BEEF CATTLE RESEARCH UPDATE

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Effect of Precipitation Received during Gestation on Progeny Performance in Brangus Cattle

Cattle producers are dependent on adequate precipitation for sustaining herds. Nutrient composition of range pastures fluctuates with time of year and annual precipitation. Variability in precipitation can cause negative effects on forage growth and quality. This relationship is especially critical in desert areas where precipitation values are generally low or seasonal. Thus, drought can be a major economic burden to cattle producers, with animal performance being altered due to low nutrient availability.[1] 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 subsequent progeny growth and lifetime performance of female progeny.[2]

In this retrospective study, 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). Precipitation data were gathered and compiled from 25 standard rain gauges located in subdivided pastures. Recorded precipitation values were used to calculate average precipitation associated with total gestation (April - March), early gestation, (July - September), and late gestation (December - February). These precipitation means were used to classify three treatments (low, average, or high rainfall) for each time period.

Average precipitation for the CDRRC during the reporting period (1969 - 2015) was 6.61 ± 0.51 inches. During the 46-year span, average, high, and low precipitation accounted for 63, 22, and 15% of the designated years, respectively. Traditional precipitation patterns in the southwest result in 50% of total precipitation during the designated monsoon season from July through September, with very little precipitation during the off-season.

The effects of precipitation received in utero on calf growth performance are shown in Table 1. Calves experiencing high precipitation throughout gestation had heavier ($P \leq 0.05$) birth (82 vs. 68 lb) and weaning weights (569 vs. 481 lb) compared to calves exposed to low precipitation levels while in utero. Similarly, calves had greater ($P \leq 0.04$) weaning (571 vs. 481 lb) and adjusted 205-day weaning weights (549 vs. 465 lb) if precipitation levels were high during the early gestation period when compared to the low-treatment group.

The effects pf precipitation received in utero on female progeny performance are shown in Table 2. There were no differences between treatment groups for age at first calving ($P \geq 0.17$). There tended to be a greater ($P = 0.06$) proportion of heifers calving by 2 years of age when exposed to average precipitation during early gestation (87%) when compared to their counterparts (77 and 81%, respectively, for low and high groups) . 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 early gestation period 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.

These researchers concluded that these results suggest animal reproductive performance may be programmed in utero (during gestation) and correlate to precipitation level. 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.

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

	Treatment			
Item	Low	Average	High	P-value
Birth Weight (lb)				
Early gestation[1]	71	77	77	0.05
Late gestation[2]	75	77	--	0.89
Total[3]	68[a]	77[b]	82[b]	0.05
Weaning Weight (lb)				
Early gestation	481[a]	520[ab]	571[b]	0.04
Late gestation	501	538		0.12
Total	481[a]	525[ab]	569[b]	0.05
Adj. 205 day Weight (lb)				
Early gestation	465[a]	507[ab]	549[b]	0.03
Late gestation	487	520		0.13
Total	463	514	545	0.08

[1]Early gestation = Summation of monthly average rainfall received the first trimester from July - September.
[2]Late Gestation = Summation of monthly average rainfall received during the last trimester (December – February).
[3]Total = Summation of monthly average rainfall from average conception date to average parturition date.
[a,b]Within a row means with different subscripts are different (P < 0.05).
Adapted from Beard et al., 2019

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

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

[1]Early gestation = Summation of monthly average rainfall received the first trimester from July - September.
[2]Late Gestation = Summation of monthly average rainfall received during the last trimester (December – February).
[3]Total = Summation of monthly average rainfall from average conception date to average parturition date.
[a,b,c]Within a row means with different subscripts are different (P < 0.05).
Adapted from Beard et al., 2019

[1] Scasta, J. D., L. Henderson, and T. Smith. 2015. Drought effect on weaning weight and efficiency relative to cow size in semiarid rangeland. J. Anim. Sci. 93:5829-5839.

[2] Beard, J. K., G. A. Silver, E. J. Scholljegerdes, and A. F. Summers. 2019. The effect of precipitation received during gestation on progeny performance in Bos indicus influenced beef cattle. Transl. Anim. Sci. 3:256-262.

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