OFIP 0042 – Final Report

A Comparison of Cattle Health, Cost of Production and Carcass Characteristics of "Natural" and Conventionally Produced Beef

November 30, 2014

Introduction

In recent years, many consumers of animal products have an increased interest in how the products they consume are produced[1]. One area of interest is in production of "natural" beef. Though the term "natural" does not have a clear and consistent definition, many consumers would consider this definition to include beef produced without the use of advanced technology such as hormone implants, ionophores, and beta-agonists[1]. Producers are often paid a premium for beef produced in this manner. However, this premium tends to be low in North America due to consumer reluctance to pay a higher price for specially produced product[2,3] and may be insufficient to cover higher costs of production if gains are decreased. Some producers are also concerned that this type of production will result in increased health problems. The purpose of this study was to determine the benefits and economics of use of a trenbolone acetate/estradiol hormone implant, ionophore (monensin), and beta-agonist (ractopamine).

Materials and Methods

This trial was conducted December 24, 2013 to August 20, 2014 and involved a total of 200 animals. The first iteration of the trial involved 120 animals selected from a larger group of feedlot animals and ran from December 24, 2013 to April 15, 2014. Animals on the trial were housed in groups of 5 in small research pens, with all pens being fed the same base diet. Animals were randomly allocated based on initial weight to one of four treatment groups, implant (trenbolone acetate and estradiol, Revalor) and ionophore (monensin, Rumensin), ionophore only, implant only, or neither implant nor ionophore (negative control). Each treatment group consisted of 6 smaller pens, resulting in 30 animals per treatment group. Additionally, half of the pens in each treatment were assigned to receive a beta-agonist (ractopamine, Optaflexx) at the end of the treatment period. The dry matter intake for each group was collected on a daily basis and weights were collected on each animal at 28-day intervals to determine growth and average daily gain. Rumen pH was measured on one animal from each pen at 84 days on feed. All animals were followed through slaughter and carcass characteristics were recorded. A second iteration was completed April 30 to August 20, 2014 to determine any seasonal variation and increase statistical power. The second iteration involved 4 pens of 5 animals for each treatment, a total of 80 animals, and followed the same protocol as the first.

Results and Discussion

Variation existed in rumen pH values among and between treatments (Table 1). The average rumen pH of animals treated with ionophores tended to be slightly higher than those that were not. However, this difference was not statistically significant and did not result in differences in metabolic problems or health outcomes.

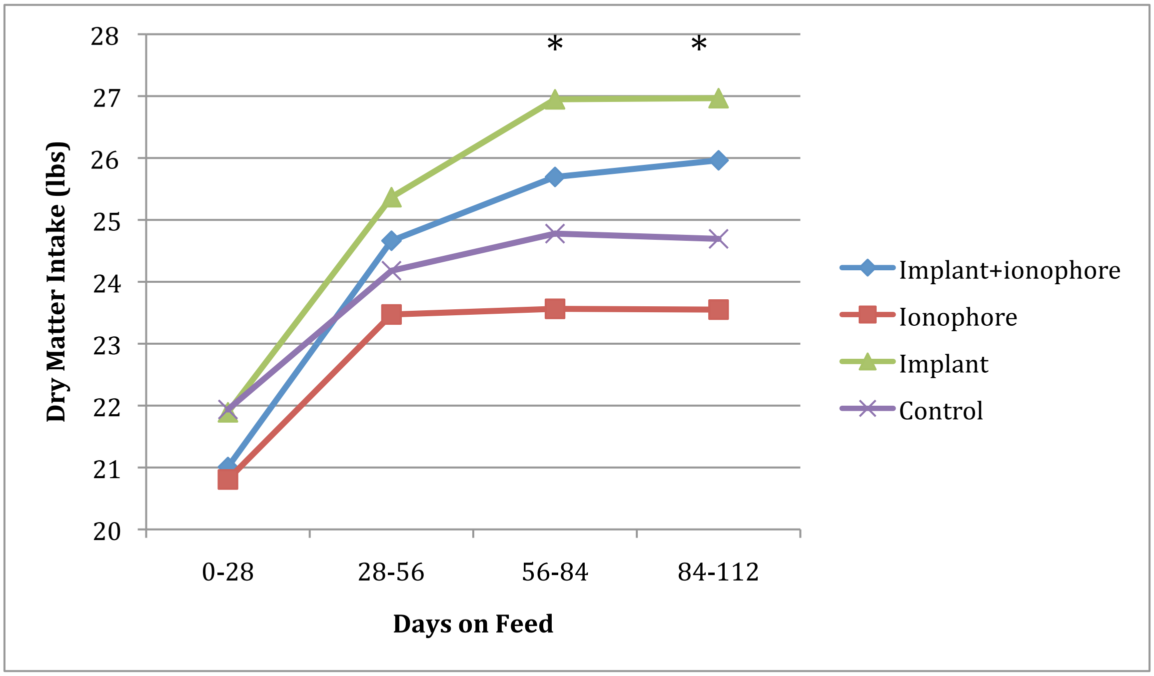
Table 1. Rumen pH by treatment group

Treatment	Ionophore+implant	Ionophore	Implant	None
Mean	6.0	6.0	5.9	5.8
Median	5.9	6.0	5.8	5.7
Range	5.7-6.3	5.6-6.3	5.7-6.2	5.6-6.1

Animals treated with an implant alone consumed the most dry matter (DM) over the study period, an average of 25.3 lbs of DM per day for the entire study period. This was significantly more DM per day than controls (23.9 lbs, *P*=0.04) and was the highest group in both iterations of the trial, 26.2 lbs for iteration 1 and 24 lbs for iteration 2. Animals treated with an ionophore alone consumed the least DM over the study period, an average of 22.8 lbs of DM per day when both iterations were combined. These animals consumed significantly less DM than controls in the study as a whole (*P*=0.05) and in the first iteration of the trial (23.3 versus 24.6 lbs, *P*=0.006). Animals treated with an ionophore alone consumed less DM than controls in the second iteration (22.2 versus 22.8 lbs, respectively), but this difference was not significant (*P*=0.5). Dry matter consumption for animals treated with an implant and ionophore was not statistically different from controls (24.3 lbs DM per day, *P*=0.4).

Dry matter consumption varied over the 112 day study period, increasing in all groups throughout the feeding period (Figure 1). All treatment groups had a greater increase in dry matter intake in the second 28 day period than controls, but only those animals treated with an implant consumed more than controls during this period. Implanted animals continued to consume more dry matter per day than controls during each subsequent period.

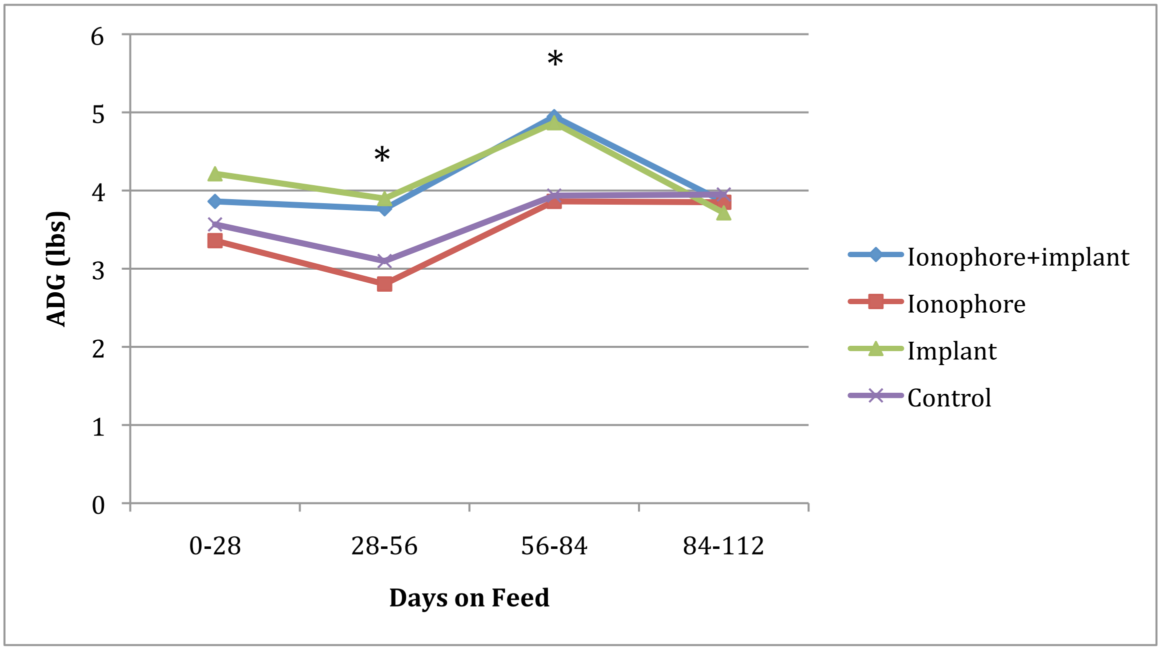
Figure 1. Average dry matter intake by treatment group for all treated animals (n=200, 50/treatment group).



*$P \leq 0.05$ compared to controls

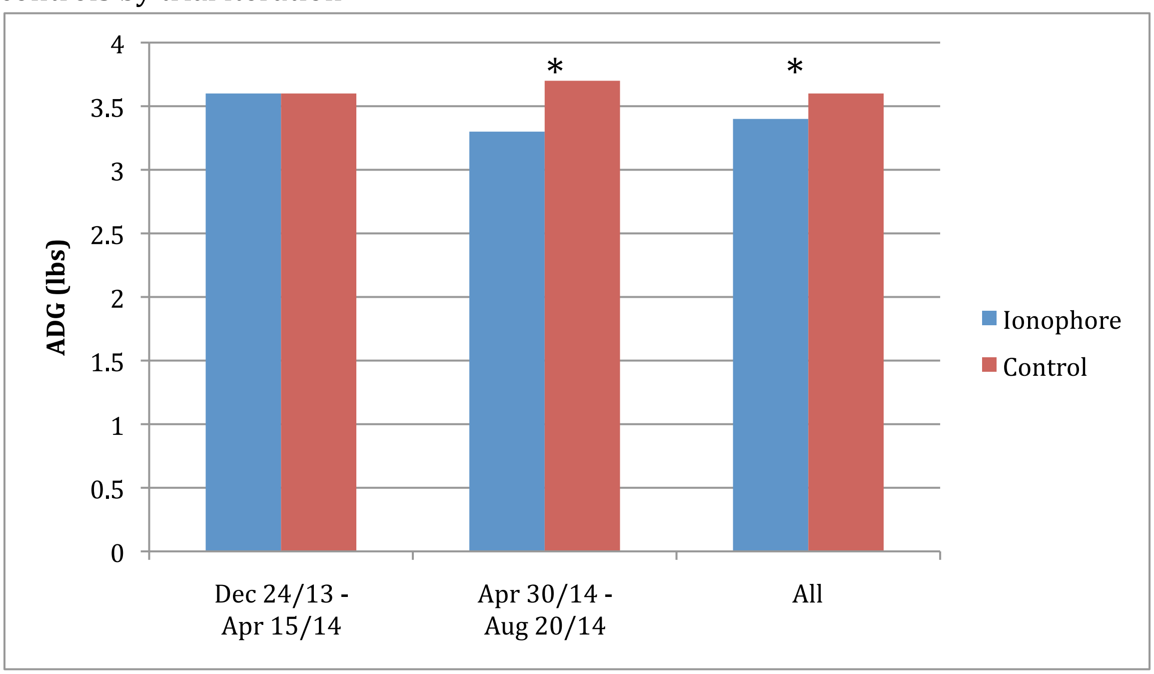
Average daily gain (ADG) was the highest for animals treated with an implant alone or with an implant and ionophore (4.1 and 4.2 lbs/d respectively). This value was consistent between trial iterations, but varied over the trial period (Figure 2). This is most likely due to the payout for the implant being shorter than the trial period. These animals gained significantly more per day than controls (3.6 lbs/d, P=0.0001) over the full trial period. Animals treated with an ionphore alone gained less than controls (3.4 lbs/d, P=0.04). The decrease in ADG in ionophore treated animals was seen in the animals that were treated from April 30 to August 20, 2014 (Figure 3). There was no difference in animals treated from December 24, 2013 to April 15, 2014.

Figure 2. Average daily gain (ADG) by treatment group for all treated animals (n=200, 50/treatment group).



*$P \leq 0.05$ compared to controls

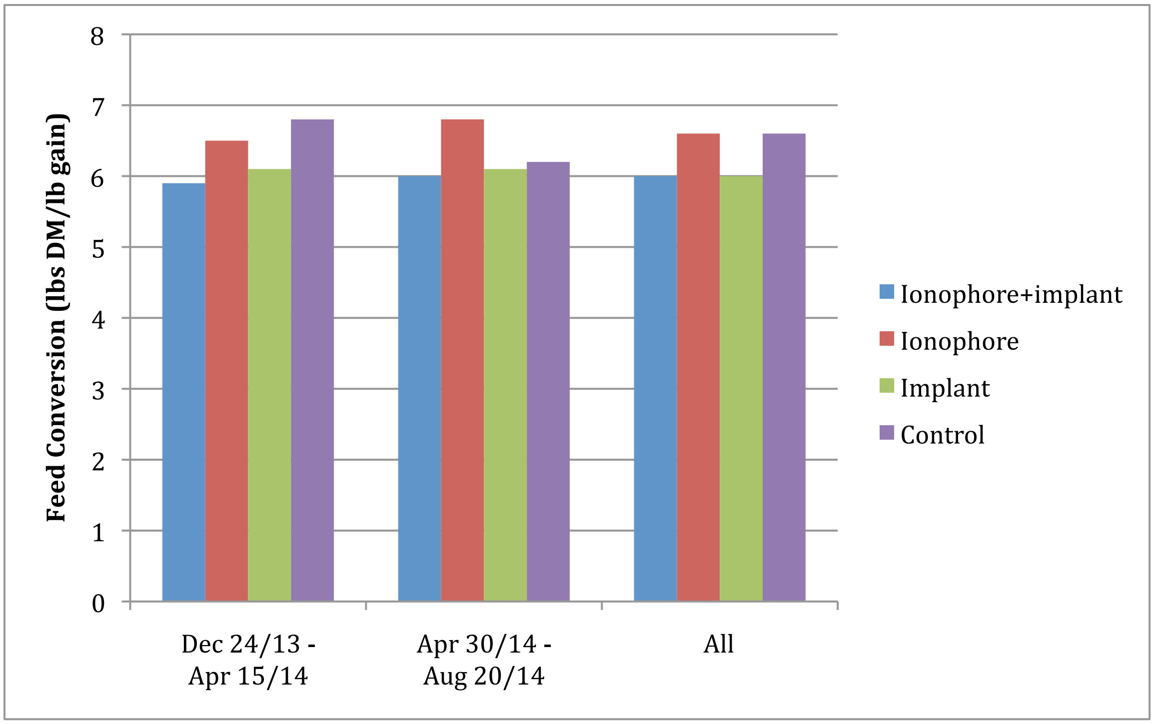
Figure 3. Average daily gain (ADG) for animals treated with an ionophore alone or controls by trial iteration



*$P \leq 0.05$

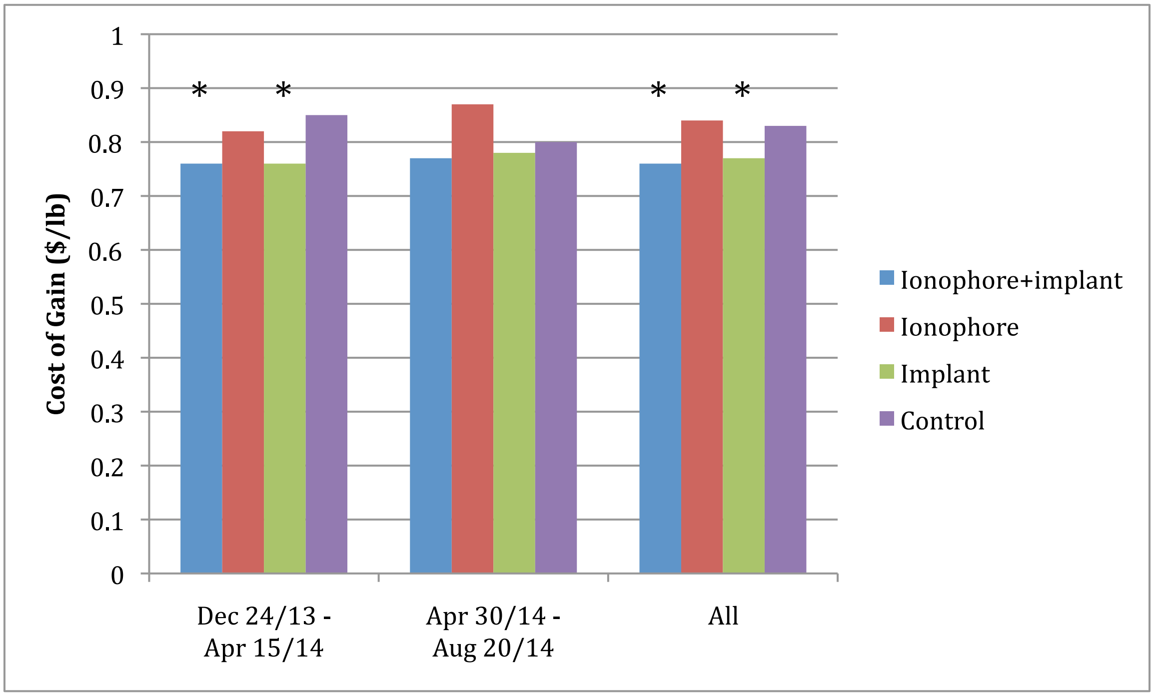
Dry matter conversion was significantly higher for control animals and those treated with an ionophore alone (6.6 lbs DM/lb gain for both) versus those treated with an ionophore and an implant or an implant alone (6.0 lbs DM/lb gain for both), though this difference was not statistically significant (*P*=0.1). This relationship was consistent between trial iterations, though the exact value for DM conversion varied slightly. Animals that were given an implant had a more consistent feed conversion between trial iterations than those that were not (Figure 4). This suggests that implanted animals are less affected by changes in weather and feed composition.

Figure 4. Feed conversion by treatment group and study period



The cost per pound of gain was significantly lower in animals that were given an implant versus those that were not ($0.76 ionophore+implant and $0.77 implant versus $0.84 ionophore and $0.83 control, P=0.03). The cost was consistent throughout trial iterations for animals that were implanted, but varied for animals that were not implanted (Figure 5). This variation is due to the variation in feed conversion for animals that were not implanted and again suggests that these animals were more affected by differences in weather and feed composition.

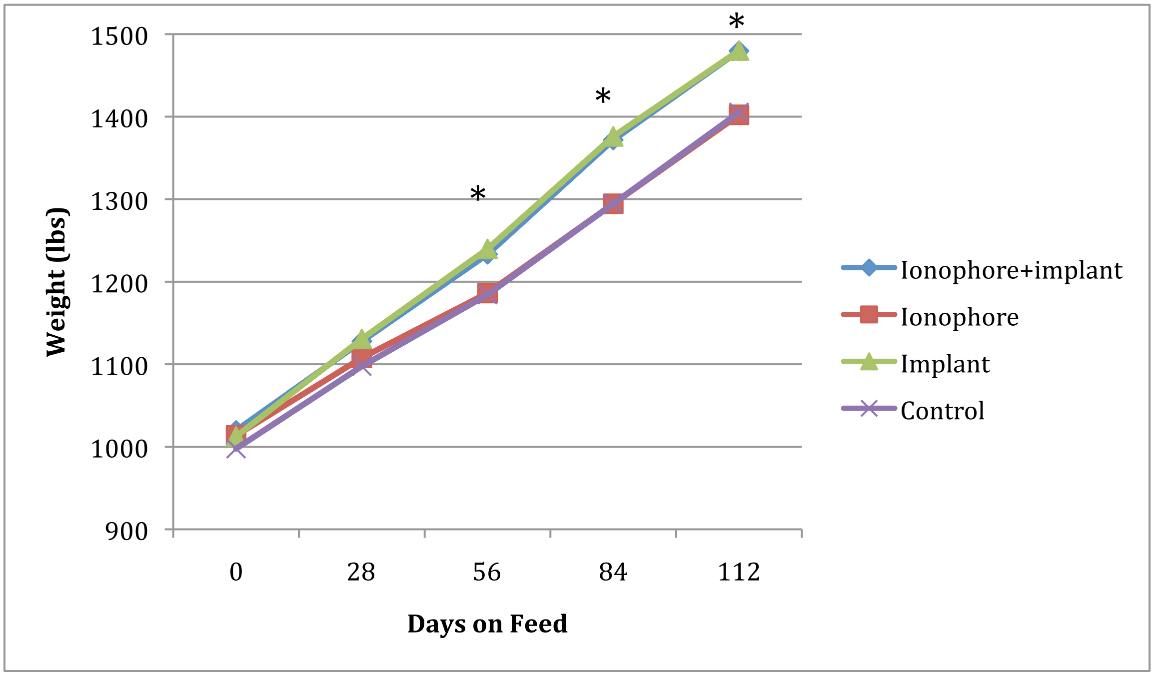
Figure 5. Cost of gain by treatment group and study period



*$P \leq 0.05$ compared to controls

Animals that were implanted weighed significantly more at 112 days on feed than those that were not implanted (P=0.001). Implanted animals weighed about 80 lbs more at the time of slaughter than those that were not implanted. This is despite the fact that there were no significant differences in starting weight. The increase in weight in implanted animals can be attributed to the higher dry matter intake and average daily gain and more efficient feed conversion. This difference in live weight equated to about 50 lbs difference in dressed weight, with implanted animals being heavier.

Figure 6. Weight by treatment group (n=200, 50/treatment group)



*$P \leq 0.05$ compared to controls

Though there was some variation in carcass characteristics between treatments, none of these differences were statistically significant or consistent between trial iterations. This is likely due to the small number of animals in the study groups. It is important to note that small differences in carcass characteristics can make a large economic impact depending on the marketing strategy (i.e. live versus grid), so further investigation in this area may be warranted.

The use of the beta-agonist overall decreased carcass quality (Table 2). In the first trial iteration, beta-agonist use significantly decreased dressing percentage (59.3 versus 59.7, P=0.02) and carcass weight (888 versus 914 lbs, P=0.02). There was no significant effect on carcass weight or dressing percentage with beta agonist use in the second iteration of the trial.

Table 2. Carcass quality by trial iteration and beta-agonist treatment group

Iteration	Treatment	Prime	AAA	AA
1	Beta-agonist	1	53	6
	Control	0	56	4
2	Beta-agonist	0	30	10
	Control	0	33	7
All	Beta-agonist	1	83	16
	Control	0	89	11

The economics of utilization of technologies can vary greatly as the price of inputs and beef change. Based on the current live price for beef of $172/cwt, $0.12/lb DM for feed, $0.05/d for ionophore, and $0.07/d for the implant, over 112 days on feed after sale of the animal implanted animals would yield $100 more per animal than those that were not implanted. This would require that producers receive a premium of $7/cwt based on a sales weight of about 1,400 lbs live for natural beef. In this study animals were grown for a specific period of time. Previous trials that have grown all animals to a specific weight or to a target quality grade have shown an even larger disparity between natural and conventionally produce beef. This is due to the lower efficiency of the animals produced without an implant. The cost would increase as the weight increased due to the higher cost per pound of gain and increased yardage due to longer days on feed.

Conclusions

Based on the results of this trial, there is no benefit to the addition of ionophore without the use of an implant, but use of an implant with or without an ionophore is highly economical. Animals given an ionophore without an implant had an ADG that was the same or slightly lower and cost of gain that was the same or slightly higher than control animals. However, animals that were implanted gained more per day and had a lower cost of gain than control animals. After consideration of all expenses and the income from sale of the animal, implanted animals yielded about $100 more per animal than controls. The use of a beta-agonist showed no benefit in any of the treatment groups and decreased carcass weight and dressing percent in the first trial iteration. The lack of effect seen in this trial, the added cost and labor for their use, and the negative social connotations all suggest that the use of beta-agonists should be discontinued. It is important to note that this trial was conducted in finishing heifers, a trenbolone acetae/estradiol implant, monensin, and ractopamine. Utilization of different products or a different class of animals may alter the results and/or economics of product use.

References

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2. Yiridoe, E.K., Bonti-Ankomah, S., Martin, R.C. 2005. Comparison of consumer perceptions and preference toward organic versus conventionally produced foods: A review and update of the literature. Renewable Ag. Food Sys. 20:193-205.
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