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# *Short communication:* The effect of premilking with a teat cup–like device, in a novel robotic rotary, on attachment accuracy and milk removal

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## ABSTRACT

This study investigated the effects of premilking teat preparation on attachment accuracy and milk removal characteristics for individual cows in a novel 16-bail prototype robotic rotary (RR; automatic milking rotary system; DeLaval AMR, Tumba, Sweden). The first commercial versions of the RR systems will have the option of purchasing and installing a teat preparation module (TPM) for premilking stimulation and cleaning of teats. It is expected that attachment of teat cups would be faster and more successful with the use of a TPM, and that the efficiency of milk removal, in terms of average and peak milk flow rates, would increase. We observed a significant effect of treatment (no wash vs. wash) and individual quarters on attachment success: cows exposed to the wash treatment had up to 1.5 times higher odds of being successfully attached. The attachment was not only more successful but was also found to be 4.3 s faster after cows were exposed to the wash treatment. Average milk flow rate was not affected by the wash treatment. Nevertheless, a significant interaction was found between wash treatment and milking interval affecting the peak milk flow (kg/min) of individual cows. This interaction showed that cows with a milking interval $\leq$8 h subjected to the wash treatment had significantly higher peak flow rates (300 g/min increase) compared with cows in the same milking interval category with no wash treatment. The relationship between premilking stimulation and attachment success shown in this study will increase awareness (of both farmers and developers of the technology) of the importance of teat cleaning within the RR. The effects of the improved system performance should be taken into account (alongside the capital investment cost) when deciding to install a RR equipped (or not) with a TPM.

**Key words:** attachment success rate, automatic milking system, robotic rotary, dairy

## Short Communication

Different methods of premilking teat cleaning are used by different automatic milking system (**AMS**) manufacturers. Premilking teat preparation creates the release of oxytocin and induces milk ejection (Bruckmaier et al., 2001). It is generally believed that AMS teat cleaning devices sufficiently stimulate the milk letdown process for complete milk removal (Bruckmaier et al., 2001; Dzidic et al., 2004). Because teat cleaning is not commonly practiced on Australasian dairy farms, studies have been conducted with single-box AMS to quantify the potential increased throughput generated when the teat cleaning devices are disabled. Timesavings of 0.5 and 1.1 min per milking were realized without a significant negative effect on the success of teat cup attachment (Jago et al., 2006) or milk yield (Davis et al., 2008).

Since 2009, a 16-bail robotic rotary [**RR**; Automatic Milking Rotary, DeLaval, Tumba, Sweden] has been codeveloped and tested by the FutureDairy project located at the Elizabeth Macarthur Agricultural Institute site (Camden, NSW, Australia). The RR is expected to be capable of carrying out approximately 50 cow milkings per hour with the installation of 2 robots (Figure 1): a teat preparation module (**TPM**) and an automatic cup attacher (**ACA**). Such high levels of throughput (compared with a single-box robot) are achieved through the design of the RR, which leaves the robotic devices (TPM and ACA) in a stationary position while the rotary platform rotates the cows around from the entry point to the exit point in a stop–start operation. Figure 1 shows a schematic overview of the 16-bail RR with the entry to the rotary, the TPM, the ACA, and the exit from the rotary.

The first commercially released RR model will be a 24-bail herringbone rotary (DeLaval) with the option of installing 2 to 5 robots (2 TPM, 2 ACA, and a teat spray module). The purchase and installation of one or more TPM will not be compulsory, which may create an opportunity for the farmer to reduce the cost of the capital infrastructure by choosing not to install a TPM. The TPM have several functions: to clean the teats in preparation for milking to reduce

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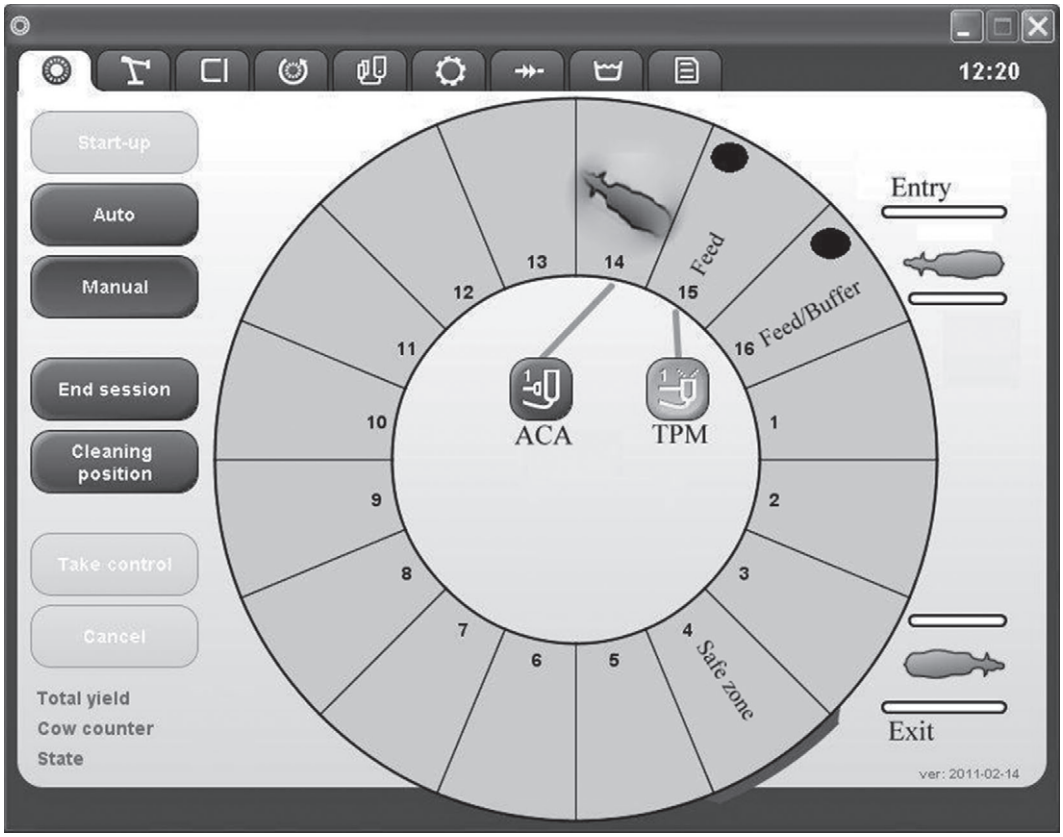


**Figure 1.** Schematic of the robotic rotary showing the entry to the rotary, teat preparation module (TPM), automatic cup attacher (ACA), exit from the rotary platform, safe zone (bar at the side of bail 4), and the feed available at the TPM and buffer bail positions (bails 15 and 16, feed bin positions indicated by black circles). Schematic graphic user interface of the automatic milking rotary (AMR) system courtesy of DeLaval (Tumba, Sweden).

bacterial contamination of the milk (Knappstein et al., 2004), stimulate oxytocin release and the milk let-down process, initiate milking (Macuhová et al., 2003), and remove and discard the foremilk. In Australia and other countries where premilking preparation before teat cup attachment is not mandatory, farmers may opt to not purchase a TPM. Although the study of Jago et al. (2006), with a single-box AMS, showed no difference in attachment success between 2 treatments (with or without premilking stimulation and cleaning), it cannot be assumed that the same results will be achieved with the RR.

We investigated the effect of premilking teat preparation on system performance in terms of attachment success and speed and milk removal characteristics of individual cows. We report the results here to ensure that informed decisions can be made regarding the installation (or not) of TPM within the RR. We hypothesized that using the TPM would result in a higher accuracy of attachment, in terms of attachment success and attachment speed (time needed for attachment of 4 teat cups), and would increase milk flow, thereby lowering the cups-on time per quarter and improving the potential and actual throughput and milk harvesting efficiency of the RR.

During the trial, a mixed-breed herd of 180 cows (range 163–193; majority Holstein-Friesian and approximately 10 to 15% Illawarra) was managed and grazed according to recommended practice (Kerrisk, 2010), as a single voluntarily trafficking herd and milked with a prototype RR at the Elizabeth Macarthur Agricultural Institute site. During the trial, the herd averaged 22.7 kg of daily milk production (median 21.6; SD 8.7 kg), were 170 d in milk (median 167; SD 115 d), and had an average parity of 2.7 (range 1–11; median 2; SD 1.8).

The RR was available for cow access 22 h/d (system washes occurred at approximately 0700 to 0800 h and 1800 to 1900 h). Cows voluntarily moved around the system, from the paddocks to the RR, passing a set of automatic drafting gates where they were drafted based on whether milking permission was granted or denied. Milking permission was granted when the interval since the previous milking exceeded 4 h or the previous milking was incomplete (<50% of expected yield harvested