The Issues Surrounding Herbicide Drift

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More genetically modified crops (GMCs) are being used in agriculture than ever before, with stacked glyphosate and dicamba resistant soybeans, Xtend™ seed, being some of the most recent players. Carry-over in the trees and in nursery soils continue to impact the plants years after the initial spray incidence, however, these impacts are neither well-described nor understood. Chemical damage to ornamental plants can be extremely expensive due to their high value, and replacement costs are generally much higher than for other crops. Pesticide law is very clear: The applicator or the licensed applicator supervising the application is always responsible for understanding the chemical being applied. Mixing and application procedures must be strictly adhered to, and only labeled crops at labeled rates should be used.

Part 1: Crop Sensitivity

F1

However, little is known about the herbicide tank-mix combinations currently being used to combat multi-site resistance or "super-weeds" in terms of drift onto sensitive crops like nursery trees, Christmas trees, small fruits, and tree fruits, to name a few. The term "super-weeds" will be defined in more detail in Part 2 of this series. Therefore, even though the applicator may be following every precaution for the target, he/she is unaware of the off-target injury potential. This lack of knowledge, in part, begets the high frequency of drift complaints and succeeding court claims being filed. Michigan ranks 11th nationally for corn silage production with 2.25 Million (Mn) acres in production in 2018 and worth $458 Mn to the Michigan economy. Michigan also ranks 12th in soybean production with 2.33 Mn acres in production in 2018 and a worth of $422.7 Mn. The lack of knowledge of off-target crop susceptibility helps no one, not the agricultural crop producer, nor the nursery grower.

The Weed Science Society of America (WSSA) (WSSA, 2019) provides a summary of Herbicide Site(s) of Action (SoA) as a number classification system with SoA. SoA is the specific process in plants that the herbicide disrupts to interfere with plant growth and development. The SoA is the most important aspect of herbicides when dealing with prevention and control of herbicide resistant weeds; therefore, WSSA recently changed their classification system to specify SoA from mode of action (MoA). However, to understand how an herbicide causes damage and potentially causes drift injury, MoA is the more important classification. Herbicides with the same MoA will have the same translocation (movement) pattern and produce similar injury symptoms. Selectivity on crops and weeds, behavior in the soil and use patterns are less predictable, however, they are often similar for the same MoA.

The risk of damaging drift is directly correlated to the level of susceptibility of the non-target plant to the MoA of the herbicide being applied (Dexter, 1995). Certainly, no MoAs used in either of the corn or soybean herbicide programs are registered for foliar applications to nursery trees. Even small percentages of Group 9 (glyphosate - ex. Roundup® Power Max) and Group 4 (synthetic auxins - ex. Dicamba) contacting foliage of nursery trees could cause severe injury. The high sensitivity of nursery trees can also vary within species, and even between cultivars. Solely based on crop sensitivity alone, the risk of damaging drift with "weed BMPs" recommended for corn and soybeans is high for nursery trees. Thus, the applicators should be hypervigilant. However, even the cut-off spray dates in the new restrictions imposed for dicamba, by various state Departments of Agriculture and EPA for 2018 and 2019, are targeted to reduce injury to staked gene soybeans (ex. soybeans still in the vegetative stage by June 20), not the susceptible specialty crops growing nearby. Even the date restriction of cutting off spray applications by June 20 will do little to reduce potential injury to nursery trees and may even increase injury as this is when nursey crops have new susceptible leaf growth that is most likely to be injured.

Wind Direction and Crop Sensitivity

Herbicide drift can occur with any herbicide. Nevertheless, **the risk of damaging drift is directly correlated to the level of susceptibility of the non-target plant** to the herbicide being applied (Dexter, 1995). For this reason, wind direction is as important as wind speed. I have heard several times people say when an ornamental crop has been severely injured, the weeds are still there so it could not have been spray drift (Fig. 1). Again, we are interested in the non-target crops' sensitivity. In many cases the ornamental crop is far more susceptible to the herbicide than the perennial weeds in adjacent areas (Fig.1). Additionally, in a drift event one genus or species may be impacted whereas another non-sensitive genus or species may not (Fig. 2). Genus/species

F1 Herbicide drift injury on field grown peonies in a commercial operation showing severe injury; however, the weeds in the field are fine. In many cases the ornamental is far more susceptible to the herbicide that drifted than the perennial weeds in adjacent areas.
(Picture by: H. Mathers, May 2016).

sensitivity also influences the severity of symptoms, their expression and manifestation (Fig. 3). It is because of the sensitivity of the non-target crop that many herbicide labels contain warnings about sensitive areas and desired vegetation including: 1) avoid application "under conditions favoring drift"; 2) take "extreme care... to avoid spray or drift onto the foliage or any other green tissue of desirable vegetation"; 3) "avoid contact … with foliage, green stems.. or "severe injury or destruction will occur"; 4) "only apply if wind direction favors on-target deposition and sensitive areas including non-target crops do not occur within 250 ft. downwind of application"; 5) "do not apply where spray drift may occur to… fruit trees and ornamentals"; 6) "avoid all direct and/or indirect spray contact with non-target plants"; and, 7) "make application when wind is blowing away from adjacent sensitive areas".

Depending on the sensitivity of non-target crop to the herbicide being sprayed, a realistic distance from the non-target crop may be ½ mile (2,640 ft.) (Successful Farming, 2018). Common sense suggests that if you are spraying next to a sensitive area of high value, do not conduct the application unless wind speed is low, wind direction is blowing away from the non-target crop, the boom is set as low as possible, drift reduction nozzles and retardants are used, all sprayer manufacturers' recommendations for GPA, speed, psi are followed, and the sensitive area is a considerable distance away.

Other factors that cause drift will be discussed in the remaining three articles in this series.

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F2 *Populus tremuloides* 'Select', Summer Splendor™ in the foreground showing injury from spray drift the year before, but the *Pyrus* sp. in the background show no injury.
(Picture by: H. Mathers, August 2016).

F3 Note the classic symptoms of Dicamba injury on the *Cercis canadensis*, Redbud *with* a darker green color, puckered appearance, marginal chlorosis, and cupping with the upper leaf surface composing the outside of the cup
(Picture by: H. Mathers, August 2017).