EMBRYO SURVIVAL IN LACTATING DAIRY COWS

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Summary

Rates of embryo survival in lactating dairy cows were assessed in three separate studies. Based on pregnancy diagnoses 27 to 29 days after timed inseminations, survival to days 40 to 50 or day 57, depending on the study, varied from 9 to 88% in cows that were not cycling before insemination compared to 57 to 90% in cows that were cycling. Previously anestrous cows had lower rates of survival. In one study, supplementing cows with progesterone before insemination improved embryo survival.

(Key Words: Embryo Survival, Cows, First AI.)

Introduction

Reproductive failure of cows results in financial liabilities to dairy producers. These liabilities include greater breeding costs, greater involuntary culling rates, and increased maintenance costs. Embryo and fetal deaths following insemination are major components of these losses.

Previous research indicates that about 90% of the eggs are fertilized, and average calving rates are 55% following single inseminations. Based on those estimates, the rate of embryonic and fetal mortality is 38%. Of this total loss, 70 to 80% probably is sustained between days 8 and 16 after AI, 10% between days 16 and 42, and 5 to 8% between day 42 and term. In so-called "repeat breeders," fertilization and embryo losses are even greater.

Current studies of pregnancy losses in dairy cows located in Ireland, where cows produce about 50% as much milk as U.S. dairy cows, seem to substantiate the losses cited above. Based on one U.S. study of dairy cows annually producing in excess of 24,000 lb of milk, pregnancy losses are much greater. These losses likely are related to the greater milk-producing capacity of our cows. Of pregnancies diagnosed on day 28 after AI (using transrectal ultrasonography), survival rates of the pregnancies were 89.5% to day 42; 83.2% to day 56; 81.5% to day 70; and 79.8% to day 98.

The purpose of the current survey of three Kansas dairy farms was to estimate the amount of pregnancy loss that was occurring after first AI services.

Procedures

Three studies were conducted in which first postpartum inseminations were programmed with various ovulation synchronization protocols.

Study 1 consisted of cows inseminated after the Ovsynch protocol (injections of GnRH given 7 days before and 48 hr after $PGF_{2\alpha}$ with timed AI [TAI] 16 to 20 hr after the second GnRH injection) compared to cows inseminated after the Select Synch protocol (injection of GnRH 7 days before $PGF_{2\alpha}$ and inseminations performed after

[1]The authors are indebted to Duane Meier (Meier Dairy, Palmer, KS) and Steve Ohlde (Ohlde's Dairy, Linn, KS) for the use of their cattle in conducting these studies.

visually detected estrus). This study was conducted during the summer of 1998 on two dairy farms and during the summers of 1998 and 1999 on a third dairy farm. Pregnancy was diagnosed once between 27 to 29 days after AI (transrectal ultrasonography) and reconfirmed by palpation between 40 and 50 days.

Study 2 (winter and spring of 1997-1998) consisted of cows inseminated after the Ovsynch protocol compared to those inseminated after the same protocol but with a CIDR (controlled internal drug release: a progesterone-releasing device) inserted intravaginally at the time of the first GnRH injection and removed 7 days later when $PGF_{2\alpha}$ was administered (Ovsynch + CIDR). Inseminations were carried out 16 to 20 hr after the second GnRH injection. Pregnancy was diagnosed (transrectal ultrasound) on day 29 after TAI and again at day 57.

Study 3 (fall, winter, and spring of 1997-1999) consisted of cows inseminated after the Ovsynch protocol compared to: 1) those inseminated after the same protocol but with one injection of $PGF_{2\alpha}$ 12 days before the cows received the first GnRH injection of the Ovsynch protocol (PG + Ovsynch), and 2) those inseminated after having received two injections of $PGF_{2\alpha}$ 12 days apart and one GnRH injection 48 hr after the last of two $PGF_{2\alpha}$ injections (2×PG12). In all three protocols, cows were inseminated 16 to 20 hr after the second or only GnRH injection. Pregnancy was diagnosed once at 27 to 29 days after AI (transrectal ultrasound) and reconfirmed by palpation between 40 and 50 days.

Results and Discussion

Embryo survival for Study 1 is summarized in Table 1. Of cows diagnosed pregnant by ultrasound on days 27 to 29, fewer (P=0.07) embryos survived to days 40 to 50 (palpated pregnancy diagnosis) after the Ovsynch than Select Synch protocols. Cows identified to be not cycling before the onset of the breeding protocols had less (P<0.05) embryo survival than cycling cows. These results may indicate that noncycling cows in both treatments were induced successfully to ovulate and subsequently conceive, but had a decreased ability to maintain pregnancy beyond 27 to 29 days.

In Study 2, embryo survival was enhanced (P<0.05) greatly by treatment of cows with progesterone (Table 1) in conjunction with the Ovsynch protocol. In this study, embryo survival was not affected by previous cycling status.

Embryo survival in Study 3 is illustrated in Table 1. Rates of embryo survival tended (P=0.09) to be affected by an interaction of treatment and cycling status. Although cycling cows had numerically better embryo survival in all treatments, survival in the 2×PG12, noncycling cows apparently was reduced. These results indicate that the noncycling cows possibly benefitted from the first GnRH injection given 10 days before TAI in both groups treated with the Ovsynch protocol.

The average survival rates were 53% in cows not cycling before insemination and 77% for cows that were cycling. These are considerably less than those reported elsewhere (approximately 83%). It is alarming to see such losses occurring in Holstein cows after they have conceived. Causes for these losses are unknown but may include insufficient energy, too much crude protein (particularly rumen-degradable protein that elevates blood and milk urea nitrogen and ammonia), and(or) insufficient luteal function (reduced concentrations of progesterone in blood serum of cows). We plan to investigate further if insufficient progesterone is a primary cause for embryo losses in lactating dairy cows.

Table 1. Embryo Survival after d 27 to 29 of Pregnancy in Lactating Dairy Cows

Treatments	Cycling Status[1]		Probabilities		
	No	Yes	Treatment	Cycling	T×C
	% embryo survival[5] (no. of pregnancies diagnosed on days 27-29)				
Study 1[2]	20 (15)	63 (95)			
Ovsynch	9 (11)	57 (58)	0.07	0.03	0.44
Select Synch	50 (4)	73 (37)			
Study 2[3]	61 (49)	78 (37)			
Ovsynch	50 (16)	63 (16)	0.02	0.20	0.56
Ovsynch + CIDR	67 (33)	90 (21)			
Study 3[4]	67 (33)	73 (223)			
Ovsynch	88 (8)	70 (70)	0.11	0.47	0.09
PG + Ovsynch	69 (16)	76 (80)			
2×PG12	44 (9)	74 (73)			

[1]Cows with elevated concentrations of progesterone (>1 ng/ml) in blood serum samples collected before insemination were cycling and those with progesterone <1 ng/ml were anestrus.

[2]Ovsynch = injections of GnRH 7 days before and 48 hr after $PGF_{2\alpha}$. Inseminations were conducted 16 to 20 hr after the second GnRH injection. Select Synch = injection of GnRH 7 days before $PGF_{2\alpha}$ and cows inseminated after detected estrus.

[3]Ovsynch = as described above. Ovsynch + CIDR (Ovsynch + a progesterone-releasing device placed in the vagina for 7 days beginning at the first GnRH injection and removed when $PGF_{2\alpha}$ was injected. In both cases, one AI was administered at 16 to 20 hr after the second GnRH injection.

[4]Ovsynch = as described above. PG + Ovsynch = one injection of $PGF_{2\alpha}$ given 12 days before the Ovsynch protocol. 2×PG12 = injections of $PGF_{2\alpha}$ given 12 days apart and one injection of GnRH given 48 hr after the second $PGF_{2\alpha}$ injection. In all cases, one AI was administered at 16 to 20 hr after the second GnRH injection.

[5]Embryo survival after days 27 to 29 (via ultrasonography) until cows were palpated for pregnancy diagnosis between 40 and 50 days. Survival in Study 2 (Ovsynch vs Ovsynch + CIDR) represent those from day 29 to day 57 (via ultrasonography).