Guide to improving *Triclopyr Ester* efficacy

(Garlon*4, Release* and Remedy*)

Practical experience applying Garlon 4 and Release has shown that if droplet size is increased to reduce drift, water volume must also be increased to maintain coverage. If this does not occur, *triclopyr* efficacy will be reduced. Research has been performed to determine the relationship between droplet circumference, droplet number and herbicide concentration, along with the effect of these factors on *triclopyr ester* efficacy.

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A recent paper by Dr. Bob Campbell (Herbicide Physiologist, Great Lakes Forestry Center) confirms and improves understanding of how spray pattern deposition (droplet circumference, droplet number, herbicide concentration) affects *triclopyr ester* efficacy. Dr. Campbell and his protégé, Dr. Huang, elegantly separated and examined the effect of each component of spray pattern deposition on *triclopyr* efficacy, in a series of three matched experiments.

Different strategies needed for optimum application

The trend to increasing operational efficiency by reducing spray volumes for aerial application of herbicides for brush management (in forestry and non-forestry applications) may not be appropriate for *triclopyr* (Garlon 4, Release and Remedy). There should not be one set of application and environmental parameters to optimize the application of *triclopyr* and *glyphosate* (Vision®). The application and environmental parameters for *triclopyr* and *glyphosate* (Vision®) are different.

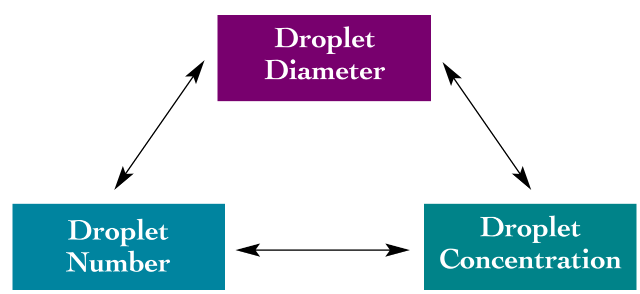
Spray parameters interconnected

Operational understanding has long held that *triclopyr* efficacy depends on "coverage." For example, when droplet size is increased to reduce risk of drift, total application volume must also be increased to maintain efficacy. Operational experience with *triclopyr* has clearly shown that efficacy is lost when spray droplet size is increased and spray volume does not change. The same experience has shown that increasing herbicide rate (spray solution concentration) does not fully maintain efficacy when increasing droplet size, if application volume is not increased.

While the impact of these factors was understood, there was no way to estimate the extent to which application volume needed to be increased.

Research clarifies interaction

Campbell and Huang assessed, separately, the effects of spray solution concentration, droplet size, and droplet number on *triclopyr* efficacy using a constant sub-lethal dose of *triclopyr* per target plant. Maintaining droplet number while varying concentration and droplet size



The application triangle – vary one parameter (example: droplet size) without adjusting at least one other (such as application volume or rate), and all three are varied. We effectively vary all three.

gave more consistent efficacy, than did either holding concentration constant (while varying droplet number and size) or holding droplet size constant (while varying droplet number and concentration.)

A model based on the physiological behavior of *triclopyr* explained why maintaining droplet number assured efficacy. The model suggests the rapid and extensive tissue damage occurring where *triclopyr* contacted the leaf surface prevented translocation (of *triclopyr*) from anywhere but the outer periphery of droplet contact with the leaf. Differences in cumulative droplet circumference per unit area (or "footprint"), a parameter integrating droplet number and size, explained most observed variations in efficacy.

How tissue damage affects uptake

Triclopyr ester causes tissue damage as it moves into the plant. The tissue damage that occurs at the edge of droplets on the plant surface prevents *triclopyr* from the center of the droplet from entering the target plant. Therefore only *triclopyr* at the circumference of spray droplets enters the target plant.

Achieving effective dosage

Increasing droplet size – if application volume is held constant – effectively reduces the ultimate dose to the target plant. Declining surface to volume ratio of droplets as droplet diameter increases magnifies this problem. Clearly, *triclopyr ester* efficacy depends on "coverage". Campbell and Huang's cumulative droplet circumference per unit area (footprint) provides a measurable parameter to quantify, compare, and assure adequate "coverage" when configuring spray application systems. (See Figure 1 and 2.)

How 'footprints' help configure sprays

Triclopyr ester is most effective when the spray system maximizes droplet circumference – an effect that occurs most with many, small droplets. When applying *triclopyr*, a trade-off between large droplets for drift control and small droplets for effectiveness can only be maintained by increasing total application volume as droplet size increases. The concept of total droplet circumference (or "footprint") based on droplet size, application volume and *triclopyr* concentration offers users of *triclopyr* an estimate of how much application volume needs to be increased to maintain efficacy when droplet size is increased.

Three parameters optimize application

Given an adequate rate for the target species, *triclopyr* efficacy depends primarily on droplet footprint (an expression of coverage) on the leaf surfaces. Applying large numbers of very small droplets maximizes droplet footprint and efficacy – an approach however that could compromise drift management. Thus, the ideal nozzle system for *triclopyr* application must optimize droplet footprint and drift management, while managing what is operationally practical.

Figure 1 shows the relationship between median droplet diameter and footprint at a constant application volume. Although 250 VMD (microns) size droplets result in the largest footprint at the volume tested, it should be noted that this might not be ideal for drift management.

Figure 1. Footprint at 50 L/ha (Volume consistent)

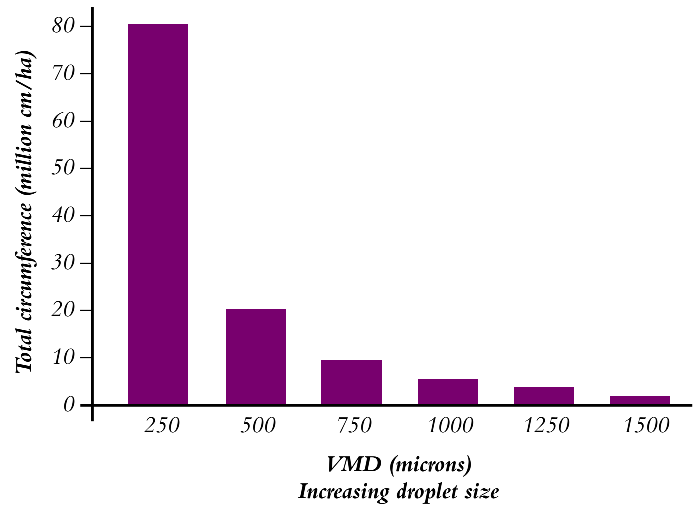
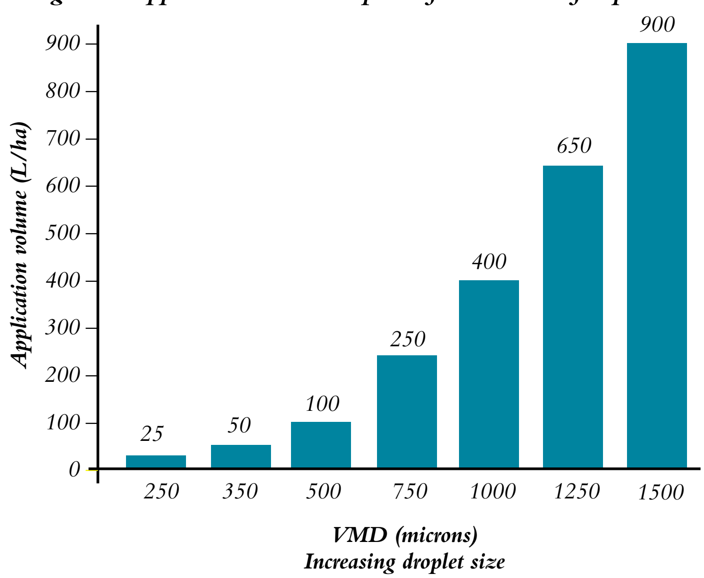


Figure 2 shows how application volume must be increased to maintain footprint as median droplet size increases.

Figure 2. Application volume required for consistent footprint



Reference:

Huang, J.Z.; R.A. Campbell; J.A. Studens, and R.A. Fleming. 2000. Absorption and translocation of triclopyr ester in Populus tremuloides as affected by concentration, and droplet size and number. Weed Sci. 48: 680-687, 2000

Glossary of terms:

Concentration – amount of chemical as a % of the spray solution

Droplet size – size of measured in VMD (volume median diameter) or microns

Translocation – movement of chemical into the plant

Footprint – Droplet footprint is the cumulative circumference of droplets (median droplet circumference times droplet number per unit area)

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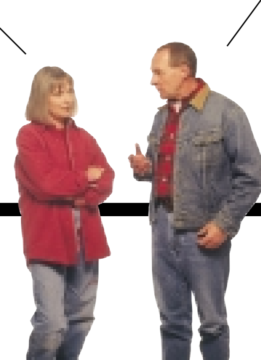

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