The effect of reproductive performance on the herd value assessed by integrating a daily dynamic programming with a daily Markov chain model

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The objective of this study was to determine the effect of reproductive performance on the herd value. The herd value was defined as the herd's average retention payoff (RPO) which is the expected profit from keeping the cow compared with immediate replacement. First, a daily dynamic programming model was developed to calculate the RPO of all cow states in a herd. Second, a daily Markov chain model was applied to estimate the herd demographics. Then, herd value was calculated by aggregating the RPO of all cows in the herd. Cow states were described by 5 milk classes (MC1 = lowest to MC5 = highest), 9 lactations, 750 days in milk (DIM) and 282 days in pregnancy. Five different reproductive programs were studied (RP1 to RP5). The RP1 used 100% timed artificial insemination (TAI) (42% conception rate (CR) for 1st TAI and 30% for 2nd and later services) and the other programs combined TAI with estrous detection (ED). The proportion of cows receiving AI after ED ranged from 30 to 80%, with CR of 25, 30, and 35%. These five reproductive programs were categorized according to their 21 d pregnancy rate (21 d PR), which is an indication of the rate the eligible cows become pregnant every 21 d. The 21 d PR was 17% for RP1, 14% for RP2, 16% for RP3, 18% for RP4, and 20% for RP5. Results showed a positive relationship between 21 d PR and the herd value. The most extreme herd value difference ($/cow per year) between two RP was $77 for MC3 (RP5 – RP2); $13 for MC1 (RP5 – RP1); and $160 for MC5 (RP5 – RP2). Reproductive programs were ranked based on their calculated herd value. With exception of the best reproductive program (RP5), all other programs showed some level of ranking change with MC. The most dramatic ranking change was observed in RP1, which moved from being the worst ranked for MC1 to the second best ranked for MC5.