DETERMINING THE OPTIMAL VOLUNTARY WAITING PERIOD IN DAIRY COWS

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A Monte-Carlo stochastic simulation model was created to calculate the economic effects of non-optimal fertility in dairy cattle. The model is dynamic and uses time steps of one week. The model simulates the reproductive cycle, the occurrence of postpartum disorders and milk production. Elements of the cow performance having an economic effect, such as milk production per year, number of calves per year, number of inseminations and number of culled cows, were summarized. An important managerial aspect of fertility is the voluntary waiting period (VWP), defined as the moment (in weeks post partum) when insemination of a cows starts, when seen in oestrus. Although there used to be general agreement that a calving interval of 365 days, and thus a VWP of 60-80 days was optimal, there are currently questions with regard to the optimal VWP. For instance, the shape of the lactation curve and the economic of effects of a lower milk production per cow per day have changed over the time. The simulation model allows for calculation of the economic effect of postponing the VWP. Because cow factors and economic values can differ between and within farms, the economic effect of extending the VWP can be estimated. Using varying cow factors and economic values for the Dutch situation, based on literature and expertise of the authors, data on the economic effect of different VWP were generated. The variables of interest were randomly varied, based upon relevant distributions. Cow factors of interest were: parity (varying from 1-5), time of the first ovulation (varying from 8-16wks pp), ovulation rate (fixed at 0.95), estrous detection rate (varying from 0.3-0.7), conception rate (varying from 0.3-0.7), gestation period (varying from 38-42 wks), milk production level (varying from 5200-10700 kg/305 days), milk persistency represented by factor C in Wood's curve (varying from 0.012-0.0562), time to peak milk production (varying from 4-8 wks pp), milk production loss due to gestation (varying from 0.26-4.32 kg/week depending on gestation period), incidence rate of postpartum disorders reducing ovulation rate (varying from 0.03-0.11) and time of disorder occurrence (varying from 6-14 wks pp), incidence rate of postpartum disorder reducing conception rate (between 0.20-0.33) and late embryonic death rate (between 0.05-0.09). The economic values in the analysis were the costs of a decreased milk production (varying from €0.07-0.20 per kg), calf price (varying from €50-200 per calf), insemination cost (varying from €7-24 per insemination), calving cost (varying from €137-167 per calving, and including costs for diseases associated with calving) and culling costs, expressed as the retention pay-off (varying from €-1479-261). The culling costs depend on parity and the level of milk production of that cow.

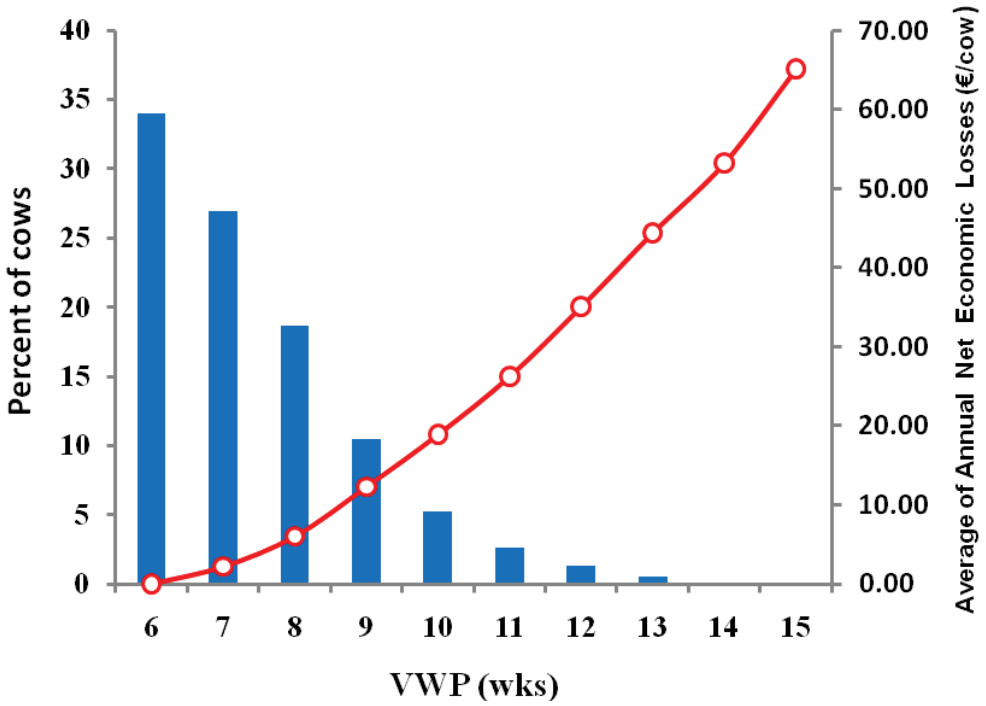

FIG. 1. Frequency distribution of optimal voluntary waiting period (VWP) for different cow factors and economic values (bar graph, left axis) and average of annual net economic losses (€/cow) for different VWP relative to a VWP of 6 weeks (line graph, right axis)

Each simulation is made up of 10,000 iterations. For each iteration, the economic effect VWP's varying from 7 to 15 weeks pp was calculated, using a VWP of 6 weeks as basis. Per iteration, the VWP with the minimum of economic loss or the maximum profit was determined. The optimal VWP of most cows (95%) was earlier than 10 weeks (FIG. 1.). For only 5% of the iterations, a VWP extended beyond 10 weeks pp was optimal. The average economic losses, when comparing the extended VWP with a VWP of 6 weeks, was also calculated and given in FIG. 1. Every VWP larger than 6 weeks gives, on average, economic losses. For instance, the average annual net economic losses of a VWP of 7 weeks are €2.20 per cow, while for 27 % of the cows, a VWP of 7 weeks is optimal. A VWP of 15 weeks is never optimal and is associated with, on average, €65.12 net annual economic losses. As a next step in this research, it is interesting to further explore the specific circumstances that determine when an extension of the VWP