

## **Factors influencing heifer survival and fertility on commercial dairy farms**

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Fertility in dairy cows has declined steadily over the past 40 years. The average UK cow survives only 3 lactations, with infertility the major cause for culling. The availability of heifers to enter the herd is therefore reducing at the same time that demand for them is increasing. We have investigated both the timing of heifer deaths and possible contributing factors. Many potential heifers are lost pre-natally due to early embryonic death (about 40%), later embryo loss (at 1-2 months, 20%) and abortion (about 5%). Our recent survey of 19 UK herds showed that 8.1% of calves were born dead and a further 3.4% died within their first month. Of 434 heifer calves recruited onto a study at 1 month of age from these herds, 27 (6.2%) had died or been culled before reaching their first service period at 15 months due to either disease or accident. Some heifers served at this stage failed to conceive (14/407, 3.4%). Of 363 heifers that have reached first calving, 12 (3.3%) were removed from the herd within 8 weeks, predominantly as a result of difficult calvings and mastitis. There is therefore steady attrition of potential replacement heifers before they even enter the herd; such losses are generally not accounted for on the farm.

Once the heifers do enter the milking herd, the most profitable animals are those which manage to combine good milk production qualities with a regular calving pattern. We have investigated some possible juvenile predictors of future performance. Low birthweight calves ( $32 \pm 0.5$  kg) were more likely to come from older dams (3+ lactations) with higher peak milk yields ( $>42$  kg/day) in comparison with high birthweight ( $42 \pm 0.8$  kg) calves. Sire affected gestation length but not birthweight. This suggested that the maternal uterine environment may limit pre-natal calf growth due to competition for nutrients with those going into milk production. Subsequent milk production was not, however, affected by birthweight. Postnatally, sire showed a greater influence with significant estimates for sire heritability on weight, body condition score, IGF-I, insulin and milk production parameters in the first lactation, coupled with a significant effect on conception rates at this stage.

As both milk production and fertility are strongly regulated by the somatotrophic axis, we determined whether measures of somatotrophic hormones at 6 months of age could predict actual performance over 3 lactations. Neither endogenous nor stimulated GH release patterns were related to peak or 305 day yield in any lactation, although the size of a stimulated GH peak was positively related to milk energy values in the first lactation. Pre-pubertal IGF-I and insulin concentrations also failed to predict milk production. Cows with delayed ovulation in the first lactation ( $>45$  days to first progesterone rise) did, however, have a higher GH pulse amplitude and lower IGF-I as a juvenile.

Age at first calving (AFC) is another parameter known to influence later performance. AFC can be influenced by heifer growth rates and management decisions on when to serve. Heifers not calving until  $>25$  months required significantly more services/conception than those calving at a younger age. Calving at over 30 months of age was associated with severe problems over the peripartum period. Optimum fertility and maximum yield in the first lactation were associated with an AFC of 24-25 months. However, heifers calving at 22-23 months performed best in terms of total milk yield and survival in the herd over the first 5 years of life. This was in part because good fertility as a heifer was associated with better fertility later in life as a cow.

In summary, many potential replacement heifers never enter the herd due to disease, accident or poor fertility. This severely limits any opportunities for on-farm selection. Good fertility as a heifer predicts good performance later. Conversely, heifers which experience initial difficulty in conceiving calve later and then perform badly.

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