Analysis of Modern Technologies Commonly Used in Beef Cattle Production: Conventional Beef Production versus Natural/Organic Production Using Meta-analysis

B.W. Wileman, *DVM*[1]; **D.U. Thomson**, *PhD, DVM*[1]; **C.D. Reinhardt**, *PhD*[1]; **A.M. O'Connor**, *MVSc, DVSc*[2]; **D.G Renter**, *DVM, PhD*[1]

[1]*Kansas State University, Manhattan, Kansas 66506*
[2]*Iowa State University, Ames, Iowa 50011*

Introduction

Conventional feeding systems use pharmaceutical products not allowed in natural or organic systems for finishing cattle. This review compares the performance effects of technologies used in feedlot cattle that are prohibited in organic and/or natural programs. The technologies evaluated were steroid implants, monensin, tylosin, endectocides and metaphylaxis. The aim of the comparison was to determine the magnitude of the effect of these technologies on ADG, FE and DMI.

Materials and Methods

Studies were identified through Pubmed, and CAB electronic databases. For inclusion in this analysis studies were conducted in the USA or Canada, utilized randomization to treatment group, utilized beef breed animals, contained an untreated control group and were from peer-reviewed sources. Extracted outcome data included were ADG, DMI, FE, and measures of variation, description of experimental unit, number of experimental units and gender. Forest plots were used to examine the data for trends towards a uniform effect of the technology on the outcomes of interest (ADG, DMI, FE). Technologies that were considered to display a uniform response compared to negative controls on the forest plot were then analyzed using a random effects mixed model in SAS described by Houwelingen (2002). A break even model to describe the cost of production implications of natural and organic systems for raising beef was also conducted.

Results

Examination of forest plots for endectocides, steroid implants, monensin and metaphylaxis appeared to show a performance advantage for treated cattle verses untreated cattle. Tylosin studies did not show a consistent response in treated cattle verses untreated cattle, and an insufficient number of studies met the inclusion criteria to conduct a meta-analysis comparing endectocides, monensin or tylosin. Therefore, a summary effect measure was only calculated for metaphylaxis and implant data sets. Average daily gain in feeder cattle given metaphylaxis on arrival increased by 0.25 lb/d (0.11 kg/d) (CI = 0.22, 0.28 lb/d (0.10, 0.13 kg/day), $P < 0.01$) relative to cattle that did not receive metaphylaxis. Implanting heifers increased ADG by 0.18 lb/day (0.08 kg/d) compared to non-implanted controls (CI = 0.022, 0.338 lb/d [0.01, 0.15 kg/d], $P = 0.09$). Implants tended to improve FE ($P = 0.14$) in heifers while having no effect on DMI ($P = 0.44$). Implanting steers was associated with higher ADG by 0.54 lb/d (CI = 0.50, 0.59 lb/d [0.23, 0.27 kg/d], $P < 0.01$) and DMI by 1.17 lb/d (CI = 0.99, 1.34 lb/d [0.45, 0.61 kg/d], $P < 0.01$) relative to non-implanted control steers. Implants also improved FE in steers relative to non-implanted steers by 0.60 lb [0.27 kg] (5.9 lb [2.68 kg] vs. 6.5 lb [2.95 kg]; implanted vs. controls, CI = 0.55, 0.67 lb [0.25, 0.30 kg], $P < 0.01$). The point estimates of differences in ADG and FE for implanted and non-implanted steers were incorporated into the breakeven model showing the need for substantial premiums for organic/natural beef production. The model suggests that implanted steers had a $60/hd lower cost of production than non-implanted steers fed similar diets. Also, implanted steers fed a non-organic diet had a $312/hd lower cost of production than non-implanted cattle fed an organic diet assuming being sold on the same market.

Significance

The review suggests advantages to using modern technology in beef cattle production. There has been a shift away from including untreated controls in many studies in an effort to compare one technology to another. This practice should be re-examined as the natural and organic industries continue to grow it will be important to evaluate the effect of various technologies on beef production efficiency. It is also important that the beef industry conducts further field trials comparing natural or organic systems directly to conventional systems. It is possible the analysis presented here overestimates the direct impact of these technologies as a strong publication bias exists; however, it is also likely that these products are effective. This is the first attempt using a meta-analysis approach to attempt to quantify the magnitude of the effect.