Pesticide use and safety

Master Gardener Fall Training Series 2022

Oregon State University
Extension Service
Douglas County

1

Disclaimer

- OSU Extension Service does not endorse or recommend the use of any of the products listed or mentioned in this module.
- Product trade names are listed purely to provide examples of certain types of pesticides that you may come across in your home and garden store.
- The information in this presentation shouldn't be regarded as a substitute for professional consultation.

2

Why should I care about pesticides?

- A pesticide may be the best or only choice
- Pesticides can be used to avoid worse problems
- Making informed management choices
- Knowing how handle and dispose of pesticides safely increases efficacy and decreases mystery around pesticides

3

Before Using Pesticides

- IPM steps review:
  - Scout your plants
  - Identify the problem
  - Establish an injury threshold
  - Evaluate appropriate management steps
  - Manage using all available strategies
    - Cultural control
    - Physical control
    - Biological control
    - Chemical control

    (In this order!)

4

Pesticide Recommendations - OSU policy

- Oregon State University Extension Service encourages **Sustainable Gardening** practices.
  - Always identify and monitor problems before acting
  - Then consider **cultural** controls
  - Then **physical** controls
  - Then **biological** controls
  - And finally **chemical** controls (always consider the least toxic approach first)
- *How would you describe this approach to pest management? Integrated*

5

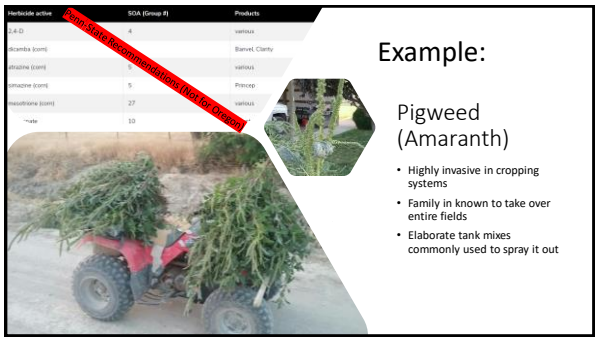
What is a pest?

Pests can be
- insects
- mice, deer and other animals
- unwanted plants (weeds)
- microorganisms (fungi, bacteria and viruses)

Pests are living organisms out of place.

-Photo: Dan Roby Lab, OSU -

6



Example:

Pigweed (Amaranth)

- Highly invasive in cropping systems
- Family in known to take over entire fields
- Elaborate tank mixes commonly used to spray it out

7

Pigweed (Amaranth)

- Some species/varieties edible
- $9-10/lb
- Traditional food source in some places

8

What is a pesticide?

US Environmental Protection Agency definition

A pesticide is:

- Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.
- Any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) of 1947

9

History of pesticides

10

The Etymology of Pesticides

Insecticide — 1865 (Paris Green)

Herbicide — 1888

Fungicide — 1889 (Bordeaux Mixture)

Pesticide — 1939

(from etymonline.com)

11

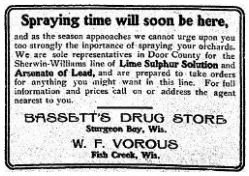
The Original Rogue Valley Golf Course—1911

The names for the nine holes with the bogies have been selected as follows:

Hole	Name	Bogy
1	Wooly Aphis	5
2	Thrips	5
3	Anthracnose	5
4	Blight	4
5	Scale	4
6	Slug	6
7	Borer	5
8	Blistermite	5
9	Codling	4

From: Medford Sun, 30 June 1911, p. 1:3.

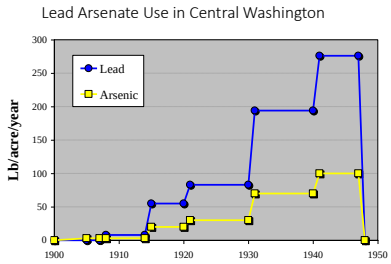
12



Ad for Sherwin-Williams pesticides from the 1911 Door County Democrat. Today, about 3.9% of the land in the county is classified as "impaired" by the local government due to persistent contamination of the soil and groundwater.

[from Wikipedia]

13



14

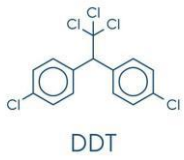
Ecology and Pest Control

Forbes. 1915. The ecological foundation of applied entomology. *Ann. Ent. Soc. Am.* 8:1-19

Hoskins, Borden & Michelbacher. 1939. Recommendations for a more discriminating use of insecticides. *Proc. 6th Pac. Sci. Cong.* 5:119-23

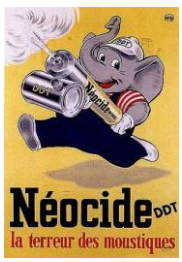
Michelbacher. 1945. The importance of ecology in insect control. *JEE* 38:129-30

15



Dichlorodiphenyltrichloroethane

16



Néocide – the original 5% **DDT** dust formulation

17

JOURNAL OF ECONOMIC ENTOMOLOGY
Official Organ American Association of Economic Entomologists
CONTENTS

Table of Contents from the Journal of Economic Entomology April 1945 (Vol. 38, No. 2)

18

Twospotted spider mite

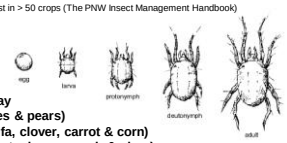
- *Tetranychus urticae*

19

Spider Mites — Pest Status

Listed as a pest in > 50 crops (The PNW Insect Management Handbook)

- **Mint**
- **Hops**
- **Grapes**
- **Hazelnuts**
- **Christmas trees**
- **Timothy grass hay**
- **Pome fruit (apples & pears)**
- **Seed crops (alfalfa, clover, carrot & corn)**
- **Stone fruit (apricot, cherry, peach & plum)**
- **Various ornamental, nursery & landscape plants**
- **Vegetable crops (beans, beets, cucumber, potato, squash, etc.)**
- **Berry crops (strawberries, caneberries, currants & gooseberries)**



20

Synthetic Insecticides
broad spectrum neurotoxins

Organochlorines (DDT, chlordane)

Organophosphates (parathion, chlorpyrifos)

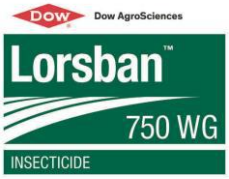
Carbamates (carbaryl, aldicarb)

Pyrethroids (permethrin, deltamethrin)

21

1972

1988



2021 (for food crops)

22

Supervised Control
Integrated Control
Integrated Pest Management

23

Integrated Control

First use in print: Michelbacher & Bacon. 1952. Walnut insect and spider mite control in Northern California. *JEE* 38:129-30

Concept is developed: Smith & Allen. 1954. Insect control and the balance of nature. *Sci. Am.* 190(6):38-92

Seminal article: Stern, Smith, van den Bosch & Hagen. 1959. The integrated control concept. *Hilgardia* 29: 81-101

24

Integrated Control

Seminal article:

Stern, Smith, van den Bosch & Hagen. 1959. The integrated control concept. *Hilgardia* 29: 81-101

"Without question, the rapid and widespread adoption of organic insecticides brought incalculable benefits to mankind, but it has now become apparent that this was not an unmixed blessing,"

25

Integrated Control

Annual Review article:

van den Bosch & Stern. 1962. The integration of chemical and biological control of arthropod pests. *Annu. Rev. Ent.* 7: 367-86

"There are problems inherent in the use of the widely toxic, synthetic, organic insecticides. They cannot be ignored or wished away, but must be attacked and wherever possible, corrected."

26

"We have put poisonous and biologically potent chemicals indiscriminately in the hands of persons largely or wholly ignorant of their potential for harm."

1962—Silent Spring (Rachel Carson)

27

TREE FRUIT IPM IN SOUTHERN OREGON — PETER WESTIGARD

CLASSIC STUDY IN IPM

LEFT A BLOCK UNSPRAYED FOR 10 YEARS—1962-71

TREATED WITH NORMAL HORTICULTURAL PRACTICES

ANNUAL PESTS	MINOR PESTS	INDUCED PESTS
CODLING MOTH	LEAFROLLERS	PEAR PSYLLA
SAN JOSE SCALE	TRUE BUGS	SPIDER MITES
PEAR RUST MITE	(e.g. LYGUS)	

28

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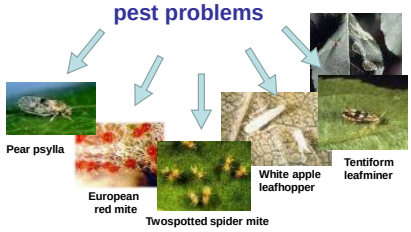
30

Disruption of naturally occurring biological control leads to secondary pest problems



31

HUFFAKER PROJECT —1972-78

Funding: NSF and EPA

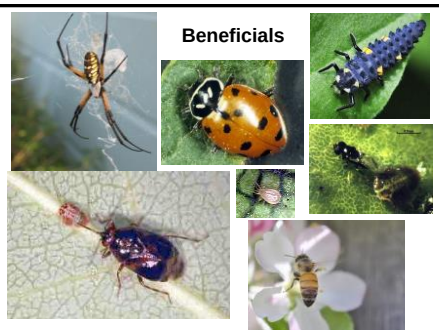
Involved: 19 Land Grant Universities, ARS, and USFS

Studied 6 cropping systems:

- Alfalfa
- Citrus
- Cotton
- Pome and Stone Fruit
- Soybeans
- Pine Trees

32

Beneficials



33

POME FRUIT IPM—RESEARCH & EXTENSION

- **Resistance Monitoring**
- **Pest Development and Phenology Models**
- **Economic Thresholds and Sampling Protocols**
- **Evaluating Control Methods**
- **Formulating and Testing Alternative Tactics**
- **Implementation on a Commercial Scale**

34

Codling Moth IPM

Phenology models for predicting development—egg hatch etc.

Monitoring systems for measuring population levels and trends

Treatment thresholds—correlating population level with crop damage

Selective controls—can target the key pest without disrupting biocontrol for other pests

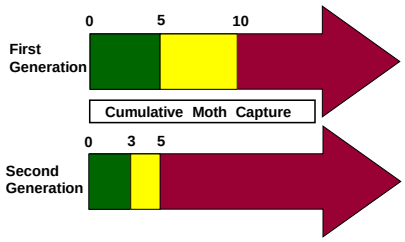
35

Codling Moth Trap

36

Treatment Thresholds

Visual inspections exceed allowable injury at any location. Borders and problem areas should be sampled separately.



37

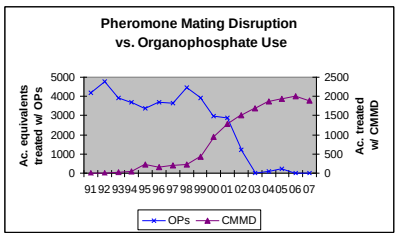
Pear IPM in Southern Oregon — Peter Westigard

Developing a Selective Program for Pears

- Insect Growth Regulators – IGRs (e.g. Dimilin)
- CM Mating Disruption 1979-80—w/ Hal Moffitt
- CM Granulosis Virus 1981-82—w/ Stan Hoyt

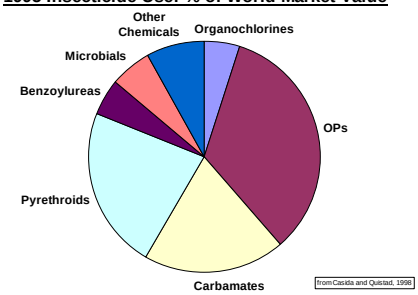
38

Growers have moved from toxic insecticides to alternative control methods



39

1995 Insecticide Use: % of World Market Value



40

Three Eras of the Insecticidal Age

- **Pre-Synthetic Era (1865-1945)**
  Inorganic compounds: Paris green, lead arsenate, sulfur; Oils; Soaps; Botanicals
- **Broad Spectrum Era (1945-current)**
  Synthetic broad spectrum neurotoxins: organochlorines, organophosphates, carbamates, pyrethroids, neonicotinoids
- **Selective Era (current-future)**
  New chemistries: selective neurotoxins, metabolic poisons, insect growth regulators; Microbials; GMOs; Behavioral methods

41

1993 — Initial Field Test of Imidacloprid In Southern Oregon Pears

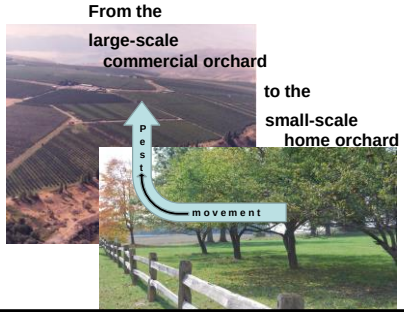
Material and Rate per Ac. [Note: NTN 33893 = imidacloprid]	Post treatment mean # spider mites per leaf
Check	24.7 b
NTN 33893 240 FS 236 mls	85.2 d
NTN 33893 240 FS 236 mls Plus spray oil at 0.25%	52.7 c
Agrimek 0.15 EC 118 mls Plus spray oil at 0.25%	8.8 a

42

2013 — Insecticide Comparison
Effect on Twospotted Spider Mite

Material and Rate per Ac.	# spider mites per shoot leaf (7/23)
Check	0.13 b
Spinosyn (spinetoram) — Delegate 6.5 oz	0.35 b
Neonicotinoid (acetamiprid) — Assail WP 3.4 oz	9.33 a
Pyrethroids (esfenvalerate then lambda cyhalothrin) — Asana 14.5 oz and Warrior 5.12 oz	1.40 b

43

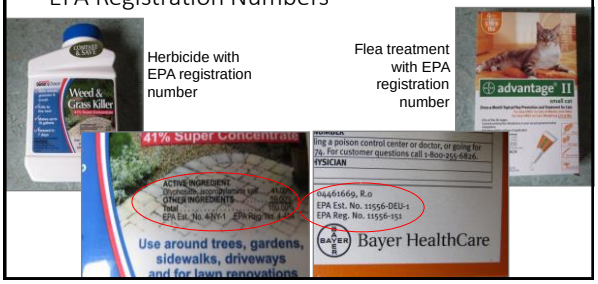


44

Understanding pesticides today

45

EPA Registration Numbers



46

What is not regulated?

- Adjuvants
- Minimum Risk Pesticides
  - No EPA registration number
  - Must be labeled with
    - Name and weight percent of each active ingredient
    - Name of each inert ingredient
    - Examples: aromatic oils, corn gluten meal, putrescent whole egg solids, citronella

47

Types of pesticides

- **ALL of these are PESTICIDES**
- **"cide" means "kill"**

- Acaricides/Miticides
- Bactericides
- Fungicides
- Herbicides
- Plant Growth Regulators (PGRs)
- Insecticides
- Larvicides
- Molluscicides
- Nematicides
- Rodenticides
- Scalecides

also

- Repellents

48

What is not a pesticide?

- Drugs used to control diseases of humans or animals
  - (U.S. Food and Drug Administration)
- Fertilizers, nutrients, and other substances used to promote
  - plant survival and health
- Biological control agents (except some microorganisms)
  - includes beneficial insects that eat insect pests.)
- Products which do not have to be registered as pesticides, as they contain certain low-risk ingredients:(for a complete list see FIFRA Sec. 152.25 (g))
  - citronella
  - citric acid
  - corn gluten meal
  - garlic and garlic oil
  - mint and mint oil
  - rosemary and rosemary oil
  - thyme and thyme oil
  - zinc metal strips

49

Pesticide Use in Perspective

- USA: 74-90% of households utilize pesticides on an annual basis (Whitmore et al. 1994; Landrigran et al. 1999, Fishel 2007)
- Oregon: 46% of households used pesticides in 2007 (PURS 2008)
- Portland Metro: 29% of households used lawn and garden pesticides and 17% used indoor pesticides (Peters et al. 2007)

50

Oregonians using pesticides?

- Pesticide use is generally underreported, and risk perception is generally underestimated (Nieuwenhuijse et al. 2005)
- PURS (Oregon's Pesticide Use Reporting System)
  - Survey "*participants were unable to determine what products were pesticides*"
  - "*continued concerns about the ability of pesticide users to read the label and correctly identify information*"
  - "*Moss control products accounted for 47% of the pounds of active ingredient, but only 2% of the reports identified moss control as the purpose*"

51

Why Learn About Pesticides?

- Educate growers so they can choose wisely
- A pesticide may be the best or only choice
- Holistic view of all options
- Provide information that is descriptive, not prescriptive
- Safe handling and disposal
- DON'T calculate application rates for growers– Send them to the appropriate extension agent

52

Pesticide Formulations

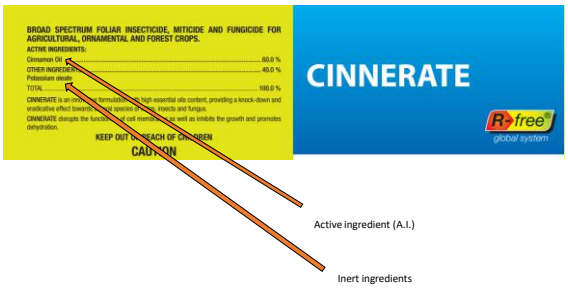
The formulation describes the physical state of a pesticide product. It is comprised of:

- **active ingredients**(s) (ai)
- solvent
- dry carrier
- adjuvant

} "Inert" ingredients

The formulation of a pesticide can have significant implications for safety and effective use

53



54

Pesticide Formulations

Liquids
- ✓Emulsifiable concentrate (EC)
- ✓Solution (S)
- ✓Flowable (F)
- ✓Aerosols

Solids
- ✓Dust (D)
- ✓Pelletized bait
- ✓Flowable (F)
- ✓Granule (G)
- ✓Wettable powder (WP)
- ✓Soluble powder (SP)
- ✓Water Dispersal Granule (WG-WDG)

Others?
Ready to Use (RTU)

55

Ready-to-Use vs. Concentrate

Pesticides that are pre-mixed or packaged in containers that double as applicators.
- Fewer steps
- No measuring and mixing
- Less chance of mistakes

Pesticides that must be measured and mixed by user
- Better for larger areas

56

57

Different Packaging

These all have the same active ingredient, but (from left to right) one is Ready to Spray (attach to a hose), one is a liquid concentrate, and one is Ready to Use.

58

Pesticide Terminology

- Commercial / Home use
- Hard/Soft
- Organic / Synthetic
- Broad / Narrow spectrum (Non-selective/Selective)
- Short term / Residual
- Contact / Systemic
- Curative / Protectant
- Pre-emergent / Post-emergent

59

Mode of Action

- Contact
  - pesticide must be sprayed directly on the target (weed, disease, insect, etc.).
- Systemic
  - pesticide can be translocated throughout the target plant to either protect it (fungicides, insecticides) or kill it (herbicides).
- Residual
  - pesticide will persist after application, offering control for a period of time (Casoron, *B. t*).

60

Pre-emergent vs. Post-emergent

- Applied prior to seedling emergence
- Prevents germination of seeds
- Can be applied over entire site before crop is seeded or plants planted
- Can be applied around perennial plants to prevent annual seedlings

- Applied after seedling emergence (weeds *or* plants)
- Controls actively growing plants
- Needs careful application
  - Roundup™ (a.i. glyphosate)

61

Curative vs. Protectant

- Corrects existing problem - can kill target pests if present
  - Quintec (quinoxyfen)

- Prevents problem from occurring - protects healthy plant parts from attack by pest organisms
  - Micronized Sulfur

62

Mode of Action

- Non-selective
  - provides broad-spectrum control of pest organisms (i.e. Roundup)
- Selective
  - targets specific organisms while doing no harm to many other organisms that may be present (i.e. Weedar 64).

63

Contact Herbicide: Caprylic acid and Capric acid (OMR

- Fatty-chain acids
- In high enough concentration to be damaging to plants and to humans (44% Caprylic, 36% Capric for HomePlate® herbicide)
- Burn Down, post emergent
- Causes Leakage and desiccation of cells
- Can damage some hardier plants (e.g., Purslane)

64

Commercial & vs. Home

Restricted Use Pesticides (RUPs)

- May be packaged in large quantities

General/Home Use Pesticides

- Not designated as RUP
- Available in small packaging

65

Organic vs. Synthetic

- Derived from an organic source
- Biodegrades rapidly
- Varying levels of toxicity

3 Classes

- Botanicals
  - Pyrethrum
  - Neem™
- Microbials
  - Bt sprays
- Naturalytes
  - Spinosad™

Neem Oil

- Manufactured via chemical reactions
- May persist in environment

Synthetic Pyrethroid

66

Organic ≠ Safe

Rotenone

- Organic pesticides may be just as toxic, or more toxic than, synthetics.
- Rotenone may only be used to kill fish
- Derived from Lonchocarpus heptaphyllus

67

Pesticide Hazards

Some pesticides are very toxic.

What is the *risk* involved in using them?

Risk = toxicity x exposure

68

Pesticide Hazards

Zero exposure = zero risk

High toxicity x good management
= Low risk

Low toxicity x poor management
= High risk hazard

69

How is toxicity determined?

- Acute toxicity is usually determined by animal testing.
- LD_{50} stands for "lethal dose fifty."
  - This is the dose that killed half of the animals in a dose-response study.
  - The smaller this number, the more poisonous the pesticide.

70

Examples of LD_{50}

Number is LD50 in mg of substance per kg of body weight for mice or rats

- table salt 3750 mg/kg
- aspirin 1750 mg/kg
- diazinon 1250 mg/kg
- imidacloprid 450 mg/kg
- carbaryl 250 to 850 mg/kg
- caffeine 150 to 200 mg/kg
- nicotine 55 mg/kg

The smaller this number, the more poisonous the substance.

71

How Much is that for a 175 lb. person

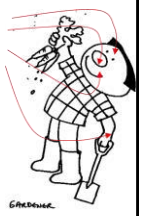
- table salt 3750 mg/kg = 1.5 to 2 cups
- aspirin 1750 mg/kg = 350 aspirin
- Diazinon 1250 mg/kg
- caffeine 200 mg/kg = 160 cups
- Rotenone 130 mg/kg
- nicotine 55 mg/kg = 25-55 cigarettes



72

Routes of Entry

- There are 4 main routes:
  - **Dermal**
  - **Ocular**
  - **Inhalation**
  - **Oral**
- Dermal & inhalation are the most common routes of pesticide exposure.



- If exposed, contact the Poison Control Center at **1-800-222-1222**

73

Pesticide Hazards

Toxicity can be:

Acute – damage resulting from a single exposure

Chronic - damage resulting from long-term (repeated) exposure

74

Signal Words

	Caution (Cat. IV)	Caution (Cat. III)	Warning (Cat. II)	Danger (Cat. I)
Oral LD_{50} in mg/kg	> 5000	500-5000 harmful	50-500 may be fatal	< 50 **fatal**
Inhalation LD_{50} in mg/l	> 20	2-20 harmful	0.2-2 may be fatal	< 0.2 **fatal**
Dermal LD_{50} in mg/kg	> 5000 Mild Irritation	2000-5000 Moderate Irritation	200-2000, Severe Irritation may be fatal	< 200 **Corrosive, irreversible, fatal**
Eye Effects	No Irritation	Reverses in 7 days	More than 7 Days	**Corrosive, irreversible**

75

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Dermal LD_{50} in mg/kg	> 5000 Mild Irritation	2000-5000 Moderate Irritation	200-2000, Severe Irritation may be fatal	< 200 **Corrosive, irreversible, fatal**
Eye Effects	No Irritation	Reverses in 7 days	More than 7 Days	**Corrosive, irreversible**

78

Signal Words

	Caution (Cat. IV)	Caution (Cat. III)	Warning (Cat. II)	DANGER Danger – Poison (Cat. I)
Oral LD_{50} in mg/kg	> 5000	500-5000 harmful	50-500 may be fatal	< 50 **fatal**
Inhalation LD_{50} in mg/l	> 20	2-20 harmful	0.2-2 may be fatal	< 0.2 **fatal**
Dermal LD_{50} in mg/kg	> 5000 Mild Irritation	2000-5000 Moderate Irritation	200-2000, Severe Irritation may be fatal	< 200 **Corrosive, irreversible, fatal**
Eye Effects	No Irritation	Reverses in 7 days	More than 7 Days	**Corrosive, irreversible**

79

Risk

- **Risk = toxicity x exposure**
  - Low toxicity x poor management = **High risk**
  - High toxicity x good management = **Low risk**
  - Zero exposure = **zero risk**

The toxicity of a pesticide can't be changed, but risk can be managed by the person applying it

80

Prevent Pesticide Poisoning

- Never store pesticides in food containers
- Keep in original container unless actively spraying
- Keep pesticide labeled with product name and EPA registration number
- Store pesticides in locked cabinets that are inaccessible to pets and children
- Post emergency phone numbers in a prominent place
- If pesticide exposure or ingestion occurs, call 1-800-222-1222 or 911 immediately

81

How should you store pesticides?

- Locked area
- Ventilated
- In their original labelling
- Stable temperatures (40-90 F°)
- Never store in application equipment
- Off the ground, but close to ground level if possible

82

Common Symptoms of Pesticide Poisoning

Mild or early symptoms:
Headache
Fatigue, Weakness
Dizziness
Restlessness
Nervousness
Perspiration
Nausea
Diarrhea
Loss of appetite
Loss of weight
Thirst
Moodiness
Joint soreness
Irritation of skin, eyes, nose, throat

Moderate symptoms:
Nausea
Diarrhea
Excessive saliva
Stomach cramps
Excessive perspiration
Trembling
No muscle coordination
Muscle twitches
Extreme weakness
Mental confusion
Blurred vision
Difficulty in breathing
Cough
Rapid pulse
Flushed or yellow skin
Weeping

Severe symptoms:
Fever
Intense thirst
Increased rate of breathing
Vomiting
Uncontrollable muscle twitches
Pinpoint pupils
Convulsions
Inability to breathe
Unconsciousness

83

If Pesticide Poisoning Occurs

- Read labels carefully prior to use so that you know what to expect and how symptoms may be treated
  - Statement of practical treatment
- If you get pesticide in eyes or on skin, immediately flush with water
- Call 911 for immediate medical attention
  - Statement of practical treatment
  - EPA Registration number
- If you notice any unusual symptoms, call National Poison Control Center: **800-222-1222** for trained medical attention
  - Keep label accessible
    - EPA registration number and product name

84

The Pesticide Label

Contains information essential for effective, safe, and legal use of product.

"The label is the law."

85

A legal document which describes:

- Ingredient(s) of the product.
- Indicates level of toxicity.
- Approved uses of the product.
- Application rates
- Environmental hazards of its use

86

The elements of a pesticide label:

- Brand name
- Common name
- Chemical name
- Ingredient statement
- Type of formulation
- Net contents
- Name & address of manufacturer
- Environmental hazards
- Physical & chemical hazards
- Signal words & symbols
- Statement of practical treatment
- Directions for use
- Pre-harvest interval

87

- Precautionary statements
- Route of entry statements
- Specific action statements
- Hazards to wildlife

88

- Environmental hazards
- Special toxicity statements
- General environmental statements
- Physical or chemical hazards

89

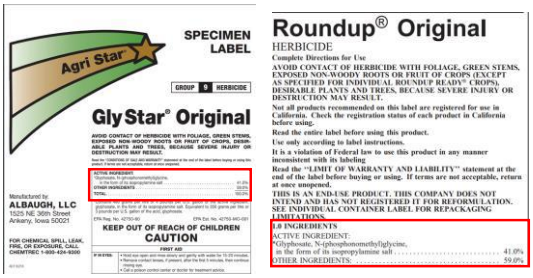
- Personal Protective Equipment (PPE)
- Other precautionary statements
- First aid or statement of practical treatment

90

Brand, Common and Chemical Names

- Different manufacturers may market the same active ingredient under different brand names.
- Do not choose products by brand name alone. Read the active ingredients on the label.

91



92

- P
- A

93

94

95

Common Label Violations

If one glug is good, two is better.

- If the label says it works great in the driveway it should be dynamite in the garden
- If it says to use it every 2 weeks, it should work even better every week
- There's just a bit left over, I'll pour it down the drain.
- Gloves are for wimps

96

What *is* allowed

- apply at a dose, concentration or frequency less than that listed on the label, but never more!
- apply a pesticide for a pest not listed on the label if the plant or other target is listed.
- use any appropriate equipment not specifically prohibited by the label.
- mix with pesticide(s) &/or fertilizer(s) not specifically prohibited.

97

The pesticide label

When should you read the pesticide label?

- Before **purchasing** the product.
- Before **using** the product.
- Before **storing** the product.
- Before **disposing** of the product or empty container.

98

Personal Protective Equipment

- Apparel and devices worn to protect the body from contact with pesticides.
- Most of a pesticide spilled on the skin is absorbed in the first few minutes
- You are legally required to follow all PPE instructions on the label.
- Some label listings are activity-specific, such as for mixing & loading.

99

Personal Protective Equipment (PPE)

- pants
- long-sleeves
- gloves
- shoes or boots
- goggles
- face mask
- hat
- protective outerwear

100

Pesticide Sensitivity

Absorption of parathion by various body parts

Body Part	Relative rate
Forearm	1.0
Abdomen	2.1
Scalp	3.7
Forehead	7.0
Genital area	11.8

101

Body Protection

- Always wear a long-sleeved shirt & long-legged pants & recommended PPE.
- An apron may be required during mixing.

102

Head & Neck

- A chemical-resistant hood or wide-brimmed hat will help keep pesticides off your head, neck, eyes, mouth & face.
- Plastic "safari" hats with plastic headbands work well and are relatively cool.

103

Personal Protective Equipment (PPE)

Several types of coats made of different fabrics, with and without hoods

104

Respiratory Tract

- If the label directs you to wear a respirator, you must, and it must be NIOSH/MSHA approved
- NIOSH/MSHA approval number prefixes:
  - TC-21C for dust/mist masks
  - TC-23C for vapor cartridges
  - TC-14G for vapor canisters

105

Eyes

- PPE for eyes include goggles, face shields and safety glasses with shields over brow & on sides.
- Goggles or glasses work well with half-face respirators.

106

107

Hands & Feet

- Wear waterproof gloves any time you may get pesticides on your hands.
- Chemical-resistant hand and footwear may be required.
- Keep at least one extra pair of gloves and footwear available in case of contamination.
- If you must remove your gloves during a handling activity, wash your gloves before removing them.

108

Gloves and Liners OK

109

Use Water Resistant Boots

110

Shoe or boot coverings

111

Choosing PPE

- Read the label.
- Label will commonly require "long-sleeved shirt and long pants" (not defined as PPE).
- PPE include:
  - Coveralls
  - Chemical resistant suits, gloves, footwear
  - Protective eyewear
  - Respirators

112

Application Equipment

- There are several types of application equipment.
- You should choose equipment that allows you to make safe and effective pesticide applications.




113

Application Equipment - Sprayers

114

Hose-end Sprayers

- Hose-end sprayers are proportioners that mix a concentrated pesticide with water and emit a spray of diluted pesticide.
- These may be very useful when making applications to the ground with high volumes of water.
- This type of sprayer may be the only non-mechanical way of spraying trees and large shrubs.

115

When using a hose-end sprayer:

Place anti-siphon device between sprayer and water source to prevent back siphoning of pesticides into your water system.

116

Compression Sprayers

Pressurized with a hand-operated pump.

Require agitation and uniform tank pressure for effective spray application.

With tank capacities of more than ~ 1.5 gallons, you should consider a backpack sprayer.

May not be suitable for spraying large shrubs and trees.

117

Backpack Sprayers

- Larger capacity
- Tend to be more comfortable
- Operate off hand pressure or battery powered pressure
- More mobile than some other options
- Nozzles can be replaced/switched out

118

Mixing & Loading

- Requires extra precautions
  - breezes
  - pesticide is in concentrated form
  - don't leave tank unattended
  - eating, drinking, smoking
- Follow the label directions each time you mix pesticides. Labels change!

119

Calibration & Calculating Amounts

120

Calibration & Calculating Amounts

Two common types of applications:

Apply to wet the plant or foliage.

Apply to cover a surface of known area.

121

Calibration & Calculating Amounts

To apply the correct amount of pesticide, you need to know:

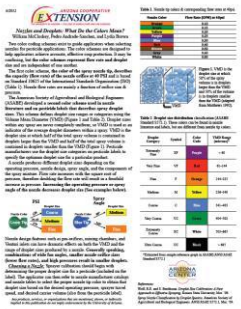
How much of the pesticide to apply per unit of area.
How large the area is.
How much liquid your sprayer puts out per unit of area.

The output volume depends on:

pressure
nozzle size
nozzle height
walking speed

calibration

122



https://www.mssoy.org/uploads/files/arizona-coop-ext.pdf

123

Calibrate sprayer for Small spaces- 1000 ft² Method

- Measure out 1000 ft² (20x50 feet)
- Using WATER ONLY, fill your backpack sprayer halfway
- Time yourself spraying the marked off area
- Once finished, fill the sprayer back up to halfway
- Spray water into a measuring cup for the same period of time it took to spray
- Record the Oz. Sprayed, and repeat 3 times
- Average the three: Oz./1000 ft² determined

124

Example: determine how much to spray

- Sprayer output: 57 Oz/1000 ft²
- Label rate: 2 Oz Chemical/ 1000 ft²
- Area to treat: 2600 ft²

125

Example: determine how much to spray

1. To determine the total spray mixture needed, set up the following ratio and cross multiply:

$$\frac{57 \text{ oz.}}{1{,}000 \text{ sq. ft.}} = \frac{X \text{ oz.}}{2{,}600 \text{ sq. ft.}}$$

X = 148.2 oz. (round off to 148).

2. To determine the amount of herbicide needed, set up the following ratio and cross multiply:

$$\frac{2 \text{ oz.}}{1{,}000 \text{ sq. ft.}} = \frac{X \text{ oz.}}{2{,}600 \text{ sq. ft.}}$$

X= 5.2 oz. of herbicide

3. To treat the target area, a little more than 5 oz. of herbicide should be added to 143 oz. of water (148 – 5). Because there are 128 ounces in 1 gallon, this will mean adding 5 ounces of herbicide to 1.1 gal. of water (143/128 = 1.1 gallons of water).

126

Calculating how much pesticide goes into a tank

- MG's DO NOT calculate application rates for clients.
- There are several great publications for this
- https://pesticidestewardship.org/calibration/backpack-sprayer/
- https://www.aces.edu/wp-content/uploads/2020/11/ANR-2681-128CalibrationMethod_102720L-A.pdf
- https://www.mssoy.org/uploads/files/arizona-coop-ext.pdf

127

Re-entry Interval

- Period of time that must pass between treatment and reentry
- Check label for REI (often 12, 24 or 48 hours, though many say, "until dry").

Preharvest Interval

- number of days allowed between the
- last pesticide application and the day
- of harvest.

128

Applying Pesticides

Cleanup & Disposal

129

Washing PPE

- Wash pesticide-contaminated items separately from uncontaminated clothing & laundry.
- Avoid direct contact with contaminated items, and work in a well-ventilated area.
- If in doubt about ability to clean an item, discard it!

130

Eyewear/Respirators

- Wash goggles, face shields, safety glasses & respirator bodies and face pieces with detergent & hot water after each day of use.
- Sanitize by soaking them for at least 2 minutes in a mixture of 2 tablespoons bleach in a gallon of water. Rinse thoroughly!

131

Storage

Original container only
Out of reach of children & pets
Avoid temperature extremes
Avoid contamination of wells & surface water
Leak proof containers

132

Plastic Closeable Containers easier to see through

133

Disposal of Pesticide Containers

Empty Containers: (not banned)

- Cardboard containers in trash (not burned)
- Triple rinse glass/plastic, apply rinse water
- Dispose of empty container in trash, or
- recycle/return to dealer if possible

Leftover pesticide or banned products:

- Check DEQ Home Hazardous Waste
- collection schedule-do not dispose

http://www.deq.state.or.us/wmc/solwaste/hhw.html
1-800-452-4011

134

Cleaning Pesticide Spills

Keep the area well ventilated

- Wear gloves and protective clothing
- Contain the spill with absorbent material
- (cat litter, clay or sand)
- Scoop material into sealed container
- Wash the surface with soap and water
- Dispose of materials as HHW

135

Softer Pesticides and IPM

- Integrate various pest management systems to reduce pesticide use
- New products that are less residual and softer on predators
- Don't use any product over and over

136

Pesticide Recommendations for Homeowners

Plant Disease Control:
PNW Disease Management Handbook
http://plant-disease.orst

Insect Pest Control:
PNW Insect Management Handbook
http://insects.ippc.orst.edu/pnw

Weed Control:
PNW Weed Handbook
http://weeds.ippc.orst.edu/

137

Other helpful links

- www.cdms.net
- www.greenbook.net
- Agrian label lookup:
https://www.agrian.com/labelcenter/results.cfm
- uspest.org can run over 100 insect pest and disease models and access weather data from across Oregon and the US

138

Online resources

uspest.org can run over 100 insect pest and disease models and access weather data from across Oregon and the US

Pest Management Guide for Tree Fruits
Hood River • The Dalles • White Salmon • Rogue Valley
https://catalog.extension.oregonstate.edu/sites/catalog/files/project/pdf/em8203.pdf

PNW Insect Management Handbook
https://pnwhandbooks.org/insect/tree-fruit/pear

UCIPM—Pest Management Guidelines for Pears
http://ipm.ucanr.edu/PMG/selectnewpest.pears.html

139

Oregon State University Extension Service

Thank you

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140