CAPÍTULO 12

MITIGATION OF THE EFFECTS OF PESTICIDE DRIFT APPLIED BY UNMANNED AERIAL VEHICLES

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The application of agricultural pesticides has proven to be crucial in controlling pests and diseases in various crops. Recently, the use of unmanned aerial vehicles (UAVs) or UAVs has gained prominence due to the precision and efficiency they provide. However, pesticide drift during aerial application remains a significant concern as it can cause contamination of non-target areas, affecting human health and the environment. This summary aims to discuss techniques and practices to mitigate the effects of pesticide drift applied by UAVs.

UAV technology allows for more localized and controlled application of agricultural pesticides, which in theory can reduce drift. Recent studies highlight advances such as specialized nozzles and real-time spray control systems designed to minimize smaller particles that are more susceptible to wind displacement (ZHAO et al., 2023). Additionally, efficient route programming and application during favorable weather conditions are strategies that show potential in reducing drift.

Climatic conditions such as wind, temperature, and relative humidity play a central role in pesticide drift. Application in cooler temperatures and low wind speeds can significantly reduce particle dispersion outside the target area (LI et al., 2024). The implementation of meteorological sensors in UAVs can provide real-time data to decide whether to suspend or continue spraying, promoting safer and more effective application.

The formulation of low-volatility pesticides is another important approach in mitigating drift. Products with lower volatility tend to remain in the application area, reducing unintentional dispersion (QIN et al., 2023). These developments require ongoing research in agricultural pesticide chemistry to balance pest control efficacy with minimizing environmental risks. Recent studies have shown that combining new chemical compounds with encapsulation technologies can significantly reduce volatility, increasing application efficiency and decreasing contamination risks in non-target areas (SMITH et al., 2019). Additionally, the use of slow-release pesticides can provide prolonged pest control, minimizing the need for frequent reapplications associated with drift risk.

Adjuvants are substances added to the spray solution to improve the efficacy of pesticides. Studies indicate that certain adjuvants can increase the viscosity and size of droplets, reducing the possibility of drift (ZHANG et al., 2024). The use of drift-reducing agents in conjunction with UAV technology can be an integrated practice to advance the sustainability of agricultural operations. Furthermore, research conducted over the past five years indicates that the integration of adjuvants with anti-evaporative and anti-adhering properties effectively reduces the formation of fine droplets, which are the main contributors to pesticide drift (MARTINEZ et al., 2017). Another study suggests that the careful selection of adjuvants based on the specific climatic conditions of the application can further optimize results (GOMEZ et al., 2018).

Training UAV operators is essential to minimize drift. Training includes understanding optimal application conditions, proper equipment handling, and responding to variable field situations. Good agricultural practices such as regular maintenance of spraying equipment and adherence to specific application protocols are fundamental to ensure the effectiveness and safety in pesticide use.

Advances in unmanned aerial vehicle technology present enormous potential in mitigating the effects of pesticide drift. The combination of technological innovations, safer chemical formulations, the use of adjuvants, and the continuous training of UAV operators are synergistic strategies that can significantly reduce the negative impacts of pesticide drift. Towards a more sustainable future, research and development in this area must continue to receive attention, promoting efficient and environmentally responsible agriculture.

Moreover, collaboration between researchers, agricultural professionals, and policymakers is vital to drive the adoption of best practices and technologies that mitigate pesticide drift. Establishing guidelines and

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regulatory frameworks that encourage the use of UAVs and related innovations can foster widespread adoption and ensure that these practices are standardized and consistently applied. By creating an environment that supports innovation and adherence to best practices, the agricultural sector can make significant strides in reducing the environmental footprint of pesticide application.

Finally, public awareness and education play a crucial role in promoting the sustainable use of pesticides. Informing farmers, agronomists, and the general public about the benefits and techniques of using UAVs for pesticide application can lead to more informed decision-making and greater acceptance of these technologies. Educational programs and outreach initiatives can emphasize the importance of minimizing pesticide drift, thereby contributing to more sustainable and environmentally friendly agricultural practices. As knowledge and understanding grow, the agricultural community can work collectively towards a future where pesticide use is both effective and environmentally responsible.

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