How to Avoid Drift in Natural Area Herbicide Applications

by Ken Langeland and Bill Kline

For the natural area herbicide applicator, pesticide drift is a major concern. Drift, as it applies to pesticide application, refers to the airborne movement of a pesticide away from the application site. Pesticide drift can cause unwanted effects that result in health risks, crop damage, and environmental damage. According to Florida Pesticide Law, it is unlawful to "cause any pesticide to drift onto any person or area not intended to receive the pesticide" (487.031 (13) (e) FS). Herbicides can move offsite as either particles (from dry formulations), droplets (from liquid applications) or vapors (vapor drift). Drift can, and should, be avoided. Many conditions affect drift including droplet size, application methods, weather conditions, vaporization and surface area.

Drift of spray droplets

Drift of spray droplets is minimized by managing droplet size. The smaller (lighter) the droplet, the more likely it is to drift (see Table 1). This is particularly important for agricultural and aerial applications where multi-nozzle booms are used, but it is also important for applications using a hand gun and single nozzle. Droplet size is maximized by using low pressures and large orifice nozzles (spray tips), which reduce shear upon the spray solution as it leaves the nozzle. Because large droplets are not as effective for coverage, a tradeoff in pressure/nozzle combinations must be made to maximize coverage and minimize drift.

Other factors that can affect drift of droplets are nozzle height and orientation. Applying the spray solution closer to the ground and with a side to side movement of the wand or handgun instead of up and down movement will minimize drift potential.

Weather conditions

Low humidity can increase drift because droplets can be reduced in size by evaporation. Drift potential also increases with wind speed because the distance that a droplet can travel is proportional to the wind speed. Wind, especially spraying into the wind, can also increase drift by causing shear at the spray tip.

With experience and using common sense, natural area herbicide applicators will learn to use the right combination of pressure and spray tips to maximize coverage and minimize particle drift as well as avoid conditions that will cause drift.

Fog	15,840
Very fine spray	1,100
Fine spray	44
Medium	28
Course	9
Fine rain	5

Table 1: Lateral distance (feet) that droplets can travel in falling 10 feet in a 3 mph wind.

Vapor drift

Vapor drift occurs when a herbicide active ingredient is transformed into a vapor and becomes airborne. Different types of herbicides vaporize at different rates. For example, triclopyr triethylamine is practically non-volatile, while triclopyr butoxyethyl ester will volatilize under conditions that favor volatilization and vapor drift. One or the other of these forms of triclopyr is the active ingredient in herbicide products commonly used for control of invasive plants in natural areas.

Factors that can affect vapor drift include concentration of the herbicide solution, the type of surface that the solution contacts (foliage vs bare soil, rock/hard surfaces, etc), the amount of herbicide applied, air movement, and temperature. Vaporization will be greater from a more concentrated solution; and more herbicide applied to an area (e.g. the denser the stems of a target species that are treated) means that more herbicide vapor will be available, which increases the potential for non-target damage. Spray solution that lands on inert surfaces such as rocks, is more likely to vaporize than if it lands on the target plants and is absorbed.

While wind can move vaporized herbicide away from the application site where it may cause damage, lack of air movement may cause more serious damage. Very still air can indicate a thermal inversion, which occurs when a layer of warm air is stratified above a layer of colder air near the earth's surface. Thermal inversions usually occur during early morning hours and are characterized by still air and a layer of fog above the ground. Under these conditions, vapors (and small droplets suspended in the air) can be more concentrated than those transported by wind. Because non-target species are often in close proximity to target plants, vapor drift under thermal inversion can be a major concern to natural area herbicide applicators.

Volatilization increases at higher temperatures. Therefore, the potential for vapor drift increases as temperature increases. Temperature is the most important factor relative to vapor drift because if volatilization does not occur or is minimized, other factors do not come into play.

Questions about non-target damage during hot summer weather can often be attributed to herbicide drift.

Q: *"I believe that we may have had some correspondence about problems with volatilization of triclopyr (ester) in the past, and this has come up again, to the point of our considering an 'in house' restriction on an upper temperature range for usage. We have had another incident of minor damage to mangroves adjacent to some Brazilian pepper cut-stump/re-sprout treatment we did. We are using an ester formulation (Element 4) with Diluent Blue as the carrier/diluent. We are using it at 10%, and have been very careful not to exceed this.*

I just read through all the MSDS and label materials and looked on-line at various sources, but can find no specific recommendations on hot-weather.

My questions to you are:

1) Do you know of any organizations that have devised 'hot weather' specs?

2) Would the addition of a surfactant to our delivery reduce volatilization?

3) Any other tips?

Many thanks!!"

A: Vaporization can be thought of as a material evaporating (vaporizing). It always happens, but less when temperature is lower. No one that we know of has "devised hot weather specs" for when to or when not to apply triclopyr ester. Experience, however, has shown that little or no symptoms have been observed to non-target vegetation when temperatures are in the 70s or below. In the 80s, sensitive plants can show some effects, especially when they are actively growing, with a flush of growth, and with young sensitive growth. In the 90s, vapor movement is likely and is not recommended if your application is in proximity to sensitive non-target species such as mangroves, especially if a dense population of Brazilian peppers is to be treated. Additional precautions should be taken such as avoiding application when a thermal inversion is indicated by still air and/or a layer of fog. Thermal inversions can also be detected by creating a column of smoke and noting its dispersion pattern. (Smoke generators can be purchased from various trade retailers.) Also, the less herbicide you use, the less vaporization there will be.

Surfactants or other adjuvants will not affect vapor pressure or vaporization - soapy water evaporates at the same rate as plain water and the same principal applies to surfactants (basically a soap-like product) mixed in herbicide solutions.

When using triclopyr ester to control Brazilian pepper and other invasive plants in proximity to sensitive, non-target vegetation such as mangroves, we recommend making applications during cooler weather – IT'S A LOT MORE COMFORTABLE, ANYWAY. If applications must be made during the warm months, cut the stems as close to the ground as possible and use a water soluble, non-volatile herbicide such as triclopyr amine to treat the cut surfaces. Concentrate the herbicide solution near the cambium, just inside the bark, and apply as soon as possible (no longer than 15 minutes) after cutting.

For additional information on pesticide drift see: Agricultural Chemical Drift and its Control, Cir1105, by Richard Cromwell (http://edis.ifas.ufl.edu/AE043).

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