

# Herbicide Do's and Don'ts

## *Common mistakes and how to fix them*

Mary Ann Rose  
Pesticide Safety Education Program

**CFAES**

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

1

---

---

---

---

---

---


---

---

# Key Topic Areas

1. Herbicide efficacy
2. Environmental safety
3. Applicator safety

*This not a product recommendation presentation*



**CFAES**

2

---

---

---

---

---

---

---

---

# 1. Herbicide Efficacy

*Common mistakes:*

- Don't read entire label
- Don't understand how herbicides work

*Sometimes the mistake is ignorance!*

**CFAES**

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

3

---

---

---

---

---

---

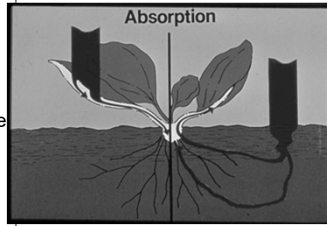
---

---

## How do systemic herbicides work?

### Systemic Herbicides

- Absorbed by weed
- Moves from treated to untreated portions
  - Foliar-applied systemics move down to roots
  - Soil-applied systemics move up to shoots
- Moves inside the plant with the water (up) or sugar (down) transport system
- Takes time to move, takes time to kill weed



THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

4

---

---

---

---

---

---

---

---

## DO: choose systemic herbicides for perennial weed control

- Work best during optimal weed growing conditions: warmth, moisture



CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

5

---

---

---

---

---

---

---

---

## Systemic Herbicide DO's

- Make applications:
  - To actively growing weeds
  - To non-stressed weeds (avoid drought, cold)
  - To intact weeds (don't mow before/ after)
  - When rain is not expected until rainfast

### Allow:

- Sufficient time for control, 7-10 days

CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

6

---

---

---

---

---

---

---


---

DO: Treat at optimum time of year or weed development stage

DON'T: Miss your optimal application window

•Annuals	When small, & before seeds formed
•Perennials	Fall - when movement down prevails
•Biennials	First year, 2 <sup>nd</sup> yr before flowering

•DO: Correctly identify your weed!



7

---

---

---

---

---

---

---


---

When treating very dense/tall vegetation-

DO:

- Cut before treating, allow to regrow

*Do you think he's wearing the required PPE?*



CFAES

Art Gover, Penn State University

8

---

---

---

---

---

---

---


---

DON'T: Miss your optimal PLANNING window

- Invasive Species

Often break bud before natives

Get out there and assess early



CFAES

9

---

---

---

---

---

---

---

---

### Systemic Herbicides

**DO:**  
Use the right herbicide formulation

<b>Water-soluble</b>	<b>Oil-soluble</b>
• Amines	• Esters (emulsifiable concentrates)
• Lower volatility	• May be highly volatile
• Lower drift hazard	• Greater drift hazard
• Won't penetrate bark	• Superior penetration – bark, stems, leaves
• Inferior in cold	• Superior control in cool weather

CFAES

**THE OHIO STATE UNIVERSITY**  
 COLLEGE OF FOOD, AGRICULTURAL,  
 AND ENVIRONMENTAL SCIENCES

10

---

---

---

---

---

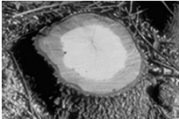


---

---

---

### Systemic Herbicides

- DO use a systemic herbicide to selectively treat invasive woody species

CFAES

**THE OHIO STATE UNIVERSITY**  
 COLLEGE OF FOOD, AGRICULTURAL,  
 AND ENVIRONMENTAL SCIENCES

11

---

---

---

---

---



---

---

---

### Systemic Herbicides

**Basal Bark treatment**

- DO use an oil-soluble herbicide formulation
- Do treat entire circumference
- DON'T treat wet bark

CFAES

**THE OHIO STATE UNIVERSITY**  
 COLLEGE OF FOOD, AGRICULTURAL,  
 AND ENVIRONMENTAL SCIENCES

12

---

---

---

---

---

---


---

---

### Systemic Herbicide

**Hack and Squirt Method**  
spaced cuts around circumference, herbicide injected or sprayed in cut

- DO use a water-soluble formulation
- DON'T completely girdle tree



**CFAES**

13

---

---

---

---

---

---

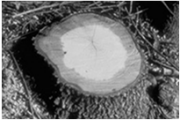
---

---

### Systemic Herbicide

**Cut Stump**

- DO apply in a continuous ring
- DO tank mix a dye to ensure coverage
- DO use the appropriate formulation for the situation
- DON'T apply during sap flow



**CFAES**

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

14

---

---

---

---

---

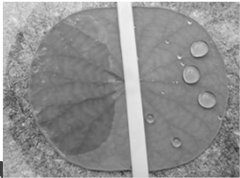

---

---

---

### Foliar Herbicides

*Do*  
Use *adjuvants*  
Read the herbicide label for adjuvant info

**CFAES**

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

15

---

---

---

---

---

---

---

---


**DO: Distinguish between Selective and Non-selective herbicides**

Selective Herbicides  
Kills Broadleaf OR grassy weeds

Non-selective Herbicides  
Kills everything (theoretically)

**DON'T CONFUSE THE TWO!**

**CFAES**



16

---

---

---

---

---


---

---

---



**No Grass to Keep Off at Ohio's University of Findlay**



Workers correct an unfortunate lawn care accident that affected most of University of Findlay's campus.

17

---

---

---

---

---


---

---

---

**Soil-Applied Herbicides**

*DON'T*  
Apply to frozen or saturated soils



**CFAES**

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

18

---

---

---

---

---

---

---

---

## Do: Select the right kind of soil-applied herbicide

- Preemergence Herbicides
  - Prevent weed growth from seed
  - Insoluble, and relatively immobile in soil
  - Short persistence - several months
  - Relatively safer to many plants
- Some soil-applied herbicides are pre + post
  - Broad spectrum
  - As a group, more soluble, mobile in soil
  - Persistent
  - Potential harm to many plants

CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

19

---

---

---

---

---

---

---

---

## Pre-emergence Herbicides: How the control barrier works

Control Barrier:  
herbicide  
stays in  
shallow soil  
layer

Example preemergent herbicides  
-Pendulum (pendimethalin)

Newly germinated  
weeds killed as they  
grow through barrier

CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

20

---

---

---

---

---

---

---

---

## Preemergence Herbicides

### Do Not

- Apply after most weeds have germinated
  - Timing is critical
- Fail to irrigate if there is no rainfall
  - Review label information on *activation*
- Disturb the soil surface after application



CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

21

---

---

---

---

---

---

---

---

## Mobile, Persistent Herbicides



- DO  
Read label carefully!
- DON'T  
Apply near desirable trees, sensitive sites
- AVOID  
Slopes, leach-prone soils, surface water, lakes, streams
- Example herbicide:  
sulfometuron-methyl (Oust XP)

CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

22

---

---

---

---

---

---

---

---

## DO: Manage Herbicide Resistance

- DON'T: Create a "super race" of weeds
- DO: preserve usefulness of herbicides

CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

23

---

---

---

---

---

---

---

---

## Herbicide Resistance

When a normally susceptible weed species develops ability to tolerate a herbicide

- Happens when a single herbicide MOA is used repeatedly to control weeds
- Over generations, resistant individuals in the population survive and multiply.....
- Over time, the resistant population takes over

CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

24

---

---

---

---

---

---

---

---



Herbicide Resistance arises naturally  
in a pest population from time to time

Resistant =  
red  
individuals



---

---

---

---

---

---

---

25

Effect of using a single MOA...

Repeat applications with  
the same chemistry  
just kill off the  
competition!



---

---

---

---

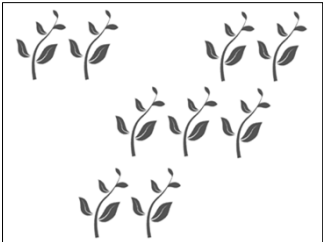
---

---

---

26

Effect of using a single MOA  
...over more time



---

---

---

---

---

---

---

27

## Managing Resistance

Let's go back in time!

- If at this point, you had switched to an alternative chemistry...



28

---

---

---

---

---

---

---

---

## Managing Resistance by Alternating Chemistries

No Survivors!

29

---

---

---

---

---

---

---

---

## DO Manage Herbicide Resistance

How:

- Alternating different modes of action  
or
- Tank mixing different modes of action  
also:
- Using full labeled rate of herbicide
- Treat weeds when small (seedlings)
- Use alternative, non-chemical controls (IPM)

CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

30

---

---

---


---

---





---

---

---



Manufacturers make it easier to select herbicides by MOA with group numbers that appear on label

31

---

---

---

---

---

---

---



---

## 2. Environmental Safety

*Common mistakes:*

- Don't read entire label
- Don't understand how or why herbicides move off target

*Sometimes the mistake is ignorance!*

32

---

---

---

---


---

---


---

---

### How can herbicides move off-target?



- *Drift* of spray droplets on air currents to sensitive areas
- *Run-off* of pesticides from surface to lakes and streams
- *Leaching* of pesticides through the soil to the groundwater
- *Uptake* by roots of desirable plants in the soil application zone



April 8, 2016

33

---

---

---

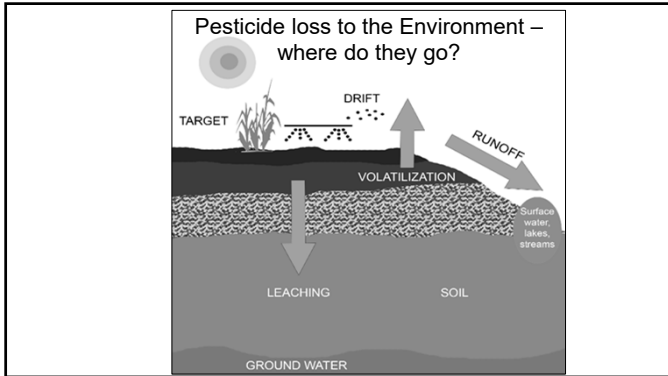
---

---

---

---

---



34

---

---

---

---

---


---

---

---

**DO: Assess the treatment area for environmentally sensitive sites**

- Ground and surface waters
  - VERNAL POOLS!
- Aquatic organisms
- Pollinators (bees and other kinds)
- Endangered species
- Sensitive crops
- Residential landscapes, schools



**CFAES**

35

---

---

---

---

---

---

---

---

**DO: Follow all label precautions/restrictions**

- Such as:
  - Windspeed
  - Setback / Buffer requirements
  - Soil type restrictions
  - Endangered species use limitations



**CFAES**

36

---

---

---

---

---

---

---

---

### DON'T apply to impervious soils

- Frozen or saturated soil
- Highly compacted soil
- Also don't apply just before heavy rainfall



**CFAES**

37

---

---

---

---

---

---

---

---

### NEVER use a product unless **labeled** for your use site

For the control of woody plants in forests, in rangeland and permanent pastures, and in non-crop areas including industrial manufacturing and storage sites, rights-of-way such as electrical power lines, communication lines, pipelines, road sides and railroads, and commercial and residential landscapes, fence rows, non-irrigation ditch banks and around farm buildings. Use on these sites may include application to grazed areas as well as establishment and maintenance of wildlife openings.



38

---

---

---

---

---

---

---

---

### Ranger v. Rodeo

Two different glyphosate formulations  
Very different site restrictions

#### Rodeo – aquatic sites on label

For control of annual and perennial weeds and woody plants in natural and production (plantations), forests for site preparation, mid-rotation release treatments, timber stand improvement activities, noncrop sites including industrial sites, rights-of-way (including roadsides, electric utility and communication transmission lines, pipelines, railroads, airports), irrigation and drainage ditches, canals, reservoirs, natural areas (including wildlife management areas, wildlife openings, wildlife habitats and refuges, parks and recreational areas, campgrounds, trailheads and trails), rangeland, and in and around aquatic sites and wetlands; also for perennial grass release, and grass growth suppression and grazed areas on these sites.

**CFAES**

39

---

---

---

---

---

---

---

---

## Ranger v. Rodeo

Two different glyphosate formulations

Ranger – aquatic sites not on label

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

CFAES

THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

40

---

---

---

---

---

---

---

---

DO: use aquatic formulations for natural areas!

CFAES

41

---

---

---

---

---

---

---

---

NEVER exceed product use rates!

...and DON'T forget annual maximum rates

CFAES

42

---

---

---

---

---

---


---

---

**Not good at pesticide math?**

**DO:**

- Get help!
- Contact Pesticide Safety Education Program – we can help!



**How much to add to tank?**  
 Tank capacity 240 gals  
 Spray volume is 30 GPA  
 Rate = 32 oz/ A

**CFAES**

43

---

---

---

---

---


---

---

---

**DON'T: Overapply!**

- Spray to Wet or Spray to Drip?



Dave Apsley, OSU

**CFAES**

44

---

---

---

---

---



---

---

---

**DO: Follow best practices for pesticide handling**

- Such as:
  - Transportation
  - Storage
  - Mixing
  - Equipment cleaning
  - Pesticide and container disposal

Dave Apsley, OSU

**CFAES**

45

---

---

---

---

---


---

---

---

DO: Follow best practices mixing in the field

- Such as:
  - Use of a containment tray



**CFAES**

46

---

---

---

---

---

---


---

---

DO: Prepare for a spill

Have a spill kit on hand

Contents:  
 Absorbent materials  
 Broom, shovel  
 Plastic Bags  
 PPE



*Also keep emergency tel. numbers handy!*

**CFAES**

47

---

---

---

---

---

---

---

---


DO: Follow best practices for equipment cleaning

Cleaning your equipment, tank, and empty pesticide containers generates *RINSATE* –  
 - water with pesticide residues

What to do with rinsate?

- Recycle the rinsate in next tank mix
- Apply rinsate to a labeled site

- Be careful where & how you clean out to prevent environmental contamination



**CFAES**

48

---

---

---

---

---

---

---

---



### 3. Applicator Safety

*Common mistakes:*

- Don't read entire label
- Careless behavior



**CFAES**

49

---

---

---

---

---

---

---

---

### What determines your RISK from Pesticides?

**Risk = Toxicity x Exposure**

<b>DANGER</b>	how <b>much</b>
<b>WARNING</b>	how <b>often</b>
<b>CAUTION</b>	how <b>long</b>
	where exposed

**CFAES**

50

---

---

---

---

---

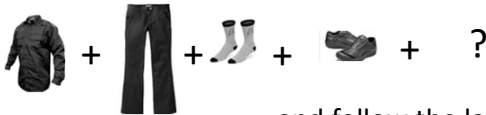
---

---

---

DO:

Wear the label-required Personal Protective Equipment (PPE)



... and follow the label

**CFAES**

51

---

---

---

---

---


---

---

---

**DO: wear the right kind of PPE**

- See pesticide label for required level of chemical resistance
- These are poor choices !



**CFAES**

52

---

---

---

---

---


---

---

---

**DO: wear chemical resistant gloves**

- Whether required by label or not
- Cuts your exposure 70-80%  
Hands and forearms are most common route of exposure
- Also wear when servicing pesticide equipment



**CFAES**

53

---

---

---

---

---

---

---

---

**DON'T assume different products with same active ingredient require same PPE**

Garlon 3A (amine)	Garlon 4 (ester)
<p><b>DANGER</b></p> <p>Corrosive • Causes Irreversible Eye Damage • Harmful If Swallowed Or Absorbed Through Skin • Prolonged Or Frequently Repeated Skin Contact May Cause Allergic Reaction In Some Individuals</p> <p>Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing before reuse.</p> <p><b>Personal Protective Equipment (PPE)</b> Applicators and other handlers must wear:</p> <ul style="list-style-type: none"> <li>• Long-sleeved shirt and long pants</li> <li>• Shoes plus socks</li> <li>• Protective eyewear</li> <li>• Chemical resistant gloves (≥14 mils) such as butyl rubber, natural rubber, neoprene rubber or nitrile rubber</li> </ul>	<p><b>CAUTION</b></p> <p>Causes Moderate Eye Irritation • Harmful If Swallowed • Prolonged Or Frequently Repeated Skin Contact May Cause Allergic Reactions In Some Individuals</p> <p>Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet.</p> <p><b>Personal Protective Equipment (PPE)</b> Applicators and other handlers who handle this pesticide must wear:</p> <ul style="list-style-type: none"> <li>• Long-sleeved shirt and long pants</li> <li>• Shoes plus socks</li> </ul>

54

---

---

---

---

---

---

---

---

DO: Have eyewash available when using pesticides with DANGER signal word



**DANGER**

Corrosive • Causes Irreversible Eye Damage • Harmful If Swallowed Or Absorbed Through Skin • Prolonged Or Frequently Repeated Skin Contact May Cause Allergic Reaction In Some Individuals  
Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing before reuse.

**Personal Protective Equipment (PPE)**

Applicators and other handlers must wear:  
• Long-sleeved shirt and long pants  
• Shoes plus socks  
• Protective eyewear  
• Chemical resistant gloves (≥14 mils) such as butyl rubber, natural rubber, neoprene rubber or nitrile rubber



55

---

---

---

---

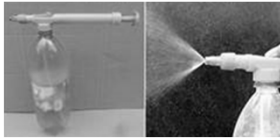
---

---

---

---

NEVER: Use food containers for pesticides



DO: Label service containers

**CFAES**

56

---

---

---

---

---

---

---

---

DO: Walk in, Spray out

- Walk to most inaccessible area first
- Spray while walking out



Benefits:

- Reduces exposure (avoids walking through the area you sprayed)
- Avoids respraying areas already sprayed



Art Gover, Penn State University

**CFAES**

57

---

---

---

---

---

---

---

---



58

---

---

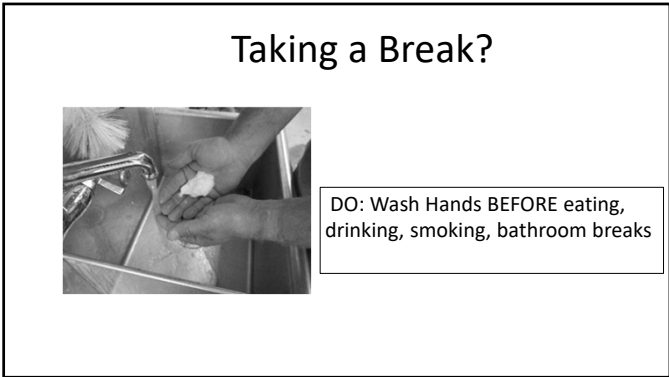
---

---

---

---

---



59

---

---

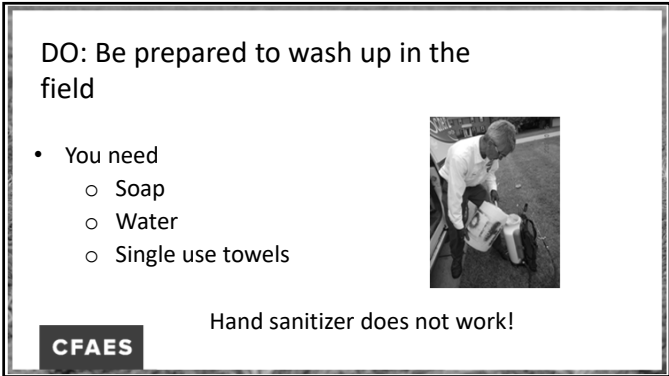
---

---

---

---

---



60

---

---

---

---

---

---

---

### DON'T Contaminate your home




- DON'T  
Wear spray boots home
- DO  
Shower, change clothing
- DON'T  
Wear spray clothes > 1X
- DO  
Wash spray clothes in separate load


THE OHIO STATE UNIVERSITY  
COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES

61

---

---

---

---

---


---


---

---

### DO: Train the people working for you

- Annual training for trained servicepersons will be required in several years
- Safety & best practices for pesticide application





62

---

---

---

---

---


---


---

---

### DO: Have pesticide labels at hand during application

- Required by law for trained service persons working in absence of licensed commercial applicator





63

---

---

---

---

---

---

---


---

*In Conclusion.....*

1. Read the label
  - before you get to the site!
2. Wear the PPE
3. Follow the label

**The label is the law!**

**CFAES**



64

---

---

---

---

---


---

---

---


**Questions???**

Pesticide Safety Education Program  
614-292-4070  
[pested.osu.edu](http://pested.osu.edu)



Where to find out more about pesticide toxicity:  
National Pesticide Information Center (NPIC)  
[npic@ace.orst.edu](mailto:npic@ace.orst.edu)  
1-800-858-7378

**CFAES**



65

---

---

---

---

---

---


---

---

EPA Emergency Spill Hotline  
1-800-282-9378  
for any spill entering waterways or other  
spills in reportable quantities

Chemtrec  
24/7 technical support for any hazardous  
substance spill  
1-800-424-9300

G. Phillips and Sons, LLC  
ACRC Container Recycling contractor  
Midwest and Northeast USA  
<https://www.acrecycle.org/>



66

---

---

---

---

---

---

---

---

### Questions???


For Invasive recommendations:

Penn State Wildland Weed Management  
(The Quicksheet series is prescriptive)

<http://plantscience.psu.edu/wildland>

Penn State Extension, Forestry Invasive and Competing Plants

<https://extension.psu.edu/forests-and-wildlife/forest-management/invasive-and-competing-plants>



---

---

---

---

---

---

---