TRAVIS ESAU
BEng (Mechanical Engineering), Dalhousie University, 2010
MSc (Agriculture), Dalhousie University, 2012

DEPARTMENT OF MECHANICAL ENGINEERING

TITLE OF THESIS: SMART SPRAYER FOR SPOT-APPLICATION OF AGROCHEMICAL IN WILD BLUEBERRY FIELDS

TIME/DATE: 1:00pm, Thursday, June 30, 2016
PLACE: Room 3107, The Mona Campbell Building, 1459 LeMarchant Street

EXAMINING COMMITTEE:
Dr. G.S. Vijaya Raghavan, Department of Bioresource Engineering, McGill University (External Examiner)
Dr. Peter Havard, Faculty of Agriculture, Dalhousie University (Reader)
Dr. Arnold Schumann, Department of Soil & Water Sciences, University of Florida (Reader)
Dr. Dominic Groulx, Department of Mechanical Engineering, Dalhousie University (Co-Supervisor)
Dr. Qamar Zaman, Faculty of Agriculture, Dalhousie University (Co-Supervisor)

DEPARTMENTAL REPRESENTATIVE: Dr. Ted Hubbard, Department of Mechanical Engineering, Dalhousie University
CHAIR: Dr. Barbara Karten, PhD Defence Panel, Faculty of Graduate Studies

ABSTRACT
Agrochemical spray applications are currently being managed on a uniform field basis despite the significant variation that exists throughout many of the wild blueberry fields. The main objective of this study was to develop and evaluate a smart sprayer using machine vision and a custom control system to apply spot-applications of agrochemicals within wild blueberry fields. A commercial boom sprayer was retrofitted with smart sprayer components to allow for real-time nozzle specific weed and blueberry plant targeting.

Wild blueberry fields were selected and performance of the smart sprayer system was evaluated for spot-applications. Water sensitive papers were used in target and non-target locations in the test tracks to determine the targeting accuracy of the system. Plant parameters including stem density, stem height, stem diameter and number of branches were collected from selected plots for determination of spot-application treatment effects. Blueberry yield data including floral bud count and harvestable yields were collected from plots to determine the effectiveness of spot-applications as compared to uniform and control treatments. Weed and bare soil areas were mapped in selected fields using a global positioning system to quantify the amount of target and non-target areas in the selected fields. Agrochemical spray amounts were recorded to compare the spot-application savings with uniform applications, based on the target areas in the field.

The smart sprayer herbicide savings ranged from 69 to 79.3% within selected fields. Results revealed that the smart sprayer saved significant amount of fungicides by avoiding applications in bare soil and weed areas. Lights with added diffusers were used to maintain the lux within an acceptable range while targeting green weeds after dark with 65% potential agrochemical savings. Rear mounted machine vision was added for increased simplification and operator ease of use. An economic analysis of a swath control sprayer and smart sprayer system to a basic boom sprayer showed reductions of 12.3% and 44.5% input cost, respectively. This study can help to reduce the amount of agrochemical usage and guide the wild blueberry industry to adopt economic and environmentally sustainable options for production to increase farm profitability.