



Pesticide Mix-Load and Sprayer Wash-down Systems for Florida Citrus¹

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Introduction

Pesticide mix-load facilities are designed to minimize environmental contamination while sprayers are being filled with water and agrichemicals. These facilities often include features to reduce worker exposure to pesticides. Wash-down systems are designed to collect spray materials rinsed from equipment and achieve the same goals of minimizing environmental and worker exposure.

Repeated filling of sprayers with pesticides results in frequent low level spillage and occasional accidents where larger amounts of concentrated spray material are spilled onto grove soil. Pesticides sprayed onto the target crop are applied at lower concentrations over a larger area and are more quickly degraded and/or more likely to bind to soil particles within the grove, reducing the potential for surface water contamination following rain or irrigation. In addition, pesticides applied properly to trees contribute to crop production while spilled materials represent cost and environmental risk without any benefits. Mix-load stations are containment facilities that prevent spilled materials from reaching the soil, and permit recovery of

materials for use in intended grove operations. In addition, many mix-load facilities include features that make mixing and loading easier and more accurate, and simultaneously increase worker safety.

All mix-load facilities are designed for containment and recovery of spilled pesticides. Several types of systems are available and can include a variety of pesticide handling and/or safety features. This document is intended to provide information on features, use, and selection of pesticide mix-load stations and wash-down systems.

Pan Containment Systems

The simplest and least expensive facilities are essentially plastic pans on which the sprayer is parked during mixing and loading. The tractor and sprayer drive over the folding wall, which returns to an upright position after passage of the equipment (Figure 1). Spillage is collected within the pan and must be pumped into another vessel for use or final disposal. Since there is no sump for material collection, a portable pump must be placed in the pan, with repeated rinsing and pumping of rinsewater into a collection tank. Since equipment travels over the containment surface, recovered materials are usually

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heavily contaminated with soil and must be filtered if recovered materials are to be used in the sprayer.

Time and effort required for cleanup with pan containment systems suggest that they are adequate to prevent contamination from severe spills but not practical for routine collection of material. While such containment systems could be used to wash-down equipment prior to maintenance, the difficulty in collecting rinse water probably would discourage routine use.

Pan containment facilities do not reduce spray operator exposure to pesticides and may actually increase this risk, since recovery of spilled materials requires additional worker handling. There are few reports of Florida citrus growers using pan containment systems.



Figure 1. Pan containment system.

Permanent Mix-Load and Wash-down Stations

Permanent mix-load stations minimally consist of a concrete containment pad with a collection sump, a water supply, and a roof designed to minimize entry of wind-driven rain. Construction of such facilities is relatively expensive and is most practical for operations in which a single well provides water for spraying substantial acreage. If a facility is intended solely as a wash-down unit, only the concrete pad and sump are necessary, and the sump can be thoroughly rinsed so that rainwater collecting between uses does not have to be handled as pesticide waste.

Materials Handling and Storage

Loading Features

Minimal loading equipment requirements are a well, a pump and plumbing to provide an overhead supply of spray water into the top of the sprayer. With this setup, the spray operator would load all materials into the sprayer by hand. While some sprayers

include chambers in which pesticides are loaded from the ground, most sprayers can only be loaded from the top. Studies indicate some applicator exposure to pesticide concentrate while loading most materials, so reduction in handling reduces risk. In addition, severe spillage is more likely when loading is awkward such as when pouring from heavy containers into the top of the sprayer.

To reduce operator exposure to pesticides, many mix-load stations include features to reduce handling of pesticides and permit loading from the ground. Such systems may include mixing funnels for powders and small volumes of liquid, work surfaces for measuring materials, enclosed pumping systems for dispensing liquids used in larger volumes, and associated water handling and metering equipment. Frequently, a slurry tank is included in which all materials including water are mixed prior to pumping into the sprayer, permitting rapid sprayer loading with maximum efficiency. A typical setup including many of these components is illustrated in Figure 2. All materials are pumped into the sprayer from the relative safety and comfort of the ground, reducing the potential for spillage and operator contamination, decreasing opportunity for injury-producing falls, and frequently decreasing the time required for loading the sprayer.



Figure 2. Permanent mix-load and sprayer wash-down site.

Pesticide Cleanup and Wash-down

A water supply and hose must be included for washing down the concrete pad and or equipment when spillage does occur. The sump must be designed to handle the maximum volume of cleanup water expected from several days use, so that overflows do not occur with failure of the sump pumping system. Typical sump volumes used range from 15 to 50 gallons. Since equipment travels over the containment surface, recovered materials are often contaminated with soil and grease requiring

filtration (usually a screen followed by a bag filter) if recovered materials are to be used in the sprayer.

A permanent mix-load station is ideal for washing down spray equipment to reduce worker exposure during maintenance. The use of a detergent or concentrated degreaser is advisable, and the resulting rinsates should not be applied to trees.

Storage of Pesticides

Most citrus producers receive deliveries of pesticides at sites where mixing and loading will occur. Pesticide storage areas should be designed in permanent mix-load facilities to: permit easy unloading, provide efficient access by spray operators, provide security, and avoid exposure to rain and wind. In addition, many mix-load sites are designed for bulk delivery of spray oil, with storage containers plumbed directly into the mix-load system.

Safety Features

Increased worker safety can be a major stimulus for building a mix-load facility. Worker Protection Standard necessities typically incorporated into mix-load sites include: 1) an emergency shower or sink for personal decontamination, 2) an eye wash station, 3) storage areas for garments, 4) personal protection equipment (ppe) storage area, and 5) a receptacle for disposable ppe and pesticide containers. While worker safety is a worthy goal in itself, controlling costs for workman's compensation and insurance may be additional incentives.

Portable Mix-Load Stations

Portable mix-load stations offer many of the same advantages as a well-equipped permanent mix-load station, but do not include a pad in which the sprayer is filled. Instead the containment and mix-load functions occur on a platform mounted on a trailer.



Figure 3. Portable mix-load stations: closeup of eyewash and shower.

Design of Portable Mix-Load Trailers

Mixing and Loading Features

Mix-load trailers are designed with an impermeable floor and integral channels (Figure 4) that direct spills into a sump. Mix-load trailers must have features that permit handling and loading of pesticides from the trailer, so that any spills will occur within the contained area.



Figure 4. Closeup of guttering for spill containment in portable mix-load station.

As with a well-equipped permanent mix-load facility, features may include mixing funnels for powders and small volumes of liquid, work surfaces

for measuring materials, enclosed pumping systems for dispensing liquids used in larger volumes, associated water handling and metering equipment, and a wash-down hose. These trailers must also have equipment to access water, typically consisting of a ditch boom and hose with a back-flow device and a pump for use with surface water supplies. Most designs include an area for storage of pesticides, with a drop down gate to facilitate delivery but prevent loss during trailer movement. Some designs have included a roof to protect pesticides from rain. Typical setups including many of these components are illustrated in Figures 5 and 6.



Figure 5. Portable mix-load stations designed for flatwoods grove with plumbing to access ditch water. This design has no oil or slurry tank.



Figure 6. Portable mix-load stations with slurry tank and spray oil storage.

Depending on grower needs, a spray oil storage container can be included in the mix-load trailer design. However, when filled for several days spraying, this will greatly increase trailer weight and equipment demands for transport. Other growers may elect to have a filled spray oil tank delivered to the spray site and simply connect to the tank for metering materials into the sprayer. As with fully-equipped permanent facilities, materials are pumped into the

sprayer from the safety and comfort of the trailer, reducing the potential for spillage and operator contamination, decreasing opportunity for injury-producing falls, and frequently decreasing the time required for loading the sprayer.

Collection and Storage of Spillage and Rinsate

The sump must have sufficient volume to contain a substantial spill, and include a pump and filter system to transfer recovered materials into the sprayer. A wash-down hose must be provided to clean spills into the sump. Since these trailers do not include a mechanism for containing spills from the sprayer, additional safety features are especially important, such as locking fittings on the transfer hose, sprayer fill limit detectors, and emergency shut-off switches.

Roadworthiness

Mix-load trailers which will be transported routinely on highways should be designed with both road safety and grove convenience in mind. Before deciding on a final design, growers should determine whether the primary use will involve delivery of spray materials for several days use to the mix-load trailer, or whether the loaded trailer will be road-hauled between groves. Trailers intended for use within a continuous grove system are often much larger since grove convenience does not need to be compromised for road-worthiness.

Safety Features

As with permanent facilities, Worker Protection Standard necessities are often included in the design. A separate source of clean water should be included rather than using surface water for personnel decontamination. A rough surface is important to provide secure footing even when small amounts of spray oil have been spilled. A waist-high railing has been installed for worker safety on most mix-load trailers. When spray applications will occur during daylight, a canvas roof similar to those often found on boats, provides welcome shelter from the sun.

Advantages of Portable Stations

Mix-load trailers are generally less expensive than permanent facilities and allow use at various application sites, often reducing the cost per acre managed. Portable mix-load stations are an excellent option when it is advantageous to load sprayers at an array of sites. For example, permanent sites are not appropriate for most flatwoods groves, since ditch water is used for most spraying and can be found throughout the grove, therefore moving mix-load operations to minimize sprayer travel increases spray efficiency.

Spilled pesticides recovered with portable stations can usually be added right into the sprayer with no concern about disposal, and potentially produce significant savings if expensive materials can be used for their intended purpose. In addition, permanent sites are more likely to accumulate pesticide residues which may cause regulatory problems.

Disadvantages of Portable Stations

Portable mix-load trailers are unlikely to offer secure pesticide storage or the degree of protection from weather which can be attained with a permanent mix-load station. Portable stations offer no wash-down opportunities for spray equipment prior to maintenance.

Dealing with Recovered Pesticides

Whenever possible, recovered pesticides should be added to the sprayer for application in a registered and originally intended use. Handling of recovered materials is different between portable and permanent mix-load sites, reflecting greater contamination in permanent systems resulting from equipment travel on the containment surface. In a mobile unit, chemicals are collected in a sump tank after passage through a screen filter and are introduced into the sprayer loading system using a separate pump. The sump system should be cleaned thoroughly (with rinse water then used to fill the sprayer) at the end of the workday (to avoid overflow of contaminated water during rain) or whenever changing to a spray not compatible with the previous use, such as

spraying a variety in which the material just used is not registered.

In most cases, material recovered in a permanent mix-load site may be contaminated by lubricants, or cleaning compounds and should not be applied to trees. Where such contamination is minimal, disposal of waste water on the grove floor using an herbicide applicator is an affordable option. Application must be made over a broad area so that ground cover pesticide loads are similar to those resulting from a normal spray application, and should only be applied in a variety for which the spray material is registered. Check with the University of Florida Pesticide Information Office (352-392-4721) before using this approach, since laws regarding this practice may change.

When pesticide wastes are heavily contaminated with lubricants or cleaning compounds, they will require more stringent filtering before application to the grove floor or must be treated as hazardous waste. Again, the University of Florida Pesticide Information Office can provide guidance on proper disposal.

Using Mix-Load Stations for Herbicide Units

Using a single mix-load facility for both herbicide units and foliage sprayers (i.e. airblast or Curtec™ units) is not recommended. The simultaneous use for both purposes requires duplicate systems to avoid contaminating the foliar spray solution with herbicide. Any spray materials recovered must be treated as suspect and should only be applied via a herbicide applicator. Potential compatibility problems in the recovered materials must be carefully considered to avoid tree injury or equipment problems such as clogging nozzles.

Maintenance

The goals of increased environmental and worker protection are not likely to be achieved unless mix-load and wash-down facilities are properly maintained. A regular schedule for monitoring each feature should be established and observed. Workers should be trained to watch for leaks or irregularities from hoses, fittings, valves, regulators, and pumps.

Grower Experience with Mix-Load Stations

Overall, growers report that use of mix-load stations substantially increases the efficiency of their spray operations, and that the worker safety advantages are important to them. While savings of spilled spray materials occurs regularly, there are few reports of more than negligible savings in terms of material value. However, within the context of a committed multi-component program to reduce environmental impact, such mix-load stations are likely to help reduce surface water pollution from cumulative modest savings across many groves and several years.