AAT Applied Research Summary

Impact of Active Ingredients on Applied Spray Droplet Size

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Research Objective

Determine the impact that active ingredients and adjuvants have on spray droplet size under aerial application conditions. Additionally, the results were used to determine whether product-specific spray nozzle models would be required.

Research Methods

Aerial applicators spray many different combinations of active ingredients and spray adjuvants in their daily operations and need to know how different combinations of products affect spray droplet size. Spray atomization tests were conducted in a high speed wind tunnel using a herbicide (PowerMax®, Monsanto Company, St Louis, Mo.) mixed with several spray adjuvants, including a non-ionic surfactant, crop oils, emulsions and polymers using 40-degree flat fan nozzles. The different tank mixtures were analyzed for droplet size across different combinations of nozzle orifice and angle, spray pressure and airspeed. Additional droplet size measurements were made using a water plus a non-ionic surfactant (NIS) solution, which is the solution used in the present USDA-ARS spray atomization nozzle models.

Research Results

The herbicide-only solution consistently lowered the overall droplet sizes by 5–10% as compared to the water+NIS solution. For example: at 160 mph, the volume median diameter decreased from 230 µm[1] with the water+NIS solution to 190 µm with the herbicide solution. Correspondingly, the portion of the spray volume contained in droplets less than 100 µm (those susceptible to off-target movement) increased from 0.4% with the water+NIS solution to 0.6% with the herbicide solution. The addition of the different spray adjuvants had minor effects on the measured droplet size as compared to the PowerMax only tank mix as a result of minor changes in the spray mixtures' physical properties and the dominance of the high speed air shear on the atomization process. These results do point to the need for updated, product-specific models, but not the need for product-plus-adjuvant-specific models.

Research Application

- The addition of any active product or adjuvant to your spray mixture will change the physical properties of the spray solution and, as a result, will affect the droplet size of the spray. Therefore, applicators can use the current USDA spray atomization nozzles to guide them in selecting spraying operational conditions and know that the addition of the herbicide will lower droplet size by 5–10%.
- Since the selected herbicide already contains a proprietary blend of adjuvants, the addition of other spray tank adjuvants had minimal impact on measured droplet as a result of minor changes in physical properties and the dominance of the strong atomization of spray droplets under high airspeeds (120+ mph).
- These results highlight the caution that applicators need to exercise when switching to a new product that they have not used before to avoid making a poor application. ■

[1] µm = micrometer