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Development of an Intelligent Tool to allow real-time evaluation of harvesting practices as part of a framework for improved harvester payment systems.

(FULL REPORT IS SRA CONFIDENTIAL)

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ABSTRACT

The project has resulted in the development of a cane loss indicator which can be a valuable tool to assist the harvester operator to optimise harvester performance as crop conditions change throughout the day.

The system differs from previous attempts at cane loss monitors in that it does not attempt to identify individual billet loss, but rather looks at the energy dissipated in the processes of extracting cane and leaf and the effective dissociation of the billets as they are processed by the harvester extractor fans. The relationship between power consumption and actual cane loss utilises both keyboard inputs and parameters measured on the harvester.

Data collection for the development of the algorithms and their calibration was undertaken in conjunction with field trials, where conventional cane loss measurement protocols were used to give the base data. Initially manual data collection strategies were utilised, followed by high accuracy data logging. The relationships observed between derived cane loss and measured cane loss in these trials allowed fine tuning of the algorithms, including the “weighting” of different measured inputs.

Analysis of all datasets of electronically logged data indicates the repeatability of the cane loss values derived by SCHLOT under typical harvesting conditions to be high and, where variance was observed between the SCHLOT estimate and the field testing protocols, the SCHLOT number could be argued to give the more accurate determination of actual cane loss.

In operation, the SCHLOT cane loss monitor gives highly useful feedback to the operator, and this drove significant changes in operating strategies by the harvester operator.

The ability to remotely log cane loss in conjunction with other parameters such as harvester speed in near real time offers very significant benefits for the Industry with respect to the implementation of Best Practice Harvesting.

EXECUTIVE SUMMARY

Harvester cleaning losses are widely acknowledged as a significant source of lost industry value. Despite ongoing harvesting programs raising awareness of the extent of cleaning losses possible, and strategies to reduce harvesting losses, the industry still lacks any real-time way of appreciating the magnitude of cane loss at any point in time, especially as operating conditions vary.

Previous international work suggested a link between the power consumption of extractor fans and the mass flow rate of material through them, and this project sought to investigate and, if possible, refine that relationship to the point that it could be used as a real-time indicator of cane loss.

The project established that extractor power consumption appears to be a good relative indicator of biomass (and therefore cane) extraction rate. Initial attempts at calibration using early trial data showed good correlation between 'measured' (mass balance and/or infield sucrose loss measurement system (ISLMS)) and 'estimated' (from extractor power) cane loss in each trial, but with significant differences in these relationships between trials.

As further data were collected, it became apparent that correlation between 'estimated' and 'measured' cane loss improved as trial protocols were fine-tuned (to reduce error) and where compliance with trial protocols (operator skill level/competence) increased; therefore, variation between early trials may have been attributable to trial inaccuracy rather than the relationships differing widely.

Based on the body of data available to date, SCHLOT Live cane loss estimates appear to be a more consistently representative assessment of instantaneous cane loss than either ISLMS or mass balance assessments, with the added advantage of instantaneous and continuous feedback without further effort once installed. Well-run mass balance trials, where there is little crop variation across the fields, remain the most definitive method of retrospectively determining the impact of different treatments on cane loss. However, this method is limited in that it provides a single average value for an entire treatment but does not describe patterns of change in instantaneous cane loss. Conversely, ISLMS data are representative of single spot measurements in the field but a large number of points is required to ensure representativity in the result. While SCHLOT Live estimates look to be highly representative and repeatable, confidence in absolute magnitude of these estimates is expected to improve with further data. Notwithstanding, the data to date strongly suggest that SCHLOT Live cane loss estimates are a better and more usable indication of cane loss than either trial protocol for the above reasons.

It is thought, based on trends identified in the data analysis, that a larger body of trial data, provided the trials are well run, would be useful in refining the absolute magnitude of SCHLOT Live estimates further.

The reaction to the prototype monitors used during the trial has been highly positive, both in terms of positive changes to harvester operation and commercial interest in adopting the technology.

The operators of harvesters fitted with the prototype equipment were kindly accommodating of the trial equipment, but at first did not seem convinced that the information provided would be of much use to them. Within a very short time frame, however, operators significantly changed the way in which the harvester was being operated, suggesting that their appreciation of the level of cane loss had been much lower than that estimated by the SCHLOT Live system.

Given the high degree of variability in harvester cleaning cane loss across the range of operating conditions a harvester experiences, it is not realistic to expect an operator to be able to appreciate instantaneous cane loss in the absence of any quantitative information. SCHLOT Live provides that quantitative information and allows harvest operators to make informed decisions around cleaning losses in real time, thereby avoiding excessive losses where appropriate while also allowing more aggressive harvester operation in less 'loss-prone' conditions.