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Efficient milking systems for pastoral dairy farms

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ABSTRACT

Factors affecting milking efficiency in pasture-based dairy systems were explored in this thesis. An industry survey was conducted on 61 commercial farms with rotary dairies to benchmark current levels of milking efficiency on-farm. Benchmarks calculated included; cow throughput (cows milked per hour), milk throughput (kg of milk harvested per hour), the operator efficiency values of these benchmarks and cluster utilisation. It was possible to milk more cows per hour in larger rotary dairies, however operator efficiency peaked at 60 bails.

There was a range of performance within a given rotary size and platform speed was identified as one of the determining factors. The second experiment modelled the effect of platform speed and rotary size on throughput using milking duration data collected during the benchmarking study. Faster platform speeds increased the number of cows requiring multiple rotations to complete milking, but this did not decrease throughput.

A further factor that may affect throughput is individual cow milk yield, and consequently cow milking duration. An experiment in late lactation was set up to evaluate strategies to reduce cow milking duration by applying pre-milking stimulation or manipulating end-of-milking criteria. Pre-milking stimulation decreased cow milking duration but also decreased milking efficiency. Conversely, changing end-of-milking criteria, by increasing automatic cluster removal (ACR) threshold, reduced cow milking duration by up to 80 s without compromising milk yield or somatic cell count (SCC). This was subsequently validated in peak lactation.

In situations without ACR, milking efficiency must not be achieved at the expense of cow health so an experiment was designed to evaluate the effect of overmilking on teat-end hyperkeratosis. Clusters remained attached for 0, 2, 5 or 9 min after milk flow rate dropped below 0.2 kg/min. Teat-end hyperkeratosis was significantly greater for the 5 and 9 min treatments than 0 and 2 min. The milking efficiency of herringbone dairies was also benchmarked on 19 commercial farms with larger dairies achieving greater throughput (in a linear relationship), due to reduced idle time, but not greater operator efficiency.

Finally, the effect of rotary size, platform speed and end-of-milking criteria were evaluated in a number of scenarios to maximise operator efficiency. These were used to calculate the internal rate of return for different rotary sizes.

DECLARATIONS

This thesis contains no material that has been accepted for a degree or diploma by the University or any other institution. To the best of my knowledge no material previously published or written by another person has been used, except where due acknowledgement has been made in text.

Each chapter is set out in the style of the journal to which it has been submitted. Consequently, there is some repetition in chapter introductions, and differences in formatting and spelling. The submitted manuscripts include supervisors as co-authors. However, for each chapter, I planned the experiment, conducted any fieldwork, and wrote the manuscripts, with guidance from these supervisors.

Paul Edwards

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