



Review article

A review of the causes of poor fertility in high milk producing dairy cows

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ABSTRACT

Fertility in dairy cows has declined over the past five decades as milk production per cow has increased. Many hypotheses have been proposed to explain this including issues of genetics, physiology, nutrition and management, and these factors have been investigated at the animal, organ and cellular level at critical time points of the productive life of dairy cows. This paper reviews the physiological events and their causes and consequences affecting fertility in dairy cows and summarises these in a downloadable poster. We consider the following points to have the greatest negative impact on fertility and that they need to be prioritised in efforts to ameliorate the problem (others have been included in the review). Firstly, minimise negative energy balance and resolve any infection of the post partum uterus. Secondly, expression and detection of oestrus followed by insemination with high quality semen (day 0). Thirdly, ovulation and fertilisation of a high quality oocyte (day 1). Fourthly, an early increase in progesterone secretion from the corpus luteum (days 3–7). Fifthly, the uterine endometrium must produce an early and appropriate environment to stimulate embryo development (days 6–13). This leads to sixthly, a large embryo producing adequate quantities of interferon tau (days 14–18) that alters uterine prostaglandin secretion and signals maternal recognition of pregnancy (days 16–18). Future strategies to improve dairy cow fertility are needed for the benefit of the dairy industry and for cow welfare and should be based upon an integrative approach of these events.

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1. Introduction

Dairy production systems that use cows that have been highly selected for milk production in recent decades have suffered a decline in cow fertility. This has occurred in countries and regions that operate diverse production systems, from continuously calving herds found mostly in the UK and North America to seasonal calving herds found mostly in Ireland, New Zealand and Australia (Lucy, 2001; Dillon et al., 2006; Macdonald et al., 2008). Reproductive efficiency is high priority in all systems yet is considered higher in seasonal calving systems as the opportunity for a cow to calve and become pregnant is time limited to ensure a calf per cow per year in synchrony with grass growth (Dillon et al., 2006). Consequently, one of the greatest challenges of reproductive biologists, nutritionists and geneticists is to gain an understanding of the underlying biology of the dairy cow that contributes to low fertility and develop strategies to improve fertility. Fertility is a multi-factorial trait and its deterioration has been caused by a network of genetic, environmental and managerial factors and their complex interactions make it difficult to determine the exact reason for this decline. Despite this, researchers have identified key causes during the productive life of the dairy cow that negatively impact on her reproductive efficiency. This review focuses on factors in the early post

partum period (Fig. 1) that affect subsequent fertility during the breeding period and the successful establishment of a viable/sustainable pregnancy within 83 days of calving in 80% of dairy cows (Fig. 2).

2. Genetic and management effects on milk production and fertility

Over the last 30 years, genetic selection for increased milk production, particularly within the North American Holstein-Friesian genotype, has been very successful. Between 1985 and 2003, the rate of phenotypic gain in milk production per cow per year has been 193 kg for the United States, 131 kg for the Netherlands, 35 kg for New Zealand and 46 kg for Ireland (Dillon et al., 2006). Despite these countries having diverse production systems, genetic selection criteria and climatic conditions, they all report a substantial decline in reproductive performance during the same period. In seasonal pasture based systems of milk production, such as in Ireland and New Zealand, studies have reported conception rates to first service between 39 and 52% (Dillon et al., 2006; Macdonald et al., 2008). In US and UK feedlot systems of milk production, conception rates to first service as low as 30–40% have also been reported (Pryce et al., 2004; Norman et al., 2009). In recent years, the emphasis within selection indices for Holstein-Friesians

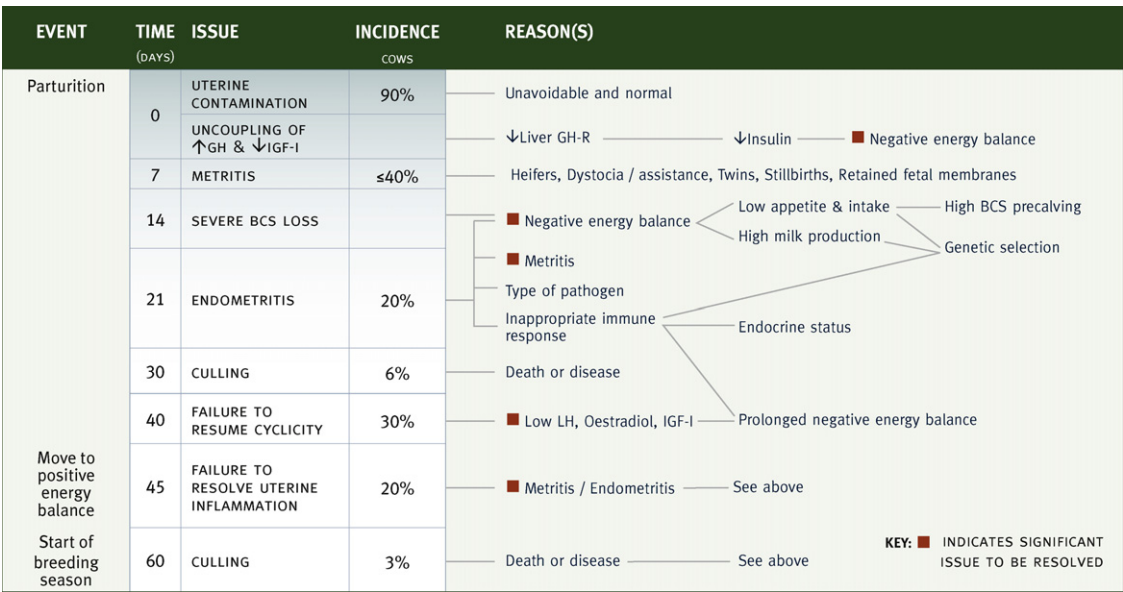


Fig. 1. Schematic presentation of the reasons for the major problems contributing to low fertility in dairy cows in the postpartum period. See text for explanation of incidence rates.

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