BEEF CATTLE RESEARCH UPDATE

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December 2017

The Effect of Precipitation Received during Gestation on Progeny Performance in Beef Cattle

Research has shown that maternal nutrient intake during gestation can alter progeny calf health and performance. Although the influences of nutrient intake in gestating range cattle have been well documented, little is known regarding the direct effects of precipitation on fetal growth and programming. Therefore, New Mexico State University researchers conducted a study to determine the effect of precipitation level during specific time points during gestation on beef progeny performance.[1] They hypothesized that precipitation level during different periods of gestation would program calves for an environment similar to that experienced in utero resulting in altered growth and reproductive performance of the calves.

To test this hypothesis, data were collected on 2,429 spring-calving Brangus cows over a 46 year span (1969 – 2015) at the Chihuahuan Desert Rangeland Research Center (CDRRC, located north of Las Cruces, NM). The average annual rainfall at the U.S. Department of Agriculture's Jornada Experimental Range which is located adjacent to the CDRRC is 9.72 inches with 53% of the annual rainfall occurring between July 1 and September 30 (based on records recorded since 1915).[2] Recorded precipitation values were utilized to calculate average precipitation associated with the first trimester of gestation (July - September which coincides with their monsoon season), late gestation (December - February), and total duration from conception to gestation (April - April). These precipitation means were used to classify three treatments (low, average, or high rainfall) for each time period.

The effects of precipitation received in utero on calf growth performance is shown in Table 1. Calves experiencing high precipitation throughout gestation had heavier birth weights and weaning weights (P = 0.05) compared to calves experiencing low precipitation in utero. Similarly, calves had increased (P = 0.04) weaning weights and adjusted 205 day weaning weights (P = 0.03) if precipitation levels were high during the monsoon period when compared to the low treatment group.

Table 1. Brangus calf growth performance based on precipitation received in utero.

	Treatment			
Item	Low	Average	High	P-value
Birth Weight (lb)				
Total[1]	68[a]	77[b]	82[b]	0.05
Monsoon[2]	71	77	77	0.29
Late gestation[3]	75	77		0.89
Weaning Weight (lb)				
Total	481[a]	525[ab]	569[b]	0.05
Monsoon	481[a]	520[ab]	571[b]	0.04
Late gestation	501	538		0.12
Adj. 205 day Weight (lb)				
Total	463	556	545	0.56
Monsoon	465[a]	507[ab]	549[b]	0.03
Late gestation	487	520		0.13

[a,b]Within a row means with different subscripts are different (P < 0.05).
[1]Total = Summation of monthly average rainfall from average conception date to average parturition date.
[2]Monsoon= Summation of monthly average rainfall received the first trimester from July - September.
[3]Late Gestation = Summation of monthly average rainfall received during the last trimester (December – February).
Adapted from Beard et al., 2017

The effects pf precipitation received in utero on female progeny performance is shown in Table 2. There were no differences between treatment groups for age at first calving (P ≥ 0.17). There tended to be a greater (P = 0.06) proportion of heifers experiencing average precipitation during early gestation (monsoon) calving by 2 years of age when compared to their counterparts. Female progeny experiencing low precipitation throughout gestation were more likely to remain (P < 0.0001) in the herd and calve after the age of 8 compared with heifers experiencing high precipitation levels in utero (38 vs. 16%, respectively). As a result, females exposed to low precipitation levels throughout gestation produced a greater (P < 0.0001) number of calves (5.23) compared to the average (3.52) and high (3.88) treatment groups. Furthermore, heifers experiencing low precipitation levels during the monsoon period (first trimester of pregnancy) resulted in a greater percentage (P < 0.0001) of females calving after the age of 8 years (48 vs. 9% for low and high groups, respectively). Similarly, low treatment calves during those same time points also had a greater number of calves (5.90) while in production (P < 0.0001) when compared to the average (3.78) and high treatment (3.11) groups.

Table 2. Brangus female progeny performance based on precipitation received in utero.

	Treatment			
Item	Low	Average	High	P-value
Age at first Calving				
Total[1]	2.22	2.26	2.20	0.82
Monsoon[2]	2.27	2.20	2.33	0.17
Late gestation[3]	2.24	2.25		0.90
Calved at 2 years of age, %				
Total	82	85	86	0.77
Monsoon	77	87	81	0.06
Late gestation	85	84		0.81
Calved after 8 years, %				
Total	38	15	16	<0.0001
Monsoon	48	18	9	<0.0001
Late gestation	18	19		0.66
Number of calves				
Total	5.23[a]	3.52[bc]	3.88[c]	<0.0001
Monsoon	5.90[a]	3.78[bc]	3.11[c]	<0.0001
Late gestation	3.63	3.95		0.22

[a,b,c]Within a row means with different subscripts are different (P < 0.05).
[1]Total = Summation of monthly average rainfall from average conception date to average parturition date.
[2]Monsoon= Summation of monthly average rainfall received the first trimester from July - September.
[3]Late Gestation = Summation of monthly average rainfall received during the last trimester (December – February).
Adapted from Beard et al., 2017

These researchers concluded that these results suggest that precipitation level during gestation can elicit a programming like effect on progeny growth and reproductive performance. Below average precipitation calves in utero appeared to be genetically adapted to the intended environment. As a result, the selection of heifers exposed to lower than average precipitation levels in utero may result in increased herd retention and productivity. The authors also noted that “utilizing precipitation values offers producers the potential for selecting efficient females specific to the herd’s environment”.

[1] Beard, J. K., G. A. Silver, E. J. Scholljegerdes, and A. F. Summers. 2017. The effect of precipitation received during gestation on progeny performance in Bos indicus–influenced beef cattle. Proc. West. Sec. Am. Soc. Anim. Soc. 68: 180-183.
[2] USDA-ARS Jornada Experimental Range. Local climate. Las Cruces, NM. Available: https://jornada.nmsu.edu/jornada/climate.