

Feedlot Cattle Performance When Fed Silage and Grain From Second-Generation Insect Protected Corn, Parental Line or Reference Hybrids

Barry M. Weber
Brandon L. Nuttelman
William A. Griffin
Josh R. Benton
Galen E. Erickson
Terry J. Klopfenstein¹

Summary

Feed conversion and carcass characteristics of cattle fed second generation insect-protected (Bt) corn and corn silage was compared to those fed a nontransgenic parental hybrid and two commercially available nontransgenic reference hybrids. Finishing performance and carcass characteristics were not influenced as a result of corn source.

Introduction

Insect-protected corn hybrids (Bt) made up 63% of the total corn acres in 2009, according to the United States Department of Agriculture's Economic Research Service. Monsanto has developed MON 89034 as a second generation insect protection product to provide enhanced benefits for the control of lepidopteran insect pests. MON 89034 produces Cry1A.105 and Cry2Ab2 proteins derived from *Bacillus thuringiensis*, which are active against *Ostrinia* species such as European corn borer and Asian corn borer, *Diatraea* species such as southwestern corn borer and sugarcane borer, and helps control fall armyworm and corn earworm. Since the mode of action of Cry1A.105 and Cry2Ab2 are different, the combination of the two proteins provides a much more effective insect resistance management tool. With a high percentage of the corn being fed directly to cattle in feedlots, it is vital for producers to know if cattle fed MON 89034 will perform similarly to cattle fed nontransgenic hybrids.

The objective of this study was to

compare the performance and carcass characteristics of finishing steers fed second generation insect-protected (Bt) corn (MON 89034) and corn silage with the nontransgenic parental hybrid (DKC 63-78) and the two nontransgenic reference hybrids (DKC 61-42 and DKC 62-30).

Procedure

Animals

British x Continental crossbred steers (initial BW = 639 ± 31 lb) were used in a randomized complete block design experiment. Steers (n = 240) were received at the University of Nebraska Agricultural Research and Development Center (Ithaca, Neb.) in the fall of 2009. On arrival, steers were weighed, vaccinated (Bovishield Gold 5, Somubac, Dectomax), and treated with Micotil (Elanco Animal Health). Following a 14-21 day receiving period, steers were limit fed five days to minimize variation in rumen fill. The limit fed ration contained a 1:1 ratio of wet corn gluten feed and alfalfa hay fed at 2% BW. Steers were weighed individually on two consecutive days in the morning before feeding to obtain an accurate initial BW. Steers were blocked by BW, stratified within block, and assigned randomly to pens (10 steers/pen) based on day 0 BW. Pens were assigned randomly to one of four treatments.

Treatments

Treatments consisted of two reference hybrids, a genetically related nontransgenic hybrid, and the second generation Bt hybrid (MON 89034). All corn was grown at the Agricultural Research and Development Center near Ithaca, Neb. under identity preserved methods. All hybrids were cut for silage at similar moisture levels

(34.2% DM ± 2.1%) and stored in silo bags by hybrid. Corn was stored in bins by hybrid prior to dry rolling, at which time the hybrids were stored in separate commodity bays. Samples of all hybrids were collected and sent to Monsanto Company where the presence or absence of the genes was verified.

Steers were adjusted to the final diet over 21 days, with ground alfalfa hay replacing corn. Alfalfa hay levels were decreased from 37.5%, 27.5%, 17.5%, and 7.5% for 3, 4, 7, and 7 days. Final diets are shown in Table 1 and contained 65.0% DRC, 15.0% corn silage, 15.0% WDGS, and 5.0% supplement.

Prior to initiation of the study, samples of corn and corn silage were collected and sent to a commercial laboratory (Romer Labs, Union, Mo.) to test for the presence of mycotoxins. Small amounts of Zearalenone and Deoxynivalenol (Vomitoxin) were found in the test hybrid (MON) and the nontransgenic parental hybrid (PAR) corn silage. Small amounts of Deoxynivalenol were also detected in all samples of whole corn, as well as Zearalenone and Fumonisin B1 and B2 in DKC 62-30 (REF2). In all samples, the levels of mycotoxins detected were well below the level of concern. Ingredient and diet samples were collected weekly, composited by month, and sent to a commercial laboratory (Dairy One, Ithaca, N.Y.) for nutrient analysis.

Individual BW was collected on day 0 and day 1 of the trial. Steers were implanted with Revalor-IS on day 1 and reimplanted with Revalor-S on day 84. All steers were slaughtered on day 175 at Greater Omaha (Omaha, Neb.). Hot carcass weight (HCW) and liver abscess data were recorded on the day of slaughter. After a 48-hour chill, USDA marbling score, 12th rib fat thickness, and LM area were

Table 1. Diet ingredient and nutrient composition (% DM).

Ingredient ¹	MON	PAR	REF1	REF2
Corn W				65.0
Corn X	65.0			
Corn Y		65.0		
Corn Z			65.0	
Corn Silage W				15.0
Corn Silage X	15.0			
Corn Silage Y		15.0		
Corn Silage Z			15.0	
WDGS	15.0	15.0	15.0	15.0
Supplement				
Fine Ground Milo	2.300	2.300	2.300	2.300
Limestone	1.681	1.681	1.681	1.681
Salt	0.300	0.300	0.300	0.300
Urea	0.400	0.400	0.400	0.400
Potassium Chloride	0.099	0.099	0.099	0.099
Tallow	0.125	0.125	0.125	0.125
Trace Mineral	0.050	0.050	0.050	0.050
Vitamin A-D-E	0.015	0.015	0.015	0.015
Rumensin-80	0.019	0.019	0.019	0.019
Tylan-40	0.011	0.011	0.011	0.011
Nutrient Composition				
CP	13.4	13.3	12.3	13.6
NDF	15.5	16.6	14.9	16.5
Ca	0.58	0.64	0.56	0.62
P	0.35	0.36	0.32	0.36
K	0.53	0.56	0.55	0.58

¹REF1 = reference hybrid DKC 61-42, REF2 = reference hybrid DKC 62-30, PAR = nontransgenic parental hybrid, MON = corn and corn silage containing Cry1A.105 and Cry2Ab2 proteins (MON 89034).

Table 2. Animal performance¹.

Variable	MON 89034	Parental	Reference 1	Reference 2	P-value
Performance					
Initial BW, lb	638	640	637	639	0.02
Final BW, lb ²	1294	1290	1293	1287	0.94
DMI, lb/day	22.3	22.6	21.9	22.5	0.96
ADG, lb	3.74	3.71	3.75	3.70	0.31
Feed:Gain ³	5.97	6.09	5.85	6.07	0.13
Carcass Characteristics					
HCW, lb	815	813	815	811	0.93
Marbling score ⁴	573	561	581	565	0.55
12 th rib fat, in	0.51	0.49	0.53	0.52	0.82
LM area, in ²	13.0	13.1	13.0	12.9	0.70
Calculated YG ⁵	3.21	3.13	3.24	3.22	0.78
% Choice	79.6	71.7	74.1	68.3	0.41

¹REF1 = reference hybrid DKC 61-42, REF2 = reference hybrid DKC 62-30, PAR = nontransgenic parental hybrid, MON = corn rootworm resistant hybrid MON 89034.

²Final weight calculated as hot carcass weight divided by 0.63.

³Analyzed as gain:feed, reported as feed:gain.

⁴500 = Small 0, 600 = Modest 0.

⁵YG calculation = $2.50 + (2.5 \times 12^{\text{th}} \text{ rib fat thickness}) - (.32 \times \text{LM area}) + (.2 \times \text{KPH} (2.5)) + (.0038 \times \text{HCW})$.

collected. Hot carcass weights were used to calculate adjusted final BW by dividing HCW by a common dressing percentage of 63%. Average daily gain and G:F were determined from adjusted final BW. Data were analyzed as G:F and reported as F:G.

One steer from the transgenic test

treatment (MON) and one from DKC 61-42 (REF1) treatment died from non-treatment related illnesses during the trial. One steer from REF1 was removed from the study for a reason not related to the treatment.

Data were analyzed using the MIXED procedures of SAS (SAS

Institute, Cary, N.C.). Pens were the experimental unit (6/treatment). Block was treated as a fixed effect in the model. Only 1 replication was included in heavy block, with 5 replications in the other weight block. Therefore, data were analyzed and statistics are based on this analysis. However, least square means are not presented due to adjustment for unequal replication of blocks. Arithmetic means are presented by treatment.

The study was blind to feedlot personnel. Each hybrid was assigned a letter before beginning the trial. All treatments, silage bags, commodity bays, pen assignments, feed sheets, and observation documents were designated by letter to limit possible partiality to treatment.

Results

Performance and carcass data are shown in Table 2. No significant differences in ADG, F:G, or carcass characteristics were observed among treatments. Due to a statistical difference in initial BW (3 lb difference), initial BW was used as a covariate of analysis and unadjusted treatment means are reported. The average across all treatments for ADG and F:G were 3.73 and 6.00, respectively. Steers fed MON and REF1 had numerically better F:G ratios, with a tendency ($P = 0.13$) for more efficient feed conversion in steers fed REF1.

The source of corn, whether transgenic or nontransgenic, had no significant effect on the performance or carcass characteristics of the cattle in this trial. These data indicate performance and carcass characteristics of cattle fed MON 89034 were not different from cattle fed nontransgenic corn. MON 89034 is nutritionally equivalent to nontransgenic corn.

¹Barry M. Weber, graduate student; Brandon L. Nuttelman, research technician; William A. Griffin, research technician; Josh R. Benton, previous research technician; Galen E. Erickson, professor; Terry J. Klopfenstein, professor, University of Nebraska–Lincoln Department of Animal Science.