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Reproductive performance in a select sample of dairy herds

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ABSTRACT

Sixteen herds were selected from a pool of 64 herds nominated by consultants for participation in a national survey to demonstrate excellence in reproductive performance. For inclusion in the survey, herds had to have comprehensive records in a farm computer database or participate in a Dairy Herd Improvement Association record system and have superior reproductive performance as judged by the herd advisor. Herd managers were asked to fill out a questionnaire to describe their reproductive management practices and provide herd records for data analysis. Reproductive analysis was based on individual cow records for active and cull dairy cows that calved during the calendar year 2010. Breeding records by cow were used to calculate indices for insemination rate (IR), conception rate (CR), pregnancy rate (PR), and culling. Herds ranged in size from 262 to 6,126 lactating and dry cows, with a mean of 1,654 [standard deviation (SD) 1,494] cows. Mean days to first insemination (DFS) was 71.2 d (SD 4.7 d), and IR for first insemination was 86.9%. Mean days between inseminations were 33.4 d (SD 3.1 d), and 15.4% of insemination intervals were greater than 48 d (range: 7.2 to 21.5%). First-service conception rate was 44.4% (SD 4.8%) across all herds and ranged from 37.5 to 51.8%. Mean PR was 32.0% (SD 3.9%) with a range of 26.5 to 39.4%. Lactation cull rate was 32.2% (SD 12.4%) with a range from 13.6 to 58.1%. Compared with mean data and SD for herds in the Raleigh Dairy Herd Improvement Association system, mean indices for these herds ranked them in the 99th percentile for IR (using heat detection rate as comparison), 99th percentile for PR, the bottom 18.6 percentile for DFS, and around the 50th percentile for CR. This suggests that excellent herd reproductive performance was associated with reproductive management that resulted in high insemination rates combined with average CR.
Key words: reproduction, management, dairy cow

INTRODUCTION

Reproductive performance has declined in dairy herds over the last 2 generations associated with changes in management practices, housing, and milk production (Lucy, 2001; Weigel, 2006). In part, performance has declined due to a reduction in reproductive biology of dairy cows, apparent as an increase in inseminations per pregnancy. Fertility has decreased coincident with increases in milk production, cows per worker, and time spent within confinement housing, along with a decrease in expression of estrus by the high-producing cow (Willard et al., 2003; Lopez et al., 2004a,b; Grimard et al., 2006). The effect has been to increase days open, from 110 d in 1965 to 150 d in 2005 (USDA AIPL summary data: http://aipl.arsusda.gov/reference/fertility/gentrd.htm; accessed May 2012). The minimum mean projected days open in the Raleigh Dairy Records Management System (**DRMS**) data was 156.8 d (SD 42.0 d, Table 1; Raleigh DRMS, 2012).

Following an insemination, pregnancy outcome is variable across farms by days postinsemination (Grimard et al., 2006). Given good insemination technique, 60% or more of ovulated ovum fertilize (Grimard et al., 2006). However, due to embryonic death, pregnancy outcome declines so that by 30 to 40 d postinsemination, only 30 to 50% of cows may be diagnosed as pregnant (Santos et al., 2004; Grimard et al., 2006). Reported conception rate (**CR**) at first insemination is 43.4% (SD 20.6%) in the Raleigh, North Carolina DHIA system (Table 1; Raleigh DRMS, 2012).

Detection of estrus (heat detection rate, **HDR**) is estimated at 43.4% (SD 16.8%) by Raleigh DRMS (2012; Table 1), indicating that less than half of the possible estrus events are observed. Many factors influence detection of estrus, including number of prior estruses and DIM, number of contemporary cows in estrus, duration of standing estrus, flooring surface, and management factors such as observation frequency and duration and use of secondary aids (Britt et al., 1986; Heersche and Nebel, 1994; Lopez et al., 2004a,b; Sveberg et al., 2011). In general, HDR is greater in the Jersey breed than in the Holstein breed (Norman et al., 2009). Because estrus detection controls insemination

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Table 1. Reproductive metrics (mean, SD in parentheses) for herds (all breeds) subscribing to Raleigh DRMS record system (Raleigh DRMS, 2012)

Item	All	South	East	Midwest	West
Herds, n	13,885	811	6,850	6,097	127
Cows per herd, n	158.4 (325)	296.4 (475.5)	124.4 (220.7)	167.9 (335.3)	656.7 (1,286.7)
Voluntary waiting period, d	58.4 (6.2)	57.2 (2.7)	59.1 (5.6)	57.9 (6.5)	54.0 (8.3)
Days to first insemination, d	95.2 (26.9)	102.4 (29.8)	92.7 (24.1)	97.2 (29.0)	91.8 (31.9)
Heat observed, current year, %	43.4 (16.8)	37.2 (18.9)	45.3 (15.7)	41.9 (17.4)	40.8 (19.6)
Conception rate for past 12 mo, %					
First service	43.4 (20.6)	48.2 (25.5)	43.1 (18.1)	43.4 (22.3)	35.7 (22.3)
Second service	42.3 (20.8)	42.5 (25.3)	43.0 (18.7)	41.6 (22.3)	34.7 (21.2)
Third+ service	40.5 (21.0)	38.1 (22.2)	42.0 (19.6)	39.3 (22.4)	32.7 (19.2)
Pregnancy rate, year average, %	15.9 (5.9)	13.3 (5.9)	16.6 (5.7)	15.3 (5.9)	12.3 (5.4)
Projected days open, d	156.8 (42.0)	171.9 (47.5)	149.2 (34.6)	162.8 (46.7)	157.2 (41.1)
Cows left herd, all lactations, %	37.1 (12.0)	37.2 (13.9)	36.8 (11.7)	37.5 (12.0)	33.7 (13.7)
Cows left herd, reproduction, %	6.6 (5.7)	6.6 (6.0)	6.7 (5.8)	6.5 (5.6)	4.2 (5.2)

rate or frequency (**IR**), it is a major control point of reproductive efficiency.

Conception rate ranges from 43.4 to 40.5% for first to third service (Table 1; Raleigh DRMS, 2012). Many factors influence CR in lactating dairy cows, including metabolic and infectious disease and environmental conditions (Coleman et al., 1985; Sheldon et al., 2006; Garnsworthy et al., 2008). Nonbiologic factors, such as thawing of semen straws and insemination technique, use of sprinklers in holding pens, and density of housing groups also influence CR and service rates (Schefers et al., 2010). Of particular concern is the association of higher milk production with lower CR, possibly due to lesser body condition (Lucy, 2001; Weigel, 2006). In general, the Jersey breed has greater CR than the Holstein breed in the United States (Norman et al., 2009).

Establishing pregnancy postcalving at early DIM is associated with high economic returns (Oltenacu et al., 1981). Inchaisri et al. (2011) observed that the optimum time to pregnancy was less than 10 wk for most dairy cows, and pregnancy after 6 wk reduced economic returns. In general, postpartum physiology delays how early postcalving insemination may recommence. Cows must resume ovulation and uterine involution must be complete, processes that usually take 30 to 50 d postcalving. The time at which a producer may begin insemination postcalving is referred to as the voluntary waiting period (**VWP**). Typically, producers have used a VWP of 40 to 60 d to begin insemination programs. Due to the shape of the lactation curve, extending the VWP may increase economic losses but, with increased milk production, some authors have observed longer VWP associated with increased CR (Tenhagen et al., 2004; Schefers et al., 2010). Therefore, producers must determine the trade-off between CR and VWP. Often VWP is not rigidly applied within a herd, as cows observed in estrus just before a reported VWP may be inseminated or cows perceived to have lower potential fertility may be delayed in first insemination past the VWP. Because of the fuzzy nature of VWP within dairy herds, some producers have used rules of proportion of first insemination of 5% (Schefers et al., 2010) or 10% (Miller et al., 2007) to define an observed VWP (**oVWP**) for a herd. One of the authors (JDF) has used the DIM by which 5% of first inseminations have occurred as an estimate of oVWP and found it to be a precise index by which to evaluate reproductive management. The oVWP is important because management should desire to have cows become pregnant rapidly after the oVWP (Ferguson and Galligan, 1993a,b).

Reproductive efficiency is an outcome of IR and CR within a herd, which can be combined in a variable termed pregnancy rate (**PR**; Ferguson and Galligan, 1993a,b). Pregnancy rate determines the proportion of nonpregnant cows that become pregnant every 21 d from the oVWP, and it is the main determinant of days open and economic returns associated with reproduction (Ferguson and Galligan, 1993a,b). Low HDR resulting in low IR combined with low CR dramatically lowers PR and reproductive efficiency. Higher milk production has been associated not only with lower CR but also with lesser and shorter expression of estrus and a decline in PR (Lopez et al., 2004a; Weigel, 2006). Mean PR for herds subscribing to Raleigh DRMS records was 15.9% (SD 5.9%; Table 1; Raleigh DRMS, 2012). Increasing PR reduces days open and increases revenue per cow (Heersche and Nebel, 1994; Meadows et al., 2005). Low PR reduces milk produced per day and calves born per year and reduces income associated with reproduction. The number of replacement animals raised within a herd may be limited when PR declines below 20%.

Intensity of insemination may be defined as the number of cows inseminated within a 21-d period divided by the number of cows available to inseminate.