DRIFT MANAGEMENT: PRACTICAL METHODS TO INCREASE SPRAY PARTICLE SIZE

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INTRODUCTION

Herbicide spray drift is the movement of herbicide from the target area to areas where the herbicide application was not intended. Herbicide drift is caused by the movement of spray droplets.

Several factors contribute to the potential for the drift of herbicide spray droplets. Drift management strategies often focus on weather conditions as the primary culprit in herbicide movement. However, the influence of weather conditions, such as wind, temperature, and humidity, is based on spray droplet size. The larger the spray droplet, the lower the risk of herbicide drift.

HOW DOES SPRAY PARTICLE SIZE RELATE TO DRIFT RISK?

Spray particle size is measured in microns (μm). One micron is 1/25,000 inch. In more relative terms, a toothbrush bristle diameter is about 300 microns.

Table 1. Droplet sizes relative to common items.

Droplet size	
850μm	Paper clip
420μm	Staple
300μm	Toothbrush bristle
150μm	Sewing thread
100μm	Human hair

The goal is to include spray particles that are small enough to result in adequate coverage and good pest control, but large enough that the risk of drift is reduced. Small particles have less mass than large particles, and therefore are more prone to travel long distances (Table 2).

Table 2. Lateral particle movement relative to spray droplet size.

Droplet size		Time required to fall 10 feet	Lateral movement in 3 mph wind
5 μm	Fog	66 minutes	3 miles
20	Very fine	4.2 minutes	1,100 feet
240	Medium	6 seconds	28 feet
400	Coarse	2 seconds	8.5 feet
1,000	Very coarse	1 second	4.7 feet

Source: Akesson and Yates, 1964.

WHAT SIZE DROPLET DO I WANT TO SPRAY?

Pesticide type

The desired spray droplet size is dependent on the type of pesticide (Table 3). In general, insecticides and fungicides require thorough coverage for maximum effectiveness, and therefore require fine or very fine droplets. Soil-applied pre-emergence herbicides are often dispersed in soil by mechanical incorporation or precipitation, so coarse droplets (greater than 450 microns) can reduce drift risk while insuring uniform control. Spray droplet size has the greatest influence on the control effectiveness of post-emergence herbicides.

Table 3. Droplet size classification.

Classification	Size (µm)	Application
Very fine	<119	Insecticide +
Fine	119-126	Fungicide
Medium	217-353	Contact herbicides
Coarse	354-464	Translocated herbicides
Very Coarse	>464	Soil-applied herbicides

Contact vs. translocated postemergence herbicides

Translocated herbicides that are readily moved throughout the plant can be applied with larger droplet size, around 350-450 microns. Examples of such herbicides include Roundup, 2,4-D, Stinger, and Tordon. The contact herbicides, however, are not translocated well through the plant and require thorough coverage for effective control. Examples include Gramoxone Extra, Buctril, and Rely. Droplet size for contact herbicides should range from 200-350 microns. **As a general rule for herbicides, spray droplet size should be greater than 200 microns.**

HOW CAN I CHANGE PARTICLE SIZE?

Spray application pressure

Spray particle size increases as spray pressure decreases. The spray solution emerges from the nozzle in a sheet, and droplets form at the edge of the sheet. As spray pressure increases, the sheet becomes thinner, and breaks into smaller droplets than from a sheet produced at lower pressure. Recommended spray pressures vary by nozzle type. Use of a nozzle outside of the recommended range can distort the pattern, resulting in poor coverage and pest control.

Spray nozzle orifice size

Larger orifice nozzles with high delivery rates produce a thicker sheet of spray solution and larger droplets than smaller nozzles.

Drift reduction additives

Several drift reduction additives have hit the market in recent years, such as Target and Border Xtra. However, minimal research has been conducted to validate their potential to reduce drift.

Nozzle type

Several new nozzle types are now available that can increase spray particle size, and thus reduce the risk of pesticide drift. These nozzles include:

- **Air induction nozzles (Figure 1)**

Air induction nozzles use a pre-orifice chamber that mixes air with spray solution. When discharged from the nozzle tip, the air expands and creates a larger spray droplet. Droplet size is about twice that of standard flat fan nozzles. Surfactants, carriers, and other additives can affect the amount of air that is mixed with spray solution and droplet size.

- **Turbulence chamber nozzles (Figure 1)**

Examples include Turbo Teejet and Turbo Floodjet nozzles. A turbulence chamber within the nozzle absorbs excess energy prior to spray droplet discharge, thus increasing droplet size. Spray droplet size and spray pattern are maintained over a wide pressure range.

- **Pre-orifice nozzles (Figure 1)**

Examples include DriftGuard and Lo-drift nozzles. Nozzles have a pre-orifice prior to the discharge orifice that reduces spray pressure. Popular with soil-applied herbicides.

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Effect of nozzle type and spray pressure on droplet size

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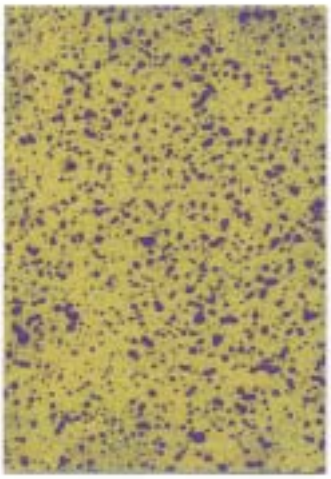
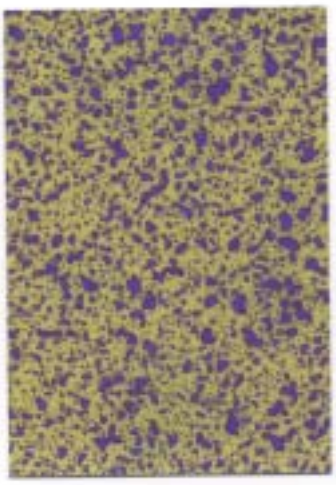
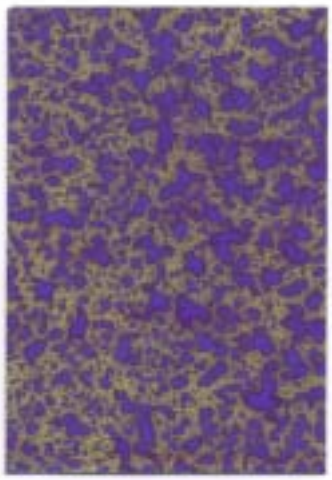
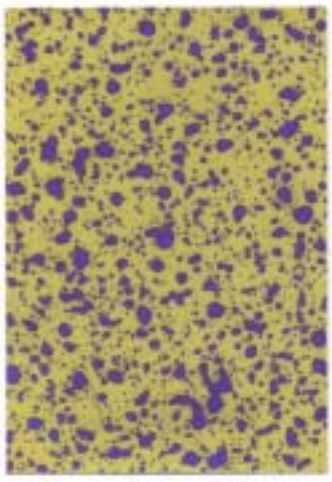
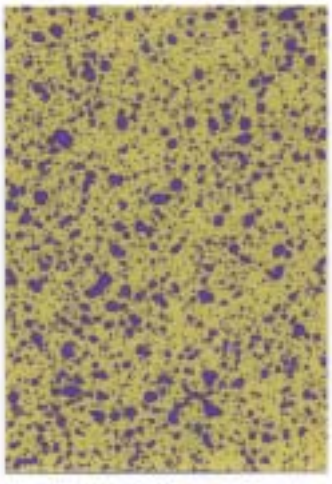
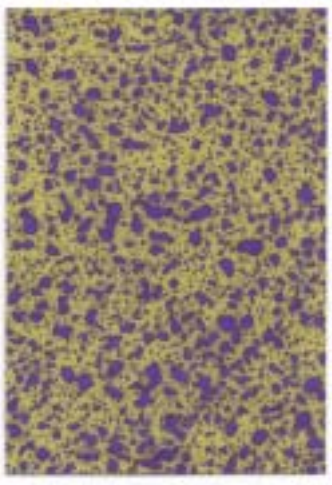
Even Fan			
Drift guard			

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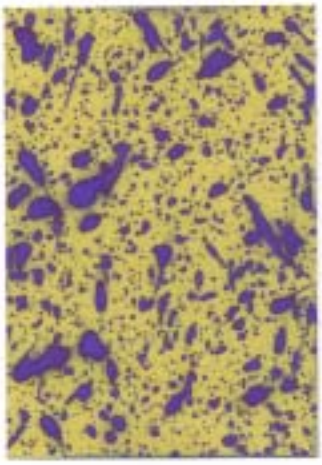
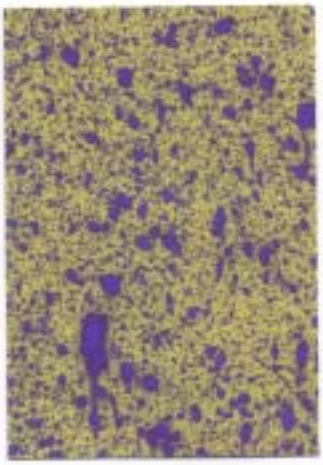
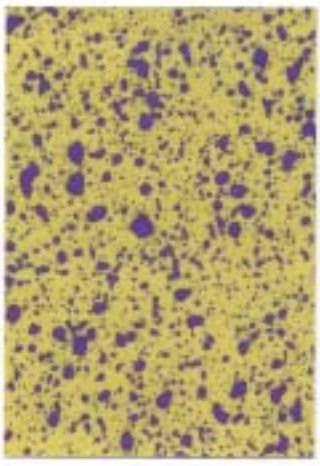
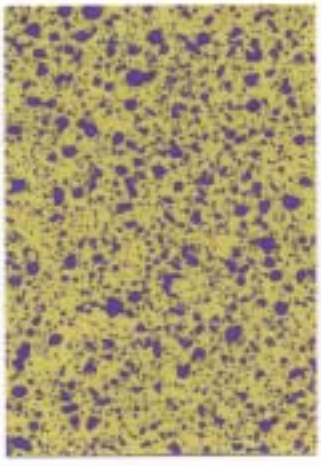
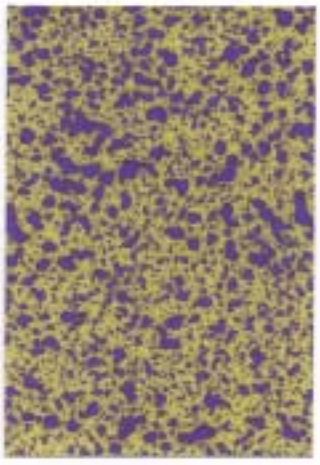
Turbo Floodjet			
Air Induction			

	20 PSI	40 PSI	60 PSI
Turbo Teejet