

Precise Robotic Weed Spot-Spraying for Improved Environmental and Economic Outcomes in the Sugarcane Industry

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Summary This paper presents a novel robotic spot spraying solution for weed management in sugarcane that exploits the latest advances in deep learning, machine vision, and robotics to reduce herbicide usage on sugarcane farms and potentially deliver significant economic and environmental impact. Most herbicides can be lost by runoff and have been detected in Great Barrier Reef (GBR) ecosystems at concentrations high enough to affect organisms. The AutoWeed smart spot spraying system utilises deep learning to detect and spray grass and broadleaf weed species within any target crop or pasture environment using their image features as the basis for detection. As part of a project funded by the partnership between the Australian Government's Reef Trust and the Great Barrier Reef Foundation, James Cook University, AutoWeed, and Sugar Research Australia are conducting trials of the novel AutoWeed spot spraying technology on sugarcane farms in the Burdekin region. Field trials compare the performance of the new spot spray technology

against existing broadcast spraying practices by measuring the efficacy to control the weeds, and water quality improvements in runoff. So far, the average results across 15 hectares of field trials show that AutoWeed spraying of nutgrass in sugarcane is 95% as effective as broadcast spraying and reduces herbicide usage by 35%, proportionally to the weed coverage. For specific trial strips with lower weed pressure, spot spraying reduced herbicide usage by up to 62%. Irrigation induced runoff, three days after spraying, also showed that spot spraying reduced the mean concentration of ametryn and trifloxysulfuron in runoff by 49% and 60% respectively compared to broadcast spraying. These promising early results reveal the capability of this technology to reduce herbicide usage on sugarcane farms without impacting weed control and potentially providing sustained water quality benefits in the GBR catchment.

Keywords Precision robotic, spot spraying, deep learning, artificial intelligence, sugarcane