BEEF CATTLE RESEARCH UPDATE

Britt Hicks, Ph.D., PAS
Area Extension Livestock Specialist
Oklahoma Panhandle Research & Extension Center

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Effect of Pubertal Status and Number of Estrous Cycles prior to the Breeding Season on Pregnancy Rates in in Beef Heifers

Replacement heifer development can significantly impact the profitability of a beef cattle operation. Research has shown that heifers that conceive early in the breeding season calve earlier and wean heavier calves, increasing longevity and productivity within the herd.[1] University of Nebraska researchers conducted three experiments to evaluate whether pubertal status and number of estrous cycles prior to breeding influences pregnancy rate in beef heifers.[2] In Experiment 1, data were collected on 1,005 Angus-based heifers at the West Central Research and Extension Center in North Platte, NE from 2002 to 2011. Estrus in these heifers was synchronized using MGA/PGF followed by artificial insemination (AI). About 10 days following AI, the heifers were exposed to bulls for 60 days. In Experiments 2 and 3, data were collected on composite Red Angus × Simmental heifers at the Gudmundsen Sandhills Laboratory near Whitman, NE from 1997 to 2011 (Experiment 2 – 1,253 heifers and Experiment 3 – 156 heifers). Heifers in these two experiments were exposed to bulls for a 45 days. In Experiments 1 and 2, pubertal status was determined by evaluating progesterone concentration in two blood samples collected 10 days apart prior to the breeding season. In Experiment 3, the number of estrous cycles prior to the breeding season was determined via serial blood collection every 10 days beginning in early January of each year until the beginning of the breeding season in late May.

The effect of pubertal status prior to breeding on date of birth, body weight (BW), pregnancy rate, and first calf characteristics of heifers are presented in Table 1 for Experiment 1. Pubertal heifers had greater ($P < 0.01$) BW compared with non-pubertal heifers from weaning through final pregnancy diagnosis. Heifers that were pubertal prior to breeding tended ($P = 0.08$) to have greater AI pregnancy rate (61.9 vs. 55.5%) and greater ($P < 0.01$) overall pregnancy rate (94.2 vs. 87.7%) compared with non-pubertal heifers. In addition, more pubertal heifers ($P < 0.01$) calved within the first 21 days of the calving season than non-pubertal heifers (77.8 vs. 66.2%).

Table 1. Effect of pubertal status prior to breeding on birth date, body weight, pregnancy rate, and first calf characteristics of heifers in Experiment 1.

Item	Pubertal	Non-Pubertal	P-value
# of Heifers	695	310	
Julian birth date, day[1]	78.9	81.9	0.12
Weaning BW, lb	529	512	<0.01
AI BW, lb	786	768	<0.01
AI pregnancy rate, %	61.9	55.5	0.08
Overall pregnancy diagnosis BW, lb	932	916	<0.01
Overall pregnancy rate, %	94.2	87.7	<0.01
Calve within 1st 21 days, %[2]	77.8	66.2	<0.01

[1]Birth date known for only subset of heifers (360 heifers).
[2]Calved within first 21 days of calving season: day 1 is the day the first calf was born.
Adapted from Vraspir et al., 2014.

The effect of pubertal status prior to breeding on date of birth, body weight, pregnancy rate, and first calf characteristics of heifers are presented in Table 2 for Experiment 2. More heifers that were pubertal prior to breeding were born during the first 21 days of the calving season ($P < 0.01$) than non-pubertal heifers (63.8 vs. 49.7%). Pubertal heifers had greater ($P < 0.01$) weaning and pre-breeding BW, and tended ($P = 0.08$) to be heavier at pregnancy diagnosis than non-pubertal heifers. Pregnancy rate was greater ($P < 0.01$) for pubertal heifers vs. non-pubertal heifers (90 vs. 82.4%)

and a greater (P < 0.01) proportion of pubertal heifers calved within the first 21 days of the calving season compared non-pubertal heifers (79.1 vs. 67%). As a result, pubertal heifers weaned older (P < 0.05) and heavier calves (P < 0.01) than non-pubertal heifers. Second season pregnancy rate was similar between groups

Table 2. Effect of pubertal status prior to breeding on birth date, body weight, pregnancy rate, and first calf characteristics of heifers in Experiment 2.

Item	Pubertal	Non-Pubertal	P-value
Experiment 2			
# of Heifers	752	491	
Julian birth date, day	83.9	87.8	<0.01
Born 1st 21 days, %[1]	63.8	49.7	<0.01
Weaning BW, lb	461	445	<0.01
Pre-breed BW, lb	665	649	<0.01
Pregnancy diagnosis BW, lb	812	805	0.08
Pregnancy rate, %	90.0	82.4	<0.01
Calve within 1st 21 days, %[2]	79.1	67.0	<0.01
Calf weaning BW, lb	413	391	<0.01
Calf weaning age, days	181	177	<0.05
2nd pregnancy rate, %	89.8	91.2	0.65

[1]Born within first 21 days of calving season; day 1 is the day the first calf was born.
[2] Calved within first 21 days of calving season: day 1 is the day the first calf was born.
Adapted from Vraspir et al., 2014.

The effect of the number of estrous cycles prior to breeding on date of birth, body weight, pregnancy rate, and first calf characteristics of heifers are presented in Table 3 for Experiment 3. There was a trend (P = 0.15) for pregnancy rate to increase with the number of estrous cycles exhibited prior to breeding. As was observed in Experiments 1 and 2, heifers that were pubertal prior to breeding had a greater pregnancy rate than non-pubertal heifers (85 vs. 68%; P = 0.05). In addition, heifers that were pubertal prior to the first breeding season had a greater (P < 0.01) second season pregnancy rate than heifers that were non-pubertal prior to the first breeding season (97 vs. 79.5%). Second season pregnancy rate was greater (P = 0.03) for heifers having 2 or more estrous cycles prior to the first breeding season than heifers having 0 or 1 estrous cycles; however, heifers that had 0 or 1 estrous cycle had similar (P = 0.81) second season pregnancy rates (79.5, 87.2, 100, 97, and 97.9% for 0, 1, 2, 3, and ≥4 estrous cycle groups, respectively). Heifers with 2 or more estrous cycles prior to the first breeding season tended to have (P = 0.08) a greater second season pregnancy rate than heifers that had one estrous cycle (98 vs. 87.2%).

Table 3. Effect of the number of estrous cycles prior top breeding on birth date, body weight, pregnancy rate, and first calf characteristics of heifers in Experiments 3.

Item	0	1	2	3	≥4	P-value
# of Heifers	25	16	22	27	66	
Julian birth date, day	85.3	85.9	85.8	78.2	84.0	0.12
Born 1st 21 days, %[1]	67.8	80.8	73.1	93.0	78.7	0.24
Weaning BW, lb	489	494	507	524	504	0.10
Pre-breed BW, lb	830	844	865	895	848	0.16
Pregnancy diagnosis BW, lb	797	804	807	837	802	0.27
Pregnancy rate, %	68.0	81.3	86.4	92.2	81.8	0.15
Calve within 1st 21 days, %[2]	65.3	83.6	87.6	82.7	75.1	0.47
2nd pregnancy rate, %	79.5[b]	87.2[ab]	100.0[a]	97.0[a]	97.9[a]	0.03

[a,b,c]Mean without a common superscript differ (P < 0.05).
[1]Born within first 21 days of calving season; day 1 is the day the first calf was born.
[2]Calved within first 21 days of calving season: day 1 is the day the first calf was born.
Adapted from Vraspir et al., 2014.

These researchers concluded that first calf pregnancy rate was greater for heifers achieving puberty prior to breeding. However, earlier onset of puberty did not significantly improve first pregnancy rates. Data from Experiment 3 suggested that heifers that were pubertal prior to the first breeding season had a greater second season pregnancy rate than heifers that were non-pubertal prior to the first breeding season. Therefore, it is recommended that replacement heifers be developed to reach puberty and allow for at least one estrous cycle prior to the breeding season to optimize heifer pregnancy rates.

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[1] Mousel, E. M., R. A. Cushman, G. A. Perry, and L. K. Kill. 2012. Effect of Heifer Calving Date on Longevity and Lifetime Productivity. In: Proceedings, Applied Reproductive Strategies in Beef Cattle. p 23-31. Available: http://appliedreprostrategies.com/pdfs/2012ARSBC_04MouselProceedings.pdf.

[2] Vraspir, R. A., A. F. Summers, A. J. Roberts, and R. N. Funston. 2014. Effect of Pubertal Status and Number of Estrous Cycles Prior to the Breeding Season on Pregnancy Rate in Beef Heifers. Nebraska Beef Cattle Report MP99: 5-7. Available: http://beef.unl.edu/c/document_library/get_file?uuid=def3bf57-1d31-4893-a1bf-4210bbd158f1&groupId=4178167&.pdf.