

Overview of Drone Crop Residue Study

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Outline

- Current regulatory status of application of pesticides by drones in Canada
- Goal of Comparison studies
- Project Planning Phase
- Final Study Plan Details
- Project Timelines
- Statistical Analysis Plan



Drone Use in Canada

- Drone use for conventional pesticides is not permitted until there is sufficient data to assess risks
- Focus of research: Quantify pesticide residues on crops when applied by drones
- Drone use will compliment conventional ground application equipment
- **Key Question: Does drone application of a pesticide result in similar residues on a crop compared to when applied by traditional application equipment?**
- **Research will measure crop residues in side-by-side trials using drone application vs conventional airblast or groundboom equipment.**

Project Planning Phase (completed summer/fall 2022)

Crop Selection

Considerations:

Choose 4 crops, one from each of the following agricultural scenarios:

- Small field crop
- Large field crop
- Trellis crop
- Orchard crop



Crops Selected

Broccoli, Edible-podded peas, Grapes and Apples

Project Planning Phase

Active ingredient Selection

Considerations:

- Active ingredient/end-use product must be registered in Canada for the crops used in the trials
- Use pattern must result in quantifiable residues on the crop at harvest
- Fungicide/Insecticide more potential for residues than Herbicides

Chemical/Pesticide Chosen

- Bayer Crop Science will be providing two end-use products, one that contains one active ingredient and the other that contains two active ingredients
- Bayer Crop Science will provide the GLP Test Items as well as manage/fund the analytical phase of the trials



Project Planning Phase

Drone Platform Selection

Considerations:

- Most representative and most appropriate for the crop
- Most likely to obtain high adoption by growers
- Use as many different drone platforms as possible

Drone Platforms Selected

- TTA M6E X V2-10L (Hexacopter with 4 nozzles)
- XAG V40-20L (Bicopter with 2 rotary discs)
- DJI T-30-30L (Hexacopter with 16 nozzles)
- Hylio AG 110-10L (Quadcopter with 6 nozzles)
- TTA M6E-X RTF-10L (Hexacopter with 4 nozzles)
- TTA M4E - 4L (Quadcopter with 4 nozzles)



Residue Study– GLP compliant

#Trials	3 trial locations/crop
Application Equipment	Side-by-side plots: <ul style="list-style-type: none">➤ 1 groundboom or airblast➤ 2 drone platforms
End-Use Products	Broccoli, Grapes, Apples: <ul style="list-style-type: none">➤ Product X containing two active ingredients Edible podded peas: <ul style="list-style-type: none">➤ Product Y containing one active ingredient
Harvested samples	Control: Samples taken from one trial location/crop Treated: 4 treated samples/plot at each of the 3 trials/crop
Total treated samples/crop	4 samples for conventional x 3 trials = 12 8 samples for drone(4/platform) x 3 trials = 24

Concurrent Spray Coverage Assessment

- Purpose: To assess spray coverage for drone and conventional application equipment
- Use water sensitive paper
- Will supplement the residue data by characterizing the deposition patterns for each crop canopy, environmental conditions and application equipment
- Will aid in interpreting the pesticide residue results

Research Timelines

- Comparison Residue Study will be conducted during the 2023 growing season
- Sample harvest: late summer/early fall 2023
- Sample analysis: late fall 2023/winter 2024
- Study report and submission to regulatory authority in Canada: late 2024/early 2025



Statistical Analysis Plan

Considerations:

- Small data set
- Total sample #s: 24 samples for drone applications/12 samples for conventional equipment/crop
- Active ingredient data:
 - Broccoli, grapes and apples: 2 active ingredients
 - Edible-podded peas: 1 active ingredient
- Appropriate test will be dependent on normality of data

Statistical Analysis Options:

- Testing for difference
- Testing for equivalence

Statistical Analysis Plan

Statistical Analysis Options:

➤ Testing for difference

Normally distributed	Normality cannot be established
One-sided t-test	Mann-Whitney U test
ANOVA F-test	Kruskal Wallis test

➤ Testing for equivalence

- Requires a pre-defined equivalence margin, which is the largest difference that is acceptable between the two application methods

Overall Research Summary

Crop Residue Study - Purpose:

- Side-by-side comparison residue trials for drone vs conventional application equipment using four different crop types

Hypothesis:

- Pesticide residues remaining on food crops are quantitatively similar when a pesticide is applied by either conventional ground application equipment or by drone equipment

Anticipated Outcome:

- Study results will aid Health Canada's Pest Management Regulatory Agency in determining the residue data required to support the addition of drones to a product label
- Study results will be shared at the international level

Questions?

