

# Intelligent Sprayer Development For Nursery And Orchard Spray Applications

## Principal Investigators:

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**Background:** Current application technology for floral, nursery, and other specialty crop production wastes significant amounts of pesticides. During past 10 years, we demonstrated that optimum spray coverage, independent of spray volume, could reduce pesticide use by over 50% and result in significant production cost savings. However, achieving optimum spray coverage required spray applicators to execute complex guidelines for a particular sprayer in order to reach the spray quality needed for effective pest and disease control. To simplify this procedure, a new spraying system with intelligent technologies was invented.

**Objectives:** Develop advanced and affordable spray systems that employ intelligent technology to automatically match spray outputs to crop structures during pesticide applications.

## Precision Sprayer Development



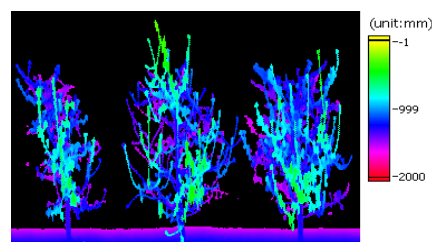
Variable-rate air-assisted sprayer



Touch screen and control box



Laser scanning sensor



Tree images from the laser sensor

**Research Significance:** Critical intelligent technology was developed to increase application efficiencies and reduce uncertainties in spray deposition uniformity, off-target loss and calibration for current pesticide sprayers. We achieved real cost benefits with new pesticide

application strategies for tree crop producers, consumers and the environment. Four of five sprayer prototypes built at a cost of \$21,000 for each are currently being tested for efficacy, reliability and durability in commercial nurseries in Ohio, Oregon and Tennessee. Commercial production of this technology can significantly reduce costs.

**New Spraying System:** A laser-guided variable-rate air-assisted sprayer was developed to improve pesticide application efficiencies for ornamental nursery and fruit tree industries. The sprayer integrates a high speed laser scanning system to a custom-designed sensor-signal analyzer and variable-rate controller, variable-rate nozzles and a multi-channel air-assisted delivery system. This unique precision sprayer can visualize the presence, size, shape, and foliage density of target trees and apply only the necessary amount of pesticide.

### **Pest control efficacy and reliability tests in Ohio, Oregon and Tennessee**



Sunleaf Nursery LLP, Ohio



Willoway Nurseries Inc., Ohio



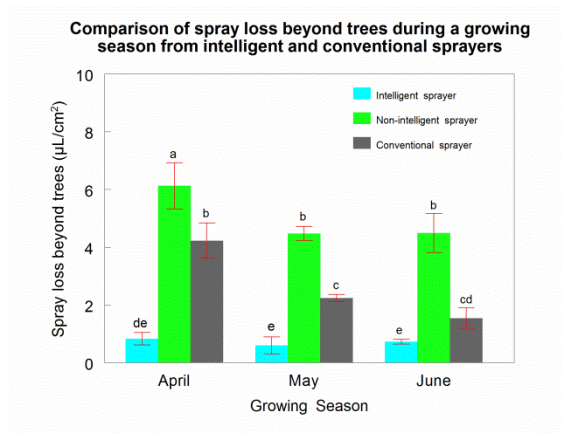
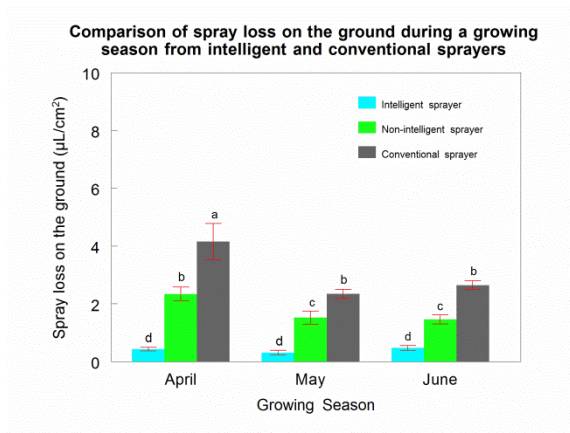
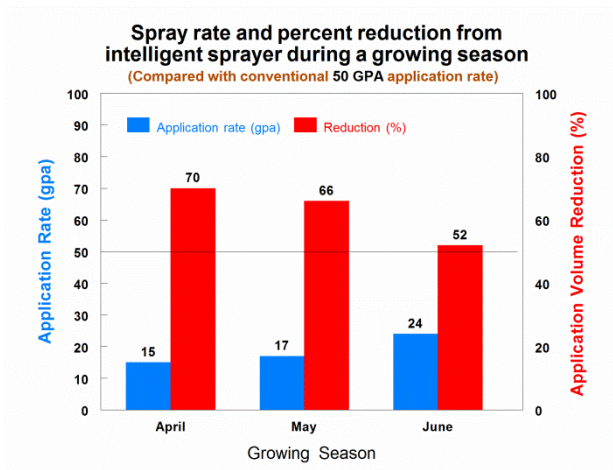
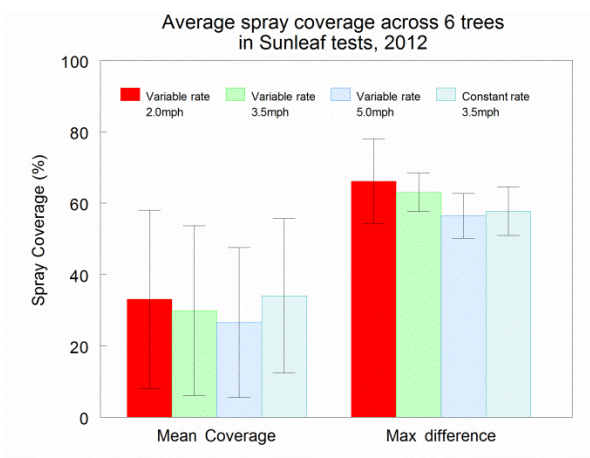
Hans Nelson and Sons Nursery, Oregon



Walker Nursery, Tennessee

**Benefits:** Controlled spray outputs to continuously match canopy characteristics in real time are now possible with intelligent sprayer capabilities. Field experiments demonstrated that the intelligent sprayer, compared to conventional sprayers, reduced variations in spray deposition due to changes in tree growth and increased consistency of spray deposition uniformity inside canopies at different growth stages. Furthermore, the new sprayer reduced spray loss beyond tree canopies by 40-87%, airborne spray drift by up to 87%, spray loss on the ground by 68-93% and spray volume by 47-73% in a growing season. Therefore, this new generation of precision sprayers will prevent excessive pesticide use and reduce production costs, worker exposure to pesticide risks, and adverse environmental contamination.





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