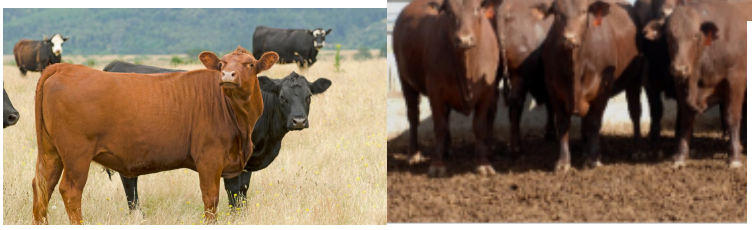
Using Growth Implants in Bos indicus Cattle Compared to Bos taurus Cattle



1. *(A) Angus (Bos taurus), (B) (Bos indicus), and (C) Santa Gertudis Cattle in Feedlot Settings*

Climate changes present many challenges for beef producers, including fluctuations in temperature, drought, and quantity and quality of available feed (Capper & Hayes, 2012). Improving beef production efficiency can mitigate the negative impacts of these challenges. One way to improve efficiency is altering breed type (i.e., *Bos indicus* vs. *Bos taurus*) or crossbreeding to maximize heterosis. This process requires evaluating breed complementarity. Breed complementarity is vital in crossbreeding schemes as different breed types are known to vary in production traits (Frisch & Vercoe, 1977), and the hybrid offspring are usually better performing in specific production traits when compared to straightbred cattle (**Figure 1**).

Introducing *Bos indicus* genetics may improve efficiency of production as these cattle are better adapted to nutritional stress, can carry a higher parasite load, are more heat tolerant, and have increased longevity compared to *Bos taurus* cattle (Forbes et al., 1998). However, only 8% of U.S. cattle inventory is *Bos indicus* influenced (Cundiff et al., 2012), possibly because these animals are more excitable and possess less desirable carcass traits, such as lower-quality grade and tenderness (Behrends et al., 2009; Voisinet et al., 1997). Crossbreeding *Bos indicus* cattle with *Bos taurus* cattle can minimize these traits. For example, Santa Gertrudis cattle are a cross between Brahman (3/8) and Shorthorn (5/8) (see **Figure 1C)**.

Beef producers use growth implants, also known as **anabolic hormone implants**, to increase cattle production efficiency and growth (Behrends et al., 2009; Cundiff et al., 2012; Voisinet et al., 1997). Growth or anabolic implants can be natural or synthetic compounds that produce physiological responses like those of naturally occurring hormones that promote muscle growth in cattle. The compounds in growth implants may be estradiol (E2), progesterone, zeranol, trenbolone acetate (TBA), or a combination of these compounds. Using an applicator, or implant gun, the pelletized growth implant is inserted between the cartilage and skin in the middle third of the animal's ear (see **Figure 2**). Once implanted, the hormones slowly release over time to promote the animal's growth.

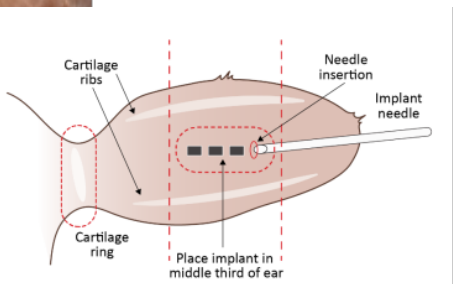


Figure 2. *Correct Implantation of Growth Implants*

Illustration by Michael Langenheim

It is well understood that growth implants increase average daily gain, feed intake, feed efficiency, hot carcass weight, and ribeye area from 5% to 20%, depending on timing and potency of the implant used (Duckett & Pratt, 2014). Using growth implants also decreases greenhouse gas emissions and overall land use (Capper & Hayes, 2012)

and results in an economic gain of $25 to $160 per animal (Duckett & Pratt, 2014). However, it is not fully understood how *Bos indicus* influenced cattle respond to implants as compared to those of different breed types.

A recent study at Utah State University compared production response to anabolic implant protocols of Santa Gertrudis-sired steers (*18.75% Bos indicus*, n = 10) and Angus-sired steers (n = 10) (Reichhardt et al., 2021). Steers were assigned to one of two implant treatments: no implant (n = 10) or an implant containing E2/TBA (n = 10). Feedlot performance, carcass characteristics, and economic analyses were completed to determine how implants affect *Bos indicus*-influenced animals. After 126 days on feed, what researchers found follows.

Performance

- Before starting the trial, steers were grouped to have the same average starting weight of 798 pounds. By the end of the trial, implanted Angus steers averaged 1,302 pounds, non-implanted angus steers averaged 1,267, implanted Santa Gertrudis steers averaged 1,258 pounds, and implanted Santa Gertrudis steers averaged 1,203 pounds.
- Implanted steers consumed more feed later in the trial than non-implanted steers. From 84–112 days of the feedlot period, implanted steers consumed an average of 29 pounds compared to non-implanted steers that consumed an average of 26.3 pounds.
- Santa Gertrudis-sired steers consumed less feed compared to Angus-sired steers. On average, Santa Gertrudis-sired steers consumed 2 pounds less than Angus-sired steers (**Figure 3**).
- Average daily gain was increased in Angus-sired steers compared to Santa Gertrudis-sired steers. Angus-sired steers gained on average 3.7 pounds/day compared to Santa Gertrudis-sired steers that gained 3.3 pounds/day.
- Angus-sired steers gained more than Santa Gertrudis-sired steers. Angus steers gained on average 477.95 pounds during the feedlot trial, and Santa Gertrudis-sired steers gained 425.7.
- Implanted steers gained on average 43.8 pounds more than non-implanted steers.

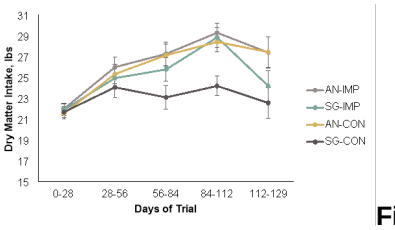


Figure 3. *Dry Matter Intake in Pounds Throughout the Trial's Duration*

Note. Angus (AN) or Santa Gertrudis (SG) and assigned to one of two treatments: (1) Control, no implant (CON), or (2) implanted with 120 mg trenbolone acetate and 24 mg estradiol (IMP).

These data, displayed in **Table 1**, suggest that implanting steers with anabolic implants will increase feed consumption while also increasing gains. Additionally, *Bos indicus*-influenced cattle will consume less feed and gain less than Angus cattle.

Table 1*. Average Daily Gain and Total Gain*

	Implant and Breed Treatments[a]				*P-Values*		
ADG, lbs	**AN-IMP**	**SG-IMP**	**AN-CON**	**SG-CON**	**SEM**	**Breed**	**Implant**
0–28	2.728	3.212	2.64	2.486	0.396	0.68	0.33
28–56	3.564	2.508	2.948	2.904	0.55	0.31	0.83
56–84	4.84	4.84	5.83	4.4	0.66	0.3	0.67
84–112	3.696	3.806	2.398	2.64	0.462	0.76	0.05
112–129	4.906	5.038	5.126	3.63	0.66	0.25	0.34
0–129	3.806^{x}	3.498^{xy}	3.564^{xy}	3.102^{y}	0.08	0.06	0.12
Total gain	495.66^{x}	451.88^{xy}	460.24^{xy}	399.52^{y}	36.08	0.06	0.1

Notes.[a]Implant treatments administered on d 0 include: no implant + Angus (AN-CON), no implant + Santa Gertrudis (SG-CON), Revalor-S + Angus (AN-IMP), and Revalor-S + Santa Gertrudis (SG-IMP).

^{x}Different letters tend ($0.05 < P > 0.10$) to be different from one another.

Carcass Characteristics

- On average, hot carcass weights between each treatment group did not have statistical differences.
- Angus-sired steers had improved marbling scores compared to Santa Gertrudis-sired steers. Angus steers had an average marbling score that was 81.8 points higher than Santa Gertrudis-sired steers, although marbling was not significant, this trait tended (P = 0.10) to vary between treatment groups (**Figure 4**).
- Santa Gertrudis-sired steers had improved yield grades compared to Angus-sired steers. Santa Gertrudis-sired steers had an average yield grade of 2.7 and Angus-sired steers had an average yield grade of 3.2 (P = 0.04) (**Figure 5**). It is important to note that lower yield grades are better than higher yield grades.

Producers are commonly paid on the grid system, meaning that yield grade and quality grade are a major factor in determining market value. The data suggests that while Angus steers have better quality grades, Santa Gertrudis-sired steers have better yield grades.

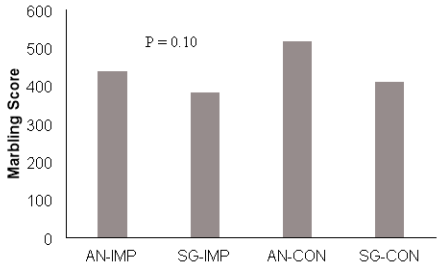


Figure 4.*Marbling Score*
Note. Angus (AN) or Santa Gertrudis (SG) were assigned to one of two treatments: (1) Control, no implant (CON), or (2) implanted with 120 mg trenbolone acetate and 24 mg estradiol (IMP).

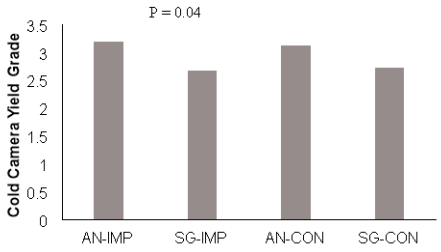


Figure 5.*Cold Camera Yield Grade*

Note. Angus (AN) or Santa Gertrudis (SG) were assigned to one of two treatments: (1) Control, no implant (CON), or (2) implanted with 120 mg trenbolone acetate and 24 mg estradiol (IMP).

Economics

- Implanted steers had on average $46.05 per head higher net returns compared to steers that were not implanted, regardless of breed.
- Implanted Angus-sired steers averaged $19.73 per head higher net returns than implanted Santa Gertrudis-sired steers. However, non-implanted Angus-sired steers averaged $71.91 per head higher net returns than non-implanted Santa Gertrudis-sired steers.

In keeping with cited studies, this data, displayed in **Table 2**, suggests that implanting cattle with anabolic implants increases net return. In addition, implanting Santa Gertrudis-sired steers may decrease the gap between net returns when compared to Angus-sired steers.

Table 2. Net Returns for Different Breeds and Implant Treatments

Net return	AN-IMP[a]	SG-IMP[a]	AN-CON[a]	SG-CON[a]
$140.19	$120.46	$120.23	$48.32	

Notes.[a]Angus (AN) or Santa Gertrudis (SG) were assigned to one of two treatments: (1) Control, no implant (CON), or (2) implanted with 120 mg trenbolone acetate and 24 mg estradiol (IMP).
Source: Adapted from Reichhardt et al., 2021 (CC BY-NC-ND 4.0)

Reichhardt et al. demonstrated that *Bos indicus*-influenced cattle may decrease economic return to producers because of lower-quality grades and decreased weight gains. However, it is well understood that anabolic implants increase return to producers for both Angus-sired steers and Santa Gertrudis-sired steers. This research suggests that producers utilizing, or wishing to utilize, *Bos indicus* genetics may increase economic return by using anabolic implants to increase efficiency and yield of steers. This, in turn, will increase economic returns.

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