

AG HEALTH 101



PESTICIDES

UNIT 8



GREAT PLAINS
Center for Agricultural Health

Chapter

DISCUSSION QUESTIONS



CHAPTER 1. INTRODUCTION TO AGRICULTURAL PESTICIDES & RULES

Many of us have purchased pesticides for use in the home or as an insect repellent for personal or pet use. Look at your household chemicals and identify one or two pesticides that you have on hand. Identify the active ingredient and look at the label (on the product or online) to see what the human health hazard is for that ingredient.



CHAPTER 2. CATEGORIES OF PESTICIDES & GENERAL USE & HAZARDS

Which compounds mentioned in this unit are the most familiar to you? Where would you go to find more information about the hazards of that compound?

Compounds: Organochlorines, Organophosphates, Neonicotinoids, Carbamates, Pyrethroids, Glyphosates, Triazine, Anilide, Chlorophenoxy, Quaternary Ammonia Salts



CHAPTER 3. EPA'S WORKER PROTECTION STANDARD

Part of the Worker Protection Standard (WPS) requires workers to have access to information on pesticides used at the site they work at. Discuss how you would ask a worker about how they know what these chemicals are and how do they get information about what precautions they need to take.



CHAPTER 4. PESTICIDE APPLICATION GUIDELINES (DRIFT)

Thinking about pesticide drift and how local conditions may affect how far they travel, what do you think about farmers sharing information with their "neighbors" about pesticide application schedules? Discuss what you think should be communicated, as well as how, when, and to whom. What can you find about procedures or guidelines from different states online?



CHAPTER 5. PESTICIDES, PPE & HAZARD COMMUNICATION

What additional information do you think is needed on these pesticide information tables? How would you use this to have conversations with farm workers about pesticide use and precautions that are being taken?

Introduction to Agricultural Pesticides

Common Pesticide Exposures

PESTICIDE HANDLER

Anyone who mixes, loads, or applies pesticides.

Exposure Routes: Dermal absorption via spills, splashes, or being sprayed directly during pesticide application or cleanup.

OTHERS

Other individuals located in neighboring fields, land, or homes may be exposed to sprayed pesticides during land application or by crop dusters via drift.

Exposure Routes: Dermal absorption via touching items with pesticide residues from drift, ingestion of food/water with pesticide residue or by placing hands/other items with pesticide residues in mouth, or inhalation of pesticide drift.

HAND LABORERS

Any worker performing hand labor in the fields.

Exposure Routes: Dermal absorption by being directly sprayed on in the field if application schedule isn't appropriately coordinated, inhalation or dermal absorption of drifted pesticides from neighboring field applications, or contact with pesticide residues on crops or soil.



ADDITIONAL EXPOSURE RISKS

Other risks to farmers & farm workers include:

- Eating with pesticide contaminated hands
- Eating contaminated fruits & vegetables
- Eating in a pesticide-contaminated field
- Drinking from, washing hands in, or bathing in irrigation canals or holding ponds where pesticides accumulate
- Take-home exposures occur when contaminated clothing is worn inside the home or when laundered inside the home with other clothing

Chapter 2

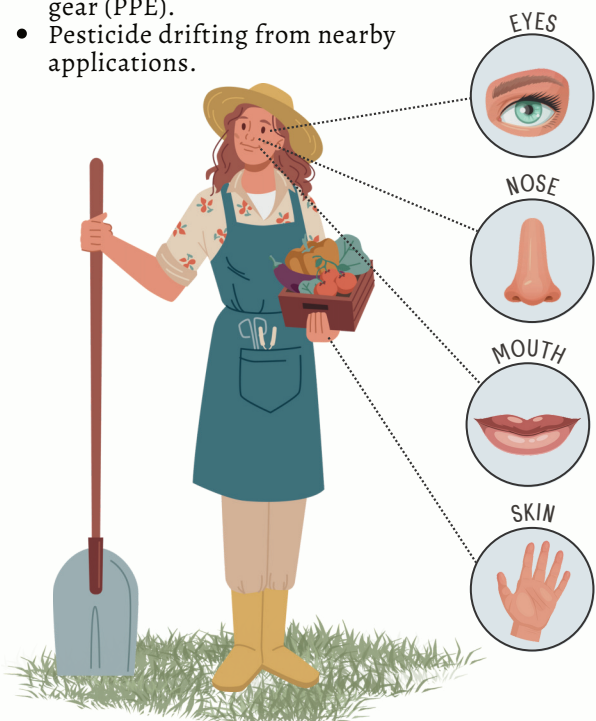
Pesticide Categories, General Uses, & Hazards

PESTICIDE	GENERAL USE	HEALTH HAZARDS
Insecticides		
Organochlorines	Often referred to as "contact insecticides"; include compounds such as DDT (banned 1972) , Dieldrin (banned 1974) , except for termite treatment), Aldrin (banned 1974) , Endrin (banned 1984) & Heptachlor (use registration cancelled in 1974) <i>While banned in the U.S., these chemicals may be available internationally</i>	Neurotoxins; Exposures for short durations can cause convulsions, nausea, muscle weakness, etc.; Long-term exposures include liver, kidney, central nervous system, thyroid, & bladder damage; Some evidence indicating it causes cancer
Organophosphates	Include a wide variety of compounds, including Chlorpyrifos, Diazinon, Dichlorvos, & Malathion Some compounds have restricted or discontinued use: Parathion no longer registered for use in U.S.; Chlorpyrifos banned for use in the home & banned from use on all food crops (as of 2022); Diazinon & Malathion still in use	Acutely toxic to bees, wildlife, & humans; Affect nervous system via excess acetylcholine (ACh) in nerve endings; High ACh concentration causes muscle contraction; Can cause muscle twitching & possible paralysis of skeletal muscle cells; Can also impair the diaphragm, with potential for respiratory paralysis Inhalation, ingestion, & dermal penetration all routes of exposure that can lead to toxic effects
Neonicotinoids	Class of neuro-active insecticides; Includes Acetamiprid, Nitenpyram, & others Typically added to treat crop seeds; Currently represent 25% of the global market for insecticides	Labeled with the signal word "Warning" or "Caution" by the EPA Can cause fatigue, headaches, seizures, coma, hypertension, tachycardia, diaphoresis, mydriasis, nausea, vomiting, & abdominal pain in humans & other mammals
Mixed Uses		
Carbamates	Approximately 25 types of carbamates, which are used as selective herbicides, insecticides, & fungicides; Examples include Carbofuran & Methiocarb Act as a contact pesticide; An oral ingestion poison	N-methyl carbamate esters cause a reversible carbamylation of the AChE, allowing accumulation of acetylcholine, like organophosphates (OPs); Poisonings with carbamates tend to have shorter durations than OP poisonings Inhalation, ingestion, & dermal absorption are all routes of exposure
Pyrethroids	Main component in commercial insecticides & repellants; The synthetic compound is lipophilic & is resistant to rain wash off of plants & insects; Permethrin is an example	Absorbed across the GI tract & pulmonary membranes; Absorbed slightly across intact skin; Can cause contact dermatitis Reported poisonings with signs & symptoms of toxicity have included abnormal facial sensation, dizziness, headache, fatigue, vomiting, diarrhea & irritability to sound & touch; In severe cases, pulmonary edema, muscle fasciculations, seizures, & coma have been reported
Herbicides		
Glyphosate-Based	Widely used in agriculture & forestry operations, particularly on "Roundup Ready" crops (corn & soy in the Midwest); General public use to control weeds NOTE: Roundup (main chemical sold containing glyphosate) banned in more than 20 countries; EPA has reviewed this chemical & determined "unlikely to be carcinogenic" in 2020	Low acute toxicity in mammals, but reports of poisonings in humans; Most severe signs & symptoms appear to be from oral ingestion, where cardiovascular, respiratory & renal systems may be affected; Roundup linked to increased risk of non-Hodgkin lymphoma
Triazines	Primarily herbicides (Atrazine, Cyanazine, Simazine); Some compounds used as a fungicide (Triazine derivatives) Atrazine (banned in EU but not in U.S.) one of the most commonly used herbicides in U.S.; Used on crops like corn, sorghum, & sugarcane	Atrazine is an endocrine disruptor; Has caused tumors, breast, ovarian & uterine cancers; Found to cause leukemia & lymphoma Triazines are mild skin irritants; Highly irritating to the eye; Compounds considered to be possible human carcinogens (except metribuzin) by EPA
Anilides	Includes Alachlor, Acetochlor, & other compounds which are selective herbicides; Alachlor often used for production of corn, potatoes, cucumbers, & beets	Alachlor (Lasso, Alanox) is a mild irritant; Can cause vomiting, hypotension, & CNS depression
Chlorophenoxy Herbicides	Often mixed into chemical fertilizers to control broadleaf weeds; Compounds include 2,4-D; 2,4,5-T; & MCPP	Common symptoms of exposure: vomiting; diarrhea; headache; confusing, bizarre or aggressive behavior; peculiar odor on breath; possible elevated body temperature; muscle weakness, peripheral neuropathy, or loss of reflexes
Quaternary Ammonium Salts	Includes Paraquat and Diquat, a common herbicide used in many crops & tree operations (wheat, corn, soy, almond, peanut, garlic, cotton, artichokes)	When ingested, paraquat affects the GI tract, kidneys, liver, heart & other organs; May be life threatening when ingested; Pulmonary edema within a few hours of severe exposure, with delayed damage including pulmonary fibrosis; Death 7-14 days after ingestion; Local skin damage, reddening, blistering, abrasion & ulceration

EPA's Worker Protection Standard

1 AVOID...

- Getting pesticides on your skin or in your body.
- Pesticide residue that may be in or on plants, soil, irrigation water, tractors & other equipment, & used work clothing or gear (PPE).
- Pesticide drifting from nearby applications.



2 STAY OUT...

- Of treated areas when told, whenever you see signs displayed, and when a pesticide application is taking place (application exclusion zone).



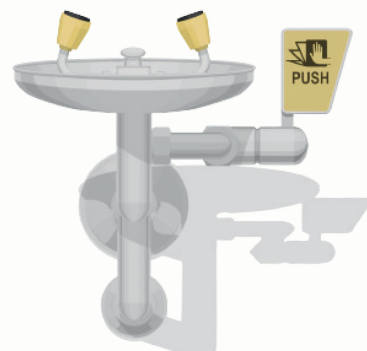
3 WASH...

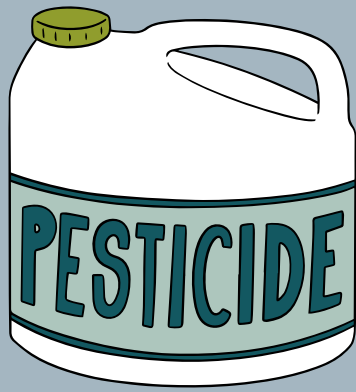
- Your hands immediately before you eat, drink, smoke, chew gum or tobacco, & before using the toilet or your phone.
- Your body & hair thoroughly with water, soap, & shampoo, & put on clean clothes after work.
- Your work clothes after each use. Keep separate from non-work clothing.



4 TAKE ACTION...

- If pesticides are spilled or sprayed on your body, wash immediately. Water, soap & towels must be provided nearby (decontamination supplies). If not nearby, rinse in clean water from springs, streams or lakes.
- Wash your body & hair with water, soap & shampoo as soon as possible & put on clean clothes.





Chapter 4

Pesticide Application Guidelines (DRIFT)



TEMPERATURE & HUMIDITY

The combination of temperature & humidity is important for pesticide application. When temperatures are ABOVE 70°F & when humidity is BELOW 40%, droplets coming out of the sprayer evaporate quickly. This means that particles that come out of the nozzle become very small & fast. Therefore, these small particles may travel much further than the droplets originally generated, resulting in pesticides drifting away from the target area. Herbicides in particular have temperature & humidity warnings. Most labels recommend not applying when temperatures are ABOVE 90°F.

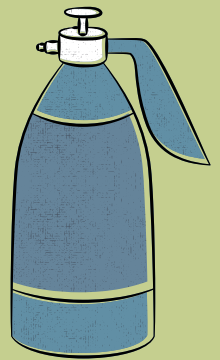
BUFFER ZONES

Defined as the distance between the point of Direct Pesticide Application & the nearest downwind boundary to a sensitive habitat.

Buffer zones are important to protecting areas where pesticide travel is unwanted.

Drift Reduction

Recommendations: Zones ranging from 200 to 500 feet



WIND SPEED

When wind increases, sprayed pesticides do not deposit on the plants as intended. When the wind is too low, the pesticides may also not deposit well on plants. The pesticide label will provide wind recommendations & should be reviewed before pesticide application. While labels often go up to 15 mph as an upper limit for application, it is important to know that most extension offices around the Midwest recommend safe wind speeds are typically 3 to 7 mph. The upper limit recommended by most is 10 mph.

GLYPHOSATE:

- Lowest Potential Drift: Wind 2-10 mph
- Wind Up to 5 mph: Do not apply aerially within 500 ft of other crops
- Wind 5-10 mph: 500 ft buffer zone may not be sufficient
- Wind Exceeds 10 mph: Do not apply

2,4-D:

- Wind Speeds > 15 mph: Do not apply; Buffer zone of 250 ft
- Wind Speed < 3 mph: Do not apply unless no inversion layer is confirmed

DICAMBA/2,4-D DMA MIX:

- Wind Speeds > 15 mph: Do not apply; Buffer zone of 250 ft
- Wind Speed < 3 mph: Determine if temperature inversion is present or stable atmospheric conditions are at or below nozzle height; If yes to either, do not apply



Chapter 5



Pesticides, PPE & Hazard Communication

Health Effects & PPE Recommendations for Most Common *Herbicides* Reported in Iowa Drift Cases

CHEMICAL	HEALTH EFFECTS*	PERSONAL PROTECTIVE EQUIPMENT (PPE) **
2,4-D	Moderate eye irritation; Currently classified as non-carcinogenic (EPA)	Air-purifying half-mask respirator with organic vapor cartridge & filtration (N95); Chemical protective gloves; Rubber boots
Acetochlor	Severe skin, eye, & airway irritation; Likely to be carcinogenic to humans (EPA)	Air-purifying half-mask respirator with organic vapor cartridge; Chemical protective gloves; Rubber boots
Atrazine	Severe skin, eye, & airway irritation; May induce fatigue, dizziness, & nausea	Chemical protective gloves; Rubber boots
Glyphosate	May be a human endocrine disruptor; Severe damage to eyes if not immediately rinsed; Currently classified as non-carcinogenic (EPA)	Air-purifying respirator (N100); Goggles and/or face shield; Chemical protective gloves; Rubber boots
Dicamba	Eye irritation, inhalation may cause dizziness; If swallowed, causes vomiting, loss of appetite, & muscle spasms; Currently classified as non-carcinogenic (EPA)	Full-face respirator (with N100 filter); Goggles (if no respirator); Chemical protective gloves; Rubber boots

Health Effects & PPE Recommendations for Most Common *Insecticides* Reported in Iowa Drift Cases

CHEMICAL	HEALTH EFFECTS*	PERSONAL PROTECTIVE EQUIPMENT (PPE) **
Chlorpyrifos	Severely hazardous to nervous system; May cause runny nose, eye irritation, sweating, headache, muscle cramps, nausea, dizziness; Exposure to large amounts may induce vomiting, difficulty breathing, spasms, & paralysis; Currently classified as non-carcinogenic (EPA)	Full-face respirator (with N100 filter) recommended during handling; Chemical protective coveralls, chemical resistant apron when mixing; Chemical protective gloves; Rubber boots
Pyrethroids	Skin irritation; May be irritating to respiratory system; May cause runny nose, cough, asthma-like symptoms, difficulty breathing, nausea, diarrhea; High exposure may result in dizziness, headache, convulsions; Carcinogenic if swallowed (EPA)	Air-purifying half-mask respirator with organic vapor cartridge; Chemical protective gloves; Rubber boots

Health Effects & PPE Recommendations for Most Common *Fungicides* Reported in Iowa Drift Cases

CHEMICAL	HEALTH EFFECTS*	PERSONAL PROTECTIVE EQUIPMENT (PPE) **
Pyraclostrobin	Moderate skin & airway irritation; May cause temporary eye injury; May cause weakness, headache, dizziness, chest pain; May be fatal if swallowed; Little data on carcinogenic potential	Air-purifying half-mask respirator with organic vapor cartridge with filtration (N95); Chemical protective gloves; Washable hat; Goggles; Rubber boots
Propiconazole	Little health data; Likely to be carcinogenic to humans (EPA)	N95 filtering facepiece respirator; Chemical protective gloves; Rubber boots

*The routes of exposure for *herbicides* includes inhalation, skin/eye contact, or ingestion.

**Always check the pesticide label to see if there are other recommendations for PPE.

PESTICIDE RESOURCES

CHAPTER 1. INTRODUCTION TO AGRICULTURAL PESTICIDES & RULES

General Information on Pesticides: <https://www.epa.gov/minimum-risk-pesticides/what-pesticide>

Definitions of Different Types of Pesticides: <https://www.epa.gov/ingredients-used-pesticide-products/types-pesticide-ingredients>

Information on Inert Ingredients in Pesticides: <https://www.epa.gov/pesticide-registration/inert-ingredients-overview-and-guidance>

EPA Search Site; Look Up "Inert" Compounds: <https://ordspub.epa.gov/ords/pesticides/f?p=INERTFINDER:1:0::NO:1::>

Short- and Long-Term Illnesses from Pesticide Exposures: <https://www.epa.gov/ingredients-used-pesticide-products/brief-overviews-about-individual-pesticides>

CHAPTER 2. CATEGORIES OF PESTICIDES & GENERAL USE & HAZARDS

- <https://www.alsglobal.eu/specialties/pesticides-testing/overview-of-pesticide-classes>
- <https://www.epa.gov/pesticide-worker-safety/recognition-and-management-pesticide-poisonings>

Organochlorine Pesticides: <https://dhss.delaware.gov/dhss/dph/files/organochlorpestfaq.pdf>

- https://www.epa.gov/sites/default/files/documents/rmpp_6thed_ch7_organochlorines.pdf

Organophosphate Pesticides:

https://www.epa.gov/sites/default/files/documents/rmpp_6thed_ch5_organophosphates.pdf

Carbamates: https://www.epa.gov/sites/default/files/documents/rmpp_6thed_ch6_carbamates.pdf

Pyrethroids: https://www.epa.gov/sites/default/files/documents/rmpp_6thed_ch4_pyrethrinspyrethroids.pdf

Glyphosate-Based Pesticides: https://www.epa.gov/sites/default/files/documents/rmpp_6thed_ch13_otherherbicides.pdf

- <https://www.epa.gov/ingredients-used-pesticide-products/glyphosate>
- <https://www.atsdr.cdc.gov/toxprofiles/tp214.pdf>

Triazine Pesticides: <https://www.state.nj.us/dep/enforcement/pcp/bpc/wps/triazines.pdf>

Anilide Pesticides: https://www.epa.gov/sites/default/files/documents/rmpp_6thed_ch13_otherherbicides.pdf

Chlorophenoxy Herbicides: https://www.epa.gov/sites/default/files/documents/rmpp_6thed_ch10_chlorophenoxys.pdf

Quaternary Ammonia Salts: https://www.epa.gov/sites/default/files/documents/rmpp_6thed_ch12_paraquatdiquat.pdf

CHAPTER 3. EPA'S WORKER PROTECTION STANDARD

WPS Content: <https://www.epa.gov/pesticide-worker-safety/agricultural-worker-protection-standard-wps#>

EPA-Approved Training Materials for Workers: <https://www.epa.gov/pesticide-worker-safety/worker-protection-standard-materials>

Pesticide Educational Resources Collaborative (PERC): <https://pesticideresources.org>

CHAPTER 4. PESTICIDE APPLICATION GUIDELINES (DRIFT)

Dicamba Application Rules: <https://crops.extension.iastate.edu/cropnews/2018/01/downwind-buffers-and-susceptible-crop-restrictions-new-dicamba-products>

Organic Farm Buffer Zones: <https://www.ams.usda.gov/sites/default/files/media/6%20Buffer%20Zones%20FINAL%20RGK%20V2.pdf>

Pesticide Drift Story Map for the Midwest: <https://gpcah.public-health.uiowa.edu/pesticide-mapping-project/>

Glyphosate Application: https://www3.epa.gov/pesticides/chem_search/ppls/089442-00042-20191021.pdf

2,4D Application: https://www3.epa.gov/pesticides/chem_search/ppls/034704-00120-20151106.pdf

Dicamba/2,4-D DMA Mixture: https://www3.epa.gov/pesticides/chem_search/ppls/066222-00302-20220831.pdf

Talking About Pesticides: <https://extension.psu.edu/talking-to-neighbors-about-pesticides>

CHAPTER 5. PESTICIDES, PPE & HAZARD COMMUNICATION

Pesticide Drift Story Map Project: <https://gpcah.public-health.uiowa.edu/pesticide-mapping-project/>

VIEW THESE LINKS FOR
MORE INFORMATION &
ADDITIONAL
RESOURCES ON THE
CONTENT PRESENTED IN
THIS UNIT.