



Pesticides & Calibration

Pesticides & Calibration

Objectives

- Gather health, safety & pesticide use information from product labels
- How to mix, load and apply pesticides so that the product is applied correctly and evenly
- Reduce the risk of contamination to us, other people, animals and the environment by applying pesticides responsibly
- Prevent, recognize & respond to pesticide-related emergencies
- Properly calibrate pesticide application equipment
- Understand the PMD Landscaper Exemptions or if an Applicator's License is required in a given situation

Pesticide Safety and Equipment Calibration Training Highlights



Pests, Pesticides and General Safety



Pesticide Label and the Pesticide Registration Process



Formulations and the Importance of Mixing and Measuring Correctly

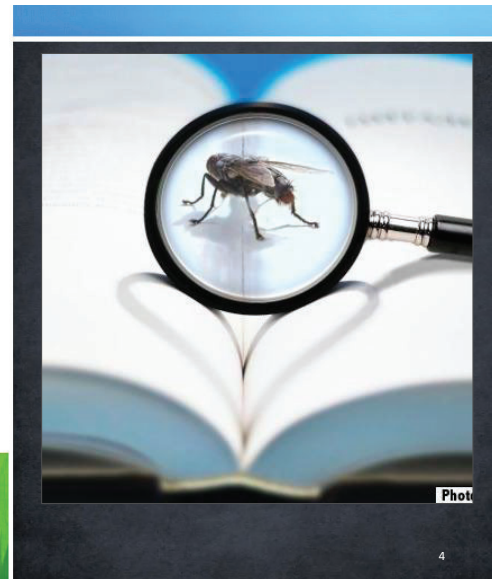


Calibrating Pesticide Application Equipment and Measuring Treatment Sites

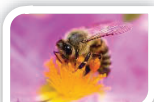
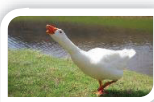
Definition of a Pest

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

Everyone sees and defines "pests" differently



Which of the following do you consider to be pests?



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?



7

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)

Overview of Applied Pest Control Methods



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



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.

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.

Definition of a Pesticide

A pesticide is any substance or mixture of substances with the purpose to:

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



13

Question:
What type of pesticide is used to control insects?



Answer: Insecticide

14

Question:

What type of pesticide is used to control rodents?



Answer: Rodenticide

15

Question:

What type of pesticide is used to control weeds?



Answer: Herbicide

16

Question:

What type of pesticide is used to control ticks?



Answer: Acaricide

17

Other types of pesticides include:



Fungicides, Avicides (birds), Antimicrobials, and Antibacterials⁸

Pesticide 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

19

20

LD50 Illustration



LD = LETHAL DOSE
50 = 50% of test population

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

2
1

SIGNAL WORD

&

PESTICIDE TOXICITY

CAUTION

DANGER

WARNING

22

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).

23

Field Testing and Trials

Does the pesticide cause plant damage = phytotoxicity?



Does the pesticide effectively manage the pest?

24

How long do residues remain in the air, soil, water and plants?

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?

Mobility
Residue



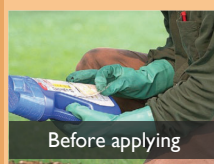
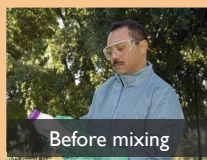
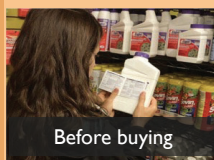
Residue tolerance: The maximum amount of pesticide residue legally allowed on or in food or feed at harvest or slaughter.



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



- **Buying the pesticide**
- **Mixing or preparing the pesticide you will apply**
- **Applying the pesticide**
- **Storing or disposing of the pesticide or the containers.**



- Brand name, manufacturer's name and address
- EPA registration number
- Ingredients
- Signal word
- Precautionary measures
- Environmental hazards
- Restricted Entry Interval
- Protective clothing and personal protective equipment
- First aid instructions
- Use instructions

[illegible]

Question:



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



What are the four routes of entry?



1. EYES / OCULAR



2. NOSE / INHALATION

#1



3. SKIN / DERMAL

Which of the four routes of entry is reported most frequently?



4. MOUTH / INGESTION

33

What is the route of entry?

What are some safer ways to clean clogged nozzles?

Where can you find first aid or emergency decontamination information to help someone who has swallowed or ingested pesticides?



#7 - First Aid and Emergency Decontamination



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

35

What is the route of entry?

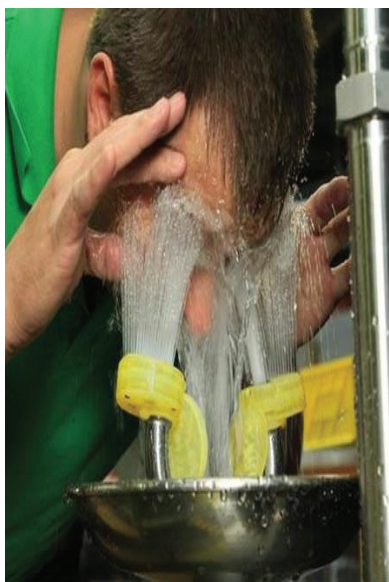
What can handlers wear if the label requires eye protection?

What should handlers have within their reach if eye protection is required on the label?

What type of first aid or emergency decontamination would you provide to this individual?



#7 - First Aid and Emergency Decontamination



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

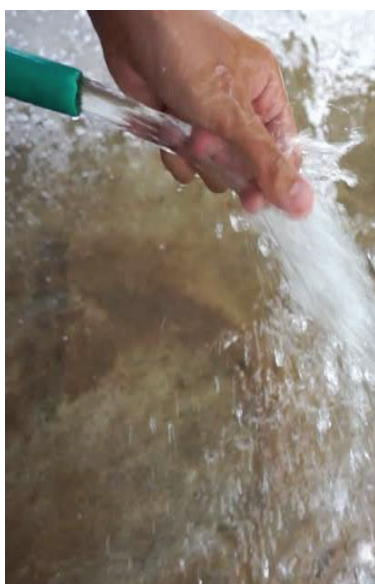
What is the route of entry?

What is the minimum personal protective equipment that must be worn when handling pesticides?

What type of first aid or emergency decontamination would you provide to this individual?



#7 - First Aid and Emergency Decontamination



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*

40

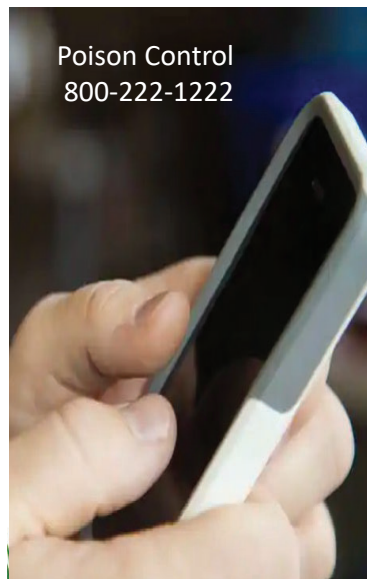
What is the route of entry?

Should you ever alter your personal protective equipment?

What type of first aid or emergency decontamination would you provide to this individual?



Poison Control
800-222-1222



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

#7 - First Aid and Emergency Decontamination

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.

43

Note: A Safety Data Sheet will also work

Company Y

PRODUCT X

Classified Chlorine-Sulfur-Fungicide-Molluscicide-Vesicant-Deodorizer for Hospital, Institutional and Industrial Use
(Effective in hot water up to 180 ppm hardness calculated as CaCO₃ in the presence of 5% serum contamination)

ACTIVE INGREDIENTS

Calcium hypochlorite (available chlorine)	1.80%
Sulfur dioxide (available chlorine)	0.05%
Sodium hypochlorite (available chlorine)	0.05%
Hydrogen peroxide (available chlorine)	0.05%
Dimethyl tertiary ammonium chloride	2.20%
INERT INGREDIENTS	94.00%
TOTAL	100.00%

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 wash contaminated clothing before reuse. If swallowed, drink promptly a large quantity of milk, egg whites, positive solution or if those are not available, drink large quantities of water. Avoid alcohol. Call a physician immediately.
NOTE: TO PHYSICIAN: Probable mucous damage may contraindicate the use of gastric lavage. Measures against emulatory shock, respiratory depression, and convulsion may be needed.
SEE LEFT PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS
Manufactured by
Company Y Chemical Company, Somerville, Somerville 12345

EPA Reg. No. 1655-XX

EPA Est. No. 15XX-MO-1

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 general "one-step" disinfectant - cleaner - sanitizer - fungicide - molluscicide - vesicant which is effective in water up to 450 ppm hardness in the presence of 5% serum contamination. Apply Product X to walls, floors and other hard non-porous surfaces such as tables, chairs, countertops, sinks, the porcelain, and bed frames with a cloth, mop or mechanical spray device as in its packaging use directions. For heavy soiled areas, preliminary scrubbing is required. Prepare a fresh solution daily or when use solution becomes milky only.
Directions - To disinfect hard, non-porous surfaces, in hospitals, add 1 cup per gallon of water. "Rinse" surfaces must remain wet for 10 minutes. At 1 1/2 cup per gallon of water, Product X will disinfect hard non-porous surfaces (floors, linoleum, etc.) and non-porous fixtures. For schools, industry and non-medical institution use: All 1 1/2 cup per gallon of water. Product X delivers excellent cleaning and germicide effectiveness. It is effective against drug resistant surface, Gram-negative bacteria, Rhinovirus, etc. and broad spectrum. The same ADAC tests used to verify performance for hospitals are used.
Fungicide Control - Product X is an effective fungicide against mold, mildew, and other fungi. It is used on walls, floors, and ceilings in areas such as locker rooms, changing rooms, shower and bath areas, restrooms, etc. and is used on floors.
Mold and Mildew Control - All 1 1/2 cup per gallon. Product X is effective against mold and mildew and the odor caused by them when applied to hard, non-porous surfaces as indicated. It gives no residual odor. Allow to dry or re-surface and repeat after mildew growth returns.
Vesicant Performance - At 1 1/2 cup per gallon, Product X was evaluated and found to be effective in the presence of 5% serum and 450 ppm hardness against the following viruses: Influenza A virus, Respiratory syncytial virus, and Parainfluenza virus. Sanitizing - Product X is used on hard surfaces such as floors, walls, tables, etc. At 1 1/2 cup per gallon, Product X is an effective sanitizer against enterococcal bacteria and Klebsiella pneumoniae on floors, walls, and non-porous environmental surfaces. Treated surfaces must remain wet for 10 minutes.

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

44

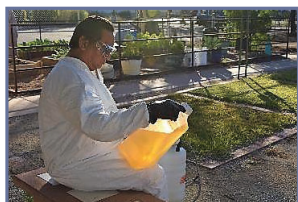
A Quick Question

#9
PERSONAL
PROTECTIVE
EQUIPMENT



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

Purpose of PPE



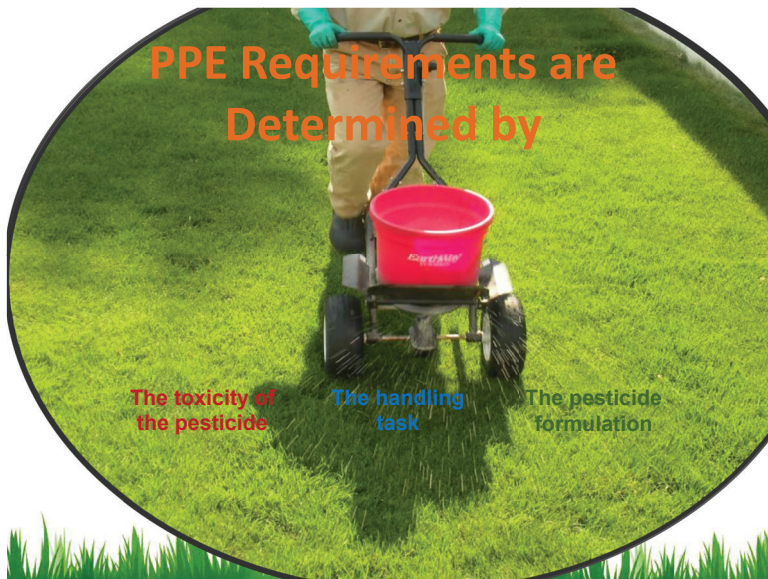
The purpose of personal protective equipment is to protect pesticide handlers from exposure to pesticides. A handler is anyone who mixes, loads or applies pesticides, as well as people who repair or clean pesticide application equipment.

PPE Requirements are Determined by

The toxicity of the pesticide

The handling task

The pesticide formulation





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

- Use when:
 - mixing and loading
 - cleaning equipment
- From neck to knees
- **WARNING:** aprons can get caught in machinery



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

Read the label

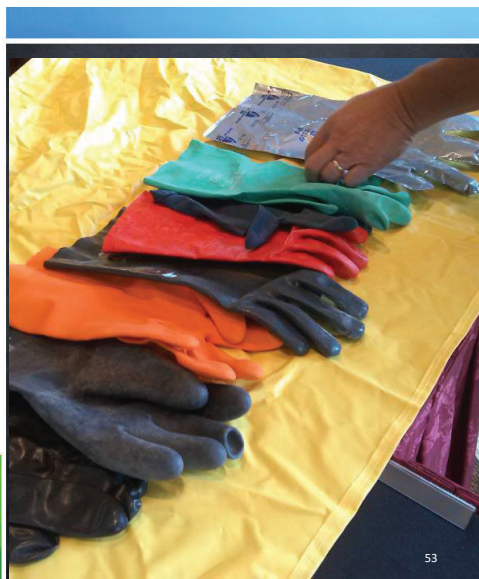
Choose the correct glove

Concentrate on the material and thickness

VERY IMPORTANT

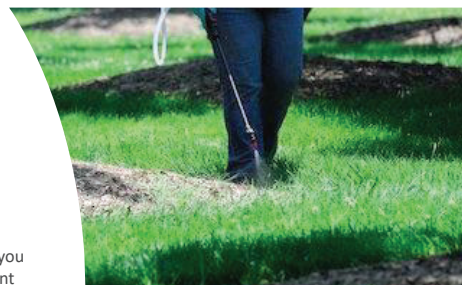
Don't wear leather, suede, cotton or cotton-lined gloves when working with pesticides.

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.



Answer: 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*	Polyethylene	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 \$7.60		Polyethylene \$0.99		Viton/Butyl I \$72.25 per glove

Which nitrile gloves are better?

A



B



C



56

Gloves over sleeves or tucked into sleeves?

- Spraying overhead



- Spraying toward the ground



57



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



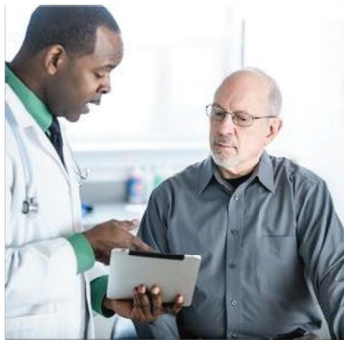
Have water or eyewash within reach if eyewear is required.



Respirator Requirements



60



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

61

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



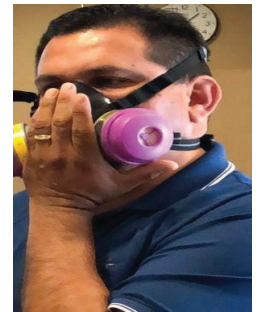
Make sure you have your own respirator



Check the Seal



Negative pressure seal check

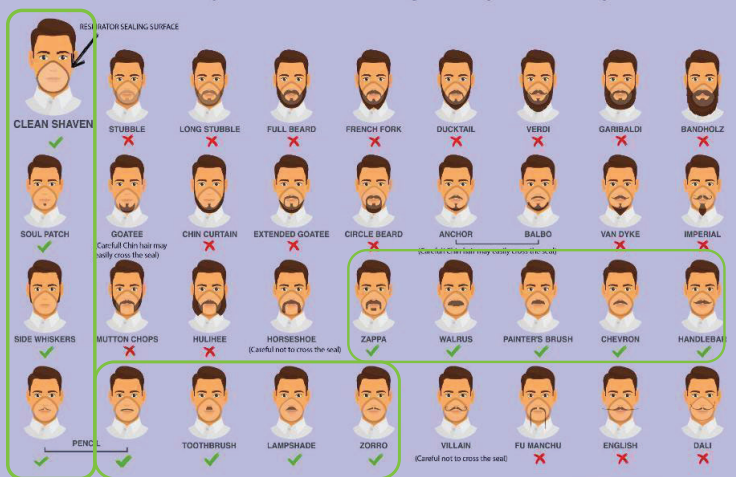


Positive pressure seal check

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

64

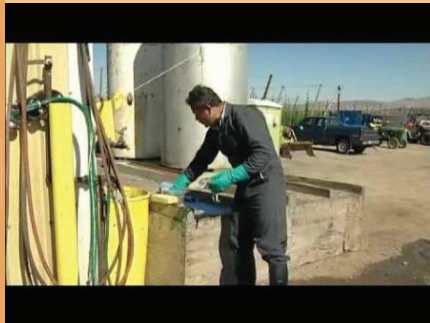
Facial Hairstyles and Filtering Facepiece Respirators



Cleaning PPE at the end of the shift

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



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

67

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



68

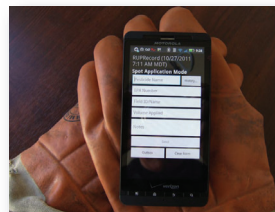
PPE

PERSONAL PROTECTIVE EQUIPMENT

Inspect equipment and replace when
necessary

Have a place at the worksite to wash, dry
and store PPE

AN OVERALL CONCERN



Contaminated items that don't get washed
such as reading glasses, cellphones,
leather work boots and baseball caps.

70

Consider wearing footwear that you are
willing to wash with soap and water



Maybe something
like this



But probably
not this

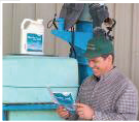
Protect the Environment



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

Always Follow the Use Instructions

Question 1



Legally:
Can you apply a pesticide **BELOW** the rate listed on the label?

YES

Question 2



Legally:
Can you apply a pesticide **ABOVE** the rate listed on the label?

NO


Question 3



Legally:
Can you apply a pesticide to control a **PEST** that is not listed on the label?

YES

Question 4



Legally:
Can you apply a pesticide to a **SITE** that is not listed on the label?

NO

73



Environmental Hazards

Always survey the area before you spray.

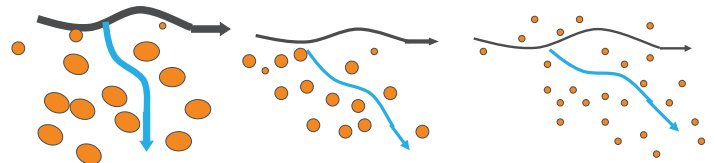
Some pesticides are especially hazardous to water sources, aquatic life, wildlife, domestic animals, or beneficial insects.

74

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
 - 3-10 mph: easier to determine wind direction
 - >10 mph: spray drift is possible

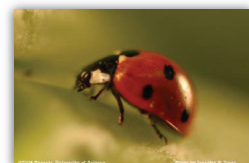
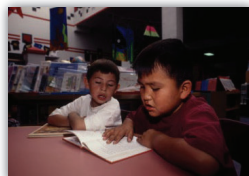
Larger Spray Droplets



Drift less than smaller droplets

Protect Sensitive Areas

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



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?

78

Persistence

- How long a pesticide remains active before it degrades
- Long-term pest control
- Can also harm sensitive plants or animals

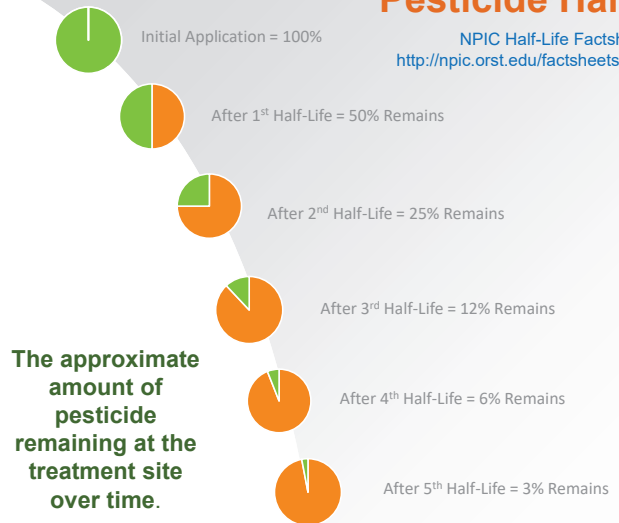
Just a side note:

- Concerns for illegal residues in rotational crops



Pesticide Half-Life

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



80

A Pesticide's Half-Life Varies

Soil	Water	Plant

8

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

7

https://www.youtube.com/watch?v=PQ_vaAa4Wal&list=PLC7E3D548C6EF985E



5

Three "C's": Control, Contain, Clean-up

Control

- Stop the source
 - Plug leaks
 - If it cannot be plugged, place container in secondary container such as plastic bucket or bag
 - Stand up fallen containers

Protect yourself

- Isolate the site from other people or animals
- Stay at the spill site

Contain

- If a liquid, use an absorbent material to soak up the spill
 - Create a dike of absorbent around the downhill side to keep spill from running off site or into waterways
- If a dry material, cover with the tarp to keep wind from blowing it around
 - Sweep up dry materials and use according to the label

Clean-up

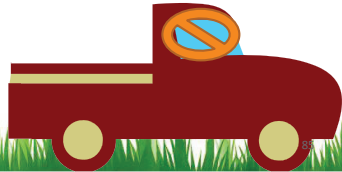
- Sweep up absorbent material and place in a plastic bag
- Seal the bag with the duct tape



6

Transporting Pesticides

- **Never** carry pesticides in the passenger compartment of any vehicle – place them in the cargo area.
- Examine the containers for leaks before loading and unloading.
- 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.



What is wrong with these two pesticide storage areas?



Root Beer
Slushie?

86

An example of a good storage area.

Organized and orderly

Dry products stored above liquids

Bins to catch pesticide leaks

Heavy boxes and containers stored low



Sufficient lighting and ventilation

Secured and locked area

Berm to contain spills inside storage area

Impervious floor

87

Organized and orderly

Dry products stored above liquids

Bins to catch pesticide leaks

Heavy boxes and containers stored low



Sufficient lighting and ventilation

Secured and locked area

Berm to contain spills inside storage area

Impervious floor

88



WEED CONTROL EXEMPTIONS AND RECORDKEEPING REQUIREMENTS

Pest Management Division



A pesticide is defined by Arizona Law as any substance that is used to kill a pest (rodents, roaches are a pest, spiders are a pest, aphids are a pest, birds, weeds, etc.)

Arizona Law defines the business of pest control as performing applying pesticides (even those over the counter), ... advertising pest control services and making pest control related recommendations

Arizona Law says if you engage in the business of pest control you need to be LICENSED with the Arizona Department of Agriculture.

§ 3-3613 (B) Unlicensed Landscapers CANNOT:

- Use herbicides that are labeled with the words "restricted use" or **"danger"**.
- Use sterilants or **pre-emergent** herbicides.
- Offer weed management as the person's primary service or **advertise weed management services**.
- Use application equipment that **collectively** holds **more than five gallons** of total mixed liquid herbicide at an address or project on the same day.

4

"Weed Control" Exemption



You can do ONE form of pest control without being licensed!

The weed control (or landscaper) exemption allows you to perform weed control (and ONLY weed control) without being licensed with the Department of Agriculture (AZDA)!

- The company does not need a AZDA Business License
- The applicator does not need an AZDA certification

You can only perform weed control without a license IF you follow very specific laws

Failing to follow those laws will result in the AZDA identifying you as an unlicensed company, which results in civil penalties!



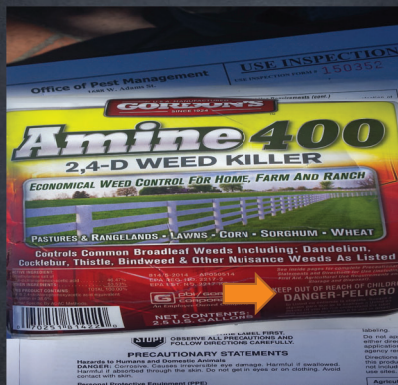
"Weed Control" Exemption

§ 3-3613 (B) Unlicensed Landscapers CANNOT:

§ 3-3613 (B) Unlicensed Landscapers CANNOT:

- Use or be part of a crew of two or more herbicide applicators at an address or project on the same day.
- Use an herbicide at a school or child care facility. (R3-8-201) An Uncertified Applicator cannot apply pesticides at Healthcare Facilities or Food Handling Establishments in addition to a school or child care facility.
- Use an herbicide at an address or project without performing lawn, garden, shrub or tree maintenance at that address or project on the same day.
- *Shall provide records to each customer and retain records....*

6



5

"Weed Control" Exemption



"Weed Control" Exemption Recordkeeping

§ 3-3613 (C) Unlicensed Landscaper Recordkeeping:

A person who is exempt from licensure, certification and registration pursuant to this section shall:

Provide treatment records to each customer on application of herbicides for the purpose of weed management and retain records containing the same information provided to customers **for at least six months** after the date of the treatment. Treatment records must include:

- **Address** of the location of the herbicide application
- **Date** of the herbicide application
- Trade **name** or common name of the herbicide applied
- **Amount** of herbicide applied
- **Name** of individual that performed the treatment

7

Recordkeeping Requirements

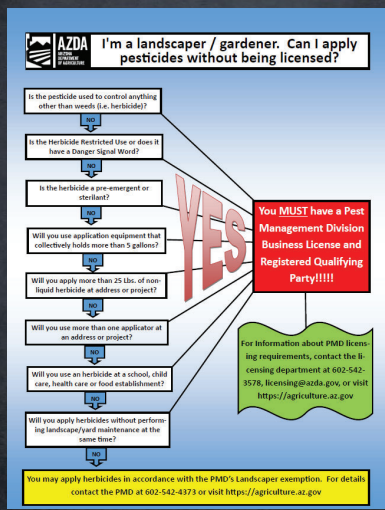
Service Records (A.A.C. R3-8-501.B)

Each pesticide application will be documented with the following:

- Customer name/address of treatment
- Date
- Specific site at which a pesticide was applied
- Target pest or purpose of service (look at label)
- Trade name of pesticide used
- Amount of pesticide applied, in terms of percent active ingredient and total amount diluent; total amount of concentrate and total amount of diluent; or total amount of ready-to-use product...
- Name of Certified Applicator and number, if the applicator is unlicensed the supervising applicator's name and certification number will accompany the name of the unlicensed applicator.

8

PMD Unlicensed FlowChart



9

PESTICIDE FORMULATIONS AND THE IMPORTANCE OF MIXING AND MEASURING CORRECTLY

DEFINITION OF A PESTICIDE FORMULATION

A pesticide product as purchased, containing a mixture of one or more active ingredients, carriers (inert ingredients), and/or other additives diluted for safety and ease of application.

INGREDIENTS

Active Ingredient(s) (Ai)

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

ACTIVE INGREDIENTS:	
Pyrethrins	6.00%
*Piperonyl butoxide	60.00%
OTHER INGREDIENTS	34.00%
	100.00%
*(butylcarbityl) (6-propylpiperonyl) ether and related compounds	
A liquid insecticide concentrate that contains 8.48 lbs./gal. (Contains 0.51 lbs./gal. of Pyrethrin, 5.1 lbs./gal. of Piperonyl Butoxide)	

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.**

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

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

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.

SURFACTANTS

SURFACE ACTIVE INGREDIENTS

- Wetting agents
- Spreaders
- Emulsifiers
- Stickers/Extenders
- Other Types of Adjuvants that are not surfactants
- Buffers or pH modifiers
- Compatibility agents
- Defoaming agents
- Colorants/dyes
- Safeners
- Thickeners

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



CHOOSE THE RIGHT ADJUVANT

- Read and follow the label
- Test a small amount in a small area
- Use adjuvants that have been tested and found effective for your use.
- Use only adjuvants manufactured for your industry (ex: ag or horticulture)
 - Don't substitute recommended adjuvant with household detergent

Adjuvants are not a substitution for safe application practices



VARIOUS TYPES OF FORMULATIONS

DRY
LIQUID
OTHER



8

GRANULES (G)

Advantages

- No mixing, easy and ready to use, low drift hazard, low applicator hazard, simple equipment, may break down slower than liquids

Disadvantages

- Frequent calibration, measured by weight, not uniform size impacts application, granules don't stick, may need to incorporate into soil or wet, non-target wildlife



PELLETS (P OR PS)



Advantages

- Similar to GRANULES except they are more 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

Disadvantages

- Frequent calibration, measured by weight, don't stick, may need to be incorporated into soil or wet, hazards for non-target wildlife

DUSTS (D)

Advantages

- No mixing; easy & ready to use; many contain less than 10% of a.i.; some used as tracking powders; effective for insect & rodent control, hard-to-reach areas or where liquid might damage area.

Disadvantages

- Drift potential; can irritate eyes, nose, skin & throat; inhalation risk; humidity could cause it to clump; hard to calibrate; difficult to evenly distribute; doesn't stick to area.



WETTABLE POWDERS (WP OR W) AND SOLUBLE POWDERS (SP OR WSP)

Advantages (both WP & SP)

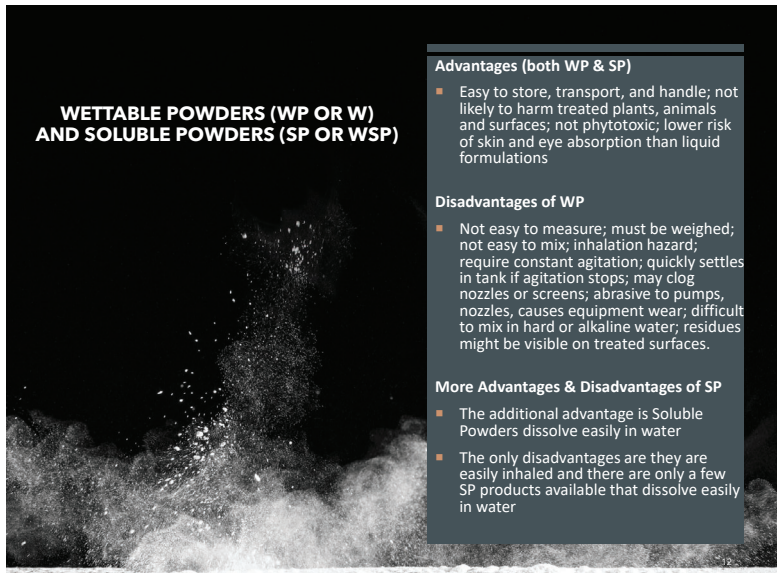
- Easy to store, transport, and handle; not likely to harm treated plants, animals and surfaces; not phytotoxic; lower risk of skin and eye absorption than liquid formulations

Disadvantages of WP

- Not easy to measure; must be weighed; not easy to mix; inhalation hazard; require constant agitation; quickly settles in tank if agitation stops; may clog nozzles or screens; abrasive to pumps, nozzles, causes equipment wear; difficult to mix in hard or alkaline water; residues might be visible on treated surfaces.

More Advantages & Disadvantages of SP

- The additional advantage is Soluble Powders dissolve easily in water
- The only disadvantages are they are easily inhaled and there are only a few SP products available that dissolve easily in water



WATER SOLUBLE BAGS OR PACKETS (WSB OR WSP)



Advantages

- Accurately premeasured units, safer for handler due to minimal contact with pesticide, lower risk of spills

Disadvantages

- Packet size may not match amount you need, if applying in pounds or gallons of active ingredient per acre might need lots of packets, packaging is sensitive to moisture and might dissolve if it gets wet before use

13

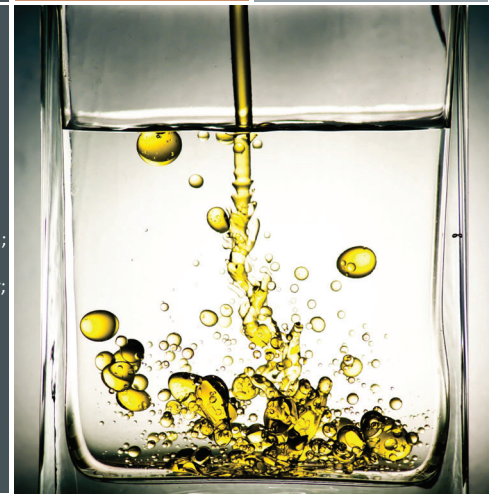
EMUSIFIABLE CONCENTRATE (EC)

Advantages

- Easy to pour, measure, transport & store; little agitation required when equip. is running; won't clog nozzles or screens; little visible residue

Disadvantages

- High concentration of a.i.; easy to over/underdose or cause calibration error; possible phytotoxicity; skin absorption; hard to clean spills; may have strong odor; solvents might damage rubber equipment parts (hoses, gaskets, etc.) or painted finishes; flammable



FLOWABLES (F), AQUEOUS FLOWABLES (AF)

Advantages

- Easy to handle, low exposure risk, not phytotoxic, lower chance of clogged nozzles or splashes

Disadvantages

- Need to shake before measuring & mixing, might settle, moderate agitation, may be abrasive to equipment, difficult to rinse product from container, visible residue on treated surface, spills are harder to clean up



SOLUTIONS: WATER-SOLUBLE CONCENTRATES (WSC), LIQUID CONCENTRATES (LC), SOLUBLE CONCENTRATES (SC)



Advantages

- Easy to handle, transport, store, pour and measure. No agitation, non-abrasive, don't clog screens or nozzles and no visible residue

Disadvantages

- Limited availability, especially water-based solutions, spills and splashes are difficult to cleanup and decontaminate, some are easily absorbed through skin

ULTRA LOW VOLUME (ULV)



Advantages

- Easy to handle, transport, store. Little to no agitation, not abrasive to equip., doesn't plug screens & nozzles, little visible residue

Disadvantages

- High drift hazard, easily inhaled & absorbed through skin, hard on equip. (hoses, gaskets, pumps), specialized equip., care during calibration & application due to concentrated form



AEROSOLS AND FOGGERS



OTHER FORMULATIONS

- Impregnates (insecticide treated ear tags, pet collars, pest strips)
- Animal systemics (external or oral pesticides to control fleas and ticks)
- Fumigant tablets
- Soil fumigants
- Microencapsulated
- Pesticide & fertilizer combos

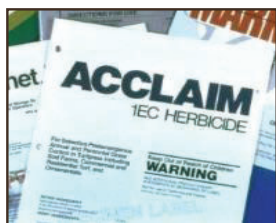


TABLE OF ABBREVIATIONS FOR COMMON FORMULATIONS

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

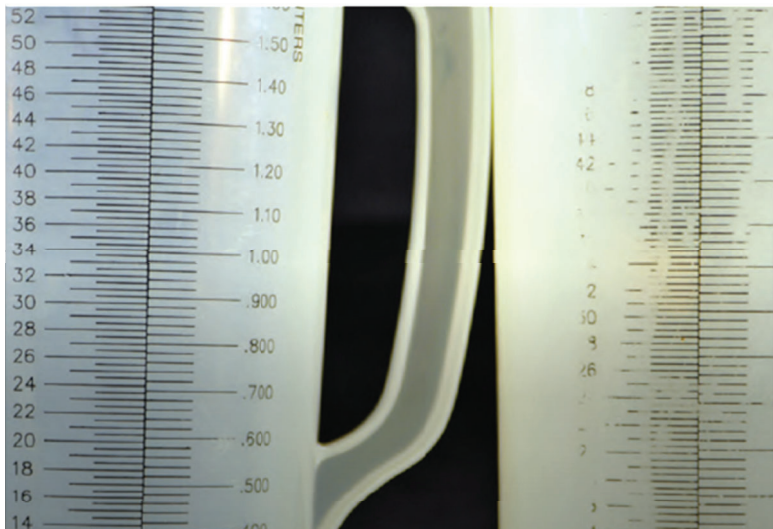
40DF
40% active ingredient
Dry Flowable

As pesticide manufacturers develop products that require smaller weights or volumes to treat larger areas, the importance of accurate measurement tools is essential.

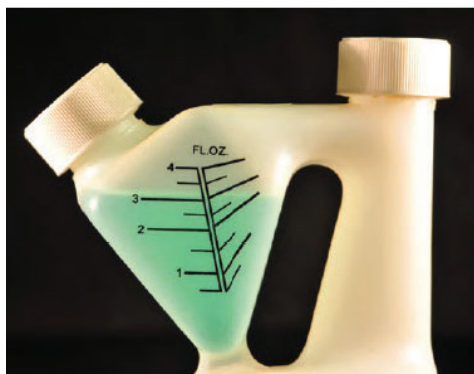


MEASURING PESTICIDES

OVERLOOKED STEPS TO GETTING THE CORRECT RATE.
(FROM PURDUE PESTICIDE PROGRAM BOOKLET "PPP-96")



REPLACE OLD OR UNUSABLE 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

Measuring Pesticides



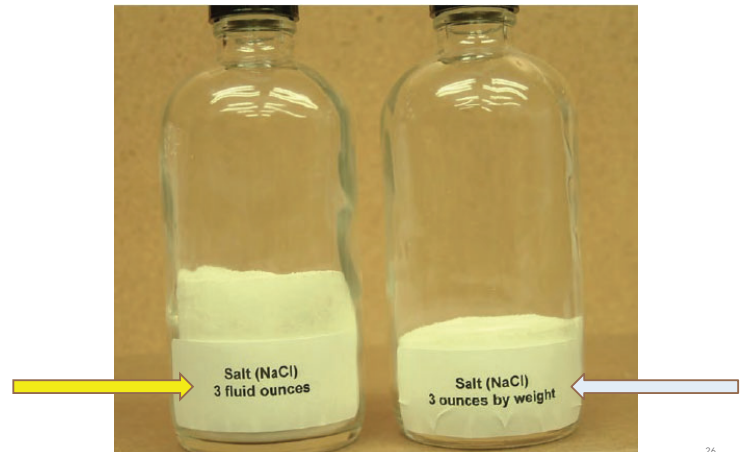
• Liquid Formulations



• Dry Formulations

25

Do You Notice a Difference?



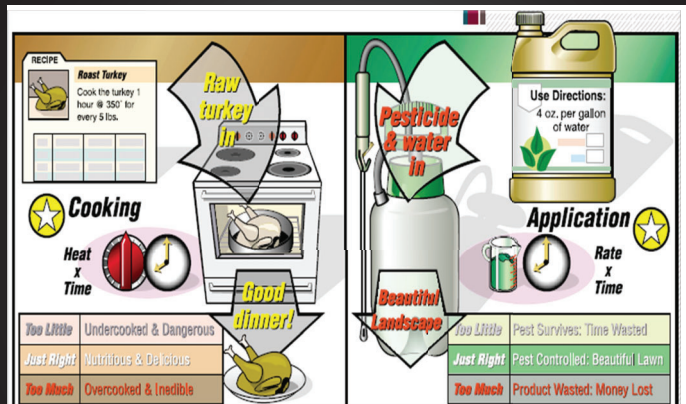
26



MEASURING DEVICES ATTACHED TO OR SENT WITH CONTAINERS

Use those provided by manufacturer

27

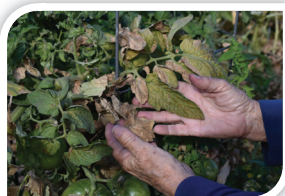


Analogy From Fred Whitford
Pesticide Education Program, Purdue University

28

Applying Too Much Pesticide. . .

- Might harm the soil, water, wildlife, plants, livestock, pets or people

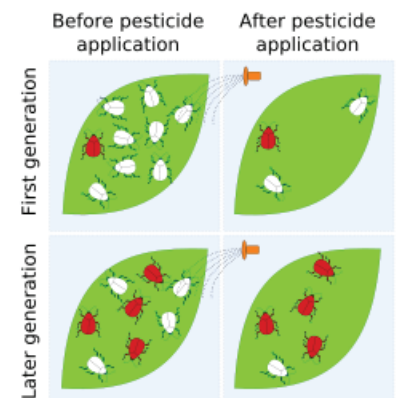


- Might result in illegal residue on treated area
- Could impact the restricted entry interval or harvest date

29

Applying Not Enough Pesticide. . .

- Might result in poor pest control
- Might lead to pesticide resistance
- Research shows that several factors can lead to resistance





Factors that impact the amount of product that is applied to the site:

Travel speed

Spray pressure

Swath Width

Flow Rate

Nozzle height

Tank Capacity

31

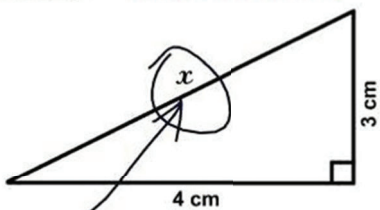
DIFFERENT APPLICATION METHODS

- Broadcast
- Air blast
- Crack and crevice
- In furrow/band
- Granular
- Backpack
- Chemigation
- Rubs, Brushing or dabbing on
- Baiting
- Fogging
- Tree injection
- Soil injection



OTHER FACTORS:

3. Find x. **MATH FAIL**



1000000

Orular Trauma - by Wade Clarke ©

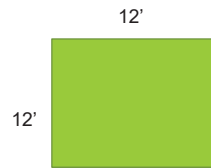
Perhaps math is not your strength.



Formulas for Measuring Treatment Sites

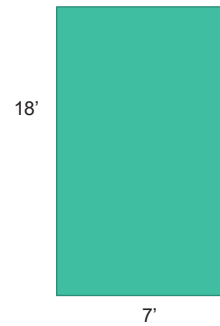
Calibration Activity

Determine the area of a square or rectangle



Formula

$$\text{Area} = \text{Length} \times \text{Width}$$



Items you will need: calculator, pencil and paper (optional)

2

Area of a Square

Formula

$$\text{Area} = \text{Length} \times \text{Width}$$



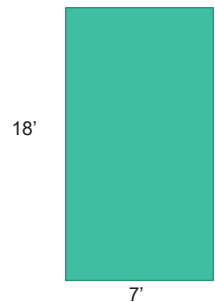
$$12 \times 12 = 144 \text{ ft}^2$$

Determine the Area of a Rectangle

Formula

$$\text{Area} = \text{Length} \times \text{Width}$$

$$18 \times 7 = 126 \text{ ft}^2$$



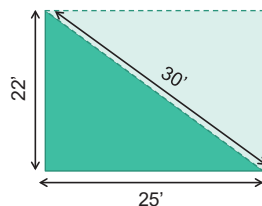
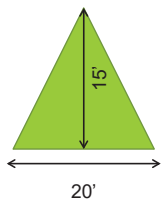
3

4

Determine the Area of a Triangle

Formula

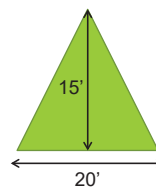
$$\text{Area} = \frac{\text{base} \times \text{height}}{2}$$



Determine the Area of a Triangle

Formula

$$\text{Area} = \frac{\text{base} \times \text{height}}{2}$$



Base =

Height =

$$20 \times 15 = 300$$

$$= \frac{300}{2} = 150 \text{ ft}^2$$

2

5

6

Determine the Area of a Triangle

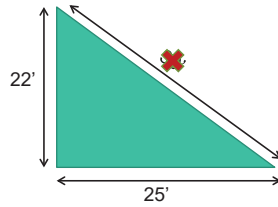
Formula

$$\text{Area} = \frac{\text{base} \times \text{height}}{2}$$

Base = Height =

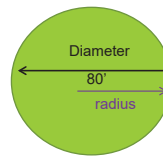
$$25 \times 22 = 550$$

$$\frac{550}{2} = 275 \text{ ft}^2$$



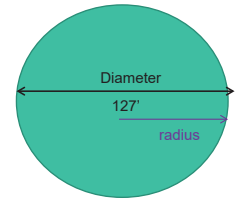
7

Determine the Area of a Circle



Formula

$$\begin{aligned} \text{Area} &= \pi r^2 \\ \pi &= 3.14 \\ r^2 &= \text{radius} \times \text{radius} \\ \text{radius} &= \frac{1}{2} \text{ of the diameter} \end{aligned}$$



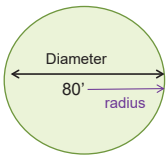
Formula

$$\text{Area} = d \times d \times (.785)$$

8

Determine the Area of a Circle – 1st Formula

Question: What is the radius?



Formula

$$\begin{aligned} \text{Area} &= \pi r^2 \\ \pi &= 3.14 \\ r^2 &= \text{radius} \times \text{radius} \\ \text{radius} &= \frac{1}{2} \text{ of the diameter} \end{aligned}$$

$$\frac{80}{2} = 40$$

$$40^2 = 40 \times 40 = 1600$$

$$\text{Area} = 3.14 \times 1600$$

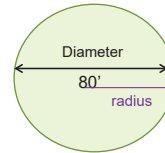
$$\text{Area} = 5,024 \text{ ft}^2$$

9

Determine the Area of a Circle – 2nd Formula

$$\text{Area} = d \times d \times (.785)$$

Question: What is the Diameter?



Formula

$$\text{Area} = d \times d \times (.785)$$

$$80 \times 80 = 6400$$

$$\times .785$$

$$= 5,024 \text{ ft}^2$$

10

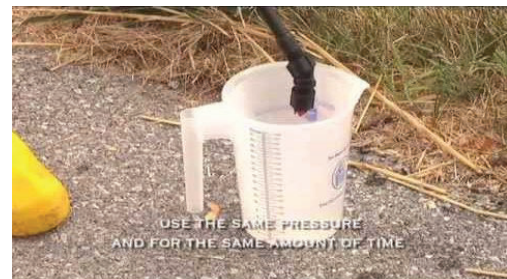


Calculating the Perimeter

$$120 + 44 + 120 + 44 = 328 \text{ feet}$$

11

Backpack Sprayer Calibration Video (note: up to 4:50)



<https://www.youtube.com/watch?v=XWQL6ppkDao>

12

Sorting Through Information in Calibration Story Problems

You determined from a calibration test that your boom sprayer delivers 8 gallons of water over a 0.25-acre (1/4 acre) test area. You need to apply pesticide to a 10-acre field. How much spray mixture is needed for the 10-acre application area?

What do I already know?

What do I want to know?

13

14

You determined from a calibration test that your boom sprayer delivers 8 gallons of water over a 0.25-acre (1/4 acre) test area. You need to apply pesticide to a 10-acre field. How much spray mixture is needed for the 10-acre application area?

You determined from a calibration test that your boom sprayer delivers 8 gallons of water over a 0.25-acre (1/4 acre) test area. You need to apply pesticide to a 10-acre field. How much spray mixture is needed for the 10-acre application area?

What do I already know?

What do I want to know?

Sprayer delivers 8 gallons of water over a 0.25-acre (1/4 acre) test area

How much spray mixture is needed for the 10-acre application area?

What do I already know?

What do I want to know?

Sprayer delivers 8 gallons per 0.25 acre.

How many gallons will your sprayer deliver for each acre?

How many 1/4 of an acre are in 1 acre?

There are 4, 1/4 acres in 1 acre.

8 gallons x 4 = 32 gallons per acre

15

16

You determined from a calibration test that your boom sprayer delivers 8 gallons of water over a 0.25-acre (1/4 acre) test area. You need to apply pesticide to a 10-acre field. How much spray mixture is needed for the 10-acre application area?

What do I already know?

What do I want to know?

8 gallons x 4 = 32 gallons/acre

How much spray mixture is needed for 10 acres?

32 gallons per acre x 10 acres

32 x 10 = 320

= You will need 320 gallons for the application area

One Down.

Two more problems to go.

17

18

From your calibration test, you determine that your backpack sprayer delivers 0.25 gallon of water to cover a 250 square foot test area. The label recommends applying pesticide at a rate of 6 ounces of product per gallon. How many ounces of product are needed to cover a 1,000 square foot application area?

What do I already know?

What do I want to know?

From your calibration test, you determine that your backpack sprayer delivers 0.25 gallon of water to cover a 250 square foot test area. The label recommends applying pesticide at a rate of 6 ounces of product per gallon. How many ounces of product are needed to cover a 1,000 square foot application area?

What do I already know?

Sprayer delivers 0.25 gallon of water to cover a 250 square foot test area.

What do I want to know?

From your calibration test, you determine that your backpack sprayer delivers 0.25 gallon of water to cover a 250 square foot test area. The label recommends applying pesticide at a rate of 6 ounces of product per gallon. How many ounces of product are needed to cover a 1,000 square foot application area?

What do I already know?

Sprayer delivers 0.25 gallon of water to cover a 250 square foot test area.

The label recommends applying pesticide at a rate of 6 ounces of product per gallon.

What do I want to know?

From your calibration test, you determine that your backpack sprayer delivers 0.25 gallon of water to cover a 250 square foot test area. The label recommends applying pesticide at a rate of 6 ounces of product per gallon. How many ounces of product are needed to cover a 1,000 square foot application area?

What do I already know?

Sprayer delivers 0.25 gallon of water to cover a 250 square foot test area.

The label recommends applying pesticide at a rate of 6 ounces of product per gallon.

What do I want to know?

How many ounces of product are needed to cover a 1,000 square foot application area?

From your calibration test, you determine that your backpack sprayer delivers 0.25 gallon of water to cover a 250 square foot test area. The label recommends applying pesticide at a rate of 6 ounces of product per gallon. How many ounces of product are needed to cover a 1,000 square foot application area?

What do I already know?

Sprayer delivers 0.25 gallon of water to cover a 250 square foot test area.

What do I want to know?

How many ounces of product are needed to cover a 1,000 square foot application area?

Question: How many times does 250 feet go into 1,000 square feet?

$$\frac{1,000}{250} = 4$$

From your calibration test, you determine that your backpack sprayer delivers 0.25 gallon of water to cover a 250 square foot test area. The label recommends applying pesticide at a rate of 6 ounces of product per gallon. How many ounces of product are needed to cover a 1,000 square foot application area?

What do I already know?

Review: How many times does 250 feet go into 1,000 square feet?

$$\frac{1,000}{250} = 4 \text{ times}$$

Review: sprayer delivers 0.25 gallon of water to cover a 250 square foot test area.

What do I want to know?

How many ounces of product are needed to cover a 1,000 square foot application area?

So, you multiplied 250 by 4 to get to 1,000 square feet. You also know that it takes 0.25 (or ¼) gallon for the 250 square foot area.

Therefore, you will also multiply 0.25 gallons by 4.

0.25 x 4 = 1 gallon needed to cover 1,000 ft²

From your calibration test, you determine that your backpack sprayer delivers 0.25 gallon of water to cover a 250 square foot test area. The label recommends applying pesticide at a rate of 6 ounces of product per gallon. How many ounces of product are needed to cover a 1,000 square foot application area?

What do I already know?

1 gallon needed to cover 1,000 ft²

The label recommends applying pesticide at a rate of 6 ounces of product per gallon.

What do I want to know?

Now it says that you apply 6 ounces of product for each gallon.

You know you need 1 gallon.

6 ounces x 1 gallon
= 6 ounces

25

Two Down.

One more problem to go.

You have calibrated your equipment to spray 50 gallons per acre. You need to spray 1 acre. The label calls for 3 pounds of formulation per 100 gallons of water. How much formulation should you add to the tank in order to make 50 gallons of finished spray?

What do I already know?

What do I want to know?

27

You have calibrated your equipment to spray 50 gallons per acre. You need to spray 1 acre. The label calls for 3 pounds of formulation per 100 gallons of water. How much formulation should you add to the tank in order to make 50 gallons of finished spray?

What do I already know?

You have calibrated your equipment to spray 50 gallons per acre.

What do I want to know?

28

You have calibrated your equipment to spray 50 gallons per acre. **You need to spray 1 acre.** The label calls for 3 pounds of formulation per 100 gallons of water. How much formulation should you add to the tank in order to make 50 gallons of finished spray?

What do I already know?

You have calibrated your equipment to spray 50 gallons per acre.

You need to spray 1 acre.

What do I want to know?

29

You have calibrated your equipment to spray 50 gallons per acre. You need to spray 1 acre. **The label calls for 3 pounds of formulation per 100 gallons of water.** How much formulation should you add to the tank in order to make 50 gallons of finished spray?

What do I already know?

You have calibrated your equipment to spray 50 gallons per acre.

You need to spray 1 acre.

The label calls for 3 pounds of formulation per 100 gallons of water.

What do I want to know?

30

You have calibrated your equipment to spray 50 gallons per acre. You need to spray 1 acre. The label calls for 3 pounds of formulation per 100 gallons of water. How much formulation should you add to the tank in order to make 50 gallons of finished spray?

What do I already know?

You have calibrated your equipment to spray 50 gallons per acre.

You need to spray 1 acre.

The label calls for 3 pounds of formulation per 100 gallons of water.

What do I want to know?

How much formulation should you add to the tank in order to make 50 gallons of finished spray?

You have calibrated your equipment to spray 50 gallons per acre. You need to spray 1 acre. The label calls for 3 pounds of formulation per 100 gallons of water. How much formulation should you add to the tank in order to make 50 gallons of finished spray?

What do I already know?

You have calibrated your equipment to spray 50 gallons per acre.

You need to spray 1 acre.

What do I want to know?

Therefore, you only need 50 gallons to spray the one acre.

You have calibrated your equipment to spray 50 gallons per acre. You need to spray 1 acre. The label calls for 3 pounds of formulation per 100 gallons of water. How much formulation should you add to the tank in order to make 50 gallons of finished spray?

What do I already know?

The label calls for 3 pounds of formulation per 100 gallons of water.

What do we want to know?

How much formulation should you add to the tank in order to make 50 gallons of finished spray?

The label calls for:

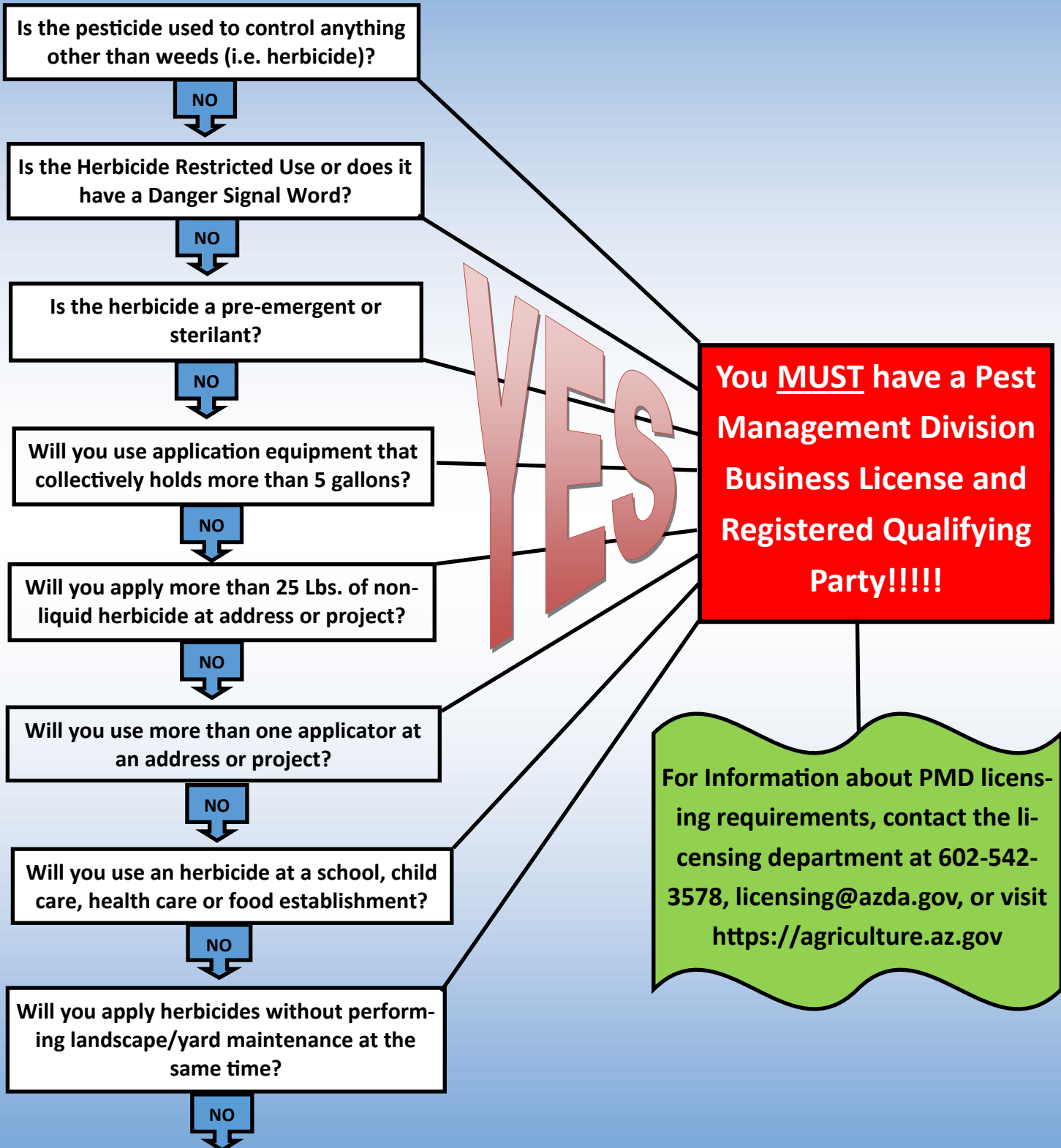
3 pounds of formulation for 100 gallons

Since you only need half of that (50 gallons), divide 3 by 2 (or multiply by 0.50)

You need = 1.5 pounds of formulation



I'm a landscaper / gardener. Can I apply pesticides without being licensed?



You may apply herbicides in accordance with the PMD's Landscaper exemption. For details contact the PMD at 602-542-4373 or visit <https://agriculture.az.gov>