ABSTRACT

The wild blueberry industry is facing increased harvesting losses due to changes in crop conditions caused by improved management practices in past two decades. The objectives of this study were to sense the variations in fruit yield, plant height and topographic features to quantify overall fruit losses, evaluate blueberry harvester for picking efficiency in relation to spatial variability, and to develop a mathematical model for prediction of fruit losses. An integrated automated sensing and control system was developed and incorporated onto a commercial blueberry harvester to sense plant height, fruit yield, slope and elevation in real-time. Four wild blueberry fields were selected and the performance of developed system and commercial blueberry harvester was evaluated. Yield plots were randomly selected and harvester was operated at different combinations of ground speed and header revolutions to mechanically harvest these plots. Total fruit yield, berry losses, plant height, fruit zone and slope were recorded manually from each plot. Results reported that the developed system performed rapidly and reliably to estimate pre-harvest fruit losses, plant height, fruit yield, slope and elevation in real-time. Significant relationship between fruit yield and total fruit losses suggested that losses during harvesting were proportional to fruit yield. Results of means comparison showed that a combination of 1.2 km h\(^{-1}\) and 26 rpm resulted in significantly lower losses in high yielding fields. Spatial variability in fruit losses corresponding with the variations in crop characteristics, fruit yield and slope suggested that these parameters had a significant effect on fruit losses during mechanical harvesting. Results of modelling suggested that the prediction accuracy of the multiple regression model was lower than the artificial neural network model for training and validation data sets. Overall, the results suggested that a suitable combination of ground speed and header revolutions based on proper characterization and quantification of spatial variability in fruit yield, plant characteristics, and topographic features can minimize fruit losses during harvesting. This study can help to identify the factors responsible for fruit losses and to suggest optimal harvesting scenarios to improve berry picking efficiency and recovery to increase harvestable yield, which will improve farm profitability with no additional cost.