J. Dairy Sci. 96:3766–3773
http://dx.doi.org/10.3168/jds.2012-6394

Milking efficiency for grazing dairy cows can be improved by increasing automatic cluster remover thresholds without applying premilking stimulation

J. P. Edwards,*†[1] J. G. Jago,* and N. Lopez-Villalobos†
*DairyNZ, Private Bag 3221, Hamilton 3240, New Zealand
†Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11222, Palmerston North 4442, New Zealand

ABSTRACT

It was hypothesized that streamlined premilking stimulation routines are effective at reducing cow cluster-on time but are not required to maintain milk yield or quality when increasing the automatic cluster remover (ACR) threshold above 0.4 kg/min. This was tested by examining the effect of 3 premilking treatments and 4 ACR thresholds over an 11-wk period with 96 mixed-age New Zealand Friesian-Jersey cross cows during peak lactation. Three premilking treatments were chosen: attach cluster immediately (control), attach cluster immediately and apply 30 s of mechanical stimulation (Stim), and remove 2 squirts of milk from each quarter and attach cluster (Strip). Four ACR milk flow rate thresholds were imposed: 0.2 kg/min (ACR2), 0.4 kg/min (ACR4), 0.6 kg/min (ACR6), and 0.8 kg/min (ACR8). Measurements included individual cow milk yield, cluster-on time, average milk flow rate, maximum milk flow rate, time to average milk flow rate, time from maximum milk flow rate to end of milking, and the milk flow rate and cumulative yield at predetermined intervals during each milking session. Milk composition and somatic cell count (SCC) were determined on composite milk samples, collected weekly. Postmilking strip yield was measured at the end of each treatment period. Cows receiving the Strip treatment had a 3 to 4% shorter cluster-on time than did cows on the control treatment, but cows receiving Stim were not different from the control cows. Milk yield, SCC, and postmilking strip yield were not different between the 3 premilking treatments. Cluster-on time of the ACR8 cows was 18 to 26% less than that of the ACR2 cows, but SCC and milk production variables did not differ between the 4 end-of-milking treatments, despite higher strip yields as the ACR threshold increased. Increasing the ACR threshold is an effective strategy to improve milking efficiency (cows milked per operator per hour) in situations where the work routine times of dairy operators can be accelerated. To achieve the greatest milking efficiency, clusters should be attached immediately without premilking manual or mechanical stimulation.

Key words: milking duration, stimulation, automatic cluster remover

INTRODUCTION

Herd sizes in pasture-based dairy farms have increased dramatically in recent decades, a trend that is likely to continue (O'Donovan et al., 2008; DAFF, 2010; DairyNZ and LIC, 2012). Herd expansion requires additional labor and often exerts pressure on existing resources. Annually, 33 to 57% of labor resources on pasture-based dairy farms are required for the milk harvesting process (O'Brien et al., 2004; Taylor et al., 2009). An efficient milk harvesting process is, therefore, important to successful expansion and management of large herds.

The cluster-on time of individual cows is an important factor determining herd milking times and thus labor requirements. It has been reported (Rasmussen, 1993; Burke and Jago, 2011) that the cluster-on time of cows can be reduced, without affecting milk yield and udder health indicators, by increasing the automatic cluster remover (**ACR**) threshold from 0.2 to 0.4 kg/min. A recent study with dairy cows in late lactation reported that ACR thresholds up to 0.8 kg/min further reduced individual cluster-on times without affecting milk yield or indicators of udder health when using a milking routine with no premilking stimulation, as is common practice on pasture-based dairy farms (Edwards et al., 2013). However, higher postmilking milk residuals were reported with increasing ACR threshold; therefore, the consequences of applying these ACR thresholds in peak lactation, when milk yields are greater, requires examination.

Premilking stimulation has been reported to reduce cluster-on time despite using a genetic strain of cow in which prestimulation has not been commonplace since the 1970s (Phillips, 1987; Edwards et al., 2013). However, the time taken to apply premilking stimulation was greater than the reduction in cluster-on time, resulting

Received November 19, 2012.
Accepted February 26, 2013.
[1]Corresponding author: Paul.Edwards@dairynz.co.nz

in cows remaining in the dairy longer and additional labor being required. The requirement for additional labor could be eliminated and the prestimulation routine shortened if the latency period between stimulation and cluster attachment was removed from the routine. Recent research has indicated that a latency period between stimulation and cluster attachment provided no benefit to milk yield or cluster-on time when udder fill was greater than 40% (Kaskous and Bruckmaier, 2011). Thus, if the time to cluster attachment can be reduced using premilking stimulation without a latency period, a net benefit to milking efficiency (cows milked per operator per hour) may be achieved without increasing labor requirements in some dairies.

Maximum throughput is achieved in many larger rotary dairies (>50 bails) when rotation speeds are greater than 10 s/bail (Edwards et al., 2012). This speed does not allow sufficient time for a single operator to apply manual stimulation and attach clusters (Armstrong and Quick, 1986). Therefore, additional labor would be required to maintain this speed, even with the removal of the latency period, unless a form of mechanical stimulation was introduced. Likewise, in larger herringbone dairies (>18 units), the addition of ~10 s/cow for stimulation during spring would reduce throughput unless labor was increased (O'Brien et al., 2012).

We hypothesized that streamlined premilking stimulation routines are effective at reducing cow cluster-on time but are not required to maintain milk yield or quality when increasing the ACR threshold above 0.4 kg/min. This was tested by examining the effect of 3 premilking treatments and 4 ACR thresholds on peak-lactation dairy cows yielding, on average, 22.3 kg/d.

MATERIALS AND METHODS

Animals

The study was conducted using 96 mixed-age New Zealand Friesian-Jersey cross cows at the DairyNZ Lye Farm (Hamilton, New Zealand) from September to December 2011. Cows were representative of those present in pasture-based production systems and, therefore, had relatively low daily milk yields compared with those achieved by cows managed in mixed ration systems typical in North America and continental Europe. The use of animals was approved by the Ruakura Animal Ethics Committee. Cows were managed as one herd and rotationally grazed on predominantly perennial ryegrass pasture following the decision rules of Macdonald and Penno (1998). Milking of the herd occurred in the morning between 0700 and 0830 h and in the afternoon between 1500 and 1630 h, through a 30-bail rotary dairy (GEA Farm Technologies GmbH, Bönen, Germany) with plant vacuum set at 42 kPa. Postmilking, a commercially available teat sanitizer (Teat-Guard Plus, Ecolab, St. Paul, MN) was applied manually to each cow by pressurized spray upon exit from the rotary platform.

Experimental Design

The experiment was arranged as a 3 × 4 factorial: 3 premilking treatments were applied across 4 ACR thresholds. Premilking treatments were as follows: clusters attached at the first bail after cows had walked onto the rotary platform (control); tactile stimulation applied by removing 2 squirts of foremilk from each quarter, requiring ~10 s, followed by immediate cluster attachment (**Strip**); and mechanical stimulation applied using StimoPuls Apex M (GEA) equipped clusters (**Stim**). The pulsator ratio was 70:30 with 300 cycles/min (at half vacuum) during stimulation and 60:40 with 60 cycles/min during normal milking. Stimulation time set at 30 s was considered appropriate for cows with a high degree of udder fill, as expected during peak lactation (Weiss and Bruckmaier, 2005).

For each premilking strategy, 4 ACR thresholds were imposed by the herd management system: 0.2 kg/min (**ACR2**), 0.4 kg/min (**ACR4**), 0.6 kg/min (**ACR6**), and 0.8 kg/min (**ACR8**). If the cow's milk flow rate remained below the respective threshold level for longer than 4 s, the ACR was activated and the cluster was removed within 5 s. Clusters remained attached for a minimum of 120 s. All treatment groups were balanced for days in milk, cluster-on time, yield, SCC, breed, and age.

Covariate data were collected in wk 1, when cows were milked using the control treatment with clusters attached at entry and the ACR threshold set at 0.35 kg/min. In wk 2, cows were transitioned to the new ACR threshold and remained on the allocated ACR threshold for the remainder of the experiment (9 wk). On the first day of wk 2, ACR2 and ACR4 cows were changed from 0.35 kg/min to their respective thresholds. At the same time, cows on the ACR6 and ACR8 treatments were increased to 0.5 kg/min and remained there for 3 d before changing to their final ACR thresholds of 0.6 and 0.8 kg/min. At the beginning of wk 3, the premilking treatments commenced and were applied for 3 wk (period 1). At the start of wk 6, cows in each of the premilking treatment groups were randomized and split evenly into each of the other 2 treatments, which were applied for a further 3 wk (period 2). At the start of wk 9, cows switched premilking treatments to the remaining treatment, which was applied for a final 3 wk (period 3), so each cow was exposed to all 3 treatments.