind. You should still monitor the site for conk formation, as described in the previous paragraph.

The fungus survives in the soil. It has been observed that replacement palms planted into the same site where a palm died from Ganoderma butt rot also became diseased and died. Therefore, replanting with another palm is risky. No other plant species (pines, oaks, woody shrubs, etc.) are affected by *G. zonatum* – only palms. In other words, replacing the *Ganoderma*-diseased palm with any other plant except a palm would be a wise choice.

We do not know how long you should wait before it is safe to plant another palm in a *Ganoderma*-infested site. We can say that the time is measured in multiple years, not months, since the fungus is probably capable of living in the soil almost indefinitely.

If you insist on replanting with a palm, follow these guidelines. Remove the stump and all roots from the site. Then, fumigate the soil. You can have this done by a licensed professional using a legally registered fumigant for the landscape. An example would be the product dazomet (trade name = Basamid). If the palm was located in a site surrounded by concrete (ex: a street median), also remove all of the old soil. Bring in new soil and then fumigate. However, this does not guarantee the new palms will remain free of *Ganoderma zonatum*, as the fungus may already be associated with the new palm and fungal spores can be easily blown into the newly fumigated site.

Selected References

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Gilbertson, R.L., and L. Ryvarden. 1986. North American Polypores. FungiFlora A/S. Oslo, Norway.

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WEEKLY TRAINING SESSION

Basic Plant Physiology

Topic Category: Lawn

Recordable Verifiable Training Hours: 0.5

Objectives: This lesson is designed to teach Basic Plant Physiology.

Length of lesson: Approx 30 minutes.

Materials needed:

- Training Guideline
- Training Document – Basic Plant Physiology found in G:\Shared\GreenUp Reference Materials\Training Documents\Presentations\General Lawn or Shrub Topics.
- Pre- and Post- tests.

Training Guidelines:

- Make copies of the tests and training materials for all Team Members attending.
- Set up the training area in an area of the office that will minimize disruptions.
- Begin the meeting by defining the training topic and handing out the Pre-test
    - Allow a few minutes for Team Members to complete the Pre-test.
    - Collect the pre-test and hand out the Verifiable Training Record Form (VTRF)
- Distribute and review the training materials on Basic Plant Physiology
- Use the Training outline as a guide for key points.
    - Encourage active participation from all Team Members
    - Ask probing questions to develop key points
    - Encourage group reading
- After reading and reviewing all materials, ask questions to verify the lesson has been understood.
- Hand out the Post-tests. When complete, grade the tests and record the score on the VTRF.
- Collect tests and place with the verifiable materials in the Service Center Verifiable Training File.
- Make copies of the VTRF and place in each Team Member's training file.
- Complete all Weekly VTM's through Massey University.

GA

WEEKLY TRAINING SESSION

Basic Plant Physiology

PRE & POST TEST

Name _____ Date _____

1. T or F Monocots are typically grass type plants
2. T or F Dicots are typically plants with woody trunks and stems.
3. T or F Palms are more closely related to grasses than to trees.
4. T or F Plants convert sunlight into proteins through the process of photosynthesis.
5. T or F Carbohydrates are transported from the leaves to the roots through the Xylem layer.
6. T or F Water is transported from the roots to the leaves through the Phloem layer.
7. T or F In Dicots, the Phloem layer is the inner layer of what we would commonly call bark.
8. T or F In Dicots, the Xylem layer is the first few growth rings of white wood.
9. T or F In Monocots, the xylem and phloem are scattered throughout the trunk in tube-like bundles.
10. T or F The primary root system of established trees and palms is typically in the top 18 inches of soil and extends well beyond the drip line of the plant.
11. T or F The primary factor the determines the depth of rooting is the availability of water.
12. T or F Planting a shrub or tree with the root ball slightly above the soil grade is much preferred to planting with the root ball slightly below the soil grade.

WEEKLY TRAINING SESSION

Basic Plant Physiology

PRE & POST TEST ANSWER KEY

1. (T) or F Monocots are typically grass type plants

2. (T) or F Dicots are typically plants with woody trunks and stems.

3. (T) or F Palms are more closely related to grasses than to trees.

4. T or (F) Plants convert sunlight into proteins through the process of photosynthesis.

5. T or (F) Carbohydrates are transported from the leaves to the roots through the Xylem layer.

6. T or (F) Water is transported from the roots to the leaves through the Phloem layer.

7. (T) or F In Dicots, the Phloem layer is the inner layer of what we would commonly call bark.

8. (T) or F In Dicots, the Xylem layer is the first few growth rings of white wood.

9. (T) or F In Monocots, the scattered throughout the trunk in tube-like bundles.

10. (T) or F The primary root system of established trees and palms is typically in the top 18 inches of soil and extends well beyond the drip line of the plant.

11. T or (F) The primary factor the determines the depth of rooting is the availability of water.

12. (T) or F Planting a shrub or tree with the root ball slightly above the soil grade is much preferred to planting with the root ball slightly below the soil grade.

Basic Plant Physiology

Basic Plant Physiology

- To understand how certain problems effect trees and palms, you first need to know the internal functions of the plant and some basic terms.

Monocots and Dicots

- "Flowering" plants can be placed into two groups – Monocots and Dicots.
- Monocots are typically grass type plants.
- They are referred to as monocots because they have one leaf that emerges from the seed.
- Dicots are typically plants with "woody" trunks and stems.
- They are referred to as Dicots because they have two leaves that emerge from the seed.

Monocots and Dicots

- Palms are Monocots and are more closely related to grasses than trees.
- Trees such as Oaks, Maples and Sycamores are Dicots

Food and Water Transportation

- A plant produces food for it's root system by gathering sunlight through the leaves and through the process of photosynthesis converts the sunlight into carbohydrates.
- Carbohydrates are transported to the down to the roots through the Phloem layer.
- Water is transported from the roots to the leaves through the Xylem layer.

Monocots and Dicots – Cross Section of Stem



Monocot



Dicot

Food and Water Transportation

- In Dicot type plants, the phloem layer is the inner layer of what we would commonly call the bark.
- The Xylem layer is the first few growth rings of white wood.

Food and Water Transportation in Dicots

- Outer Bark
- Phloem
  - Moves "food" from the leaves to the roots
- Xylem
  - Moves water from the roots to the leaves
- Cambium
  - Separates the xylem from the phloem.
  - Cambium cells produce phloem on one side and xylem on the other.



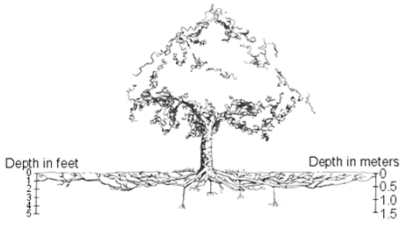
Food and Water Transportation in Monocots

- Palms do not have separated areas of Xylem and Phloem in the same manner as “trees”.
- The xylem and phloem are scattered in tube-like bundles throughout the trunk.



Root System

- The primary root system of shrubs, trees and palms is in the top 18 inches of soil.
- Most of the functional roots extend well beyond the drip line of the plant.



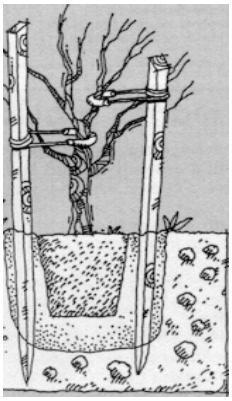
Root System

- The primary factor that determines the depth of rooting is oxygen.
- Roots need oxygen to survive and function properly.



Proper Planting Depth

- Shrubs and trees should be planted at the same depth they were growing before they were planted.
- Planting with the root ball slightly out of the ground is much preferred over planting too deep.



Planting Depth

- Trees planted at the correct depth will show exposed root flares.



WEEKLY TRAINING SESSION

Monthly Landscape Service Protocol

Topic Category: Lawn

Recordable Verifiable Training Hours: 0.75

Objectives: This lesson is designed to teach our Monthly Landscape Service Protocol.

Length of lesson: Approximately 45 minutes.

Materials needed:

- Training Guideline
- Monthly Landscape Service Protocol (G:\Shared\GreenUp Reference Materials\GreenUp Protocols\Individual Protocols\Lawn Care Basic Application)
- Pre- and Post- tests.

Training Guidelines:

- Make copies of the tests and training materials for all Team Members attending.
- Set up the training area in an area of the office that will minimize disruptions.
- Begin the meeting by defining the training topic and handing out the Pre-test
    - Allow a few minutes for Team Members to complete the Pre-test.
    - Collect the pre-test and hand out the Verifiable Training Record Form (VTRF)
- Distribute and review the Monthly Landscape Service Protocol
    - Encourage active participation from all Team Members
    - Ask probing questions to develop key points
    - Encourage group reading
- After reading and discussing all materials, ask questions to verify the lesson has been understood.
- Hand out the Post-tests. When complete, grade the tests and record the score on the VTRF.
- Collect tests and place with the verifiable materials in the Service Center Verifiable Training File.
- Make copies of the VTRF and place in each Team Member's training file.
- Complete all Weekly VTM's through Massey University.

WEEKLY TRAINING SESSION

Monthly Landscape Service Protocol

Name _____ Date _____

PRE & POST TEST (Page 1 of 2)

1. The objective(s) of performing our Monthly Landscape Service is to _____.
   A. Build our relationship with our customer
   B. Perform an application to enhance the beauty of the customer's landscape and prevent future problems.
   C. Provide solutions to customer concerns that may not be included in the services they have already purchased and obtain payment for services
   D. All of the above.

2. T or F Small trees under 4 inches diameter at chest height are included in our Landscape Service.

3. T or F Ground covers are included in our Landscape Service.

4. T or F Annual plantings are included in our Landscape Service.

5. T or F Plant pests are commonly present due to a deficiency with one of the 5 Key Principles

6. T or F Our manner of conduct with a customer should be similar to what would be provided to a respected member of your family such as a parent or grandparent.

7. T or F The primary purpose of calling our customer is to inform them that we will be coming to treat their lawn or shrubs.

8. T or F When calling our customer, we should always ask to speak with the customer by name, followed by who we are and where we are from.

9. T or F It is okay to use the speaker phone when calling a customer so long as we pick the phone up quickly when they answer.

10. T or F The word "just" used in the following sentence makes the service we are going to provide sound friendly. "I am just going to come by to treat your lawn".

11. T or F When initially speaking with the customer at the door, we should inform them that we are going to inspect the back lawn before we start our treatment.

12. T or F When inspecting the landscape, we should only inspect the plant material that is due for service.

WEEKLY TRAINING SESSION

Monthly Landscape Service Protocol

PRE & POST TEST (Page 2 of 2)

13. T or F The focus of our inspection is to identify what plants need treatment.

14. T or F If there are weeds present in the lawn when we are scheduled to perform a shrub care treatment, we should perform treatment to control them as well as identify why they are there.

15. T or F Performing only the Lawn Care Application or only the Shrub Care Application and not addressing the needs of both the lawn and shrubbery is not performing the service in its entirety.

16. T or F Pesticide application signs must always be posted by the mailbox.

17. T or F Corner lots will need a sign posted on both streets.

18. T or F We must always return to the door after treatment.

19. T or F We must always obtain a signature on the Service Report or handheld computer and ask for payment when the customer is available.

20. T or F When the customer has a problem that is not included with the service we are providing such as the need for Irrigation or Renovation, we must always provide the customer with a solution and pricing when we have the expertise to do so or inform the customer that you will have an Inspector contact them to set up a time to help them with a solution.

Name _____ Date _____

WEEKLY TRAINING SESSION

Monthly Landscape Service Protocol

PRE & POST TEST ANSWER KEY

1. The objective(s) of performing our Monthly Landscape Service is to _____.
   - A. Build our relationship with our customer
   - B. Perform an application to enhance the beauty of the customer's landscape and prevent future problems.
   - c. Provide solutions to customer concerns that may not be included in the services they have already purchased and obtain payment for services
   - (d.) All of the above.

2. (T) or F Small trees under 4 inches diameter at chest height are included in our Landscape Service.

3. (T) or F Ground covers are included in our Landscape Service.

4. T or (F) Annual plantings are included in our Landscape Service.

5. (T) or F Plant pests are commonly present due to a deficiency with one of the 5 Key Principles

6. (T) or F Our manner of conduct with a customer should be similar to what would be provided to a respected member of your family such as a parent or grandparent.

7. T or (F) The primary purpose of calling our customer is to inform them that we will be coming to treat their lawn or shrubs. (It is to build long-term lasting relationships)

8. T or (F) When calling our customer, we should always ask to speak with the customer by name, followed by who we are and where we are from. (Tell them who we are first)

9. T or (F) It is okay to use the speaker phone when calling a customer so long as we pick the phone up quickly when they answer.

10. T or (F) The word "just" used in the following sentence makes the service we are going to provide sound friendly. "I am just going to come by to treat your lawn". ("Just" is a devaluing word)

11. (T) or F When initially speaking with the customer at the door, we should inform them that we are going to inspect the back lawn before we start our treatment.

12. T or (F) When inspecting the landscape, we should only inspect the plant material that is due for service.

WEEKLY TRAINING SESSION

Monthly Landscape Service Protocol

13. T or F — The focus of our inspection is to identify what plants need treatment.
(We should be focused on all 5 Key Principles)

14. T or F — If there are weeds present in the lawn when we are scheduled to perform a shrub care treatment, we should perform treatment to control them as well as identify why they are there.

15. T or F — Performing only the Lawn Care Application or only the Shrub Care Application and not addressing the needs of both the lawn and shrubbery is not performing the service in its entirety.

16. T or F — Pesticide application signs must always be posted by the mailbox.

17. T or F — Corner lots will need a sign posted on both streets.

18. T or F — We must always return to the door after treatment.

19. T or F — We must always obtain a signature on the Service Report or handheld computer and ask for payment when the customer is available.

20. T or F — When the customer has a problem that is not included with the service we are providing such as the need for Irrigation or Renovation, we must always provide the customer with a solution and pricing when we have the expertise to do so or inform the customer that you will have an Inspector contact them to set up a time to help them with a solution.

GREENUP SERVICE PROTOCOLS

Georgia Specific Monthly Landscape Service Protocol

Objective

Each of our regularly scheduled services provides us with an opportunity to:

- Build our relationship with our customer
- Perform an application to enhance the beauty of the customer's landscape
- Prevent future problems
- Provide solutions to customer concerns that may not be included in the services they have already purchased
- Obtain payment for services performed.

Achieving each of these objectives requires actions in a particular manner which must be done with purposeful intent.

Monthly Landscape Service Protocol

Our Monthly Landscape Service is our premier landscape service offering. The Monthly Landscape Service is designed to include both inspection and service of the lawn and landscape plants on a monthly service frequency, as well as an annual aeration service with an application of high efficiency lime and irrigation inspection. Eight services out of 12 provide scheduled treatment for the lawn plus perform supplemental treatments to the shrubs as needed; the remaining four services provide scheduled treatment for the shrubs and perform supplemental treatments to the lawn as needed. By being on our customer's property every month and providing inspection and treatment for the lawn and shrubs, our customer is buying peace of mind that our service will reduce any chance of problems or damage in their landscape. The scope of landscape coverage includes agronomic care for the turf, shrubs, small trees under 4 inches diameter at chest height and ground covers (annual plantings are not included with the service). The care we provide includes insect and disease control as well as nutritional treatments (including soil pH adjustment) for the landscape plantings listed above. The service also includes weed control in turf areas (not shrub beds) for all weeds that have a selective treatment available and non-selective weed control as required and when the customer has been informed and has agreed to such action. The types of turf we service are Bermuda, Zoysia and Tall Fescue. We do not service St. Augustine or Centipede grasses. Our programs are not suitable for these grasses and damage will occur.

Providing these services requires a holistic approach, with the 5 Key Principles of Plant Health Care as our constant guide. The 5 Key Principles are:

1. **Right Plants in the Right Place and Installed Properly**- Are the plants suited to the environmental conditions of the site? Are alterations or renovations to the landscape appropriate to obtain a long-term sustainable solution for the customer's concerns? Have the plants been installed in a manner that supports proper structural development of the root system?
2. **Create Healthy Soils**- Is the soil pH and soil structure capable of supporting healthy growth? Does the soil have the proper balance of oxygen, water and minerals for good root growth?
3. **Watering**-Is the amount and frequency of irrigation proper to meet the needs of the plant without creating problems with diseases and weeds?

GREENUP SERVICE PROTOCOLS

Georgia Specific Monthly Landscape Service Protocol

4. **Mowing and Pruning**- Is the turf mowed at the proper height and frequency for proper development of the turf according to the turf species? Are the shrubs and trees pruned in an appropriate manner to ensure healthy growth and proper structural development? Are the tools used sharp?
5. **Pest Management**- This is the final step in Plant Health Care. Plant pests are commonly present due to a deficiency with one of the Key Principles above. Be alert to indicator pests, which let you know there is a problem with one or more of other Key Principles.

Building Long-Term and Lasting Customer Relationships

The relationship between our Customer and the Specialist must be professional yet in a friendly manner. In other words, not so "professional" as to seem robotic or impersonal and not so "friendly" to remove the level of respect the customer should be provided. Our manner of conduct with a customer should be similar to what would be provided to a respected member of your family such as a parent or grandparent.

- The emotional feeling that we not only want to convey, but are striving to instill in our customer is that we are experts in our profession, we know that our job is to serve them as our customer, and we genuinely like them and care about them as people. The only way to instill this emotion to our customer is to feel it ourselves; it cannot be faked.

1. Call our Customer the Day Before Treatment

- The purpose of calling our customer the day before treatment is to create a deeper relationship between the Customer and the Specialist. It is very important to be consciously aware of this purpose; this is not a call to simply inform the customer we are coming.
- When calling our customer, be attentive when the phone is answered. Listen and be aware if the phone is being answered by someone who is probably the customer or who is unlikely to be the customer. For example:
  - If you are calling for Mr. or Mrs. Jones and a mature and obviously male voice answers the phone, it is probably Mr. Jones. The response to his answering the phone would be, "Hi Mr. Jones, this is Joe from Massey Services…"
  - If you are not sure if Mr. or Mrs. Jones answered the phone or if you are specifically requesting either Mr. *or* Mrs. Jones and someone other than Mr. or Mrs. Jones has answered the phone, your response should be, "Hello. This is Joe from Massey Services. Could I please speak with Mr. or Mrs. Jones?"
  - If you are calling for Mr. or Mrs. Jones and a childlike voice answers the phone, the response would be, "Hi. This is Joe from Massey Services. Could I please speak with Mr. or Mrs. Jones?" Remember that the tone of your voice must still be friendly and professional; it should not change as if you are talking to a child. Do not ever ask, "Is your mommy or daddy home?" If you are speaking to a child, you should not ask questions that require them to say if their mom or dad is home. Be aware of the following:
    - You may not be speaking to a child. It may be someone with an immature voice.
    - The child you are speaking to might not be the child of your customer.

GREENUP SERVICE PROTOCOLS

Georgia Specific Monthly Landscape Service Protocol

- If the voice answering the phone is obviously a very young child, ask the question, “Is Mr. or Mrs. Jones *available*?” rather than, “Can I speak to Mr. or Mrs. Jones” or “Is Mr. or Mrs. Jones home?” This helps the young child provide the proper answer of, “They are not available” rather than, “They are not home”.

- Do not use speaker phone when dialing or speaking to our customer. Doing so makes the call sound less personal or even like an auto-dialed call from a solicitor.
- Never ask to speak with the customer without first informing the other person of your name and where you are from (Massey Services).
- Our phone conversations must always:
  - Begin with “Hi” or “Hello” followed promptly with stating who you are and where you are from.
  - Address the customer by Mr. or Ms. and use their last name. Do not address a customer by their first name unless they specifically request that you do so.

- **The Objectives of your Call**
  - Inform the customer that you will be at their home tomorrow to perform their service.
    - Do not “ask” if you can perform the service.
    - Do not depreciate the service you are going to perform by using devaluating words such as, “I am ***just*** *going to come* by to…”
    - Example: “I wanted to give you a call to let you know that I will be out tomorrow to perform your Monthly Landscape Service”.
  - Explain a little about the service you are going to perform.
    - Example, “I will be applying your granular lawn fertilizer for the spring as well as treating for weeds and of course inspecting and treating for any other problems I find on your lawn or shrubs”.
      - Use value words such as apply or treat, broadcast treatment, localized treatment
      - Do not use devaluing statements such as spray or “weed and feed” or scary words such as pesticide or insecticide.
  - Ask them if they have any *particular* concerns to which they would like you to provide particular attention.
    - Be careful with this question. If stated improperly, the customer may think you only pay attention to problems they tell you about.
    - Remind them that they can leave a note at the door if they think of something and they are not home at the time you perform the treatment. This works particularly well when you must leave a message on the voicemail because the customer is not home when you call.
  - Remind the customer of payment for the service.
    - Let the customer know the billing amount for the service you are going to provide. Inform them that you can collect the payment when you are there to perform the service or they can even leave payment at the door or under the welcome mat if they will not be home.

GREENUP SERVICE PROTOCOLS

Georgia Specific Monthly Landscape Service Protocol

- Close the conversation. Use the customer's name when saying thank you or when saying goodbye. Example, "Thank you for being our customer Mr. Jones. Goodbye."

2. Be Prepared to Perform the Service

- **Items needed:**
  - Handheld Computer and Printer
  - Landscape Inspection Graphs
  - Lawn Posting Signs
  - Soil Probe
  - Bags for soil samples
  - Gas Powered Blower
  - Broadcast Spreader
  - Liquid Broadcast Application Equipment
  - 3 Backpack Applicators
  - Products to perform the required application according to the Agronomic Program.
  - Graph and Start Sheet for Initial Services

3. Arrive at the Property

- Be on time and courteous. Being punctual expresses care, concern and respect for the customer and their time. This distinguishes you as a courteous service professional with which they are happy to do business.

- Park your vehicle in the street at the curb and with the flow of traffic. Avoid blocking the mailbox and driveway. Do not park in the driveway if it is avoidable.

- Perform simple acts of courtesy, such as putting garbage cans away, bringing newspapers to the door, moving toys, etc. It is the little things that help develop trust and build long term relationships.

- Be aware of the conditions of the landscape as you are walking to the door. Are there dry spots, excessive moisture, insect, fungus or weed issues?

4. Greet the Customer

- Remove your sunglasses and have your uniform badge in plain view. Knock on the door firmly, but not too loud. Take 3 steps back from the door so they can see you through the peephole and are not alarmed by your presence.

- When the customer answers the door, smile and politely inform the customer who you are, where you are from and what you are going to do.
  - Example, "Hi Mr. Jones. I am Bob from Massey Services and I am here to perform your Monthly Landscape Service."

- Provide a brief overview of the service you will be performing.

- Ask if they have any special concerns or if they wish to bring anything to your attention.

GREENUP SERVICE PROTOCOLS

Georgia Specific Monthly Landscape Service Protocol

- Inform them that you will begin your service by performing an inspection of the back lawn.
  - ➢ This is important for two reasons. It reminds the customer that you are going into the back lawn so they can remember to put up the dog and it provides value to what the customer may otherwise just think that you are walking around in the back lawn for no particular reason.

- Inform the customer that you will be coming back to the door when you are finished to explain the service provided and the findings of your inspection and that you would be happy to collect the payment for the service being provided. These are important statements.

  1) It alerts the customer that you are going to come back to the door. What if the customer has other things going on that makes your coming back to the door inconvenient? Do not assume that this is always the case, but sometimes it is.

  2) You are again reminding the customer that you can collect and bring in payment for the service.

6. Inspect the Landscape

- Inspect the entire landscape (lawn and shrubs). Do not limit your focus to areas identified by the sales inspector and/ or the customer.

- Evaluate site conditions according to each of the Five Key Principles. Use the salesperson's graph as a starting point, make any changes necessary to the graph, and formulate your treatment strategy.

- As you perform your inspection, you should be thinking of providing long-term sustainable solutions. **Anticipate landscape and specific customer concerns!**

7. Perform the Service

- Perform the service according to the Agronomic Program for the particular application you are performing and according to the Protocols for the particular type of application whether Liquid Broadcast, Granular Broadcast, Liquid Spot Treat or Granular Spot Treat. These protocols are provided by the GreenUP Technical Department and can be found in the G: Drive/Shared/GreenUP Reference Materials/GreenUP Protocols.
- Perform any addition treatment required for the needs of the turf and landscape shrubbery.
  - ➢ Our Monthly Landscape service includes both the turf and the shrubs. You may be at the property to perform the Lawn Care Application, but if our customer has our Monthly Landscape Service and the shrubs have insect, disease or nutritional issues, these issues must be addressed. Likewise, if you are at the property to perform the Shrub Care Application and the turf areas have issues, perform treatment or provide communication for these issues.
  - ➢ Performing only the Lawn Care Application or only the Shrub Care Application and not addressing the needs of both the lawn and shrubbery is not performing the service in its entirety.

GREENUP SERVICE PROTOCOLS

Georgia Specific Monthly Landscape Service Protocol

- Remove any fertilizer debris from all impervious surfaces with the power blower after performing any granular fertilizer or granular pesticide application.

8. Complete the Landscape Service Report via the Handheld Computer

- Keep all paperwork clean and dry so it looks presentable to the customer.
- Complete the Landscape Service Report according to SPP 415.
- Write neatly or, if you are printing the Service Report from the handheld computer and printer, follow all steps outlined in the GreenUP Protocol for Handheld Printed Service Reports.
- Identify all steps performed in your service. Remember that it is the Service Report that shows our customer the value and quality of your work.

9. Post the Treatment Notification Sign

A GreenUP pesticide application sign should be posted according to P&P #904.

- Post the sign on any property that had any type of pesticide application. The sign should be oriented so that a person approaching the property from either direction can read the text.
- Insert the plastic mounting stake holding the sign into the ground approximately 4-6 inches deep.
  - That depth should prevent the sign from being blown over.
- Avoid placing the sign near or around the mailbox if possible.
- Some large residential and commercial properties may require more than one sign posted due to extensive roadway frontage.
  - Consider placing one sign every 50 to 75 feet and at multiple driveway entrances.
  - Corner lots should be posted on both corners

10. Return to the Door

- Make sure you look presentable
- Remove sunglasses and have uniform badge in plain view. Knock on the door firmly, but not too loud. Take 3 steps back from the door so they can see you through the peephole and are not concerned by your presence.
- When the customer answers the door, smile and politely inform the customer that you have completed the service.
  - Example, “Hi Mr. Jones. I have completed your Monthly Landscape Service.”
  - Explain all applications performed and the purpose of the application.

Georgia Specific Monthly Landscape Service Protocol

- Explain any findings of your landscape inspection that may require involvement from the customer or the acceptance of other services such as Landscape Renovation or Irrigation Repair and Maintenance.
    - Landscape Renovation is the long-term sustainable solution for concerns with Key Principle #1- Wrong Plant in the Wrong Place.
    - If the customer does not have our Irrigation Maintenance Service, it is highly likely they will have some repair needs and all customers who do not have our Irrigation Maintenance Service need the service.
- Provide the customer with your solutions and the price if you have the expertise to do so.
    - Provide them with scheduling options of when you can perform the repairs.
    - Wait for them to give you the okay.
    - Ask the customer to authorize the repairs.
- If you do not have the expertise to provide the customer with the Renovation or Irrigation Repair solutions, inform the customer that you will have an Inspector contact them to set up a time to help them with a solution.
    - Provide the customer's information to the Service Manager during your check-in

- Have the customer sign the handheld computer and, if they have not paid in advance, ask for payment for today's service.
- Thank the customer by name and say goodbye.

WEEKLY TRAINING SESSION

Basic Plant Physiology

Topic Category: Lawn

Recordable Verifiable Training Hours: 0.5

Objectives: This lesson is designed to teach Basic Plant Physiology.

Length of lesson: Approx 30 minutes.

Materials needed:

- Training Guideline
- Training Document – Basic Plant Physiology found in G:\Shared\GreenUp Reference Materials\Training Documents\Presentations\General Lawn or Shrub Topics.
- Pre- and Post- tests.

Training Guidelines:

- Make copies of the tests and training materials for all Team Members attending.
- Set up the training area in an area of the office that will minimize disruptions.
- Begin the meeting by defining the training topic and handing out the Pre-test
    - Allow a few minutes for Team Members to complete the Pre-test.
    - Collect the pre-test and hand out the Verifiable Training Record Form (VTRF)
- Distribute and review the training materials on Basic Plant Physiology
- Use the Training outline as a guide for key points.
    - Encourage active participation from all Team Members
    - Ask probing questions to develop key points
    - Encourage group reading
- After reading and reviewing all materials, ask questions to verify the lesson has been understood.
- Hand out the Post-tests. When complete, grade the tests and record the score on the VTRF.
- Collect tests and place with the verifiable materials in the Service Center Verifiable Training File.
- Make copies of the VTRF and place in each Team Member's training file.
- Complete all Weekly VTM's through Massey University.

WEEKLY TRAINING SESSION

Basic Plant Physiology

PRE & POST TEST

Name _____ Date _____

1. T or F Monocots are typically grass type plants
2. T or F Dicots are typically plants with woody trunks and stems.
3. T or F Palms are more closely related to grasses than to trees.
4. T or F Plants convert sunlight into proteins through the process of photosynthesis.
5. T or F Carbohydrates are transported from the leaves to the roots through the Xylem layer.
6. T or F Water is transported from the roots to the leaves through the Phloem layer.
7. T or F In Dicots, the Phloem layer is the inner layer of what we would commonly call bark.
8. T or F In Dicots, the Xylem layer is the first few growth rings of white wood.
9. T or F In Monocots, the xylem and phloem are scattered throughout the trunk in tube-like bundles.
10. T or F The primary root system of established trees and palms is typically in the top 18 inches of soil and extends well beyond the drip line of the plant.
11. T or F The primary factor the determines the depth of rooting is the availability of water.
12. T or F Planting a shrub or tree with the root ball slightly above the soil grade is much preferred to planting with the root ball slightly below the soil grade.

WEEKLY TRAINING SESSION

Basic Plant Physiology

PRE & POST TEST ANSWER KEY

1. (T) or F Monocots are typically grass type plants

2. (T) or F Dicots are typically plants with woody trunks and stems.

3. (T) or F Palms are more closely related to grasses than to trees.

4. T or (F) Plants convert sunlight into proteins through the process of photosynthesis.

5. T or (F) Carbohydrates are transported from the leaves to the roots through the Xylem layer.

6. T or (F) Water is transported from the roots to the leaves through the Phloem layer.

7. (T) or F In Dicots, the Phloem layer is the inner layer of what we would commonly call bark.

8. (T) or F In Dicots, the Xylem layer is the first few growth rings of white wood.

9. (T) or F In Monocots, the scattered throughout the trunk in tube-like bundles.

10. (T) or F The primary root system of established trees and palms is typically in the top 18 inches of soil and extends well beyond the drip line of the plant.

11. T or (F) The primary factor the determines the depth of rooting is the availability of water.

12. (T) or F Planting a shrub or tree with the root ball slightly above the soil grade is much preferred to planting with the root ball slightly below the soil grade.

Basic Plant Physiology

Basic Plant Physiology

- To understand how certain problems effect trees and palms, you first need to know the internal functions of the plant and some basic terms.

Monocots and Dicots

- "Flowering" plants can be placed into two groups – Monocots and Dicots.
- Monocots are typically grass type plants.
- They are referred to as monocots because they have one leaf that emerges from the seed.
- Dicots are typically plants with "woody" trunks and stems.
- They are referred to as Dicots because they have two leaves that emerge from the seed.

Monocots and Dicots

- Palms are Monocots and are more closely related to grasses than trees.
- Trees such as Oaks, Maples and Sycamores are Dicots

Food and Water Transportation

- A plant produces food for it's root system by gathering sunlight through the leaves and through the process of photosynthesis converts the sunlight into carbohydrates.
- Carbohydrates are transported to the down to the roots through the Phloem layer.
- Water is transported from the roots to the leaves through the Xylem layer.

Monocots and Dicots – Cross Section of Stem



Monocot



Dicot

Food and Water Transportation

- In Dicot type plants, the phloem layer is the inner layer of what we would commonly call the bark.
- The Xylem layer is the first few growth rings of white wood.

Food and Water Transportation in Dicots

- Outer Bark
- Phloem
  - Moves "food" from the leaves to the roots
- Xylem
  - Moves water from the roots to the leaves
- Cambium
  - Separates the xylem from the phloem.
  - Cambium cells produce phloem on one side and xylem on the other.



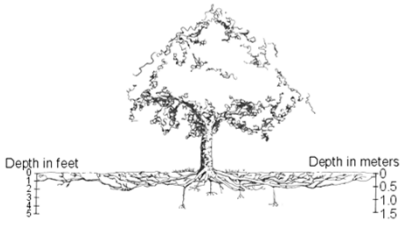
Food and Water Transportation in Monocots

- Palms do not have separated areas of Xylem and Phloem in the same manner as “trees”.
- The xylem and phloem are scattered in tube-like bundles throughout the trunk.



Root System

- The primary root system of shrubs, trees and palms is in the top 18 inches of soil.
- Most of the functional roots extend well beyond the drip line of the plant.



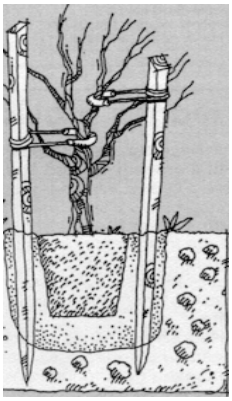
Root System

- The primary factor that determines the depth of rooting is oxygen.
- Roots need oxygen to survive and function properly.



Proper Planting Depth

- Shrubs and trees should be planted at the same depth they were growing before they were planted.
- Planting with the root ball slightly out of the ground is much preferred over planting too deep.



Planting Depth

- Trees planted at the correct depth will show exposed root flares.



TX

WEEKLY TRAINING SESSION

Ganoderma Butt Rot

Topic Category: Lawn

Recordable Verifiable Training Hours: 0.5

Objectives: This lesson is designed to teach the identification of Ganoderma Butt Rot of palms.

Length of lesson: Approx 30 minutes.

Materials needed:

- Training Guideline
- Ganoderma Butt Rot Training Document G:Drive\Shared\GreenUp Reference Materials\Training Documents\Palm Info\Palm Diseases
- Collect samples of Ganoderma mushroom conks from the field, if available.
- Pre- and Post- tests.

Training Guidelines:

- Make copies of the tests and training materials for all Team Members attending.
- Set up the training area in an area of the office that will minimize disruptions.
- Begin the meeting by defining the training topic and handing out the Pre-test
    - Allow a few minutes for Team Members to complete the Pre-test.
    - Collect the pre-test and hand out the Verifiable Training Record Form (VTRF)
- Distribute and review the training materials on Ganoderma Butt Rot of Palms.
- Use the Training outline as a guide for key points.
    - Encourage active participation from all Team Members
    - Ask probing questions to develop key points
    - Encourage group reading
- After reading and reviewing all materials, ask questions to verify the lesson has been understood.
- Hand out the Post-tests. When complete, grade the tests and record the score on the VTRF.
- Collect tests and place with the verifiable materials in the Service Center Verifiable Training File.
- Make copies of the VTRF and place in each Team Member's training file.
- Complete all Weekly VTM's through Massey University.

WEEKLY TRAINING SESSION

Ganoderma Butt Rot

Name _____ Date _____

PRE & POST TEST

1. T or F Ganoderma butt rot only affects Canary Island Date Palms.
2. T or F Ganoderma butt rot is a lethal disease of palms.
3. T or F Ganoderma butt rot can be prevented or controlled with the use of fungicides.
4. T or F A palm cannot be diagnosed with Ganoderma butt rot until the mushroom conk forms on the trunk or the internal rotting of the trunk is observed after the palm is cut down.
5. T or F Ganoderma butt rot is spread by spores, which are produced and released from the mushroom conk.
6. T or F A palm showing the evidence of Ganoderma butt rot should be removed as soon as possible.
7. T or F Because Ganoderma butt rot survives in the soil, planting another palm in the same location is not recommended.
8. T or F If a palm is found that exhibits evidence of Ganoderma butt rot, it will surely die.

WEEKLY TRAINING SESSION

Ganoderma Butt Rot

PRE & POST TEST ANSWER KEY

1. T or (F) Ganoderma butt rot only affects Canary Island Date Palms.
2. (T) or F Ganoderma butt rot is a lethal disease of palms.
3. T or (F) Ganoderma butt rot can be prevented or controlled with the use of fungicides.
4. (T) or F A palm cannot be diagnosed with Ganoderma butt rot until the mushroom conk forms on the trunk or the internal rotting of the trunk is observed after the palm is cut down.
5. (T) or F Ganoderma butt rot is spread by spores, which are produced and released from the mushroom conk.
6. (T) or F A palm showing the evidence of Ganoderma butt rot should be removed as soon as possible.
7. (T) or F Because Ganoderma butt rot survives in the soil, planting another palm in the same location is not recommended.
8. (T) or F If a palm is found that exhibits evidence of Ganoderma butt rot, it will surely die.

PP-54

UF UNIVERSITY of FLORIDA
IFAS Extension

Ganoderma Butt Rot of Palms[1]

Monica L. Elliott and Timothy K. Broschat[2]

Summary

- Ganoderma butt rot is caused by the fungus *Ganoderma zonatum*. This fungus degrades or rots the lower 4-5 feet of the trunk.
- All palms are considered hosts of this fungus. This fungus is not a primary pathogen of any other plant species.
- Symptoms may include wilting (mild to severe) or a general decline. The disease is confirmed by observing the basidiocarp (conk) on the trunk. This is a hard, shelf-like structure that will be attached to the lower 4-5 feet of the palm trunk. However, not all diseased palms produce conks prior to death.
- A palm cannot be diagnosed with Ganoderma butt rot until the basidiocarp (conk) forms on the trunk, or the internal rotting of the trunk is observed after the palm is cut down.
- The fungus is spread by spores, which are produced and released from the basidiocarp (conk).
- Conditions that are conducive for disease development are unknown.
- There are currently no cultural or chemical controls for preventing the disease or for curing the disease once the palm is infected.
- A palm should be removed as soon as possible after the conks appear on the trunk. Remove as much of the stump and root system as possible when the palm is removed.
- Because the fungus survives in the soil, planting another palm back in that same location is not recommended.

Introduction

Ganoderma butt rot is a lethal disease of palms, both in the landscape and natural settings. While the disease is more prevalent in the southern half of the state, where palms are in greatest abundance, it is certainly not restricted to that area. The fungus that causes the disease is distributed throughout Florida, from Key West to Jacksonville to Pennsacola. It is also known to occur in Georgia and South Carolina.

1. This document is Fact Sheet PP-54, one of a series of the Plant Pathology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date November 2000. Revised May 2009. Visit the EDIS Web sSite at http://edis.ifas.ufl.edu.

2. Monica L. Elliott, professor, Plant Pathology Department, and Timothy K. Broschat, professor, Environmental Horticulture Department, Fort Lauderdale Research and Education Center--Fort Lauderdale, FL; Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL.

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Pathogen and Hosts

The fungal genus *Ganoderma* is a group of wood-decaying fungi that are found throughout the world on all types of wood — gymnosperms, woody dicots, and palms. There are many different species of this fungus in Florida, but only one is a pathogen of palms. That fungus is G*anoderma zonatum*. Another fungal name that was associated with this disease in the first half of the 20th century was *Ganoderma sulcatum*. Recently, these two species have been grouped together as one, *G. zonatum*.

While there are a few reports of *G. zonatum* on non-palm hosts, these reports are very limited. Therefore, palms are considered the primary hosts of this fungus. In general, if you observe a basidiocarp (conk) on a palm trunk, especially if it is still living, it is probably safe to assume it is *G. zonatum* and not some other *Ganoderma* species. Likewise, the *Ganoderma* species often observed on hard-wood trees, such as oak, are rarely observed on living palms. These other *Ganoderma* species may occur on dead palm trunks and stumps, but they are present simply as saprobes (fungi that live off dead plant material).

All palms are assumed to be susceptible to this disease. While not all palms growing in Florida have been documented with Ganoderma butt rot, at least 65 species of palms have. Those not documented with this disease are not commonly grown and have thus far escaped. The only possible exceptions would be palm species that do not form woody trunks — e.g., *Sabal minor* and some *Chamaedorea* spp. Since *G. zonatum* kills by degrading wood, these palm species may not have any suitable tissue to serve as a substrate for the fungus.

Symptoms, Signs and Diagnosis

Ganoderma zonatum is a white rot fungus that produces numerous enzymes that allow it to degrade (rot) woody tissue, primarily lignin and cellulose. As the fungus destroys the palm wood internally, the xylem (water-conducting tissue) will eventually be affected. Therefore, the primary symptom that may be observed is a wilting, mild to severe, of all leaves but the spear leaf (Figures 1 and 2). Other symptoms can best be described as a general decline – slower growth and off-color foliage. However, these symptoms alone should not be used for diagnosis of Ganoderma butt rot, since other disorders or diseases may also cause these symptoms.



Figure 1. *Sabal palmetto* (sabal palm) with wilted and dessicated leaves due to *Ganoderma zonatum* infection. Credits: M. L. Elliott

The basidiocarp or conk is the most easily identifiable structure associated with the fungus. The conk originates from fungal growth *inside* the palm trunk. Figure 3 illustrates different stages in the development of the conk. When the conk first starts to form on the side of a palm trunk or palm stump, it is a solid white mass that is relatively soft when touched. It will have an irregular to circular shape and is relatively flat on the trunk or stump.

As the conk matures, a small shelf or bracket will start to form as the basidiocarp begins to extend or protrude from the trunk. It will still be white, both on the top and bottom surfaces. Eventually, it will form a very distinct shelf-like structure that is quite hard with a glazed reddish-brown top surface and a white undersurface (Figure 4). A mature conk will have distinct zones, hence the name *G. zonatum*. The conk will have a half-moon shape with the relatively "straight" side directly attached to the trunk.



Figure 2. *Syagrus romanzoffiana* (queen palm) dying from *Ganoderma zonatum*. Only the spear and one other leaf remain green. Credits: M. L. Elliott



Figure 3. Three phases of basidiocarp (conk) development of *Ganoderma zonatum*. The white "button" near the top of the picture is the beginning stage of the conk. The lower-right structure is a mature conk. The lower-left structure is also a mature conk, but it is an old one; the underside of this conk is no longer white. Credits: M. L. Elliott

If a conk is present on the trunk at the same time the wilt or decline symptoms appear, then it is safe to diagnose Ganoderma butt rot. However, it is not uncommon for conks not to appear prior to severe decline and death of a palm. In that situation, the only way to determine if Ganoderma butt rot is the cause is to cut cross-sections through the lower 4 feet of the trunk after the palm is cut down (Figures 5 and 6). Conks may form on the palm stump after the diseased palm is removed.



Figure 4. Basidiocarp (conk) of *Ganoderma zonatum*. Note glazed reddish-brown top surface and white undersurface. The "straight" side of the conk is directly attached to the trunk. There is no "stem" or "stalk" that attaches the conk to the trunk. Credits: M. L. Elliott



Figure 5. Cross-sections of lower trunk of *Syagrus romanzoffiana* infested with *Ganoderma zonatum.* Top-left section is bottom section (section 1) and remaining sections progress up the trunk. Note darkening of wood due to fungal degradation (rot). Credits: M.L. Elliott



Figure 6. Comparison of pygmy date palm sections that are either healthy (right) or diseased (left) with *Ganoderma zonatum*. Credits: M.L. Elliott

Conks of *G. zonatum* can be up to 8 inches at their widest point and 2 inches thick. However, conks will take on the shape and size of the area in which they are growing (Figure 7). Microscopic

basidiospores are produced in the "pores" present on the underside of the conk. When basidiospores are dropped en mass on a white surface, they will appear brownish-red in color (Figure 8). Objects immediately around a conk that has dropped its spores may appear to be covered with a rusty colored dust. One conk can produce 3 cups of spores.



Figure 7. Cut palm stump with numerous basidiocarps (conks) of *Ganoderma zonatum* forming on it. The conks in the palm stump's center are crowding each other and thus are forming into shapes different from those on the outer edges of the stump. Credits: M. L. Elliott



Figure 8. Spore release from mature conks (same stump as Figure 7) has resulted in reddish-brown appearance of conks and surrounding area. Credits: M. L. Elliott

Disease and Fungus Life Cycle

The fungus is spread primarily by the spores produced in the basidiocarp (conk). The spores become incorporated into the soil, germinate and the hyphae (fungal threads) then grow over the palm roots. The fungus does not rot the palm roots, it simply uses the roots as a means of moving to the woody trunk tissue (Figure 9). Once a palm is infected with *G. zonatum*, the fungus will move with that palm to the location in which it is transplanted. It is also possible that soil associated with transplanted palms is infested with the fungus.



Figure 9. Longitudinal section through *Phoenix roebelenii* trunk and root system. The trunk is darkened due to infection with *Ganoderma zonatum*. The fungus is not rotting the roots but was isolated from the roots. Credits: M. L. Elliott

We do not know exactly how many months or years pass between initial infection of a palm and development of the conk. There is *no* method that can determine if a palm is infected with *G. zonatum*. Until the conk forms, there can be no confirmation of this disease. Therefore, it is not possible to guarantee that a palm is free of *Ganoderma* when first planted in the landscape.

Figures 5 and 10 are examples of the wood rotting and disease progression pattern observed. The fungus colonizes and degrades the palm trunk tissue closest to the soil line first, expands in diameter at the base and moves up the center or near-center of the trunk. Therefore, the disease progression pattern within the trunk is best described as cone-shaped, widest at the soil line and narrowing to a pinpoint.

The location of the conk is where the fungus is *emerging* from the trunk. This means the degradation is occurring internally as the fungus moves from the lower center of the palm to the outside. Therefore, wounds are *not* a likely factor in disease initiation. Other external environmental factors associated with the trunk are probably not associated with disease development either, such as too much mulch around



Figure 10. Sections 5 and 6 of Figure 5 (bottom row, middle sections) after incubation in a moist chamber for 4 days. White growth is hyphae of *Ganoderma zonatum* and corresponded with the discolored area of the cross-sections. Credits: M. L. Elliott

the trunk, irrigation heads striking the trunk, flowers or shrubs too close to the trunk, or painting the trunk.

Disease Management

No environmental conditions or landscape management practices have been observed that favor the development of Ganoderma butt rot. The disease occurs in natural settings (palms never transplanted) and in highly-maintained, transplanted landscapes. It occurs on palms that have been maintained very well nutritionally (no nutrient deficiencies) and on palms that were severely stressed by deficiencies. The disease occurs in well-drained settings and in swamps. The fungus has killed trees that had no apparent mechanical injuries and those that had been severely damaged by, for example, weed trimmers. Soil type appears to have no relationship with disease either, as diseased palms have been observed on deep sands (both silica and calcareous), muck (peat), and limestone rock. There has been no discernible pattern to provide clues as to why some palms become infected and die from *G. zonatum*, and others do not.

In general, the fungus will be located in the lower 4-5 feet of trunk. This has three implications. First, this means the fungus is not spread with pruning tools since the fungus is not associated with leaves. Second, this means that only the lower trunk portion should *not* be chipped and used for mulch. If possible, the diseased section should be placed in a landfill or incinerated. The remaining, fungus-free portion of the palm trunk could be chipped and used for mulch in the landscape.

Third, only the lower 4-5 feet of trunk will need to be protected from the fungus. However, typical xylem-limited, systemic fungicides will not be effective unless they are capable of spreading beyond the vascular tissue and protecting *all* the wood in the lower portion of the trunk. We know of no fungicide with these capabilities. Also, no fungicide will be effective once the conks have formed, since a large percentage of the trunk cross-sectional area has already been destroyed. Since we have no means of predicting or determining which palms are infected with *G. zonatum*, this effectively eliminates the use of fungicides as a control method, either preventively or curatively, for the present time. Therefore, there are no fungicide recommendations for this disease.

Since basidiospores from the basidiocarps (conks) are probably the primary method of spreading the fungus, palms should be monitored closely, especially after a palm has died or been removed *for any reason*. The fungus will readily colonize and degrade palm stumps (See Figures 7 and 8). Once the fungus becomes established in this dead wood, it will normally produce conks with millions of basidiospores that are easily moved by wind and water.

Therefore, monitor palms and palm stumps for the conks. Remove the conk and place in a trash receptacle that will be incinerated or delivered to a landfill. Do not place in trash that will be recycled in the landscape. The earlier the conk is removed (i.e., before it becomes a distinct shelf-like structure), the less likely that spores will be released into the environment. If you have never observed Ganoderma butt rot on the property, monitoring the palms once every six months will be adequate. Once you have observed the conks on palms or have a palm cut or fall down for any reason, monitor your palms at least once a month. Also, monitor the entire neighborhood, not just your yard. These spores blow with the wind, so it should be a community effort to reduce the spread of the spores of this lethal fungus.

Once a conk is observed on a palm, the palm should be removed – primarily for safety reasons. This is especially important during the hurricane season. As indicated before, if conks are being produced on a live palm, it means that a significant

portion of the trunk is already rotted. These palms are likely to be the first blown down in heavy winds. As much as you may want to keep the palm, it is probably best not to do so. When you remove the palm, remove as much of the stump and root system as possible. Alternatively, if you cannot remove the stump, then grind-up the stump. This will allow the infected stump material to degrade more quickly. By removing the stump or grinding the stump into smaller pieces, this will help to limit conk formation on any palm trunk material left behind. You should still monitor the site for conk formation, as described in the previous paragraph.

The fungus survives in the soil. It has been observed that replacement palms planted into the same site where a palm died from Ganoderma butt rot also became diseased and died. Therefore, replanting with another palm is risky. No other plant species (pines, oaks, woody shrubs, etc.) are affected by *G. zonatum* – only palms. In other words, replacing the *Ganoderma*-diseased palm with any other plant except a palm would be a wise choice.

We do not know how long you should wait before it is safe to plant another palm in a *Ganoderma*-infested site. We can say that the time is measured in multiple years, not months, since the fungus is probably capable of living in the soil almost indefinitely.

If you insist on replanting with a palm, follow these guidelines. Remove the stump and all roots from the site. Then, fumigate the soil. You can have this done by a licensed professional using a legally registered fumigant for the landscape. An example would be the product dazomet (trade name = Basamid). If the palm was located in a site surrounded by concrete (ex: a street median), also remove all of the old soil. Bring in new soil and then fumigate. However, this does not guarantee the new palms will remain free of *Ganoderma zonatum*, as the fungus may already be associated with the new palm and fungal spores can be easily blown into the newly fumigated site.

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SPRINKLERS, TRENCHING, AND PIPE REPAIR

I. Sprinklers

A. Setting the sprinkler

1. The top of the sprinkler should be installed flush with the top of the soil. (not the top of the grass)
2. When setting the sprinkler next to any hardscape, it should be at least 4” from the hardscape edge or turf/landscape edge.
3. When setting the sprinkler next to a building, house, or framed structure, it should be set at least 12” from that structure. (this is suggested Water Star procedures, which we follow)
4. Compact the soil around the base of the sprinkler before backfilling the soil to the top. When the base is stable, it will prevent the sprinkler from settling or becoming crooked.
5. Always have extra soil with you!!
    a) Keep a 5 gallon bucket of soil in the truck
    b) Home Depot sells 40 pound bags of soil for $1.49 a bag.

B. Swing joint assembly with flex pipe.

1. The assembly will require a ½” street 90, at least 12” or more of flex pipe, and a ½” 90, tee, or tee for the connection to the lateral.
2. Never use Teflon® tape or pipe dope at the base of a sprinkler!
    a) Only needed on PVC to PVC or PVC to metal joints

C. Swing joint assembly with swing or ‘funny’ pipe.

1. The assembly for spray bodies will require two ½” swing pipe ells, ½” threaded SCH40 fitting to connect to the PVC pipe, and about 12” to 24” of funny pipe between the PVC pipe and the sprinkler to position the sprinkler correctly
2. Rotors requires one ¾” swing ell for the sprinkler, a ½” swing ell for the fitting, one ½” threaded SCH40 fitting to connect to the PVC pipe, and about 12” to 24” of funny pipe between the PVC pipe and the sprinkler to position the sprinkler correctly.
    a) These are threaded and push-on fittings.
    b) No glue required.
    c) No Teflon or pipe dope required.

II. Straightening sprinklers

A. Spray or Rotor body

1. Dig the soil out from the opposite side of the direction of the lean.
2. Dig all the way down to the threaded fitting under the sprinkler.
3. Pull the sprinkler to level.
4. If the fitting that the sprinkler is connected to does not move when you pull on the sprinkler, dig more soil out from around the base and try again.
5. Replace the soil to the hole where the direction of the lean was.
6. Compact it at the base of the head first before covering to the top.
7. If the sprinkler has been hard piped it will not move. You will need to dig it up and install a swing joint on it.

III. Excavating for sprinkler repairs or replacements

A. If the replacement of the sprinkler involves replacing the exact same sprinkler, it is very possible to only replace the top and guts of the sprinkler without removing the body.

1. However, be sure that it is the exact type of sprinkler.
2. If it's not the same brand and model, dig it up!!

B. Replacing the sprinkler

1. The most efficient way to excavate around a sprinkler, without knowing what you will find underground, is to use a round point shovel.
    a) Dig a circle around the sprinkler at approximately a 12" to 14" radius.
    b) This will give you a hole 24" to 28" in diameter, and a little deeper than the depth of the sprinkler.
2. After excavating around the sprinkler, you will know what type of connection it has to the lateral lines. This could be a swing joint or a hard pipe type of connection.
    a) A swing joint type of connection has flex pipe or funny pipe in use from the hard pipe of the lateral lines to the base of the sprinkler.
    b) A hard pipe connection has hard PVC all the way up to the base of the sprinkler.
    c) With this information you will be better suited to make the type of repair best suited for the application.
3. If the sprinkler has been hard piped and there is a leak at the base of the head
    a) Regardless of the reason for the leak, cut out the hard pipe about 12" back and replace it with the swing joint assembly using flex pipe.

C. Raising Sprinklers

1. Raising a sprinkler can take anywhere from 45 seconds to 10 minutes.
2. Pull the sprinkler up and compact soil underneath in order to raise the sprinkler to the needed height.
3. Many times we can raise a sprinkler by adding a riser extension underneath it.
4. Changing a 4” sprinkler to a 6” sprinkler can be done in order to achieve the raise you are looking for.
    a) When changing a 4” sprinkler to a 6”, you may need to dig to the base of the sprinkler and determine if there is enough flex pipe to lower the street ell at the base of the head to accommodate the extra height of a 6” sprinkler.
    b) If the 4” sprinkler is hard piped, cut out the pipe and replace it with a swing joint.

D. Lowering sprinklers

1. If a sprinkler is too high, in order to lower it, it must first be dug it up!
2. If flex or funny pipe is used, dig underneath the sprinkler and lower.
3. Be sure to dig all the way around and underneath the sprinkler and flex
4. Follow the flex for about 1 to 2 feet.
5. Keep in mind that when doing this the soil around the flex must also dug up.
6. Follow it back towards the lateral line connection.
7. This will enable the sprinkler to be lowered without kinking the funny pipe or applying too much stress on the flex pipe.
8. If there isn’t enough flex to lower the sprinkler to the required height, cut the flex, add a coupling, and extend the length to a more suitable one.
9. If the sprinkler has a hard pipe connection, there is no way to lower it other than cutting the pipe and adding a swing joint.
10. Be sure to put 1 to 2 feet of flex on the assembly in order to drop the head to the appropriate height.

IV. Add/replace a concrete donut

A. There is NO technical reason to install a donut.

1. Sprinkler need to be able to move with the surrounding soil without breaking the pipe or fittings.
    a) This is the reason for a swing joint

B. The main function of the donut cutters is to replace or install concrete donuts.

1. Line up the center of the sprinkler with the center of the donut and stomp on the cutter
2. Twist it left and right
3. Tip it sideways and pull the grass and donut out
4. Flip the cut out piece of grass over and place it back in place with a few handfuls of soil over it
5. Set the donut in place and make sure the top of the donut is approximately ½" above the top of the sprinkler.
6. If the donut is to low, add more soil underneath it.

V. Trenching

A. Trenching for a move or addition

1. The starting point will always be the location of an existing sprinkler (the point of connection).
2. The ending point will be the location of the new sprinkler or the new location for the existing one.
3. Start in either location with a pony shovel. Chop a line, to a depth of one shovel blade from one point to the other.
4. Next chop another line, parallel to the completed line approximately 4" away.
5. When both cuts are done turn the pony perpendicular to them and cut between them every 12" to 18". This will make short sections of soil, roots and grass to deal with.
6. Pull the cut sod sections out of the ditch and lay them in order on one side of the trench.
7. Next, use a trenching shovel and clean out the ditch from one end to the other.
8. Put the loose soil on the opposite side of the ditch from the cuts of sod. (Using plastic or cardboard to put the soil can make the clean up faster.)
9. At the location of the existing sprinkler, continue to dig underneath and around the sprinkler until the soil is removed from around the pipe leading up to the sprinkler. This is the pipe to which the new pipe will be connected for the move or addition.
10. Be sure to remove enough soil to get pipe cutters in the hole to make a proper cut and to have the room for the appropriate fitting to be installed.
11. On the end of the trench where the new sprinkler will be placed, excavate a hole, with straight vertical edges, and 3" deeper than the length of the sprinkler being installed.

B. Piping in the ditch

1. This explanation is based on adding a PGP with a 1.5GPM nozzle with 20' of pipe and trenching.
2. At 1.5 GPM through 20' of ½" flex the pressure loss will be less than .5 psi loss. So we are good to use ½" flex for the addition.
3. At the point of connection cut in a ½" tee within 12" of where the existing flex connects to the PVC lateral line.
4. Connect the flex into the tee for the 20' run to the new sprinkler location. If there isn't enough room to bend the flex into a 90 degree angle, just cut in a ½" slip 90 then make the 20' run.
5. Before continuing down the ditch, reset the existing sprinkler.
6. As the new flex is placed in the trench, be sure it is on the bottom by adding backfill and compacting along as it is placed.
7. Move the 12" to 18" pieces of sod back where they were originally cut from and compact them.
8. Use any access soil to fill in the cut lines if compaction isn't enough.
9. At the end of the ditch install the PGP with the ½" by ¾" street ell already threaded into it.
10. Compact the soil under the sprinkler and set the top of the head flush with the ground level
11. If you need any extra soil to fill in the cracks between the sod pieces just use the 40lb bag of soil already on your truck.

C. Trenching for wire installation

1. For wire that is being installed in the same ditch as pipe, lay the wire in the ditch so that it is below the top of the pipe, next to, but NOT UNDER the pipe, then backfill and compact.
2. Digging a ditch for only wire does depend on where it is being installed.
3. If it is going around a house, along the foundation, you can wedge the soil away from the structure with a pony shovel, and push the wire AT LEAST 6" down.
4. If you do this process, be sure to push the wire in the wedge by hand or a hand shovel and compact it well. It must not come up!!
5. If the wire path must cross a grass area with no structures, follow the instructions for trenching for a move or addition.

VI. Pipe Repairs

A. Excavation

1. Turn on the zone with the leak.
2. Where you see water, first try to get a hand or fingers on or around the pipe leaking.
3. If it cannot be reached, dig it up with a shovel while the zone is running.
4. The purpose for this is to find the exact place where the leak is. Fitting? Pipe?
5. Once the leak is located, turn the water off and dig a bigger hole.
6. Dig until the leak is uncovered, then dig 6” below and on both sides of the pipe, the width of a trenching shovel.
7. Make sure the hole is dug at least 12” on either side of the leak along the length of pipe.
8. If it is at a tee fitting that is leaking, do the same along all directions of the pipe.
9. Dig at least 6” below the pipe, then clean out all the soil around it.

B. Making the repairs

1. Never use flex pipe for a mainline repair. No exceptions!!!!
2. Very visual!
3. The first question to ask is “which pipe will give enough room to get this fitting in place??”
4. Repairing at a tee
5. Repairing at a 90
6. Repairing in line
7. Fittings in tight quarters
8. Repairing at fittings already under stress. That’s why it broke!!

VII. Troublesome moves, additions, repairs, and replacements

A. Pay attention to utilities!!

B. Roots

C. Heads one foot away from a 3’ caliper oak

D. Leaks under large trees

E. Large and old shrubs

F. Getting around large shrubs

G. Moving mulch out of the way

H. Dealing with rock mulch

I. Palm tree roots

J. Leaks that show up in the concrete seam of a new patio

K. Leak on one pipe where there are multiple pipes in the ditch

L. Stagger the pipe cuts

VIII. Differences between the flex pipe and swing pipe (also called funny pipe).

A. The inside diameter of the ½" flex pipe is much larger than the inside diameter of the 3/8" swing pipe. This means that, AT THE SAME FLOW, there is less friction loss in the flex than the swing pipe, allowing the flex pipe to be run farther with less impact on the sprinkler performance. ½" flex pipe can be used for a 3 gallon per minute application up to 10 feet with acceptable pressure loss. The maximum length of any run of swing pipe should be no longer than 3 feet. Even if it is only running 1 gallon per minute.

B. Flex pipe will not kink. Swing pipe will kink!! You must have a larger hole in order to loop the funny pipe enough to prevent any kinking.

   1. NOTE: Purchase the kink resistant swing pipe such as Hunter's FLEXSG

C. Flex pipe connections must be glued. Swing pipe connections are barbed connections. Installing flex pipe will take longer because of the glue must set. Proper use and installation of the swing pipe can be a time saver in some applications.

D. For the application that we at Massey run across, the use and benefits of flex pipe will always be the suggested course to take. However we must be prepared to use both and should always have access to funny pipe and fittings when the situation