Effects of Twinning on Gestation Length, Retained Placenta, and Dystocia[1,2,3]

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ABSTRACT: Constraints to maximal productivity from twinning in beef cattle include increased incidence of dystocia and retained placenta, longer postpartum interval, and lower conception rate. Incidence and cause(s) of the shorter gestation length and of the increased retained placenta and dystocia associated with twinning were evaluated for 3,370 single and 1,014 twin births produced in a population of cattle selected for natural twin births. Gestation length was shorter for twin than for single pregnancies (275.6 vs 281.3 d, $P < .01$) and likely contributed to the higher incidence of retained placenta associated with twin births (27.9 vs 1.9%; $P < .01$). Incidence of retained placenta was also higher in the spring (March–April) than in the fall (August–September) calving season (18.3 vs 11.4%; $P < .01$). The higher incidence of dystocia with twins than with singles (46.9 vs 20.6%, $P < .01$) was primarily due to abnormal presentation (37.0 vs 4.5%, respectively) of one or both twin calves at parturition. First- (40.5%) and second- (22.7%) parity dams with a single birth had more ($P < .01$) dystocia than older dams (13.4%), whereas dystocia was not affected ($P > .10$) by parity with twin births. Because of the shorter gestation length and the increased incidence of retained placenta and(or) dystocia, achievement of increased productivity with twinning in cattle necessitates intensive management of twin-producing dams and their calves during the calving season. Management of the increased dystocia can be facilitated by preparturient diagnosis of twin pregnancies, enabling timely administration of obstetrical assistance to facilitate delivery of twin calves and to increase their neonatal survival.

Key Words: Twinning, Reproduction, Dystocia, Beef Cattle

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Introduction

Increasing the incidence of twin births in cattle is one method to increase productivity of beef cattle. Based on results from experimentation (twins produced by embryo transfer) and from production systems simulation, estimated increase in efficiency of producing beef through twinning was 24% when progeny were marketed at 400 d and labor and veterinary costs were assumed to be increased 40% per cow (Guerra-Martinez et. al., 1990). As proposed by Rutledge (1975) and later confirmed by the results of Echternkamp et al. (1990), Gregory et al. (1990a), and Van Vleck et al. (1991), an increase in twinning rate for cattle can be achieved through genetic selection when multiple observations of ovulation rate are the primary selection criterion for replacement heifers and sires (i.e., ovulation rate of daughters and female siblings). The frequency of natural twin births in the experimental cattle population at the Roman L. Hruska U.S. Meat Animal Research Center (MARC) now exceeds 35%. Implementation of a twinning technology presents a new paradigm in beef cattle management because twinning in cattle is reported to increase the incidence of dystocia and(or) retained placenta, to lower calf survival, to lengthen the postpartum interval, and to decrease conception (Turman et al., 1971; Bellows et al., 1974; Johansson et al., 1974; Cady and Van Vleck, 1978; Anderson et al., 1979, 1982; Gregory et al., 1990b). However, most of the preceding observations were obtained from cattle populations with a small number of twin births or from twinning induced by hormone therapy or embryo transfer. The objective of this study was to evaluate

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[3]Names are necessary to report factually on available data; however, the USDA neither guarantees nor warrants the standard of the product, and the use of the same by USDA implies no approval of the product to the exclusion of others that may also be suitable.

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the effects of twinning on gestation length, retained placenta, and dystocia in a population of cattle with a high incidence of natural twin births.

Materials and Methods

Reported data are a summary of results for a 7-yr period (i.e., 1988 through 1994) in a comprehensive study at MARC to evaluate the feasibility of increasing dizygotic twinning in cattle by genetic selection (Gregory et al., 1988, 1990a). Data for the 4,384 parturitions were from 1,697 dams ($\bar{x}$ = 2.6 parturitions/dam, range 1 to 7) and 236 sires ($\bar{x}$ = 26.8 parturitions/sire, range 1 to 203); number of sires of dams was 200 ($\bar{x}$ = 8.5 dams/sire, range 1 to 89). Management procedures, selection protocols, and historical data on herd formation and breed composition have been reported previously (Echternkamp et al., 1990; Gregory et al. 1990a,b, 1996). Approximately equal numbers of females were bred to calve in the spring and fall. The spring breeding season was from late May until early August and the fall breeding season was from late October until late December; breeding seasons were 70 or 60 d, respectively, in duration. Nulliparous heifers were bred to calve at 2.5 yr of age.

Beginning with spring breeding 1990, the uterus of all females was examined by ultrasonography between 40 and 70 d of gestation to determine number of fetuses. Ultrasound examinations were performed transrectally by scanning the dorsal surface of the uterine body and horns with a 3.5-MHz convex array rectal probe connected to a real-time ultrasound scanner (Aloka 500V, Corometrics Medical Systems, Wallingford, CT). Pregnancy was reconfirmed by rectal palpation at an average of 100 d of gestation. Maternal BW was recorded at an average of 70 d before the beginning of the calving season (i.e., prepartum BW).

Throughout the calving season, cows were monitored frequently (every hour for cows gestating twins) 24 h a day for signs of parturition. Obstetrical assistance was provided to cows gestating twins within .5 to 1 h after detection of approaching parturition, which was sooner than for cows gestating singles. Dystocia was evaluated subjectively using descriptive scores: 1 = no assistance, 2 = little assistance by hand, 3 = little assistance with a calf jack, 4 = slight assistance with calf jack, 5 = moderate assistance with calf jack, 6 = major assistance with calf jack, 7 = Caesarean birth, and 8 = abnormal fetal presentation. Calves receiving a score of 8 were given a second assistance score of 2 through 7 if traction was required. For twins, each calf was assigned a dystocia score(s). Dystocia was subsequently categorized as 0 (scores 1 and 2) or 100% (scores 3 to 8) and analyzed as three traits: 1) total incidence of dystocia, 2) incidence requiring only traction (scores 1 and 2 vs 3 to 7), and 3) incidence of abnormal fetal presentation (scores 1 and 2 vs score 8); percentage traction excluded abnormal presentations with a traction score. Failure to expel the fetal membranes within 72 h after parturition constituted a retained placenta.

Data were analyzed by least squares fixed-model procedures (Harvey, 1985) to evaluate the effect of twinning on gestation length, retained placenta, dystocia, and prepartum BW. The effects of type of birth (**TOB**) on dystocia were evaluated for total incidence of dystocia as well as for traction (scores 1 and 2 vs 3 to 7) and abnormal fetal presentations (scores 1 and 2 vs 8) separately. Because of the small number of triplet births, data for the 28 sets of triplets (.64% of all births) were excluded from the statistical analyses. Fixed effects in the model were TOB, age of dam, year of birth, season of birth (spring vs fall), sex of calf (single), sex of calf (twins), and all possible two-way interactions. Modification to the model included adding retained placenta as a fixed effect in the analysis of gestation length and dystocia as a fixed effect in the analysis of retained placenta and of prepartum BW. Sex of calf was deleted from the model for analysis of prepartum BW. Three-way interactions were assumed to be nonexistent. Nonsignificant (P > .10) two-way interactions were deleted from the final analyses except in the analysis of dystocia, for which an interaction significant for one dystocia trait was retained for all three traits. Because retained placentae were associated primarily with twin births, a subsequent analysis evaluated the effects of age of dam, year, season, dystocia, and gestation length on incidence of retained placenta in only dams of twins. Gestation length was classified as ≤ 264, 265 to 269, 270 to 274, 275 to 279, 280 to 284, 285 to 289, or ≥ 290 d.

Results and Discussion

Gestation Length

Distribution of gestation lengths for dams of singles and of twins is illustrated in Figure 1. Gestation length (Table 1) was 5.7 d shorter (P < .01) for twins than for singles; however, magnitude of the difference between twin and single pregnancies varied among years (TOB × year; P < .05). Similar differences in gestation length between twins and singles have been reported previously (Turman et al., 1971; Vincent and Mills, 1972; Bellows et al., 1974; Cady and Van Vleck, 1978; Anderson et al., 1979; Wheeler et al., 1982; Gregory et al., 1990b; Guerra-Martinez et al., 1990).

Other factors linked to gestation length were retained placenta, age of dam, and sex of calf. Gestation length was 5.1 d shorter in dams of singles with vs without a retained placenta and 2.2 d shorter in dams of twins with a retained placenta (TOB × retained placenta; P < .05). Similarly, gestation

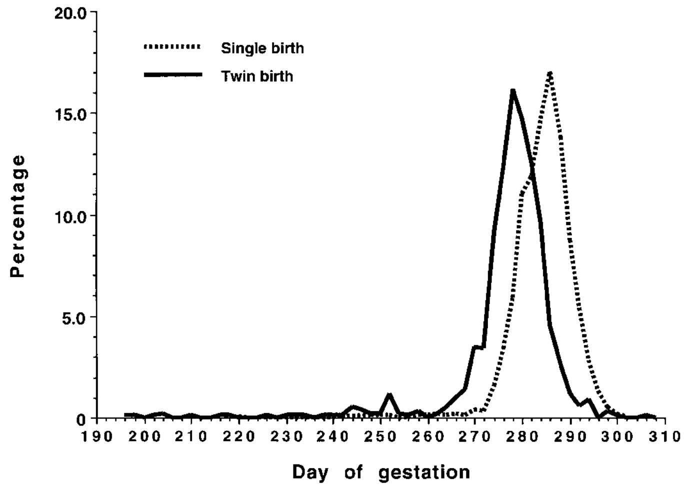

Figure 1. Distribution of gestation lengths for single and twin births.

length was approximately 2 d shorter (*P* < .01) for first-parity dams than for dams 3 yr of age and older. For single births, gestation length was approximately 1 d longer (*P* < .01) for male calves than for female calves, whereas sex of the twin pair had no effect (*P* > .10) on gestation length. The observed differences in gestation length between twin and single births and between single-born male and female calves likely contributed some of the reported differences in calf birth weight (Gregory et al., 1996). Regression analysis of birth weight on gestation length indicated that birth weight increased linearly at a rate of .45 kg/calf for each extra day of gestation length for twin calves vs .59 kg/d for singles.

Retained Placenta

The incidence of retained placenta (Table 2) was significantly higher in females delivering twin vs single calves (27.9 vs 1.9%; *P* < .01), as has been observed in previous studies (Pfau, 1948; Turman et al., 1971; Vincent and Mills, 1972; Bellows et al., 1974; Anderson et al., 1982; Wheeler et al., 1982; Gregory et al., 1990b; Guerra-Martinez et al., 1990). Because the majority (79.6%) of the retained placentae occurred with twin births, results from a separate analysis of factors affecting the incidence of retained placenta for dams of twins are reported in Table 3. The significant (*P* < .01) TOB × year interaction (Table 2) revealed significant variation in incidence of retained placenta among years for dams of twins, whereas the low incidence for dams of singles did not differ among years. However, the effect of year was not significant (*P* > .10) in the separate analysis for dams of twins (Table 3).

Premature induction of parturition with glucocorticoids and(or) prostaglandins increases the incidence of retained placenta (McDonald et al., 1954; Carroll, 1974; Chew et al., 1978; Wiltbank et al., 1984; Echternkamp et al., 1987). Thus, it is hypothesized that the higher incidence of retained placenta with twin births resulted from the shorter gestation length ($\bar{x}$ = 7.6 d; Table 1) for twin vs single births. Likewise, dams of singles with a retained placenta also had a significantly (*P* < .05) shorter gestation length (Table 1). However, a comparison of the incidence of retained placenta among gestation length classes for dams of twins (Table 3) indicated only a trend for reduced incidence with increasing gestation length. Variable relationships between gestation length and incidence of retained placenta were also observed in studies using corticoids and(or) prostaglandins to induce parturition, especially when gestation length was > 270 d (Carroll, 1974). Previous findings (Chew et al.,

Table 1. Comparison of length of gestation between dams of singles and twins

Variable	Value			
	df		F-value	
Analysis of variance				
Type of birth (TOB)	1		68.0**	
Retained placenta (RP)	1		29.6**	
Age of dam	4		6.2**	
Year (Y)	5		2.7*	
Season (S)	1		1.7	
Sex of single	1		13.3**	
Sex of twins	2		.8	
TOB × RP	1		4.4*	
TOB × Y	5		2.4*	
Residual mean square	2,810		56.5	
	n		Day	
Least squares means				
Age of dam				
2 yr	270		276.7	
3 yr	653		278.4	
4 yr	592		278.9	
5 yr	476		279.0	
≥ 6 yr	841		279.2	
Sex of singles				
Male	1,105		281.9	
Female	994		280.7	
Sex of twins				
Male:male	207		275.8	
Male:female	331		276.0	
Female:female	195		275.1	
	Single		Twin	
	n	Day	n	Day
TOB × RP				
Without	2,058	283.8	522	276.7
With	41	278.7	211	274.5
TOB × year				
1989	307	282.2	54	274.0
1990	387	280.3	96	274.7
1991	367	280.9	117	276.3
1992	381	281.8	152	275.6
1993	344	281.5	142	277.5
1994	313	280.7	172	275.7

*P < .05.
**P < .01.

1977) suggested that the retained placentae resulted from physiological immaturity of the placenta (i.e., decreased estradiol-17β and increased progesterone synthesis) at parturition, which presumably would be more prevalent in twin births with the shorter gestation length. Similarly, twin calves are smaller (Gregory et al., 1990b, 1996) and physiologically less mature at birth.

Incidence of retained placenta was about 40% lower in fall- vs spring-calving females, the seasonal difference being statistically significant only for twin births (TOB × season; $P < .01$; Table 2). The cause(s) of the lower incidence in the fall season is unknown, but it may have resulted from environmental and nutritional differences such as temperature and concentrate:forage ratio in the diet. Exposure of pregnant ewes to chronic heat stress reduced both placental and fetal development (Bell et al., 1989). In the present study, spring-calving females were subjected to heat stress in early to midgestation compared to late gestation for fall-calving females. Forage quality and proportion in the diet also fluctuated between the two calving seasons. Fall-calving females were fed a mixture of corn silage and haylage during the first trimester of pregnancy and high-quality, improved pasture during most of the last two trimesters, whereas spring-calving females received the opposite dietary regimen. Such seasonal differences in nutrition may have influenced placental development; ovine placental growth (i.e., mass and net cellular proliferation) is reported to be maximal in the first half of gestation (Ehrhardt and Ball, 1995), and maternal feed restriction from d 30 to 100 of gestation induces compensatory growth of the ovine placenta (Faichney and White, 1987). Gregory et al. (1996) reported that fall-born calves had heavier ($P < .01$) birth weights than spring-born calves in this population, and calf birth weight and placental weight have been reported to be correlated positively in cattle (Thatcher et al., 1980; Echternkamp, 1993). Thus, the heavier birth weights suggest that the placenta of fall-calving dams was larger and possibly more physiologically differentiated or mature, which would have reduced the incidence of retention. As in the spring, retained placenta in fall-calving dams was associated with a shorter gestation length (i.e., 9.2 d shorter than without a retained placenta; $P < .01$). However, gestation length did not differ ($P > .10$) between spring- and fall-calving dams (Table 1) and, thus, did not account for the lower incidence of retained placenta in the fall.

Dystocia, which increased with twins (Table 4), was associated with a 50% increase ($P < .01$) in

Table 2. Incidence of retained placenta for all births

Variable	Value	
Analysis of variance		
	df	F-value
Type of birth (TOB)	1	761.9**
Age of dam (A)	4	.9
Year (Y)	5	3.7**
Season (S)	1	57.9**
Dystocia (D)	1	27.0**
Sex of single	1	2.0
Sex of twins	2	.3
TOB × Y	5	3.3**
TOB × S	1	42.9**
TOB × D	1	19.6**
A × Y	20	1.8*
Y × S	5	2.5*
Residual mean square	4,336	596.8
Least squares means		
	n	%
Type of birth		
Single	3,370	1.9
Twin	1,014	27.9
TOB × S		
Single spring	1,734	2.4
Single fall	1,636	1.3
Twin spring	495	34.3
Twin fall	519	21.5
TOB × D		
Single without	2,630	1.7
Single with	740	2.5
Twin without	528	23.7
Twin with	486	32.7

*$P < .05$.
**$P < .01$.

Table 3. Incidence of retained placenta for twin births

Variable	Value	
Analysis of variance		
	df	F-value
Age of dam (A)	4	.9
Year (Y)	5	.3
Season (S)	1	22.4**
Dystocia (D)	1	9.9**
Gestation length	6	.3
Residual mean square	653	1,899.0
Least squares means		
	n	%
Season		
Spring	495	34.8
Fall	519	21.5
Dystocia		
Without	528	23.8
With	486	32.6
Gestation length, d		
≤ 264	40	52.5
265–269	23	43.5
270–274	97	26.8
275–279	247	26.7
280–284	196	24.5
285–289	51	37.3
≥ 290	18	38.8

*$P < .05$.
**$P < .01$.

incidence of retained placenta (Table 3). Again, because the majority of the retained placentae were associated with twin births, the effect of dystocia on retained placenta was statistically different ($P < .01$) only for twin births (TOB × dystocia; $P < .01$; Table 2). Presumably, the trauma of dystocia, especially malpresentations, alters the normal chain of hormonal events associated with parturition and the delivery of both the fetus(es) and placenta. Thus, the higher incidence of retained placenta with dystocia may result from asynchronous or inadequate release of hormones (e.g., PGE or $PGF_{2\alpha}$, oxytocin, relaxin, etc.) associated with maturation of the placentomes and induction of parturition, from physical trauma and altered blood flow to the tissue, or from a combination of these factors.

Sex of calf (calves) did not influence ($P > .10$) the occurrence of a retained placenta for either single or twin births. Variation in incidence among age groups across years resulted in a significant ($P < .05$) age of dam × year interaction; for example, the lower incidence in 1990 did not occur in 2- and 3-yr-old dams. The main effect for age of dam was not significant ($P > .10$).

Dystocia

Incidences of dystocia (Table 4) were approximately twofold greater ($P < .01$) and differed in physical nature for twin births compared to single births. Dystocia with twins resulted primarily (i.e., 78.9% of the dystocia) from abnormal presentation of head and(or) legs for one or both twin fetuses at parturition, whereas only 21.8% of the single births with dystocia required fetal repositioning. However, 59.3% of the fetal malpresentations with twin births required some traction in addition to fetal repositioning (Table 4). The TOB × year interaction ($P < .01$) for abnormal presentations reflected the higher frequencies and larger yearly variations in frequency for twin births than for single births.

The increased incidence of fetal malpresentation with twins may result from the higher circulating concentrations of progesterone and estradiol found in cows gestating multiple fetuses (Echternkamp, 1992). Several investigators have administered progesterone (McDonald et al., 1954; Jöchle et al., 1972) or estrogen (Garverick et al., 1972; LaVoie and Moody, 1973) in conjunction with corticoids and(or) prostaglandins to reduce the incidence of retained placenta associated with premature induction of parturition. Although the progesterone or estrogen treatments did not reduce the incidence of retained placenta, the treatments did increase dystocia, including abnormal fetal presentations. Also, the release of PGE and $PGF_{2\alpha}$ at parturition directly or indirectly enhances uterine contractions, cervical dilation, and fetal delivery. Thus, the premature birth of twins may elicit inadequate release of prostaglandins to facilitate fetal positioning. However, early induction of parturition (i.e., after 270 d of gestation) does not increase occurrence of malpresentations for single births (MacDiarmid, 1983).

The high incidence of abnormal fetal presentations observed in the present study was not reported for twin births created by hormone therapy or embryo transfer (Turman et al., 1971; Bellows et al., 1974; Anderson et al., 1982; Wheeler et al., 1982; Guerra-Martinez et al., 1990). Conversely, twinning reduced dystocia in first-parity heifers in those studies. The number of twin pregnancies evaluated in those studies was relatively small, so the incidences of dystocia or of abnormal presentation may have been low by chance or the dams were older in age. Alternatively, the embryo-transfer twins were created by the addition of an embryo to the uterine horn contralateral to the CL, or natural embryo, which resulted in only bilateral twin pregnancies. Location of the twin fetuses between the two uterine horns was not recorded in the present study. However, previous observations in the MARC population indicated that approximately 60% of the twin fetuses were located in the same uterine horn (Echternkamp et al., 1990), and orientation of the fetuses in utero may be disrupted when both are in one horn. Also, the MARC twin calves are of relatively large physical size/birth weight (Gregory et al., 1996), which may affect their ability to orient themselves within the uterus; the lower frequency of abnormal presentations for the smaller female twin pairs compared to male twin pairs (Table 4) concurs with such speculation.

Dystocia with single births in cattle is generally associated with larger physical size and(or) birth weight and(or) with small or young dams (Bellows et al., 1971; Gregory et al., 1990b, 1996). Similarly, 78.1% of the dystocia with single births in the present study required use of hand or mechanical traction to deliver the calf. As noted by the significant ($P < .01$) interaction (Table 4) for TOB × age of dam for traction alone and for traction and malpresentation combined (i.e., all dystocia), the number of single births requiring traction decreased ($P < .01$) as age of dam increased, whereas use of traction with twin births was unaffected by age of dam. A separate analysis of dystocia for single births (i.e., same fixed effects) indicated that larger single-born male calves required use of traction at twice the frequency ($P < .01$) of single-born female calves in all ages of dams, but the differential between sexes was greater in younger dams (age of dam × sex of calf; $P < .05$); for example, male calves had 20.3% more dystocia compared to female calves in 2-yr-old dams vs 6.5% more in 4-yr-old dams (unpublished data). Female twin pairs also required traction less frequently ($P < .05$) and had a lower incidence ($P < .05$) of abnormal presentation than male twin pairs (Table 4); the incidence of abnormal presentation with single births was unaffected (*P* > .10) by sex of the calf. In addition, prepartum maternal BW (Table 5) was greater (*P* < .01) for dams of singles with vs without dystocia, whereas prepartum BW did not differ (*P* > .10) between dams of twins with or without dystocia (TOB × dystocia; *P* < .05).

In addition to requiring extra obstetrical assistance, increased dystocia with twins decreases calf vigor and survival (Gregory et al., 1990b, 1996), emphasizing the importance of diagnosing twin pregnancies and of monitoring the dams at parturition. For twins, abnormal presentation of the fetus at delivery decreased perinatal calf survival from 88.2 to 80.6%, and a malpresentation requiring traction further reduced calf survival to 73.6% (Gregory et al., 1996), whereas normal presentation of a twin with traction had no effect on calf survival at birth (91.5%). Respective survival rates for twins at 72 h after birth were 1 to 2% lower than at birth. Contrary to expectation, prior diagnosis of twin pregnancies by ultrasonography did not increase calf survival in comparison to the three previous years without prior diagnosis (i.e., 1988 to

Table 4. Type and incidence of dystocia in dams producing single vs twin births

		Type of dystocia		
Variable		Total	Malpresentation	Traction
Analysis of variance	df	F-value	F-value	F-value
Type of birth (TOB)	1	261.5**	790.2**	21.1**
Age of dam (A)	4	19.8**	1.6	22.5**
Year (Y)	5	.1	2.1	2.7*
Season (S)	1	5.1*	1.4	2.9†
Sex of single	1	78.7**	1.7	92.9**
Sex of twins	2	7.7**	3.9*	3.0*
Interactions				
TOB × A	4	11.3**	1.7	13.4**
TOB × Y	5	2.9*	3.1**	1.4
TOB × S	1	1.5	.02	2.6†
Residual mean square	4,359	1,754.0	883.8	1,190.7
Least squares means	n	%	%	%
Type of birth				
Single	3,370	20.6	4.5	16.1
Twin	1,014	46.9	37.0	9.9
Season				
Spring	2,229	21.3	21.4	14.1
Fall	2,155	19.9	20.1	11.9
Sex of single				
Male	1,785	27.0	5.2	21.8
Female	1,585	14.1	3.8	10.3
Sex of twins				
Male	277	53.6	39.9	13.7
Female	274	39.6	33.1	6.5
Mixed	463	47.7	38.1	9.6
TOB × A				
Single				
2 yr	792	40.8	5.8	34.9
3 yr	669	22.6	4.3	18.3
4 yr	547	13.8	3.5	10.3
5 yr	477	11.9	4.1	7.8
≥ 6 yr	885	13.8	4.7	9.1
Twin				
2 yr	227	51.6	38.7	12.8
3 yr	231	41.6	33.7	8.0
4 yr	200	52.4	41.1	11.3
5 yr	135	46.2	36.4	9.9
≥ 6 yr	221	42.7	35.3	7.5

†*P* < .10.
**P* < .05.
***P* < .01.

1990). However, this experiment was initiated in 1981 and early experience with twins indicated the necessity for intensive management of the herd to maintain a higher level of calf survival, which would not occur in a traditional beef cattle management system. Also, husbandry practices cannot alleviate calf mortality associated with premature twin births; survival of twin calves at birth increases from 20% at < 265 d of gestation to 81% at 265 to 274 d and to 93% at ≥ 275 d (unpublished data).

Prepartum Body Weight

At an average of 70 d before calving, cows gestating twins were 23.9 kg heavier ($P < .01$) than cows gestating a single (Table 5). Based on previous measurements of fetal, placental, and fluid weights for single bovine fetuses (Ferrell et al., 1976), the 23.9 kg was sufficient for the 50% increase in total birth weight of twin calves (Gregory et al., 1996). However, the difference in BW between dams of twins and singles was greater in the spring than in the fall because dams of twins were heavier ($P < .05$) in the spring than in the fall (TOB × season; $P < .01$). Prepartum maternal BW (Table 5) was also significantly ($P < .01$) heavier for dams of singles with vs without dystocia, whereas prepartum BW did not differ ($P > .10$) between dams of twins with or without dystocia (TOB × dystocia; $P < .05$). This result is consistent with the reported increase in occurrence of dystocia in dams of singles with increasing maternal size and fetal size or birth weight (Bellows et al., 1971; Gregory et al., 1990b, 1996).

As expected, BW increased with age of dam and differed ($P < .01$) among the four age groups except in

Table 5. Effect of type of birth on prepartum body weight[a]

Variable	Value			
Analysis of variance				
	df		F-value	
Type of birth (TOB)[b]	1		25.8**	
Dystocia (D)	1		8.0**	
Retained placenta	1		.1	
Age of dam (A)	3		886.9**	
Season (S)	1		1.9	
Year (Y)	6		8.5*	
TOB-N × D	1		5.3*	
TOB-N × S	1		6.9**	
A × Y	18		9.6**	
S × A	3		5.9**	
S × Y	6		33.3**	
Residual mean square	4,204		3,615.4	
Least squares means				
	n	kg	n	kg
TOB × D	Single		Twin	
Without	2,542	652.7	506	682.6
With	753	669.1	445	687.1
TOB × S				
Spring	1,684	659.5	437	689.5
Fall	1,612	662.3	514	680.1
S × A	Spring		Fall	
2 yr	581	598.1	537	583.5
3 yr	505	659.7	477	662.5
4 yr	396	700.8	350	707.3
≥ 5 yr	639	739.5	762	731.4
S × Y				
1988	166	637.1	219	678.3
1989	254	704.8	334	670.5
1990	317	713.0	321	683.0
1991	355	680.5	537	650.5
1992	381	655.0	293	684.8
1993	335	664.9	323	648.7

[a]The BW was measured at an average of 70 d before the beginning of the calving season.
[b]Single vs twin births.
*$P < .05$.
**$P < .01$.

1991, when 4- and ≥ 5-yr-old dams did not differ ($P > .10$) in prepartum BW (age of dam × year; $P < .05$). Also, 2- and ≥ 5-yr-old dams were heavier in the spring than in the fall, whereas 3- and 4-yr-old dams did not differ in BW between seasons (age of dam × season; $P < .01$).

In summary, the shorter gestation length and increased incidence of dystocia and(or) retained placenta, and their associated effects on calf survival, rebreeding performance, labor input, and herd health, with twin births impose constraints to maximizing economic returns from twinning in beef cattle. Such constraints are contrasted with a 65.2% increase in number of calves weaned from cows birthing twins (Gregory et al., 1996).

Implications

Twinning in cattle shortens the length of gestation and increases the incidence of retained placenta and of dystocia. In contrast to single births, the majority of the dystocia with twins results from abnormal presentation of one or both fetuses at delivery rather than from large birth weight or physical size. Management of the dystocia is aided by preparturient diagnosis of the twin pregnancy and timely administration of obstetrical assistance to facilitate delivery of twin calves and to increase their neonatal survival. Thus, a high level of intensive management is required for twin-producing dams and their calves during the calving season to achieve the increased productivity possible with a twinning technology in cattle.

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