

2014

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Kelsey Phelps

K. A. Miller

Cadra L. Van Bibber-Krueger

J. Jennings

See next page for additional authors

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Recommended Citation

Phelps, Kelsey; Miller, K. A.; Van Bibber-Krueger, Cadra L.; Jennings, J.; Depenbusch, Brandon E.; Drouillard, James S.; and Gonzalez, John M. (2014) "Comparison of conventional and Alltech Beef PN finishing programs: meat water-holding capacity and tenderness," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 1. <https://doi.org/10.4148/2378-5977.1480>

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Comparison of conventional and Alltech Beef PN finishing programs: meat water-holding capacity and tenderness

Abstract

Tenderness, juiciness, and flavor play important roles in a satisfactory beef eating experience. All three factors can be affected by management decisions made by producers during the production of beef. Beef producers currently use a multitude of production programs that utilize feed additives such as Rumensin or Tylan (Elanco Animal Health, Greenfield, IN), and growth promotants such as implants and Optaflexx (Elanco Animal Health). Rumensin and Tylan are fed in combination to improve feedlot performance, whereas growth promotants improve feed efficiency, average daily gain, hot carcass weight, and yield grades of carcasses. Although the use of feed additives and growth promotants improves production efficiency, they can affect meat characteristics such as tenderness and water-holding capacity. The Alltech PN Beef Program (Alltech Inc., Nicholasville, KY) consists of two products that are designed to replace components of the conventional feedlot diet. The PN Beef Receiver is intended to be fed during the step-up period of feeding, whereas PN Beef Finisher is intended to be fed during the remainder of finishing period. Because both products are new feed alternatives, the objective of this study was to compare the fresh cooked meat quality of the Alltech PN Beef Program to a conventional feedlot diet when both diets are combined with or without growth promotants.

Keywords

Cattlemen's Day, 2014; Kansas Agricultural Experiment Station contribution; no. 14-262-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1101; Beef Cattle Research, 2014 is known as Cattlemen's Day, 2014; Beef; Feed additives; Growth promotants; Meat quality; Altech PN Beef Program

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Authors

Kelsey Phelps, K. A. Miller, Cadra L. Van Bibber-Krueger, J. Jennings, Brandon E. Depenbusch, James S. Drouillard, and John M. Gonzalez

Comparison of Conventional and Alltech Beef PN Finishing Programs: Meat Water-Holding Capacity and Tenderness

K.J. Phelps, K.A. Miller, C.L. Van Bibber-Krueger, J. Jennings¹, B.E. Dejenbusch², J.S. Drouillard, and J.M. Gonzalez

Introduction

Tenderness, juiciness, and flavor play important roles in a satisfactory beef eating experience. All three factors can be affected by management decisions made by producers during the production of beef. Beef producers currently use a multitude of production programs that utilize feed additives such as Rumensin or Tylan (Elanco Animal Health, Greenfield, IN), and growth promotants such as implants and Optaflexx (Elanco Animal Health). Rumensin and Tylan are fed in combination to improve feedlot performance, whereas growth promotants improve feed efficiency, average daily gain, hot carcass weight, and yield grades of carcasses. Although the use of feed additives and growth promotants improves production efficiency, they can affect meat characteristics such as tenderness and water-holding capacity. The Alltech PN Beef Program (Alltech Inc., Nicholasville, KY) consists of two products that are designed to replace components of the conventional feedlot diet. The PN Beef Receiver is intended to be fed during the step-up period of feeding, whereas PN Beef Finisher is intended to be fed during the remainder of finishing period. Because both products are new feed alternatives, the objective of this study was to compare the fresh cooked meat quality of the Alltech PN Beef Program to a conventional feedlot diet when both diets are combined with or without growth promotants.

Experimental Procedures

Crossbred yearling steers ($n = 512$; 848 ± 17 lb initial body weight) were blocked by body weight and assigned to 64 pens with 8 steers assigned to each pen. The study was conducted as a randomized complete block experiment with a 2×2 factorial treatment arrangement. Factors in the study design consisted of dietary program and growth promotant regimen. For the dietary program factor, steers were separated into a conventional finishing program treatment or Alltech PN Beef Program treatment (Table 1). The components of the Alltech PN Beef Program diet were premixed into a ground corn carrier and subsequently blended into the total mixed ration. Both supplements contained a proprietary blend of organic trace elements, ascorbic acid, fermentation products, fermentation extracts, and selenium yeast. The PN Receiver portion of the diet was included in the total mixed ration for the first 21 days at a rate of 0.5 oz/animal daily. The PN Finisher was included in the total mixed ration at a rate of 0.7 oz/animal daily for the final 154 days of the feeding period. Each diet was fed with or without growth promotants. Steers receiving growth promotants were administered a Component E-S (Elanco Animal Health) implant on day 1 of the study, reimplanted with Component TE-IS (Elanco Animal Health) on day 94, and fed Optaflexx at a rate of 400 mg/animal daily the final 28 days before harvest.

¹ Alltech, Nicholasville, KY.

² Innovative Livestock Services, Great Bend, KS.

On day 175 of the experiment, animals were harvested at a commercial abattoir where slaughter and carcass data were collected. After a 24-hour chill, strip loins were randomly selected from two carcasses per pen and transported back to Kansas State University. Upon arrival, strip loins were weighed, vacuum-packaged, and stored for 14 days. On day 14, packages were opened and loins were patted dry and reweighed for moisture loss calculations. Two 1-in.-thick steaks were cut for subjective and objective measurements of cooked meat characteristics.

Results and Discussion

Moisture retention during aging and cooking is an important quality attribute of fresh meat. The ability of meat to hold more moisture through aging and cooking can result in a juicier and more tender final product. Results show no interaction between dietary program and growth promotant (Figure 1; $P > 0.10$) for moisture retention during aging. In addition, growth promotants did not affect ($P > 0.10$) moisture retention during aging, but dietary program did ($P < 0.05$). Loins from animals fed the Alltech PN Program retained more moisture during aging than loins from animals fed the conventional program. In addition to moisture retention during aging, moisture retention during cooking was measured. No dietary program and growth promotant interaction was detected on moisture retention during cooking (Figure 2; $P > 0.10$). Dietary program and growth promotants individually influenced moisture loss during cooking ($P < 0.05$). Steaks from steers in the Alltech PN Beef Program treatment retained 1.3% more moisture during cooking and growth promotants increased moisture loss by 1.6%.

Tenderness is continuously reported as the most important quality attribute consumers use to determine the acceptability of the beef eating experience. Analysis of objective steak tenderness was conducted on strip loin steaks aged for 14 days. For objective tenderness, there was no interaction between dietary program and growth promotants (Figure 3; $P > 0.10$). In addition, dietary program did not affect ($P > 0.10$) the tenderness of steaks. Numerous research studies have concluded that utilizing both implants and beta-agonists can decrease meat tenderness when products are aged for 14 days or less. In the current study, we aged loins for 14 days and duplicated these previously published studies, because use of growth promotants during finishing decreased ($P < 0.05$) tenderness. When utilizing objective measures to quantify tenderness, the literature reports that shear values above 9.0 lb correlate to a negative consumer eating experience. Although average tenderness for all treatment groups was below the rating considered tough by a consumer, 14.5% (Alltech PN Beef Program) and 25% (conventional program) of steaks from steers administered growth promotants would have been perceived as tough.

To further explore these results, a trained taste panel evaluated steaks from the same loins aged 14 days for six attributes (Table 2). Results indicate a dietary program and growth promotant interaction for myofibrillar tenderness, connective tissue amount, and overall tenderness score ($P < 0.01$) but no interaction for juiciness and beef flavor intensity. The impact of the growth promoting programs can be seen by the steaks from the PN Beef Program and conventional program that were subjected to growth promotants being myofibrillarly tougher than their counterparts without growth promotants ($P < 0.05$). When the growth promotants were applied to the PN Beef Program, this resulted in panelists detecting more connective tissue in these steaks compared with

other treatment groups ($P < 0.05$). This result, combined with the myofibrillar tenderness data, caused the steaks originating from steers in the PN Beef Program that were administered growth technologies to be rated tougher overall than all other treatment groups ($P < 0.05$). In addition, steaks originating from steers in the conventional program that were administered growth technologies were also rated tougher overall than the remaining two treatment groups without growth promotants ($P < 0.05$).

Implications

Using the Alltech PN supplements can favorably impact water-holding capacity without compromising tenderness, and use of implants and Optaflexx negatively affected water-holding capacity and steak tenderness.

Acknowledgements

We would like to thank Alltech, Inc. for financial support of this experiment.

Table 1. Diets (dry basis) for steers fed conventional feedlot diets¹ or Alltech PN program²

Ingredient, %	Conventional	Alltech
Wet corn gluten feed	35.00	35.00
Steam-flaked corn	53.55	53.56
Ground wheat straw	7.00	7.00
Feed additive premix	2.16	–
Mineral/vitamin supplement	2.29	2.23
PN supplement	–	2.21

¹ Conventional diets included vitamin A at 1,000 IU/lb; vitamin E at 10 IU/lb; copper sulfate to provide 10 ppm Cu; cobalt carbonate to provide 0.15 ppm Co; ethylenediamine dihydriodide to provide 0.5 ppm I; manganous sulfate to provide 60 ppm Mn; sodium selenite to provide 0.3 ppm Se; zinc sulfate to provide 60 ppm Zn on a dry matter basis; as well as 300 mg/animal daily of Rumensin and 90 mg/animal daily of Tylan (Elanco Animal Health; Greenfield, IN).

² The Alltech diet included PN Receiver (Alltech, Nicholasville, KY) in the total mixed ration for the first 21 days at the rate of 14 g/animal daily, which contained: zinc proteinate to provide 10.7 ppm Zn; manganese proteinate to provide 7.1 ppm manganese; cobalt proteinate to provide 1.2 ppm cobalt; copper proteinate to provide 2.9 ppm copper; calcium iodate to provide 0.6 ppm iodine; selenium yeast to provide 0.3 ppm selenium on a dry matter basis; as well as ascorbic acid, *Aspergillus oryzae* fermentation product, *Lactobacillus acidophilus* fermentation product, and *Enterococcus faecium* fermentation product. Thereafter, PN Finisher was included in the total mixed ration at the rate of 20 g/animal daily: 10.7 ppm Zn; manganese proteinate to provide 7.1 ppm manganese; cobalt proteinate to provide 1.2 ppm cobalt; copper proteinate to provide ppm mg/kg copper; calcium iodate to provide 0.6 ppm iodine; selenium yeast to provide 0.3 ppm selenium on a dry matter basis; as well as ascorbic acid, *Aspergillus niger* fermentation product, *Lactobacillus acidophilus* fermentation product, and *Enterococcus faecium* fermentation product. Both supplements were premixed into a ground corn carrier and subsequently blended into the total mixed ration.

Table 2. Interaction least squares means of trained sensory panel scores¹ of steaks from steers fed conventional diets or Alltech PN² program with and without exogenous growth promotants (EGPs)

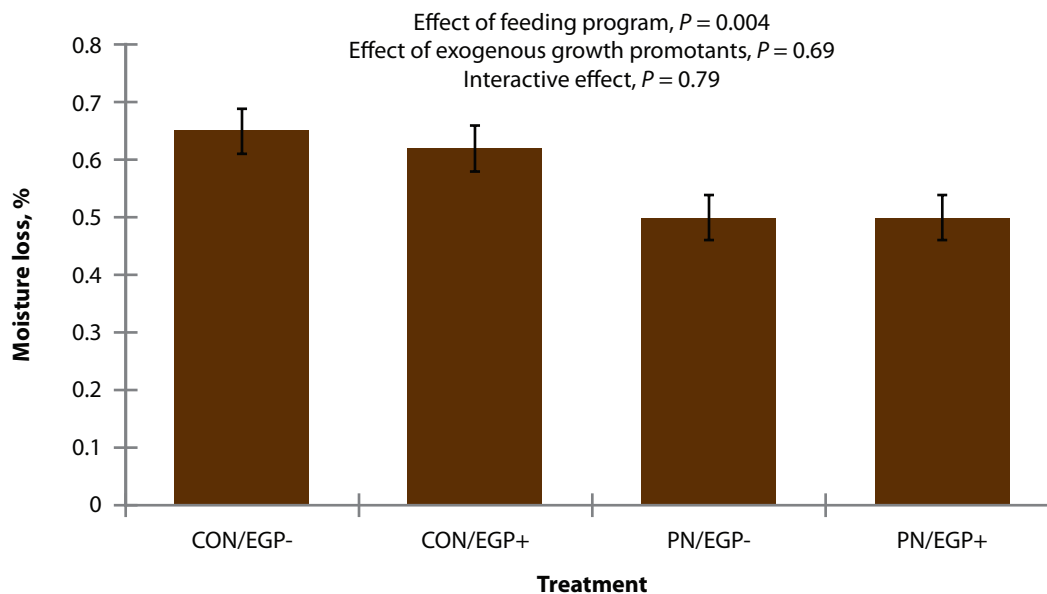
Item	Conventional		Alltech PN		SEM	P-value		
	EGP-	EGP+	EGP-	EGP+		Program	EGP	Program × EGP
Myofibrillar tenderness	5.59 ^{ay}	5.36 ^b	5.77 ^{ax}	5.03 ^c	0.09	0.30	< 0.01	0.01
Juiciness	5.21	5.02	5.12	4.97	0.07	0.18	0.003	0.70
Beef flavor intensity	5.28	5.30	5.23	5.26	0.05	0.39	0.62	0.96
Connective tissue amount	6.51 ^a	6.44 ^a	6.71 ^b	6.18 ^c	0.08	0.75	< 0.01	0.01
Overall tenderness	5.59 ^a	5.37 ^b	5.80 ^c	5.00 ^d	0.09	0.27	< 0.01	< 0.01
Off-flavor intensity	7.70	7.68	7.65	7.61	0.05	0.24	0.57	0.84

¹Myofibrillar tenderness (1 = extremely tough, 8 = extremely tender); juiciness (1 = extremely dry, 8 = extremely juicy); beef flavor intensity (1 = extremely bland, 8 = extremely intense); connective tissue amount (1 = abundant, 8 = none); overall tenderness (1 = extremely tough, 8 = extremely tender); off-flavor intensity (1 = abundant, 8 = none).

²Alltech; Nicholasville, KY.

^{a,b,c,d} Values within a row with different letters are significantly different ($P < 0.05$).

^{xy} Values within a row with different letters tend to be different ($P < 0.10$).

**Figure 1. Beef strip loin moisture loss during wet-aging for 14 days.**

CON/EGP- = conventional feeding program; CON/EGP+ = conventional feeding program with exogenous growth promotants; PN/EGP- = Alltech Programmed Nutrition (PN) program with no exogenous growth promotants; PN/EGP+ = Alltech PN program with exogenous growth promotants.

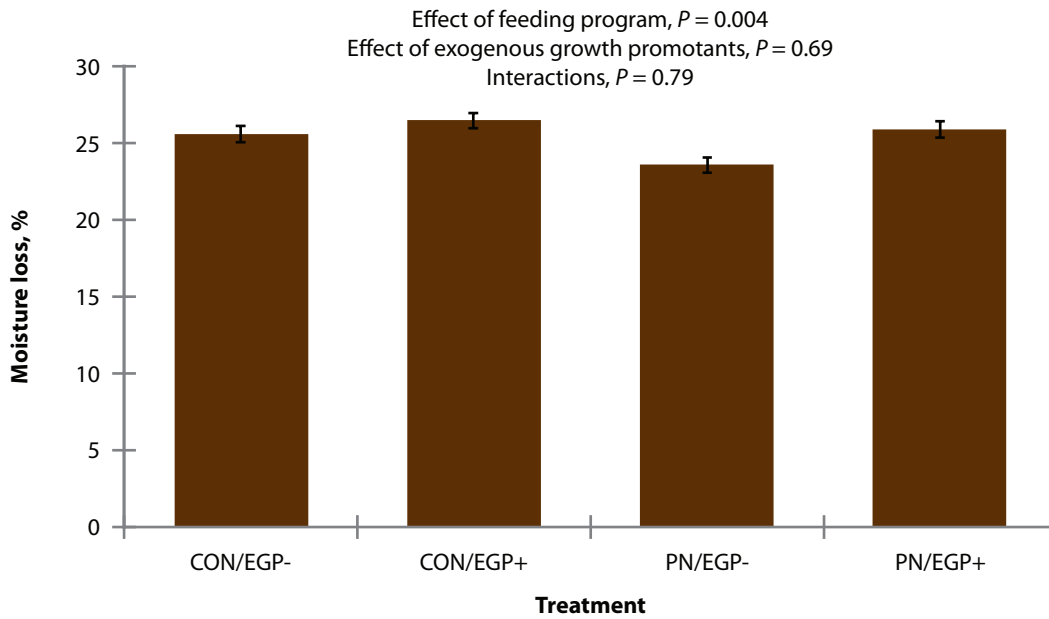


Figure 2. Moisture loss during cooking.

CON/EGP- = conventional feeding program; CON/EGP+ = conventional feeding program with exogenous growth promotants; PN/EGP- = Alltech Programmed Nutrition (PN) program with no exogenous growth promotants; PN/EGP+ = Alltech PN program with exogenous growth promotants.

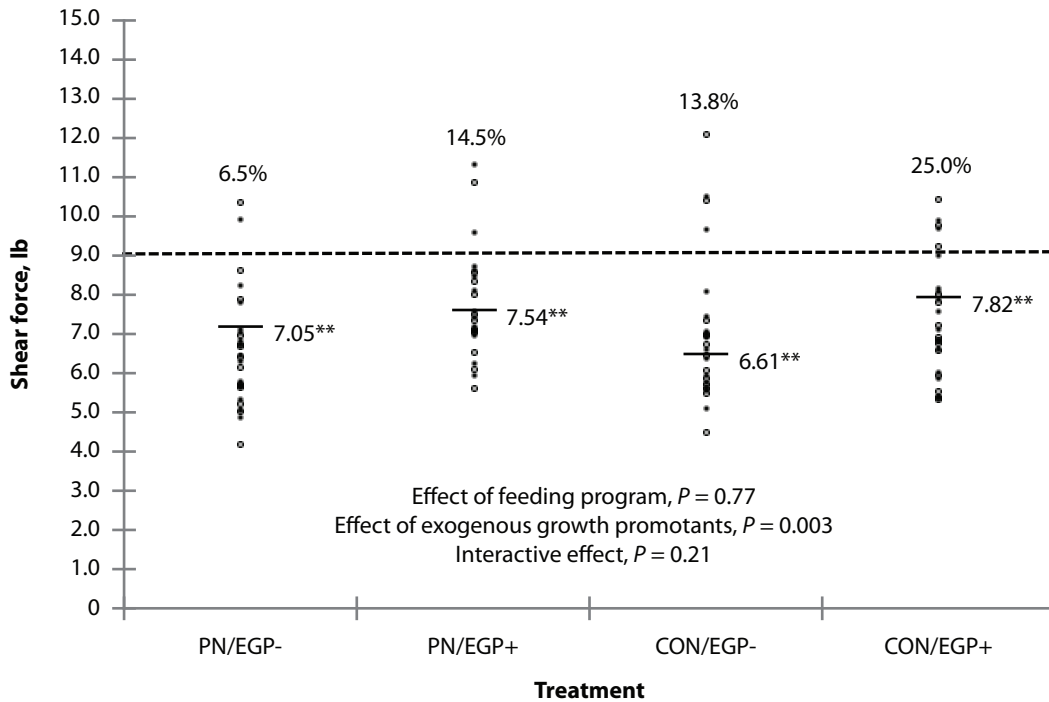


Figure 3. Tenderness of strip loin steaks wet-aged for 14 days.

CON/EGP- = conventional feeding program; CON/EGP+ = conventional feeding program with exogenous growth promotants; PN/EGP- = Alltech Programmed Nutrition (PN) program with no exogenous growth promotants; PN/EGP+ = Alltech PN program with exogenous growth promotants.