BEEF CATTLE RESEARCH UPDATE

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Effects of Beef Production System (Conventional vs. Natural) on Cattle Performance

In the February 2015 issue of this newsletter, I reviewed an Oklahoma State University (OSU) study that evaluated the effects of an all-natural system (without use of growth implants, beta agonists, and Rumensin/Tylan) compared to a conventional system with the use of these efficiency enhancing technologies on feedlot performance and carcass characteristics.[1] In this study, these researchers concluded that their data showed that conventional production resulted in more rapid and efficient production that resulted in heavier carcasses with superior yield grade (YG) while still maintaining desirable quality grades as compared to natural production. A 2013 economic analysis of this research showed that net returns per steer were $203.69 greater for conventional cattle vs. natural cattle.

In an additional recently published study, these same OSU researchers examined the effects of feedlot production systems with and without the use of a beta agonist compared to an all-natural production program on feedlot performance and carcass characteristics.[2] In this study, 336 crossbred beef steers (834 lb initial weight) were assigned to three treatments: 1) an all-natural treatment (NAT), 2) a conventional treatment (CONV), and 3) a conventional treatment with a beta agonist (CONV-Z). The CONV and CONV-Z cattle were implanted with a trenbolone acetate/estradiol combination implant (Revalor-XS, Merck Animal Health) and fed monensin (33 g/ton of DM) and tylosin (9 g/ton of DM) daily. The CONV-Z cattle were fed Zilmax (Merck Animal Health) at 88 mg/steer/day for the last 20 days of the experiment followed by a 3 to 5 day Zilmax withdrawal period.

The effects of the treatments on feedlot performance and carcass characteristics are shown in Table 1. Intake was not effected by treatment. However, CONV-Z steers gained 3.8% faster (3.61 vs. 3.48 lb/day) and were 5.3% more efficient (0.160 vs. 0.152 than CONV steers, and CONV steers gained 32.8% faster (3.48 vs. 2.62 lb/day) and were 26.7% more efficient (0.152 vs. 0.120) than NAT steers. The improvement in gain and efficiency for CONV-Z compared to NAT was similar to the results reported in the first OSU study. There was a 37.8% improvement in ADG and a 33.3% improvement in G:F in the current experiment compared to a 28.4% improvement in ADG and a 24.2% improvement in G:F in the first study.

Hot carcass weight was increased by 18 lb for CONV-Z steers compared to CONV steers and 102 lb compared to NAT steers. Rib-eye area was increased by 0.57 square inches for CONV-Z steers compared to CONV steers and 1.89 square inches for CONV-Z steers compared to NAT steers, resulting in a 9.6% unit increase in USDA YG 1 and a 21.6% unit reduction in USDA YG 3 for CONV-Z steers compared to CONV steers. The CONV-Z steers had a lower marbling score compared to the other treatments, resulting in an 11.7% unit increase in USDA Select carcasses compared to CONV steers.

Theses researchers concluded that the results of this experiment show the production advantages of producing beef in a conventional manner compared to a natural system. These results clearly illustrate that beta agonists, growth implants, and ionophores are all valuable technologies that help improve gain and efficiency, with minimal effects on carcass quality. These authors also noted that to meet the expected 70% increase in food demand by 2050, it will be imperative that efficiency enhancing technologies continue to be used in beef production.

Table 1. Effects of treatment on feedlot performance and carcass characteristics.

Item	NAT	CONV	CONV-Z	P-value
Feedlot Performance:				
Days on feed	136	136	136	---
Initial weight, lb	834	834	832	0.54
Final weight, lb	1191[a]	1305[b]	1323[b]	<0.01
DMI, lb/day	22.02	22.90	22.66	0.18
ADG, lb/day	2.62[a]	3.48[b]	3.61[c]	<0.01
Gain/Feed	0.120[a]	0.152[b]	0.160[c]	<0.01
Carcass Characteristics:				
Hot carcass weight, lb	767[a]	851[b]	869[b]	<0.01
Dressing percentage	63.02[a]	63.43[a]	64.68[b]	<0.01
Fat thickness, in.	0.44[ab]	0.48[b]	0.43[a]	0.53
Rib-eye area, sq. in.	12.42[a]	13.74[b]	14.31[c]	<0.01
USDA Yield Grade	3.04[a]	2.99[a]	2.65[b]	<0.01
Marbling Score	471[a]	470[a]	432[b]	<0.01
USDA YG 1, %	4.67[a]	5.52[a]	15.14[b]	0.04
USDA YG 2, %	42.86	39.25	52.88	0.16
USDA YG 3, %	48.61[a]	52.32[a]	30.70[b]	0.02
USDA UG 4-5, %	3.59	2.56	0.89	0.47
Choice or greater, %	90.10[a]	91.02[a]	78.77[b]	0.03
Select, %	9.90[a]	9.03[a]	20.70[b]	0.04

[a,b,c] cWithin a row, means without a common superscript differ (P < 0.05).
Adapted from Maxwell et al., 2015.

In 2012 publication, researchers from Washington State University and Iowa State University analyzed the environmental and economic impact of withdrawing growth-enhancing technologies (GET) from the U.S. beef industry.[3] The growth-enhancing technologies considered in this analysis were growth implants, in-feed ionophores (Rumensin, Bovatec), in-feed hormones (MGA), and beta agonists (Optaflexx, Zilmax). Theses researchers concluded that withdrawing GET from U.S. beef production reduced productivity (growth rate and slaughter weight) by 9.2% and increased the population size required to produce one billion lb of beef by 11.8% (385,000 animals). Feedstuff and land use were increased by 10.6% (3.12 million tons) and 10% (~1013 sections), respectively, by GET withdrawal, with 5.32 billion more gallons of water being required to maintain beef production. In addition, manure output increased by 10.1% (1.98 million tons) and carbon emissions increased by 9.8% (787,396 tons) as a result of GET withdrawal. They noted that the projected increased costs of U.S. beef produced without GET resulted in the effective implementation of an 8.2% tax on beef production, leading to reduced global trade and competitiveness.

A 2011 study comparing the environmental impact of modern (2007) US beef production with production practices characteristic of the US beef system in 1977 showed that modern beef production requires considerably fewer resources than the equivalent system in 1977, with 69.9% of animals, 81.4% of feedstuffs, 87.9% of the water, and only 67.0% of the land required to produce 1 billion kg of beef.[4] Waste outputs were similarly reduced, with modern beef systems producing 81.9% of the manure, 82.3% of the methane, and 88.0% of the nitrous oxide per billion kilograms of beef compared with production systems in 1977. The carbon footprint per billion kilograms of beef produced in 2007 was reduced by 16.3% compared with equivalent beef production in 1977.

In conclusion, these studies clearly illustrate that modern technology has both improved production efficiency and reduced the environmental impact of beef production. Withdrawing growth-enhancing technologies from U.S. beef production would reduce both the economic and environmental sustainability of the beef industry.

[1] Maxwell, C. L.,C. R. Krehbiel, B. K. Wilson, B. T. Johnson, B. C. Bernhard, C. F. O'Neill, D. L. VanOverbeke, G. G. Mafi, D. L. Step, and C. J. Richards. 2014. Effects of beef production system on animal performance and carcass characteristics. J. Anim. Sci. 92: 5727-5738.

[2] Maxwell, C. L., B. C. Bernhard, C. F. O'Neill, B. K. Wilson, C. G. Hixon, C. L. Haviland, A. N. Grimes, M. S. Calvo-Lorenzo, D. L. VanOverbeke, G. G. Mafi, C. J. Richards, D. L. Step, B. P. Holland, and C. R. Krehbiel. 2015. The effects of technology use in feedlot production systems on feedlot performance and carcass characteristics1. J. Anim. Sci. 93: 1340-1349.

[3] Capper, J. L. and D. J. Hayes. 2012. The environmental and economic impact of removing growth-enhancing technologies from U.S. Beef production. J. Anim. Sci. 90:3527-3537.

[4] Capper, J. L. 2011. The environmental impact of beef production in the United States: 1977 compared with 2007. J. Anim. Sci. 89:4249-4261.