ABSTRACT

Basic knowledge of mechanisms controlling reproductive processes in mammals was limited in the early 20th century. Discoveries of physiologic processes and mechanisms made early in the last century laid the foundation to develop technologies and programs used today to manage and control reproduction in dairy cattle. Beyond advances made in understanding of gonadotropic support and control of ovarian and uterine functions in basic reproductive biology, advancements made in artificial insemination (AI) and genetics facilitated rapid genetic progress of economically important traits in dairy cattle. Technologies associated with management have each contributed to the evolution of reproductive management, including (1) hormones to induce estrus and ovulation to facilitate AI programs; (2) pregnancy diagnosis via ultrasonography or by measuring conceptus-derived pregnancy-associated glycoproteins; (3) estrus-detection aids first devised for monitoring only physical activity but that now also quantitate feeding, resting, and rumination times, and ear temperature; (4) sex-sorted semen; (5) computers and computerized record software packages; (6) handheld devices for tracking cow location and retrieving cow records; and (7) genomics for increasing genetic progress of reproductive and other economically important traits. Because of genetic progress in milk yield and component traits, the dairy population in the United States has been stable since the mid 1990s, with approximately 9 to 9.5 million cows. Therefore, many of these technologies and changes in management have been developed in the face of increasing herd size (4-fold since 1990), and changes from pastoral or dry-lot dairies to increased housing of cows in confinement buildings with freestalls and feed-line lockups. Management of groups of “like” cows has become equally important as management of the one. Management teams, including owner-managers, herdsmen, AI representatives, milkers, and numerous consultants dealing with health, feeding, and facilities, became essential to develop working protocols, monitor training and day-to-day chores, and evaluate current trends and revenues. Good management teams inspect and follow through with what is routinely expected of workers. As herd size will undoubtedly increase in the future, practical reproductive management must evolve to adapt to the new technologies that may find more herds being milked robotically and applying technologies not yet conceived or introduced. 

Key words: dairy cow, management, reproduction, technology

INTRODUCTION

Management of reproduction in dairy cattle requires a mixture of science, technology, and the art of animal husbandry. Reproduction is a complex science, so much so that William Hansel, formerly of Cornell University, always told his students, “it is not a wonder that reproduction sometimes fails, but rather a miracle that so many pregnancies terminate successfully” (Bearden and Fuquay, 1997). It is also a wonder that so many pregnancies occur, given the innumerable ways in which the human can interfere in attempts to control the complex physiologic pathways and mechanisms that lead to and support pregnancy and eventual parturition.

Several factors during the last 100 yr have influenced and altered how dairy cows are managed to promote reproductive efficiency. As the total number of dairy cows decreased with increased milk production per cow (Figure 1), herd size increased and nearly all dairy farms qualified as grade A milk producers, requiring upgrading of facilities and equipment. As a perspective from the 1920 US Census, 19.6 million dairy cows produced milk on 4.5 million dairy farms, representing an average of 4.4 cows per farm, and annual yield per cow was 1,385 L. In 2016, 9.3 million cows (223 cows per farm) produced milk on 41,809 dairy farms, and average production per cow was approximately 10,024 L (USDA, 2017). By 1950, average herd size was only
6.5 dairy cows per farm, but since then, it has increased exponentially (Figure 1). The numbers of herds with larger numbers of cows have also clearly changed. The number of cows per US dairy operation and its distribution by herd size reveals the exponential growth in large dairy herds beginning in the 1960s (Figure 2). Furthermore, proportion of total US milk produced annually by larger herds has increased dramatically since 1980. In 2012, 63% of milk was produced by herds of 500 or more cows (NMPF, 2016). With 49,300 dairy herds in 2012, 63% of US milk was produced by only 35.7% of the dairy farms.

Average number of cows managed or volume of milk sold per dairy worker has increased with time and that is particularly true in larger than in smaller dairy herds (NDFS, 2015). Moreover, the labor force has changed culturally from predominantly immigrant Americanized Europeans to predominantly Hispanics, with the need for bilingual managers with a working knowledge of Spanish. Currently, Hispanic employees (of which approximately 63% are Mexican) represent approximately 75% of the hired labor force on dairy farms in California (Bello et al., 2012).

During the early half of the past century, most dairy cows grazed pastures and may have been housed in ties-tall or stanchion barns during winter months. Housing types on US dairies then changed by growth of operations housed in freestall and dry-lot systems (NAHMS, 2007). The NAHMS (2007) survey was conducted in 17 of the United States’ major dairy states, representing 79.5% of US dairy operations and 82.5% of US dairy cows. Estimates in the NAHMS report refer to calendar year 2006. Further changes in the 1960s included greater usage of confinement housing, in which cows were housed almost exclusively on concrete after first calving. In these larger herds, adoption of feedline head lockups to confine cows individually after the morning milking introduced opportunities to manage much more efficiently reproduction and health care for large numbers of cows. Insemination, pregnancy diagnosis, health monitoring, and assessment of paint or tail chalk rubs as a means of detecting prior standing activity became much easier. Some managers without feedline lockups took advantage of return-alley sorting gates to segregate cows into palpation rails for various reasons or into a sorting pen with feedline lockups.

Key technologies and discoveries (Appendix Table A1) have led to changes in reproductive management and clearly have become important drivers for change in day-to-day management of dairy operations, particularly in larger herds. Breeding strategies have moved from predominantly natural service to an overwhelming prevalence of AI and ovulation-synchronization programs before timed AI (Caraviello et al., 2006). In the AI industry, changes in frozen semen packaging and sperm dose and use of sex-sorted semen facilitated genetic progress by making available more progeny of genetically proven sires (Foote, 1996). Detection of estrus by means of measuring correlated traits such as increased physical activity or body temperature became
دریافت فوری متن کامل مقاله

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات