Recent advances in vineyard sprayer technology

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In order to minimize pesticide in fruit crops, researchers at Cornell University are developing a number of automated precision canopy sprayers. This presentation describes new developments in canopy spraying to improve deposition and reduce drift.

Precision spraying requires a well-tuned sprayer; attention to detail is necessary to ensure the spray hits the target and doesn't drift.

In previous research and extension presentations on sprayer development, I have shown growers how to reduce the airflow being emitted from an airblast sprayer (the volume and speed of air is too great for modern canopies). Many airblast sprayers used in vineyards were designed for traditional apple plantings, not grapevine trellises. For example, some former orchard sprayers create around 50,000 cubic yards of air per hour and a well-pruned canopy might only require 3,000 cubic yards of air – this is extreme over-capacity.

Initially I showed growers deflectors to direct the air towards the canopy. This was followed by the ubiquitous "Cornell doughnuts" to restrict air coming into the fan. An alternative was to reduce tractor PTO speed for growers operating on flat land, a 25% reduction in PTO speed resulted in a 75% reduction in drift. An alternative for growers on slopes was to use a hydraulic motor and flow regulator to adjust fan speed.

Over the last three years we have developed and patented adjustable louvres to retrofit onto the air outlet of the fan. The louvres are moved across the airstream using an electric actuator - each side is independent of the other, allowing adjustment according to the direction of the ambient wind for example. Why would we wish to adjust the air? To keep the spray plume within the canopy, thus improving deposition and reducing drift considerably. Canopy density changes as the season progresses, with different varieties and trellis designs, we know we should change liquid flow according to canopy characteristics, should we not consider changing airflow?

In a series of Extension twilight meetings, using fluorescent tracer and blacklights, growers are able to see how only a small amount of spray is actually deposited on the target, yet the rachis and trellis wire is well covered in small droplets. Aerodynamics plays an important part in improving deposition, slowing down air speed improves deposition.

The presentation will conclude with our most recent advances in the use of canopy sensors to detect canopy volume and adjust the airflow and liquid flow in real-time.