Impact of Inoculating Corn Silage with Buchnerii 500 on Feedlot Cattle Performance with or without Added Yeast Product at Time of Feeding

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Summary

Inoculant, Biotal® Buchneri 500, was used to evaluate effects of silage inoculant on feedlot cattle performance and the inclusion of a yeast product, Levucell-SC. Silage was fed at 15 or 40% inclusion so overall treatment structure was a 2 × 2 × 2 factorial arrangement of treatments. Numerous 3-way interactions were observed, but appear due to inconsistent patterns of treatment effects. Feeding silage at 40% increased DMI, decreased ADG, and increased F:G compared to feeding 15% silage. Inoculant or feeding Levucell-SC did not improve performance.

Introduction

Numerous studies have evaluated the effects of bacterial inoculants on silage fermentation, dry matter recovery, and aerobic stability. Fewer experiments evaluate how bacterial inoculants affect digestibility. However, very little has been done to determine if bacterial inoculants affect performance and carcass characteristics of feedlot cattle.

Most studies with yeast cultures have been completed with dairy cattle and how yeast cultures affect dairy cattle milk production and composition. Little work has been done to evaluate yeast cultures in feedlot cattle and impact on performance or carcass characteristics. The objective of our study was to evaluate the impact of using Biotal® Buchneri 500 as an inoculant with or without a yeast product (Levucell-SC) added at feeding on feedlot performance and carcass characteristics when silage was fed at 15 or 40% of diet DM.

Procedure

Corn silage from two fields under irrigation was harvested using a silage chopper on September 10, September 13, and September 14, 2013 (the break was due to rain and inability to enter the field). Two silage treatments were applied to silage at harvest in sequential loads by turning on or off the inoculator system, mixing all hybrids between the two treatments. Treatments were no inoculant (CON) or Biotal® Buchneri 500 (B500) (Lallemand Animal Nutrition) applied at 500,000 CFU/g of silage. This allowed for 100,000 CFU/g of *Pediococcus pentosaceus 12455* and 400,000 CFU/g of *Lactobacillus buchneri 40788*. Separate trucks were used to deliver each treatment of silage to avoid cross contamination, and each truck was weighed and a sample taken from each load for analysis. The silage was packed into individual bunkers, covered with silage plastic, and weighted down with tires at the end of harvest. Individual samples from each load were mixed and sampled. Half the sample was placed into a bucket of composited samples by harvest day and treatment. The remaining half of the sample was quartered and divided for DM analysis using a forced-air oven at 140°F, freeze drying for nutrient analysis, and DM analysis using toluene displacement. Density testing was completed at three points during the feeding period (May 16, 2014; July, 10, 2014; August 26, 2014), to reflect the first quarter of the bunker, middle of the bunker, and last quarter of the bunker. On d 153 post ensiling, core samples, of approximately 340 g were taken from each of the bunkers, transported to the lab, frozen and sent to DairyOne for testing of DM, VFA analysis, pH, and CP. Feeding began May 8, 2014 or 236 d post ensiling. On May 20, 2014, weekly samples were taken shortly after feeding was complete for the day. Samples were weighed, mixed and subsampled for freeze drying, toluene displacement, oven dry matters at 140°F in a forced-air oven, and compositing at the conclusion of the trial. At the end of the feeding trial, samples were composited by weeks 1–3, 4–7, 8–11, and 12–15. These composites were stored overnight in the freezer and shipped to DairyOne for silage nutrient analysis (DM, VFA analysis, pH, CP, and ammonia content).

The feeding trial was set up in a 2 × 2 × 2 factorial arrangement (Table 1), using 320 steers, beginning May 7, 2014 (d 0). The first factor was the control (no inoculant) versus silage inoculated with Biotal® Buchneri500 (B500; Lallemand Animal Nutrition). The second factor was feeding both silage types at 15% or 40% inclusion of diet DM. The final factor was adding a yeast product (Levucell SC, Lallemand Animal Nutrition) or not. Levucell SC (LEV) is a live yeast product containing *Saccharomyces cerevisiae* I-1077, and was fed at a rate of 0.5 oz/steer daily (14 g). Steers were blocked by BW into light (1), middle (2), and heavy (2) weight blocks, stratified by BW and assigned randomly to one of 40 pens, with pens assigned randomly to 1 of 8 dietary treatments. There were eight treatment diets with five replications per treatment and eight steers per pen. Steers were limit-fed at approximately 2% BW on a 50% alfalfa and 50% Sweet Bran diet for 5 d, followed by weighing two consecutive days and averaged for initial BW. Steers were implanted with Revalor-200 (Merck Animal Health) and sorted into treatment pens on May 8 (d 1). Following initial weighing, steers were adapted to treatment diets over a period of 22 days. All pens were weighed and shipped on the afternoon of September 2, 2014 and harvested in the morning on September 3, 2014. Hot carcass weight, liver scores for abscesses and kill order were recorded on the day of harvest. After a 48-h chill, fat thickness, LM area, and marbling score were measured. Dry matter intake was calculated from the amount fed and the amount of feed rejected by each pen, corrected for DM. Using the limit-fed initial BW and carcass-adjusted final BW, ADG

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Table 1. Diet composition of feedlot cattle finishing trial on a DM basis

Silage Inclusion:	15				40			
Inoculant:[a]	CON	CON	B500	B500	CON	CON	B500	B500
Levucell SC:	–	+	–	+	–	+	–	+
MDGS[b]	30	30	30	30	30	30	30	30
Corn (HMC)[b]	51	51	51	51	26	26	26	26
Silage CON	15	15	0	0	40	40	0	0
Silage B500	0	0	15	15	0	0	40	40
Supplement								
Gr. Corn	1.84	1.70	1.84	1.70	1.84	1.70	1.84	1.70
Limestone	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
Tallow	0.30	0.10	0.30	0.10	0.30	0.10	0.30	0.10
Salt	0.10	0.30	0.10	0.30	0.10	0.30	0.10	0.30
Beef Trace Min[c]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Vitamin A-D-E[d]	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Rumensin-90[e]	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Tylan-40[f]	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Levucell SC[g]	—	0.14	—	0.14	—	0.14	—	0.14

[a]CON = Silage with no Inoculant, B500 = Silage inoculated with Biotal® Buchneri 500
[b]MDGS = Modified distillers grains with solubles, HMC = High moisture corn
[c]Mineral Pre-mix contains: 6.0% Zn, 5.0% Fe, 4.0% Mn, 2.0% Cu, 0.29% Mg, 0.2% I, 0.05% Co.
[d]Vitamin Pre-mix contains: 30,000 IU vitamin A, 6,000 IU vitamin D, 7.5 IU vitamin E per gram.
[e]33.0 mg/hd/d
[f]90.0 mg/hd/d
[g]14.8 g/hd/d

Table 2. Change in inoculated (B500) or not (CON) silage nutrient and acid profile[a]

Treatment	% DM	pH	% Crude Protein	Lactic Acid %[b]	Acetic Acid %[b]	Propionic Acid %[b]	Butyric Acid %[b]
CON	35.5	3.88	8.9	3.98	4.03	0.64	0.01
B500	36.5	3.91	8.9	3.47	4.31	0.60	0.01

[a]DairyOne results
[b]As a percent of total dry matter

was calculated. Carcass-adjusted final BW was calculated by HCW/0.63. Dressing percent was calculated as HCW divided by final live BW (pen weight/number in pen) multiplied by 0.96.

No statistical analysis was performed on the silage nutrient data due to lack of bunker replication. Performance and carcass characteristics were analyzed using the MIXED procedures of SAS (SAS Institute, Inc., Cary, N.C.) as a randomized block design. Pen was the experimental unit and block was treated as a fixed effect. Treatments were evaluated for 3-way and 2-way interactions, and main effects.

Results

Corn Silage Composition

At the time of ensiling, DM averaged 37.8 percent. Dry matter percentage across the feeding period averaged 35.5% for CON and 36.5% for B500. After fermentation, the pH of both silages was 3.9. Percent crude protein was 8.9 percent for both silages (Table 2). Lactic acid content was greater for CON at 4.0% compared to 3.5% for B500. The acetic acid percentage was higher for B500 silage (4.31%) than CON (4.03%). Silage recovery (% of initial DM weight accounted for in DM weight) was 86.9% for CON and 85.2% for B500. The DM densities were 16.6 and 17.3 lb/ft^3 for CON and B500, respectively.

Performance

A three way interaction ($P < 0.05$) between inclusion, inoculant, and Levucell for final live BW, HCW, calculated ADG, F:G, and dressing percent (Table 3) was observed. Greater inclusion of silage (i.e., 40% vs. 15%) in the diet increased DMI ($P < 0.01$). There was no effect of silage inoculant on DMI ($P = 0.84$), and no effect of Levucell on DMI ($P = 0.90$). A 3-way interaction ($P < 0.01$) was observed for ADG and G:F between inclusion level, inoculant, and LEV. The interaction was due to CON with LEV and B500 without LEV being greatest when fed at 15%, yet the lowest when fed at 40% relative to the other combinations of treatments. In general, no consistent positive performance effects were observed where B500 silage or feeding LEV. Treatments with silage at 15% inclusion, CON with LEV and B500 without LEV, numerically had the greatest ADG. However, the previous difference was only significantly greater from those fed B500 with LEV. Within 40% silage inclusion, no treatments were significantly different from one another. A 3-way interaction was observed ($P = 0.01$) for F:G, which mimicked ADG. Feeding silage at 40% increased F:G compared to 15% silage, but main effects for B500 and LEV were non-significant.

Final live BW was numerically greatest for cattle fed CON silage at 15% inclusion with LEV. However this was not significantly different from the groups fed the CON silage at 15% without LEV, B500 at 15% without LEV, CON fed at 40% without LEV, or B500 at 40% with LEV ($P > 0.10$). Cattle fed the treatment containing CON silage fed at 40% with LEV had the numerically lowest final live BW.

Carcass Data

A three way interaction ($P < 0.05$) between inclusion, inoculant, and Levucell for HCW and dressing percentage was observed. Hot carcass weights followed a similar pattern as final live BW. Amount of silage was a significant main effect, but no other main effects or 2-way interactions were significant. In general, when

Table 3. Feedlot performance results for steers feed inoculated silage (B500) or not (CON) with Levucell (+) or not (–)

Inclusion	15				40				SEM	3-WAY	Main Effects[a]		
Incoculant	CON	CON	B500	B500	CON	CON	B500	B500					
Levucell	–	+	–	+	–	+	–	+			Incl	Inoc	Lev
Initial BW, lb	919	922	920	919	921	919	921	921	0.94	0.06	0.30	0.65	0.45
Final live BW, lb	1409^{cdef}	1433^{c}	1434^{cd}	1413^{def}	1424^{cdef}	1415^{f}	1435^{ef}	1428^{cde}	8.7	< 0.01	0.03	0.69	0.53
DMI, lb/d	26.6	27.2	27.0	26.8	28.1	27.7	27.7	27.9	0.40	0.22	< 0.01	0.84	0.90
ADG, lb	3.98^{cde}	4.17^{c}	4.17^{c}	3.94^{de}	4.00^{cde}	3.79^{e}	3.92^{c}	4.01^{cde}	0.08	< 0.01	0.02	0.85	0.50
F:G	6.71^{cde}	6.49^{c}	6.49^{c}	6.80^{def}	7.04^{efg}	7.30^{g}	7.09^{fg}	6.94^{efg}	—	0.01	< 0.01	0.60	0.42
HCW, lb	870^{cdef}	885^{c}	884^{cd}	867^{def}	872^{cdef}	856^{f}	867^{ef}	873^{cde}	5.8	< 0.01	0.03	0.66	0.53
Dressing %	61.7^{c}	61.8^{c}	61.6^{c}	61.4^{c}	61.3^{cd}	60.5^{de}	60.4^{c}	61.1^{cde}	0.27	0.03	< 0.01	0.34	0.76
LM area, in[b]	13.52	13.56	13.44	13.33	13.49	13.17	13.50	13.49	0.24	0.52	0.78	0.98	0.56
Fat Depth, in	0.61	0.57	0.57	0.59	0.58	0.56	0.54	0.53	0.027	0.45	0.12	0.18	0.54
Marbling [b]	470	457	472	471	448	448	443	469	17	0.78	0.20	0.49	0.81

[a]P-values for 3-way interaction, and main effects of silage inclusion (Incl), silage inoculate (Inoc), and feeding yeast (Lev). All 2-way interactions were not significant ($P > 0.33$).
[b]300 Slightly Abundent; 400 Small; 500; Modest
[cdefg]Numbers with differing letters are significantly different.

silage was included at 15% of the diet, cattle consuming the CON with LEV and the B500 without LEV had the greatest HCW. At 40% corn silage inclusion, steers consuming the CON without LEV diet and the B500 with LEV had numerically greatest HCW. There was a significant 3-way interaction, in addition to a main effect of silage inclusion level for dressing percent. Dressing percent was numerically greatest for the treatments with 15% inclusion CON with LEV (61.8%); however, this was not significantly different from other treatments within 15% silage inclusion ($P > 0.20$). The dressing percent in these diets averaged 61.6%. At 40% silage inclusion, CON without LEV and B500 with LEV were not significantly different from treatments with 15% inclusion ($P \geq 0.10$). Steers fed 40% silage generally had lower dressing percent, likely due to gut fill.

Conclusions

The lack of composition differences between the B500 silage and CON silage may be why the feeding trial results were similar. At 15% silage inclusion without an inoculant, feeding Levucell SC numerically improved ADG and F:G, but not statistically. When silage was inoculated with Biotal® Buchneri500, the addition of Levucell SC was not beneficial for ADG and F:G, and had lower HCW and dressing percent. At 40% silage inclusion, the opposite trend was observed. No inoculant with no Levucell SC had numerically improved performance, but not statistically. But with inoculant Buchneri500, the addition of Levucell SC numerically increased performance, but not significantly. If silage is fed at only 15% of diet DM, it is unlikely that inoculation would impact performance. A lack of major impacts of inoculation when 40% silage is fed on F:G suggests little impact would be expected. Based on density testing, and nutrient profiles, silages used in these studies were ensiled appropriately and fermentation was typical.

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