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Design and testing of an automated high-throughput computer vision guided waterjet knife strawberry calyx removal machine

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8 **Abstract**

9 An automated high-speed strawberry calyx removal machine was designed, built, tested, and evaluated. The three main
10 components of the machine consisted of 1) a strawberry loading and orientation conveyor, 2) a color-based machine
11 vision section for strawberry feature identification, and 3) a synchronized multi-waterjet knife calyx removal system. An
12 overview of the machine as well as a description of the working principles of each component is included. A full-scale
13 model of this machine was evaluated through a 12-week pilot study, during which the machine processed over 70 metric
14 tons of strawberries. Results indicated that the machine could produce an average calyx-free strawberry weight yield of
15 49.6 percent at a rate of 2270 kg/hr. Furthermore, it was seen that strawberry size had a significant effect on machine
16 efficacy.

18 **Keywords**

19 Automated; High-throughput; Waterjet Knife; Strawberry; Calyx Removal; Machine

21 **1. Introduction**

22
23 In 2014, processed strawberries in the U.S. reached annual evaluation of over \$241 million, growing 30 percent
24 over the previous year (Noncitrus Fruits and Nuts 2014 Summary, 2015). This represents over 550 million pounds of
25 strawberries harvested for processing. These processed strawberries end up in foods such as ice cream, yogurt, juices,

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