

NOZZLE TYPE AND DRIFT REDUCTION

Drift reduction is the practice of reducing the “driftable fines” in a spray system which are the droplets less than 150 micrometers (um) and can become easily buoyant and travel great distances from the sprayer. These driftable fines are controlled as follows:

Nozzle Selection:

Nozzle type selection is one of the best ways to reduce driftable fines in the spray pattern. Figure 1 shows the different type of nozzles and the percentage of drift produced by each type. Air induction (A.I.) nozzles scored the best in drift reduction and are recommended for most spraying operations except for AIM command sprayers (which use a larger orifice flat fan nozzle). A.I. turbo tees had the best drift reduction qualities, but also produce a very coarse droplets which maybe too coarse for some spraying operations (note that some pesticide labels require these types of nozzle for use with that chemical), A.I. flat fans are a good choice for many spraying operations as they can have a smaller droplet spectrum (medium with appropriate choice in orifice size and pressure), while still maintaining better drift reduction qualities. XR and Cone Jets produce the most driftable fines but still may be useful in some applications such as fungicide and insecticides applications, where contact is a premium. All other types of nozzles - Turbo Tees, 80-degree Flat Fans, D.G. [drift guard] Flat Fans, and Turbo Tee Twin, etc. - fell in-between these two nozzle types for drift reduction.

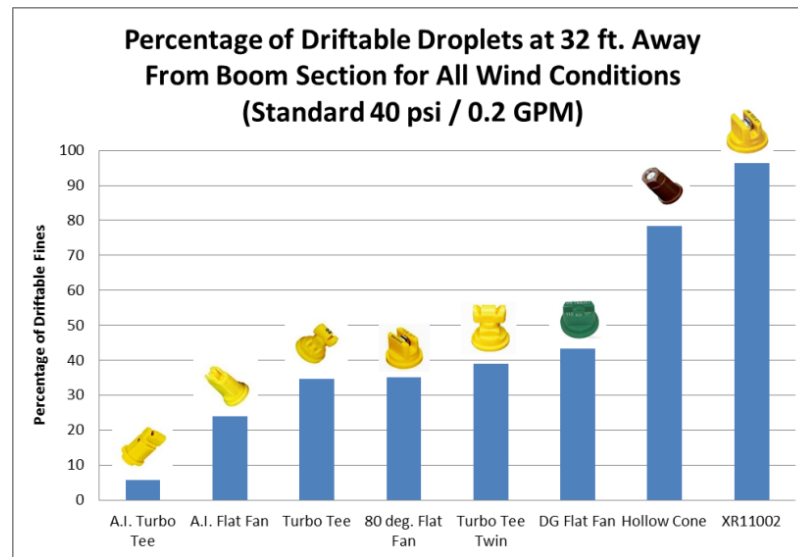


Figure 1: Percentage drift associated with each nozzle type operated in similar conditions.

Equipment Settings:

Equipment settings can greatly affect the driftable fines in a spray system and the following guidelines are given to help create a “safer” drift resistant system:

- 1) **Lower Boom Pressure:** Lowering the boom pressure and/or using a slightly larger nozzle orifice size can greatly help reduce the number of driftable fines in a spray system. In one case, research showed that a large XR flat fan nozzle combined with lower boom pressures had nearly the same effect on drift reduction as an A.I. Flat Fan (note though that A.I. flat fans still have a better pressure and flowrate changing qualities than a standard flat fan and maybe preferred for this reason). Sizing nozzles for drift reduction should include using slightly larger nozzle size with lower boom pressures in some cases.

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- 2) **Travel speed:** Research has shown (Figure 2) that increasing travel and/or wind speeds across a boom can greatly increase the number of driftable fines in a spray system. In XR and Cone Jets, the driftable fines emitted into the open air increased by 6.5 times for each additional 1 mph of extra wind or travel speed across the boom. A.I. type nozzles had a much lower increase in driftable fines of only 0.8. For this reason, lower travel speeds are always recommended over faster speeds for reducing drift.
- 3) **Boom height:** Keep boom heights as low as possible. Typically, 18 to 20 inches above crop surface is the appropriate height for most nozzles. Overly high booms conditions allow more time for wind to affect the spray pattern and cause more inconsistent spray patterns.
- 4) **Sprayer shields:** Spray shields can greatly decrease the number of driftable fines emitted into the open environment from a spray system. These shields block the wind and allow smaller droplets to either impact the crop or collect on the hood surface. Remember to keep sprayer shields tight on the crop surface or high-speed winds can move through the opening and increasing drift (flexible skirts can help prevent this).

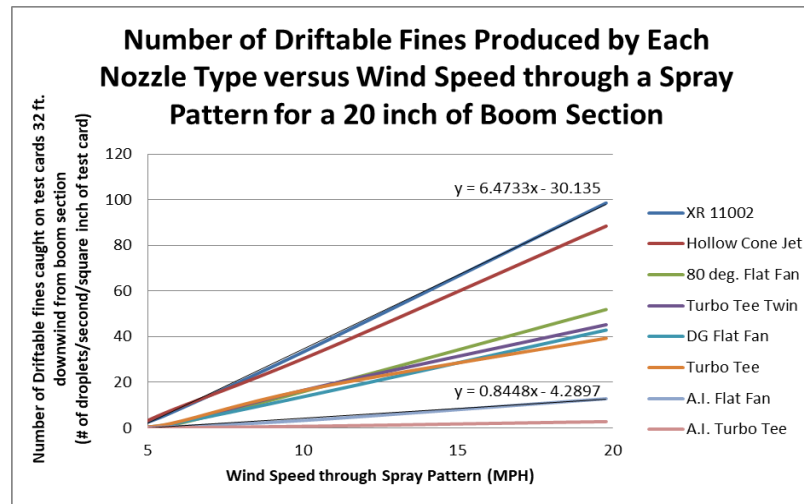


Figure 2: Chart of wind speed on a spray boom versus on the amount of “driftable fines” released into the atmosphere (3 to 5 MPH) for different nozzle types.

Environmental Conditions:

Environmental factors can play a large role in driftable fines and the following parameters are given to help prevent drift:

- 1) **Inversion layers:** Inversion layers trap driftable fines emitted from the sprayer and concentrate them in a layer in the atmosphere. This layer then moves off the field and deposits somewhere else in a thick chemical laden cloud (sometimes 10 to 50 miles away). Surface inversion layers most often occur when air temperatures is warmer above the ground than on the ground surface, but can also exist in low-wind and humid conditions. To prevent thermal layers from occurring, spraying should not be done too early in the morning, nor too late at night. Many states recommend waiting until the morning temperature rises 3 degrees above the morning low to spray, and then recommend ceasing spraying operations when the air temperatures fall more than 3 degrees from the daily high. Spraying when the winds are greater than 2 mph will help ensure that inversion layers do not exist.
- 2) **Wind conditions:** Spray when winds are between 2 and 10 MPH.
- 3) **Relative humidity:** Spraying in lower humidity (R.H.) situations can greatly reduce the number of driftable fines as some research has shown that driftable fines can greatly increase in higher humidity conditions.

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Additives:

Additives are a good way to reduce drift (over bare water). In most cases, additives (Figure 3) reduced the driftable fines in all nozzles by up to 60 percent over pure water. The biggest reduction in driftable fines was seen in nozzles that created the most driftable fines (such as XR and Cone Jets). No negative effects were seen in additives except in very cold or low humidity conditions (where small droplets did not evaporate as well).

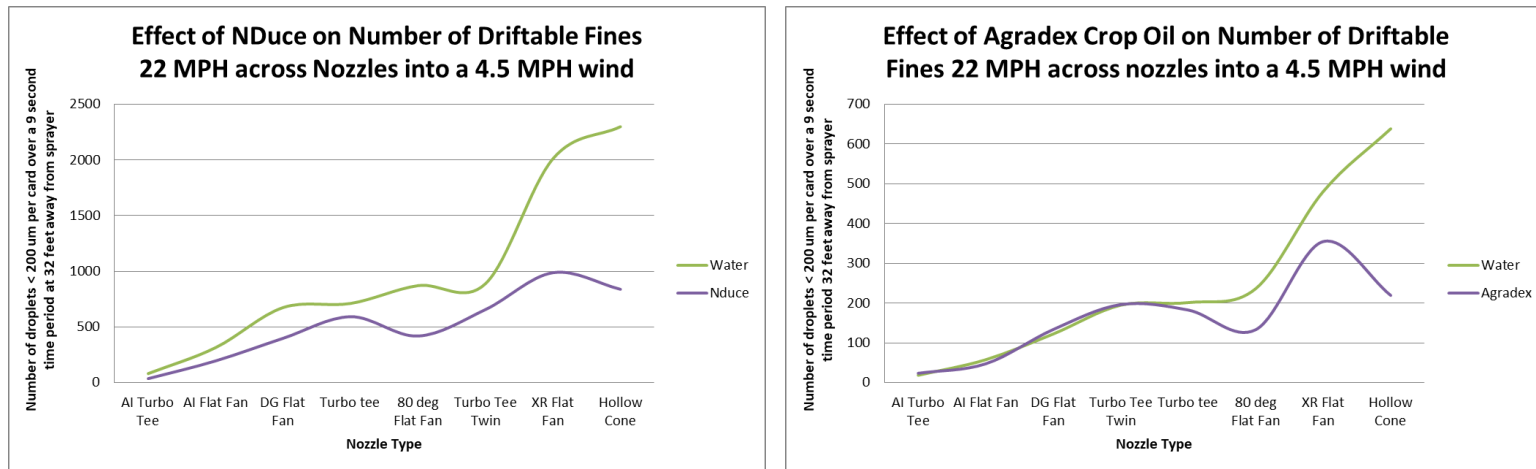


Figure 3: Graphs of several additives on spray drift for different nozzle types. Most other additives had similar responses.

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Table I lists the recommended tips for different spraying operations.

Table I: Pesticide Mode of Action and Recommend Nozzle or Sprayer Tip Selection

Pesticide and Mode of Action	Tip or Nozzle Selection	Recommended Practices
Most Herbicides with Systemic Type Attributes – Coarse to Medium Droplets	A.I. (Air Induction) Flat Fans	<ul style="list-style-type: none"> - Use higher flow rates to ensure good coverage (although higher flow rates are not always necessary to attain good results). <ul style="list-style-type: none"> o Spray when environmental conditions are optimum. o Make sure a low-level inversion layer is not present (fog, heavy air, etc.). o Make sure winds are between 2 and 10 mph (some winds are needed to insure a stable, non-inversion layer environment). - Monitor back of sprayer and droplet evaporation. <ul style="list-style-type: none"> o If you see a large amount misting behind sprayer, check system for over-pressurization or wrong tip selection and flow rate. - Keep boom height at recommended distance from canopy (typically 18-20 inches from canopy surface). - Use hooded sprayers to further aid in drift reduction. <ul style="list-style-type: none"> o Make sure to run hood on the surface of the crop canopy.
Herbicides and Pesticides with Contact and/or Partially Systemic Attributes – Medium Droplet Size	Turbo Tee, DR and DG (Drift Reduction and Drift Guard), 80-degree Flat Fans	
Fungicides – Medium to Fine Droplet Sizes Insecticides – Fine Droplet Size	Fungicide and Insecticides – DR/DG (Drift Reduction/Guard) and Hollow Cones or Equivalent	