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The Difference Between Two Implants and No Implants in Nebraska Steers

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INTRODUCTION

A small-pelleted implant placed under the skin on the back of the ear of a calf can help increase average daily gains (ADG) by 10-20% when compared to non-implanted calves (Payne 2012). As a result of increased feed efficiency from the implant(s), less feed is needed, which in return decreases the costs of production by 5-10% (Payne 2012). Implants can influence weight gain in cattle, resulting in an overall increase in beef supply for producers. Implants work by slowly dissolving under the skin to release a small amount of artificial hormones daily anywhere from 60 to 120 days. They are approved and regulated by the U.S. Food and Drug Administration Nationwide, 33 percent of cow/calf producers use growth implants.

Using proprietary data and comparative analysis, this study compares the average weight gain per calf among calves who received two implants over a five month period to those who received no implants over the same time period. The results are based on the unique data gathered from Boyce Land & Cattle, which includes: implants given, individual calf weights, and group weights, if and when taken. Unlike previous studies that focused on studying the comparison of weight gains, different carcass values, marbling, and many other factors, this study covers the average amount of weight steers gain from two implants compared to no implants in the same environment and conditions. In the next section, the approaches and major findings of the previous literature are reviewed.

REVIEW OF LITERATURE

Previous studies have compared weight gains, carcass values, marbling, and other factors among cattle that have been implanted to those receiving no implants. The majority of the studies reviewed below have found positive outcomes from using different implant strategies. However, there are some experiments where implanting did not significantly impact any of the factors that can affect the performance of growth in steers and heifers. The following discussion reviews the effects of implanting beef cattle.

Implants can increase daily protein gains, daily fat gains, and ADGs in steers and heifers. Guiroy, et al. (2002) used a sample of 13,640 beef cattle to conduct a study involving fifteen different implant strategies. The control group received no implants, while the treatment groups received single implants or a combination of different implants. Depending on the implant strategy used, there was either a positive change seen or production remained unchanged. The weight ranges for steers were from 520 kg in the unimplanted group to 564 kg in those implanted and reimplanted with Revalor-S (REV-S). For the heifers, the weight ranges were from 493 kg in unimplanted to 532 kg in those implanted and reimplanted with Revalor-H (REV-H). Total lean carcass mass and carcass protein increased in the steers that received implants. Throughout the series of different implanting strategies, implants increased ADG by 22 percent, increased daily

protein gains by 29 percent, and increased daily fat gains by 19 percent. The increases seen in the ADG, daily protein gains, and daily fat gains provided by the implants helped improve the required live weight to meet the same marbling point.

Implant dosage and release patterns can affect the performance and carcass traits on steers. Parr, et al. (2011a) conducted four experiments where each had different implant strategies and different amounts of days on feed. Final results for each experiment varied. Treatments for the four experiments varied from no implants to multiple implants. In experiment 1, four different treatments were administered while on feed for 174 days, one of which was receiving no implant. For experiment 1, steers in the implanted groups experienced increases in body weight (BW), ADG, dry matter intake (DMI), and the ratio of weight gain to feed intake (G:F). Also, marbling scores were higher among the implanted groups, and a higher percentage of steers were graded at the Premium Choice and Prime levels. The steers in experiment 2 were on feed for 131 days and were give a series of four treatments. Experiment 2 results showed implanting did not affect the shrunk and carcass-adjusted final BW, ADG, DMI, G:F, and hot carcass weight (HCW). However, it did improve the quality grade. In experiment 3, two treatments with different implants were given to the steers during their 197 days on feed.

Implanting increased the final BW and ADG. Daily DMI and shrunk G:F did not differ between the implant treatment groups. The marbling score also did not differ, but there was an increase in the percent of carcasses grading at the Premium Choice and Prime levels. Experiment 4 had steers on feed for 243 days with two different treatments. Results showed no difference in steer performance, HWC, dressing percent, or marbling score. However, an increase was seen in the percentage of carcasses graded at the Premium Choice and Prime level. Overall, the four experiments resulted in different outcomes, some showing implants have a positive effect while others did not.

Parr, et al. (2011b) examined the dosage and payout pattern of trenbolone acetate (TBA) and estradiol-17 (E2) implants, as well as the feeding of zilpaterol hydrochloride (ZH) on performance and carcass characteristics of finishing steers. The authors used numerous implant strategies on 168 steers. The different treatments resulted in an increased BW from day 28 to day 152. The steers implanted with Revalor-XS (REV-X) had a greater BW, ADG, and G:F than those that were implanted with REV-S. Overall, this study indicates that steers can increase their daily weight gains by receiving an implant or multiple implants over a period of time.

Parr, et al. (2014) used the same TBA and E2 implants with the feeding of ZH as Parr, et al. (2011b) but also added two new growth-promoting products. The new products, REV-X and β-agonist (BAA) ZH, had recently been approved for the use on finished beef cattle. The sample of 168 steers were used again and were exposed to a variety of implant strategies, including six different treatments. The results showed that the combination of implant treatments, ZH supplement, and the additional growth-promoting products was not significant for any of the variables measured. This indicates that mixing or adding too many different products into steers may not be effective in the long run with daily weight gains.

Past studies show mixed results on the impact of implants on daily weight gains in beef cattle. Guiroy, et al. (2002) showed that weights for steers ranged from 520 kg in the unimplanted group to 564 kg in the implanted and reimplanted group. For the heifers, the ranges were from 493 kg in unimplanted to 532 kg in the implanted and reimplanted group. On the contrary, Parr, et al. (2011a) showed that, depending on the treatment used and implanting strategies, there were no differences observed in weight gain among steers. Overall, previous studies have examined many different implanting treatments and strategies that can show improvement in daily weight gains in cattle. This study adds to the literature by examining the impact of two implants on a sample of cattle in Nebraska. The following section will discuss both the data and methods utilized in this study.

DATA & METHODS

Statistical analysis is used to determine if the difference in average total weight gain exists between calves that received no implants and those that received a total of two implants. Data was gathered from Boyce Land & Cattle.

Methods

In a good portion of the literature, implants have shown to have positive effects on weight gain in calves. Implants can help improve or increase the ADG, daily protein gains, daily fat gains, marbling scores, and other variables in beef cattle. Implants can help producers increase their ending profits by inserting a simple and very affordable implant under the skin on the back of calves' ears. The implants are designed specifically to be able to release the hormones into the bloodstream slowly over time. Researchers find "implants work by increasing the amount of growth regulating hormones, which are naturally produced by the animal. This, in turn, increases feed efficiency, protein deposition and growth rate" (Oklahoma State University 2012). Overall, this technological advancement increases the supply of beef into the market.

To test if average total gains are higher when using two implants compared to no implants, a comparative analysis was conducted. The analysis involves two tests. First, to test that the variances of weight gains for each group of calves are the same, an F-test is conducted. This is necessary for determining the appropriate test statistic to use when conducting the t-test. Specifically, the F-test hypotheses are:

$$H_0: \sigma_0^2 = \sigma_2^2$$
$$H_1: \sigma_0^2 \neq \sigma_2^2$$

σ_0^2 denotes the variance of total gains in calves that did not receive any implants and σ_2^2 denotes the variance of total gains in calves that received a total of two implants.

The t-test is used to compare the average total gains in calves that received no implants and those that received two implants. Specifically, the t-test hypotheses are:

$$H_0: \mu_0 \geq \mu_2$$
$$H_1: \mu_0 < \mu_2$$

μ_0 denotes the average total gains in those receiving no implants and μ_2 denotes the average total gains in those receiving two implants. It is hypothesized that average total gains will be greater among those calves that are implanted than among those calves that receive no implants.

Data

The data for the two groups of steers is cross sectional and obtained from Boyce Land and Cattle. The operation was located approximately 10 miles southwest of North Loup, NE. There were 36 steers used for the study. Starting in May 2016 at the branding stage, 18 steers were randomly assigned to the implant group and received a green tag, and another 18 steers were randomly assigned to the control group (i.e., no implants) receiving a pink tag. After the steers were sorted into the implant group and non-implant group, each group was weighed so an average weight could be recorded. Also at that time, the 18 steers in the implant group received their first implant of Synovex C (calf). The second implant, Synovex S (steers) was given around the first of August 2016 at the pre-conditioning stage. Finally, both groups were weighed a second time towards the end of September for an average group weight and individual weights to be used for the data analysis. Table 1 illustrates the timeline for when the calves were implanted and weighed.

Table 1. Timeline for Implants and Weighings.

Group	3-May-16		9-Aug-16		16-Sep-16	
Implanted (green tags)	*Implanted?*	YES	*Implanted?*	YES	*Implanted?*	NO
	Avg. Total Weight Obtained?	YES	*Avg. Total Weight Obtained?*	NO	*Avg. Total Weight Obtained?*	YES
	Indv. Weights Obtained?	NO	*Indv. Weights Obtained?*	NO	*Indv. Weights Obtained?*	YES
Non-Implanted (pink tags)	*Implanted?*	NO	*Implanted?*	NO	*Implanted?*	NO
	Avg. Total Weight Obtained?	YES	*Avg. Total Weight Obtained?*	NO	*Avg. Total Weight Obtained?*	YES
	Indv. Weights Obtained?	NO	*Indv. Weights Obtained?*	NO	*Indv. Weights Obtained?*	YES

**Test was conducted for this period.*

All other conditions of the two groups of steers were identical. They were placed in the same dry lot pen together with their mothers after branding. The reason for them staying in the dry lot is because they are mainly calves from heifers and a few second and third calvers so we like to keep them conditioned for breeding. Both mothers and calves were fed the same feed rations and calves received creep feed to help aid in weight gain. One calf in the non-implanted group bloated multiple times from overeating creep, so he and his mother were sorted off and put in a neighboring pasture until the entire group was brought in for pre-conditioning in August. Salt and mineral was put out weekly for the cows and calves. Calves typically do not consume as

much, if any, when compared to the cows and bulls with them. Overall, the conditions for the two groups were very similar, the only difference being one group received implants and the other did not. The next section will discuss results.

RESULTS

Table 2 presents the descriptive statistics, as well as the comparative analysis results. The table shows that, on average, calves that received a total of two implants weighed 651 pounds with minimum and maximum weights of 550 and 720 pounds, respectively. To compare, the average weight of those that received zero implants was 639 pounds, which is a 12-pound difference. The minimum and maximum weights in this group were 575 and 715 pounds, respectively. The F-test results indicate the variance of the weights among steers receiving two implants was not significantly different than the variance of the steers that did not receive a single implant (p-value = 0.322). Moreover, the t-test results indicate the mean weight of those steers that received two implants (651 ponds per head) is not significantly higher than the mean weight of the steers that did not get implanted (639 pounds per head; p-value = 0.191). This is not consistent with what was expected. It was expected the implanted group of steers would have a significantly higher mean than the group that did not receive any implants.

Although the results show implants did not significantly increase weight gain in steers, it does not necessarily mean implants cannot make an operation more profitable by additional weight gain. It should be noted that at the beginning of the project the steers used for the implant group had an average starting weight 12-pounds lower than steers used for the non-implanted group (239 pounds vs. 251 pounds). By the end of the trial, the steers with the lower average starting weight gained more weight with the implants and ended with a higher average weight compared to the control group. That is, the implanted steers' average weight was 651 pounds, whereas the non-implanted steers' average weight was 639 pounds. This is a 12-pound difference, which is significant.

Using the group averages from the data obtained from Boyce Land & Cattle, the following is an example of how a steer with a larger weight can generate more money than one with a lower weight. If calves weighing an average of 651 pounds per head are currently bringing $123/cwt (per hundred weight), this means each calf brings $800.73 (651lb x $1.23) for total revenue of $14,413.14 for the implanted group of 18. Conversely, the non-implanted group with an average weight of 639 pounds would bring $785.97 (639lb x $1.23) per head. The total revenue for this group would be $14,147.46 for a difference of $265.68 between the two groups or $14.78/head. Each implant cost $1.40 per head, which means for a total of 36 implants used it only cost the operation $2.80/head, making the profit margin $11.98 per head ($14.78 - $2.80). With implants not costing much over one dollar, it makes it hard for a producer to not want to pay the small amount to, in return, see a larger profit than not implanting. A profit of $11.98 per head may not seem like a big difference, but when you can get that much more per steer in a larger group it can quickly add up.

Overall, I am pleased with the results received from my comparative analysis, even though statistically I found no difference between the two groups. Like the previously researched

data on implants, it does show implants can help increase weight gain in calves (Parr et al. 2011b). It is believed the main reason why the results are not statistically significant is because of the small group sizes of 18. If the groups each had 30 steers, the precision of the results would have improved.

Table 2.: Two Impants vs. No Implants

	Two Implants	**No Implants**
Avg. lb/head	651.111	638.889
Std. Deviation	1911.752	1522.575
Max	720	715
Min	550	575
F-Statistic	1.256	
P-Value	0.322	
α = 0.05	p > α	
t-Statistic	0.885	
P-Value	0.191	
α = 0.05	p > α	

Source: Boyce Land & Cattle

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to estimate how using two implants when compared to no implants could increase weight gain in steers over the same amount of time in the same environment. Implanting can help beef producers receive greater weights, resulting in a rise in beef supply and greater returns to the producer. A comparative analysis was completed using a unique dataset received from Boyce Land & Cattle in Nebraska. This research adds to the literature on different types of implant strategies by examining the effect of two implants versus none on total average gains.

Overall, the results indicate the average total weight of steers in the implanted group (651 pounds) is higher than the average total weight of steers in the control group (639 pounds); however, the results are not statistically different. Over the five-month period, this is an average of 12-pounds more per head than those that did not receive any implants. Results from Guiroy, et al. (2002) show implanting increased ADG between steer and heifers by 22 percent. However,

the results of this study are more consistent with Parr, et al. (2011a), who found steers given a series of four implants treatments did not have significant improvements in BW, ADG, DMI, G:F, and HCW.

An unexpected result is that using two implants did not show a statistical advantage over no implants. Implants are known to help calves gain more weight without costing producers a large amount of money. The extra gains that can be achieved by using implants help increase the beef supply. However, the results indicate that using a series of two implants does not necessarily increase weight in steers when compared to those that received zero. It is believed that if the two groups would have been larger than eighteen head each, the results would have been more precise. Another factor that could have improved the results is if there were more time so there could have been another weight recorded. When the individual weights were obtained in September, the second implant given in August was just then getting hot. Even though the results of this study are not statistically significant, the outcome of the implanted group weighing more in the end when coming in at a lower weight is remarkable.

The goal of cattle production is profit maximization. Increasing weight gain is one part of accomplishing that goal. Results of this study would be very useful to a producer considering who is considering using implants in their cattle operation. This study and thus the results can be strengthened with the availability of more data.

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