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Feeding Transgenic (*Bt* Corn Rootworm Protected and Roundup-Ready®) Corn to Feedlot Cattle

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Feeding two transgenic corn hybrids (*Bt* corn rootworm protected and Roundup Ready®) had no effect on feedlot performance or carcass characteristics when compared with non-transgenic reference and control hybrids.

Summary

Two finishing trials were conducted to evaluate the effect of feeding corn root worm protected (Bt) and Roundup Ready® (RR) corn hybrids on animal performance and carcass characteristics in the feedlot. Two commercially available non-genetically engineered reference hybrids, and the non-transgenic control hybrid were compared to the two genetically enhanced hybrids. No significant differences were observed on animal performance or carcass characteristics for either trial as a result of corn source in feed.

Introduction

The introduction of transgenic plants into modern agriculture has had a significant effect on management plans for a variety of agronomic crops grown in the United States. The use of genetically enhanced corn, cotton and soybeans has allowed producers to reduce their use of chemicals and minimize tillage. This technology has also led to the development of new herbicides and insecticides that have zero or minimal residue in the soil. These factors have led modern agriculture to become more efficient and more environmentally conscious.

According to National Ag Statistic Service (NASS, 2000) the livestock industry uses 60% of the corn that is grown in the United States annually, with the beef feedlots using the highest percentage among all livestock. Therefore, if 60% of the corn grown in the United States is fed to livestock, and 33% of the corn is genetically enhanced, this results in tremendous number of feedlot cattle that use transgenic corn. It is important for livestock producers to know if cattle fed biotech corn will perform similar to animals fed non-transgenic corn.

The objectives of these research studies were to compare the performance and carcass characteristics of finishing steers fed corn root worm protected corn (event MON863), or Roundup Ready® corn (event nk603) with their genetically related non-transgenic hybrid, or to the average of two non-transgenic commercial reference hybrids.

Procedure

Animals

Two-hundred crossbred steer calves (706 lb) were used in the Roundup Ready® (RR) trial, which was conducted during the winter and early spring of 2001. Two hundred crossbred yearling steers (805 lb) were used in the corn root worm protected corn (*Bt*) trial which was conducted during the fall and early winter of 2001 and 2002. The cattle were purchased in the fall of 2000, received and backgrounded on stockpiled smooth bromegrass pastures (45 days), with RR steers then entering the feedlot, and *Bt* steers managed in a conventional yearling production system (corn stalk grazing, limit fed drylot, summer pasture grazing). Prior to the initiation of the feeding period both groups were limit fed at 2% of body weight for five days. Steers on the RR trial were implanted with Ralgro® on day one of the trial, and were reimplanted with Revelor-S® on day 56. Steers on the *Bt* trial were implanted with Revelor-S® on day 28.

Limit fed weights were taken for steers on both trials two days before the initiation of the feeding period. Both trials were analyzed as a completely randomized design, therefore animals were stratified by weight, and assigned randomly to one of 20 pens (10 steers/pen). Pens were then assigned randomly to treatment (5 pens/treatment).

Diets

Treatments for the RR trial consisted of the two reference hybrids, DK647 (Ref1), RX740 (Ref2), the genetically related non-transgenic hybrid RX670 (PAR) and the Roundup Ready® hybrid nk603 (RR). Treatments for the *Bt* trial were similar to the treatments on the RR trial. However, the Roundup Ready® hybrid was substituted with the corn root protected hybrid MON863 (*Bt*). All corn was grown at the Agricultural Research and Development Center near Mead, Neb. After harvest, all corn hybrids were stored separately on site to minimize any cross contamination. Samples of all hybrids were taken and sent to Monsanto Company, where the presence/absence of the genes were verified.

Diets for the RR and *Bt* trials are presented in Table 1. Steers on the RR trial were adapted to the final diet for 28 days, while steers on the *Bt* trial were adapted to the final diet for 21 days. Adjustments to the diet for adaptation

Table 1. Finishing diet composition (% of DM) for Roundup Ready® and *Bt* trials.

Ingredient	Roundup Ready® Trial (% of Diet DM)	*Bt* Trial (% of Diet DM)
Dry rolled hybrid[a]	79.5	77.5
Steep liquor	10.0	10.0
Alfalfa hay	7.5	7.5
Dry supplement[b]	3.0	5.0
Fine ground milo	0.85	2.50
Limestone	1.39	1.60
Urea	0.29	0.45
Salt	0.30	0.30
Tallow	0.10	0.10
Trace mineral premix[c]	0.03	0.05
Rumensin premix[d]	0.016	0.017
Tylan premix[e]	0.013	0.012
Vitamin A, D, E premix[f]	0.010	0.010

[a]Reference hybrid DK647, Reference hybrid NK740, Near isogenic parental hybrid RX670, or Roundup Ready® hybrid nk603 (Roundup Ready® trial) or hybrid MON863 (*Bt* trial).
[b]Supplement formulated to be fed at 3% (Roundup Ready® trial) or 5% (*Bt* trial) of diet DM.
[c]Premix contained 10% Mg, 6% Zn, 4.5% Fe, 2% Mn, 0.5% Cu, 0.3% I, 0.05% Co.
[d]Premix contained 80 g/lb monensin.
[e]Premix contained 40 g/lb tylosin.
[f]Premix contained 1500 IU vitamin A, 3000 IU vitamin D, 3.7 IU vitamin E per g.

Table 2. Roundup Ready® finishing trial animal performance[a].

	REF1	REF2	PAR	RR®	SE	F-test[b]
Initial wt, lb	706	707	705	707	0.83	0.24
Final wt, lb[c]	1288	1270	1296	1270	13.38	0.33
Carcass wt, lb	811	800	817	800	8.37	0.42
DMI, lb/day	24.4	23.9	23.9	23.9	0.27	0.42
ADG, lb/day	4.04	3.91	4.11	3.91	0.09	0.39
Feed:gain[d]	6.10	6.13	5.82	6.12		0.22
Marbling[e]	533	544	539	541	9.16	0.85
12th rib fat, in	0.62	0.62	0.58	0.56	0.02	0.20
REA, in^2	13.59	13.37	13.91	13.30	0.24	0.30

[a]REF1= reference hybrid DK647, REF2=reference hybrid NK740, PAR=near isogenic parental hybrid RX670, and RR®=Roundup Ready® hybrid hK603.
[b]F-test p-value for treatment effect due to corn hybrid.
[c]Based on hot carcass weight adjusted to a 63% common yield.
[d]Statistically analyzed as gain:feed, which is the reciprocal of feed:gain.
[e]500=Small 0, 600=Modest 0.

Table 3.*Bt* corn finishing trial animal performance[a].

	REF1	REF2	PAR	*Bt*	SE	F-test[b]
Initial wt, lb	804	807	805	808	1	0.09
Final wt, lb[c]	1331	1351	1333	1362	12	0.24
Carcass wt, lb	838	851	840	858	8	0.24
DMI, lb/day	28.0[fg]	28.8[f]	27.3[g]	28.1[fg]	0.3	0.03
ADG, lb	4.66	4.86	4.71	4.95	0.11	0.27
Feed:gain[d]	6.02	5.92	5.82	5.68		0.15
Marbling[e]	568	558	551	551	12	0.72
12th rib fat, in	0.49	0.50	0.50	0.48	0.02	0.86
REA, in^2	13.0	13.1	13.0	13.4	0.2	0.39

[a]REF1= reference hybrid DK647, REF2=reference hybrid NK740, PAR=near isogenic parental hybrid RX670, and Bt=corn root worm protected hybrid MON863.
[b]F-test p-value for treatment effect due to corn hybrid.
[c]Based on hot carcass weight adjusted to a 63% common yield.
[d]Statistically analyzed as gain:feed, which is the reciprocal of feed:gain.
[e]500=Small 0, 600=Modest 0.
[f, g]Means with unlike superscripts differ $P<0.05$.

were similar for both trials, with ground alfalfa hay replacing corn. Alfalfa hay levels were decreased from 45, 35, 25 and 15% of diet DM, for either 7 days each (RR trial) or 3, 4, 7, and 7 days (*Bt* trial). The diets were formulated to meet or exceed NRC (1996) recommendations for DIP, UIP, calcium, phosphorus and potassium. The dry supplement was formulated to be fed at 3 and 5% of the diet DM for the RR and *Bt* trials respectively, with diets containing 27 g/ton of Rumensin® and 9 g/ton of Tylan® (DM basis).

The average dry matter content of the corn hybrids was 90.2 + 0.5 %. Because the corn was low in moisture, steep liquor was added to the diet at 10% of DM to reduce dust, and potential acidosis problems, from fines separating in the feedbunk, created when corn was dry rolled.

This was a blind study for feedlot personnel. Each hybrid was assigned a letter before the initiation of the trial. Study treatments, feed sheets, commodity bays, and pen assignments were designated by letter only to minimize any treatment bias. A non-study load was mixed and fed between each load of feed to minimize the possibility of cross-contamination of the transgenic corn.

Measurements

Animals on both trials were weighed every 28 days. Feed refusals were collected every 28 days and at the discretion of the feedlot manager. Diets and feed ingredients were sampled weekly, composited monthly and sent to a commercial laboratory (DHIA Forage Laboratory, Ithaca, NY) for subsequent analysis.

Cattle were harvested at a commercial packing plant (IBP, West Point, Neb.) on day 144 for the RR trial and day 112 for the *Bt* trial. Hot carcass weight, and liver scores were taken on the day of slaughter, while REA, and 12th rib fat thickness measurements were taken after a 24 hour chill. Marbling score and yield grade were assigned to each carcass by a certified USDA grader 24 hours post harvest.

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Final weight and performance calculations are based on the hot carcass weights adjusted to a common 63% yield.

Data were analyzed as a completely randomized design using the General Linear Model procedure of SAS. A protected F-test was used to test treatment effect due to corn hybrid. If significant, a Bonferroni t-test was used to separate means.

Results

Animal performance and carcass data for the RR trial are shown in Table 2. No significant differences were observed in terms of performance or carcass characteristics for cattle on the RR trial. The average across all treatments for ADG and feed conversion were 3.99 lb/day and 6.05 respectively. The overall average across treatments for 12th rib fat thickness was .60 in, which may be an explanation for the average USDA marbling score of 539 (low choice). Overall, source of corn in the feed had little impact on any performance parameter measured in this experiment based on F-test statistics.

Animal performance and carcass data for the *Bt* trial are shown in Table 3. Based upon the F-test statistics, no significant differences were observed for initial weight, final weight, ADG, feed efficiency, hot carcass weight, 12th rib fat thickness, or marbling score between all hybrids. Dry matter intakes were significantly different ($P<0.05$). Cattle fed the REF2 hybrid had the highest DMI, followed by the *Bt*, REF1, and PAR hybrids respectively.

Cattle fed corn genetically enhanced for agronomic traits had similar performance and carcass characteristics compared to cattle fed non-transgenic corn. These data suggest feeding attributes of Roundup-Ready® and corn root worm protected corn hybrids are similar to non-transgenic corn hybrids.

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