Growth Promoting Technologies – Strengthening Your Bottom-line While Preserving Meat Quality

Bailey Harsh[1]

[1]UF/IFAS Department of Animal Sciences, Gainesville, FL

Introduction

Modern beef production economics and small returns relative to input costs demand that producers capture incremental improvements in animal productivity to improve profitability. Anabolic implants and beta-adrenergic agonists are two such growth-promoting technologies the beef industry has used for many years to do just that, improving performance and reducing production costs.

Indicated for increased rate of gate and feed efficiency, beef implants have been developed for use in heifers and steers at multiple stages of production from feedlot cattle to calves on pasture prior to weaning. Anabolic implants have been designed to steadily release active ingredients such as estrogenic and androgenic hormone over a set period and are delivered through hormone pellets administered under the skin of the ear. With similar indications, beta-agonists such as Optaflexx and Actogain are demonstrated to increase performance, feed efficiency, and carcass leanness when delivered in a complete feed. Approved for use in both steers and heifers, beta-agonists are intended to be used for only the last 28-42 days of the finishing period.

While these technologies improve the economics and sustainability of beef production, as well as improve beef's price competitiveness compared to other proteins, these technologies also have the potential to erode marbling scores and negatively affect beef palatability if not used appropriately. Since tenderness, juiciness, and beef flavor are major components of consumer eating satisfaction, it's important for producers to understand effective usage and timing of these technologies as well as their effects on meat quality.

Implants

To a producer new to beef implanting, the number of different implants commercially available may be a little overwhelming. The variety of available implants is a result of multiple implant strategies designed to maximize benefits of exposure while reducing negative impacts and most commonly focus on targeted finish date, price spread, genetic potential for marbling, nutritional plane and feeding programs (Holt, 2009). While many implants are similar, they may have slightly different characteristics such as active hormone, dosage, and hormone release duration. It is these characteristics that provide producers the flexibility to use implants in multiple stages of beef production.

Beef production has historically been a highly segmented industry. This segmented nature has led to implanting decisions being dictated by phase of production in which cattle are to be marketed (Duckett and Andrae, 2001). Historical wisdom has been to implant when entering the finishing stage. With the greatest increase in animal value associated with implant use being tied to the finishing phase ($51.34/hd), some feedlots offer premiums for unimplanted calves (Duckett and Andrae, 2001). However, research has reported carryover effects of implanting suckling and stocker calves are minimal relative to feedlot performance.

The same characteristics that provide usage flexibility, have a major impact on potency (or "aggressiveness") and effects on meat quality characteristics. Timing of implant administration and frequency of reimplantation (administering an implant at multiple stages of beef production) has been shown to affect beef quality grade and objective tenderness (Platter et al., 2003). On average, the use of implants may decrease marbling scores by 4 to 11% (Duckett and Pratt, 2014). In extremes, Platter et al. (2003) demonstrated almost a full quality grade reduction in carcasses from cattle implanted five times compared to nonimplanted steers, although five implants is well above the industry average of 1-2 implants per animal. Flavor and juiciness are other traits of consumer importance. Platter et al. (2003) reported an additive effect of implants on consumer palatability with little change observed in steaks from cattle implanted 1-2 times, and greater negative effects observed in steaks from cattle implanted 3, 4, or even 5 times.

Beta-agonists

Limited to the last 28-42 days of the finishing period, it would appear there are fewer usage considerations associated with beta-agonist use. However, several factors including dosage, sex, and breed type can influence effects of beta-agonists on meat quality.

In a summary of 45 research studies, Lean et al. (2014) reported an average increase of 13.6 lbs in hot carcass weight, 0.29 square-inch increase in ribeye area, and a 0.23% unit increase in dressing percentage compared with carcass characteristics of control-fed cattle. However, steaks from beta-agonist fed cattle demonstrate a modest decrease in objective tenderness. Studies where steers and heifers were fed a beta-agonist at a low-dosage for shorter feeding periods demonstrate smaller negative effects on tenderness values when compared with control cattle, whereas in studies where cattle were fed greater doses for longer periods prior to slaughter, marked decreases in tenderness were observed. Nonetheless, classical postmortem aging strategies (14-21 days) have been proven effective in reducing detrimental effects of beta-agonists on objective tenderness (Boler et al., 2012) although postmortem aging did not change the proportion of steaks classified as "tender" according to USDA guidelines (Martin et al., 2014).

Sex is another important factor when considering beta-agonist responsiveness. Quinn et al. (2008) reported feeding heifers a beta-agonist less effect on carcass weight, ribeye area, 12th-rib fat thickness, yield- or quality grade than observed in steers. Despite the smaller response in carcass effects, beta-agonists did improve feed efficiency of finishing heifers (Quinn et al., 2008).

Another consideration is the effect of beta-agonists in Bos taurus- vs. Bos indicus-type cattle. Gruber et al. (2008) reported that beta-agonist usage had a more detrimental effect on tenderness values of steaks from Brahman-cross steers than British-breed steers, with Continental-cross steers intermediate. However, these effects were mitigated when Brahman-cross steers were fed a beta-agonist at a lower dosage.

Conclusion

Anabolic implants and beta-agonists have had a crucial role in helping cattle feeders to be profitable in the face of an ever-shrinking U.S. cattle inventory, fluctuating corn prices and high beef demand. In the later stages of feeding, when cattle start to deposit more fat than muscle, the use of growth-promoting technologies can help to increase muscle synthesis, ultimately increasing feed efficiency and pounds of lean beef produced. Nonetheless, if not managed properly detrimental effects on quality grade made be observed, negatively impacting the price feeders may be willing to pay for calves as well as the bottom-line for producers choosing to retain ownership.

Boler, D. D., A. L. Shreck, D. B. Faulkner, J. Killefer, F. K. McKeith, J. W. Homm, and J.A. Scanga. 2012. Effect of ractopamine hydrochloride (Optaflexx) dose on live animal performance, carcass characteristics, and tenderness in early weaned beef steers. Meat Sci. 92: 458-463. doi: 10.1016/j.meatsci.2012.05.011

Duckett, S. K. and J. G. Andrae. 2001. Implant strategies in an integrated beef production system. J. Anim. Sci. 79(E. Suppl.):E110-E117.

Duckett, S. K. and S. L. Pratt. 2014. MEAT SCIENCE AND MUSCLE BIOLOGY SYMPOSIUM-Anabolic implants and meat quality. J. Anim. Sci. 92:3-9.

Gruber, S. L., J. D. Tatum, T. E. Engle, K. J. Prusa, S. B. Laudert, A. L. Schroeder, and W. J. Platter. 2008. Effects of ractopamine supplementation and postmortem aging on longissimus muscle palatability of beef steers differing in biological type. J. Anim. Sci. 86: 205-210. doi: 10.2527/jas.2007-0201.

Holt, S. 2009. Beef Tech-Line: Implants. Tech. Bul. Hubbard, Mankato, MN. http://admin.hubbardlife.com/files/files/BeefTechLineMay2009%20Implants.pdf (Accessed 14 September 2014).

Lean, I. J., J. M. Thompson, and F. R. Dunshea. 2014. A meta-analysis of zilpaterol and ractopamine effects on feedlot performance, carcass traits and shear strength of meat in cattle. PLOS ONE. 9: e115904. doi: 10.1371/journal.pone.0115904

Martin, J. N., A. J. Garmyn. M. F. Miller, J. M. Hodgen, K. D. Pfeiffer, C. L. Thomas, R. J. Rathmann, D. A. Yates, J. P. Hutcheson, and J. C. Brooks. 2014. Comparative effects of beta-adrenergic agonist supplementation on the yield and quality attributes of selected subprimals from calf-fed Holstein steers. J. Anim. Sci. 92: 4204-4216. doi: 10.2527/jas2014-7881

Platter, W. J., J. D. Tatum, K. E. Belk, J. A. Scanga and G. C. Smith. 2003. Effects of repetitive use of hormonal implants on beef carcass quality, tenderness, and consumer ratings of beef palatability. J. Anim. Sci. 81:984-996.

Quinn, M. J., C. D. Reinhardt, E. R. Loe, B. E. Depenbusch, M. E. Corrigan, M. L. May, and J. S. Drouillard. 2008. The effects of ractopamine-hydrogen chloride (Optaflexx) on performance, carcass characteristics, and meat quality of finishing feedlot heifers. J. Anim. Sci. 86: 902-908. doi: 10.2527/jas.2007-0117.