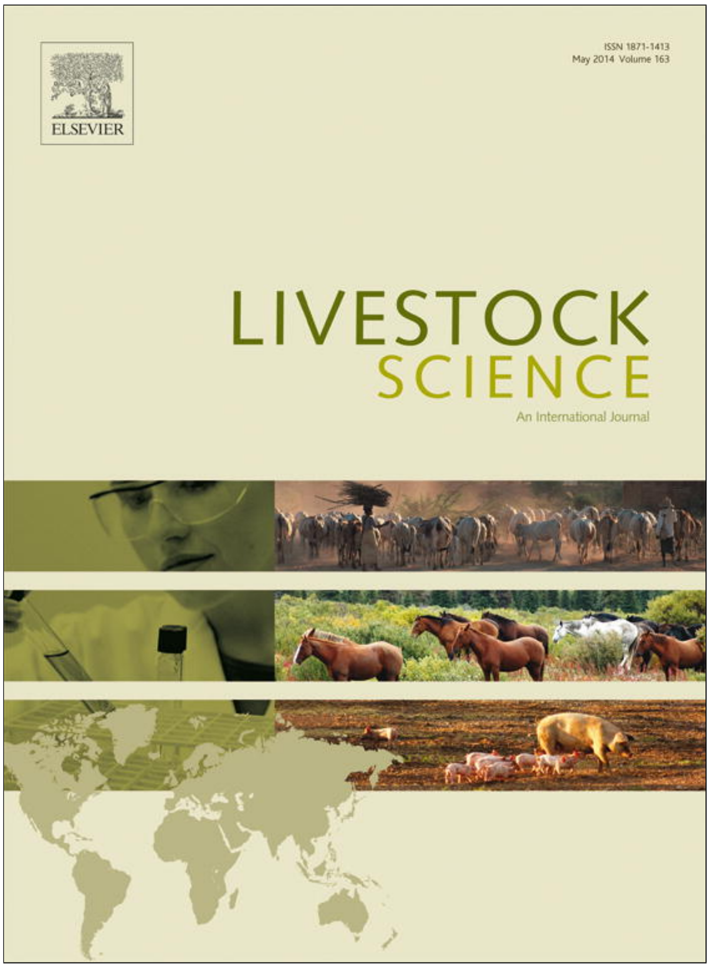
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Incorporation of sexed semen into reproductive management of cow–calf operations ☆

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ABSTRACT

The objective of this experiment was to compare reproductive performance and weaning outcomes of beef cows inseminated with sexed or conventional semen. Over 2 consecutive years, lactating Angus × Hereford cows were assigned to an estrus synchronization + artificial insemination (**AI**) protocol. At the time of AI, cows were ranked by parity and assigned to be inseminated with conventional non-sorted semen (**CONV**; $n=454$) or with semen sorted for male sperm (**SEXED**; $n=439$). Beginning 18 days after AI, cows from both treatments were grouped and exposed to mature bulls for 50 days (1:25 bull to cow ratio). Cow pregnancy status to AI was verified by detecting a fetus via transrectal ultrasonography 40 days after AI. Calf birth date, sex, and birth BW were recorded during the subsequent calving season. Cows that were diagnosed as pregnant during the transrectal ultrasonography exam and gave birth during the initial 2 weeks of the calving season were considered pregnant to AI. Pregnancy rates to AI and final pregnancy rates (AI+bull breeding) were reduced ($P \leq 0.05$) in SEXED compared with CONV cows. The proportion of male calves born to AI or AI+bull breeding was greater ($P < 0.01$) in SEXED compared with CONV cows. No treatment effect was detected ($P=0.34$) for weaning rate, whereas SEXED cows had a greater ($P < 0.01$) proportion of steers in the weaned calf crop compared with CONV cows. Steers and heifers from SEXED cows were younger ($P < 0.01$), whereas only SEXED heifers were lighter ($P=0.05$) at weaning compared with cohorts from CONV cows. Across genders, calves from SEXED cows had reduced ($P \leq 0.01$) weaning age and BW compared with calves from CONV cows. Cows assigned to SEXED had greater ($P=0.05$) kg of steer weaned/cow exposed to breeding, but reduced kg of heifer weaned/cow exposed to breeding ($P < 0.01$) compared with CONV cows. Across genders, SEXED cows tended ($P=0.09$) to have reduced kg of calf weaned/cow exposed to breeding compared with CONV cows. In summary, inseminating beef cows with sexed semen reduced pregnancy rates, but increased the proportion of steers weaned and kg of steers weaned/cow exposed to breeding. However, overall kg of calf weaned/cow exposed to breeding was not improved by the use of sexed semen, particularly because of its negative impacts on weaning age and BW of the heifer progeny.

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1. Introduction

The major objective of cow–calf systems is to produce 1 calf per cow annually. Therefore, profitability of cow–calf operations is primarily determined by reproductive performance of the cowherd, which defines the number of calves born and weaned annually (Wiltbank et al., 1961). Economic returns in cow–calf systems can also be increased by adding quality and value to the weaned calf crop, which can be accomplished via breeding strategies such as inseminating the cowherd with sexed semen. More specifically, steers have greater weaning and yearling BW compared with contemporary heifers (Koch and Clark, 1955; Koger and Knox, 1945). In addition, average value/kg of live BW was 10% greater for feeder steers compared with feeder heifers during the last 5 years in the U.S. (USDA-Agricultural Marketing Service, 2013). Therefore, we hypothesized that inseminating beef cows with semen sorted for male sperm benefits economic returns in cow–calf operations by increasing the proportion of steers available for marketing after weaning.

Nevertheless, early research demonstrated that sexed semen yield reduced pregnancy rates when compared to conventional semen (Seidel, 2007), which may prevent optimal reproductive performance of the cowherd and annul the potential benefits on calf crop value. However, with recent advances in semen sorting and freezing, some research has suggested that pregnancy rates to sexed semen are improving and reaching comparable results to conventional semen (Hall et al., 2010), although additional studies with larger groups of beef cattle are warranted to validate this outcome. Further, no research has assessed the impacts of inseminating beef cows with sexed semen on calf crop performance and overall weaning returns in cow–calf systems. Therefore, the objective of this experiment was to compare reproductive performance and weaning outcomes of lactating beef cows inseminated with sexed or conventional semen.

2. Materials and methods

This experiment was conducted over 2 consecutive years (2011 and 2012) at the Oregon State University (OSU) – Eastern Oregon Agricultural Research Center (EOARC; Burns station and Union station). In 2011, a total of 441 lactating Angus × Hereford cows were enrolled in the experiment (Burns station, $n=209$ multiparous and 34 primiparous; Union station, $n=149$ multiparous and 49 primiparous). In 2012, a total of 452 lactating Angus × Hereford cows were enrolled (Burns station, $n=196$ multiparous and 49 primiparous; Union station, $n=160$ multiparous and 47 primiparous). All cows and calves utilized herein were managed as described by Cooke et al. (2012), and cared for in accordance with acceptable practices and experimental protocols reviewed and approved by the Oregon State University, Institutional Animal Care and Use Committee.

2.1. Animals and treatments

All cows were assigned to an estrus synchronization + artificial insemination (**AI**) protocol (Larson et al., 2006). More specifically, cows received 100 μg of GnRH (Factrel; Zoetis, Florham Park, NJ, USA) plus a controlled internal device release (**CIDR**) containing 1.38 g of progesterone (Zoetis), followed in 7 days with 25 mg of prostaglandin $F_{2\alpha}$ (Lutalyse; Zoetis) and CIDR removal, followed in 60 h by a second 100 μg injection of GnRH and AI. At the time of AI, cows were ranked by parity and assigned to be inseminated with conventional non-sorted semen (**CONV**; $n=360$ multiparous and 94 primiparous; Genex Cooperative, Inc., Shawano, WI, USA) or with semen sorted for male sperm (**SEXED**; $n=354$ multiparous and 85 primiparous; GenChoice 90™, Genex Cooperative, Inc.). At the Union station, cows that displayed estrus beginning after the prostaglandin $F_{2\alpha}$ injection and until 24 h before the second GnRH injection were inseminated 12 h after estrus detection ($n=56$ for CONV and 51 for SEXED), whereas all other cows were timed-AI at the time of the second GnRH injection ($n=151$ for CONV and 147 for SEXED). The CONV semen contained approximately 20 million non-sorted sperm cells per straw, whereas SEXED contained approximately 2.1 million sperm cells per straw with 90% of these sperm cells expected to be male sperm (Rath and Johnson, 2008). Within each year and location, cows were inseminated by the same technician with CONV or SEXED originated from the same bull. The Burns station cowherd was inseminated with semen from Club King (1SM00115, Genex Cooperative, Inc.) in 2011 and Upgrade (1SM00121; Genex Cooperative, Inc.) in 2012, whereas the Union station cowherd was inseminated with semen from Chisum (1AN01170; Genex Cooperative, Inc.) during both years. Beginning 18 days after AI, all cows from both treatments were grouped and exposed to mature Angus and Hereford bulls (age $=5.6 \pm 0.4$ years) for 50 days (1:25 bull to cow ratio). All bulls utilized in this experiment were submitted to and approved by a breeding soundness evaluation (Chenoweth and Ball, 1980) before the breeding season.

2.2. Sampling

Cows were evaluated for BCS at the time of AI (Wagner et al., 1988). Blood samples were collected concurrently with AI and 7 days later for determination of plasma progesterone concentration to assess estrus synchronization rate. Blood samples were collected via jugular venipuncture into commercial blood collection tubes (Vacutainer, 10 mL; Becton Dickinson, Franklin Lakes, NJ, USA) containing sodium heparin (158 USP units), placed on ice immediately, and centrifuged at 2400g for 30 min at room temperature for plasma collection. Plasma was stored at −80 °C on the same day of collection. Plasma progesterone concentration was determined as described by Munro and Stabenfeldt (1984) with modifications described by Galvão et al. (2004). The intra- and inter-assay CV were 7.8% and 6.0%, respectively, whereas assay sensitivity was 0.05 ng/mL. Cows with plasma progesterone concentration <1.0 ng/mL at AI, but ≥ 1.0 ng/mL 7 days later were classified as responsive to the estrus synchronization protocol.

Cow pregnancy status to AI was verified by detecting a fetus via transrectal ultrasonography (5.0-MHz transducer;

500 V, Aloka) 40 days after AI. During the subsequent calving season, calf birth date, sex, and birth BW were recorded. Pregnancy loss during gestation was not accounted for in the present experiment because cow pregnancy status was not evaluated after the end of bull breeding. Hence, all cows that gave birth during the calving season were classified as becoming pregnant during the experiment. Calf paternity (AI or bull breeding) was determined according to transrectal ultrasonography and birth date. Only cows that were diagnosed as pregnant during the transrectal ultrasonography exam and gave birth during the initial 2 weeks of the calving season were considered pregnant to AI. Calves that died at birth or up to weaning were accounted for as calf loss from birth to weaning. No incidences of dystocia were observed in the present experiment. Calf BW was determined again at weaning, whereas 205-day adjusted weaning BW was calculated according to BIF (Beef Improvement Federation) (2010). Calf weaning value was estimated based on US$/kg of BW within 45.5 kg increments for feeder steers and heifers (from 114 to 386 kg of BW), according to the latest 5-year U.S. average (2008–2012; USDA-Agricultural Marketing Service, 2013).

2.3. Statistical analysis

All data were analyzed with cow as the experimental unit and Satterthwaite approximation to determine the denominator degrees of freedom for the tests of fixed effects. All quantitative data were analyzed using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC), whereas binary data were analyzed using the GLIMMIX procedure of SAS (SAS Inst. Inc.). Model statements contained the effects of treatment, parity, year, location, calf gender (for analyses containing calf parameters), and all resultant interactions. The random statements contained the effect of cow(treatment × location × year × parity), or cow(treatment × location × year × parity × calf gender) for analyses containing calf parameters. However, analyses of cow age at AI, as well as quantitative and binary data containing 205-day weaning BW, did not contain the effects of parity in the model and random statements. Pregnancy rates to AI at the Union station were also analyzed using a model statement containing the effects of treatment, parity, year, AI method (after estrus detection or fixed-time AI), all resultant interactions, and with a random statement containing the effect of cow(treatment × year × parity × AI method). Results are reported as least square means and separated using LSD. Significance was set at $P \leq 0.05$, and tendencies were determined if $P > 0.05$ and ≤ 0.10. Results are reported according to treatment effects if no interactions were significant, or according to the highest-order interaction detected.

3. Results

3.1. Overall reproductive results

No treatment effects were detected ($P \geq 0.51$) for cow BCS and age at AI, as well as estrus synchronization rate (Table 1).

Pregnancy rates to AI were reduced in SEXED compared with CONV cows (Table 2), independently if analysis contained all cows exposed to AI ($P < 0.01$) or only cows that were effectively synchronized to the estrus synchronization protocol ($P < 0.01$). Within the Union station, SEXED cows had reduced ($P \leq 0.05$) pregnancy rates to AI compared with CONV cows independently if cows were inseminated 12 h after estrus detection (53.6 vs. 74.5% for all cows, SEM=6.7%; 57.4 vs. 76.0% for synchronized cows, SEM=6.7%; for SEXED and CONV, respectively) or without estrus detection at fixed-time AI (42.6 vs. 56.3% for all cows, SEM=4.0%; 48.9 vs. 68.5% for synchronized cows, SEM=4.2%; for SEXED and CONV, respectively).

Within cows that did not become pregnant to AI, pregnancy rates to bull breeding were similar ($P=0.51$) between CONV and SEXED cows (Table 2). Final pregnancy rates (AI+bull breeding) were also reduced ($P=0.05$) for SEXED compared with CONV cows (Table 2). Within pregnant cows only, SEXED cows had a reduced ($P < 0.01$) proportion of pregnancies to AI and hence greater ($P < 0.01$) proportion of pregnancies to bull breeding compared with CONV cows (Table 2).

3.2. Calving results

Within pregnant cows to AI, the proportion of male calves born was greater ($P < 0.01$) in SEXED compared with CONV cows (Table 2). No differences were detected ($P=0.38$) in the proportion of male calves from cows pregnant to bull breeding (Table 2). Accordingly, pregnant SEXED cows also had a greater ($P < 0.01$) proportion of male calves at the end of the calving season (AI+bull breeding) compared with pregnant CONV cows (Table 2). Calves from SEXED cows had greater ($P=0.05$) birth BW compared with calves from CONV cows (Table 3). However, SEXED and CONV cows had similar ($P=0.19$) kg of calf born/cow exposed to breeding (Table 3).

Table 1
Age, BCS, synchronization rate, and pregnancy rates to AI in cows inseminated with sexed ($n=439$) or conventional (CONV; $n=454$) semen.[a]

Item	SEXED	CONV	SEM	*P*-value
Age, years	5.43	5.47	0.13	0.83
BCS at AI, 1 to 9 scale[b]	4.75	4.73	0.03	0.45
Synchronization rate[c] (%)	84.6 (370/439)	84.5 (383/454)	1.7	0.96

[a] Within parenthesis, number of cows divided by total cows.
[b] According to Wagner et al. (1988).
[c] Evaluated based on plasma progesterone concentration obtained at AI and 7 days later. Cows with plasma progesterone concentrations < 1.0 ng/mL at AI, but ≥ 1.0 ng/mL on 7 days later were classified as responsive to the estrus synchronization protocol.

Table 2
Pregnancy rates to AI, bull breeding, final pregnancy rates (AI+bull breeding), and proportion of male calves born from cows inseminated with sexed (n=439) or conventional (CONV; n=454) semen[a].

Item	SEXED	CONV	SEM	*P*-value
Pregnancy rates to AI (%)				
All cows	34.9 (149/439)	56.0 (252/454)	2.2	< 0.01
Synchronized cows	40.6 (149/370)	66.1 (252/383)	2.4	< 0.01
Pregnancy rates to bull breeding (%)	74.6 (218/290)	72.0 (148/202)	2.8	0.51
Final pregnancy rates[b] (%)	83.5 (367/439)	87.9 (400/454)	1.6	0.05
Pregnancies to AI (%)	41.6 (149/367)	63.8 (252/400)	2.4	< 0.01
Pregnancies to bull (%)	58.4 (218/367)	36.2 (148/400)	2.4	< 0.01
Proportion of male calves[c] (%)				
Pregnancies to AI	91.2 (136/149)	57.3 (144/252)	3.0	< 0.01
Pregnancies to bull breeding	48.2 (105/218)	52.9 (78/148)	3.8	0.38
All pregnancies	65.5 (241/367)	55.3 (222/400)	2.5	< 0.01

[a] Within parenthesis, number of cows divided by total cows. Beginning 18 days after AI, cows were exposed to mature Angus and Hereford bulls for 50 days.
[b] Within cows classified as pregnant, the proportion of cows pregnant to AI or bull breeding.
[c] Proportion of males calves in the calf crop sired by AI (pregnancies to AI), bull breeding (pregnancies to bull breeding), or AI+bull breeding (all pregnancies).

Table 3
Calf and cow–calf performance parameters from cows inseminated with sexed (n=439) or conventional (CONV; n=454) semen.[a]

Item	SEXED	CONV	SEM	*P*-value
Calf parameters				
Birth BW (kg)	40.4	39.6	0.3	0.05
Weaning age (kg)	206.4	212.6	0.9	< 0.01
Weaning BW (kg)	239.3	245.6	1.8	0.01
205-day adjusted weaning BW[b] (kg)	246.4	247.5	1.3	0.56
Cow–calf production parameters [c]				
Kg of calf born per cow exposed to breeding (kg)	33.8	35.1	0.7	0.19
Calf loss from birth to weaning (%)	4.8 (17/367)	6.5 (27/400)	1.2	0.31
Weaning rate (%)	79.5 (350/439)	82.0 (373/454)	1.8	0.34
Proportion of steers weaned (%)	66.1 (232/350)	56.2 (210/373)	2.5	< 0.01
Kg of calf weaned/cow exposed to breeding (kg)				
Steers (kg)	130.4	115.2	6.0	0.05
Heifers (kg)	59.5	85.8	5.1	< 0.01
Overall	189.9	201.0	4.7	0.09
205-day adjusted kg of calf weaned/cow exposed to breeding[b] (kg)				
Steers (kg)	133.1	116.7	6.1	0.05
Heifers (kg)	62.4	86.4	5.2	< 0.01
Overall	195.5	203.2	6.7	0.25

[a] Within parenthesis, number of cows divided by total cows.
[b] Calculated according to BIF (2010).
[c] Kilograms of calf born and calf weaned per cow exposed to breeding were calculated based on calving rate, weaning rate, and calf BW at birth and weaning.

3.3. *Weaning results – calf parameters*

No treatment effects were detected ($P \geq 0.31$) for calf loss from birth to weaning and weaning rate (Table 3). The proportion of steers weaned was greater ($P < 0.01$) in SEXED compared with CONV cows (Table 3).

A treatment × calf gender interaction was detected ($P < 0.01$) for calf age, BW, and estimated value at weaning. Steers from SEXED cows were younger ($P < 0.01$) compared with steers from CONV cows (Table 4), whereas no treatment effects were detected for steer BW and estimated value at weaning ($P \geq 0.75$). Heifers from SEXED cows were lighter ($P = 0.05$), younger ($P < 0.01$), and had reduced ($P < 0.01$) estimated value at weaning compared with heifers from CONV cows (Table 4). Across genders, calves from SEXED cows had reduced ($P \leq 0.01$) weaning age and BW compared with calves from CONV cows (Table 3), while estimated calf value at weaning did not differ ($P = 0.24$) between treatments (Table 4).

A treatment × calf gender interaction was also detected ($P < 0.01$) for 205-day adjusted BW and subsequent estimated weaning value. Heifers from SEXED cows also had reduced 205-day adjusted weaning BW ($P < 0.01$) and estimated weaning value ($P = 0.01$) compared with heifers from CONV cows, whereas these parameters were similar ($P \geq 0.78$) among steers from CONV and SEXED cows (Table 4). Across genders, calves from SEXED cows had similar 205-day adjusted BW ($P = 0.25$; Table 3) and estimated weaning value compared with calves from CON cows ($P = 0.27$; Table 4).

Table 4
Estimated weaning economical returns, based on original or 205-day adjusted calf weaning BW, from cows inseminated with sexed ($n=439$) or conventional (CONV; $n=454$) semen[a].

Item	SEXED	CONV	SEM	*P*-value
Original calf weaning BW				
Weaned steers				
Age at weaning (days)	210.6	213.0	0.5	< 0.01
Weaning BW (kg)	250.3	250.9	2.1	0.84
Calf value (US$)	641.6	643.3	3.8	0.75
Weaned heifers				
Age at weaning (days)	197.7	212.3	1.4	< 0.01
Weaning BW (kg)	218.3	238.4	2.5	< 0.01
Calf value (US$)	529.1	565.3	4.6	< 0.01
Overall				
Value per calf (US$)	603.2	609.5	3.8	0.24
Calf value/cow exposed to breeding (US$)	479.0	499.3	11.7	0.22
205-day adjusted calf weaning BW[b]				
Weaned steers				
Weaning BW (kg)	253.7	253.5	1.7	0.95
Calf value (US$)	646.3	645.2	2.8	0.78
Weaned heifers				
Weaning BW (kg)	232.4	239.7	1.8	< 0.01
Calf value (US$)	553.6	564.7	3.1	0.01
Overall				
Calf value (US$)	614.7	610.0	3.1	0.27
Calf value/cow exposed to breeding (US$)	488.3	500.7	11.6	0.45

[a] Within parenthesis, number of cows divided by total cows.
[b] Calculated according to BIF (2010).

3.4. *Cow–calf production parameters*

A treatment × calf gender interaction was detected ($P<0.01$) for kg of calf weaned/cow exposed to breeding. Cows assigned to SEXED had greater ($P=0.05$) kg of steer weaned/cow exposed to breeding, but reduced kg of heifer weaned/cow exposed to breeding ($P<0.01$) compared with CONV cows (Table 3). Across genders, SEXED cows tended ($P=0.09$) to have reduced kg of calf weaned/cow exposed to breeding compared with CONV cows (Table 3), whereas estimated calf value/cow exposed to breeding did not differ between treatments ($P=0.22$; Table 4).

A treatment × calf gender interaction was also detected ($P<0.01$) for 205-day adjusted kg of calf weaned/cow exposed to breeding. Cows assigned to SEXED had greater ($P=0.05$) 205-day adjusted kg of steer weaned/cow exposed to breeding, but reduced 205-day adjusted kg of heifer weaned/cow exposed to breeding ($P<0.01$) compared with CONV cows (Table 3). Across genders, no treatment effects were detected ($P\geq0.25$) for 205-day adjusted kg of calf weaned/cow exposed to breeding (Table 3) or estimated calf value/cow exposed to breeding (Table 4).

4. Discussion

4.1. *Overall reproductive results*

The lack of treatment effects on cow BCS at the time of AI and estrus synchronization rate indicate that all treatment effects reported herein were independent of cow nutritional status and response to the estrus synchronization protocol (Table 1). As expected by the experimental design, cow age at AI was also similar among treatments given that treatment groups were balanced for cow parity (Table 1).

Pregnancy rates to AI were reduced by 37% in SEXED cows compared with CONV cows (34.9% divided by 56.0%, respectively; Table 2), corroborating with previous research reporting substantial decreases in pregnancy rates to AI when beef or dairy females are inseminated with sex-sorted semen (Sá Filho et al., 2012; Seidel et al., 1999). These outcomes are mostly attributed to sperm damage associated with the sorting and cryopreservation processes, which reduces the viability and quality of the sexed-sorted sperm (Seidel, 2007). Nevertheless, the AI method (fixed-time or upon estrus detection) and sire utilized may influence pregnancy rates to AI with sexed semen. More specifically, sperm fertility and tolerance to the physical insults associated with the sorting process vary among bulls (Frijters et al., 2009). In addition, inseminating cows upon estrus detection has been recommended to optimize pregnancy rates to AI when sexed-semen is used (Schenk et al., 2009; Seidel, 2007). In the present experiment, treatment effects on pregnancy rates to AI were independent of location and year, suggesting that the sex-sorted semen from all 3 sires utilized herein were less fertile compared with their conventional semen. It is important to note, however, that the current experimental design did not allow proper sire comparison, given that the sire effect is confounded with location and year. Pregnancy rates to AI were decreased in SEXED cows compared with CONV cows at the Union station, independently if cows were inseminated after estrus detection or at fixed-time AI. Likewise, Sá Filho et al. (2012) also reported that *Bos indicus* cows that displayed estrus had reduced pregnancy rates to AI if inseminated with sexed-semen compared with conventional semen.

When exposed to bulls, SEXED and CONV cows were managed in a single group and exposed to the same bull battery within each year and location. Although a greater proportion of SEXED cows were non-pregnant when exposed to bulls compared with CONV cows, pregnancy rates to bull breeding were similar between treatments (Table 2). Given that the bull to cow ratio was approximately 1:25 (36 bulls and 893 cows exposed in the experiment), and a total of 492 cows did not become pregnant to AI (Table 2), the actual bull to non-pregnant cow ratio was 1:14. Hence the number of bulls available to service non-pregnant cows was above the recommended ratio for a 50-day breeding season (Healy et al., 1993; Pexton et al., 1990), which likely contributed to the similar pregnancy rates to bull breeding between CONV and SEXED cows. However, final pregnancy rates (AI+bull breeding) were still reduced by 5% in SEXED cows compared with CONV cows (83.5% divided by 87.9%, respectively; Table 2). Therefore, differences in pregnancy rates to AI between SEXED and CONV cows were not completely offset by the 50-day bull breeding despite the elevated bull to cow ratio.

4.2. Calving results

The proportion of male calves born to AI in SEXED cows was in accordance with the expected male to female ratio yielded by the semen sorting process (Rath and Johnson, 2008), which increased the final proportion of male calves born to SEXED compared with CONV cows during the calving season (Table 2). Given that male calves are generally heavier at birth compared with female calves (Bellows et al., 1971), calves from SEXED cows had greater birth BW compared with calves from CONV cows (Table 3). However, kg of calf born/cow exposed to breeding was similar between treatments, which can be attributed to the reduced final pregnancy rates of SEXED cows compared with CONV cows (Table 2).

4.3. Weaning results

Weaning rate was similar between SEXED and CONV cows (Table 3), despite differences in final pregnancy rates (Table 2) and similar calf loss from birth to weaning (Table 3) between treatments. Hence, inseminating lactating beef cows with sexed semen impaired their reproductive performance, but this outcome was not sufficient to impact the annual calf weaning rate. However, calves from SEXED cows were younger and hence lighter (Lesmeister et al., 1973) at weaning compared with calves from CONV cows, which is supported by the greater proportion of CONV calves being conceived at AI (Table 2). In addition, this outcome was primarily detected in the female offspring, given that the majority of heifers from SEXED cows were conceived during bull breeding, hence later during the breeding season and sired by bulls with less genetic potential compared to AI sires. Supporting this later rationale, when heifer weaning age across treatments was accounted for using 205-day adjusted weaning BW, heifers from CONV cows were still heavier compared with heifers from SEXED cows, which suggests different genetic potential between heifers from CONV and SEXED cows because all cow–calf pairs were managed similarly (Cooke et al., 2012). Accordingly, estimated weaning value based on original and 205-day adjusted weaning weight were greater in heifers from CONV cows compared to heifers from SEXED cows, although this difference was not sufficient to impact estimated overall calf value at weaning (Table 4).

4.4. Cow–calf production parameters

In accordance with our main hypothesis, inseminating beef cows with sexed semen increased the proportion of steers and kg of steer weaned/cow exposed to breeding (Tables 3 and 4). However, the decreased heifer weaning BW in SEXED cows offset these benefits, whereas overall kg of calf weaned/cow exposed to breeding was reduced in SEXED compared with CONV cows. Similar outcomes were detected when 205-day adjusted steer and heifer weaning BW was evaluated, although the age adjustment canceled treatment effects on overall kg of calf weaned/cow exposed to breeding. The use of 205-day adjusted weaning BW has the intent of normalizing weaning BW across calves of different ages and born from cows from different parities (BIF (Beef Improvement Federation) (2010)). In the present experiment, cow parity was included into all statistical models and did not impact any of the treatment effects reported herein. But more importantly, age at weaning has direct influence on weaning BW, and is a valuable indicator of calving distribution and overall reproductive efficiency of a cowherd. Hence, in research experiments where the goal is to evaluate overall cow–calf productivity, including breeding, calving, and weaning parameters, the use of original weaning BW and age may be more appropriate than 205-day adjusted weaning BW. Despite treatment differences in kg of heifer weaned/cow exposed to breeding, estimated calf value/cow exposed to breeding based on original or 205-day adjusted weaning BW was not impacted by treatments. It is important to note that this experiment did not account for any additional costs associated with purchasing sexed semen (Seidel, 2007), which may impact the economical returns of cows inseminated with sexed-semen. Nevertheless, results from this experiment suggest that inseminating beef cows with sexed semen does not improve economic returns in cow–calf operations that market the calf crop upon weaning.

5. Conclusion

In summary, inseminating beef cows with sexed semen reduced pregnancy rates to AI and final pregnancy rates (AI+50-day bull breeding), but increased the proportion of steers weaned and kg of steers weaned/cow exposed to breeding. However, overall kg of calf weaned/cow exposed to breeding and estimated calf value/cow exposed to breeding were not improved by the use of sexed semen, particularly because of its negative impacts on weaning age and BW of the heifer progeny. Based on these results, inseminating beef cows with sexed semen may not be a viable option to improve economic returns in cow–calf systems that inseminate and expose the cowherd to a 50-day bull breeding, and subsequently market the calf crop upon weaning.

Conflict of interests

No conflict of interests to report.

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