Automatic oestrus detection using a camera-software device and oestrus detector strips in dairy cattle at pasture

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General Abstract

This study aimed to develop an automated system of oestrus detection building on the widely utilised technique of tail paint, which assists effective and accurate oestrus detection. A camera-software device (CSD) and oestrus detector strips (ODS) were tested in this study. This system has extended the technique of tail painting and modified it so that the CSD can automatically detect, read and interpret paint removal optically using digital technology.

A clinical trial involving 480 New Zealand dairy cows grazing pasture was conducted to determine the efficiency of ODS with CSD compared to traditional farm management comprising visual observation and tail paint and to the tail paint technique alone as scored by an observer in the milking shed. Tail paint readings were classified into four categories 1-25%, 26-50%, 51-75%, 76-100% of tail paint removed. Visual observation on the two groups was conducted for 30-45 minutes before morning and afternoon milking and at other times when work was occurring near the cows. Milk samples were collected for progesterone (P4) analysis. The sensitivity, specificity, predictive values and accuracy of oestrus detection were compared. The confirmed pregnancy diagnosis and artificial insemination (AI) results were used as one standard to allow comparison of the different oestrus detection methods. When P4 results became available, they were integrated into the performance standard (a strong level of agreement was found between P4 results and oestruses that were confirmed by pregnancy diagnosis $\kappa=0.74$). Standardised reproductive analysis for each group was conducted using DairyWin™ farm records.

The test sensitivity, specificity, positive predictive value (PPV) and overall accuracy for the CSD group were higher than those for traditional farm management (comprising tail paint and visual observations; $p<0.0063$; $p<0.001$, $p<0.0001$, $p<0.0001$ respectively based on pregnancy diagnosis (PD) outcome for confirmation the occurrence of oestrus; $p<0.039$, $p<0.01$, $p<0.0001$, $p<0.0001$ respectively based on PD outcome and P4 combined to confirm the occurrence of oestrus). They were also higher than for tail paint use alone ($p<0.004$, $p<0.0001$, $p<0.05$, $p<0.0001$ respectively; based on PD outcome for confirmation of the occurrence of oestrus). Negative predictive value (NPV)

didn't differ between CSD and traditional farm management ($p=0.28$ based on PD outcome for confirmation of occurrence the oestrus and $p=0.55$ based on PD outcome and P4 results combined for confirmation of the occurrence of oestrus) and was significantly higher ($p<0.0001$) when compared to the NPV of tail paint alone. The pregnancy rate and non-return rate (49 day) to first service by artificial insemination were higher (72%, 71% respectively; $p<0.05$) in the CSD group than that in the control group (39%, 47% respectively). CSD application significantly influenced the proportion conceiving from planned start of mating (PSM) until the end of the artificial breeding season ($p= 0.044$).

The study showed that the CSD system can satisfactorily detect oestrus in seasonally calving dairy herds grazing pasture. With the positive influence that the CSD had on this farm's performance it appears that the CSD offers the potential to increase conception rate in similar herds if AI is timed using the results of CSD oestrus detection.

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