#### **UF IFAS Extension** UNIVERSITY of FLORIDA

# **UF/IFAS Extension Hendry County**

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## **Mix and Load Pesticides Safely**

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Pesticides are one of many tools available to farmers for the protection of crops from weeds, insects, and diseases. **Pesticides require special care and handling.** The following article will outline safe, responsible, and effective procedures for pesticide mixing and loading that can help protect the environment, water supplies and pesticide applicators and handlers.

A few pesticides may be used as is, in the form they are purchased. These include baits, garden dusts, dry granular materials, aerosols, and some liquid household and livestock sprays primarily intended for homeowner use.

Most agricultural and commercial applicators will purchase concentrated pesticides, such as wettable powders or emulsifiable concentrates which must be diluted with other liquids before using. Water is the most common liquid used for diluting pesticides.

Mixing and loading pesticides can be very hazardous because you're working with a pesticide in its most concentrated, undiluted form. Exposure to even a small amount of a highly toxic, undiluted pesticide can cause serious harm.

#### **Goals of This Module**

- Understand the potential hazards of mixing and loading
- Know how to determine PPE requirements for mixers and loaders
- Learn to determine how, when, and where to mix concentrations of pesticides.
- Understand the importance of protecting the environment from spills and the safety measures that should be taken.
- Learn how to determine the compatibility of pesticides.

### **Before Mixing and Loading**

Immediately prior to mixing and loading give your equipment a thorough inspection. Check pumps, lines, and fittings for leaks by filling the sprayer with clean water while assessing entire sprayer for wear, severe rust, or breakage.

Always read and follow all product label directions and precautions appearing on or included with pesticide containers. Read and follow local, state, and federal regulations regarding pesticide handling procedures. Read the label thoroughly and make sure you have selected the correct pesticide for the job, have the required personal protective equipment and are aware of any particular hazards that the product might pose.

Carefully follow all mixing and loading instructions. Don't use more or less of the pesticide than the amount that's recommended.

Check the safety data sheet (SDS) for additional safety precautions.

Check for people and animals. If there are any people in the immediate area, be sure they are wearing personal protective equipment (PPE). Don't mix and load near animals or food.

#### When to Mix

It is a good practice not to add the pesticide to the tank or the granules to the hopper until just before you are ready to apply the pesticide. This is particularly true when you are going on a job that you have not checked previously. If the pest complex or conditions are different than you had expected, you may be faced with the disposal of a tankful of the wrong pesticide.

### **Applicator Safety**

The applicator is most at risk and most likely to be exposed to pesticides when mixing and loading since they are handling the undiluted pesticide in its concentrated form. At this time, mixers and loaders may splash liquid concentrates on their skin or in their eyes unless they are protected. Pesticides may spill on you or on your clothing where they can soak through to the skin or contaminate family members who may handle the clothing later on. Without respiratory protection, handlers may breathe particles from highly concentrated wettable powders or from granules or dusts. Carelessly handling concentrated pesticides may contaminate hands and then unintentionally carry the pesticide to your mouth when smoking, eating, or just rubbing your face or eyes. Handlers should always wear adequate protective clothing and equipment and make it a habit to don the label-specified PPE before handling or opening a pesticide container.

Depending on the label, required PPE may include:

- coveralls worn over work clothes
- a chemical-resistant apron
- unlined chemical-resistant gloves or gloves with removable liners
- a respirator
- a face shield, shielded safety glasses or goggles
- unlined chemical-resistant footwear (not leather)
- unlined chemical-resistant headgear for overhead exposure

A respirator and an appropriate form of eye protection should be worn if there is any chance of pesticide inhalation or eye exposure. It is a good practice to wear chemicalresistant gloves, goggles, and a respirator when handling moderately toxic materials, even if the label does not call for them. Never use bare hands when mixing a highly toxic material or when cleaning a tank. It is also important that adequate soap, water and decontamination facilities be maintained at the mixing area. Handlers should never eat, drink, or smoke while handling pesticides.

Equipment should be operational and calibrated prior to filling and using. The spray tank must also be clean; oil, grease, and chemical residues which can cause incompatibility problems. The agitation system should be running and the spray tank should be filled approximately half full of water before any pesticide is added. Handlers should always keep their head higher than the level of the tank mouth and avoid spills or splashes when putting adding pesticides to the tank.

It is important to review the label before opening the container so that you are familiar with mixing and usage directions. This is essential as information on the label, including amounts and methods, may change.

The pesticide mixing and loading area should be selected carefully. It should be outside, away from other people, livestock, and pets. Pesticides should not be mixed in areas where a spill or overflow could get into a water supply. If possible, mix and load pesticides on a containment pad so that spilled pesticides can be cleaned up easily and not absorbed into the ground. Handling areas are sometimes located near a pond or stream bank. If this is the case, the area should be graded to slope away from the water. If you must work indoors, or at night, be sure there is adequate ventilation and light. Have a supply of clean water and soap available and, if possible, do not work alone.

If mixing and loading pesticides in a grove or field, be sure to change locations frequently to avoid possible buildup of soil contamination. Do not tear paper containers to open them; use a sharp knife or scissors. Label the knife or scissors, clean it after use and do not allow it to be used for other purposes. When pouring from a container, keep the container at or below eye level and avoid splashing or spilling on your face or protective clothing. Never use your mouth to siphon a pesticide from a container. Always stand upwind, or so that the wind does not blow the pesticide toward your body. To prevent spills, close containers after each use. If an accident occurs, attend to it immediately. Remove any contaminated clothing and wash yourself thoroughly with soap and water. Spills on the floor or ground should also be attended to immediately. Some chemicals in the concentrated form will remain in toxic quantities in the soil for months.

Measure accurately; follow label instructions and mix only the amount you plan to immediately use. Newer measuring devices, such as "tip and pours", are a great help in handling small amounts of concentrate. All measuring devices (spoons, cups, scales) should be labeled and kept in the pesticide storage area and should never be used for any other purpose.

#### More safety tips

- Never eat, drink or smoke when mixing and loading.
- Never siphon pesticides with your mouth.
- Stand upwind when mixing and loading to avoid breathing vapors.
- Immediately stop working if a pesticide spills or splashes on you. Remove all contaminated clothing and PPE, then thoroughly wash your skin with soap and water. Put on clean PPE before cleaning up a spill and be sure to notify your supervisor.
- Always discard clothing or PPE that has been heavily contaminated with a concentrated pesticide.

#### **Protect the Environment**

Careless mixing and loading procedures can result in environmental contamination. Areas where pesticides are mixed and equipment is loaded have potential to result in soil or groundwater contamination with pesticides. Groundwater may be contaminated when pesticides are spilled during filling and mixing, run off the area during rinsing and washing equipment, or are back-siphoned directly into the water source. When adding water to a spray tank, the pipe or hose should remain above the level of the tank mouth, providing an air-gap between the hose and spray tank. The air-gap will prevent the possibility of back -siphoning the pesticide into the water source. Fill hoses should be equipped with an anti-siphoning device. If the hose is not equipped with a check valve, the spray mixture from the tank may run back down the hose into a water source. In Florida, pesticide law requires that an

air-gap or anti-siphon device be provided at loading sites to protect water sources. Handlers should never leave a piece of equipment unattended when it is being filled as it may overflow carrying pesticides and contaminate ground water or soil at the load site.

#### **Spills and Safety Measures**

One of the most hazardous activities involving pesticides is mixing and loading of concentrates. Use no more than the amount called for on the label to prevent injury to exposed plants and/or animals and to prevent illegal residues. Do not combine pesticides unless the combination is called for on the label or you have consulted an authority.

The following procedures are recommended for cleaning up small spills or spills that will not contaminate water. Remember to wear all the PPE indicated on the pesticide label before attempting to manage a spill and throughout the entire clean-up process.

- Control the spill. Do everything possible to immediately stop the leak or spill. If the material is a liquid, construct a dam to prevent it from spreading. Isolate the contaminated area. Rope off the area or use chalk to draw a line around it. Keep people at least 30 feet away from the spill.
- 2. Contain the spill. Spread an absorbent material such as vermiculite, fine sand, or sawdust over the entire spill.
- 3. Clean up the spill. Collect the material for disposal. Sweep or shovel the contaminated absorbent material into a heavy-duty plastic bag. Decontaminate the area. For floors, work a decontamination agent (usually hydrated lime or a high pH detergent) into the spill area with a coarse broom. Add fresh absorbent material to soak up the now contaminated cleaning solution. Sweep or shovel the contaminated material into a heavy-duty plastic bag. Repeat this procedure several times to ensure thorough decontamination.

For soils, shovel the top 2 to 3 inches of soil into a heavyduty plastic bag. Next, cover the area with at least 2 inches of lime. Finally, cover the lime with clean topsoil. Minor spills can sometimes be cleaned up by immediately applying activated charcoal to the contaminated surface.

To clean up contaminated vehicles and equipment, use a mixture of liquid bleach and alkaline detergent to clean metal surfaces. Porous materials and equipment such as brooms, leather gloves, and sponges cannot be decontaminated effectively and, therefore, must be disposed of.

Dispose of contaminated materials. Remember that this includes contaminated absorbent materials, soil, and porous equipment. Check with your state regulatory agency

to determine what to do with these materials. Most can be disposed of in a licensed sanitary landfill, but some contaminated materials are considered hazardous waste and require special handling.

For major spills, or spills that may contaminate water, follow the first three steps under the directions for cleaning up minor spills. Then call the CHEMTREC telephone number (800) 424-9300. A qualified person will answer and direct you regarding what procedures to follow and whom to notify. If necessary, the area coordinator will dispatch a pesticide safety team to the site.

Spills may also require notification to other authorities. If a state highway is the site of a spill, notify the highway patrol and the state highway department. If food is contaminated, notify state or federal food and drug authorities and city, county, or state health officials. If water is contaminated, notify public health authorities; regional, state, or federal water quality or water pollution authorities; and the state fish and game agency.

#### **Empty and Rinse**

"Empty" pesticide containers are not truly empty as they contain pesticide residues. As soon as they are emptied, containers with liquid pesticides should be triple-rinsed or pressure rinsed. Measuring cups should be rinsed and the rinse water put into the spray tank. Rinse them at least three times with the same liquid that the tank is being filled with. Pour the rinse water into the spray tank to avoid disposal problems and wasting product. Rinsate can be used as make upo water and legally applied to a labeled crop or site at the labeled rate. Replace container caps and close bags. Return them to the pesticide storage area. All containers should be accounted for and properly disposed of.

#### **Triple Rinsing**

Handling empty pesticide containers is an important task as well. Even if the container appears empty, it may still contain traces of the pesticide and should never be used for any purpose other than the storage or transportation of a pesticide. The rinse process should take place as soon as the container becomes empty. If the container is allowed to dry, that dried material may become difficult to adequately remove with rinsing. Never take the containers home, use them for garbage containers or any other purpose. Once you have removed all of the pesticide from the containers, they should be triple-rinsed, unless otherwise required.

To triple rinse, use a pressure system or fill the container to one-quarter full with water and shake or roll the container to dilute or remove as much of the chemical as possible. After shaking or rolling the container around, the rinse water and any rinse material should be placed in the spray tank to be used as diluent for future sprays to labeled crops. This process of rinsing should be conducted at least two more times, hence the name triple-rising. After triple-rinsing, if the container is still visually contaminated with pesticides, rinse again. For containers that are not returnable, the rinsed containers should be offered for recycling, if possible, or rendered unusable. These unusable containers should be stored in a secured location until proper disposal can be conducted.

Pressure rinsing is an alternative to triple rinsing. Some pesticide equipment, including some closed system mixing and loading equipment, is equipped with a mechanism to pressure rinse pesticide containers when they are emptied.

The system usually operates by:

- inserting a high-pressure nozzle and hose into the container.
- rotating the nozzle and rinsing for at least 30 seconds, and
- draining the container thoroughly into the mix tank. Some systems puncture the base or side of the container to insert the nozzle. Other systems insert the nozzle into the container's regular opening.

#### Closed Pesticide Handling Systems

A closed handling system allows you to remove a pesticide from its original container, rinse the empty container, and transfer the pesticide and rinse solution to the spray tank without contacting the pesticide. Closed handling systems can dramatically reduce your exposure to concentrated pesticides. There are two basic types of closed systems; gravity systems and suction systems.

Gravity systems, sometimes called "punch and drain" systems can open, drain, then deliver the pesticide to the equipment tank. Unopened pesticide containers are inserted into a box, which is then sealed. A punch opens the container allowing all of the pesticide to drain into the mixing tank. The punch is attached to a clean water line which sprays the inside of the container to rinse it and then returns the rinse to the mixing tank. The applicator than removes the rinsed pesticide container for disposal. One limitation of gravity systems is that full containers are used and it is not possible to use part of a pesticide container.

Suction systems pump the pesticide out of the container through a probe inserted into the container. Some containers are being equipped with built-in probes. A pipe moves the pesticide to the mixing tank. A clean water pipe rinses the container when it is empty and the rinse water is added to the mix tank.

#### Compatibility

Often two or more pesticides are mixed together in the spray tank in order to control more than one pest with the same application. However, the pesticides must be compatible; that is, they must be able to be mixed together without reducing their effectiveness in any way. Some pesticides may be chemically incompatible. A chemical reaction between pesticides in a tank mix may result in loss of pesticide activity, increased toxicity to the applicator, or injury to the plants or treated surface. It is possible for the pesticides may cause wettable powders to form lumps. Liquids may settle into layers or form solids that settle out. The label often lists compatibilities of the pesticide involved and compatibility charts are available in pest management recommendations, pesticide trade publications, etc.

A way to remember the correct sequence for mixing solids and liquid pesticides is abbreviated W -A-L-E. When formulations of different types, including wettable powders, water dispersible granules, liquid flowables and emulsifiable concentrates are mixed together in the spray tank, they should be added in the right order to assure proper dispersion and uniformity.

- Fill the spray tank 1/2 full of water and get the agitation going until the water in the tank is rolling.
- Now begin the W-A-L-E sequence:
- Add wettable powders and water dispersible granules first. (W)
- Agitate until the W's are uniformly dispersed, meanwhile adding water until the tank is 90% full. (A)
- 3. Add liquid pesticides and adjuvants. (L)
- 4. Emulsifiable concentrates go in last. (E)

Lastly top off the tank, continue agitation and the pesticides are properly mixed.

It is better to mix liquids with liquids or wettable powders with wettable powders, rather than a liquid with a wettable powder. Small quantities of wettable powders often mix easier if a slurry is made first.

#### Water pH

Keep in mind that water chemistry can influence the effectiveness of some pesticides. Alkaline spray water, for example, can lead to chemical breakdown of many organophosphates and carbamates. If your water supply is alkaline, especially if the pH is 8.0 or greater, and you are using a pesticide that is sensitive to high pH, you should lower the pH of the water in the spray tank. A pH in the range of 4-6 is recommended for most pesticide sprays. You can adjust your spray solution to the 4-6 pH range by using adjuvants that are marketed as buffering agents.

#### Adjuvants

An adjuvant is any chemical added to a pesticide mixture or spray tank that helps make the active ingredient safer, easier to handle or more effective. Most pesticide formulations include a small percentage of adjuvants (additives). Wetting agents and emulsifiers are needed so that the pesticide chemical will mix with water. Spreaders and stickers help make the active ingredient spread evenly over the treated surface and stay there in spite of rain, wind, or bad weather. Some pesticides, especially herbicides, must be absorbed by the target to be effective. Penetrants aid the pesticide to get through the outer surface (leaf, root, skin) and into the plant. The formulation, as manufactured, contains enough of these materials for many jobs, but sometimes extra additives are called for. For example, when treating waxy surfaces such as cabbage or onion leaves, a spreader-sticker may be needed. These extra additives are added directly into the spray tank. Care must be taken to use only the amount recommended or the result may be less deposit rather than more, resulting in poor control. Other types of additives include thickeners, emulsifiers, buffering agents, and foaming agents.

#### Disposal

Small amounts of plastic, paper and/or cardboard containers can be burned at the application site, unless prohibited by local regulations. You must to ensure that all material is removed from these containers before burning.

Special caution during mixing and filling are well worth your time and effort. Your reward will be safety for you, others, the environment and perhaps monetary savings as well.

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