



# **HOW INSECTICIDES ARE USED**

# Pesticide Sale and Use



- Pesticides ... include insecticides, herbicides, fungicides, bactericides, rodenticides ... all are regulated by the US EPA
- General-use pesticides are sold to homeowners, residents, farmers, and others ... with no requirement to produce evidence of training
- Restricted-use pesticides are sold only to licensed applicators and may be used only by or under the supervision of a licensed applicator (commercial or private)

# Legal status of pesticide labels



- Crops, rates, restrictions, pre-harvest intervals, re-entry intervals, other safety precautions, etc. stated on a pesticide label are legally binding
- Rarely “policed” for homeowners, gardeners, etc., but ...
- Violations by farmers and custom applicators may result in fines, imprisonment, and business-destroying lawsuits
- “The label is the law.”

# Pesticide Applicator Licensing (in IL)



- Commercial Applications ... people who apply pesticides for hire, by ground or by air
  - Commercial Applicator (boss and maybe also the actual worker)
    - ✦ Needs to pass an exam in one or more of various categories, including field crops, rights-of-way, turf, aquatic, grain facilities, fruits and vegetables, etc.
  - Commercial Operator .. the person who applies the pesticides
    - ✦ Needs to pass a “General Standards” test and work for a licensed applicator
- Private applicator ... pretty much means farmer applicator

# Illinois Pesticide Safety Education Program



- See Illinois PSEP ...  
<http://web.extension.illinois.edu/psep/>
- Training provided by University of Illinois Extension
- Testing administered by the Illinois Department of Agriculture

# Drift



- Off-target movement of pesticide applications via drift – spray particles or vapors – is one of the most important problems associated with pesticide misuse
- DriftWatch – FieldWatch ... <http://www.fieldwatch.com/>
- Penalties (fines) for violations do not reimburse victims for losses associated with misuse ... usually drift. Suits and court decisions (or settlements) do this.
  - Many custom applicators routinely defy label restrictions on field crop herbicide applications in spring herbicide applications made when winds exceed label-specified limits
  - Many applicators / growers defy label restrictions by spraying insecticides on fruits, vegetables, field corn, and soybeans when crops (or weeds in orchards) are in bloom ... in conflict with label restrictions.

# I. Soil-applied & seed-treatment insecticides

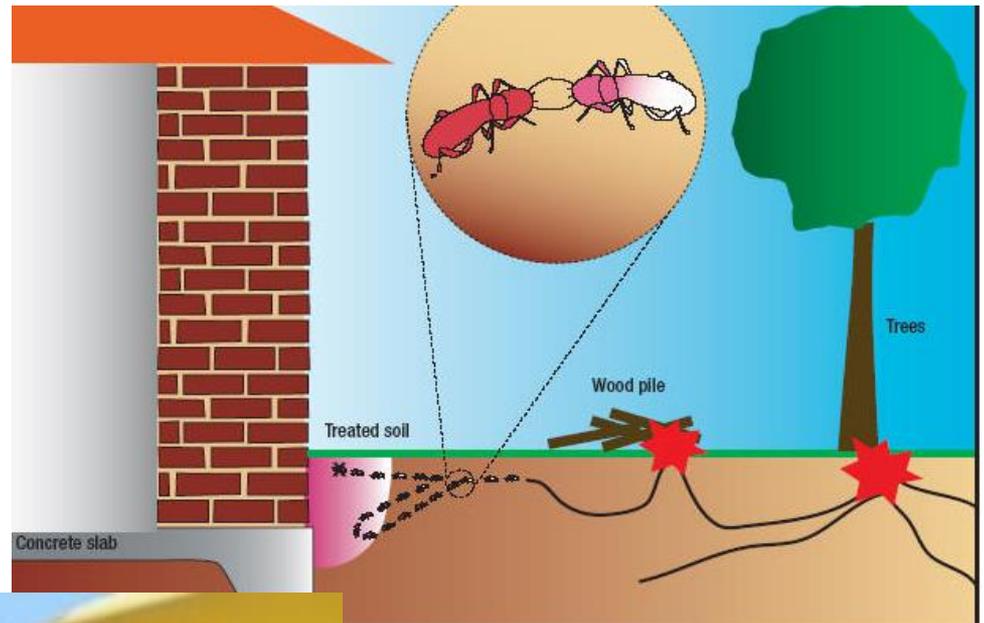


- Soil-applied for residual control:
  - Applied to kill insects in treated soil at time of application and for a period up to several weeks later; incorporated (at least lightly) or injected to mix with soil
    - ✦ Applied at planting for control of rootworms, cutworms, wireworms, grubs, seed and root maggots, etc. in field crops, vegetables, small fruits, gardens
    - ✦ Applied as soil treatments for termite control around houses, other buildings
    - ✦ Examples:
      - Organophosphates: Lorsban/Dursban, Counter, Diazinon
      - Pyrethroids: Force, Fortress
    - ✦ Band applications instead of broadcast applications are most common in crops

# I. Soil-applied & seed-treatment insecticides



- Soil-applied residual insecticides
  - Typically have (or should have) half-lives of (very roughly) 30 to 90 days
  - Typically are low to very low in water solubility (so that they do not leach out of the treatment zone in spring rainfall)
  - Are not bound too tightly to soil particles as to be unavailable in contact with insects
  - Historic problems have included too-great persistence (aldrin, dieldrin, heptachlor, chlordane, and other organochlorines) and too-great solubility and too little persistence (enhanced degradation of carbofuran / Furadan)



# I. Soil-applied & seed-treatment insecticides



- **Seed-applied residual insecticides**
  - Insecticides applied to seed at seed company facility or as a planter-box mixture
  - Kill insects that feed directly on seeds and below-ground portions of seedlings
  - Common seed protectants have included diazinon, Lorsban, lindane, and permethrin
  - Targets: seedcorn maggot, other seed and root maggots, wireworms, white grubs, seedcorn beetles, and symphylans
  - IF effective, seed treatments are appealing because they use a lot less insecticide than band or broadcast applications



# I. Soil-applied & seed-treatment insecticides



- Soil-applied for systemic uptake
  - Applied at planting or transplanting or as a side-dress
  - Historically in IL: Furadan and Thimet in corn, cucurbits, and/or potatoes for control of flea beetles, cucumber beetles, Colorado potato beetle, or aphids feeding on foliage
  - Elsewhere: Temik and Di-Syston in potatoes, (citrus), and wheat ... problems with leaching into groundwater
  - Currently: Neonicotinoids such as Admire (imidacloprid) and Platinum (thiamethoxam) in similar crops against similar pests and in urban use for tree and shrub insect control
  - Control usually begins a few days after application and persists 2 to 4 weeks; somewhat dependent on precipitation; neonicotinoids used around trees and shrubs may remain active for a year or more

# I. Soil-applied & seed-treatment insecticides

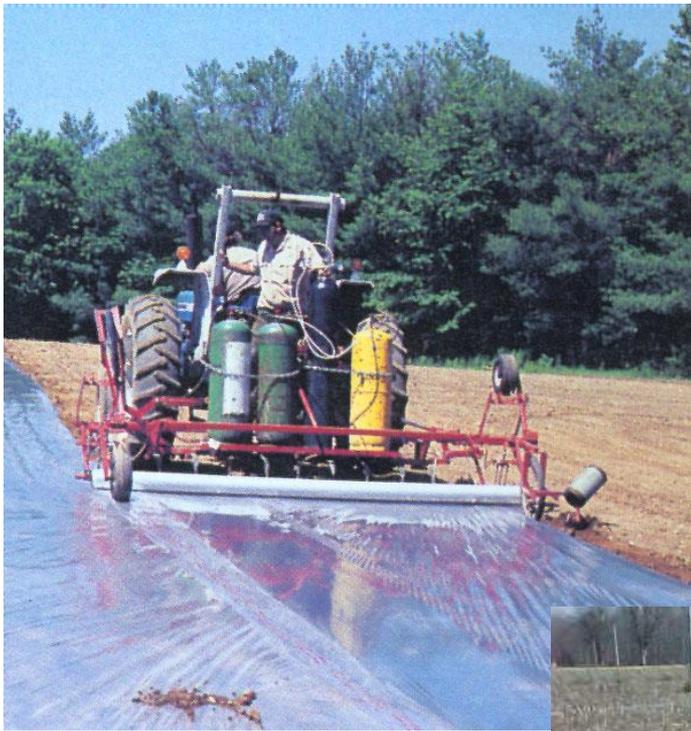


- Seed-applied for systemic uptake
  - Old O-Ps and carbamates that are systemic were not used as seed treatments because they were phytotoxic (poisonous to the seeds)
  - Current systemic seed treatments are sold under the trade names Cruiser, Gaucho, Poncho, and FarMore – all are neonicotinoids
    - ✦ On field crops, vegetables, and some ornamental plants
    - ✦ Targets include bean leaf beetle, corn flea beetle, cucumber beetles, leafhoppers, and aphids for 1 – 3 weeks after seedling emergence
    - ✦ Greater persistence and off-target movement may pose risks to pollinators

## II. Soil fumigants



- Primary fumigant against insects, pathogens, and weeds in the soil is methyl bromide
  - Applications usually made to raised beds tarped with plastic (for specialty crops)
  - Fumigant gas kills organisms present at the time of fumigation; dissipates in a few days
  - Cost = several hundred dollars to \$2,000 per acre
  - In IL, crops are “plasticulture” strawberries; some peppers and tomatoes
  - Soil fumigation is rare in IL, but in FL, TX, and CA (and a few other areas), fumigating before planting high-value fruits and vegetables is common.
  - Phase-out of methyl bromide because of its ozone-depleting effects presents a major challenge



# III. Foliar-applied insecticides



- Foliar “knock-down” insecticides (with little or no residual control intended)
  - Very few insecticides are applied with the intent that they NOT last at least a few days, but insecticides that kill only the insects that are present at the time of application or persist for only a short time include: dormant oils, soaps, pyrethrins, and malathion.
  - Most insecticides that break down rapidly have short **preharvest intervals** (as do some others that are very low in toxicity to consumers who eat treated produce); this can be especially important in fruits and vegetables where control may be necessary right up to the time the crop is picked.

# III. Foliar-applied insecticides



- Foliar residual insecticides ... Most applications of insecticides to plant foliage, by aerial or ground sprayers, are intended to last for a few to several days as residues on plant foliage
  - Most last from 3 to 10 days as effective residues
  - Treatments remain effective if sprays dry before rainfall of up to 1 inch
  - In general, most foliar residual sprays are effective as contact poisons ... insects that crawl across treated surfaces are killed when insecticides are absorbed through the insect's cuticle



# IV. Animal insecticides



- Insecticides are applied directly to animals for control of lice, flies, grubs, ticks, mites, mosquitoes, etc.
- Application methods for residual insecticides include:
  - ✦ Self-treatment devices such as back rubbers and dust bags
  - ✦ Controlled-release devices such as ear tags and flea collars
  - ✦ High-pressure sprays and mists
  - ✦ Pour-on or spot-on treatments that distribute in the coat
- Application methods for systemic insecticides include:
  - ✦ Pour-ons and spot-ons
  - ✦ Feed additives
  - ✦ Injections



**FRONTLINE®** 3 Applicators

**Kills fleas, flea eggs & ticks**

- Fast-acting
- Kills ticks including those that may transmit Lyme disease
- Waterproof

*Plus* for dogs

**For Dogs**  
89-132 lbs.

ACTIVE INGREDIENTS

Spinosad	9.8%
(S)-methoprene	8.8%
INERT INGREDIENTS	81.4%
TOTAL	100.0%

**KEEP OUT OF REACH OF CHILDREN**  
**CAUTION**  
Contains 3 0.135 fl oz (4.02 mL) applicators

Lift Here To Open

MERIAL



# V. Surface residual sprays



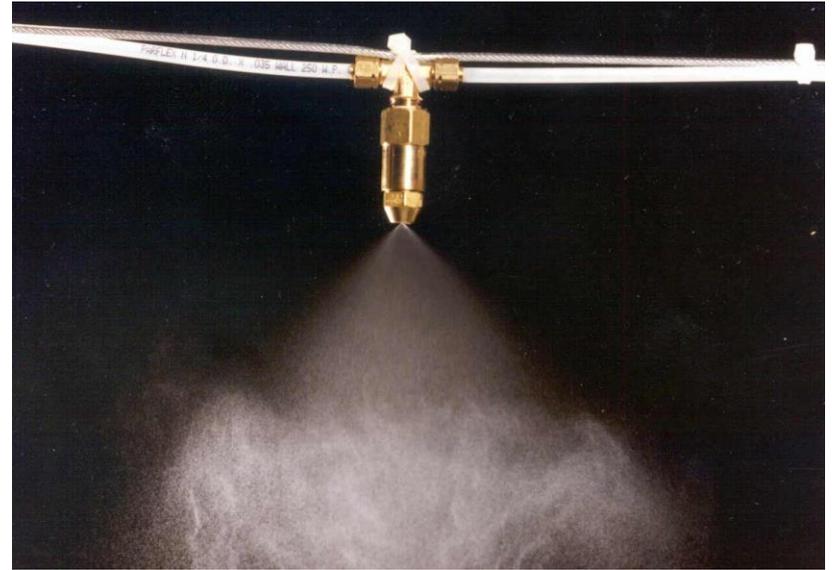
- Surfaces may be barn walls, bin walls, baseboards, wall voids, carpets, and more
  - Sprays applied to barn walls, wooden fences, etc. for fly control
  - Empty-bin sprays applied to grain bin walls for control of weevils, “bran bugs,” Indianmeal moth, etc.
  - Baseboard sprays and wall void treatments for cockroach control
  - Foundation and crawl-space sprays to control crickets, other “invaders”



## VI. Aerosol space sprays



- Examples include “bombs” for flea control, mists for fly control in livestock buildings, aerosols in food processing plants – often pyrethrins or pyrethroids with short residual and low toxicity
- These are not fumigants ... the active ingredient is dispersed in very small droplets of liquid that float through the air and deposit on exposed surfaces (including insects’ cuticles). They do not move as a gas into closed spaces such as cabinets, drawers, etc.



# VII. Space and Commodity Fumigants



- Examples: methyl bromide, phosphine, chloropicrin, sulfuryl fluoride, and even carbon dioxide.
- In agriculture, used to disinfest stored grains, flour, flour mills and other food processing plants, and ripe fruits and vegetables (Mediterranean fruit fly and similar pests).
- In general, fumigants are **EXTREMELY** toxic and require special training and equipment for safe handling



**Fumigation chamber**