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Improvements in pesticide drift reduction technology (DRT) call for improving liability provisions to offer incentives for adoption

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ABSTRACT

Background: The widespread use of pesticides has contributed to increased crop productivity accompanied by problems of releasing toxic substances into the environment. One of the concerns is the release of pesticide spray drift that is carried to off-target properties causing injuries.

Objectives: In 2016, the EPA released a generic verification protocol for pesticide drift reduction technology (DRT). With this protocol, applicators of pesticides can select verified products and equipment with the assurance that the technology will reduce the risk of spray drift damages, but there are inadequate incentives for its adoption.

Discussion: Drift reduction technology can only reduce injuries to people, flora, and fauna if it is adopted by applicators. To address incentives for adoption, an analysis of liability provisions governing spray drift damages suggests that the jurisprudence governing liability might need updating to capture technological benefits. Two proposed legislative provisions are offered that would incorporate DRT into negligence law.

Conclusion: Through the amendment of negligence law, liability provisions for pesticide spray drift damages can offer encouragement for applicators to adopt DRT.

1. Introduction

The increasing productivity of agricultural lands has been important in providing more food to feed the world's growing population (Lambin, 2012; Tilman and Clark, 2015). However, physical constraints imposed by amounts of arable land and the availability of water have meant that food production has become very dependent on the use of other inputs and technologies (Schneider et al., 2011). Fertilizers, genetically engineered plants, mechanical devises to assist in production and harvesting, and pesticides have all made marked contributions to enhancing the productivity of the agricultural sector (Ahmad et al., 2012; Benbrook, 2012; Fridman and Zamir, 2012; Godfray et al., 2010; Tester and Langridge, 2010).

The use of synthetic organic pesticides is a technology that has augmented the production of increased food supplies (Fuglie et al., 2007). Yet, increases in pesticide usage have coincided with growing controversies regarding the impact of pesticides on human safety, food safety, residues on non-target crops, pest resistance, water quality, and wildlife mortality (Hoffmann et al., 2013; McKinlay et al., 2008; Osteen and Fernandez-Cornejo, 2013). One troublesome issue is pesticide spray drift that damages neighboring crops (Centner, 2014). In response to both public concerns and the expressed interests of farmers and pesticide manufacturers, governments are continually balancing health and economic considerations to determine optimal regulatory controls (Cropper et al., 1992; Tsaboula et al., 2016). With the development of new technologies to reduce spray drift (Ferguson et al., 2014; Herbst et al., 2013; U.S. EPA, 2016a), it is appropriate for governments to examine the legal assignment of liability for injuries resulting from off-target pesticide deposits (Centner et al., 2014; Rodrigues et al., 2013).

Spray drift may be defined as "the movement of spray droplets through the air at the time of application or soon thereafter from the target site to any non- or off-target site, excluding pesticide movements by erosion, migration, volatility, or windblown soil particles after application" (U.S. EPA, 2016a). This definition excludes vapor drift occurring with the volatilization of pesticides into a gas that migrates to nearby areas and can cause significant damage to crops (Egan and Mortensen, 2012). Vaporization of the dicamba herbicide has sparked a debate about governments needing to be more active in protecting agricultural producers (U.S. EPA, 2017; Gray, 2017).

Spray drift has repercussions on public health and the environment as well as on the applicators themselves (Ferguson et al., 2014). In 1995, the EPA started the Environmental Technology Verification

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Program with the goal to prevent damages, encourage best practices, and lower transaction costs (U.S. EPA, 2016a). Through this program, the EPA sought to incentivize the development of pesticide drift reduction technologies (DRTs) and their use. Through the use of innovative technologies to boost productivity and reduce damages, pesticide usage would be reduced and cause fewer problems.

DRTs consist of several technologies with the most important being spray nozzles, sprayer modifications, spray property modifiers, spray delivery assistance, and landscape modifications (U.S. EPA, 2016a). One or more of these technologies can lower the number applications required to achieve pest control and increase the efficacy of pesticides by keeping more spray on-target (U.S. EPA, 2014b). In 2016, the EPA released a generic verification protocol for pesticide DRTs. The protocol will be used to test pesticide spray application technology for its drift-reducing capabilities. The EPA's goal is to hasten the innovation, adoption and use of cost-effective DRTs for the protection of the environment and the general public (U.S. EPA, 2016a). The technologies would be verified on a rating system and marketers would affix the ratings on their products.

Although the protocol is expected to have far-reaching consequences on applicators, manufacturers, and the general public, its goals of encouraging innovation and widespread adoption remain elusive. To secure a DRT rating, a firm needs to pay for the verification of the product and this may be costly. In the absence of verification, firms cannot readily quantify the drift-reducing capabilities of their technologies. Other limitations embodied in the protocol concern its ability to encourage innovation.

Another impediment to the adoption of DRTs is jurisprudence that make it difficult for persons to collect damages for injuries from spray drift. Because pesticide applicators may not incur liability for the injuries they inflict on others, there is little incentive to adopt DRTs. Drawing from evidence demonstrating how state jurisprudence on liability has encouraged good practices in hydraulic fracturing and providing workers' compensation, proposals for updating state pesticide liability law can be offered. A legislative provision that establishes a presumption of negligence for spray drift damage but provides an exemption for adopters of DRTs would offer an incentive for adoption. This would increase demand for DRT products and encourage manufacturers to continue with innovations.

2. An overview of pesticide use and regulation

The development of synthetic organic materials during World War II, especially DDT, led to a new era of chemical pesticides (Osteen and Fernandez-Cornejo, 2013). Use of pesticides grew from the 1960s to the 1980s until a saturation point was reached when most crop acreage was treated annually (Osteen and Fernandez-Cornejo, 2013). With the creation of the EPA in the 1970s, regulation of pesticides was removed from the U.S. Department of Agriculture to balance the influence of farmers and pesticide manufacturers with that of environmental groups and consumers (Cropper et al., 1992). Modern pesticides include fungicides, herbicides, insecticides, as well as other agents (Osteen and Fernandez-Cornejo, 2013).

Controlling pesticide drift is important due the associated costs. Ecologically, pesticide drift can cause wildlife mortality, habitat loss, lower biological diversity, and increase pesticide resistance of weeds (Egan et al., 2014; Hewitt, 2000; Osteen and Fernandez-Cornejo, 2013). Damage from spray drift on adjacent semi-natural habitat fragments can adversely affect beneficial communities of pollinators and arthropods that provide natural biological controls on pests (Egan et al., 2014). From a public health perspective, water quality may be compromised and drift can harm farm workers (Ferguson et al., 2014; Osteen and Fernandez-Cornejo, 2013). Economically, drift squanders chemicals that never reach their target and creates disputes that can be costly (Londo et al., 2010; Osteen and Fernandez-Cornejo, 2013).

The goal of past EPA regulation on pesticide drift was to enforce the polluter-pays principle by compelling applicators to internalize the costs of spray drift damages (Blomquist, 1995). The release of the generic verification protocol for pesticide DRTs addresses the internalization of costs from a different angle. Applicators are encouraged to proactively seek out DRTs due to their economic benefits, such as smaller buffer zones, less chemical waste, and lower risk of damage to third parties (U.S. EPA, 2014b). While the protocol highlights beneficial technologies, the EPA's mandate includes addressing risks to society. Within this mandate, DRTs might be referenced in laws governing liability claims for off-target spray drift.

3. Generic verification protocol for pesticide DRT

The generic verification protocol for pesticide DRTs has been designed to test and verify technology for drift reducing capabilities. The generic character of the tests allows them to be applied to many technologies while yielding comparable data. The scope of the verification tests quantifies two areas: the performance of the technology relative to manufacturers' statements and the test conditions under which performance is measured (U.S. EPA, 2016a). Two other areas of interest, not quantified but nonetheless considered, are potential associated environmental impacts and resources associated with operating technology relative to standard application equipment (U.S. EPA, 2016a).

The EPA focused on five categories of DRTs for row and field crops: spray nozzles, sprayer modifications, spray property modifiers, spray delivery assistance, and landscape modifications (U.S. EPA, 2016a). These categories are not exclusive, as evidenced by a need for DRT for non-row and field crops. However, the five categories are generally consistent with international efforts including protocols by the United Kingdom's Local Environmental Risk Assessment for Pesticides (LERAP), Germany's Federal Biological Research Center for Agriculture and Forestry (BBA), and the International Organization for Standardization (ISO) (Table 1).

Critical measures for pesticide spray DRT are droplet size distribution and deposition (U.S. EPA, 2016a). Supplemental measures may also be collected, including application rate and pressure, air speed, humidity, and temperature (U.S. EPA, 2016a). The three test methods are low and high wind speed tunnel testing and field testing. Low speed wind simulates air across a ground boom sprayer, while high speed wind simulates air across an aerial sprayer (U.S. EPA, 2016a). Realistic estimates for field drift can be obtained from wind tunnel testing (Nuyttens et al., 2010).

For establishing DRT technologies, the four major international protocols have adopted divergent rating systems (Table 2). The LERAP and EPA protocols both use a star rating system, the BBA uses a class

Table 1
Categories of DRT according to protocols.

DRTs Categories.	Protocol LERAP[a]	EPA[b]	BBA[c]	ISO[d]
Spray nozzles	Yes	Yes	Yes	Yes
Sprayer modifications	Yes, as part of a complete sprayer system	Yes	Yes	Yes
Spray property modifiers	No	Yes, when paired with a nozzle	No	No
Spray delivery assistance	Yes, as part of a complete sprayer system	Yes	Yes	Yes
Landscape modifications	No	Yes	Yes	No

[a] Health and Safety Executive (2016).
[b] U.S. EPA (2016a).
[c] Rautmann (2001) and Herbst et al. (2012).
[d] ISO (2005).