DOUGLAS A. DUCEY
Governor

MARK W. KILLIAN
Director

Arizona Department of Agriculture

Office of Pest Management

1688 W. Adams Street, Phoenix, Arizona 85007
(602) 255-3664 FAX (602) 542-0466
http://agriculture.az.gov

Certification Examination Procedure

1. Submit Certified Applicator (CA) or Certified Qualified Applicator (QA) Application and Application Fees. The Director may approve the application, deny the application (citing legal grounds for denial), or request additional information.

2. Upon approval, the applicant will receive a letter indicating the approval date and expiration date of their application as well as the examination categories in which they were approved.

3. The applicant may then contact Metro Institute (the exam facilitator) at 602-452-2900 or 877-533-2900 to schedule any or all exams they have been approved for. Exams may be scheduled online at http://www.metrosignup.com/signup/index.asp

4. Currently exam fees are $55.00 per exam, which can be paid by Cash, Check, Visa, MasterCard or American Express. Mail (or bring for walk-in appointments) check payments to Metro Institute, 331 N First Ave, Ste 100, Phoenix, AZ 85003. Please do not mail cash.

5. If, for any reason, you cannot make your exam appointment, you may reschedule at no charge with 24 hours notice.

6. Don't forget: You must bring your picture ID to the testing site.

Statewide Testing Sites:

Phoenix – Metro Institute Testing Center – 331 N. First Ave, Ste. 100

Glendale – Metro Institute Testing Center – 6677 W. Thunderbird, Bldg F, Ste. 103

Tucson – Pima Community College Testing Center – 2202 W. Anklam, C-141

Flagstaff – Coconino Community College – 3000 N Fourth Street, Room B22

Prescott – Yavapai College – 1100 E. Sheldon St., Bldg 1, Room 225

Kingman – U of A Cooperative Extension Center – 101 E. Beale St., Ste. A

Yuma – U of A Cooperative Extension Center – 2200 W. 28th St., Ste. 102

Certified Applicator Resources – CORE, ROW, O&T

PMD Website – Choose "Industry Resources" tab for: Licensing Forms/Documents, Certification Testing & Training, Study Materials and more. This is where you will always find the most current information.
https://opm.azda.gov/

PMD Order form for Hard Copy Publications for Exam Preparation
https://opm.azda.gov/Assets/PDFDocuments/Hard-Copy_Study_Material_List.pdf

CORE:

National Pesticide Applicator Core Exam Study Manual (PDF)

https://agriculture.az.gov/sites/default/files/National_Pesticide_Applicator_Certification_Core_Manual_2ndEdition.pdf

PPT presentations that accompany each chapter in the Core Exam Study Manual

http://academic.uprm.edu/ofarrill/id40.htm#powerpoint_presentations

Category 3 Ornamental & Turf:

Turf Pest Management – Purdue University – Indiana Commercial Pesticide Applicator Training Manual

Category 4 Right of Way:

Right of Way Vegetation Management

Frequently Asked Questions from the Pest Management Division:

https://agriculture.az.gov/pestspest-control/pest-management-faq

Online Application for New Applicators:

https://opmssl.azda.gov/Applications/Applicator/New/NewApplicatorInitial.php

Label and Safety Data Sheet Information
Compare and Contrast Activity

Instructions: The following table includes a list of information that can be found on pesticide labels and/or safety data sheets (SDS). On the pesticide label and SDS provided, search for the information/section listed on the first column. When you find the information/section listed, place a check mark under the corresponding column. (Some sections may be found on both the label and SDS so place a check mark under each column). This will help you to identify the similarities and differences between a label and SDS.

Information/Section	Label	SDS	Misc. Notes
Brand name			
Chemical name			
Common name			
EPA Registration #			
Type of Pesticide			
List of pests controlled			
Product formulation			
Manufacturer name			
Signal word			
LD 50 information			
Symptoms of exposure			
Health effects			
Long-term health effects (chronic health effects)			
Carcinogenicity			
Stability and Reactivity			
Universal Pictograms			
First Aid Statements			
Note to Physician statements			
General precautionary statements			

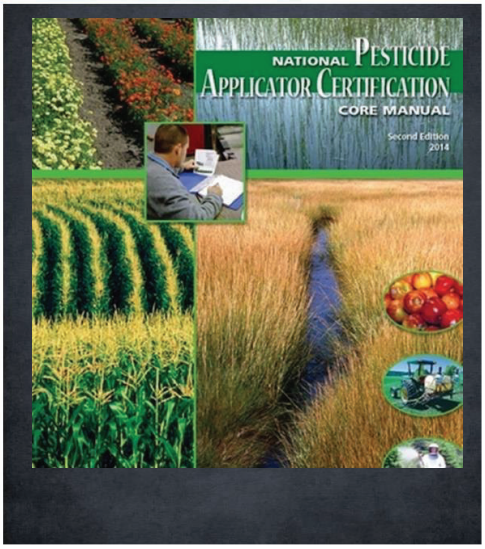
Information/Section	Label	SDS	Misc. Notes
Physical and Chemical properties			
Flammability and combustion information			
Fire-fighting measures			
Spill cleanup procedures			
Transport Information			
Storage and disposal			
Restricted entry interval			
Pre-harvest interval			
Personal Protective Equipment			
Environmental hazards			
Drift management instructions			
Pictograms/symbols			
Emergency phone numbers			
Manufacturer's contact information			
Product compatibilities and incompatibilities			
Engineering controls			
Sites and crops on which the product can be applied			
Mixing instructions			
Mobility in Soil			

Pest Management

Chapter 1

THE UNIVERSITY OF ARIZONA

ALCA
ARIZONA LANDSCAPE CONTRACTORS ASSOCIATION



DEFINITION

PEST

An undesirable organism that injures humans, desirable plants, animals, manufactured products, or natural substances.

4 Main Groups of Pests

- Invertebrates (insects, mites, ticks, spiders, snails, & slugs)
- Pathogens (viruses, bacteria or fungi)
- Weeds (undesirable plants)
- Vertebrates (birds, reptiles, amphibians, fish, and animals)

Question:

What are some of the vertebrates, invertebrates, pathogens and weed pests you might find in your worksites?

Pesticide Definition

A pesticide is any substance or mixture of substances that is intended to:

Prevent, destroy, repel, or mitigate any pest or is intended for use as a plant regulator, defoliant, or desiccant.

Nature Keeps Some Pests in Check

Rivers
Lakes
Mountains

Air or Water Pollution

Wind
Temperature
Sunshine
Rain

There are several applied pest control methods (chemical and non-chemical)

"We use only chemical-free methods to rid homes of ants."

Overview of Applied Pest Control Methods

BIOLOGICAL CONTROL: The use of natural enemies (predators, parasites, pathogens, & competitors) to control pests and their damage.

CULTURAL CONTROL: Practices that reduce pest establishment, reproduction, dispersal, and survival.

GENETIC CONTROL: Breeding or selecting plants and animals to resist specific problems.

Overview of Applied Pest Control Methods

REGULATORY CONTROL: Regulatory agencies carry out pest control programs to prevent the introduction and spread of specific pests.

MECHANICAL/PHYSICAL CONTROL: These methods can kill a pest directly or make its environment unsuitable.

CHEMICAL CONTROL: Using naturally derived and/or synthetic chemicals to manage pests.

What applied pest management method is this?

DEFINITION

IPM

Integrated Pest Management

A pest management strategy that uses a wide range of tactics.

The goal is to prevent pests from reaching economically or aesthetically damaging levels with the least risk to the environment.

COMPONENTS OF IPM

1. Identify the pest and understand its biology.
2. Monitor the pest to be managed.
3. Develop the pest management goal.
4. Implement the IPM program.
5. Record and evaluate results.

Why practice IPM?

- IPM helps to keep a balanced ecosystem
- Pesticides can be ineffective
- IPM can save money
- IPM promotes a healthy environment
- IPM maintains a good public image

Pest Population Thresholds

- You have a small aphid problem in your alfalfa
- You don't worry until you notice it becomes a bigger problem
- You reach a point when you realize you must control the pest population before it ruins the quantity or quality of your crop
- This is your **Economic Threshold**

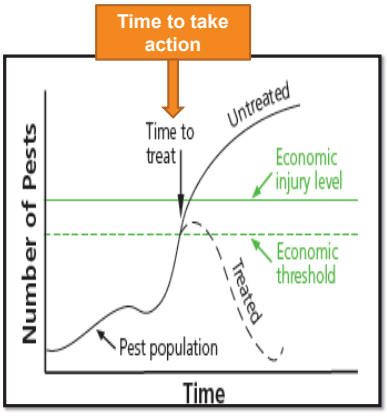
Pest Population Thresholds

- Once you hit your economic threshold, it's time to take action.
- This is your **Action Threshold**

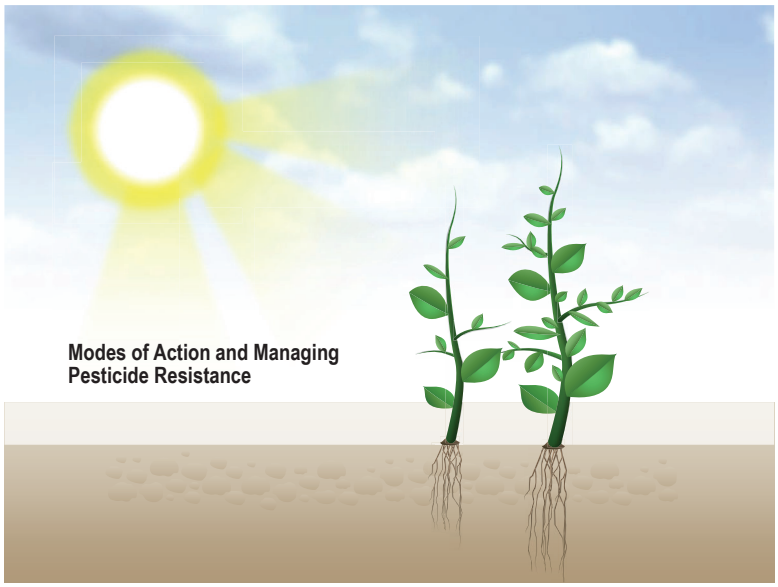
Pest Population Thresholds

- **If you do not control the pest you could reach an Economic Injury Level**
- **This is when the pest population density causes losses equal to the cost of the control measures.**

PEST POPULATION THRESHOLDS



- Therefore, to be profitable or to break even – set the **economic threshold below** the **economic injury** level so you know when to take **action.**



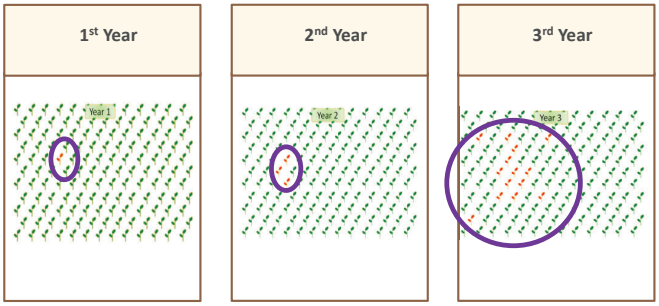
History

- Resistance to insecticides was first documented in 1914 (scale insect resistance to an inorganic pesticide)
- Housefly resistance to DDT (an organic pesticide) was detected in 1947
- The first reported case of herbicide resistance in the United States was reported in the 1950s

Statistics *(various sources & dates)*

- Worldwide, over 600 species of pests have developed some level of resistance to pesticides - *Dr. Wayne Buhler, North Carolina Cooperative Extension*
- Worldwide, more than 500 species of **insects**, mites, and spiders have developed some level of **pesticide resistance.** – *Michigan State University Extension*
- **There** are currently 502 unique cases (species x site of action) of **herbicide resistant weeds** globally, with 258 species (150 dicots and 108 monocots). **Weeds** have evolved **resistance** to 23 of the 26 known **herbicide** sites of action and to 167 different **herbicides**. – *weedscience.org (Sept. 18, 2019)*

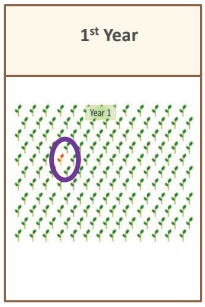
A common illustration and explanation of herbicide resistance



Whenever an herbicide is used, there is a potential for that use to contribute to the evolution of herbicide resistance, particularly if the population of a weed species is subjected to repeated sublethal doses of herbicide.

Herbicide resistance

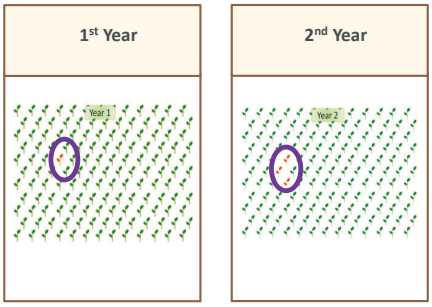
As described by Robert Battel, Michigan State University



- **There might be a few million weed seeds of a particular species in a large area.**
- **The majority of plants from those seeds are controlled by a given herbicide.**
- **A handful are identical in every way except for one genetic difference.**
- **That difference allows the weeds from those seeds to overcome the effects of the herbicide as they germinate.**

Herbicide resistance

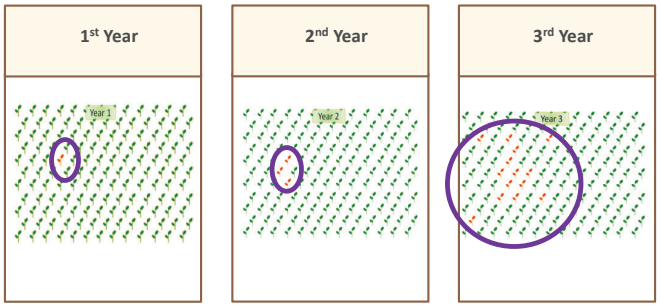
As described by Robert Battel, Michigan State University



- **After several years of using the same herbicide, or herbicides from the same group, that version of the weed is allowed to reproduce.**
- **At first it might look like an escape, or a small patch of weeds that survived.**

Herbicide resistance

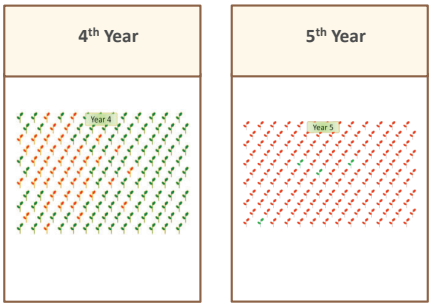
As described by Robert Battel, Michigan State University



This resistance continues and expands.

Herbicide resistance

As described by Robert Battel, Michigan State University



Eventually, it becomes the dominant type of that weed in the area.

"Survival of the Fittest"

How herbicide resistance occurs

- Herbicide resistance is the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide that would normally be lethal to the wild plant.
- Resistant plants were already found, very infrequently, in the weed population before an herbicide was ever used.

SITE OF ACTION

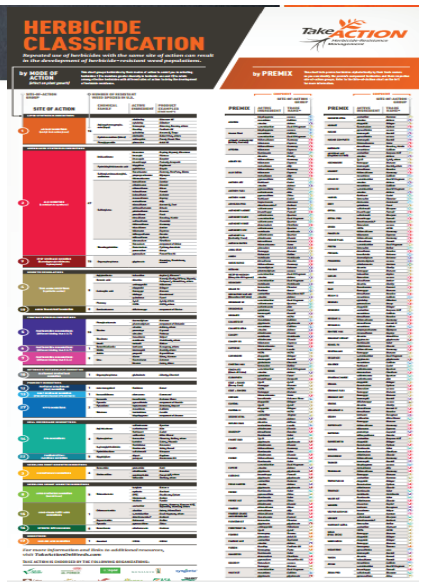
The location within the plant where the herbicide impacts the development process. ***The WHERE***

MODE OF ACTION

The process the herbicide uses to control the weed. ***The HOW***

Add a Footer

Just for illustration purposes

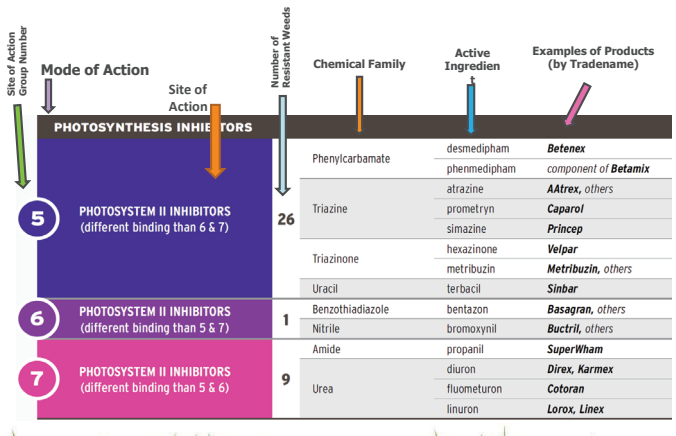


Classification charts

MODE OF ACTION

This is an example of a chart showing groups herbicides by their modes of action to assist handlers in selecting herbicides

1) to maintain greater diversity in herbicide use and
2) to rotate among effective herbicides with different sites of action to delay the development of herbicide resistance.

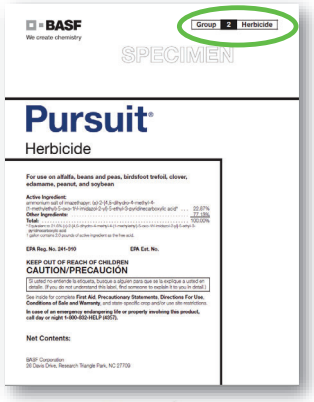


Great Decision-Making Tools

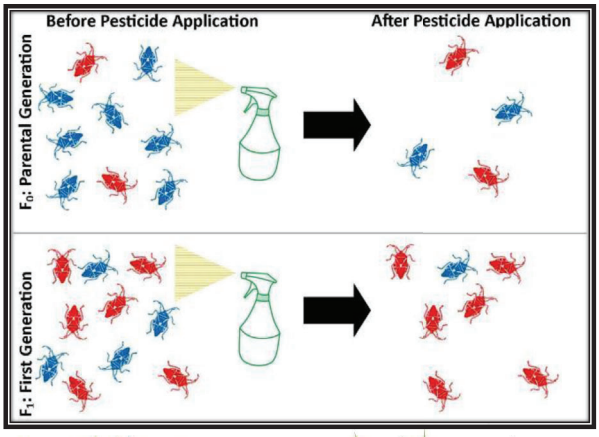
Herbicide mode of action classification[1] with example herbicides

Group	Mode of Action	Family[2]	Common name	Trade name
1	ACC-ase inhibitor	'fops'	quizalofop	Assure II
		'dims'	clethodim	Select
2	ALS inhibitors	sulfonylurea	nicosulfuron	Accent
		imidazolinone	imazethapyr	Pursuit
		-	flumetsulam	
3	Mitosis inhibitors	dinitroaliine	trifluralin	Treflan
4	Synthetic auxins	phenoxy	2,4-D	many
		-	dicamba	Clarity
5	Photosystem II inhibitor[3]	triazine	atrazine	many
6	Photosystem II inhibitor[3]	-	bromoxynil	Buctril
9	EPSPS inhibitor	-	glyphosate	Roundup
10	Glutamine synthetase inhibitor	-	glufosinate	Ignite
13	Carotene inhibitor	-	clomozone	Command
14	PPO inhibitors	diphenylether	fomesafen	Reflex
		-	flumioxazin	Valor
15	Lipid inhibitors	acetamide	metolachlor	Dual
		-	dimethenamid-P	Outlook
19	Auxin transport inhibitor	-	diflufenzopyr	Status
22	Photosystem I inhibitor	bipyridilliums	paraquat	Gramoxone
27	HPPD inhibitor	trikatones	tembotrione	Laudis
		-	mesotrione	Callisto

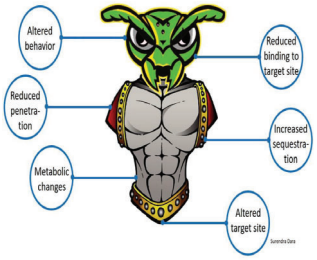
[1]Weed Science Society of America Mechanism of Action. Only groups used in corn and soybean included in the table.
[2]Family name listed for groups with multiple herbicides.
[3]Group 5 and 6 herbicides bind at different locations of the same target site.



Insecticide Resistance



How insects become resistant



Metabolic	• The resistant insect can break down the toxin faster than other insects
Altered Target site	• The insecticide can no longer connect or bind to the target site
Penetration	• The insect's shell absorbs the insecticide at a slower rate
Behavioral	• Certain insects sense the insecticide and move away from it

Factors impacting rate at which insect resistance develops

- How rapidly the insects reproduce
- The insects' level of resistance
- The migration and host range of the insects
- The insecticide's persistence and specificity, and
- The rate, timing and number of applications of insecticide made.

★ Resistance increases faster in greenhouses, where insects or mites reproduce rapidly, there is little or no migration of susceptible insects and the area might be sprayed frequently with the same insecticide or insecticides from the same chemical class.

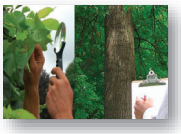
Similar Chart for Insecticides

4	Nicotinic acetylcholine receptor agonists	4A	neonicotinoids	acetamiprid	*Assail 30SG, Assail 70WP, Intruder Max 70WP*
				clothianidin	*Belay, Inovate*, Intego Suite Soybeans*, NipsIt Inside*, Poncho 600*, Poncho/VOTiVO*, Poncho/ VOTiVO 2.0*
				imidacloprid	*Acceleron*, Admire Pro, Alias 4F, AmTide Imidacloprid 2F, Attendant 480FS*, Attendant 600*, Dyna-Shield Imidacloprid 5*, Enhance AW*, Gaucho 600*, Kickstart*, Nuprid 2SC, Nuprid 4F Max, Prey 1.6, Senator 600FS*, Sherpa, Wrangler*
				thiamethoxam	*Cruiser 5FS*, CruiserMaxx*, CruiserMaxx Vibrance*, Upshot Soybeans**
		4D	butenolides	flupyradifurone	*Sivanto 200 SL, Sivanto Prime*

What can you do to manage resistance?

Resistance management

Scout/Monitor pests



Use Integrated Pest Management

Always follow the pesticide label

Select and use pesticides wisely

If repeated applications of pesticides are necessary

- alternate pesticides with different modes of action against the pest
- no more than two consecutive applications of pesticide with the same MOA.

Tank-Mixing and Pre-Packs

Applying two or more pesticides with different modes of action in a tank-mix or pre-pack might

- delay the onset of resistance
- mitigate, existing pest resistance.

Tank-mixing allows handler to adjust the ratio of pesticides to fit local pest and environmental conditions

Premixes or Pre-packs are formulated by the manufacturer

"The different pesticides in the mixture must be active against the target pest so that insects with resistance to one mode of action are controlled by a pesticide partner with a different mode of action. Theoretically, repeated use of any tank-mix or pre-pack combination may give rise to insecticide resistance, if resistance mechanisms to each insecticide in the mix arise together but the probability is very low."

Dr. Wayne Buhler, PhD

Pre-Mix products

Repeated use of insecticides with the same mode of action can result in the development of resistant insect populations.

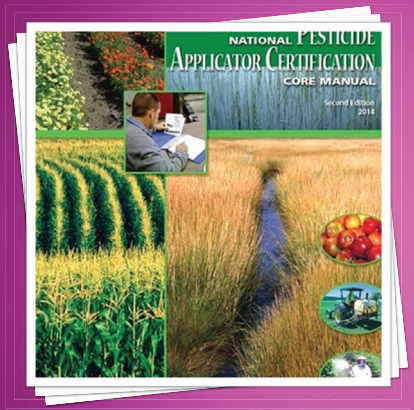
Site of action group #

DOUBLETAKE	diflubenzuron	15
	lambda-cyhalothrin	3
ENDIGO ZC	*lambda*-cyhalothrin	3
	thiamethoxam	4
HERO	*zeta*-cypermethrin	3
	bifenthrin	3
INTREPID EDGE	methoxyfenozide	18
	spinetoram	5
JUSTICE	acetamiprid	4
	bifenthrin	3
KILTER	imidacloprid	4
	lambda-cyhalothrin	3
LEVERAGE 360	imidacloprid	4
	beta-cyfluthrin	3
MATCH-UP	chlorpyrifos	1
	bifenthrin	3

Better-Than-Homework Task for Additional Prep

- Interview an employer, family member, coworker or friend about any non-chemical pest management methods they have used in the past
- Ask them to share what has and hasn't worked and why
- How would you categorize these methods? (i.e., biological, mechanical, genetic control, etc.)
- Did incorporating these methods reduce the amount of pesticide they used?

PESTICIDE LABELS AND SAFETY DATA SHEETS



CHAPTER 3

Pesticide Labeling

REGISTRATION

It takes many years and millions/billions of dollars to get a pesticide approved and registered for use.

WHY DOES IT TAKE SO LONG TO REGISTER A NEW PRODUCT?

Lab Screening and Testing

Field Trials and Research

Label Review and Registration

LD_{50} Illustration

LD = LETHAL DOSE
50 = 50% of test population

- Measures the acute toxicity – immediate health effects
- Determines the signal word placed on the label

SIGNAL WORD & PESTICIDE TOXICITY

DANGER

WARNING

CAUTION

This table is in Chapter 5

Table 5.1 Toxicity Categories

Signal Word & Symbol	Toxicity Level & Class	LD_{50} Oral (mg/kg)	LD_{50} Dermal (mg/kg)	LC_{50} Inhalation (mg/l)	Contact Injury Concern	Toxicity Concern
DANGER—POISON/PELIGRO Skull & Crossbones	Highly toxic, Hazard Class I	Trace to 50	Trace to 200	Trace to 0.2	Signal word based on oral, dermal, or inhalation toxicity.	Very low dose could kill a person (a few drops to 1 teaspoon).
DANGER/PELIGRO	Highly toxic, Hazard Class I				Corrosive—permanent or severe skin, eye, or respiratory damage.	Based on the corrosive or irritant properties of the product.
WARNING/AVISO	Moderately toxic, Hazard Class II	50 to 500	200 to 2,000	0.2 to 2	Moderate skin, eye, or respiratory damage.	Small to medium dose could cause death, illness, or skin, eye, or respiratory damage (1 teaspoon to 1 ounce).
CAUTION	Slightly toxic, Hazard Class III	500 to 5,000	2,000 to 20,000	2 to 20	Mild skin, eye, or respiratory irritation.	Medium to large dose could cause death, illness, or skin, eye, or respiratory damage (1 ounce to 1 pint or 1 pound).
CAUTION or no signal word	Hazard Class IV	Greater than 5,000	Greater than 20,000	Greater than 20	Slight concern for skin, eye, or respiratory injury.	Slight to none (over 1 pint or 1 pound).

Field Trials and Research

The efficacy of the pesticide and its impacts on

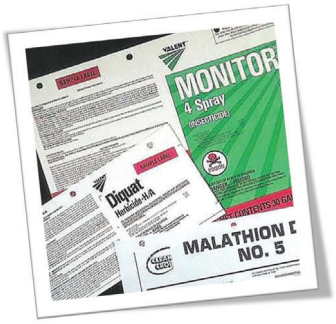
- **The target pest**
- **The crop, other plants or treatment site**
- **Bees and other beneficial insects**
- **Wildlife, livestock and pets**

ADDITIONAL ENVIRONMENTAL IMPACTS

Birds
Fish and other aquatic life
Surface and groundwater

How long do residues remain in the air, soil, water and plants (half-life)?

THE ENVIRONMENTAL PROTECTION AGENCY



- reviews every pesticide product
- must approve labeling language
- may require labeling changes

PESTICIDE REGISTRATION

- Section 3 - standard registration
  - *Memory tip: "3 standard sizes = S, M, L"*
- Section 25 (b) Minimum-risk pesticides
  - Minimal risk to human health and the environment and therefore may qualify for an exemption from registration.
  - *Memory tip: Think about car insurance rates - Once you turn 25-years old rates are better, because you've grown up and are a minimum risk to the insurance company.*

PESTICIDE REGISTRATION ~ REQUESTED BY STATES ~

- Section 18 - emergency exemptions
  - *An emergency exemption may be requested by a state if there is a serious pest problem and no federally registered pesticide*
  - *Memory tip: At 18 you are suddenly an adult and everything becomes a emergency.*
- Section 24 (c) - special local needs
  - *Used when additional uses are added to the label of a registered product*
  - *Memory tip: Every college town needs a 24-hour coffee shop to meet students' special local needs for caffeine*

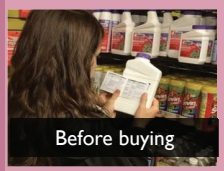
LABELS AND "LABELING"

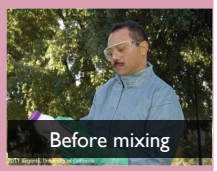
Label = Document on the container/packaging

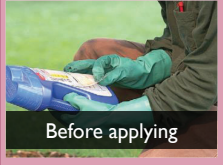
Labeling = The label itself, plus all other information referenced on the label or received from the manufacturer (brochures and leaflets)

No matter what type of pesticide you will use, you must read the label

- **Before buying the pesticide**
- **Before mixing or preparing the pesticide you will apply**
- **Before applying the pesticide**
- **Before storing or disposing of the pesticide or the containers.**







RESTRICTED USE PESTICIDE
DUE TO TOXICITY TO FISH AND AQUATIC ORGANISMS.
For retail sale to and use by Certified Applicators, or persons under their direct supervision, and only for those uses covered by the Certified Applicator's certification.

Tame®
2 . 4 EC SPRAY
INSECTICIDE-MITICIDE

For Commercial Nonfood Use On Indoor and Outdoor Ornamental and Nursery Plantings

Active Ingredient	By Wt.
*Fenpropathrin	30.9%
Other Ingredients	69.1%
Total	100.0%

*alpha-Cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate

Contains 2.4 pounds ai per gallon

Contains Petroleum Distillates

EPA Reg. No. 59639-77
EPA Est. 39578-TX-01

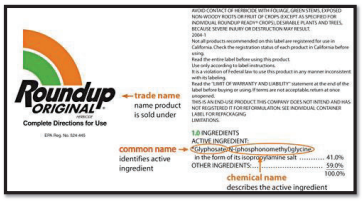
USE CLASSIFICATION STATEMENT

RESTRICTED USE OR UNCLASSIFIED/GENERAL USE

RESTRICTED USE PESTICIDE
For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certified applicator's certification.

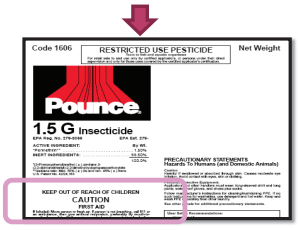
CLASSIFICATION

General use: Is considered to be one which offers little hazard to man or environment when used in accordance with label directions.



Restricted use (RUP): is one which if improperly used poses a potential threat to man and/or environment and one requiring additional information to that on the label and application by a certified applicator.

RESTRICTED USE PESTICIDES



Determined by EPA that the pesticide has to be applied by, or under the direct supervision of a Certified Applicator

No Relation to Toxicity Category

RESTRICTED USE PESTICIDE
DUE TO TOXICITY TO FISH AND AQUATIC ORGANISMS.
For retail sale to and use by Certified Applicators, or persons under their direct supervision, and only for those uses covered by the Certified Applicator's certification.

Tame®
2 . 4 EC SPRAY
INSECTICIDE-MITICIDE

For Commercial Nonfood Use On Indoor and Outdoor Ornamental and Nursery Plantings

Active Ingredient	By Wt.
*Fenpropathrin	30.9%
Other Ingredients	69.1%
Total	100.0%

*alpha-Cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate

Contains 2.4 pounds ai per gallon

Contains Petroleum Distillates

EPA Reg. No. 59639-77
EPA Est. 39578-TX-01

TRADE AND BRAND NAME

Trade, Brand, or Product Name

The brand name "**PLANTGUARD 50W**" indicates the registered trade name is **PLANTGUARD**, it is formulated as a **w**ettable powder, and it contains **50**% active ingredient

PLANTGUARD 50W
ORNAMENTAL FUNGICIDE

UNIRAY CHEMICAL

RESTRICTED USE PESTICIDE DUE TO TOXICITY TO FISH AND AQUATIC ORGANISMS.
For retail sale to and use by Certified Applicators, or persons under their direct supervision, and only for those uses covered by the Certified Applicator's certification.

Brand Name

Tame®
2.4 EC SPRAY
INSECTICIDE-MITICIDE

Trade Name

For Commercial Nonfood Use On Indoor and Outdoor Ornamental and Nursery Plantings

Active Ingredient	By Wt.
*Fenpropathrin	30.9%
Other Ingredients	69.1%
Total	100.0%

*alpha-Cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate

Contains 2.4 pounds ai per gallon
Contains Petroleum Distillates
EPA Reg. No. 59639-77
EPA Est. 39578-TX-01

COMMON VS. CHEMICAL NAME

Common Name

- Short version of the chemical name
- **Examples:** carbaryl, imidacloprid, dichlobenil, glyphosate, 2,4-D, permethrin, chlorothalonil
- Purchase pesticides according to their common names!

Turf Care®
Turf and Ornamental Fungicide
Active Ingredient:
Chlorothalonil (tetrachloroisophthalonitrile) . . . 82.5%
Other Ingredients: 17.5%
Total: 100.0%
(82.5% Water Dispersible Granules)
EPA Reg. No. 50534-202-100
EPA Est. 50534-TX-001

COMMON VS. CHEMICAL NAME

Chemical Name

identifies chemical components and structure of the active ingredient

Turf Care®
Turf and Ornamental Fungicide
Active Ingredient:
Chlorothalonil (tetrachloroisophthalonitrile) . . . 82.5%
Other Ingredients: 17.5%
Total: 100.0%
(82.5% Water Dispersible Granules)
EPA Reg. No. 50534-202-100
EPA Est. 50534-TX-001

RESTRICTED USE PESTICIDE DUE TO TOXICITY TO FISH AND AQUATIC ORGANISMS.
For retail sale to and use by Certified Applicators, or persons under their direct supervision, and only for those uses covered by the Certified Applicator's certification.

Tame®
2.4 EC SPRAY
INSECTICIDE-MITICIDE

For Commercial Nonfood Use On Indoor and Outdoor Ornamental and Nursery Plantings

Common Name

Active Ingredient	By Wt.
*Fenpropathrin	30.9%
Other Ingredients	69.1%
Total	100.0%

*alpha-Cyano-3-phenoxybenzyl 2,2,3,3-tetramethylcyclopropanecarboxylate

Chemical Name

Contains 2.4 pounds ai per gallon
Contains Petroleum Distillates
EPA Reg. No. 59639-77
EPA Est. 39578-TX-01

NON-AGRICULTURAL USE REQUIREMENTS

Can be found on pesticide labels that are approved for uses in areas that are not agricultural production areas (such as landscaping)

NON-AGRICULTURAL USE REQUIREMENTS

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

The area being treated must be vacated by unprotected persons.

Keep unprotected persons out of treated areas until sprays have dried.

IF YOU WORK FOR A NURSERY, YOU MIGHT ALSO REFER TO THE AG USE REQUIREMENTS BOX:

Agricultural Use Requirements

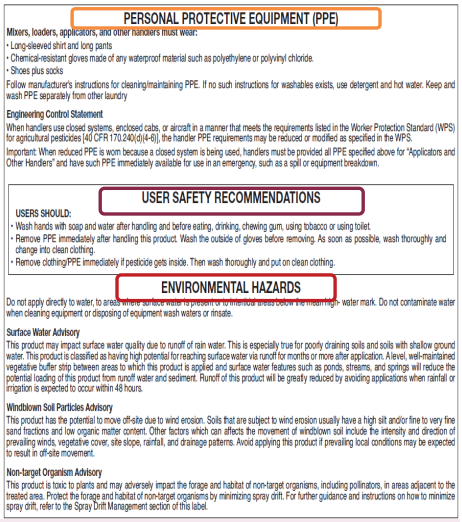
Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE)and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 4 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil or water, is:

- Coveralls
- Waterproof gloves
- Socks and chemical-resistant footwear

SECTIONS WE WILL COVER IN OTHER PRESENTATIONS



PERSONAL PROTECTIVE EQUIPMENT (PPE)

Mixers, loaders, applicators, and other handlers must wear:

- Long-sleeved shirt and long pants
- Chemical-resistant gloves made of any waterproof material such as polyethylene or polyvinyl chloride.
- Shoes plus socks

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exists, use detergent and hot water. Keep and wash PPE separately from other laundry

Engineering Control Statement

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

Important: When reduced PPE is worn because a closed system is being used, handlers must be provided all PPE specified above for "Applicators and Other Handlers" and have such PPE immediately available for use in an emergency, such as a spill or equipment breakdown.

USER SAFETY RECOMMENDATIONS

USERS SHOULD:

- Wash hands with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using toilet.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

ENVIRONMENTAL HAZARDS

Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high- water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash waters or rinsate.

Surface Water Advisory

This product may impact surface water quality due to runoff of rain water. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having high potential for reaching surface water via runoff for months or more after application. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of this product from runoff water and sediment. Runoff of this product will be greatly reduced by avoiding applications when rainfall or irrigation is expected to occur within 48 hours.

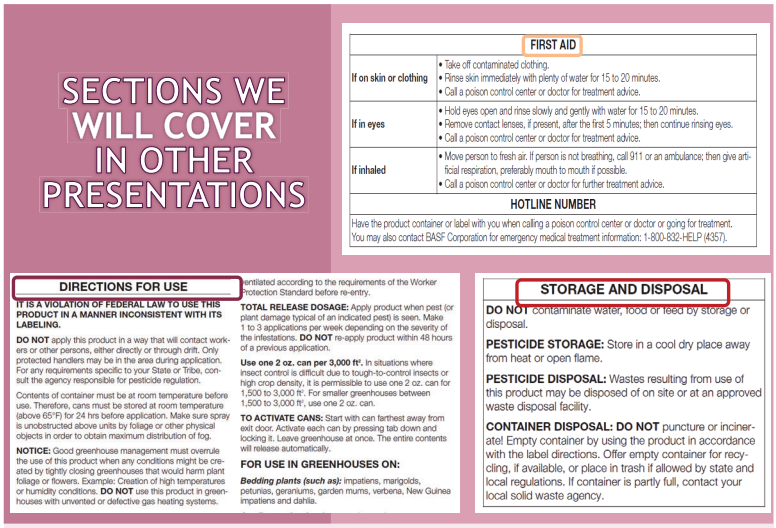
Windblown Soil Particles Advisory

This product has the potential to move off-site due to wind erosion. Soils that are subject to wind erosion usually have a high silt and/or fine to very fine sand fractions and low organic matter content. Other factors which can affects the movement of windblown soil include the intensity and direction of prevailing winds, vegetative cover, site slope, rainfall, and drainage patterns. Avoid applying this product if prevailing local conditions may be expected to result in off-site movement.

Non-target Organism Advisory

This product is toxic to plants and may adversely impact the forage and habitat of non-target organisms, including pollinators, in areas adjacent to the treated area. Protect the forage and habitat of non-target organisms by minimizing spray drift. For further guidance and instructions on how to minimize spray drift, refer to the Spray Drift Management section of this label.

SECTIONS WE WILL COVER IN OTHER PRESENTATIONS



FIRST AID

If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15 to 20 minutes. • Call a poison control center or doctor for treatment advice.
If in eyes	• Hold eyes open and rinse slowly and gently with water for 15 to 20 minutes. • Remove contact lenses, if present, after the first 5 minutes; then continue rinsing eyes. • Call a poison control center or doctor for treatment advice.
If inhaled	• Move person to fresh air. If person is not breathing, call 911 or an ambulance; then give artificial respiration, preferably mouth to mouth if possible. • Call a poison control center or doctor for further treatment advice.

HOTLINE NUMBER

Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact BASF Corporation for emergency medical treatment information: 1-800-832-HELP (4357).

DIRECTIONS FOR USE

IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING.

DO NOT apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

Contents of container must be at room temperature before use. Therefore, cans must be stored at room temperature (above 65°F) for 24 hrs before application. Make sure spray is unobstructed above units by foliage or other physical objects in order to obtain maximum distribution of fog.

NOTICE: Good greenhouse management must overrule the use of this product when any conditions might be created by tightly closing greenhouses that would harm plant foliage or flowers. Example: Creation of high temperatures or humidity conditions. **DO NOT** use this product in greenhouses with unvented or defective gas heating systems.

entilated according to the requirements of the Worker Protection Standard before re-entry.

TOTAL RELEASE DOSAGE: Apply product when pest (or plant damage typical of an indicated pest) is seen. Make 1 to 3 applications per week depending on the severity of the infestations. **DO NOT** re-apply product within 48 hours of a previous application.

Use one 2 oz. can per 3,000 ft². In situations where insect control is difficult due to tough-to-control insects or high crop density, it is permissible to use one 2 oz. can for 1,500 to 3,000 ft². For smaller greenhouses between 1,500 to 3,000 ft², use one 2 oz. can.

TO ACTIVATE CANS: Start with can farthest away from exit door. Activate each can by pressing tab down and locking it. Leave greenhouse at once. The entire contents will release automatically.

FOR USE IN GREENHOUSES ON:

Bedding plants (such as): impatiens, marigolds, petunias, geraniums, garden mums, verbena, New Guinea impatiens and dahlia.

STORAGE AND DISPOSAL

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

PESTICIDE STORAGE: Store in a cool dry place away from heat or open flame.

PESTICIDE DISPOSAL: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: DO NOT puncture or incinerate! Empty container by using the product in accordance with the label directions. Offer empty container for recycling, if available, or place in trash if allowed by state and local regulations. If container is partly full, contact your local solid waste agency.

ANOTHER VERY IMPORTANT DOCUMENT

MATERIAL SAFETY DATA SHEETS (MSDS) NOW CALLED SAFETY DATA SHEETS (SDS)

- Manufacturers required to develop and provide upon request for each product
- Get from your dealer
- Details a product's composition, properties, hazards, first-aid procedures
- Companies required to have SDS readily-available for employees

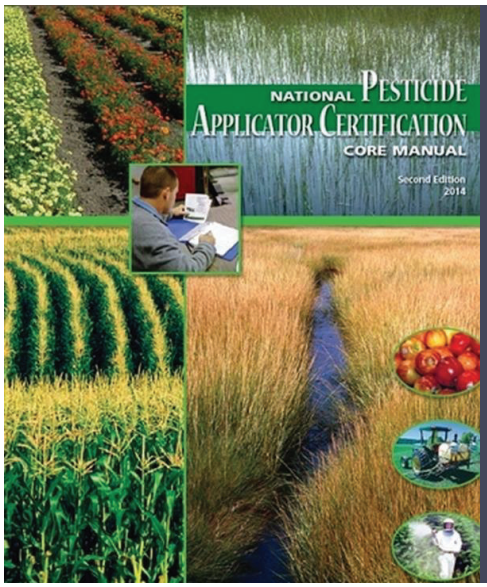
SAFETY DATA SHEET SECTIONS (PAGES 193 - 194)

- Section 1: Identification
- Section 2: Hazard(s) Identification
- Section 3: Composition/Information on Ingredients
- Section 4: First Aid Measures
- Section 5: Fire Fighting Measures
- Section 6: Accidental Release Measures
- 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 (when prepared and revised)

Information/Section	Label	SDS	Misc. Notes
Brand name			
Chemical name			
Common name			
EPA Registration #			
Type of Pesticide			
List of pests controlled			
Product formulation			
Manufacturer name			
Signal word			
LD 50 information			
Symptoms of exposure			
Health effects			
Long-term health effects (chronic health effects)			
Carcinogenicity			

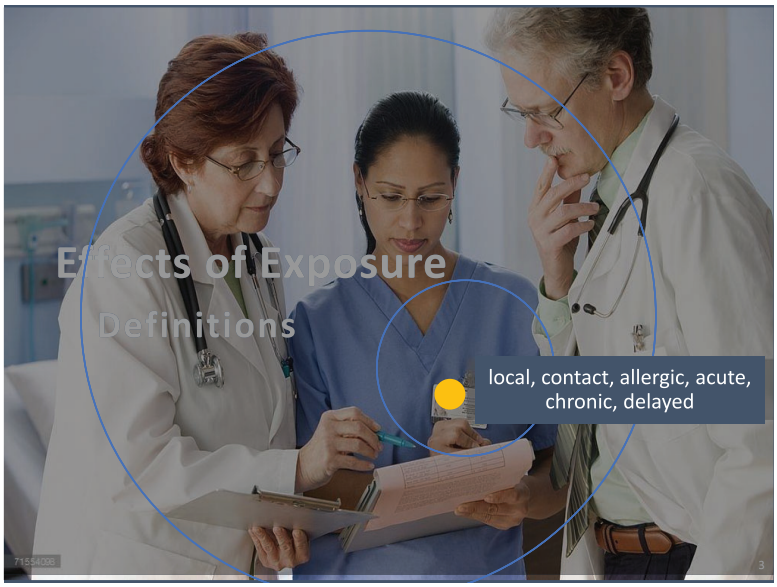
Better-Than-Homework Task for Additional Prep
Compare and Contrast Activity Label and Safety Data Sheet Information

Instructions: You can download a 2-page table with a list of information that can be found on pesticide labels and/or safety data sheets (SDS). On the pesticide label and SDS provided, search for the information/section listed on the first column. When you find the information/section listed, place a check mark under the corresponding column. If a section is found on both the label and SDS, place a check mark in each column. This will help you to identify the similarities and differences between labels and safety data sheets.



Chapter 5
Pesticide Hazards and First Aid

Chapter 6
Personal Protective Equipment



Local Effects

Injury at the point of contact

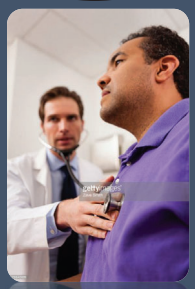
May include

skin discoloration and irritation (dermatitis) redness, rashes, blisters and burns

swelling, stinging, and burning of eyes, nose, mouth, or throat

4

Systemic Effects



Occurs once a pesticide has been absorbed and distributed throughout the body.

Nervous system disorders
Effects blood clotting ability
Cancer
Impaired metabolism
Hormonal effects
Kidney or liver damage

5

Allergic Effects

A sensitivity to a substance

May cause

- **dermatitis, blisters, hives**
- **itchy eyes**
- **asthma-like symptoms**
- **shock**

Often the entire body is affected

Acute and Chronic

A Comparison Between Acute and Chronic

• Exposure	• Appearance	• Effects
Acute = a single, one-time exposure event Chronic = long-term exposure, small repeated exposures over time. Test on lab animals for about 2 years.	Acute = symptoms appear within 24 hours Chronic = symptoms develop over time.	Acute = respiratory, eye or skin irritation. Burns or blindness. Both contact and systemic. Chronic = Liver disease, fertility and reproductive problems, cardiovascular disease, nervous system disorders, cancer, etc.

7

Delayed Effects

Illnesses or injuries that don't appear within the 1st 24 hours after exposure.

May be delayed for weeks, month, or years.

Can be caused by an acute or chronic exposure.

Comparison of Symptoms
Heat Stress
vs.
Organophosphate & N-methyl Carbamate Exposure

Similarities	Heat Stress Differences	Organophosphate and N-methyl Carbamate Differences
•SWEATING •HEADACHE •FATIGUE •NAUSEA •CENTRAL NERVOUS SYSTEM DEPRESSION •LOSS OF COORDINATION •CONFUSION	•DRY MOUTH •NO TEARS / NO SPIT •FAST PULSE (Slow if person has fainted) •DILATED PUPILS •FAINTING (Prompt Recovery)	•SALIVATION •TEARS / SPIT (MOUTH) •SLOW PULSE •DIARRHEA •POSSIBLE SMALL PUPILS •COMA

Could lead to nervous system disorders, such as Parkinson's Disease

Question:

- When and where might a person come into contact with pesticides or pesticide residues at your worksite?

A few ideas:

- Mixing, loading, or applying pesticides, cleaning and repairing application equipment, responding to emergencies such as spills, handling labels or open containers, checking pesticide storage areas, container collection events

Questions

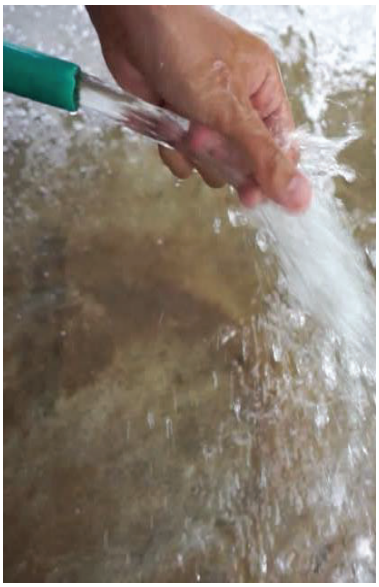
- **What are the four routes of entry through which pesticides can enter your body?**
- **Which route of entry is reported most frequently?**

What are the four routes of entry?

1. **EYES / OCULAR**
2. **NOSE / INHALATION**
3. **SKIN / DERMAL** — #1
4. **MOUTH / INGESTION**

Skin exposure scenario

- What is happening in this pictures?
- How would you prevent this types of exposure?
- How would you assist a person who got pesticide on their skin?



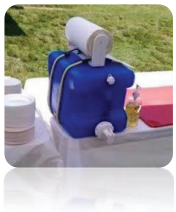
Remove contaminated clothing	• Remove any pesticide contaminated clothing
Wash skin	• Wash the contaminated skin with soap and water
Label may have more instructions	• Some labels may recommend rinsing or washing the skin for 15 minutes and seek medical attention if irritation persists

Decontamination Materials

- **Water**
- **Soap**
- **Single-use towels**

Plus

- **Change of clothing**



** Must be immediately available at the mixing and loading site*

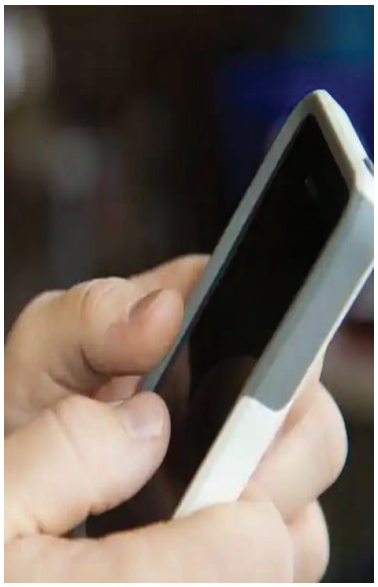
Eye Exposure Scenario

- What is happening in this pictures?
- How would you prevent this types of exposures?
- How would you assist a person who has pesticide in their eyes?

Rinse eye with water	• Rinse the eye with for 15 minutes with a cool stream of water
Inner to outer corner	• Rinse from the inner to the outer corner of the contaminated eye
Remove contact lenses	• If the person wears contact lenses, remove the lenses and continue rinsing the eye

Inhalation exposure scenario

- What is happening in this pictures?
- How would you prevent this types of exposure?
- How would you assist a person who has inhaled a pesticide?



Fresh air
- Get the person to fresh air

Do not go into enclosed area
- If the person is in an enclosed area and appears to be unconscious due to pesticide vapors, do not go in to rescue the person unless you have the proper respiratory equipment

NOTE
- NOTE: Call for emergency services, such as the fire department and explain the situation so they can come prepared to rescue the person

Ingestion exposure scenario

- What is happening in this pictures?
- How would you prevent this types of exposure?
- How would you assist a person who swallowed a pesticide?

Read label instructions
- Always read the label instructions before helping someone who has swallowed a pesticide

Labels instruction vary
- Some labels recommend vomiting and others state you must not induce vomiting
- Other labels will recommend water to sip, egg whites, milk, gelatin or activated charcoal

Never give anything to an unconscious person
- Never give any food or liquid to an unconscious person

Employee's Rights if Exposed to Pesticides at Work

If you suspect that you have been exposed to pesticides at work:

- **You have the right to medical treatment.**
- **You have the right to information about the pesticides that were used at your worksite.**
- **You have the right to receive transportation to the nearest medical facility. You should not drive yourself to the doctor if you are ill.**

Note: A Safety Data Sheet will also work

EPA Reg. No. 1658-XX

EPA Est. No. 18XX – MO – 1

Company Y

PRODUCT X

Disinfect-Cleaner-Sanitizer-Fungicide-Mildewstat-Virucide'–Deodorizer for Hospitals, Institutional and Industrial Use

Effective in hard water up to 400 ppm hardness (calculated as CaCO3) in the presence of 5% serum contamination

ACTIVE INGREDIENTS:

Octyl decyl dimethyl ammonium chloride	1.650%
Dioctyl dimethyl ammonium chloride	0.626%
Didecyl dimethyl ammonium chloride	0.025%
Alkyl (C14, 50%; C12, 40%; C16, 10%) Dimethyl benzyl ammonium chloride	2.200%
INERT INGREDIENTS	94.500%
TOTAL	100.000%

KEEP OUT OF REACH OF CHILDREN

DANGER

Statement of Practical Treatment

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. For eyes, call a physician. Remove and was contaminated clothing before reuse. If swallowed, drink promptly a large quantity of milk, egg whites, gelatine solution; or if these are not available, drink large quantities of water. Avoid alcohol. Call a physician immediately.

NOTE TO PHYSICIAN: Probable mucosal damage may contraindicate the use of gastric lavage. Measures against circulatory shock, respiratory depression, and convulsion may be needed.

SEE LEFT PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

Manufactured by
Company Y Chemical Company, Sometown, Somestate 12345

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

Product X is a proven "one-step" disinfectant – cleaner – sanitizer – fungicide – mildewstat – virucide which is effective in water up to 400 ppm hardness in the presence of 5% serum contamination. Apply Product X to walls, floors and other hard (inanimate) non-porous surfaces such as tables, chairs, countertops, sinks, tile, porcelain, and bed frames with a cloth, mop or mechanical spray device so as to thoroughly wet surfaces. For heavily soiled areas, a preliminary cleaning is required. Prepare a fresh solution daily or when use solution becomes visibly dirty.

Disinfection – To disinfect hard, non-porous surfaces, in hospitals, add 2 oz. per gallon of water. Treated surfaces must remain wet for 10 minutes. At 1 ¼ oz. per gallon of water, Product X will disinfect hard non-porous surfaces in school, industry and non-medical institutions. **2 oz. gallon use-level.** The activity of Product X has been evaluated in the presence of 5% serum and 400 ppm hard water by the AOAC use dilution test and found to be effective against a broad spectrum of gram negative and gram positive organisms as represented by:

Pseudomonas aeruginosa	*Enterobacter aerogenes*
Staphylococcus aureus	*Streptococcus faecalis*
Salmonella choleraesuis	*Shigella dysenteriae*
Escherichia coli	*Brevibacterium ammoniagenes*
Streptococcus pyogenes	*Salmonella typhi*
Klebsiella pneumoniae	*Serratia marcescens*

For schools, industry and non-medical institution use:
At 1 ¼ oz. /gallon of water, Product X delivers excellent cleaning and germicidal effectiveness. It is effective against *Staphylococcus aureus, Salmonella choleraesuis, Escherichia coli* and *Serratia marcescens*. The same AOAC tests used to confirm performance for hospitals were used.

Fungicidal Control – Product X is an effective fungicide against *Trichophyton mentagrophytes* (the athlete's foot fungus) when used on surfaces in areas such as locker rooms, dressing rooms, shower and bath areas, exercise facilities, etc., at 2 oz./gallon.

Mold and Mildew Control. At 1 ¼ oz./gallon, Product X will effectively inhibit the growth of mold and mildew and the odors caused by them when applied to hard, non-porous surfaces (as indicated in general instructions above). Allow to dry on surface and repeat when mildew growth returns.

Virucidal Performance. At 1 ¼ oz. /gallon use-level, Product X was evaluated and found to be effective in the presence of 5% serum and 400 ppm hard water, against the following viruses: Influenza A/Brazil, Herpes Simplex and Vaccinia on inanimate environmental surfaces.

Sanitizing-Non-Food Contact Surfaces (such as floors, walls, tables, etc.). At 1 oz. per 2% gallon use-level, Product X is an effective sanitizer against *Staphylococcus aureus* and *Klebsiella pneumoniae* on hard porous and non-porous environmental surfaces. Treated surfaces must remain wet for 60 seconds.

Reminder:
The label is an important document to take with you to the healthcare facility

- Brand name
- Manufacturer's name and address
- Active ingredients
- Inert ingredients
- EPA registration number
- EPA establishment number
- Signal words
- First aid instructions
- Precautionary statements
- Directions for use

Personal Protective Equipment

Question

- What is the purpose of Personal Protective Equipment (PPE)?

Purpose of PPE

The purpose of personal protective equipment is to protect pesticide handlers from exposure to pesticides

- Mixing
- Loading
- Applying
- Repairing or cleaning pesticide application equipment

Protective Clothing and Equipment

- The label might list long-sleeved shirt, long pants, shoes and socks ("protective clothing")
- It might include eye protection, respiratory protection, or gloves ("personal protective equipment")
- Some may specify certain types of materials, such as waterproof or chemical-resistant

PERSONAL PROTECTIVE EQUIPMENT

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category B on an EPA chemical-resistance category selection chart.

Applicators and other handlers must wear:

Long-sleeved shirt and long pants.
Chemical-resistant gloves, such as barrier laminate or butyl rubber.
Shoes plus socks.
Protective eyewear.
For exposures in enclosed areas, a respirator with either an organic vapor-removing cartridge with a prefilter approved for pesticides (MSHA/NIOSH approval number prefix TC-23C), or a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G), or NIOSH approved respirator with an organic vapor (OV) cartridge or a canister with any R, P, or HE prefilter.
For exposures outdoors, Dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C), or a NIOSH approved respirator with any R, P, or HE prefilter.

Cleaners and repairers of application equipment must wear:

Long-sleeved shirt and long pants.
Chemical resistant gloves.
Chemical resistant footwear.
Protective eyewear.
Respirator as outlined above.
Chemical resistant apron.

Chemical-Resistant Clothing

- Prevents most chemicals from reaching the skin
- PVC plastic, rubber, non-woven coated fabrics


Rubber


Nitrile


PVC


Barrier Laminate

Chemical-Resistant Aprons

The label might require an apron when:

- mixing and loading pesticides
- cleaning application equipment

Length - from chest to knees

- WARNING: aprons can get caught in machinery/moving parts

Gloves reduce dermal exposure by 99% when pouring, mixing, and applying pesticides

- Read the label
- Choose the correct glove
- Concentrate on the material and thickness

- VERY IMPORTANT
- Don't wear leather, suede, cotton or cotton-lined gloves when working with pesticides.
- These materials absorb chemicals.

Additional Tips

- If gloves are listed on the label, remember to wear them when you repair, clean, or adjust equipment or nozzles.
- Read and follow the labels of all products. Some organic pesticides and "green" products are skin irritants and may also require gloves.

Barrier Laminate

Only Gloves Rated 'High' Are Selected for Labels

EPA Chemical Resistant Glove Chart -- SHORT TERM TASKS are noted

Solvent Category	Barrier Laminate	Butyl Rubber ≥ 14 mils	Nitrile Rubber ≥ 14 mils	Neoprene ≥ 14 mils	Natural Rubber ≥ 14 mils*	Poly-ethylene	Polyvinyl Chloride (PVC) ≥ 14 mils	Viton ≥ 14 mils
A (dry and water- based)	High	High	High	High	High	High	High	High
B	High	High	Slight	Slight		Slight	Slight	Slight
C	High	High	High	High	Moderate	Moderate	High	High
D	High	High	Moderate	Moderate				Slight
E	High	Slight	High	High	Slight		Moderate	High
F	High	High	High	Moderate	Slight		Slight	High
G	High	Slight	Slight	Slight				High
H	High	Slight	Slight	Slight				High
Approximate price per pair (A.Shaw)	Barrier Laminate $5.70	Butyl Rubber $24.90	Nitrile $2.95	Neoprene $7.50		Polyethylene $0.99		Viton/Butyl $72.25 per glove

A B C

Which nitrile gloves are better?

Gloves over sleeves or tucked into sleeves?

- Spraying overhead

- Spraying toward the ground

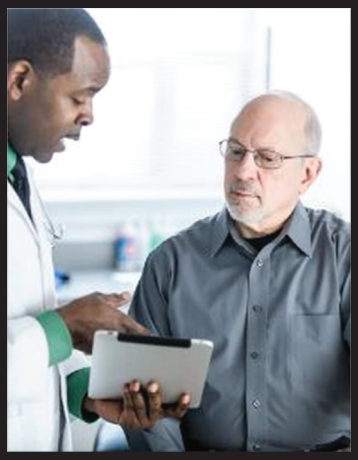
Protective eyewear

- Protect your eyes when mixing concentrates, handling dusts or spraying
- Select eyewear with side and brow protection
  - Goggles
  - Faceshield
  - Safety glasses
  - Full-Faced Respirator

Respirator Requirements

Medical Evaluation

- Must occur before using a respirator
- Note: Some health conditions may become worse with use of respirator (example: asthma & claustrophobia)



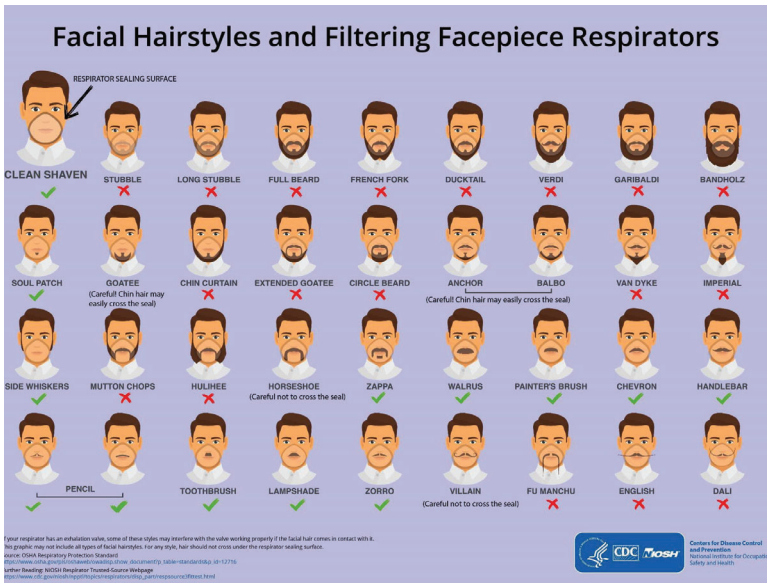
Respirator Use Training

- Includes instructions on use, proper fit, care and maintenance
- How to find NIOSH number

Make sure you have your own respirator

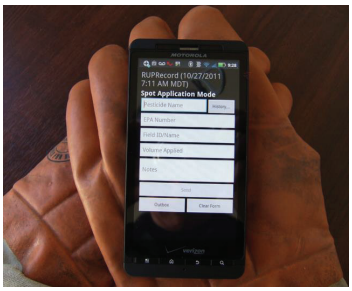
Check the Seal

- Make sure the respirator forms a tight seal to prevent pesticides from entering.



General concern

- **Wear items listed on the label that you are willing to wash after the pesticide handling task.**
- **Contaminated items that people forget to or don't want to wash are eyeglasses, leather boots, baseball caps and cell phones.**

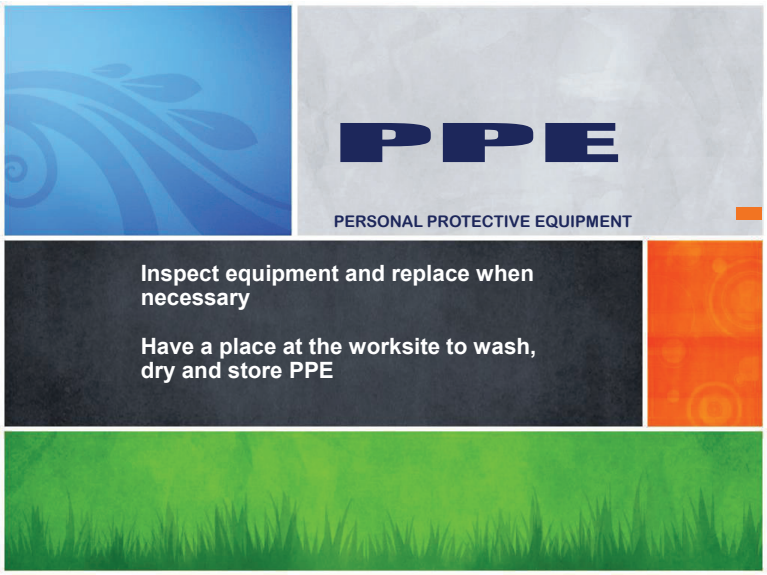


https://www.youtube.com/watch?v=SKdvpxbp7A0

Now we will view the last 2-minutes of this video about cleaning PPE.

Note: You can watch the full 11-minute video using the link below

Do not take PPE into your home.
Wash work clothes separately from other clothing.

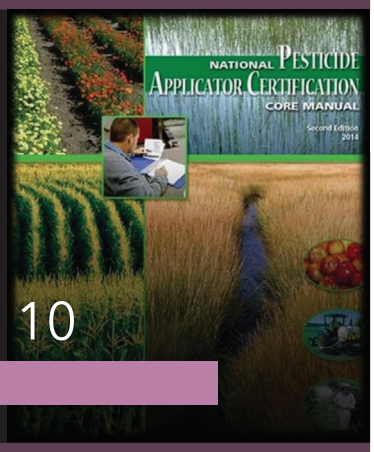


Better-Than-Homework Task for Additional Prep

- Check the labels of products you use at work
- Do you have all of the PPE listed on these labels?
- If you do not, what do you need to purchase or have available before you use the pesticides?

Pesticide Formulations, Adjuvants, Tank Mixing and Compatibility

Chapters 4 and 10



Active Ingredient(s) (Ai)

The actual chemical in the product mixture that controls the pest. **Each active ingredient will be listed on the label.**

CARBARYL INSECTICIDE

INTENDED FOR AGRICULTURAL OR COMMERCIAL USE
Includes Residential Turf Spot Treatments
ACTIVE INGREDIENT:
Carbaryl (1-naphthyl N-methylcarbamate) ..... 43.0% by wt.
OTHER INGREDIENTS: .....57.0% by wt.
TOTAL: 100.0%
(Contains 4 Pounds Carbaryl Per Gallon)
EPA Reg. No. 432-1227

Inert Ingredients (more often referred to as "other" ingredients)
Other materials added with the AI when the product is formulated. **The inert ingredients are not required to be listed on the label at this time. They are included as a percentage.**

Granules (G) pages 57- 58

- A: No mixing, easy and ready to use, low drift hazard, low applicator hazard, simple application equipment, may break down slower than liquids
- D: Frequent calibration, measured by weight, not uniform size impacts application, don't stick, may need to be incorporated into soil or wet, non-target wildlife

Pellets (P or PS) page 58

- A: Similar to GRANULES except that they are uniform in size and can be applied with precision. No mixing, easy and ready to use, low drift hazard, low applicator hazard, simple application equipment, may break down slower than liquids
- D: Frequent calibration, measured by weight, not uniform size impacts application, don't stick, may need to be incorporated into soil or wet, non-target wildlife

Dust (D)
pages 56-57

- A: No mixing, easy and ready to use, many (not all) contain less than 10% of active ingredient, some dusts are used as tracking powders and are effective for insect and rodent control, effective in hard to reach areas or where a liquid formulation might damage area.
- D: Drift potential, doesn't easily stick to area, can irritate eyes, nose, throat and skin, high inhalation risk, humidity could cause it to clump, hard to calibration, difficult to evenly distribute

Wettable Powders or Soluble Powders in Water Soluble Bags/Packets (WSB or WSP) page 62

- A: Accurately premeasured units, safer for handler due to minimal contact with pesticide, lower risk of spills
- D: Packet size may not match amount you need, if applying in pounds or gallons of ai per acre may need lots of packets, packaging is sensitive to moisture and might dissolve if it gets wet before use

Emusifiable Concentrate (EC) page 52

- A: Easy to pour, measure, transport and store. Little agitation required when equipment is running, will not clog nozzles or screens, little visible residue
- D: High concentration of ai makes easy to over/underdose or calibration error, possible phytotoxicity, dermal absorption, difficult to clean up spills, may have strong odor, solvents may cause wear/tear on rubber equipment parts (hoses, gaskets, etc.), damage painted finished, flammable

Solutions
Water-Soluble Concentrates (WSC), Liquid Concentrates (LC), Soluble Concentrates (SC) page 53

- A: Easy to handle, transport, store, pour and measure. No agitation, non-abrasive, doesn't clog screens or nozzles and no visible residue.
- D: Limited availability, especially water-based solutions, spills and splashes difficult to cleanup and decontaminate, some are easily absorbed through skin.

Flowables
Aqueous Flowables (AF) page 55

- A: Easy to handle, low exposure risk, not phytotoxic, lower chance of clogged nozzles or splashes
- D: May settle, need to shake before measuring/mixing, moderate agitation, may be abrasive to equipment, difficult to rinse product from container, visible residue on treated surface, spills harder to clean up.

Ultra Low Volume (ULV) page 54

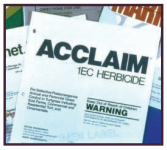
- A: Easy to handle, transport, store. Little to no agitation, not abrasive to equipment, doesn't plug screens and nozzles, little visible residue
- D: Small droplets lead to high drift hazard, specialized equipment, easily absorbed through skin and easily inhaled, hard on equipment parts such as rubber, hoses, gaskets, and pumps, special care during calibration and application due to concentrated form.

Table of Abbreviations for Common Formulations ~ Chapter 4, pg. 51

Table 4.1 Abbreviations for Common Formulations

A	= Aerosol	PS	= Pellets
AF	= Aqueous flowable	RTU	= Ready-to-use
B	= Bait	S	= Solution
C	= Concentrate	SP	= Soluble powder (*or* soluble packet; see WSP)
D	= Dust	ULV	= Ultra-low volume
DF	= Dry flowables (see WDG)	W	= Wettable powder
E	= Emulsifiable concentrate	WDG	= Water-dispersible granules (see DF)
EC	= Emulsifiable concentrate	WP	= Wettable powder
F	= Flowable	WS	= Water soluble
G	= Granules	WSB	= Water-soluble bag (see WSP: water-soluble packet)
GL	= Gel	WSC	= Water-soluble concentrate
L	= Liquid	WSL	= Water-soluble liquid
LC	= Liquid concentrate	WSP	= Water-soluble powder (*or* water-soluble packet; see WSB)
LV	= Low volatile		
M	= Microencapsulated		
P	= Pellets		

Sometimes you can gather a lot of information about the formulation by looking at the product's name:



1EC
1 lb Ai/gallon
emulsifiable concentrate

80SP
80% active ingredient
by weight
Soluble Powder

40DF
40% active ingredient
Dry Flowable

Tank Mixing and Compatibility

Mixing two or more pesticides together for single application.

14

Tank mixing

- **Saves time, labor, money and fuel**
- **It is convenient, as long as the combinations are compatible**

Incompatibility – mixing of two products that do not physically or chemically suit each other

EFFECTS OF INCOMPATIBILITY

Some effects

- **Heat, clumping, precipitate**
- **Inactivity of active ingredients**
- **Increased phytotoxicity**
- **Field incompatibility can still occur.**

16

Some products don't mix or don't stay mixed

Putty, paste, separation, cottage cheese-like

Inadequate agitation in tank

Improper mixing order - always mix in powders before ECs
EC and fertilizer incompatibility

Hard water (pH) - some products require buffers to alter pH of water

Physical incompatibility

Tea

Chemical incompatibility

- Degradation occurs
  - Hard or chlorinated water, addition of fertilizer
- Increased toxicity can result in loss of selectivity
- Some products when mixed are altered through chemical reactions

Other Types of Incompatibility

Timing incompatibility

- Mixing a pre-emergent and post emergent pesticide

Placement incompatibility

- Mixing a soil incorporated pesticide with a foliar applied pesticide

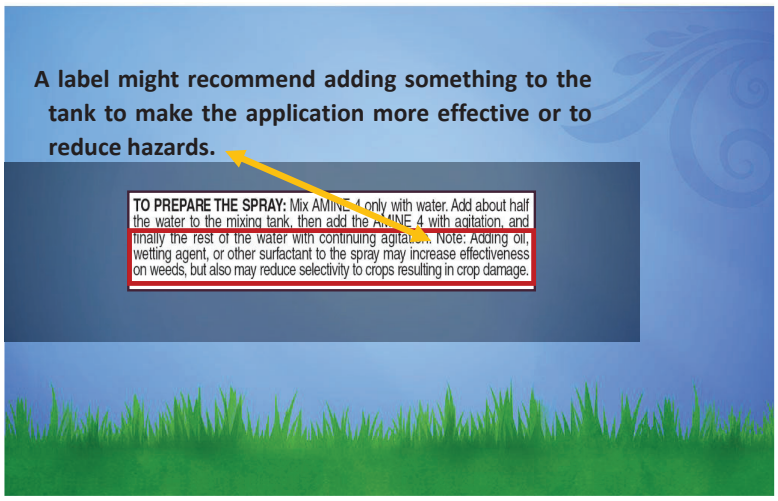
Read the label

- Specific recommendations for tank mixes known to be compatible
- Specific prohibitions for tank mixes known to be incompatible
- No statement, applicator responsibility to jar test for compatibility

Jar Test for Compatibility

- **Mix proportionate amounts of all products**
- **Fill jar halfway with water or carrier (often fertilizer)**
- **Add products one at a time in proper order**
- **Shake jar and see what happens**
- **Allow jar to stand for 10-15 minutes.**
- **Products are not compatible if have a precipitate, heat is given off, or products separate into layers**

A label might recommend adding something to the tank to make the application more effective or to reduce hazards.



Adjuvants

Adjuvant are chemicals or agents added to a pesticide mixture to help the active ingredient do a better job.

•Wetting Agents – allow wettable powders to mix better with water

•Spreaders – allow pesticide to form a uniform coating over treated surface

•Stickers – allow pesticide to stay on treated area

•Emulsifiers – allow petroleum-based products to mix with water

•Invert Emulsifiers – allow water-based pesticides to mix with petroleum carrier

•Penetrants – allow pesticide to get through outer surface to inside of treated area

•Foaming Agents – help to reduce drift

•Thickeners – help to reduce drift by increasing droplet size

Surfactants *(surface)* - group

Wetting agents
Spreaders
Emulsifiers
Stickers/Extenders

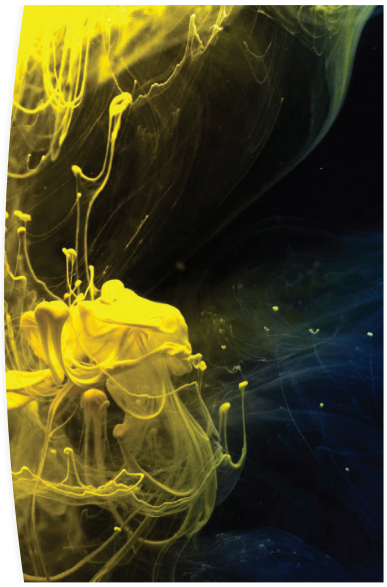
OTHER

Buffers
Compatibility agents
Defoaming agents
Colorants/dyes
Safeners
Thickeners

Adjuvants
Purchased additives to add to tank mix or added during formulation process

Mixing Order for Pesticide Tank Mix

- Fill tank one-fifth to one-half full with the carrier (e.g., water or liquid fertilizer). Start agitation.
- Add compatibility agent (if needed).
- Add suspension products: first, dry formulations—wettable powders (WP), dry flowables (DF), water-dispersible granules (WDG) (as a preslurry, if necessary), then liquids—flowables (F), liquids (L), microencapsulated (ME).
- Add solution products—solutions (S), soluble powders (SP).
- Add surfactants or other adjuvants (if needed).
- Last, add emulsion products—emulsifiable concentrates (EC).



Better than Homework Task for Additional Exam Prep

- Take cellphone photos or jot down the names of 5 different products representing formulations of pesticides you find at work, home or in a store.
- Identify one pro and one con of each type of formulation

PEST MANAGEMENT DIVISION

INITIAL LICENSING TRAINING FOR CATEGORY 3 & 4

PREPARED BY:
ARIZONA DEPARTMENT OF AGRICULTURE
PEST MANAGEMENT DIVISION

R3-8-201. ACTIVITIES THAT REQUIRE A LICENSE; EXEMPTIONS

C. Applicator licensure.

1. An individual who provides pest management services shall be a certified applicator and only provide pest management services in a certification category for which the applicator is currently certified except as provided under subsections (C)(2) and (C)(3) or as otherwise exempt by this Chapter or the PMD's statutes.

3. An individual may provide pest management services on behalf of a business licensee without being a certified applicator if the individual: a. Is registered as an applicator of the business licensee under R3-8-207; b. Has been registered as an applicator of the business licensee for not more than 90 calendar days out of the last 365 days; and:

R3-8-201. ACTIVITIES THAT REQUIRE A LICENSE; EXEMPTIONS

a. Is registered as an applicator of the business licensee under R3-8-207;

b. Has been registered as an applicator of the business licensee for not more than 90 calendar days out of the last 365 days; and

c. Is supervised by a certified applicator who:

i. Is certified in the category for which supervision is provided;

ii. Provides immediate supervision when the individual performs pest management services in the wood-destroying organism treatment, aquatic, or fumigation category, uses a restricted use pesticide, or uses a pesticide under an experimental use permit; and

iii. Provides direct supervision when the individual performs pest management services not covered by subsection (C)(3)(c)(ii).

R3-8-201. ACTIVITIES THAT REQUIRE A LICENSE; EXEMPTIONS

4. An individual may not provide pest management services at a school, child care facility, health care institution, or food-handling establishment unless the individual is a certified applicator in the certification category for which services are being provided.

- Applicator registration. An applicator may not provide pest management services on behalf of a business licensee or political subdivision unless the applicator is registered as an applicator of the business licensee or political subdivision pursuant to R3-8-207.

R3-8-207. APPLICATOR REGISTRATION

A. Every applicator of a business licensee or political subdivision shall be registered with the PMD as an applicator for that business licensee or political subdivision before providing pest management services for the business licensee or political subdivision. This requirement is in addition to applicator certification requirements.

R3-8-208. LICENSE, CERTIFICATION AND REGISTRATION RENEWAL

A. An application to renew a business license, applicator or QA certification, or qualifying party, branch office, branch supervisor, or applicator registration is due May 1 of the year the license, certification, or registration expires. Failure to receive a renewal application does not justify a failure to timely renew.

R3-8-301. USING PESTICIDES AND DEVICES

A. An applicator shall use only a pesticide that is currently registered for use by the Department or was registered by the Department and does not have a passed EPA end use date.

B. An applicator shall not misuse a pesticide or device. It is misuse of a pesticide or device if an applicator:

1. Applies, handles, stores, or disposes of a pesticide or device in a manner that is inconsistent with the label or labeling;

2. Provides a pest management service or handles a pesticide without wearing clothing and using the personal protective equipment required by the label or labeling to protect the applicator from pesticide exposure;

R3-8-301. USING PESTICIDES AND DEVICES

3. Uses a pesticide in a manner that causes the pesticide to come into contact with a person, other than the applicator, animal, or property, other than the property receiving the pest management service, unless the contact results from an accident beyond the reasonable control of the applicator;

4. Uses a pesticide in a food-handling establishment that the label or labeling recommends not be used in a food-handling establishment; and

5. Uses a pesticide in a manner that contaminates food, feed, or drugs or equipment used to prepare or serve food, feed, or drugs.

R3-8-301. USING PESTICIDES AND DEVICES

C. While mixing a pesticide with water, an applicator shall protect the water supply from back-siphoning of the pesticide mixture. An applicator shall not add water to a tank in which a pesticide is mixed or from which a pesticide is dispensed by protruding a fill-pipe or hose connection into the tank. An applicator shall ensure that a fill-pipe or hose connection terminates at least two inches above the tank fill opening or is equipped with an effective anti-siphoning device.

D. An applicator shall ensure that all equipment, including auxiliary equipment such as a hose or metering device, used for mixing or applying a pesticide is in good repair and operating properly.

E. An applicator shall apply, store, or dispose of a pesticide designated by the EPA as restricted use only if the applicator is certified or working under the immediate supervision of an applicator certified in the category for which the restricted-use pesticide is applicable.

R3-8-301. USING PESTICIDES AND DEVICES

F. An applicator shall clean a pesticide spill in accordance with the pesticide label and labeling directions and in a manner that minimizes exposure to humans and other non-target organisms. If a pesticide spill may endanger humans, an applicator shall clean the pesticide spill in accordance with recommendations by health and medical personnel and local authorities.

G. An applicator shall apply a pesticide at a rate provided by a Special Local Need registration issued by the Department and the pesticide labeling. The applicator shall have in the applicator's possession at the time of the application both the Special Local Need labeling and the EPA section 3 label and labeling.

R3-8-302. STORING AND DISPOSING OF PESTICIDES AND DEVICES

A. An applicator shall store and dispose of a pesticide or device in a manner consistent with its label and labeling.

B. An applicator shall store a pesticide in a closed container that is free from corrosion, leakage, or pesticide contamination on the outside of the container and properly labeled.

C. An applicator shall ensure that a service container bears a durable and legible specimen label with the following information:

1. The name, address, and telephone number of the business licensee or political subdivision;
2. The common chemical or trade name of the principal active ingredients;
3. The EPA registration number;
4. The strength of the concentrate or dilution expressed as a percentage of active ingredients;
5. Any signal word required on the label; and
6. The phrase "KEEP OUT OF REACH OF CHILDREN."

R3-8-302. STORING AND DISPOSING OF PESTICIDES AND DEVICES

D. An applicator shall not place words or markings on a service container or on the label affixed to the service container that are unrelated to the pesticide in the service container, except for markings related to a method of tracking the product.

E. If the label affixed to a pesticide container becomes lost or damaged, an applicator shall attach a specimen label to the pesticide container.

F. An applicator shall replace a damaged container, other than a fumigant container, with an identically labeled container or a properly labeled service container.

G. Application equipment from which a pesticide is directly discharged and in which the pesticide is not stored is not subject to the labeling requirements of this Section.

R3-8-302. STORING AND DISPOSING OF PESTICIDES AND DEVICES

H. An applicator shall not store a pesticide in a manner which food, beverage, feed, drugs, cosmetics, eating utensils, or tobacco products can be contaminated.

I. An applicator shall not store a pesticide in a container that was used for food, beverage, feed, drugs, or cosmetics, or which by size, shape, or marking could be confused as being a food, beverage, feed, drug, or cosmetic.

J. An applicator shall not store a fumigant within a residence, office or cab of a vehicle.

K. An applicator shall ensure that a pesticide in an original or service container, an empty pesticide container that has not been prepared for disposal in accordance with its label, or a returnable or reusable pesticide container is kept in a locked storage space when on an unattended service vehicle or is within view and under the supervision of the applicator responsible for the service vehicle.

R3-8-303. PESTICIDE AND DEVICE STORAGE AREA

A. A business licensee or political subdivision shall provide a pesticide and device storage area that complies with all federal, state, and local laws. The storage area may include an area on a service vehicle.

B. A business licensee or political subdivision shall secure the storage area required under subsection (A) from unauthorized entry by equipping its entrance or access with a lock.

C. Immediately after storing a pesticide, a business licensee or political subdivision shall conspicuously post a sign at the entrance or access to a non-vehicle storage area and on a vehicle storage area indicating there is a pesticide, chemical, or poison stored inside.

D. A business licensee or political subdivision shall provide sufficient ventilation to the outside of the storage area required under subsection (A) to prevent build-up of odors and preclude chemical injury to an individual or animal.

R3-8-303. PESTICIDE AND DEVICE STORAGE AREA

E. A business licensee or political subdivision shall provide the following in or immediately adjacent to the storage area required under subsection (A), including a storage area on a service vehicle:

1. Electric or battery-powered lighting that is sufficient to read a pesticide label;
2. Fully charged and operational fire extinguisher or fire suppression system appropriate to each pesticide stored in the area;
3. Emergency medical information including the telephone number of the state or local poison control center;
4. Material capable of absorbing a spill or leak of at least one gallon;
5. Specimen label and SDS for each pesticide stored in the area; and
6. Washing facilities that include at least one gallon of fresh water, soap, and towels.

R3-8-305. EQUIPPING A SERVICE VEHICLE

A business licensee or political subdivision shall provide each service vehicle with the following:

1. All equipment and supplies required by the label and labeling to apply properly the pesticides on the service vehicle;
2. A measuring and pouring device compatible with the pesticides on the service vehicle;
3. Protective clothing and safety equipment suitable for use when handling, mixing, or applying the pesticides on the service vehicle;
4. Material capable of absorbing a spill or leak of at least one gallon;
5. A storage container large enough to hold material contaminated by absorbing a spill or leak of pesticides;
6. At least one gallon of clean, drinkable water for each individual using the service vehicle at one time;
7. Uncontaminated change of clothing;
8. Specimen label and SDS for each pesticide on the service vehicle; and
9. A locking storage space designed to prevent a pesticide container from being damaged while in transit.

R3-8-306. PROVIDING NOTICE TO CUSTOMERS

A. Immediately following an application, the applicator shall provide a written notice to a customer for whom the applicator provides a pest management service that contains the:

1. Name and address of the customer;
2. Specific site to which a pesticide was applied;
3. Date of service;
4. Target pest or purpose of service;
5. Trade name of pesticide applied;
6. EPA registration number of restricted use pesticide applied;
7. Amount of pesticide applied, in terms of percent active ingredient and volume of diluted mixture or in terms of total amount of liquid concentrate, ready-to-use product, granular material, or bait stations;
8. Name and certification number of the applicator or if the applicator is uncertified, the name of the uncertified applicator and the name and certification number of the applicator providing supervision; and

R3-8-306. PROVIDING NOTICE TO CUSTOMERS

9. Following statement printed in at least an eight-point font: "Warning—Pesticides can be harmful. Keep children and pets away from pesticide applications until dry, dissipated, or aerated. For more information, contact [business licensee's name and business license number issued by the PMD] at [business licensee's telephone number]."

3-3606. PESTICIDE APPLICATIONS AT SCHOOLS AND CHILD CARE FACILITIES; ADVANCE NOTIFICATION; EXEMPTIONS

A. Only a certified applicator may apply pesticides at a school or child care facility.

B. A business licensee or certified applicator shall notify a school or a child care facility at least seventy-two hours in advance of any pesticide application in order to permit the school to comply with section 15-152 and the child care facility to comply with section 36-898. The seventy-two-hour advance notice shall include:

1. The scheduled date and time the application is to occur.

2. The location and area of the application and the brand name of the pesticide or pesticides to be applied.

3. The name, address, phone number and contact person of the business licensee or certified applicator.

4. A statement that further information, the product label or the safety data sheet is available by contacting the business licensee or certified applicator.

3-3606. PESTICIDE APPLICATIONS AT SCHOOLS AND CHILD CARE FACILITIES; ADVANCE NOTIFICATION; EXEMPTIONS

C. The following pesticide applications are exempt from the notification requirement prescribed by subsection B of this section:

1. Nonresidual pesticide applications performed or contracted by public health agencies for adult vector control, provided that oral notification is attempted at least seventy-two hours before the application, when possible, to the school office or child care facility office with a statement of the pest problem, treatment procedure, area to be treated and approximate time of the application.

2. Emergency applications of a pesticide that has a toxicity category of III or IV pursuant to 40 Code of Federal Regulations section 156.62 to control harmful pests that pose an immediate threat to the public health. Under the circumstances described in this paragraph or paragraph 1 of this subsection, the business licensee or certified applicator shall do all of the following:

3-3606. PESTICIDE APPLICATIONS AT SCHOOLS AND CHILD CARE FACILITIES; ADVANCE NOTIFICATION; EXEMPTIONS

(a) Notify the school office or child care facility office before the application with a statement of the pest problem, treatment procedure, area to be treated and approximate time of application.

(b) Immediately after the application has been completed, notify the school office or the child care facility office of the name of the pesticide applied, the formulation, the strength and dosage and the date and time of application and provide the pesticide label.

(c) Post the treated area immediately after the application. The posting shall be at least eight and one-half inches by eleven inches and shall include the name of the pesticide, the registration number issued by the United States environmental protection agency, the date and time of application and the name and telephone number of the business licensee and certified applicator. A copy of the posting shall also be placed at the main entrance to the school or child care facility. The posting and the copy of the posting shall remain in place for at least forty-eight hours after the application.

3-3606. PESTICIDE APPLICATIONS AT SCHOOLS AND CHILD CARE FACILITIES; ADVANCE NOTIFICATION; EXEMPTIONS

3. Disinfectants or swimming pool chemicals.

4. Block, gel or paste-type bait that is a toxicity category III or IV formulation of insecticide pursuant to 40 Code of Federal Regulations section 156.62 and that is either of the following:

(a) Secured in an enclosed, tamper-resistant bait station and placed in an area that is inaccessible to children.

(b) Applied to a crack or crevice that is inaccessible to children.

5. Block-type bait that is a toxicity level III or IV formulation of rodenticide pursuant to 40 Code of Federal Regulations section 156.62 and that is secured in an enclosed, tamper-resistant bait station placed in an area that is inaccessible to children.

6. Personal repellants.

7. Nonrestricted use sanitizers and deodorizers.

ALCA
ARIZONA LANDSCAPE CONTRACTORS ASSOCIATION

PMD Certification Training

PMD Licensing Information, Study & Exam Procedures

Topics we will cover:

- The steps to take to become a licensed applicator
- How to prepare for taking the exam
- Where to go for more support

Steps to become PMD Licensed Applicator

- If you haven't already, go to our website www.alca.org > Training & Certification > Pre-Certification Applicator Training and download the "Certification and Licensing Information" document
- This document is also available on the PMD website https://opm.azda.gov/ under Industry Resources > Licensing Forms\Documents > Licensing Information PDF
- This document outlines all the steps you must take to become licensed

DOUGLAS A. DUCEY
Governor

MARK W. KILLIAN
Director

Arizona Department of Agriculture
Pest Management Division
1688 W. Adams Street, Phoenix, Arizona 85007
(602) 255-3664 FAX (602) 542-0466
opm.azda.gov

Certification & Licensing Information

The Arizona Department of Agriculture Pest Management Division (PMD) is the Arizona regulatory body that regulates the use, disposal and storage of pesticides (which includes herbicides, etc.). The Environmental Protection Agency regulations, State Statutes and Rules guide the PMD.

"Pest" means a vertebrate or invertebrate insect, bird, mammal, other animal or organism, or a weed or plant pathogen that is in an undesirable location.

"Pesticide" is defined as any substance or mixture of substances intended to be used for preventing, destroying, repelling, or mitigating insects, fungi, microbes, weeds, rodents, predatory animals or any form of plant or animal life that is, or that the director may declare to be, a pest and that may infest or be detrimental to vegetation, humans, animals or households or be present in any environment. In additional to Insecticides, fungicides, rodenticides, termiticides, fumigants, larvacides, adulticides, herbicides, avicides, or molluscicides, all-natural or organic substances such as essential oils or water may be considered a pesticide.

The **"Business of Pest Management"** is defined as: Engaging in, offering to engage in, advertising for, soliciting or performing pest management, including any of the following:

(a) Identifying infestations or making inspections for the purpose of identifying or attempting to identify infestations. (b) Making written or oral inspection reports, recommendations, estimates or bids with respect to infestations. (c) The application of pesticides or the making of contracts or submitting of bids for the application of pesticides or the use of devices for the purpose of eliminating, exterminating, controlling or preventing infestations.

Please read the information below, it contains information about each certification and license that is required to provide pest management services in Arizona. It is crucial to become familiar with the Arizona Revised Statutes (LAWS) and Arizona Administrative Codes (RULES) with regard to the Pest Management Division.

Notwithstanding the examination requirements in A.A.C. R4-29-203(C), R4-29-204(G), and R4-29-211, the Director may waive the examination requirements in whole or in part for an individual who is certified as an applicator pursuant to A.R.S. Title 3, Chapter 2 or by another state.

Below is basic information with regard to PMD Licensing. More in depth information is available on the PMD website. A list of Study Materials is also available.

Certified Applicator Requirements:

- Submit completed application to PMD
- Pay fee
- Submit statement and evidence of lawful presence **submit proof of citizenship if possible – one time vs proof of lawful presence needs resubmission every renewal**
- Pass the Core and at least one category-specific examination with a score of 75% or higher

- Application is available online:

https://opmssl.azda.gov/Applications/Applicator/New/NewApplicatorInitial_SCS.php

Prepare for the Exam - It is up to you!

- Attend Pre-Certification classes/workshops like this one
- PMD: "Exam Preparation courses may supplement but cannot replace study of the recommended materials"
- Review all the Resources from our website:
  - https://www.azlca.com/pre-certification-applicator-pmd-training
- Review all the resources on the PMD website:
  - Industry Resources > Certification Testing & Training
- Study the Core Manual

https://agriculture.az.gov/sites/default/files/National_Pesticide_Applicator_Certification_Core_Manual_2ndEdition.pdf

Preparing for the Exam - Continued

- Study for your Category Exams
  - Use today's training, PMD recommended materials and more
  - Category 3 O&T:

Turf Pest Management – Purdue University - Indiana Commercial Pesticide Applicator Training Manual
$30.75; postage $2.58
Guide To Identifying and Controlling Turf Pests. Color Photos.

  - Category 4 ROW:

Right of Way Vegetation Management
$8.00; postage $1.90
Control Of Weeds Commonly Found On Rights-Of-Way. Illustrated.

- These publications are available through the PMD:

https://opm.azda.gov/Assets/PDFDocuments/Hard-Copy_Study_Material_List.pdf

Remember these from the ALCA website?

Resources:

PMD Certification & Licensing Information

PMD Certification Exam Procedure

PMD Hard Copy Study Material List & Order Form

PMD Pre Cert Study Outline

Pre Cert Resource List

National Pesticide Applicator Certification Core Manual 2nd Edition

Pest Images

O & T Pest List

PMD Unlicensed Flowchart

Category 3 Ornamental & Turf Study Materials - PMD

Category 4 Right of Way Study Materials - PMD

Register and Pay for Exam

- See "Certification Exam Procedures" from PMD (next slide)
- Register for an account at Metro Institute in order to register and pay for an exam
  - http://www.metrosignup.com/signup/index.asp
    602-452-2900 or 877-533-2900
- GOOD LUCK!

DOUGLAS A. DUCEY
Governor

AZDA
ARIZONA DEPARTMENT OF AGRICULTURE

MARK W. KILLIAN
Director

Arizona Department of Agriculture
Pest Management Division
1688 W. Adams Street, Phoenix, Arizona 85007
(602) 255-3664 FAX (602) 542-0466
http://agriculture.az.gov

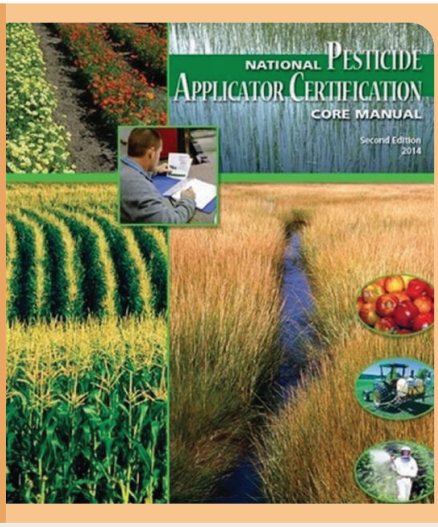
Certification Examination Procedure

1. Submit Certified Applicator (CA) or Certified Qualified Applicator (QA) Application and Application Fees. The Director may approve the application, deny the application (citing legal grounds for denial), or request additional information.
2. Upon approval, the applicant will receive a letter indicating the approval date and expiration date of their application as well as the examination categories in which they were approved.
3. The applicant may then contact Metro Institute (the exam facilitator) at 602-452-2900 or 877-533-2900 to schedule any or all exams they have been approved for. Exams may be scheduled online at http://www.metrosignup.com/signup/index.asp
4. Currently exam fees are $50.00 per exam, which can be paid by Cash, Check, Visa, MasterCard or American Express. Mail (or bring for walk-in appointments) check payments to Metro Institute, 331 N First Ave, Ste 100, Phoenix, AZ 85003. Please do not mail cash.
5. If, for any reason, you cannot make your exam appointment, you may reschedule at no charge with 24 hours notice.
6. Don't forget: You must bring your picture ID to the testing site.

Statewide Testing Sites:

Phoenix –	Metro Institute Testing Center – 331 N. First Ave, Ste. 100
Glendale –	Metro Institute Testing Center – 6677 W. Thunderbird, Bldg F, Ste. 103
Tucson –	Pima Community College Testing Center – 2202 W. Anklam, C-141
Flagstaff –	Coconino Community College – 3000 N Fourth Street, Room B22
Prescott –	Yavapai College – 1100 E. Sheldon St., Bldg 1, Room 225
Kingman –	U of A Cooperative Extension Center – 101 E. Beale St., Ste. A
Yuma –	U of A Cooperative Extension Center – 2200 W. 28th St., Ste. 102

Chapters
7 and 9



Recap - Efficacy Tests

Does the pesticide cause plant damage = phytotoxicity?

Does the pesticide effectively manage the pest?

Additional Questions

What happens to the pesticide after it is applied?
Does it move through soil to the groundwater?
Does it move into plants from the soil?

Degradation

Mobility

Residue

Solubility

- The ability of a pesticide to dissolve in a solvent, usually water
- Soluble pesticides are more likely to move with water in surface runoff or through the soil to groundwater

Leaching or Percolation through Soil

Soil structure and texture

– Sandy: pesticides can pass through quickly

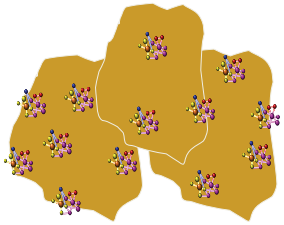
– Clay or soils with organic matter: leaches slowly

The depth of the water table/groundwater

The amount of rain and time of irrigation

Adsorption

- Binding of chemicals to soil particles
- Higher with oil-soluble pesticides
- Clay and organic matter increase binding
- Decreases the potential for a pesticide to move through soil

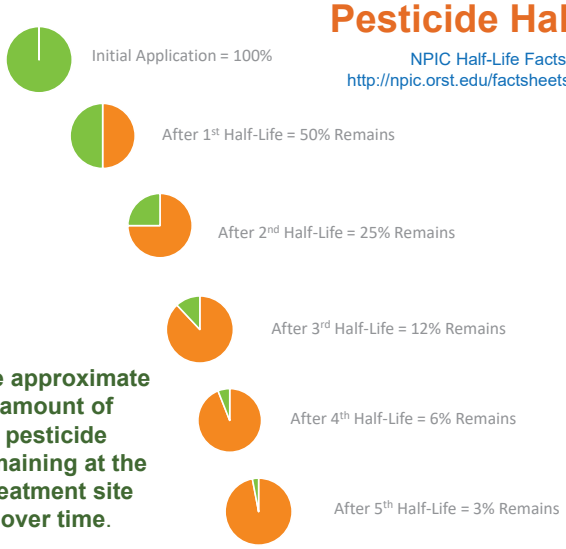


Persistence

- How long a pesticide remains active before it degrades
- Long-term pest control
- Can also harm sensitive plants or animals
- Concerns for illegal residues in rotational crops

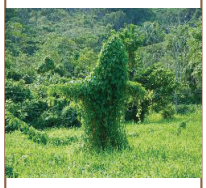
Pesticide Half-Life

NPIC Half-Life Factsheet:
http://npic.orst.edu/factsheets/half-life.html



The approximate amount of pesticide remaining at the treatment site over time.

A Pesticide's Half-Life Varies

Soil	Water	Plant
		

•You can prevent damage to the environment when you use pesticides safely and according to label instructions.

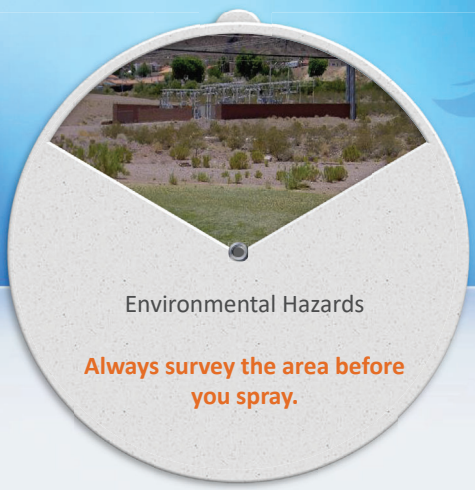
Factors that Contribute to Contamination of the Environment

The pesticide handler's experience with pesticides and attitude about safety measures

The time of year and weather conditions

Pesticide formulation and type of equipment

Droplet size and spray pressure



Environmental Hazards

Always survey the area before you spray.

Some pesticides are especially hazardous to water sources, aquatic life, wildlife, domestic animals, or beneficial insects.

Protect Sensitive Areas

- **Schools**
- **Parks**
- **Hospitals**
- **Gardens**
- **Rivers, lakes, and streams**
- **Other plants**
- **Bees and other beneficial insects**

Notification about applications, include buffer strips, select pesticides that are less harmful to environment, and incorporate IPM strategies.

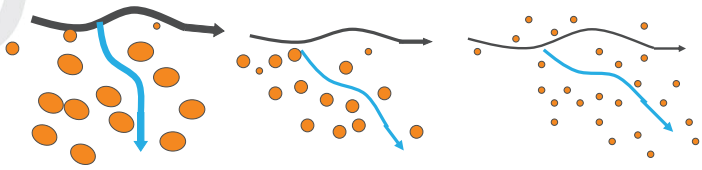
Pollinator Protection: Questions to ask before you mix and load the pesticide

- Are bees or other beneficial insects present or near the area?
- Are there beekeepers within 5-10 miles?
- Are there flowers on the plants near the treatment site?
- What are the weather conditions and how does the pesticide react or breakdown in these conditions?
  - Cloud cover
  - Moisture
  - Extreme heat or cold
- Is there an area where the pesticide you're applying is puddling?
- Are you applying a dust?
- Is the pesticide persistent? How long will it remain in the plant?
- Most importantly – is there a pesticide you can use that isn't toxic to bees and how can you implement IPM into your pest control program?

Wind

- What is the wind direction?
- What is downwind of the application site?
- What is the windspeed?
  - 0-3 mph:
    stable air; difficult to determine wind direction
  - 3-7 mph:
    easier to determine wind direction
  - >7 mph:
    spray drift is possible

Larger Spray Droplets



Drift less than smaller droplets

Volatility

The tendency of a pesticide to turn into a gas or vapor

Temperature ↑
Wind ↑ = Higher Volatility
Humidity ↓

Think about Arizona – when it's hot, dry and windy, pesticides are more volatile (move around)

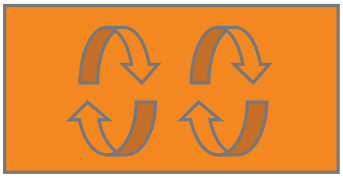
In this situation there is a pest problem that requires:

- High pressure sprayer
- Nozzle/equipment that produces fine/ultra fine droplets

What are your concerns with this situation?

What would you do differently?

What would you do before you spray?



Normal Weather Conditions

Air mixes continually - dilutes material – less concentrated

Temperature Inversion

Temperature Inversion Layer Demo

https://www.youtube.com/watch?v=LPvn9qhVFbM

Temperature Inversion Pesticide Concerns

- A layer of cooler air is trapped by a layer of warmer air above.
- At night, the ground level temperature cools faster than the air above it. Pesticides can become trapped under the layer of warm air.
- If there is isn't any wind, the air can become stagnant.
- Once the wind or breeze picks up, pesticide vapors can travel for long distances/drift and settle in other areas

Spill Cleanup

CLEANING UP SPILLS:

- **Control** the spill and protect yourself.
- **Contain** the spill to prevent it from spreading.
- **Clean up** the pesticide

Handout: Spill Cleanup Procedures

- *Cleanup of liquid spills on concrete and in soil*
- *Cleaning up dry formulations*
- *Steps for spills on public roadways*

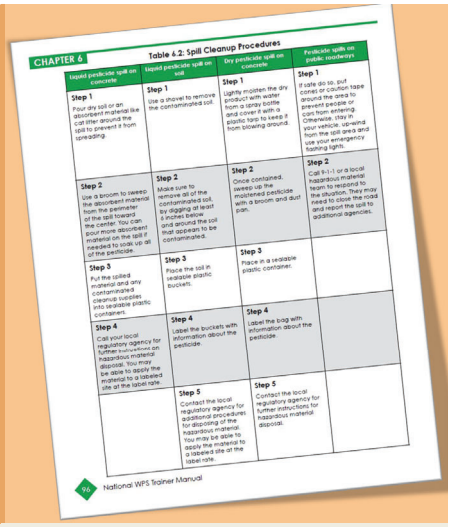

CHAPTER 6

Table 6.2: Spill Cleanup Procedures

Liquid pesticide spill on concrete	Liquid pesticide spill on soil	Dry pesticide spill on concrete	Pesticide spill on public roadways
Step 1 Pour dry soil or an absorbent material like cat litter around the spill to prevent it from spreading.	**Step 1** Use a shovel to remove the contaminated soil.	**Step 1** Lightly moisten the dry product with water from a spray bottle and cover it with a plastic tarp to keep it from blowing around.	**Step 1** If safe do so, put cones or caution tape around the area to prevent people or cars from entering. Otherwise, stay in your vehicle. Up-wind from the spill area and use your emergency flashing lights.
Step 2 Use a broom to sweep the absorbent material from the perimeter of the spill toward the center. You can pour more absorbent material on the spill if needed to soak up all of the pesticide.	**Step 2** Make sure to remove all of the contaminated soil, by digging at least 6 inches below and around the soil that appears to be contaminated.	**Step 2** Once contained, sweep up the moistened pesticide with a broom and dust pan.	**Step 2** Call 9-1-1 or a local hazardous material team to respond to the situation. They may need to close the road and report the spill to additional agencies.
Step 3 Put the spilled material and any contaminated cleanup supplies into sealable plastic containers.	**Step 3** Place the soil in sealable plastic buckets.	**Step 3** Place in a sealable plastic container.	
Step 4 Call your local regulatory agency for further instructions on hazardous material disposal. You may be able to apply the material to a labeled site at the label rate.	**Step 4** Label the buckets with information about the pesticide.	**Step 4** Label the bag with information about the pesticide.	
	Step 5 Contact the local regulatory agency for additional procedures for disposing of the hazardous material. You may be able to apply the material to a labeled site at the label rate.	**Step 5** Contact the local regulatory agency for further instructions for hazardous material disposal.	

National WPS Trainer Manual

Be Prepared for Spills – Spill Kit Items

- Chemical-resistant gloves
- Boots
- Chemical-resistant apron
- Protective eyewear
- Respirator (if listed on label)
- Absorbent material (soil, sand, cat litter)
- Cones and/or caution tape
- Shovel
- Broom
- Dustpan
- Heavy-duty detergent
- Small squirt bottle to moisten dry products
- Plastic container with a lid for collecting contaminated material
- Other spill cleanup materials listed on the label of the spilled pesticide
- Phone numbers for local pesticide regulatory agencies, hazmat teams, and emergency response departments

Better-Than-Homework Task for Additional Prep

- Think about the types of formulations you will use and the areas where you will store, mix, load and apply them
- If you were to spill pesticides in those areas, what cleanup materials would you need?
- Does the SDS have unique cleanup instructions?
- Check the cleanup supplies you currently have available and the area where they are stored
- Make a list of any supplies you need to add and additional areas where you should keep them.

Pesticide Storage

This module begins with a 13-question quiz about your pesticide storage area.

Items you will need during this module:

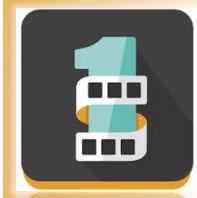
- Pen or pencil and scratch paper, or
- Calculator

What are the benefits of a good storage area?

- Prevent damage to pesticides from extreme temperatures and weather
- Safeguard against theft, vandalism, and unauthorized use
- Protect people, animals and the environment
- Reduce likelihood of liability

Let's start with a simple quiz

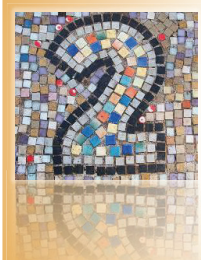
It is best to store…



1. No more than 1 gal. or 10 lbs. of each pesticide.
2. More than 1 gal. or 10 lbs., but less than 55 gals or 50 lbs. of each pesticide
3. More than 55 gals or 50 lbs. of several pesticides.

Your answer: Your score:

The pesticide storage area should …



1. Be a roofed building with a waterproof (sealed or coated) concrete floor and curb to contain leaks and spills.
2. Be a roofed building with a concrete floor without a curb.
3. Have a gravel or dirt floor or be out in the open.

Your answer: Your score:

The pesticide storage area should have …

1. Holes or vents to provide cross ventilation (a passive ventilation system).
2. An electrical (active) ventilation system.
3. No ventilation.

Your answer: Your score:

The pesticide storage area should be…

1. Within 100 ft. of a public water supply or surface waters or within 50 ft. of a well.
2. In your well house or in a facility containing an unsealed well.
3. More than 100 ft. (horizontally) from a public water supply or surface waters and more than 50 feet from a private water supply well.

Your answer: Your score:

The pesticide storage area should be…

1. Unsecured and open to theft, vandalism, and children or unauthorized persons.
2. Locked or secured and separated from other activities.
3. Secured, but it's o.k. if it is sometimes open to activities that could damage containers or spill pesticides.

Your answer: Your score:

The pesticide storage area should be used…

1. For pesticides only.
2. To store seed, fertilizer or other nonfood/nonfeed products.
3. To store human food or animal feed products.

Your answer: Your score:

Unusable or cancelled pesticides should be…

1. Kept with other pesticides in clearly marked containers.
2. Kept separately in the pesticide storage area until safe disposal through a state, county or tribal community disposal assistance program.
3. Buried.

Your answer: Your score:

Pesticides should be stored in…

1. Metal containers with holes or weak seams that may leak or are stored in containers that have previously been used for food, feed or beverages.
2. Some metal containers that are deteriorating.
3. Plastic or metal containers. Containers in poor condition should be placed inside another liquid-proof container.

Your answer: Your score:

Pesticides should be…

1. Stored in clearly-labeled original containers.
2. Transferred to another container with the following labeling information: common chemical name, percentage of each active ingredient, EPA registration number, signal word (Caution, Warning, Danger), and use classification (restricted or general use).

Your answer: Your score:

Pesticides should be stored…

1. Without sorting for liquids or type of pesticide.
2. With liquids below dry pesticides.
3. With liquids on lower shelves below dry products and herbicides separated from insecticides and fungicides.

Your answer: Your score:

The pesticide storage should have…

1. Warning signs posted on all entrances to the storage area, which read “Danger – Pesticides – Keep Out – No Smoking.”
2. Warning signs posted, even if they have become weathered and are difficult to read.
3. No warning signs.

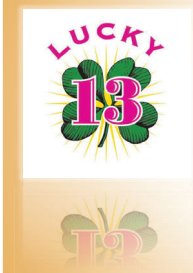
Your answer: Your score:

The local fire authorities…

1. Should be aware of your pesticide storage facility.
2. Should have a copy of your pre-fire plan for handling agricultural chemical fires at your storage area.
3. Do not need to know about your pesticide storage facility and don’t need to visit your site.

Your answer: Your score:

The inventory of pesticides in storage …

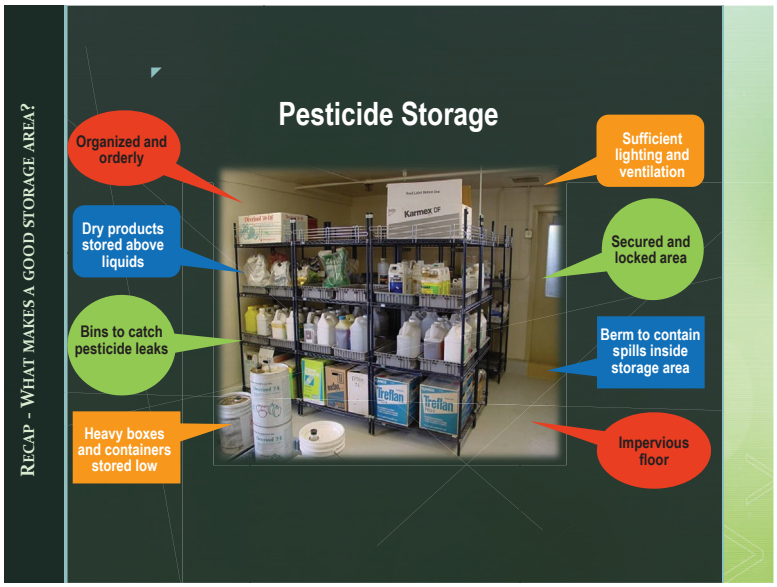


1. Can be out-of-date or nonexistent.
2. Can be slightly out-of-date (pesticides placed in storage in the last 6 months to a year don’t need to be recorded).
3. Must be up-to-date, have Safety Data Sheets for each product, and kept at a central location.

Your answer: Your score:

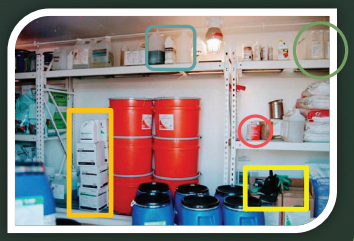
How is your knowledge about pesticide storage areas?

1. Fabulous = 21-26 points
2. O.K. but you use a few pointers = 15 – 20 points
3. Take lots of notes today = under 15 points
4. Please get another cup of coffee = 1 to - 6 points



What potential hazards do you notice?

Storing pesticides



- Keep pesticide storage areas free of combustible materials or anything that could create a fire such as petroleum products and welding items.

Aha – but what is wrong with this picture?

Inventory list

- Maintain an inventory list
- Store the inventory list in an office or area outside of the pesticide storage area.
- Buy only the amount you need
- Check the expiration dates and use up your older products first

HOW CAN WEATHER IMPACT YOUR STORED PESTICIDES

AND THE PESTICIDE CONTAINERS?

Weather's Potential Impact on Pesticides and Pesticide Containers

Extreme Cold

- Containers can crack and leak
- Product's ingredients (active and inert ingredients) can separate
- Pesticides can crystalize or coagulate

Extreme Heat

- Pesticides can expand and cause buildup or pressure in container leading to leaks
- Plastic containers may melt or become brittle
- May cause an explosion or fire

Flooding and Humidity

- Metal containers can rust
- Paper and cardboard can split or crumble
- Labels may peel, smear and become difficult to read
- Dry pesticides can clump, degrade or dissolve

Severe Wind

- May cause damage to roof or sides of storage structure
- Structure damage can make pesticides susceptible to heat, dust and humidity
- Pesticides might fall off shelves, tip over and spill

What should you do if your storage area is flooded?

Before entering the storage area, put on gloves, boots, a chemical-resistant apron, eye protection, and respiratory protection.

- Assume standing water is hazardous and don't allow standing water to come into contact with your skin.
- Be cautious as water may contain a mixture of different pesticides
- If damage is minor, clean up spills and place damaged packages in secondary containers (drums or heavy plastic bags)
- If severe flooding situation, call hazmat team to respond
- Report the damage to the appropriate agencies

RECAP - WHAT MAKES A GOOD STORAGE AREA?

Keep emergency numbers handy near your storage area/mix load area

- National Poison Center Number:

1-800-222-1222

Arizona Pesticide Hotlines:

800-423-8876 (agricultural)

602-542-0026 (structural)

Note: If you apply pesticides on tribal land,

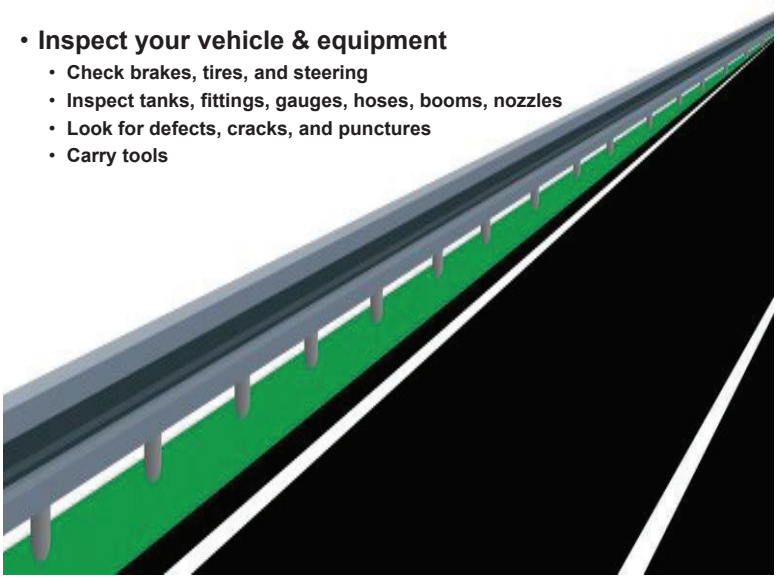
please contact the tribal pesticide or environmental program office

Transporting Pesticides

- Never carry pesticides in the passenger compartment of any vehicle – place them in the cargo area.
- Secure all pesticide containers in the cargo area and protect them from rain and other potential damage.
- Never transport food, animal feed, or clothing in the same compartment.
- Do not leave pesticides - unattended.

- **Carelessness can cause harm**
- **Some pesticides are highly flammable**
- **Spills can result in human exposures, pollution, financial loss, legal action**
- **Vehicles can scatter spilled pesticides**

- **Inspect your vehicle & equipment**
  - **Check brakes, tires, and steering**
  - **Inspect tanks, fittings, gauges, hoses, booms, nozzles**
  - **Look for defects, cracks, and punctures**
  - **Carry tools**



Other Vehicle Precautions

- Inspect containers before loading: legible labels? tight seals? clean surfaces?
- Use tubs and liners for extra containment and easier cleanup
- Less handling of containers equals reduced likelihood of damage
- Secure load with tarps, ropes, and tie downs, even when transporting equipment

Containing Cargo

- Enclosed boxes are best, but not always practical
- Truck beds are convenient but be cautious!
  - Never stack higher than side of vehicle
  - Secure containers and tanks
  - Check for nails, stones, sharp edges
  - Steel beds are better than wood (easier to clean)
  - Always ask, “How accessible is the load to others?”

How far was the person going with this load?

How stable are the containers in the back?

What would you do differently?

Vehicle owners and operators are held responsible for spills

They **MUST** be trained in emergency response procedures for spills and notification

For emergency preparedness, always carry in the vehicle

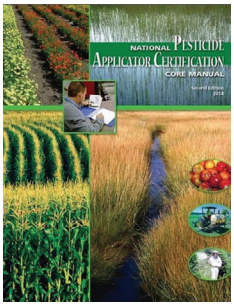
- The label and Safety Data Sheet
- A spill cleanup kit
- A list of emergency phone numbers

Better-Than-Homework Task for Additional Prep

- Find the hazard information on a Safety Data Sheet
- Search for the following:
  - Precautionary statements about storing near certain items or other types of pesticides, fertilizers, etc.
  - Storage temperature ranges
  - Special instructions for first responders or firemen

Safe Pesticide Mixing, Loading and Application

Chapter 10

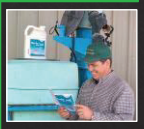


Pesticide Selection

Before selecting and applying a pesticide:

- **Know the pest**
- **Know federal, state and local pesticide regulations**
- **Know how to properly use application equipment**
- **Read the Label**

Review the Directions for Use

Question 1	Question 2	Question 3	Question 4
			
Legally: Can you apply a pesticide **BELOW** the rate listed on the label?	**Legally:** Can you apply a pesticide **ABOVE** the rate listed on the label?	**Legally:** Can you apply a pesticide to control a **PEST** that is not listed on the label?	**Legally:** Can you apply a pesticide to a **SITE** that is not listed on the label?
YES	**NO**	**YES**	**NO**

Keep Reading the label

You may come across some speed bumps, such as…

Application Timing Considerations

For residual control of weeds, apply in later summer, fall or early spring to ensure adequate moisture for soil activation.

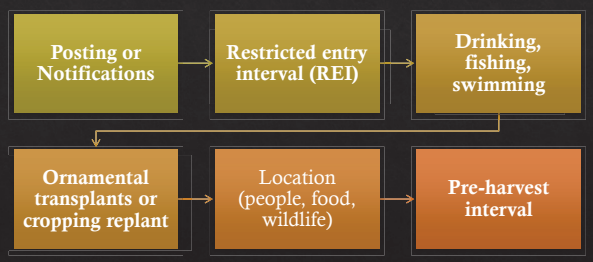
Make applications prior to egg hatch or when larvae are small and actively feeding (late spring through mid-summer.

Look for application restrictions

Application restrictions:

- Do not use in chemigation systems

Post-Application Restrictions



APPLICATION PREPARATION

Does label recommend the use of an **adjuvant** (buffer, surfactant, colorants)?

TO PREPARE THE SPRAY: Mix AMINE 4 only with water. Add about half the water to the mixing tank, then add the AMINE 4 with agitation, and finally the rest of the water with continuing agitation. Note: Adding oil, wetting agent, or other surfactant to the spray may increase effectiveness on weeds, but also may reduce selectivity to crops resulting in crop damage.

SAFE MIXING AND LOADING

Appropriate Mixing and Loading Area

- Outdoors
- Well-ventilated
- Away from people and animals

Always check equipment
Adjust or repair if necessary

Note: In my search for a photo to place on this slide, I found several YouTube videos and checklists on sprayer repair. You can try gemplers.com and your sprayer manufacturer's websites for tips.

HERE IS A LIST OF COMMON PROBLEMS AND THEIR RESOLUTIONS.

If you need additional assistance, please visit our online product support knowledge base - http://support.solousa.com/ or call our customer support des

Solo parts are available on our website – https://us.solo.global/8-parts-accessories

PROBLEM	CAUSE	SOLUTION
Difficulty in moving pump lever	Dirty bushing	Remove pump lever, clean & grease bushings
	Dirty cylinder walls (425)	Remove piston, clean/replace piston & collar
		Replace collar and maintain according to instructions
	Collar swollen from long term exposure (425)	Lubricate Viton® collar
	Lack of lubrication (425)	
Insufficient resistance during repeated pumping and no pressure	Damaged/dirty valve plates	Clean or replace valve plates or cylinder
	Damaged O-ring at valve seat	Replace O-ring
	Collar or piston (425) worn	Replace collar or piston
	Seal in pressure regulator is leaking	Check seal and valve seat
High resistance after just a few pumping strokes, pressure lasts only briefly	Little or no air cushion in pressure cylinder	Remove PVC hose, drain pressure cylinder, Reconnect hose. Preventive measure - release pressure after each use
During spraying, upward pumping becomes more & more difficult and tank walls may indent upwards	Wrong formula tank cap (no vent hole)	Replace with vented cap
	Vent hole clogged	Clean vent hole.
	Lower valve plate sticks	Replace valve plate
When handle is pulled up it wants to move itself forcibly back down	Intake channels clogged	Clean channels & tank
	Inlet screen at base of pressure cylinder clogged	Clean intake screen with a small brush and detergent
Leaks inside cylinder (425) Leaks outside cylinder (425)	Damaged/dirty collar or piston	Clean or replace collar and possibly cylinder if worn
	Damaged O-ring on cylinder	Replace O-ring
	Damaged O-ring on pressure cylinder	Replace O-ring
Leaks from diaphragm pump (474, 475, 476, 485)	Damaged diaphragm	Replace diaphragm
	Damaged O-ring on diaphragm housing	Replace O-ring
	Damaged O-ring on pressure cylinder	Replace O-ring
Leaks from end of spray wand	Worn or damaged shut-off valve	Inspect and rebuild shut-off valve

Note: Always wear rubber gloves, safety goggles and appropriate protective clothing when repairing a sprayer. Work in well ventilated area. Prior to repair, flush unit with water by filling, then spraying the water into an appropriate container or area. Ensure that all pressure is released by locking the shut-off valve in the open position. Once a repair is completed, fill the unit with clean water, pressurize, and check for leaks. If the sprayer leaks, Do Not Use. Repair leaks and recheck.

Protect Water Sources

- When water is turned off, it can create a vacuum effect
- An air gap, check valve or backflow prevention device prevents the mixture from being pulled back into the water source

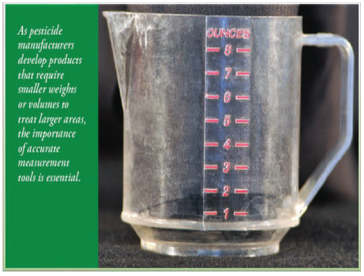
Protect Water Sources

- Mix and load site away from water sources (ponds, streams, etc.)
- Containment pad to protect groundwater from leaks and spills

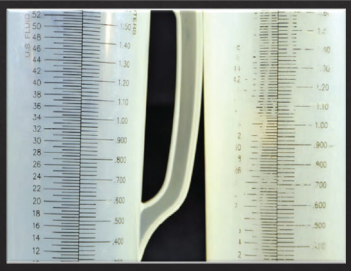
Measuring Pesticides

Overlooked steps to getting the correct rate.

(From Purdue Pesticide Program booklet "PPP-96")



MEASURING DEVICES



Overlooked Steps to Getting the Correct Rate.

(From Purdue Pesticide Program booklet "PPP-96")

Measuring Devices

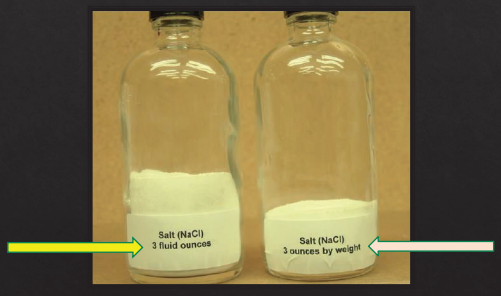
Some pesticide products come with their own measuring devices. "Tip and pour" products are easy to measure and can be safer to use.

Measuring Devices

Liquid Pesticides

Dry Formulations

Do You Notice a Difference?



Measuring Devices Packaged with the Products

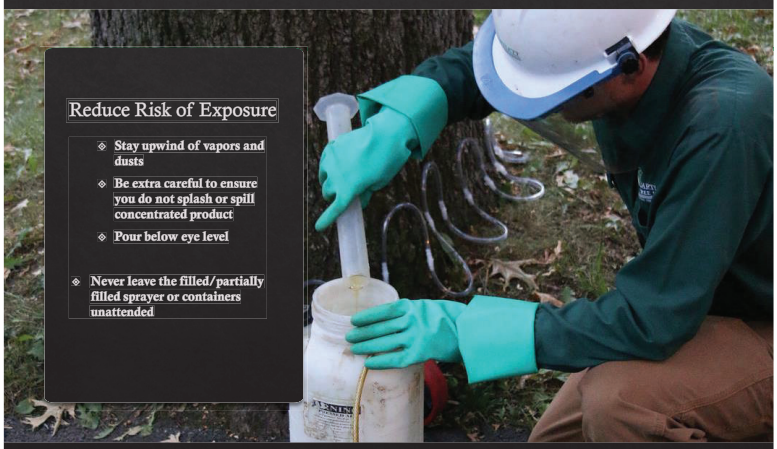
Dispose of the measuring device, after you have used all of the pesticide in the container.

Manufacturers may change the product's formulation.

There are only four measuring tubes, but eight containers. You should have a measuring tube for each lot of material you purchase.

Pesticide Measuring Devices

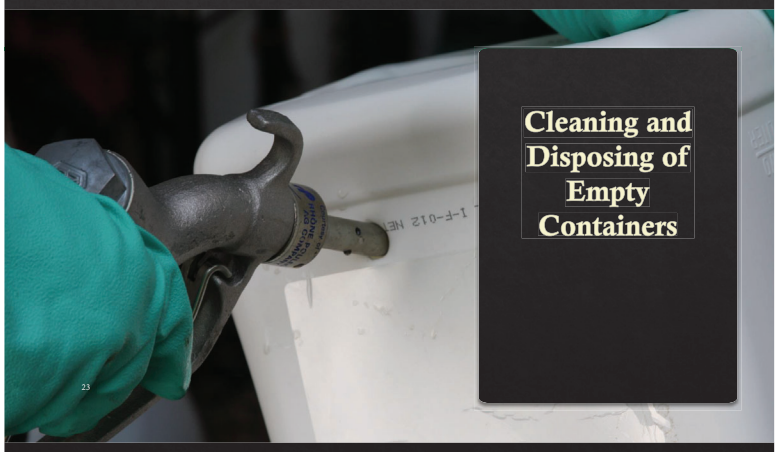
- Use an accurate scale or measuring device
- Clearly mark measuring devices
- Store measuring devices in pesticide storage area
- Carefully open containers
- Close container when not measuring and transferring pesticide



Reduce Risk of Exposure

- Stay upwind of vapors and dusts
- Be extra careful to ensure you do not splash or spill concentrated product
- Pour below eye level

- Never leave the filled/partially filled sprayer or containers unattended



Cleaning and Disposing of Empty Containers

Rinseable Containers

- Triple-Rinse immediately
  1. Completely empty pesticide concentrate
  2. Fill container about 20% with water, replace lid, shake container
  3. Drain and rinse water into spray tank
  4. Repeat rinse 2 more times

Non-Rinseable Containers

- Empty as best as possible
- Return if appropriate
- Dispose of in normal refuse if not recyclable or returnable
- Render unusable

Applying Pesticides

- Clear all people, pets, toys and other items from application area

Apply Pesticides Evenly

- Make sure pesticide application looks appropriate
- Make sure pesticide contacts target area
- Check hoses, valves, nozzles, etc. for clogs or leaks during application.
- Clean or repair if needed.

Turn the equipment off when you pause during the application

Cleaning Up After the Application

Never store pesticides in application equipment.

- Carefully calculate and measure for the application.
- If excess mixture remains, it should be applied according to label directions to your property.
- If kept, clearly label what it is and use it soon.

Clean Application Equipment

- Rinse empty spray tank – apply to site
  - Carry rinse water with you
  - Will not wash pesticide off
  - Tank is fairly clean

Sorry – just a random photo I found of someone cleaning out their drone sprayer.

NOTE: Wear PPE even when you clean up after the application

Rinse empty spray tank

- Collect and hold rinsate for use in subsequent spray batch, if similar product is to be mixed later

Decontaminate tank if necessary

- Water-detergent solution
- Label-prescribed decontamination instructions and materials
- Circulate in entire system for few minutes
- Flush twice with clean water
- Don't re-use rinsate if it contains containing cleaning agents
- Any unusable material most likely will be considered a hazardous waste

Container Recycling or Disposal

- Recycle plastic containers
  - Triple/pressure-rinsed and clean
  - Stains are acceptable
- If recycling is not available, take to local landfill or incineration facility

Agricultural Container Recycling Council: ACRC

Better Than Homework Task for Additional Prep

This is something that may sound strange but sometimes it helps to get yourself in the mindset of the people writing the exam questions.

Task:

Write 5 multiple-choice exam questions and answers about pesticide application procedures.

Optional – Each chapter in the National Pesticide Applicator Certification Study Manual ends with practice test questions. Review each question and decide what makes the incorrect answers incorrect.

ALCA
ARIZONA LANDSCAPE CONTRACTORS ASSOCIATION

PMD Certification Training

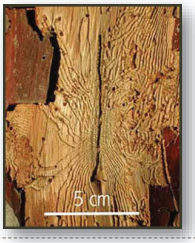
Ornamental & Turf

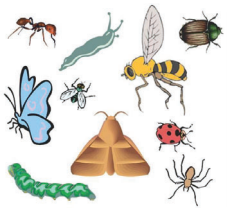
What you will learn

- Terminology for diagnosing O&T problems
- Ornamental and turf pathogens
- Ornamental and turf pests
- Cultural practices and treatments available for management
- Weed ID and management in turf areas

The Key to Ornamental & Turf Pest Control

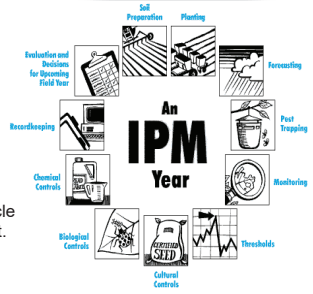
- Evaluate the problem areas
- Identify target pests and locations
- Employ various IPM strategies





Integrated Pest Management

- IPM
- Cultural Controls
  - Crop Rotation & Resistant Varieties
- Biological Controls
  - Predators, Viruses & Bacteria
- Chemical Controls
  - Herbicides & IGR's
- Monitoring
  - Viewing Results & Recordkeeping



*IGR is an insect growth regulator that controls the lifecycle of pests such as roaches by inhibiting maturity of the pest.

IPM: Identification

- **Occasional pests** may become troublesome from time to time
- **Secondary pests** become problems when key pests are controlled or eliminated
  - such as spider mites

IPM: Monitoring the Pest

- Use scouting, trapping, weather data, models
- Economics or aesthetics trigger need for action
  - Pest population
  - Beneficial population
  - Geographic location
  - Plant variety
  - Plant type & stage of growth
  - Cost of control measure(s)
  - Value of plant or crop

How many pests need to be present before action is taken?

IPM: Monitoring the Pest

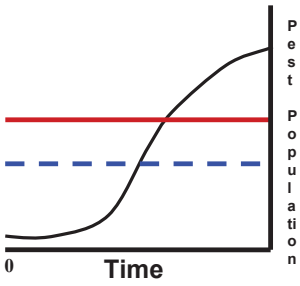
- **Action threshold level** (ATL)
  - Unacceptable pest level
  - Do something
  - Sometimes the action threshold may be **zero!**
  - Action thresholds vary by pest, site, and season

6 aphids per plant = no problem - no action

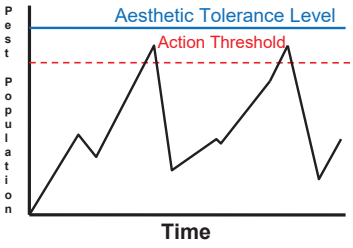
15 aphids per plant = hits the pocketbook - take action

IPM: Treatment or Action Threshold

- Treatment or Action Threshold
- **Economic Threshold**
  - pest population density when *control is necessary* to prevent economic injury
- **Economic Injury Level**
  - when the cost of losses equals the cost of control measures
  - Apply control measure prior to reaching economic injury level



IPM: Monitoring the Pest



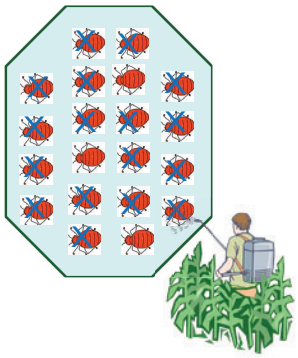
- Action Threshold is also based on aesthetics or public health issues
- At what point does the cost of control ward off future expenses

IPM: Goal

- **Prevention:** weed-free seed, resistant plants, sanitation, exclusion, pesticide treatments
- **Suppression = reduction:** cultivation, biological control, pesticides
- **Eradication = elimination:** small, confined areas, or government programs

Pest Resistance

- Intensive pesticide use kills susceptible pests in a population, leaving some resistant ones to reproduce
  - Use of similar modes of action
  - Frequency of applications
  - Persistence of the chemical
  - Pest rate of reproduction & offspring numbers



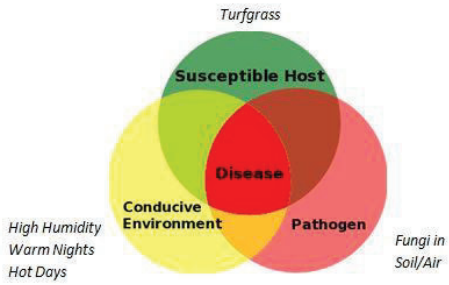
Pesticide Resistance Management

- Do not use products repeatedly that have similar modes of action
- Allow some pests to survive
  - Limit treatment areas
  - Consider using lower dosages
- Use caution: new compounds having very specific actions - may develop resistance more quickly
- Use non-chemical means to control resistant pest populations

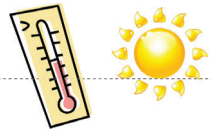
Plant Diseases

All three factors must be present for disease to occur

Disease Triangle



Abiotic Causal Agents



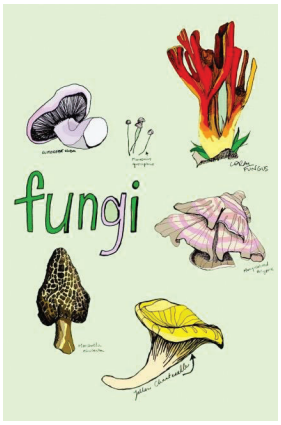
- Weather conditions
- Nutritional disorders (likely due to another abiotic factor)
- Pollution damage
- Water quality
- Drought
- Soil conditions
  - Compaction issues
  - Mechanical injury
    - String trimmers
  - Chemical injury (phytotoxicity)
    - Pesticide, herbicide, insecticide, fungicide or PGR injury

Biotic Pathogens

- Insects, mites, nematodes
- Parasitic plants
- Fungi
- Bacteria
- Protists
- Virus

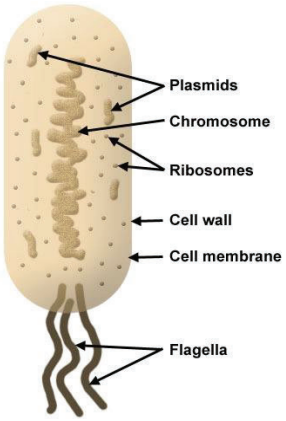
Pathogens

- **Fungi**
- Thread-like forms of plant life that live on dead or living plant and animal matter.



Pathogens

- **Bacteria**
- Single celled microbes that reproduce by dividing

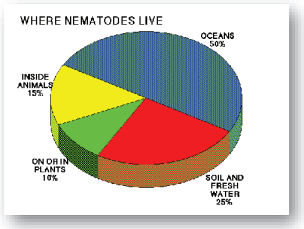


Pathogens

- **Viruses**
- Smaller than bacteria, can exist and multiply only inside living cells

Pathogens

- **Nematodes**
- Tiny roundworms than cannot be seen with naked eye

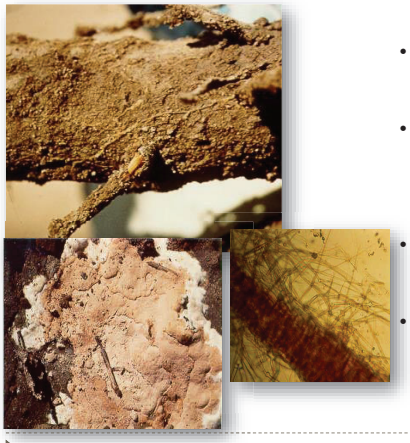


Beneficial nematodes help control disease & cycle nutrients. A handful of soil will contain thousands of microscopic worms.

Texas Root Rot

- Caused by *Phymatotrichopsis omnivora*
- Only affects dicots
- Affects over 2300 plant species
- Symptoms
  - wilting
  - rapid death in summer
  - dead foliage remains attached to limbs

Texas Root Rot



- Visible hyphae can be seen covering roots
- Fungal mats may form after rain storms around infected plants
- Can be a very quick death or slow decline
- No cure or treatment available

Phytophthora Root Rots

Many species of *Phytophthora,* water loving organisms (oomycetes), cause root and crown rots

Control disease by watering less frequently and good drainage

Wilting of transplants, spreading quickly through beds

Roots turn blackish brown with root rots caused by *Pythium* and *Phytophthora*, yet remain white with other diseases

23

Damping-off

- Collapse of seedlings and root rot of transplants
  Phytophthora, Pythium, (water loving oomycetes)
  Rhizoctonia, Thielaviopsis (soil borne fungi)
- Prevent disease by planting at the right time and using healthy, fast growing plants
- Rotate the kinds of plants in any one location from year to year
- Often seen in overwatered soil conditions

Wood Rots

- Pose hazards by weakening limbs
- Transmitted through wounds or grafted roots
- Once conk visible the damage is extensive
- No treatment available
- Tree may fail quickly or survive many years with few symptoms

Crown Gall

- Caused by bacteria *Agrobacterium tumefaciens*
- Enters via wounds on lower stems, trunks and roots
- Large tumor at soil line
- No treatment

Seen on almonds, apples, cottonwoods, figs, peaches, pears, pecan, privet, roses, willows and pyracantha

Bacterial Necrosis of Saguaro

- Caused by *Erwinia cacticida*
- If lesion is small, remove one half inch beyond rotting tissue
- Disinfect tissue with 10% bleach solution and one teaspoon of detergent per gallon solution
- Allow air to heal wound

Sooty Canker

- Fungal pathogen
- Occurs most commonly in smooth bark trees
- Caused by
  - Sunburn
  - Overpruning (opening up canopy)
  - Wounds
  - Commonly seen in Citrus, Mulberry, Ash

Powdery Mildew

- Fungal pathogen
- Grey or white spots on leaves and stems
- Very common in springtime
- Many hosts, but disease is host-specific
- Disease prefers:
  - moderate temperatures
  - moderate to high humidity
  - no surface water
  - low light and poor air flow
- Treat with labeled fungicide

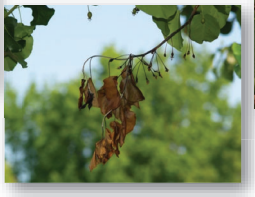
Rust

- Commonly seen on snapdragons
- Rust-colored circular spores seen on underside of leaves
- Infected leaves dry up
- Plant may become stunted or die
- Host-specific (won't spread to other plant types)
- Fungicides labeled for rust offer management

Other Foliar Diseases

Anthracnose on sycamore

- Common fungus of shade trees
- Symptoms include brown, dead areas that develop along leaf veins & expand outwards, leaves eventually drop off



Fire Blight

(Erwinia amylovora)

- Bacterial infection causing branch tips to turn dark brown or black
- Commonly transmitted by bees on pear trees

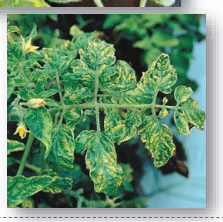
Fungal leaf spot

(*Cercospora spp.*)

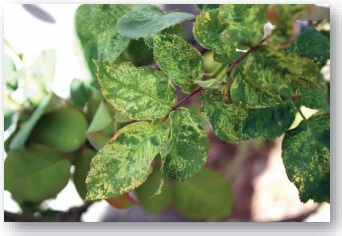
- Leaf spots are brown or black spots randomly scattered across the leaf
- Caused by spores produced in spots on last year's leaves

Viruses

- Mosaic



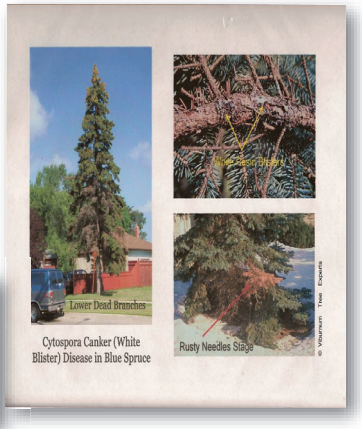
- Rose Virus



- Impact many different plant varieties
- Yellow stripes or spots on foliage
- Wrinkled or curled leaves
- Stunted growth and reduced yields
- Infected fruit appears mottled and develops raised "warty" areas

Cytospora Canker

- Above ground
- Caused by fungus
- Remove dead branches, do not prune trees when bark is wet
- Clean pruning tools between cuts with bleach



Verticillium Wilt

- Below ground
- Fungus that occurs through wounds
- Leaves on plant or limbs will suddenly wilt in spring
- Infection occurs in winter
- Single most important disease of olive trees in Arizona

Fungal Pathogens of Turf

- Almost all major diseases of turf in Arizona are caused by fungi
- Fungi will develop in plants when
  - Irrigation is too frequent
    Irrigation is at night
    Poor drainage conditions
    Plants are in constant shade

Fungal Pathogens

- Favorable Environmental Conditions
- Moisture is necessary for the reproduction, spread, germination, and infection of disease-causing fungi
- Fungi also has a specific temperature range which it is active

Disease Control Methods

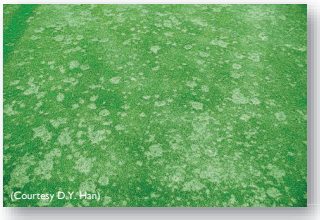
- **Cultural Practices**
- Changing watering times to reduce moisture
- Improved air circulation
- Reducing thatch
- **Resistant Varieties**
- Seeding with disease-resistant grasses
- Using mixture of blends

Brown Patch/ Large Patch (*Rhizoctonia solani*… different strains)

- Above ground (no damage seen on roots or crown)
- Attacks all cool season turf
- Active during hot humid periods
- Management
  - Avoid excess nitrogen
  - Improve airflow
  - Irrigate in morning to avoid wet foliage for long periods
  - Fungicide program

Dollar Spot (*Sclerotinia homoeocarpa*)

- Above ground
- Caused by fungi
- Found in cool season grass
- Dead grass areas the size of a silver dollar
- Management
  - Maintain appropriate nitrogen levels
  - Do not irrigate in the evening
  - Fungicide program



Gray Snow Mold (*Typhula spp.*)

- Caused by a fungi
- Affects cool season grasses
- Appears after snow melt (only appears after extended periods of snow cover over 40 days)
- Circular patterns 6 – 12" in diameter which may grow together
- Management
  - Remove snow to prevent cover for long periods
  - Contact fungicide in late fall

Sclerotia
(survival structures)

Pink Snow Mold (*Microdochium nivale*)

- Caused by a fungi (formerly called Fusarium, updated name above)
- Affects cool season grasses (creeping bentgrass is most susceptible)
- Extended periods of snow cover favors infection but not required
- Broader temperature range than Grey Snow Mold
- Pink snow mold does NOT produce sclerotia on diseased leaf blades

Leaf Spot or Melting Out (*Drechslera/ Bipolaris*)

- Caused by fungi (two different types)
- Infects Bermudagrass, St. Augustine, tall fescue and ryegrass
- Occurs in cool season and warm seasons (see different types)
- Impacts roots, shoots and leaves
- Browning purple lesions on blade
- Management
  - Avoid excess Nitrogen
  - Limit foot traffic
  - Raise mow height to reduce stress
  - Fungicide program

Pythium Blight (*Pythium spp.*)

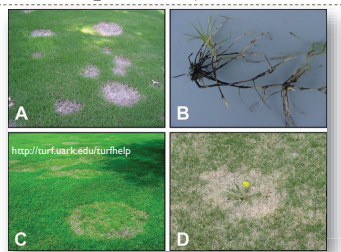
- Foliar disease of ryegrass, bentgrass and bluegrass
- Affects leaves, crowns and kills plant
- Caused by fungi
- Prefers evenings warmer than 68°F, lush growing (excess Nitrogen)
- Water management and proper drainage along with helping air circulation helps prevent disease

Referred to as 'Grease spot'

White mycelia seen in morning on infected turf

Spring Dead Spot (*Ophiosphaerella korrae* and *O. herpotricha*)

- Dead spot 6"-3'
- Below ground, roots dark and rotted
- Caused by a fungus
- Most serious disease of Bermuda grass
- Management over the course of years
  - Improve compaction & drainage issues with aerification
  - No excess Nitrogen
  - Reduce pH if possible
- Multi-year fungicidal program



Summer Patch (*Magnaporthe poae*)

- Infect roots, rhizomes and crown
- Cool season turf (creeping bentgrass, annual bluegrass, Kentucky bluegrass, fine fescue
- Infection occurs during cool season, symptoms seen appear in hot dry weather
- Only symptom: appears to be dying from lack of water
- Streaks or crescents in turf

Fairy Ring
(a number of wood- decaying basidiomycetes)

- Small to very large rings
  - Ring grows in size each year
  - Dead ring or dark green ring outside dead ring
- Soil inhabiting fungus
- Fungal mats in soil causes hydrophobic soil preventing water penetration causing wilting and death (fungus does not directly attack turf)
- Mushrooms may be seen at circle edge
- Use of fertilizers and soil wetting agents help mask symptoms
- Eradication of disease is rare

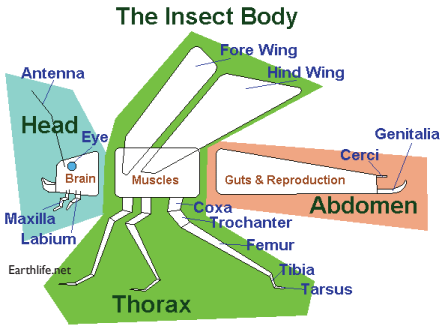
Additional Turf Fungal Pathogens

- Powdery Mildew
- In elevations above 4500'
- Decrease shading, prune surrounding ornamentals

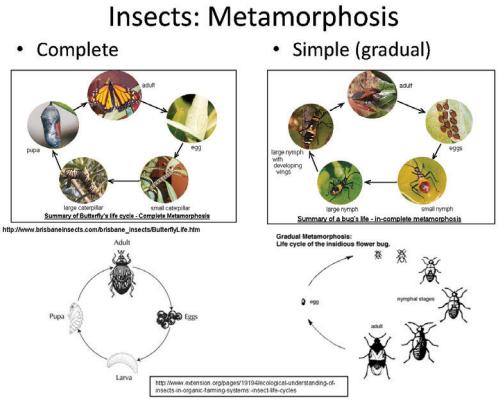
- Slime Mold
- Caused by fungi, bacteria & organisms feeding on decaying organic matter
- Harmless but unsightly

- Rust
- Mostly cosmetic, but can damage newly seeded lawns
- Poor nutrition and tall mow heights can invite fungus

Insect Anatomy



Insect Life Cycle



Foliar pests

- Recognize feeding damage
  - Chewing mouthparts
  - Piercing/sucking mouthparts
  - Rasping mouthparts

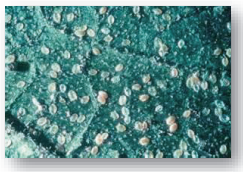
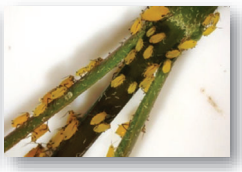
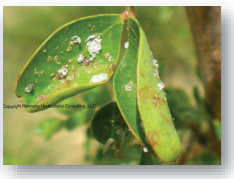
Thrips

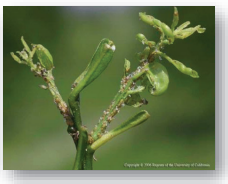
- Rasping mouthparts
- Citrus thrips and western flower thrips
- Leaf, fruit or flower distortion
- Once damage is observed, it's too late to manage
- Commonly seen on citrus in the springtime


Whitefly, Aphids and Psyllids

- Piercing-sucking mouthparts
- Fast generation time
- Cause
  - Stippling
  - Defoliation
  - Sooty mold
  - Honeydew mess on nearby hardscape or vehicles

Whiteflies Aphids Psyllids

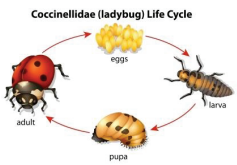
Spider mites

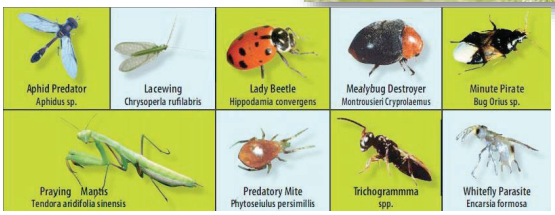
- Sucking mouthparts (but different than sucking mechanism of piercing/sucking insects)
- Twospotted Spider mite
- Prefers dry, warm and dusty conditions
- Sucks sugars out of leaf and petiole
- Webbing likely seen once population establishes on plant
- Hosing off plant regularly helps keep populations low during peak season (April-May and Sept.-Oct)
- Miticide applications may be used if necessary

Flea Beetle

- Small beetles- 1/16 - ¼"
- Black, greenish or bluish black, green or yellow
- Strong hind legs allowing them to jump like fleas
- Wide host range
- Chewing mouthparts


Beneficial Organisms





Leafcutter Bees

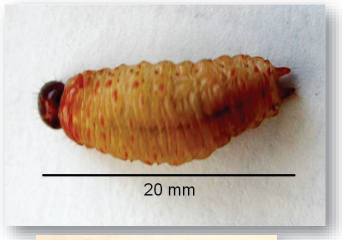
- Seen on *Bougainvillea* and roses
- Important pollinators
- Impossible to control
- Purely cosmetic

Mistletoe

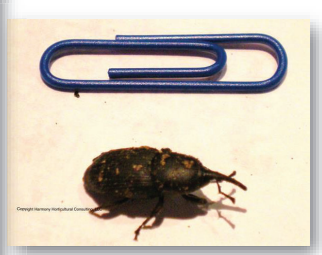
- Parasitic flowering plants with characteristic clumps of growth on host plant
  - Disseminated by birds that eat or transport the berries and deposit seeds on host plants
- Reduces growth of host plant
  - Takes many years for true mistletoe infections to kill a mature tree or shrub
- Can be managed by periodic removal of aerial shoots
  - Cut off infected branches
  - Remove heavily infested trees and shrubs

Agave Weevil

- Prefer large, open-rosette forms
- Also attacks desert spoon and yucca
- Bacteria found on weevil transmitted to agave, causing plant to wilt
- Spring *imidacloprid* application may help prevent larvae from feeding



Agave Weevil

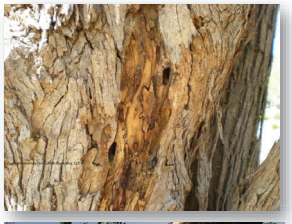


Borers

- Flathead
- Roundhead
- Attack stressed plants
  - Sunburn
  - Freeze damage
  - Over-pruned
  - Other stresses like poor irrigation management

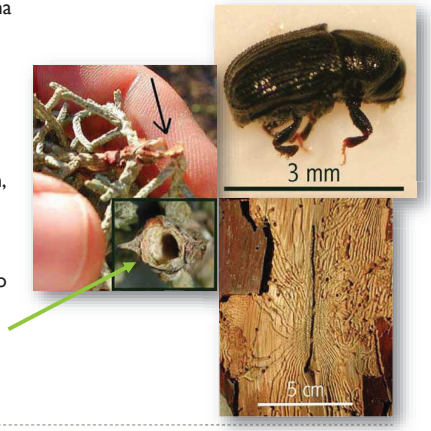
Borers

- Borers tunnel through sapwood then continue into heartwood
- Galleries often found just under bark
- Management with insecticides may or may not be helpful
  - If feeding on sapwood, treatment may work
  - If feeding on heartwood, pesticide will not reach borer (including systemic)
- Removal of infested limb and dispose off site
- Maintain tree health to prevent borer invasion



Cypress Bark Beetles

- Native pest of Cypress in Arizona
- 2-3mm long
- Feed on inner bark (phloem), cambium, and outer sap-wood, the tree is girdled cutting off the flow to the lower portion of the tree
- Causes top-kill and branch death, can lead to tree death
- Adults bore into branch tips causing hollow stems
- Maintain appropriate irrigation to help prevent infestations
- No pesticide treatment recommended



Palo Verde Root Borer

- Large beetle larvae feed on palo verde and other roots
- Emerge in summer leaving large holes in soil under tree canopy
- Best defense is good tree health
- May kill tree or may weaken, becoming prone to blowing over in wind
- Branches turn a golden brown, then reddish brown as they die
- No treatment once tree has extensive damage

Giant Palm Borer (*Dinapate wrightii*)

- Larvae or grubs lives inside the trunk of both *Phoenix* and *Washingtonia* palms
- Round holes in the trunks, about the size of a quarter, where the adult beetle has exited after 3 to 9 years of feeding on the trunk tissue.
- Grubs feeding inside a palm can weaken the trunk to the point that it may snap off in a high wind.
- No treatment available
- Avoid buying trees with the visible exit holes
- Ensure good health and vigor to prevent infestation
- The number of holes is indication the degree of infestation

Turf Pests

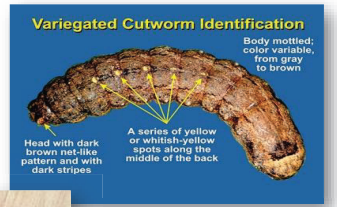
- Harvester & Fire Ants
  - Above ground
  - Invade sunny, well-drained turfgrass
  - Galleries disturb roots
  - Cause grass to thin

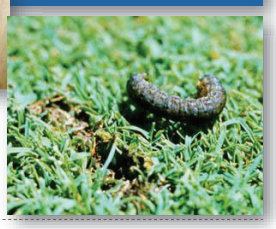
Chinch Bugs

- Above ground
- Nymphs suck sap from grass
- Cause yellow patches
- Invade St. Augustine

Cutworms

- Above ground
- Feed at night and hide in turf
- Damage: birds tear up lawns looking for larvae
- Larvae: night flying moth





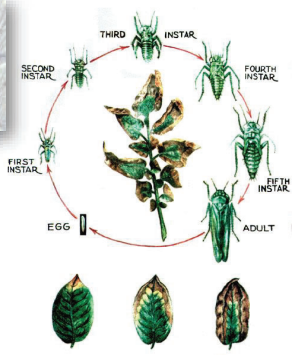
Flea Beetles

- Above ground
- Adult beetles feed on upper surfaces & skeletonize leaves
- Injury mistaken for lack of water or fertilizer burn
- Attacks dichondra

Dichondra is a warm season perennial ground cover

Leafhopper

- Above ground
- They suck the sap from leaves & stems
- Plants become yellow & spotted
- Lawns or turf appear scorched or wilted



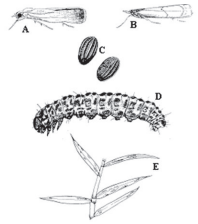
*** Instar is a developmental stage for insects**

Rove Beetles

- Above ground pest of Bermuda, ryegrass, bent and bluegrass
- Make small mounds of soil on turf which disrupts golf play and appearance
- Does not feed on turf, but eats other insects and decaying organisms

Sod Web Worms

- Multiple species
- 1" long, tan or dusky brown
- Hide in silk-lined tunnels in thatch
- Feed on leaf blades
- Damage appears as small brown areas in grass
- Damage occurs at night
- Attack Bentgrass & Bluegrass



Sod webworm. A and B, Adults. C, Eggs. D, Larva. E, Damage by early instar larvae.

Frit Flies

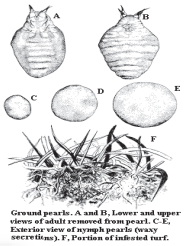
- Below ground
- Larvae tunnel in stems of grasses near surface
- Grass turns brown and dies
- Adults are an annoyance to golfer since they are attracted to white (balls)

Billbugs

- Below ground feeding weevils
- Adults eat small holes in grass blade
- Larvae feed on roots, grass stems, & crown
- Causes grass to turn brown in spots, then larger patches

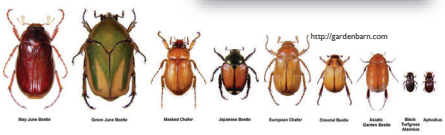
Ground Pearl Scale

- Below ground
- Damage: yellowish irregular circles on turf
- Secrete a waxy shell like coating
- Attacks Bermudagrass



Ground pearls. A and B, Lower and upper views of adult removed from pearl. C-E, Exterior view of nymph pearls (waxy secretions). F, Portion of infested turf.

White Grubs



- Species include Japanese beetles, masked chafers, May and June beetles
- C-shaped larvae with brown heads, 6 legs
- ¼"- 1 ½" in length
- Bermuda, rye are commonly attacked

White Grubs

- Wilting and browning due to root damage
- Animal damage in turf may be seen as they dig for grubs
- Turf can easily be pulled up
- Insecticide applications vary based on species, life cycle

Other IPM Strategies

- **Cultural practices**
  - Rotating crops
  - Irrigation management
  - Fertilizing
- **Mechanical practices**
  - Hoeing weeds
  - Landscape fabric
- **Sanitation**
  - Remove food source (remove weeds to help manage ants)
- **Biological control**
  - Parasites & predators
- **Chemical control**
  - Use of pesticides

Pesticide Types

- Herbicide
- Insecticide
- Acaricide (miticide)
- Ovicide
- Bactericide
- Fungicide
- Nematicide
- Insect Growth Regulator

Pesticides

Pesticide Classifications

- Contact
- Systemic
- Ingestants
- Insect Growth Regulator
- Fumigant

Pesticide Types

- Inorganic
- Organic
  - Natural
  - Synthetic
- Botanical

Definitions

- **Systemic Herbicide: Translocated through plant**
- **Contact Pesticide: Kills on contact**
- **IGR: Insect Growth Regulator**
- **Risk: Toxicity & Exposure**
- **Die Back: Symptom of insect turf damage**
- **Re-entry time: Waiting time after treatment**

ALCA
ARIZONA LANDSCAPE CONTRACTORS ASSOCIATION

PMD Pre-Certification Training

Weed Management

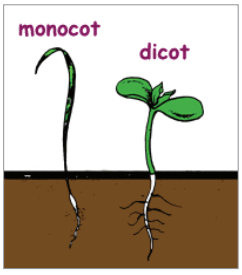
Outline

- Weed identification
  - Classifications, life cycles, regional weed species
- Weed management options
- Herbicide selection
  - Herbicide classifications
- Herbicide labels

Weeds

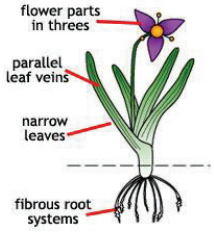
Two Basic Kinds of Weeds

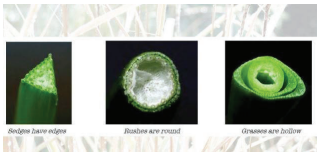
- **Monocotyledonous (Monocot)**
  - One seed leaf
  - Grass or sedge
- **Dicotyledonous (Dicot)**
  - Two seed leaves
  - Broadleaf



Monocotyledons

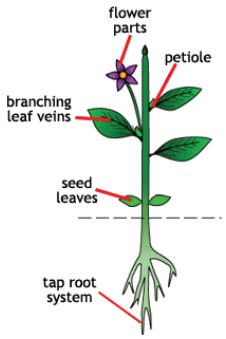
- Monocots
  - Long narrow blades
  - Parallel veins
  - Flowers in three parts
  - Fibrous root systems
- Grasses
  - Hollow, round, open sheath
- Sedges
  - Triangular, solid, closed sheath





Dicotyledons

- Dicots
  - Net-like leaf veins, usually originating from one larger vein
  - Flowers in 4s or 5s
  - One central tap root with smaller lateral roots



Plant Lifecycles

Annual Weeds

- Complete lifecycle in one year (seed -> adult -> seed)
- Seeds may remain dormant in soil for years (soil seed bank)
- Summer or winter annual

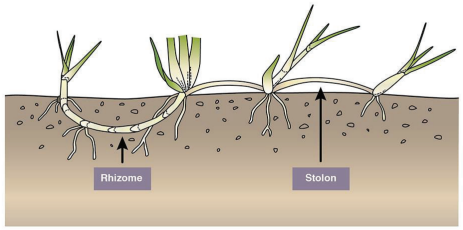
Perennial Weeds

- Persist year after year
- May go dormant during drought or cold weather
- Can sprout back if roots or underground portions not removed or killed
- Summer or winter perennial

Biennials reproduce from seed and complete life cycle in 2 years

Root Structures

- Perennial weeds may have
  - Rhizomes
  - Stolons
  - Tubers (nuts)



http://www.evergraze.com.au

Ways to categorize weeds

- Annual vs. perennial vs. biennial
- Cool season vs. warm season
- Broadleaf (dicot) vs. grass and sedge (monocot)

Bermudagrass

- Warm season perennial
- Reproduces by seed and vegetatively (rhizomes and stolons)
- Loves sidewalk cracks, growing among broadleaf shrubs
- Poa family

Crabgrass

- Warm season annual
- 6”-2’ tall, yet spreads wide from plant base (often shortened due to mowing)
- Flattened blade, ¼ - ½”wide, sheath has long stiff hairs
- Poa family

Poa Annua (annual bluegrass)

- Cool season annual
- Common in turf areas
- Flattened stems spreading or erect
- Bright green with white seed heads
- Light green appearing patches seen in winter lawns
- Poa family

Johnsongrass

- Warm season perennial
- Rhizome and seed spread
- 2-8' tall
- Shiny red to purple inflorescent spikelets
- Plant forms hydrocyanic acid when frosts or under stress, making it toxic to livestock
- Poa family

Nutsedge (purple and yellow)

- Warm season perennial
- Difficult to control
- Prefers high moisture soil conditions
- Spreads via seed and underground 'nut', sending up new plants right and left
- Purple nutsedge tubers formed in chains, yellow nutsedge tubers are larger and formed at the end of numerous rhizomes
- Sedge family

Common Ragweed

- Warm season annual
- 4' in height
- Blue-green leaves covered with fine hairs
- Source of allergies for many
- Western ragweed also in area, which is a shorter perennial

Purslane

- Warm season annual
- Prostrate growth
- Smooth, succulent-like foliage with red stems
- May be up to 12" dense mats in DG or in turf
- Can be used as an herb
- Portulaca family

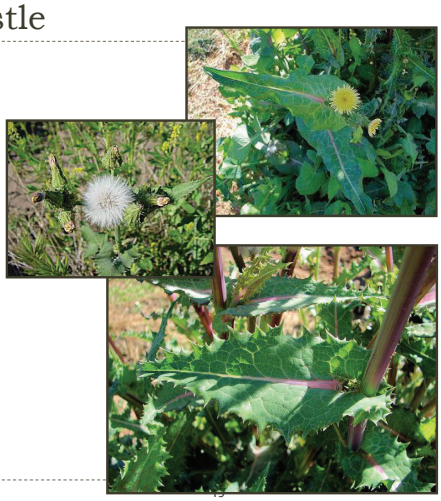
Puncturevine

- Warm season annual
- Prostrate, mat forming
- ½"-5' long
- Hairy, opposite leaves
- Yellow flowers
- Hairy, spiny burs find bicycle tires
- Caltrop family

Spurge

- Annual
- Warm season
- Prolific seeds
- Often seen accompanied by ants
- Turns purple at first frost
- Prostrate spurge, Hyssop spurge, etc..
- Euphorbia family (milky substance)

Annual Sowthistle



- Cool season annual
- Flower is dandelion-like, followed by white puff seed head
- Can reach 5 feet in height
- There are many other thistles, use guides to help identify
- Sunflower family

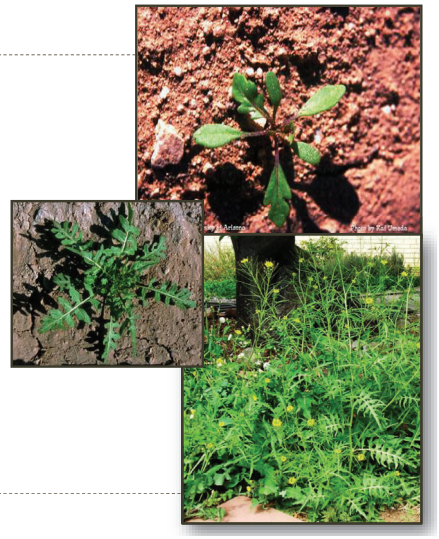
Common Cocklebur

- Warm season annual
- 2-4" tall with stem erect, branched, ridged, spotted, very rough
- Leaves alternate
- Small flower heads
- Male & Female on separate flowers
- Common in cultivated fields, abandoned land, ditches

Sunflower

- Warm season annual
- 1-10" tall
- Erect, simple, leaves alternative
- Showy yellow flowers
- Common along roadsides, fence rows and pastures

London Rocket



- Cool season annual
- Small yellow flower clusters on stem tips
- Leaves 1-4", deeply divided
- Center bolts straight up when ready to flower
- Mustard family

Morninglory

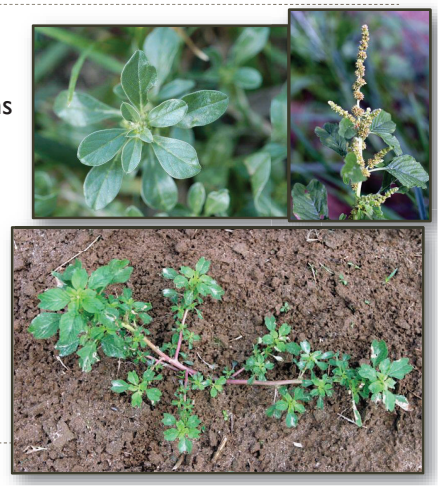
- Warm season annual
- Sometimes cultivated as ornamentals
- Ivyleaf morninglory has taproot, Tall morninglory has fibrous roots
- Leaves heart-shaped to 3-5 lobed leaves

Prostrate Knotweed

- Warm season annual
- 1-3’
- Leaves hairless, alternate
- Small pink flowers, in late winter, early summer
- Papery sheaths at each stem node
- Wiry stems

Prostrate Pigweed

- Warm season annual
- Prostrate stems radiating in all directions from central taproot
- Stems fleshy, pliable, smooth red- purple in color
- Leaves ½” wide in clusters
- Common garden weed



Redroot Pigweed

- Warm season annual
- 2-6” tall, erect
- Lower stems red or red stripes
- Taproot
- Flower clusters are full of stiff, spine-like scales
- Common in gardens, cultivated areas

Shorter than other pigweeds, in clusters and have stiff spine-like scales. This species will hybridize with Palmer Amaranth and become less distinguishable.

Yellow Foxtail

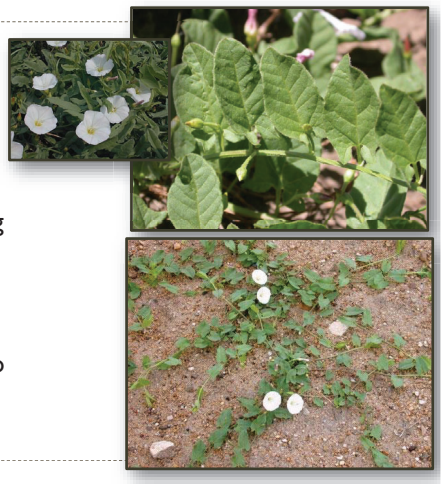
- Warm season annual grass
- 1-3” tall
- Erect stems, branch at base
- Hairs at base of leaf
- Common in row crops in spring
- Flowers/ seeds in July to September

Common Mullein

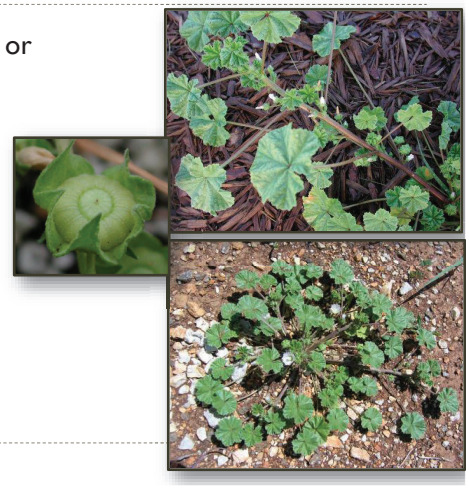
- Warm season biennial or annual
- Large, thick rosette of fuzzy leaves the first year, and a single stout erect stem 2-6’ the second year
- Common along river bottoms, pastures, fence rows
- Flowering & seed production from June to August

Field Bindweed

- Warm season perennial
- Extensive root system (20’ deep!)
- Climbing, forming dense mats
- Stems prostrate 1-4’ long
- Leaves alternate, arrow shaped
- Seeds viable for 50 years
- Flowers from late June to first frost



Mallow (common or little mallow)



- Cool season annual or biennial
- Low spreading or erect
- Long taproot
- Palmate venation
- aka "cheeseweed"
  - Seed looks like a wheel of cheese
- Mallow family

Redstem Filaree

- Cool season annual or biennial
- 1"-2' spreading or erect
- Rosette
- Hairy foliage, fern-like
- Purple flowers
- Geranium family

Lambsquarters

- Cool season annual
- 1-6' tall
- Stems often striped with pink or purple
- Small white to grey-mealy flowers
- Common in cultivated fields, gardens
- Fast grower, high water user
- Goosefoot family

California Burclover

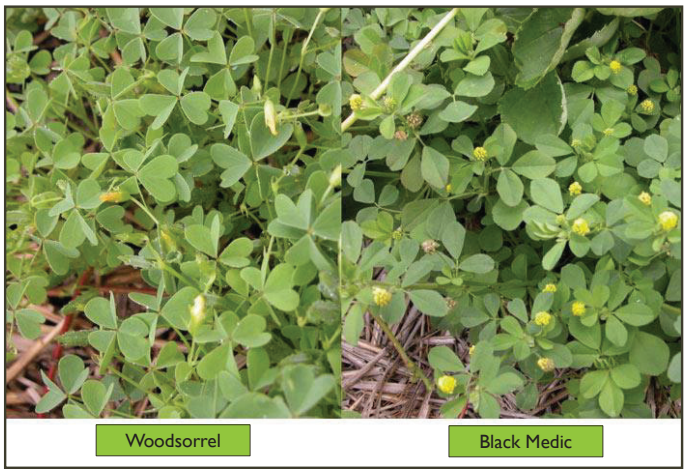
- Cool season annual or short lived perennial
- Trails up to 2' or erect
- Leaves have 3 round leaflets
- Yellow flowers
- Burs curved spines and hairless
- Pea family

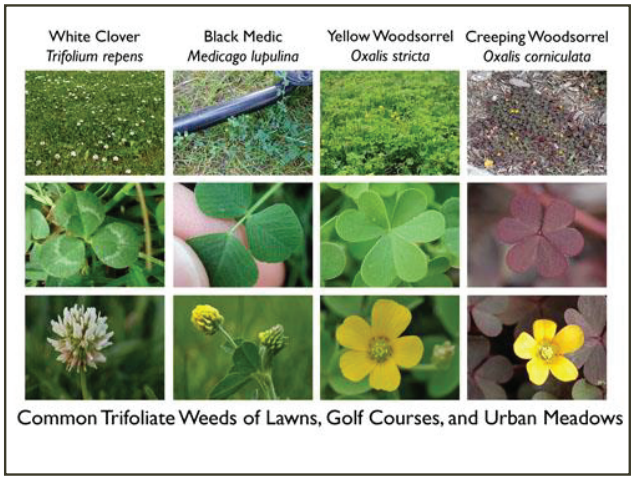
Black Medic

- Cool season annual (or short lived perennial)
- Low trailing
- 3 oval-shaped leaflets on short stalk
- Small bright yellow flowers
- Hairy seed pots (not spined, which is a burclover)
- Pea family

Creeping Woodsorrel/ Oxalis

- Cool season perennial
- Prostrate creeping with taproot
- Tri-foliate with heart-shaped leaflets
- Enjoys invading lawns and flowerbeds
- Woodsorrel family





Russian Thistle 'tumbleweed'

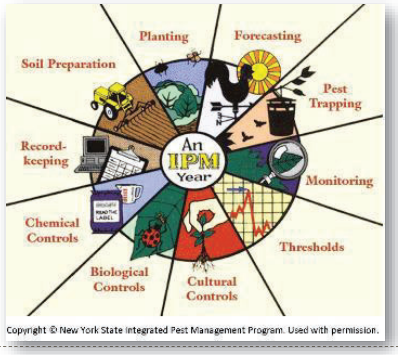
- Warm season annual
- Round, bushy
- 1.5-3' tall
- Massive seed producer
- Leaves are long string-like, then becoming stiff spines at tips
- Rapid germination
- Deep tap root
- Goosefoot family

Dandelion

- Cool season perennial
- Milky juice in stems
- Tap root
- Lobbed leaves clustered at the top of the root crown
- Yellow flowers
- White puff ball seed head
- Sunflower family

Integrated Pest Management

- A strategy that employs all of the available methods of managing weeds



Cultural Practices

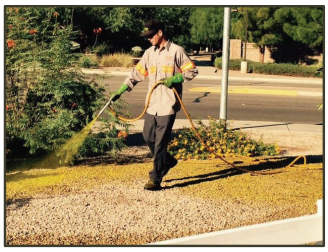
- High quality weed-free sod and seed
- Adequate and appropriate water supply
- Mowing at recommended height
- Fertilization
- Mulching

Mechanical Procedures

- Regular mowing to remove seed heads
- Tillage to disrupt weed root systems
- Aeration & thatching

Chemical Control

- Herbicide
  - A chemical used to kill weeds
- Plant Growth Regulator (PGR)
  - Alters the growth cycle of the plant



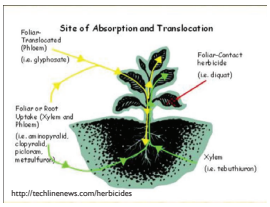
Herbicide Goals

- Prevention
  - Keep weeds from growing
- Suppression
  - Keep weeds to acceptable level
- Eradication
  - Eliminate all weeds

Chemical Control/ Herbicides

Contact herbicide

- Kills only plant parts they touch
- "Burn down"
- Useful with certain annual weeds
- May or may not be impacted by temperature
  - Reward herbicide is **not** impacted by temperature, burns tissue it contacts



Systemic herbicide

- Absorbed by leaves and transported throughout plant
- Kill roots
- May be impacted by temperature if plant is not growing
  - Round-up is slow to act in the winter because growth is slow in cold weather

Chemical Control/ Herbicides

Pre-emergent

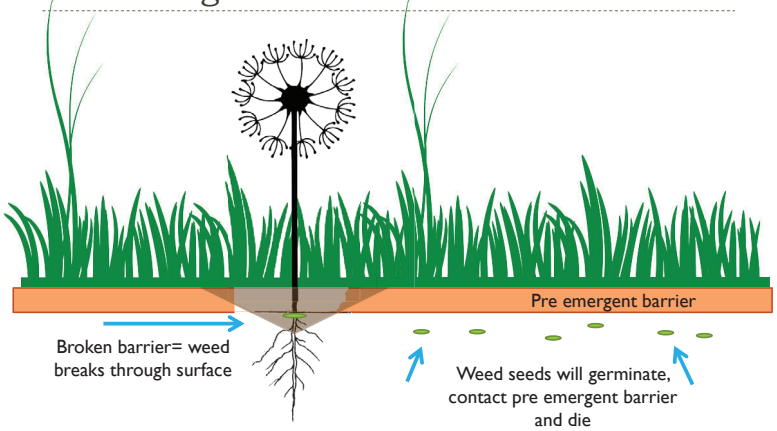
- Helps prevent weed outbreaks
- Soil applied via spray or granule
- Watered in via rain or irrigation
- Kills germinating seedlings as they emerge and contact barrier in soil

Post-emergent

- Kills growing weed
- Foliar applied
- Full coverage necessary
- Adjuvants help
  - Stickers
  - Spreaders
  - Water conditioners

Pre-plant is applied before crop is planted or landscaped to eliminate current weeds

Pre-emergent herbicide



Herbicide Classification

Selective herbicide

- Control of some plant species without harming of desirable plants
  - Broadleaf herbicides use in turf
    - 2,4-D, MCPP, dicamba, triclopyr
  - Grass killer, safe overtop of broadleaf ornamentals
    - Fusilade II

Non-Selective herbicide

- Broad spectrum herbicides
- Will harm most plants that come in contact with
  - Round-up, Reward, Finale

Soil Sterilant prevents plant growth for 5+ years

Mode of Action (MOA)

- Chemical response that a plant has to the herbicide injury
  - Anatomical, physiological, bio-chemical
- How the plant processes the herbicide that leads to injury
- i.e. Roundup (glyphosate) depletes certain amino acids needed to make necessary proteins involved in plant growth
  - Inhibits growth, leads to chlorosis and death

Herbicide Guidelines

- Granules: Need water to activate
- Groundwater: Follow label directions
- Know: Residual life of herbicide
- Plant Identification: Always first step
- Temperature: 65 to 85 degrees is best
- Use adjuvant: Penetrate leaf cuticle

Herbicide Selection

- Things to consider:
  - Type of turf grass
  - Risk of injury to ornamentals and trees
  - Type of application equipment needed
  - Stage of weed growth
  - Cost of treatment

Herbicide Applications

- Liquid Sprays
  - Broadcast
  - Soil incorporation
- Granular Applications
  - Drop Spreader
  - Whirly bird
- Dust Applications
  - Manual or electric duster

Herbicide Failures

- Application rate too high or low
- Rain within 4-8 hours after application
- Weeds not actively growing
- Herbicide leaches too deep into the soil
- Herbicide resistance
- Wrong product for targeted weed

Confront Specialty Herbicide

- What is active ingredient?
- How much a.i. per pound?
- What PPE should be worn?
- Who can apply this product?

Specimen Label

Dow AgroSciences

Confront®

Specialty Herbicide

®Trademark of Dow AgroSciences LLC

For the control of annual and perennial broadleaf weeds in established turfgrass including, but not limited to, sod farms

A.I.

Active Ingredients:
triclopyr: 3,5,6-trichloro-2-pyridinyloxyacetic acid, triethylamine salt 33.0%
clopyralid: 3,6-dichloro-2-pyridinecarboxylic acid, triethylamine salt 12.1%
Other Ingredients 54.9%
Total 100.0%

Acid Equivalent:
triclopyr - 23.7% - 2.25 lb/gal
clopyralid - 7.9% - 0.75 lb/gal

EPA Reg. No. 62719-92

Only a licensed applicator

Keep Out of Reach of Children
DANGER PELIGRO
Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

Precautionary Statements
Hazards to Humans and Domestic Animals

Personal Protective Equipment (PPE)
Applicators and other handlers must wear:
- Long-sleeved shirt and long pants
- Shoes plus socks
- Protective eyewear

Protect yourself!

Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Controls
When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS.

User Safety Recommendations
Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

First Aid
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. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a 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 mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.

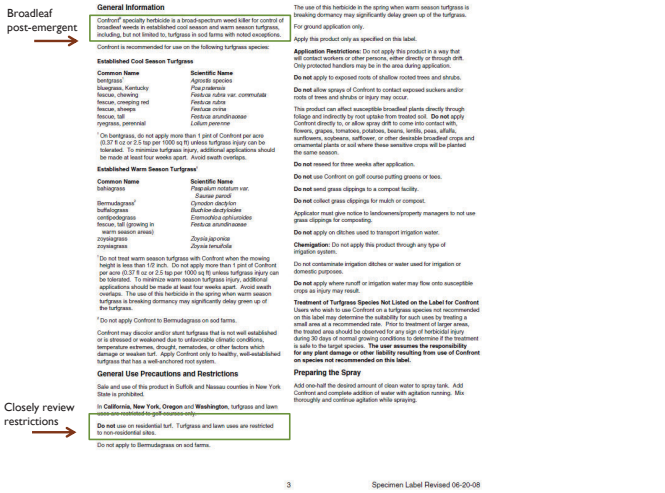
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-992-5994 for emergency medical treatment information.

Note to Physician: Probable mucosal damage may contraindicate the use of gastric lavage.

Environmental Hazards

Confront Specialty Herbicide

- Is Confront a pre or post- emergent herbicide?
- Does it work on nutsedge?
- Can this be used at a residential site?



Broadleaf post-emergent

General Information

Confront® specialty herbicide is a broad-spectrum weed killer for control of broadleaf weeds in established cool season and warm season turfgrass, including, but not limited to, turfgrass in sod farms with noted exceptions.

Confront is recommended for use on the following turfgrass species:

Established Cool Season Turfgrass

Common Name	Scientific Name
bentgrass[1]	*Agrostis* species
bluegrass, Kentucky	*Poa pratensis*
fescue, chewing	*Festuca rubra* var. *commutata*
fescue, creeping red	*Festuca rubra*
fescue, sheeps	*Festuca ovina*
fescue, tall	*Festuca arundinacea*
ryegrass, perennial	*Lolium perenne*

[1] On bentgrass, do not apply more than 1 pint of Confront per acre (0.37 fl oz or 2.5 tsp per 1000 sq ft) unless turfgrass injury can be tolerated. To minimize turfgrass injury, additional applications should be made at least four weeks apart. Avoid swath overlaps.

Established Warm Season Turfgrass[2]

Common Name	Scientific Name
bahiagrass	*Paspalum notatum* var. *Saurae parodi*
Bermudagrass[3]	*Cynodon dactylon*
buffalograss	*Buchloe dactyloides*
centipedegrass	*Eremochloa ophiuroides*
fescue, tall (growing in warm season areas)	*Festuca arundinacea*
zoysiagrass	*Zoysia japonica*
zoysiagrass	*Zoysia tenuifolia*

[2] Do not treat warm season turfgrass with Confront when the mowing height is less than 1/2 inch. Do not apply more than 1 pint of Confront per acre (0.37 fl oz or 2.5 tsp per 1000 sq ft) unless turfgrass injury can be tolerated. To minimize warm season turfgrass injury, additional applications should be made at least four weeks apart. Avoid swath overlaps. The use of this herbicide in the spring when warm season turfgrass is breaking dormancy may significantly delay green up of the turfgrass.

[3] Do not apply Confront to Bermudagrass on sod farms.

Confront may discolor and/or stunt turfgrass that is not well established or is stressed or weakened due to unfavorable climatic conditions, temperature extremes, drought, nematodes, or other factors which damage or weaken turf. Apply Confront only to healthy, well-established turfgrass that has a well-anchored root system.

General Use Precautions and Restrictions

Sale and use of this product in Suffolk and Nassau counties in New York State is prohibited.

In **California, New York, Oregon** and **Washington**, turfgrass and lawn uses are restricted to golf courses only.

Closely review restrictions

Do not use on residential turf. Turfgrass and lawn uses are restricted to non-residential sites.

Do not apply to Bermudagrass on sod farms.

The use of this herbicide in the spring when warm season turfgrass is breaking dormancy may significantly delay green up of the turfgrass.

For ground application only.

Apply this product only as specified on this label.

Application Restrictions: Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

Do not apply to exposed roots of shallow rooted trees and shrubs.

Do not allow sprays of Confront to contact exposed suckers and/or roots of trees and shrubs or injury may occur.

This product can affect susceptible broadleaf plants directly through foliage and indirectly by root uptake from treated soil. **Do not** apply Confront directly to, or allow spray drift to come into contact with, flowers, grapes, tomatoes, potatoes, beans, lentils, peas, alfalfa, sunflowers, soybeans, safflower, or other desirable broadleaf crops and ornamental plants or soil where these sensitive crops will be planted the same season.

Do not reseed for three weeks after application.

Do not use Confront on golf course putting greens or tees.

Do not send grass clippings to a compost facility.

Do not collect grass clippings for mulch or compost.

Applicator must give notice to landowners/property managers to not use grass clippings for composting.

Do not apply on ditches used to transport irrigation water.

Chemigation: Do not apply this product through any type of irrigation system.

Do not contaminate irrigation ditches or water used for irrigation or domestic purposes.

Do not apply where runoff or irrigation water may flow onto susceptible crops as injury may result.

Treatment of Turfgrass Species Not Listed on the Label for Confront
Users who wish to use Confront on a turfgrass species not recommended on this label may determine the suitability for such uses by treating a small area at a recommended rate. Prior to treatment of larger areas, the treated area should be observed for any sign of herbicidal injury during 30 days of normal growing conditions to determine if the treatment is safe to the target species. **The user assumes the responsibility for any plant damage or other liability resulting from use of Confront on species not recommended on this label.**

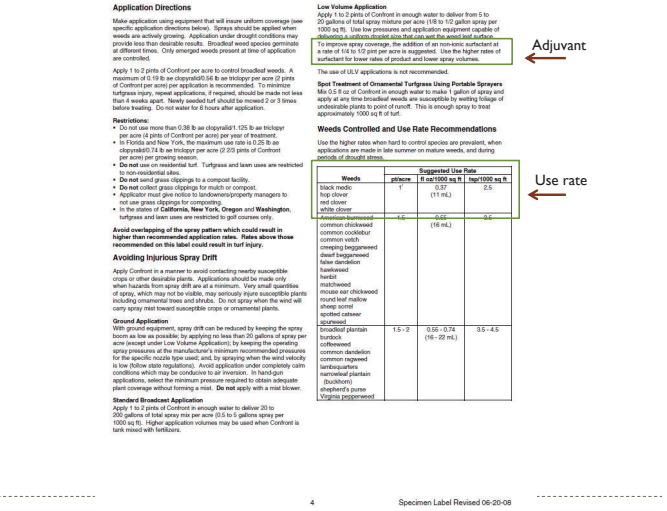
Preparing the Spray

Add one-half the desired amount of clean water to spray tank. Add Confront and complete addition of water with agitation running. Mix thoroughly and continue agitation while spraying.

3 Specimen Label Revised 06-20-08

Confront Specialty Herbicide

- How much product will you use for black medic control in perennial ryegrass?
- Should you use a surfactant with this application?



Application Directions

Make application using equipment that will insure uniform coverage (see specific application directions below). Sprays should be applied when weeds are actively growing. Application under drought conditions may provide less than desirable results. Broadleaf weed species germinate at different times. Only emerged weeds present at time of application are controlled.

Apply 1 to 2 pints of Confront per acre to control broadleaf weeds. A maximum of 0.19 lb ae clopyralid/0.56 lb ae triclopyr per acre (2 pints of Confront per acre) per application is recommended. To minimize turfgrass injury, repeat applications, if required, should be made not less than 4 weeks apart. Newly seeded turf should be mowed 2 or 3 times before treating. Do not water for 6 hours after application.

Restrictions:
- Do not use more than 0.38 lb ae clopyralid/1.125 lb ae triclopyr per acre (4 pints of Confront per acre) per year of treatment.
- In Florida and New York, the maximum use rate is 0.25 lb ae clopyralid/0.74 lb ae triclopyr per acre (2 2/3 pints of Confront per acre) per growing season.
- **Do not** use on residential turf. Turfgrass and lawn uses are restricted to non-residential sites.
- **Do not** send grass clippings to a compost facility.
- **Do not** collect grass clippings for mulch or compost.
- Applicator must give notice to landowners/property managers to not use grass clippings for composting.
- In the states of **California, New York, Oregon** and **Washington**, turfgrass and lawn uses are restricted to golf courses only.

Avoid overlapping of the spray pattern which could result in higher than recommended application rates. Rates above those recommended on this label could result in turf injury.

Avoiding Injurious Spray Drift

Apply Confront in a manner to avoid contacting nearby susceptible crops or other desirable plants. Applications should be made only when hazards from spray drift are at a minimum. Very small quantities of spray, which may not be visible, may seriously injure susceptible plants including ornamental trees and shrubs. Do not spray when the wind will carry spray mist toward susceptible crops or ornamental plants.

Ground Application
With ground equipment, spray drift can be reduced by keeping the spray boom as low as possible; by applying no less than 20 gallons of spray per acre (except under Low Volume Application); by keeping the operating spray pressures at the manufacturer's minimum recommended pressures for the specific nozzle type used; and, by spraying when the wind velocity is low (follow state regulations). Avoid application under completely calm conditions which may be conducive to air inversion. In hand-gun applications, select the minimum pressure required to obtain adequate plant coverage without forming a mist. **Do not** apply with a mist blower.

Standard Broadcast Application
Apply 1 to 2 pints of Confront in enough water to deliver 20 to 200 gallons of total spray mix per acre (0.5 to 5 gallons spray per 1000 sq ft). Higher application volumes may be used when Confront is tank mixed with fertilizers.

Low Volume Application
Apply 1 to 2 pints of Confront in enough water to deliver from 5 to 20 gallons of total spray mixture per acre (1/8 to 1/2 gallon spray per 1000 sq ft). Use low pressures and application equipment capable of delivering a uniform droplet size that can wet the weed leaf surface.

To improve spray coverage, the addition of an non-ionic surfactant at a rate of 1/4 to 1/2 pint per acre is suggested. Use the higher rates of surfactant for lower rates of product and lower spray volumes.

Adjuvant

The use of ULV applications is not recommended.

Spot Treatment of Ornamental Turfgrass Using Portable Sprayers
Mix 0.5 fl oz of Confront in enough water to make 1 gallon of spray and apply at any time broadleaf weeds are susceptible by wetting foliage of undesirable plants to point of runoff. This is enough spray to treat approximately 1000 sq ft of turf.

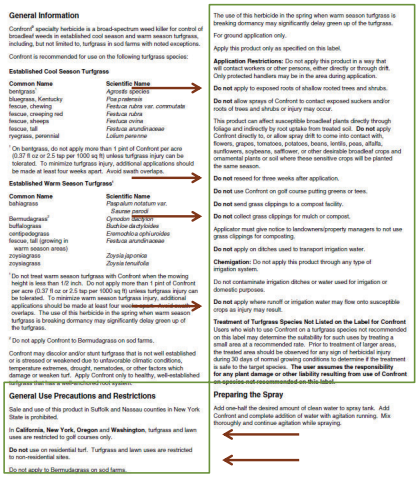
Weeds Controlled and Use Rate Recommendations
Use the higher rates when hard to control species are prevalent, when applications are made in late summer on mature weeds, and during periods of drought stress.

Weeds	Suggested Use Rate pt/acre	fl oz/1000 sq ft	tsp/1000 sq ft
black medic hop clover red clover white clover	1	0.37 (11 mL)	2.5
American burnweed common chickweed common cocklebur common vetch creeping beggarweed dwarf beggarweed false dandelion fiuweed henbit matchweed mouse ear chickweed round leaf mallow sheep sorrel spotted catsear spurweed	1.5	0.55 (16 mL)	3.5
broadleaf plantain burdock coffeeweed common dandelion common ragweed lambsquarters narrowleaf plantain (buckhorn) shepherd's purse Virginia pepperweed	1.5 - 2	0.55 - 0.74 (16 - 22 mL)	3.5 - 4.5

Use rate

4 Specimen Label Revised 06-20-08

Watch for restrictions: Review label prior to selecting herbicide to confirm it is appropriate product for your site and targeted pest



General Information

Confront® specialty herbicide is a broad-spectrum weed killer for control of broadleaf weeds in established cool season and warm season turfgrass, including, but not limited to, turfgrass in sod farms with noted exceptions.

Confront is recommended for use on the following turfgrass species:

Established Cool Season Turfgrass

Common Name	Scientific Name
bentgrass[1]	*Agrostis species*
bluegrass, Kentucky	*Poa pratensis*
fescue, chewing	*Festuca rubra var. commutata*
fescue, creeping red	*Festuca rubra*
fescue, sheeps	*Festuca ovina*
fescue, tall	*Festuca arundinaceae*
ryegrass, perennial	*Lolium perenne*

[1] On bentgrass, do not apply more than 1 pint of Confront per acre (0.37 fl oz or 2.5 tsp per 1000 sq ft) unless turfgrass injury can be tolerated. To minimize turfgrass injury, additional applications should be made at least four weeks apart. Avoid swath overlaps.

Established Warm Season Turfgrass[1]

Common Name	Scientific Name
bahiagrass	*Paspalum notatum var. Saurae persil*
Bermudagrass[2]	*Cynodon* species
buffalograss	*Buchloe dactyloides*
centipedegrass	*Eremochloa ophiuroides*
fescue, tall (growing in warm season areas)	*Festuca arundinaceae*
zoysiagrass	*Zoysia japonica*
zoysiagrass	*Zoysia tenuifolia*

[1] Do not treat warm season turfgrass with Confront when the mowing height is less than 1/2 inch. Do not apply more than 1 pint of Confront per acre (0.37 fl oz or 2.5 tsp per 1000 sq ft) unless turfgrass injury can be tolerated. To minimize warm season turfgrass injury, additional applications should be made at least four weeks apart. Avoid swath overlaps. The use of this herbicide in the spring when warm season turfgrass is breaking dormancy may significantly delay green up of the turfgrass.

[2] Do not apply Confront to Bermudagrass on sod farms.

Confront may discolor and/or stunt turfgrass that is not well established or is stressed or weakened due to unfavorable climatic conditions, temperature extremes, drought, nematodes, or other factors which damage or weaken turf. Apply Confront only to healthy, well-established turfgrass that has a well-established root system.

General Use Precautions and Restrictions

Sale and use of this product in Suffolk and Nassau counties in New York State is prohibited.

In **California**, **New York**, **Oregon** and **Washington**, turfgrass and lawn uses are restricted to golf courses only.

Do not use on residential turf. Turfgrass and lawn uses are restricted to non-residential sites.

Do not apply to Bermudagrass on sod farms.

The use of this herbicide in the spring when warm season turfgrass is breaking dormancy may significantly delay green up of the turfgrass.

For ground application only.

Apply this product only as specified on this label.

Application Restrictions: Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

Do not apply to exposed roots of shallow rooted trees and shrubs.

Do not allow sprays of Confront to contact exposed suckers and/or roots of trees and shrubs or injury may occur.

This product can affect susceptible broadleaf plants directly through foliage and indirectly by root uptake from treated soil. **Do not** apply Confront directly to, or allow spray drift to come into contact with, flowers, grapes, tomatoes, potatoes, beans, lentils, peas, alfalfa, sunflowers, soybeans, safflower, or other desirable broadleaf crops and ornamental plants or soil where these sensitive crops will be planted the same season.

Do not reseed for three weeks after application.

Do not use Confront on golf course putting greens or tees.

Do not send grass clippings to a compost facility.

Do not collect grass clippings for mulch or compost.

Applicator must give notice to landowners/property managers to not use grass clippings for composting.

Do not apply on ditches used to transport irrigation water.

Chemigation: Do not apply this product through any type of irrigation system.

Do not contaminate irrigation ditches or water used for irrigation or domestic purposes.

Do not apply where runoff or irrigation water may flow onto susceptible crops as injury may result.

Treatment of Turfgrass Species Not Listed on the Label for Confront
Users who wish to use Confront on a turfgrass species not recommended on this label may determine the suitability for such uses by treating a small area at a recommended rate. Prior to treatment of larger areas, the treated area should be observed for any sign of herbicidal injury during 30 days of normal growing conditions to determine if the treatment is safe to the target species. **The user assumes the responsibility for any plant damage or other liability resulting from use of Confront on species not recommended on this label.**

Preparing the Spray

Add one-half the desired amount of clean water to spray tank. Add Confront and complete addition of water with agitation running. Mix thoroughly and continue agitation while spraying.

Ornamental Pests

Caterpillar

Cypress Bark Beetle

Leafcutter Bee

Aphids

Whiteflies

Spider Mites

Palo Verde Borer

Giant Palm Borer

Flea Beetles

Agave Weevil

Flatheaded Borer

Ornamental Diseases

Fungal Leaf Spot

Cytospora Canker

Anthracnose

Texas Root Rot

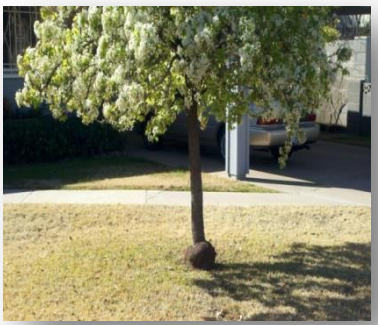
Phytophthora

Bacterial Necrosis of Saguaro

Sooty Canker

Verticillium Wilt

Fire Blight



Crown Gall

Rust

Rose Mosaic Virus

Turf Pests

Harvester Ant

Fire Ant

Leafhopper

Sod Webworm

Frit Fly

Billbug

Ground Pearl Scale

White Grubs

Chinch Bug

Cutworm

Rove Beetle

Turf Diseases

Brown Patch/ Large Patch

Powdery Mildew

Dollar Spot

Grey Snow Mold

Melting Out

Pink Snow Mold

Pythium Blight/
Grease Spot

Slime Mold

Spring Dead Spot

Summer Patch

Fairy Ring

Beneficial Insects

Parasitic Wasp

Lady Beetle

Lady Bug Larvae

Lacewing

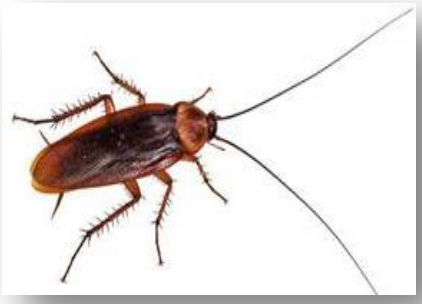
Lacewing Larvae

Praying Mantis

Minute Pirate Bug

Assassin Bug

Structural Pests



American Roach

German Roach

Brown Banded Roach

Turkistan Roach

Oriental Roach

Crab Spider

Bark Scorpion

Jumping Spider

Black Widow

Brown Recluse

Sun Spider

Structural Pests

Tarantula

Webbing Clothes Moth

Dog & Cat Flea

Arizona Brown Spider

Brown Dog Tick

Bed Bug

Bumble Bee

Honey Bee

Pigeon

Varied Carpet Beetle

Red Flour Beetle

Indian Meal Moth

Structural Pests

House Fly

Earwig

Northern Mole Cricket

House Cricket

Field Cricket

House Mouse

Jerusalem Cricket

Pocket Gopher

Centipede

Pill & Snow Bug

Weeds

Annual Sowthistle

California Burclover

Common Lambsquarters

Common Cocklebur

Common Sunflower

London Rocket

Common Crabgrass

Japanese Morninglory

Arizona Brome

Prostrate Knotweed

Prostrate Pigweed

Prostrate Spurge

Weeds

Puncturevine

Redroot Pigweed

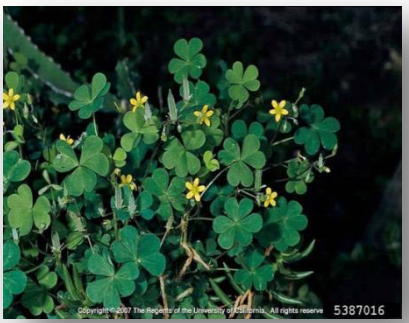
Redstem Filaree

Russian Thistle

Yellow Foxtail

Common Mullein

Buffalo Gourd



Creeping Woodsorrell

Dandelion

Field Bindweed

Johnsongrass

Yellow Nutsedge

Ornamental & Turf Management

Test Plan Development

I. Pest Identification

a. Bi-annuals
b. Annuals
c. Perennials
d. Desirable vs. Pest (selective control)
e. Monocot
f. Dicot
g. Insect – growth stage, appropriate time for control (thresholds)
h. Disease identification
i. Rodent
j. Scouting/ Monitoring/ Trapping for Pests
k. Growth Regulators

Pests

l. Ants
    1. Southern fire ant
    2. Red Imported fire ant (Qualified Applicator)
    3. Harvester ant
m. Cockroaches
    1. Oriental
    2. Turkestan
n. Beetles
    1. Flat-head borer
    2. Palo Verde
    3. Bark Beetles
    4. White Grubs
    5. Bill Bugs
    6. Long-Horned Beetles
    7. Agave Weevils
    8. Yuccas
o. Pests of Public Health concern
    1. Mosquitoes
    2. Ticks
    3. Mites
    4. Chiggers
p. Scorpions
    1. Bark scorpion
q. Wasps
    1. Yellow-jacket-2 + 1 invasive
    2. Paper wasps
r. Other invaders
    1. Aphids
    2. Whiteflies

3. Psyllids
4. Stink bugs
5. Mealy bugs
6. False chinch bugs
7. Ground Pearl
8. Armyworm, Cutworm, Webworm
9. Skeletonizers

s. Vertebrates
1. Gophers
2. Ground Squirrels
3.

t. Crickets
1. Mole Crickets
2. Camel Crickets
3. Field Crickets

Weeds

a. Clovers
1. Black medic
2. Bur clover
3. Annual sweet clover

b. Mustards
1. London rocket
2. Mustards (sahara, black, wild radish)
3. Shepherds purse
4. Swine cress

c. Composites
1. Groundsel
2. Sow thistle
3. Prickly lettuce

d. Other
1. Cheese weed
2. Red stem filaree
3. Chickweed
4. Knotweed
5. Dodder

e. Summer annual broadleaves
1. Spurge
2. Horseweed
3. Pigweed
4. Common purslane
5. Russian thistle
6. Puncturevine
7. Toadflax
8. Thistles
9. Globe Chamomile
10. Hairy Fleabane

11. Camphorweed

f. Winter annual grass weeds
    1. Hare Barley
    2. Red brome
g. Summer annual grass weeds
    1. Goosegrass
    2. Southwestern cupgrass
    3. Crabgrasses
    4. Sandbur
    5. Bermudagrass
h. Perennial weeds
    1. Purple Nutsedge
    2. Yellow Nutsedge
    3. Kyllinga
    4. Silverleaf nightshade
    5. Johnsongrass
    6. Rescuegrass
    7. Dallisgrass
    8. Buffelgrass
    9. Fountaingrass
    10. Camelthorn
    11. Hogpotato

II. Read and Comprehend Label and Labeling

a. Safety Issues
    1. Spray Drift
    2. Run Off
    3. Wildlife
    4. Surface Waters (lakes, rivers, washes)
    5. Groundwater Protection List – A.I.
b. Worker Safety – PPE
c. Public Safety
    1. Re-entry
    2. Workers
    3. Children
    4. Pets
d. Calculate chemicals
        1. Application Rates
            i. Site
            ii. Pests
e. Types of Applications
    1. Pre-emergent
    2. Post-emergent
        i. Spray to Wet
        ii. Broadcast

iii. Spot spray
iv. Spray to run-off

3. Injection
   i. Stump treatment
4. Drench
5. Baits
6. Gases
7. Traps
8. Use of Adjuvants

f. Tank Mixes
g. Growth Regulators

III. Planning and Implementing a Vegetation /Pest Management Plan

a. Appropriate Product formulations
b. Secondary poisoning
c. Application Timing
   1. Weather
   2. Life Stage
d. Pesticide Resistance Issues
e. Monitoring after Application

IV. Laws and Rules

a. Ground water protection reporting
   1. A.A.C. R3-8-505
      i. Reporting Requirements
      ii. Where to find the list (QA)
   2. QA Responsibilities
   3. School Posting

V. Equipment Types, Uses, Maintenance and Calibration

a. Nozzles
b. Pumps
c. Hoses
d. Hand Sprayers
e. Backpack Sprayers
f. Broadcast Sprayers
g. Granular Spreaders

Resources – *Category 3b: Turf Management (Purdue Extension); Rights-of-Way Management (Washington State University Extension); Weeds of California and other Western States Vol. 1 & 2 (University of California); Truman's Scientific Guide to Pest Management Operations Seventh Edition;* *Handbook on Pests of Community Environments in the Desert Southwest United States*; *UC IPM;* Arizona Revised Statute Title *(A.R.S.)* 3 Chapter 20; Arizona Administrative Code *(A.A.C.)* Title 3 Chapter 8; and National Pesticide Applicator Certification Core Manual

Right-of-Way Pest Management

Test Plan Development

I. Pest Identification

a. Bi-annuals
b. Annuals
c. Perennials
d. Desirable vs. Pest (selective control)
e. Monocot
f. Dicot
g. Insect – growth stage, appropriate time for control (thresholds)
h. Rodent
i. Scouting/ Monitoring/ Trapping for Pests
j. Growth Regulators

Pests

k. Ants
    1. Southern fire ant
    2. Red Imported fire ant (Qualified Applicator)
    3. Harvester ant
l. Cockroaches
m. Beetles
    1. Flat-head borer
    2. Palo Verde
    3. Bark Beetles
    4. Bill Bugs
    5. Long-Horned Beetles
    6. Agave Weevils
    7. Yuccas
n. Pests of Public Health concern
    1. Ticks
o. Scorpions
    1. Bark scorpion
p. Wasps/Bees
q. Noctuid moths/insects that come to lights/occasional invaders
    1. Aphids
    2. Whiteflies
    3. Psyllids
    4. Stink bugs
    5. Mealy bugs
    6. False chinch bugs
    7. Leaf hoppers
r. Vertebrates
    1. Gophers

Weeds

a. Clovers
    1. Black medic
    2. Bur clover
    3. Annual sweet clover
b. Mustards
    1. London rocket
    2. Mustards (Sahara, Black, Wild Radish)
    3. Shepherds purse
    4. Swine cress
c. Composites
    1. Groundsel
    2. Sow thistle
    3. Prickly lettuce
d. Other
    1. Cheeseweed
    2. Red Stem Filaree
    3. Chickweed
    4. Knotweed
e. Summer annual broadleaves
    1. Spurge
    2. Horseweed
    3. Pigweed
    4. Common purslane
    5. Russian thistle
    6. Puncturevine
    7. Toadflax
    8. Thistles
    9. Globe Chamomile
    10. Hairy Fleabane
    11. Camphorweed
f. Winter annual grass weeds
    1. Hare Barley
    2. Red brome
g. Summer annual grass weeds
    1. Goosegrass
    2. Southwestern cupgrass
    3. Crabgrasses
    4. Sandbur
    5. Bermudagrass
h. Perennial weeds
    1. Purple Nutsedge
    2. Yellow Nutsedge
    3. Kyllinga
    4. Silverleaf nightshade
    5. Johnsongrass

6. Buffelgrass
7. Fountaingrass
8. Camelthorn
9. Hogpotato

II. Read and Comprehend Label and Labeling

a. Safety Issues
   1. Spray Drift
   2. Run Off
   3. Surface Waters (lakes, rivers, washes)
   4. Groundwater Protection List – A.I.
b. Worker Safety – PPE
c. Calculate chemicals
   1. Application Rates
      i. Site
      ii. Pests
d. Types of Applications
   1. Pre-emergent
   2. Post-emergent
      i. Spray to Wet
      ii. Broadcast
      iii. Spot spray
      iv. Spray to run-off
   3. Injection
      i. Stump treatment
   4. Drench
   5. Baits
   6. Traps
   7. Use of Adjuvants
e. Tank Mixes
f. Growth Regulators

III. Planning and Implementing a Vegetation /Pest Management Plan

a. Appropriate Product formulations
b. Secondary poisoning
c. Application Timing
   1. Weather
   2. Life Stage
d. Pesticide Resistance Issues
e. Monitoring after Application
f. Mowing
g. IPM
h. Bio/cultural controls
   1. Beneficial Insects

2. Bacillus Thuringiensis

IV. Laws and Rules

a. Ground water protection reporting
   1. A.A.C. R3-8-505
      i. Reporting Requirements
      ii. Where to find the list (QA)
   2. QA Responsibilities

V. Equipment Types, Uses, Maintenance and Calibration

a. Nozzles
b. Pumps
c. Hoses
d. Hand Sprayers
e. Backpack Sprayers
f. Broadcast Sprayers
g. Granular Spreaders

Resources – *Rights-of-Way Management (Washington State University Extension); Weeds of California and other Western States Vol. 1 & 2 (University of California); Truman's Scientific Guide to Pest Management Operations Seventh Edition; Handbook on Pests of Community Environments in the Desert Southwest United States; UC IPM; US Forest Service Region 3 Invasive Weeds; Arizona Revised Statute Title 3 Chapter 20 – Pest Management Division; Arizona Administrative Code Title 3 Chapter 8 – Pest Management Division; and National Pesticide Applicator Certification Core Manual*