Sprayer Clean-Out and Drift Management – Back to the Basics

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The "winter of 2005" will be one of those years most of us won't forget. The prolonged wet winter we had brought growers many challenges in the southern San Joaquin Valley, including being able to get into the field to make "routine" winter dormant tree and vine herbicide sprays. Many growers found it difficult, if not impossible, to make those applications between storms and before the trees or vines started breaking bud. If you were lucky enough to get into fields that drained nicely, it mostly went well. For those not so fortunate, it meant waiting until the first of March when soils were dry enough before it was full-bore ahead. By then, most of the orchards and vineyards were coming to life and spray rigs were burning rubber. Planes were also swarming on the west-side as fallow cotton beds and cereals were being treated for weeds. With all that in mind, it's no wonder why many orchards and vineyards felt the hit of some herbicide-induced injury (although this most noticeable on the west side of the valley, particularly in almonds, apricots, grapes, tomatoes, and onions).

Perhaps the "winter of 2005" will help remind us that, while we can control a lot of things, Mother Nature often has the final say. It's years like this that give us an opportunity to remember the basics when it comes to herbicide application and prevention of crop injury. While we can't control Mother Nature, we can adapt by being prepared, especially when it comes to sprayer cleanout and drift management. The bottom line is, like changing the oil in your pickup, proper sprayer maintenance, application, and sprayer cleanout can help prevent problems from occurring. While it takes a little longer and costs a few extra bucks to make sure the job is done properly, the added expense can be looked at as insurance for making sure this and future crops will be healthy and profitable.

Sprayer Clean-out

Proper maintenance and sprayer clean-out are essential parts of effective weed control. Using a contaminated sprayer is an often over-looked cause of crop injury, both within the field being treated and subsequent fields once the spray job is done. This problem can be avoided by ensuring that sprayers are properly cleaned *before and after* each use. Many factors can influence sprayer clean-out procedures, including design and maintenance of the equipment, residues from previous applications, and the presence of tank-mix partners, including additives. It is important to remember that spray equipment should be well maintained, operating as designed, and properly calibrated before herbicides are applied. Older, poorly maintained spray equipment with rusted and/or pitted components can trap herbicides, making them difficult to remove. Repeated applications over a period of time without interim rinsing can lead to a buildup in deposits, which can break free during subsequent applications, causing crop injury. When the same equipment is used to spray different crops or different products are used between applications, crop injury can occur if traces of previously used products remain in the sprayer. Herbicides, like 2,4-D, are very active at sub-lethal doses and can be difficult to completely remove from sprayers. It is desirable to dedicate a sprayer solely for the use of herbicides to reduce the likelihood of potential crop injury, particularly when foliar applications of insecticides, fungicides, or nutrient sprays follow an herbicide treatment from the same sprayer.

Some sources of contamination of spray equipment include:

- *Improper or inadequate clean-out*
- *Re-dissolved residues*
- *Contamination from using remix water*

- *Poly-fiber tanks and rubber hoses* (use stainless steel tanks and polyethylene hoses)
- *Products with low use rates and highly active molecules*
- *Presence of tank-mix partners and additives*

To help reduce the likelihood of crop injury, clean out the sprayer when changing products, changing crops, and after finishing the day's work. The following steps are useful to reduce possible crop injury due to sprayer contamination:

1. *Read the product label to determine the recommended cleaning procedure*: When using multiple herbicides per tank load, follow the label with the most intense clean-out procedures. Use appropriate personal protective equipment. The steps below are recommended when there are no specific cleaning requirements given on the label.
2. *Start with clean spray equipment*: Residues from previous applications can trap subsequent compounds and make it more difficult to clean them from the system.
3. *Use stainless steel tanks and polyethylene hoses*: Herbicide residues can be tightly bound to poly-fiber tanks and rubber hoses.
4. *Dispose of excess spray solution*: One method is to dilute the remaining spray solution at least 10:1 with water. This diluted solution can then be applied to the previously treated area as long as the maximum recommended product rate on the label is not exceeded.
5. *Drain, fill, and flush*: Drain the tank and lines, fill the tank half full with clean water, and operate and flush the system for a minimum of 5 minutes.
6. *Fill with cleaning solution and flush*: Fill the spray tank and add 1 gallon of household ammonia (3%) for every 100 gallons of water (other detergent and tank cleaner products can also be used). Agitate the sprayer for 15 to 20 minutes. Flush the boom and hoses with the solution, allow to stand for several hours (overnight if possible), and then flush boom and nozzles again and drain tank.
7. *Inspect tank*: If visual residues are present inside tank, repeat step 6 above.
8. *Clean nozzles, screens, and strainers*: Remove nozzles, screens, and strainers and clean them separately in a bucket with cleaning solution.
9. *Final rinse*: Wash outside of entire sprayer with soap or mild detergent and water and rinse.

Drift Management

Reducing spray drift is necessary to prevent crop injury, both within the field being treated and off-site. Environmental conditions (air temperature inversions, wind velocity, etc.), applicator awareness, type of spray equipment, nozzle selection, spray boom operating pressure, water volume discharge, and other factors affect the degree of drift that may occur during any application. While spray shields do not guarantee drift will not occur, they can greatly minimize the risk of drift, especially in open fields or where young vineyard and orchard plantings are being treated. The following steps should be taken to minimize the risk of drift from ground sprayer equipment:

1. *Don't spray when it's windy*: Do not spray in winds above 6 - 10 mph.
2. *Be cautious on calm days*: Do not spray under dead calm conditions in early morning, evening, or the night. Calm conditions are often associated with temperature inversions which can result in long-distance spray drift (1 mile or more). Burning tires on calm days can give an indication on the presence of temperature inversions (refer to local regulations on restrictions for obtaining a burning permit).
3. *Check the buffer zones*: Refer to the product label to determine adequate buffer zones outside of the field treated. Do not spray if the wind is blowing towards a nearby sensitive crop, garden, waterway, or other sensitive area.

4. *Use a shield*: Consider equipping your sprayer with a protective shield. A number of designs are available that can reduce drift between 35 and 75%. Avoid spraying trunk-to-trunk with unshielded spray booms.
5. *Use a spray drift retardant*: Spray drift retardants are available that can be added to many products to help reduce off-target drift.
6. *Check the formulation*: Use amine formulations of 2,4-D when possible. Use special care when using ester or other volatile herbicides. Avoid spraying these products on or immediately before hot days.
7. *Sprayer type*: Sprayers designed to apply herbicides at low volumes (<10 gpa), such as controlled droplet applicators, produce extremely fine droplets which can drift long distances. Advances in sprayer technology allow for certain postemergence herbicides (like glyphosate) to be applied through low volume, shielded equipment or in low doses based on weed populations present at the time of treatment. Examples are shown below in figures 1 and 2.
8. *Watch the nozzle pressure*: Avoid nozzle pressures above 45 psi for conventional flat fan tips. Excessive pressure can create fine droplets that are prone to drift. Use a minimum of 10 gal/acre, unless otherwise specified on the label.
9. *Nozzle height*: Operate nozzles at their lowest recommended height. For 80° tips, this is 18", and for 110° tips, this is 12". Orienting nozzles forward also allows for further height reductions.
10. *Nozzle selection*: Special nozzles are available by various manufacturers, that create coarse, low-drift sprays. These nozzles can reduce drift by 50 to 95%. Refer to the chart below for some of the various types of nozzles that can be used to help prevent drift.

Nozzle Type	Function	Size - Angle	Operating psi	Spray height
XR TeeJet	Uniform cover at low pressure	8001 – 8015 11001 – 11015	15 – 60	12 – 18"
DG TeeJet	Drift guard with large droplets	80015 – 8005	30 – 60	15 – 19"
Turbo FloodJet	Pre-orifice for large droplets	2 – 10	10 – 30	14 – 20"
LP TeeJet	Larger droplets at low pressure	8001 – 8010 110015 – 11010	15 – 40	12 – 18"

Other low-drift nozzles are available; refer to your local dealer for specific nozzles available and read the product label for specific application recommendations.

Figure 1. Enviromist sprayer with shield reduces the volume of water and herbicide needed.

Figure 2. Smart Sprayer; a shielded selective sprayer that treats the weeds, not the bare soil.