CATTLE FEEDERS' DAY 1993

Report of Progress
684

Agricultural Experiment Station
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Garden City

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General Procedures for Feeding Trials

Unless otherwise specified in individual reports contained herein, the following represent standard operating procedures for experiments reported.

Animal Receiving and Processing:

Cattle were individually weighed and ear-tagged immediately upon arrival. Processing, which occurred 24 to 48 hours later, consisted of implanting and treatment for endo- and ectoparasites with a dewormer drench or injectable and pour-on insecticide, respectively. Animals were vaccinated against IBR, BVD, PI_3 (modified-live vaccine), and BRSV in combination with five strains of *Leptopomona* and(or) *Haemophilus somnus* and injected with a 7-way clostridial bacterin. Revaccination against respiratory diseases was performed approximately 14 days after initial vaccination. Horns were tipped and(or) removed to poll and castrations were performed as needed.

Animal Weights and Slaughter:

Initial weights, except where specifically stated, were off-truck weights adjusted to pay weight. Interim weights to monitor trial progress were single-day, individual, early morning, 'full live' weights taken approximately every 28 days. Final full live weights were obtained on 2 consecutive days. Animals were generally shipped and slaughtered on the same morning that the second, final, full live weight was taken. Liver abscess and hide pull scores were taken at slaughter. Carcass characteristics were obtained following a 24-hour chill.

Animal Feeding:

All cattle were fed once daily from a truck-mounted mixer-feeder equipped with programmable scales and printers. Generally, cattle in a finisher trial were stepped-up to a final diet within 14 days. Steam-flaked grains and rolled grains were processed through an 18 X 24 inch Ross roller mill. Intended flaking densities for milo, corn, and wheat were 26, 28, 39 lbs/bu, respectively. Micro-ingredients were added to the daily ration at mixing by way of a computer-operated, automatic flushing, weigh machine.

EFFECT OF CORN SILAGE LEVEL ON FEEDLOT PERFORMANCE, CARCASS MERIT, AND INCIDENCE OF LIVER ABSCESSES OF BEEF STEER CALVES

by
A. S. Freeman

SUMMARY

A 124-day finishing trial with 144 feedlot steers (avg wt 689 lb) was conducted to evaluate effects of switching the level of corn silage level in the finishing diet on performance, carcass merit, and incidence of liver abscesses. Treatments were: 1) L/L, 8% corn silage, dry matter basis, throughout; 2) L/H, 8% switched to 16% corn silage 40 days before slaughter; 3) H/H, 16% throughout; and 4) H/L, 16% switched to 8%. Final weights, adjusted to a common dressing percentage, were not different. Dry matter intake (20.5 lbs) was not affected by treatments. Overall ADG was improved 6.3% (P<.08) by L/H compared with other treatments. Cumulative feed conversion was similar for L/L and H/L (avg of 5.99). However, L/H required 10% less feed per unit gain compared with H/H and 5% less feed per unit gain compared with L/L and H/L (P<.08). The H/H steers had the poorest feed conversion; a 4% depression compared with L/L and H/L steers (P<.08). Carcass merit was not affected by treatments. Liver abscess score was improved with increasing corn silage (P<.02). Liver condemnation was similar for L/H and H/H (13.9%), but was 2.4 times greater (P<.06) for L/L and H/L (33.3%), which were similar. Liver condemnation for beef steer calves was decreased with increasing corn silage 40 days before slaughter, but feedlot performance and carcass merit were minimally affected.

INTRODUCTION

High concentrate finishing diets (>85%) often cause recurring short periods of greatly reduced rumen pH and high accumulations of lactic acid. The resulting condition can cause subacute acidosis, which is believed to throw animals off feed and elevate incidence of liver abscesses. Increasing roughage level and(or) feeding the antibiotic tylosin are two management practices used to control subacute acidosis and reduce incidence of liver abscesses. Traditionally, finishing diet roughage levels remain low and constant throughout the finishing period, once animals are accustomed to a high concentrate diet. Increasing roughage levels are perceived to decrease performance and increase cost of gain. Additionally, feeding subtherapeutic levels of antibiotics is causing concern about possibly selecting for resistant bacterial strains. However, it may be possible to reduce liver abscesses by increasing the roughage level for a short period of time without reducing cattle performance.

OBJECTIVES

Our main objective was to determine the effects of switching from a low or high level of silage feeding in a finishing diet to either a high or low level 40 days before slaughter on beef steer calf feedlot performance, carcass characteristics, and incidence of liver abscesses. Additionally, treatment cost of gains will be evaluated.

PROCEDURES

Cattle. One hundred forty-four crossbred steers from cattlemen in the Morton County area of southwestern Kansas were used for this trial. These calves arrived at the SWREC on December 4, 1991 and were used in a receiving trial (KAES Report of Progress #659, p. 11.) before starting the silage level trial. The calves' average starting weight for this trial was 689 lbs.

Processing. All calves were processed within 24 hours after arrival. Processing included individually weighing on 2 consecutive days, ear tagging, dehorning and castrating if necessary, and implanting with an implant containing progesterone and estradiol (Synovex-S®). Calves were vaccinated against IBR, BVD, PI_3, and BRSV in combination with five strains of *Leptopomona* (modified live virus) and(or) *Haemophilus somnus-Pasteurella* *haemolytica-multocida* bacterin and injected with a 7-way clostridial bacterin. A pour-on containing ivermectin (Ivomec®) was used to control internal and external parasites.

Weighing and Slaughter. After the 14-day receiving trial, all cattle were individually weighed on 2 consecutive days for initial weights. Interim weights, every 28 days for the first three weigh periods, were single-day, early morning, full live weights taken on each calf individually. Individual, final, full live weights were obtained on 2 consecutive days after a final 40-day weigh period. Feedlot performance was based on an average 4.75% pencil shrink on live interim weights because of muddy conditions and imposed different roughage level treatments. Cattle were slaughtered on the second final weigh-day at a local packer. Liver abscess scores were taken at slaughter. All carcass characteristics were obtained after a 24-hour chill.

Treatments. The experimental design was a completely randomized block using initial weight as the blocking factor. Three pen replicates (weight blocks) per treatment with 12 head in each pen were used. The treatments were randomly assigned to pens, with steers randomly assigned to each treatment within a weight block. Treatments were: L/L, low feeding level of corn silage (8% on a dry matter basis) throughout the finishing trial; L/H, low level of silage switched to a high feeding level (16% on a dry matter basis) 40 days before slaughter; H/H, high feeding level of silage (16%) fed throughout; H/L, high level of silage (16%) switched to a low feeding level (8%) 40 days before slaughter. Cattle on both the L/H and H/L treatments were switched to the next roughage level within 1 day. All feedlot performance and carcass data were analyzed by using pen as the experimental unit.

Rations and Feeding. Starting, step-ups, and final rations are presented in Table 1. Number of days that each ration was fed is also given with nutrient composition of each ration. Feed was provided once daily in the morning to allow for ad libitum consumption without excessive accumulation of feed. Any feed refusals were removed by first estimating their weight visually then discarding them into the pen. Daily intakes were adjusted for any feed refusals. All micro-ingredients were added to feed batches by a micro-ingredient weigh machine as the last feed batch ingredient was added. None of the rations contained tylosin, but did contain monensin (Rumensin®) at levels given in Table 1. Fresh water was provided daily via heated automatic waterers that were cleaned weekly. Ration dry matters and ingredients were sampled weekly, and a running composite within rations and ingredients was retained for nutrient analysis.

Health. Animals deemed sick and in need of medical treatment were pulled, treated according to standard SWREC procedures, and returned to their respective pens. Pen intakes were adjusted for any animals removed from the study for medical reasons or death.

RESULTS AND DISCUSSION

Dry Matter Intake. Dry matter intake (Table 2) was not affected by treatments. Throughout the trial, steers fed the high level of corn silage consumed more total feed than those fed the low level. However, total energy consumption (NEm and NEg) was nearly identical for all treatments. Corn silage level was switched on day 85 of the feeding trial. Cattle switched from the low level to the high level did not experience any depression in intake. In fact, the opposite occurred; intake gradually increased to the end of the trial. But switching cattle from the high level of corn silage to the low level did cause intake to decrease below amounts that would be considered normal for a more energy- dense ration. Possibly, the high to low switch caused some lactic acidosis, which disrupted feed intake for several days after. By the end of the trial, intake for the H/L group was greater than before the switch occurred. The initial depression in intake after the switch could probably be avoided by including an intermediate 'step-down' ration for 2 to 3 days.

Average Daily Gain. During the first 56 days, gains were similar across all treatments. On day 84, gains were similar for L/L, L/H, and H/L. Also, gains were not different for L/L, H/L, and H/H. However, ADG of L/H steers was 17.2% above ($P < .02$) the ADG of H/H steers. Cumulative 84-day gains were similar for all treatments except the H/H steers, whose gain was depressed 8% ($P < .07$). Overall cumulative average daily gain for the L/H steers was improved ($P < .08$) 6% compared to the average of the other treatment groups, which had similar gains. An increased ADG for the L/H steers was not due to fill differences, because cumulative gains were calculated on an adjusted final weight basis and L/H carcass weight averaged 15 lbs more than average hot carcass weight of other treatments. Final shrunk weight was calculated by dividing treatment hot carcass weight by an average dressing percent of 64.5%

Feed Conversion. Feed conversion was analyzed as gain to feed but will be reported as feed to gain.

Feed conversion was similar for L/L and H/L steers. The L/H steers converted 5% more feed (P < .08) to gain compared with the average conversion of the L/L and H/L steers. In addition, the L/H conversion was improved 10% above the H/H rate of conversion. The H/H steers had the poorest feed conversion, requiring 0.25 lbs more feed for every unit of gain compared with the L/L and H/L steers and 0.55 lbs more feed per unit gain compared to the L/H group. Cost of gain was calculated from the following treatment diets costs per cwt and included only feed costs; L/L $4.48, L/H $4.34, H/H $4.04, and H/L $4.18.

Carcass Merit. Carcass characteristics are given in Table 3. No treatment effects on carcass merit were detected. Hot carcass weight averaged 720 lbs, dressing percent was 64.5%, rib-eye-area 12.7 sq. in., back fat thickness 0.36 in., kidney-pelvic-heart fat percentage 2.4%, yield grade 2.55, and marbling score 5.22 (Choice -); 64.6% of the steers graded Choice or better. Hot carcass weight for the L/H steers was 15 lbs greater than the average of the other treatments.

Table 1. Ingredient and Nutrient Composition of Dietary Rations Expressed on a Dry Matter Percentage Basis

		Step-1		Step-2		Finisher[a]	
Ingredients	Initial	Low	High	Low	High	Low	High
Dry-rolled Corn	48.8	26.6	24.0	0	0	0	0
Steam-flaked Corn	0	26.1	24.0	52.2	47.6	59.5	52.7
Dry-rolled Milo	20.9	20.7	19.2	20.9	19.3	19.8	17.5
Alfalfa Hay	11.2	5.8	6.0	5.8	6.0	0	0
Corn Silage	7.4	8.0	13.3	8.1	13.4	8.0	16.1
Molasses	1.6	1.6	1.7	1.6	1.7	1.1	1.2
Pelleted Supplement[b]	7.1	7.8	8.2	7.8	8.3	7.9	8.5
Special Tallow[c]	3.0	3.4	3.6	3.4	3.6	3.8	4.1
Days Ration Fed	6	6	6	6	6	106	106
Nutrients							
Dry Matter	79.7	78.4	74.3	77.7	73.7	77.5	71.6
Crude Protein	12.3	12.0	12.0	11.8	11.9	11.8	11.3
TDN	81.2	84.1	83.0	85.4	84.1	88.4	87.5
Corn Silage NDF[d]	3.5	3.7	6.2	3.8	6.2	3.7	7.5
NEm, Mcal/cwt	91	95	93	97	95	104	102
NEg, Mcal/cwt	60	64	63	96	64	71	70
Ca	0.94	0.95	1.00	0.96	1.02	0.85	0.84
P	0.34	0.36	0.35	0.37	0.37	0.31	0.3
K	1.05	0.95	1.03	0.95	1.04	0.81	0.79
Monensin[e]	150	150	150	300	300	300	300

[a] Finisher ration: Low = 8% corn silage on a dry matter basis; High = 16% corn silage on a dry matter basis.
[b] Supplement: Processed grain by-products, calcium carbonate, forage products, urea, potassium chloride, animal protein products, salt, ammonium sulfate, dicalcium phosphate, cobalt carbonate, copper sulfate, sodium selenite, zinc oxide.
[c] Qual-Fat™, Special tallow, prime #1, National By-Products, Garden City, KS.
[d] Percent contribution of corn silage neutral detergent fiber (46.5% NDF).
[e] Monensin (Rumensin®) dose in mg per head daily. Vitamin A:D_2 (10:1 ratio) was fed at 40000 IU and 4000 IU, respectively; Vitamin E at 200 IU per head daily. These ingredients were delivered by a Micro-Weigh System®, Micro Chemical, Inc.®, Amarillo, TX.

Table 2. Effect of Switching Silage Level on Feedlot Performance of Beef Steer Calves Fed a High Concentrate Finishing Diet

	Treatments				
Item	L/L	L/H	H/H	H/L	SEM[a]
No. of Pens	3	3	3	3	
No. of Steers	36	36	36	36	
Initial Weight, lbs	693	687	695	684	.5
Final Weight, lbs[b]	1116	1132	1105	1108	7.2
Dry Matter Intake, lbs	20.3	20.4	20.6	20.5	2
Average Daily Gain, lbs	3.41[d]	3.59[e]	3.30[d]	3.42[d]	.1
Feed Conversion[c]	5.96[d]	5.69[e]	6.24[f]	6.02[d]	.1
Cost of Gain, $/cwt	34.45	32.66	35.21	35.35	

[a] SEM = Standard error of least square means, n = 3.
[b] Final weight was adjusted to a common dressing percentage of 64.5%. ADG was calculated on a shrunk basis and adjusted final weights.
[c] Feed conversion was statistically analyzed as gain to feed ratio.
[def] Means with different superscripts differ, P < .08.

Table 3. Effect of Switching Silage Level on Carcass Merit of Beef Steers Fed a High Concentrate Finishing Diet

	Treatments				
Item	L/L	L/H	H/H	H/L	SEM[a]
No. of Pens	3	3	3	3	
No. of Steers	36	36	36	36	
Hot Carcass Wt, lbs	720	731	713	715	4.7
Dressing Percent, %	64.2	65.1	64.4	64.4	.3
Rib-eye Area, in^2	12.7	13.0	12.2	12.8	.3
Back Fat, in	.38	.36	.34	.34	.02
KPH, %	2.43	2.43	2.33	2.40	.04
Marbling Score[b]	5.17	5.24	5.18	5.28	.11
Percent Choice, %	63.9	66.7	66.7	61.1	5.5
Yield Grade[c]	2.62	2.50	2.63	2.46	.11

[a] SEM = Standard error of least square means, n = 3.
[b] 4 to 4.99 = Select (slight); 5 to 5.33 = Choice - (small); 5.34 to 5.66 Choice 0 (modest); 5.67 to 5.99 = Choice + (moderate).
[c] Yield grade was calculated from carcass characteristics.

Carcass merit was not expected to be affected by treatments.

Liver Abscesses. Liver abscess scores were taken at slaughter and are given in Table 4. Each liver was given a score from 1 to 4; a score of 1 being a normal liver and 4, a condemned liver severely abscessed. Liver scores were similar for L/H, H/H, and H/L steers. Abscess damage to L/L livers as indicated by the liver scores was 43.3% greater (P < .02) than that of the other treatment groups. The liver damage in the H/L group increased as a result of switching to the low level of corn silage feeding. The percentage of livers condemned was similar for the L/L and H/L groups and 2.4 times greater than that for the L/H and H/H groups, which were not different (P < .06). Apparently, liver abscess damage can be reduced by increasing the roughage level in finishing diets 40 days before slaughter. Also, decreasing the roughage level caused an increase in the number of condemned livers in the A+ conditions and in overall condemnation.

CONCLUSIONS

The effects of switching corn silage feeding level 40 days before slaughter on feedlot performance were mostly predictable. Costs of gains were highest for the cattle consuming the high level of silage for the longest duration. Switching silage feeding level did not affect carcass characteristics, including dressing percentage. The performance and liver abscess data, indicate that increasing corn silage feeding level 40 days before slaughter improved animal performance by reducing the severity of liver abscess damage and condemnation rate.

Table 4. Effect of Switching Silage Level on Incidences of Liver Abscesses of Beef Steer Calves Fed a High Concentrate Finishing Diet

	Treatments				
Item	L/L	L/H	H/H	H/L	SEM[a]
No. of Pens	3	3	3	3	
No. of Steers	36	36	36	36	
Liver Score[b]	1.94[c]	1.28[d]	1.22[d]	1.56[d]	.13
Condemned, %	36.11[e]	13.89[f]	13.89[f]	30.56[e]	4.25
O Livers, no.[g]	23	31	31	25	
A- Livers, no.	1	2	3	6	
A Livers, no.	3	1	1	1	
A+ Livers, no.	9	2	1	4	

[a] SEM = Standard error of least square means.
[b] Liver score: 1 = O Liver; 2 = A- Liver; 3 = A Liver; 4 = A+ Liver.
[cd] Means (n =36) with different superscripts differ, P < .02.
[ef] Means (n = 3) with different superscripts differ, P < .06.
[g] O Liver = Normal noncondemned liver; A- = One or two very small abscesses, condemned; A = two to four well organized abscesses, condemned; A+ = one or more large abscesses, adhesion of diaphragm possible, condemned.

EFFECT OF DENSITY OF STEAM-FLAKED MILO ON ANIMAL PERFORMANCE, MILL PRODUCTION RATE, AND SUBACUTE ACIDOSIS[1]

by

C. D. Reinhardt, R. T. Brandt, Jr., A. S. Freeman, and T. P. Eck

SUMMARY

In Trial 1, 336 yearling steers (755 lb) were fed diets containing milo flaked to 22 (L), 25 (M), or 28 (H) lb/bu. The steers fed L consumed 3.2% less dry matter than cattle fed H (P<.05), and had 6.9% lower gains (P<.05). Feed efficiency tended (P=.15) to favor cattle fed H. The H milo was flaked 27% faster than M and 67% faster than L (P<.0001), resulting in lower production cost for the heavy flake-weight milo. In Trial 2, six ruminally cannulated steers were fed the same diets used in Trial 1 in a replicated 3x3 Latin square. After adaptation to the respective diets, the cattle were fasted and then overfed to simulate drastic intake fluctuation. The L diet was fermented more rapidly in the rumen than the H diet, resulting in greater ruminal pH depression (P<.10) following overconsumption. Under the conditions of this experiment, flaking milo more intensively than 28 lb/bu (58.7% starch gelatinization) resulted in decreased consumption, lower mill efficiency, and increased propensity for acidosis in finishing steers.

INTRODUCTION

Current information relative to steam flaking of milo suggests that conversion efficiency by beef cattle is optimized when the grain is flaked to 22-28 lb/bu (Theuer; Xiong et al., 1991 Cattle Feeders' Day). However, the cost of producing various densities of flaked milo at near maximum mill load and correlating the production cost to animal performance have not been addressed under a controlled situation. Also unknown was the effect flake density has on subacute acidosis resulting from periods of intake fluctuation.

OBJECTIVE

Our objective was to determine the effects of milo steam-flaked to three diferent flake densities on feedlot performance, carcass characteristics, milling efficiency, and subacute acidosis in finishing beef steers.

PROCEDURES

Trial 1. Three hundred thirty-six crossbred steers were received off wheat pasture in April, 1992. They were dewormed, vaccinated, ear-tagged, and stepped up to a medium-energy ration at a commercial feedyard in western Kansas. The cattle were then shipped to the SWREC in Garden City. The steers were stratified into four weight blocks and stepped up to the final ration containing milo flaked to 22, 25, or 28 lb/bu. Diets contained (DM basis) 82.5% flaked milo, 4% corn silage, 4% alfalfa hay, 7% supplement (43% CP, 8.7% urea), and 2.5% molasses. The cattle were weighed initially (May 25 and 26, 1992; avg 755 lb) and monthly until finished, at which time they were again weighed (September 27 and 28, 1992; avg 1139 lb) and slaughtered. Daily pen feed intakes were recorded.

At start-up each day, when the steam chest[2] reached 212˚ F, the rolls[3] were warmed for 20 minutes by flaking grain to 25 lb/bu. After warm-up, the rolls were tightened to flake the 22 lb/bu grain (L). When enough grain was processed for the light density treatment, the rolls were relaxed to flake the 25 lb/bu grain (M), and then the 28 lb/bu grain (H). While flaking the grain for the test diets, mill load was maintained at 25 amperes (90% of maximum mill load) for all three densities. This resulted in average steam chest retention times of 90, 70, and 50 minutes for L, M, and H, respectively.

The grain was sprayed with water and a wetting agent[3] and allowed to react for about 18 h prior to steaming. Dry matter content of flaked milo averaged 79.5% beneath the rolls. Degree of starch gelatinization was determined on processed grain using differential scanning calorimetry (DSC).

Trial 2. Six ruminally cannulated steers (avg 928 lb) were fed concurrently with the cattle in Trial 1 at the SWREC. The steers were assigned in a replicated 3x3 Latin square arrangement to receive the same treatments as fed in Trial 1 (L, M, and H). A subacute acidosis challenge model was prescribed. Briefly, cattle were acclimated to their respective treatment (intake restricted to 2% of BW per d, equal portions fed twice daily) for 9 d and baseline rumen samples were taken on d 10. The p.m. feeding on d 11 was skipped, and then 1% of BW was provided in the a.m. on d 12. The cattle were allowed 90 min to consume the feed, at which time any unconsumed feed along with another 1.5% of BW was placed through the cannula into the rumen. Rumen samples were taken at feeding and at 3, 6, 9, 12, 18, and 24 h postfeeding. A second subacute acidosis challenge, similar to that on d 12, was conducted on d 13.

RESULTS AND DISCUSSION

Cattle fed L consumed significantly less feed ($P<.05$) and gained more slowly ($P<.05$) throughout the trial than those offered H, with cattle fed M responding intermediately (Table 1). Feed efficiency tended ($P=.15$) to favor those cattle fed H. These results conflict with previous reports of improved efficiency by cattle fed extensively processed grain (Xiong et al., 1991 Cattle Feeders' Day). There were no differences in carcass parameters as a result of flake density.

At steady mill load, the situation in a commercial feedmill, grain was processed much more rapidly when flaked to H than M or L ($P<.0001$; Table 1). Increased pressure from the rolls resulted in a linear increase ($P<.05$) in starch gelatinization (Table 1). However, extensive processing placed more electrical drain on the mill per unit of grain, so less grain was presented to the rolls at constant amperage. All costs associated with residence time and throughput (gas cost of maintaining chest temperature and electrical cost of running the mill) on a per unit production basis increased proportionately with decreasing production rate. Therefore, the L and M treatments cost more to produce than H milo.

Table 1. Effect of Degree of Milo Flaking on Animal Performance, Mill Power Consumption, and Degree of Starch Gelatinization (Trial 1)

Item	Degree of Flaking[a]		
	L	M	H
Performance Data			
Number of Pens	12	12	12
Number of Steers	112	112	112
DMI, lb	18.4[b]	18.8[bc]	19.0[c]
ADG, lb	2.99[b]	3.09[bc]	3.21[c]
Feed/Gain	6.13[d]	6.10[de]	5.92[e]
Production Data			
Rate, ton/h	1.155[f]	1.521[g]	1.929[h]
Energy Usage/ton			
Electricity, kwh	15.5	11.77	9.28
Natural Gas, mcf	1.674	1.266	.997
Energy Cost, $/ton	3.79	2.87	2.26
Gelatinization, %[i]	85.7	74.3	58.7

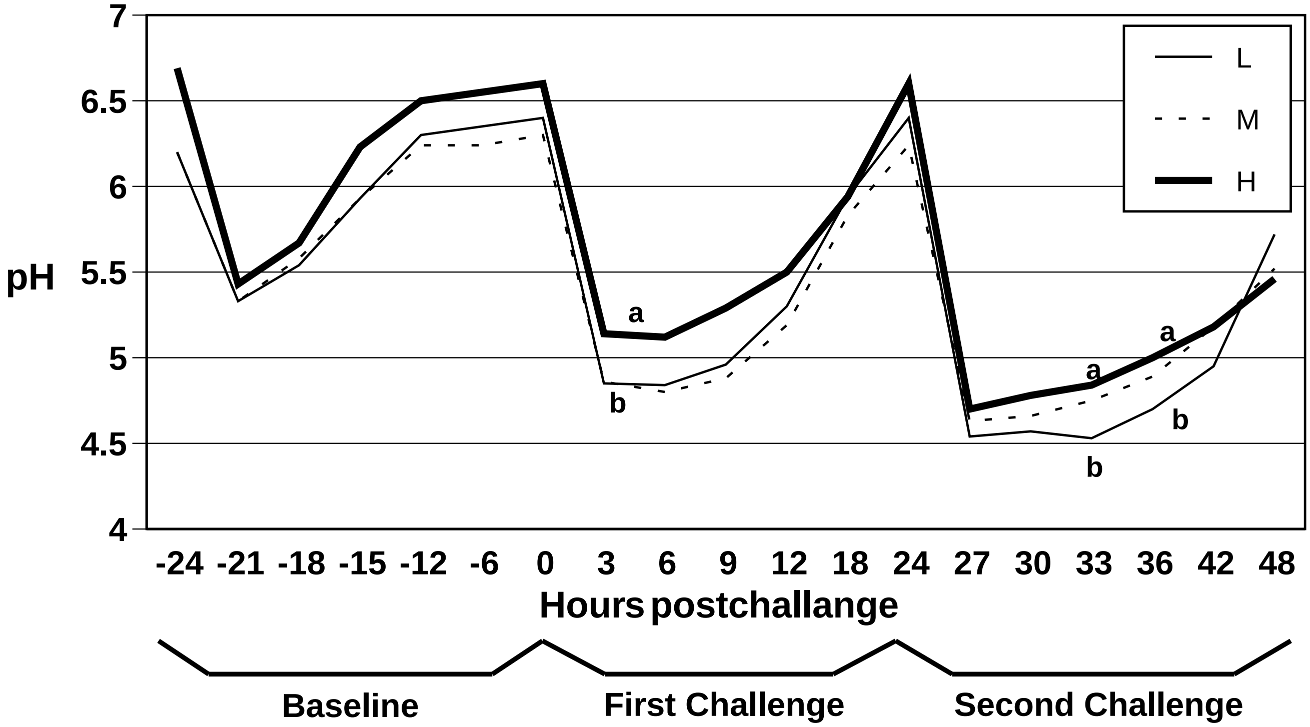
[a] L=22 lb/bu, M=25 lb/bu, H=28 lb/bu.
[bc] Means within a row without a common super script differ ($P<.05$).
[de] Means within a row without a common super script differ ($P=.15$).
[fgh] Means within a row without a common super script differ ($P<.0001$).
[i] Linear effect ($P<.05$).

In Trial 2, diet L reduced ruminal pH to a greater extent than H ($P<.10$; Figure 1). The lightweight grain was probably fermented more rapidly in the rumen, resulting in greater pH depressions following the challenges. However, there were no significant treatment effects on ruminal concentration of either total VFA or lactate, which averaged 126.6 and 1.31 mM, respectively. Data from Trial 2 suggest that finishing cattle fed highly processed milo are more susceptible to subacute acidosis resulting from irregular feed consumption patterns initiated by factors such as weather fronts, missed feeding schedules, etc.

CONCLUSIONS

Under the conditions of these experiments, flaking milo more extensively than 28 lb/bu (58.7% starch gelatinization) resulted in lower animal performance, lower mill efficiency, and increased animal susceptibility to subacute acidosis. Therefore, the proposed benefits from extensive steam-flaking of milo, except where light test-weight milo is used, are suspect.

Figure 1. Effect of Degree of Flaking on Ruminal pH Changes Postchallenge (a,b H differs from L (P<.10) within a Sampling Time; L=22 lb/bu, M=25 lb/bu, H=28 lb/bu



[1]The cooperation of Grant County Feeders, Ulysses, KS, who supplied the cattle used in Trial 1, is gratefully acknowledged.

[2]Superior Boiler, 50hp,1725 lbs steam per hour.

[3]Ross 18"x24" flaking mill, 25hp.

[4]Red-E-Flake®; Cargill, Inc.; Molasses Div., Minneapolis, MN

EFFECT OF STEAM-ROLLED WHEAT AND TRITICALE SUBSTITUTION FOR STEAM-FLAKED CORN ON FEEDLOT PERFORMANCE AND CARCASS CHARACTERISTICS OF BEEF STEERS

by

A. S. Freeman

SUMMARY

A 114-day finishing trial with 216 steers (avg wt 733 lb) was conducted to evaluate effects of substituting steam-rolled wheat or triticale for steam-flaked corn in finishing diets on feedlot performance and carcass merit. The six treatments were: **W25**, 25% of steam-flaked corn (SFC) replaced with steam-rolled wheat (SRW); **W50**, 50% of SFC replaced with SRW; **W75**, 75% of SFC replaced with SRW; **T25**, 25% of SFC replaced with steam-rolled triticale (SRT); **T50**, 50% of SFC replaced with SRT; **T75**, 75% of SFC replaced with SRT. Daily dry matter intake was not affected by treatments. Final weights and gains, adjusted to a common dressing percent, were not affected by treatments. Carcass gain averaged 2.02 lbs per head daily and was not influenced by treatments. Feed conversion also was not affected by treatments. Carcass characteristics were not affected by treatments. Grain type did not affect liver abscess score. However, as level of grain substitution increased, liver abscess score decreased linearly ($P_1 < .01$). Cost-of-gain decreased with triticale and as level of grain substitution increased. Our data suggest that steam-rolled triticale could replace greater than 25% of the steam-flaked corn in a finishing ration and improve overall economic returns.

INTRODUCTION

In the fall of 1990 to the end of spring of 1991, wheat and corn prices were very low and similar. Consequently, wheat began to 'price into' finishing rations. Locally, some feedlots found a source of triticale to replace the wheat being fed. Triticale (*Triticum secale*) is a cross between wheat and rye. Nutritionally, triticale is similar to wheat being higher in crude protein and essential amino acids than corn. Most earlier feeding comparison or substitution trials with cattle have been conducted with dry-rolled triticale. Information on the feeding value of steam-rolled triticale may be lacking altogether.

OBJECTIVE

Our objective was to compare beef cattle feedlot performance, carcass characteristics, and cost of gains of animals being fed a steam-flaked corn grain based finishing diets with corn replaced on an as-fed basis by either 25%, 50%, or 75% steam-rolled wheat or triticale.

PROCEDURES

Cattle. From 268 crossbred steers (predominantly Angus and Hereford crosses) shipped from Allen, Kansas, 216 were chosen for this trial. These steers arrived at the SWREC on October 30, 1991 during a snow storm. The calves average starting weight for this trial was 733 lbs. Because of the storm, processing did not take place until November 4 and 5. The remaining cattle were fed a steam-flaked corn ration along with the trial cattle for nonstatistical comparisons.

Processing. Processing included individually weighing on 2 consecutive days, ear tagging, de-horning, and castrating, if necessary. Steers were vaccinated against IBR, BVD, PI_3, and BRSV in combination with five strains of *Leptopomona* (modified live virus) and injected with a 7-way clostridial bacterin containing a *Haemophilus somnus* bacterin-toxoid. On the second weigh day, steers were randomly sorted to pens by weight, condition, frame score, and breeding. Pour-on (Trichlorfon®) was used to control cattle grubs and external parasites. Two weeks after arrival, all animals were revaccinated with IBR-BVD modified live virus vaccine and implanted with a 24 mg estradiol implant (Compudose200®).

Weighing and Slaughter. Six days after arrival, all cattle were individually weighed on 2 consecutive days for initial weights. Individual steer interim weights were single-day, early morning, 'full live' weights taken 37, 65, and 114 days after starting the trial. Individual, final, full live weights were obtained on 2 consecutive days. Cattle were slaughtered on the second final weigh-day at a local packer. Liver abscess scores were taken at slaughter. All carcass characteristics were obtained after a 24-hour chill.

Treatments. The experimental design was a completely randomized block using initial weight as the blocking factor. Six pen replicates (weight blocks) per treatment with six head in each pen were used. The treatments were randomly assigned to pens, with steers randomly assigned to pens, within a treatment-weight block. Treatments were: **W25**, 25% of steam-flaked corn replaced with steam-rolled wheat; **W50**, 50% of steam-flaked corn replaced with steam-rolled wheat; **W75**, 75% of steam-flaked corn replaced with steam-rolled wheat; **T25**, 25% of steam-flaked corn replaced with steam-rolled triticale; **T50**, 50% of steam-flaked corn replaced with steam-rolled triticale; **T75**, 75% of steam-flaked corn replaced with steam-rolled triticale. Actual substitution rates on a dry matter basis were 23%, 52%, and 77% for both grains. The triticale used was a Texas variety, T-23, Lot #SC 799, obtained from a local producer. All feedlot performance and carcass data were analyzed by using pen as the experimental unit.

Rations and Feeding. Final ration composition and nutrient analysis are presented in Table 1.

Table 1. Ingredient and Nutrient Composition of Final Rations on a Dry Matter Basis

Ingredients	Treatments						Extra
	W25	W50	W75	T25	T50	T75	SFC
Steam-flaked							
Corn	57.64	37.91	18.66	57.64	38.05	18.75	78.11
Wheat	21.07	41.61	61.48	0	0	0	0
Triticale	0	0	0	21.07	41.76	61.81	0
Alfalfa Hay	5.46	5.33	5.31	5.46	5.89	5.87	5.56
Corn Silage	3.78	4.21	4.24	3.78	4.46	4.61	3.84
Supplement[a]	6.36	5.70	4.77	6.36	4.58	3.39	7.05
Molasses	1.58	1.17	1.53	1.58	1.17	1.54	1.24
Tallow[b]	4.12	4.07	4.01	4.12	4.08	4.03	4.19
Nutrients							
Dry Matter	81.2	82.3	83.5	81.2	82.0	83.7	79.8
Crude Protein	12.2	13.9	14.2	11.9	12.2	12.2	11.6
ADF[c]	5.5	8.7	7.4	6.0	7.1	6.8	5.9
TDN[d]	88.8	84.9	86.4	88.2	86.8	87.2	88.2
NEm, Mcal/cwt	104	99	101	103	101	102	103
NEg, Mcal/cwt	71	66	68	70	69	69	71
Calcium	.83	.67	.61	.76	.57	.36	.83
Phosphorus	.29	.32	.34	.31	.34	.33	.28
Magnesium	.14	.17	.15	.14	.15	.15	.14
Potassium	.88	.95	.87	.84	.83	.75	.89

[a] Supplement: Processed grain by-products, calcium carbonate, forage products, urea, potassium chloride, animal protein products, salt, ammonium sulfate, dicalcium phosphate, cobalt carbonate, copper sulfate, sodium selenite, zinc oxide.
[b] Qual-Fat™, Special tallow, prime #1, National By-Products, Garden City, KS.
[c] ADF = Acid detergent fiber.
[d] TDN = Total digestible nutrients.

Feed was provided once daily in the morning to allow for ad libitum consumption without excessive accumulation of feed. Daily intakes were adjusted for any feed refusals. Initial receiving ration contained decoquinate (Deccox®) fed at a rate of 180 mg per head daily for 15 days. Monensin (Rumensin®) was fed at 150 mg per head daily for 17 days in step-up rations, then increased to a final level of 360 mg in the finisher. Tylosin (Tylan®) was fed at a constant level of 90 mg per head daily. Neither monensin nor tylosin were fed when decoquinate was being fed. Feeding levels of vitamins A, D_2, and E were held constant throughout the trial at 40000 IU, 4000 IU, and 200 IU, respectively. The micro-ingredients were delivered by a Micro-Weigh System®, Micro Chemical, Inc.®, Amarillo, TX. Fresh water was provided daily via heated automatic waterers that were cleaned weekly. Ration feedstuffs and dry matters were sampled weekly, and a running composite within rations and feedstuffs was retained for nutrient analysis.

Extra Cattle. The steers not chosen were treated identically as the study cattle. Their ration consisted of steam-flaked corn, corn silage, ground alfalfa hay, a pelleted supplement, molasses, and animal tallow (Table 1). The feedlot performance, carcass measurements, and liver abscess scores were not statistically analyzed with the trial data; however, the data were used for comparison purposes with the trial data.

RESULTS AND DISCUSSION

Dry Matter Intake. Daily dry matter intake was not affected by treatments (Tables 2 and 3). A group of extra steers, four pens with an average of five head per pen, were fed a diet containing only steam-flaked corn for comparison. Intake for the extra steers averaged 17.7 lbs compared with an intake of 17.5 lbs for the other treatment steers. A numerical increase in intake was seen with increasing levels of either grain substitution and a slight increase with triticale over wheat.

Average Daily Gain. Final weights and gains, adjusted to a common dressing percent, were not affected by treatments (Tables 2 and 3). Cumulative average daily gain for the extra steers was 2.79 lbs per head daily. All other steers averaged 2.65 lbs per head daily. Gains numerically improved with triticale substitution and with increasing steam-rolled grain levels. Carcass gain averaged 2.02 lbs per head daily and was not influenced by treatments. Carcass gain was calculated by multiplying initial weight shrunk 4% by .572 and subtracting this from hot carcass weight shrunk 2%. The resulting adjusted carcass gain was then divided by 114 days to give average daily carcass gain.

Feed Conversion. Feed conversion was also not affected by treatments (Tables 2 and 3). Steers receiving only steam-flaked corn had a feed conversion ratio of 6.28 compared with 6.67 for

Table 2. Main Effects of Substituting Steam-rolled Wheat or Triticale for Steam-flaked Corn on Feedlot Performance in Beef Steers

Item	GrainType		SEM[a]	Corn
	Wheat	Triticale		
No. of Pens	18	18		4
No. of Steers	107	108		20
Initial Weight, lbs	732	734	18.1	783
Final Weight, lbs[b]	1030	1039	27.6	1101
Dry Matter Intake, lbs	17.45	17.54	.36	17.69
Average Daily Gain, lbs	2.62	2.68	.10	2.84
Carcass Gain, lbs[c]	2.00	2.04	.07	2.32
Feed Conversion[d]	6.74	6.59	.15	6.23
Cost of Gain, $/cwt	42.61	41.26		45.79

[a] SEM = Standard error of least square means, n = 18.
[b] Final weight was adjusted to a common dressing percentage of 62.4%.
[c] Carcass gain = ((Hot carcass weight * .98) - ((Initial weight * .96) * .572))/114 days.
[d] Feed conversion was statistically analyzed as gain to feed ratio.

Table 3. Main Effects of Level of Substitution of Wheat or Triticale for Steam-flaked Corn on Feedlot Performance in Beef Steers

Item	Grain Levels 25%	50%	75%	SEM[a]	Corn
No. of Pens	12	12	12		4
No. of Steers	71	72	72		20
Initial Weight, lbs	733	732	734	22.2	783
Final Weight, lbs[b]	1032	1036	1037	33.8	1101
Dry Matter Intake, lbs	17.28	17.53	17.67	44	17.69
Average Daily Gain, lbs	2.62	2.66	2.66	.12	2.84
Carcass Gain, lbs[c]	2.00	2.03	2.02	.08	2.32
Feed Conversion[d]	6.67	6.63	6.69	.18	6.23
Cost of Gain, $/cwt	45.72	41.44	38.63		45.79

[a] SEM = Standard error of least square means, n = 12.
[b] Final weight was adjusted to a common dressing percentage of 62.4%.
[c] Carcass gain = ((Hot carcass weight * .98) - ((Initial weight * .96) * .572))/114 days.
[d] Feed conversion was statistically analyzed as gain to feed ratio.

the other steers. Comparing wheat with triticale, the feed to gain ratio was improved numerically for the triticale. No trends were evident with level of grain substitution. Lower costs-of-gains were realized with the triticale substitution compared with wheat and also with increasing levels of grain substitution. Cost-of-gain was lower for both wheat and triticale substitutions compared to the steam-flaked corn. However, level of grain substitution should be greater that 25% of the steam-flaked corn to obtain improved cost-of-gains. Actual costs-of-gains for all seven rations were: **W25**, $47.40; **W50**, $42.17; **W75**, $38.25; **T25**, $44.05; **T50**, $40.71; **T75**, $39.02; and **SFC**, $45.79.

Carcass Merit. Carcass characteristics were not affected by treatments (Tables 4 and 5). Hot carcass weight averaged 646 lbs, rib-eye-area 11.66 sq. in., back fat thickness .39 in., KPH 2.35%, dressing percent 62.4%, marbling score 5.2 or low choice, percent choice 77%, yield 2.66, and percent cutability 50.6%. If trial treatments were compared with the steam-flaked corn steers, carcass characteristics were numerically depressed.

Liver Abscesses. Liver abscess score is a measure of the severity and number of livers condemned because of abscesses. Grain type did not affect liver abscess score (Table 4). However, fewer livers were condemned in steers consuming triticale compared with wheat. Steers consuming just steam-flaked corn had a score of 1.86. Level of grain substitution did affect liver abscess score (Table 5). As level of grain substitution increased, liver abscess score decreased linearly ($P_1 < .01$). Incidence of subacute acidosis was probably decreased when fermentation rate was reduced by substituting either wheat or triticale for steam-flaked corn in the ration.

CONCLUSIONS

Feedlot performance was not affected by replacing steam-flaked corn with either steam-rolled wheat or triticale at 25%, 50%, and 75% on an as-fed weight basis. However, carcass merit was improved with feeding just steam-flaked corn compared with the grain substitution rations. Costs-of-gains were lower with steam-rolled triticale substituted at a level greater than 25% compared with just steam-flaked corn. Liver condemnation was decreased with increasing levels of grain substitution. These data indicate that steam-rolled triticale could replace greater than 25% of the steam-flaked corn fed to finishing beef steers and improve economic returns.

Table 4. Main Effects of Substituting Steam-rolled Wheat or Triticale for Steam-flaked Corn on Carcass Merit and Liver Abscess Score in Beef Steers

Item	Grain Type		SEM[a]	Corn
	Wheat	Triticale		
No. of Pens	18	18		4
No. of Steers	107	107		20
Hot Carcass Wt, lbs	642.8	648.3	17.2	694
Dressing Percent, %	62.3	62.4	.3	63.0
Yield Grade[b]	2.64	2.68	.1	2.40
Cutability[b], %	50.7	50.6	.3	51.2
Marbling Score[c]	5.18	5.21	.1	5.30
Percent Choice, %	83.1	70.9	3.6	85.0
Rib-eye Area, in^2	11.7	11.7	.3	12.75
Back Fat, in	.38	.39	.02	.35
Liver Score[d]	1.43	1.30	.08	1.86

[a] SEM = Standard error of least square means, n = 18.
[b] Yield grade and cutability was calculated from carcass characteristics and an average KPH of 2.35%.
[c] 4 to 4.99 = Select (slight); 5 to 5.33 = Choice - (small); 5.34 to 5.66 Choice 0 (modest); 5.67 to 5.99 = Choice + (moderate).
[d] Liver score: 1 = O Liver, normal; 2 = A- Liver, condemned; 3 = A Liver, condemned; 4 = A+ Liver, condemned.

Table 5. Main Effects of Level of Substitution of Wheat or Triticale for Steam-flaked Corn on Carcass Merit and Liver Abscess Scorein Beef Steers

Item	Grain Levels			SEM[a]	Corn
	25%	50%	75%		
No. of Pens	12	12	12		4
No. of Steers	71	72	71		20
Hot Carcass Wt, lbs	643.8	646.0	646.9	21.1	694
Dressing Percent, %	62.2	62.6	62.2	.37	85.0
Yield Grade[b]	2.56	2.66	2.77	.14	2.40
Cutability[b], %	50.9	50.6	50.4	.33	51.2
Marbling Score[c]	5.24	5.09	5.25	.09	5.30
Percent Choice, %	74.6	72.2	84.2	4.4	85.0
Rib-eye Area, in^2	11.84	11.78	11.38	.40	12.75
Back Fat, in	.37	.40	.39	.02	.35
Liver Score[d]	1.58	1.29	1.24	.10	1.86

[a] SEM = Standard error of least square means, n = 12.
[b] Yield grade and cutability was calculated from carcass characteristics and an average KPH of 2.35%.
[c] 4 to 4.99 = Select (slight); 5 to 5.33 = Choice - (small); 5.34 to 5.66 Choice 0 (modest); 5.67 to 5.99 = Choice + (moderate).
[d] Liver score: 1 = O Liver, normal; 2 = A- Liver, condemned; 3 = A Liver, condemned; 4 = A+ Liver, condemned. Linear decrease, $P < .01$.

EFFECTS OF *ASPERGILLUS ORYZAE* (MSE) ON THE PERFORMANCE OF BEEF STEER CALVES DURING A GROWING PHASE

by

A. S. Freeman

SUMMARY

One-hundred ninety-two (avg wt 594 lbs) British-Continental crossbred steer calves were used to evaluate the effects of *Aspergillus oryzae* (MSE) addition to a high-concentrate limit-fed or high-roughage full-fed growing ration on feedlot performance during a 62-day growing trial. The treatments were: CON-FF, control with no MSE with steers offered high-roughage, full-fed ration; CON-LF, control with steers offered high-concentrate, limit-fed ration; MSE-FF, MSE with steers offered high-roughage, full-fed ration; MSE-LF, MSE with steers offered high-concentrate limit-fed ration. The MSE was fed at a rate of 1 lb per 40,000 lbs live body weight (11.35 mg/lb of live body weight). Dry matter intake for the limit-fed steers was restricted to provide an average daily gain of 2 lbs per head daily. Approximately 48 calves were used per treatment with five pen replications per treatment. Within limit-fed groups, cumulative dry matter intake was depressed 5.6% (P = .06) for MSE-LF compared with CON-LF steers. Cumulative dry matter intake for CON-FF and MSE-FF steers was similar. Cumulative average daily gain was not affected by treatment within a feeding level. Feed conversion for days 28 and 56 was affected by feeding level (P < .0001). But period and cumulative feed conversions were not affected by treatment within a feeding level. Within limit-fed groups, MSE-LF reduced (P < .03) days-on-feed by 9.6 days compared with CON-LF steers. Treatment did not affect days-on-feed for the full-fed high-roughage group (56 days). These data suggest that adding MSE to a high-concentrate diet fed at a restricted level during a growing phase reduced days-on-feed. But the added MSE did not affect growing phase performance when steer calves were fed a high-roughage, full-fed, growing diet.

INTRODUCTION

This article is a continuation of the study evaluating the effects of adding Maximum Stabilized Enzyme (MSE) to the ration of receiving, growing, and finishing beef steer calves (KAES Report of Progress #659). This article will present and summarize the effects of MSE addition to either a high-concentrate limit-fed or high-roughage full-fed diet on the feedlot growing phase performance of beef steer calves.

OBJECTIVES

Our main objective was to determine effects of adding *Aspergillus oryzae* enzyme extract (MSE) directly to high-concentrate, limit-fed and high-roughage, full-fed diets on dry matter intake, average daily gain, feed conversion, and days-on-feed of beef calves during a growing phase. Additionally, the cost of gain of each treatment combination was evaluated during the growing phase from the feedlot performance.

PROCEDURES

One-hundred ninety-two (avg wt 594 lbs) British-Continental crossbred steer calves were previously randomized by frame score, breedtype, and body condition to 20 pens with approximately 10 head each. The experimental design was a completely randomized block with treatments arranged in a two-by-two factorial. Main effects were diets with or without added MSE and feeding level either limit-fed or full-fed.

Weighing. Average of the two consecutive weigh-day weights after the receiving phase were used as initial trial starting weights for the growing phase. Weights were taken approximately every 28 days during the growing phase. Final trial weights were obtained from a single weigh day. Feed and water were not withheld before weighing. Cattle weights were taken after the morning bunk calls just before feeding. When steers in a pen reached an average weight of 725 lbs or greater on a scheduled weigh day, they were moved to the finisher phase of the study.

Feeding and Diets. All cattle were fed once daily in the morning. Growing phase diets are provided in Table 1. All micro-ingredients (ionophores, antibiotics, and vitamins) were added to daily feed batches by a micro-ingredient weigh machine. Feed was provided to allow for ad libitum consumption without excessive accumulation of feed in the high-roughage, full-fed pens. Cattle in limit-fed pens were fed once daily. Amount of ration offered to the limit-fed steers was determined from the calculated dietary net energy for maintenance and production and projected performance of 2 lbs gain per head daily. Dry matter factors were used to convert offered amount to an as-fed amount. Dietary dry matter factors were determined weekly in a force-air drying oven for individual feedstuffs and rations. The limit-fed amounts were increased every 2 weeks. All calculations were done on a pen basis, not on an individual animal basis.

TABLE 1. Ingredient Composition and Nutrient Analysis for High- Concentrate Limit-Fed and High-Roughage Full-Fed Diets Offered during the Growing Phase

Item	High-Concentrate Limit-Fed	High-Roughage Full-Fed
	—— Dry Matter Basis, % ——	
Ingredients[a]		
Alfalfa Hay	14.76	20.27
Corn Silage	9.53	13.54
Dry-Rolled Corn	49.48	43.19
Dry-Rolled Milo	17.27	15.11
Blended Molasses	2.90	3.02
Pelleted Supplement	6.07	4.87
Cost per cwt, $/cwt	5.50	5.23
Nutrient Analysis		
Dry Matter	71.6	69.6
TDN	83.3	79.3
Crude Protein	11.4	12.4
Acid Detergent Fiber	10.0	13.4
NEm, Mcal/cwt	97.0	91.0
NEg, Mcal/cwt	64.0	59.0
Calcium	.51	.85
Phosphorus	.32	.32
Magnesium	.17	.20
Potassium	1.02	1.28

[a] Micro-ingredients per head daily were: 150 mg Monensin for 14 days then 280 mg Monensin; 90 mg Tylosin phosphate; 40,000 IU Vitamin A; 4,000 IU Vitamin D_2; 200 IU Vitamin E 40%.
All micro-ingredients were delivered by a Micro-Weight Machine.

Treatments. Main effect factors were without (CON) or with MSE (MSE) and high-roughage, full-fed (FF) or high-concentrate, limit-fed (LF). The treatments were: CON-FF, control, no MSE with steers offered high-roughage, full-fed ration; CON-LF, control with steers offered high-concentrate, limit-fed ration; MSE-FF, MSE with steers offered high-roughage full-fed ration; MSE-LF, MSE with steers offered high-concentrate, limit-fed ration. The MSE was added at a rate of 1 lb per 40000 lbs live body weight or 11.35 mg per lb live body weight. Within each factor level (treatment combination) there were five pen replicates with approximately 10 steers in each pen.

Statistical Analysis. All performance data were analyzed as a completely randomized design using PC SAS GLM procedures for the analysis of variance. Pen served as the experimental unit for performance data. Grower phase initial pen weight served as the covariate. Dry matter intake and average daily gain were analyzed within a feeding level. Feed conversion was analyzed as gain per feed consumed across feeding levels. Conversion was presented as feed to gain. A treatment effect was considered significant if the probability (P) value was less than or equal to the 10% level ($P<.10$).

RESULTS AND DISCUSSION

Dry Matter Intake. The growing phase was approximately 62 days (weighted average for days-on-feed). Dry matter intake for the limit-fed steers was restricted to provide an average daily gain of 2 lbs per head daily. Intake is given in Table 2. Period dry matter intake was not affected ($P > .13$) by treatments within a feeding level. Because dry matter intake was restricted for the limit-fed calves and based on a pen average weight, no differences in period intake would be expected. However, within the limit-fed group, cumulative dry matter intake was depressed by 5.6% (P < .06) for MSE-LF compared with CON-LF steers. Cumulative dry matter intakes as percents of live body weight were 1.77% for the CON-LF calves and 1.75% for the MSE-LF group. The decreased intake for the MSE-LF calves was probably a result of their lighter cumulative body weights (which is a direct result of days-on-feed to reach 725 lbs). Period dry matter intake for the full-fed calves was similar (P > .28). Cumulative dry matter intake for CON-FF and MSE-FF steers was similar (P > .93). Cumulative dry matter intake as a percent of live body weight for the CON-FF calves was 2.49% and 2.47% for MSE-FF group.

Average Daily Gain. High-roughage full-fed calves were 55.5 lbs heavier (P < .06) than the high-concentrate limit-fed calves (Table 2). This weight difference would be expected, because intake and, thus, performance for the latter calves was held at a restricted level. Period and cumulative average daily gains were not affected by treatment within a feeding level (P > .12). The CON-LF steers' gain was 0.14 lbs per head daily more (P > .22) than that of MSE-LF steers. Limit-fed steers gained an average of 0.59 lbs per head daily more than projected. Typically, gains are greater than projected by the net energy equations. The MSE-FF steers gained 0.07 lbs per head daily more (P > .74) than CON-FF steers. The slight differences in gain for the treatments were probably caused by intake differences.

Feed Conversion. Feed conversion (Table 2) was analyzed as lbs of gain per lb of dry matter consumed, but is reported as intake to gain ratio. Feed conversion by days 28 and 56 was affected by feeding level (P < .0001). The full-fed calves required 26.2% less feed per unit of gain compared with the limit-fed calves by 28 days-on-feed. The converse was true by 56 days-on-feed; the limit-fed calves required 26% less feed per unit of gain. But period and cumulative feed conversions were not affected by treatment within a feeding level (P > .19). However, MSE fed steers did convert more dry matter to gain (P > .69). These data suggest that the MSE did not influence nutrient utilization by these steer calves receiving either a high-concentrate, limit-fed or high-roughage, full-fed ration.

Days-on-Feed and Cost-of-Gain. Within the limit-fed group, MSE-LF reduced (P < .03) days-on-feed by 9.6 days to reach 725 lbs compared with CON-LF steers (Table 2). Because cumulative dry matter intake and days-on-feed for the MSE-LF calves were both decreased compared with the CON-LF group, cost-of-gain was reduced by $0.33 per cwt gain for the MSE-LF calves. Also, feed cost was reduced by $10.14 per head for the calves being limit-fed and consuming the MSE during the growing phase. Treatment did not affect days-on-feed for the full-fed, high-roughage group (56 days). The difference in feed cost for the full-fed, high-roughage groups was only $0.14 per head for the growing period.

CONCLUSIONS

These data suggest that adding MSE to a high-concentrate diet fed at a restricted level during a growing phase will decrease days-on-feed by approximately 10 days. But the added MSE did not affect growing phase performance when steer calves were fed a high-roughage, full-fed, growing diet.

TABLE 2. Period and Cumulative Feedlot Performance of Beef Steer Calves Fed either a High-Concentrate Limit-Fed or High-Roughage Full-Fed Diet without (CON) or with MSE (MSE)

	High-Concentrate Limit-Fed				High -Roughage Full-Fed			
Item	CON	MSE			CON	MSE		
Pen	5	5			5	5		
Steers	45	50			49	48		
Weight Changes, lb			SEM [a]	P = [b]			SEM	P =
Initial	596	603	26	0.8441	586	589	26	0.8441
Day 28	654	656	26	0.8436	697	705	26	0.8436
Day 56 [c]	740	744	27	0.0544	794	801	27	0.0544
Cumulative	792	758	21	0.5195	794	801	21	0.5195
Dry Matter Intake, lb [d]			SEM	P =			SEM	P =
Day 28	11.96	11.62	.14	0.1315	17.79	18.23	.56	0.5977
Day 56	14.77	14.36	.20	0.1785	21.84	21.29	.33	0.2846
Cumulative	14.02 [e]	13.23 [f]	.25	0.0558	19.81	19.76	.42	0.9308
Average Daily Gain, lb								
Day 28	2.08	1.88	.08	0.1427	3.96	4.17	.08	0.1252
Day 56	3.08	3.16	.07	0.4713	3.47	3.39	.19	0.7799
Cumulative	2.66	2.52	.07	0.2165	3.71	3.78	.13	0.7433
Feed Conversion [g]								
Day 28 [h]	5.85	6.18	.24	0.3766	4.49	4.39	.13	0.6044
Day 56 [h]	4.82	4.56	.13	0.1909	6.37	6.31	.31	0.8836
Cumulative	5.32	5.26	.15	0.7983	5.35	5.25	.17	0.6971
Days on Feed	72.0 [i]	62.4 [j]	.24	0.0240	56	56		

[a] SEM = Standard Error of Least Square Means adjusted for covariate.
[b] P = Treatment Probability Levels. If P < .1000, then significant treatment affect across and within a Feeding Level.
[c] Main effect of Feeding Level, P < .06.
[d] Initial grower phase weight was the covariate. Analysis was done within a Feeding Level.
[ef] Least Square Treatment Means within a Feeding Level differ, P < .06.
[g] Feed conversion analyzed as gain to feed across Feeding Levels.
[h] Main effect of Feeding Level, P < .0001.
[ij] Least Square Treatment Means within a Feeding Level differ, P < .03.

COMPARISON OF TWO DIFFERENT COVERINGS FOR BUNKER-TYPE SILOS

by
M. Vass and A. S. Freeman

INTRODUCTION

Approximately 298,000 ton of corn silage was produced in 1991 in southwestern Kansas. The on-farm cash value of this crop was about $5.9 million. During the ensiling process and feeding-out of silage, dry matter losses can range from 2 to over 40% of that ensiled. Dollar value losses could range from $118,000 to $2.4 million annually!

Most dry matter losses occur from the feeding face and the first 20 inches of top-depth running the length of the silo. A covering of some kind can reduce dry matter losses within the first 20 inches by as much as 30%.

Typically, trench or bunker-type silos are not covered or are covered with black polyethylene sheeting and discarded automobile tires. Use of black plastic and tires is a very labor intensive method. Also, the tires can provide breeding grounds for mosquitos, represent an aesthetic storage problem, and become a health hazard if they catch fire. An inexpensive, labor-saving, and effective sealant that could be fed with the silage would be preferable to black plastic and tires.

OBJECTIVE

Our objective was to compare black polyethylene sheeting and scrap tires with a molasses-based sealant (Liqui-seal™, Cargill, Inc.) as coverings to preserve corn silage in bunker-type silos.

PROCEDURES

Two concrete slab bunker-type silos (180 ton capacity) were simultaneously filled with whole corn plant silage over a 3-day period. The corn silage was cut to 3/8" and harvested between early dent and black-layer from four different fields at the SWREC. The bunkers were 70 feet long with a base width of 8 feet widening to 15 feet at the top and 7 feet high.

Bunker #3 received 29 loads of corn silage (390,700 lbs) averaging 65.3% moisture. Bunker #4 was packed with 26 loads of corn silage (341,180 lbs) at 63.5% moisture.

Bunker #3 was covered with black polyethylene sheeting (10 mil) and scrap tires 24 hours after filling. Bunker 4# was covered with Liqui-Seal 24 hours after filling with silage. Table 1 has a description of the Liqui-Seal product donated by Cargill, Inc. Both bunkers were packed for several hours during filling and before covering.

Each bunker was fed-out separately. Grab samples were taken from five areas of the fresh silage face and composited for lab analysis. A physical description of the silage face and measurement of spoilage depth were taken when the samples were obtained.

Table 1. Description of Sealing Agent for Corn Silage Bunker #4

Liqui-Seal
Sealing Agent #600/AA CARMOL™
Guaranteed Analysis:
Dry Matter…Min. 54.0%
Moisture……Max. 46.0%
Ingredients:
Lignin Sulfonate, Molasses Products
Directions for use: Apply at the rate of 3/4 to 1 gallon per square foot of exposed surface area. Actual application rate to Bunker #4 was 1.05 gal/ft^2.

Liqui-Seal manufactured by : Cargill, Inc.
Molasses Liquid Prod. Div.
P.O. Box 9300
Minneapolis, MN 55440

RESULTS AND DISCUSSION

This comparison of black plastic and tire covering with the Liqui-Seal sealant was meant only to be a demonstration study. No statistical analysis was performed on the data nor was animal performance evaluated. However, several useful observations were made.

The whole corn plant material that was ensiled is described in Table 2. The corn silage was harvested at an average dry matter of 35.6%. The other characteristics listed indicate well-eared silage as described in most nutritional tables. Note that approximately one-third of the crude protein nitrogen was soluble and mostly nonprotein nitrogen.

Tables 3 and 4 present various nutritional and ensiled properties of the silage fed from each bunker. Percent ash, NDF, and crude protein increased because of dry matter fermentation losses and moisture seepage. Soluble nitrogen as a percent of crude protein increased 43% for the black plastic and tire-covered bunker and 59% for the Liqui-Seal bunker. This increase in soluble nitrogen content indicate that normal plant proteolysis during the ensiling process.

The pH values (degree of acid production) in Table 4 indicated a very complete ensiling process occurred in both bunkers. Lactic acid production appeared to be similar between bunkers. However, overall bunker lactate means were quite variable. This was also true for volatile fatty acid production. Dry matter and organic matter digestibilities (Table 4) increased for the silage in the Liqui-Seal-covered bunker compared to the fresh material (Table 2). The opposite occurred for the silage in the black plastic and tire-covered bunker.

Spoilage losses were greater for the Liqui-Seal- covered bunker (Table 5). Average spoilage depth was over twice that observed in the black plastic and tire-covered silage. However, percent shrink or loss of usable dry matter was approximately 10% less for the Liqui-Seal-covered bunker compared with the other bunker. Total dry matter loss also was less for the Liqui-Seal-covered bunker. While feeding the Liqui-Seal-covered silage, we observed that cattle would consume the top layer containing the sealant if they were being limit fed. But, if offered enough feed, the cattle would sort out the sealant layer and not consume it.

Table 6 provides a cost analysis comparing

Table 2. Characteristics of Whole Corn Plant Silage with Two Bunker Coverings

Item[a]	Black Plastic and Tires			Liqui-Seal Sealant		
Dry Matter	34.7	±	4.0	36.5	±	3.7
Ash	5.8	±	.1	5.0	±	.7
Organic Matter	94.2	±	.1	95.0	±	.7
Neutral Detergent Fiber	48.8	±	4.8	49.1	±	4.9
Acid Detergent Fiber	29.0	±	.2	28.1	±	.2
Crude Protein	7.4			7.2		
Soluble Nitrogen[b]		32.6			35.8	
Soluble NPN[c]			99.4			99.3
Soluble Protein[c]			.6			.7
IVDMD[d]	72.2	±	.9	73.3	±	.8
IVOMD[e]	76.0	±	.7	77.2	±	1.3

[a] Dry matter basis, except dry matter percentages. Bunker means with standard deviations.
[b] As a percentage of crude protein.
[c] Soluble NPN is soluble nonprotein-nitrogen as percentage of soluble nitrogen.
Soluble protein as a percentage of soluble nitrogen.
[d] In vitro dry matter digestion.
[e] In vitro organic matter digestion, calculated from IVDMD and ash percentages.

Table 3. Characteristics of Fed-out Corn Silage with Two Bunker Coverings

Item[a]	Black Plastic and Tires			Liqui-Seal Sealant		
Dry Matter	36.1	±	2.1	36.8	±	2.0
Ash	6.9	±	1.0	6.6	±	1.8
Organic Matter	93.1	±	1.0	93.4	±	1.8
Neutral Detergent Fiber	45.9	±	3.4	41.3	±	3.7
Acid Detergent Fiber	28.8	±	1.4	27.6	±	5.2
Crude Protein	7.6	±	.7	7.9	±	1.0
Soluble Nitrogen[b]	46.6	±	5.2	56.9	±	8.2
Soluble NPN[c]	99.2	±	.3	99.4	±	.1
Soluble Protein[c]	.8	±	.3	.7	±	.1

[a] Dry matter basis. Except dry matter percentages. Bunker means with standard deviations.
[b] As a percentage of crude protein.
[c] Soluble NPN is soluble non-protein-nitrogen as percentage of soluble nitrogen. Soluble protein as a percentage of soluble nitrogen.

Table 4. Characteristics of Fed-out Corn Silage with Two Bunker Coverings

Item[a]	Black Plastic and Tires			Liqui-Seal Sealant		
pH	3.95	±	.3	3.93	±	.1
Lactic Acid[b]	3.95	±	1.01	3.95	±	.73
Volatile Fatty Acids[b]						
Acetic, C_2	1.74	±	.43	1.30	±	.29
Propionic, C_3	.40	±	.07	.14	±	.02
IVDMD[c]	70.1	±	1.8	74.5	±	2.7
IVOMD[d]	75.3	±	2.1	79.8	±	2.4

[a] Bunker means with standard deviations.
[b] Percent of dry matter.
[c] Percent in vitro dry matter digestion.
[d] Percent in vitro organic matter digestion

the black plastic and tires with the Liqui-Seal sealant. We assumed that corn was valued at $2.50 per bushel, the silage was well-eared (50% dry weight being grain), and the value of the fresh whole corn plant was eight times the value of a bushel of corn. All weights used from Table 5 to calculate the weights in Table 6 were adjusted to a common dry matter of 35%. The breakeven charge was lower for the silage covered with the Liqui-Seal sealant because of the increased dry matter retention. However, total breakeven charge was $1.69 per ton greater for the silage covered with the Liqui-Seal sealant compared to the black plastic and tires. Any conclusions drawn from Table 6 must be temperred with the

Table 5. Dry Matter Loss and Physical Appearance of Corn Silage with Two Bunker Coverings

Item[a]	Black Plastic and Tires	Liqui-Seal Sealant
Ensiled Dry Matter, lb	136,048	123,981
Spoiled Dry Matter, lb	962	11,307
Percent Spoilage, %	.7	9.1
Avg Spoilage Depth, in	4.9	11.6
Usable Dry Matter, lb	135,086	112,674
Fed Dry Matter, lb	100,105	95,318
Percent Shrink, %	25.9	15.4
Percent Dry Matter Loss, %	26.4	23.1
Days to Feed-out, d	271	150

Table 6. Cost Analysis of Corn Silage Bunker Coverings

Item	Black Plastic and Tires	Liqui-Seal Sealant
Fresh Ensiled Material, lbs	388709	354231
Total Dollar Value, $[a]	$3,887.09	$3,542.31
Fresh Ensiled Material, tons	194	177
Adjusted Fed Material, tons	143	136
Breakeven, $/ton[b]	$27.18	$26.01
Difference, $/ton	$1.17	
Covering/Labor Cost, $/ton[c]	$1.23	$4.09
Total Breakeven,$/ton	$28.41	$30.10
Difference, $/ton	($1.69)	

[a] Silage value based on $2.50/bu. corn value X 8 = $20.00 per ton of silage at 35% dry matter.
[b] Amount needed to recover just the cost of silage based on adjusted fed material weight.
[c] Includes plastic, material to secure plastic to bunker, and 8 man-hours @ $10.00/hr to cover and remove plastic and tires. Liqui-Seal cost @ $0.65 per gallon and .8 gallons per sq. foot of surface area plus $50.00 to apply.

fact that the Liqui-Seal bunker was fed out at a faster rate (1.7 times) than the black plastic and tire-covered bunker. Percent shrink would probably have been similar between bunkers, if the feeding rate had been the same.

CONCLUSIONS

Conclusive recommendations cannot be drawn from this demonstration study. However, several observations made during feeding of the silages warrant further controlled study. The Liqui-Seal sealant appeared to conserve dry matter and nutrients and improve in vitro digestibility of the silage. Also, the Liqui-Seal product was much easier to apply and remove while feeding compared with the black plastic and tires.

SUMMARY OF 1991/92 SW KANSAS 4-H CATTLE FEEDING PROJECT

by

K.C. Dhuyvetter and T. P. Eck

SUMMARY

A project such as the SW Kansas 4-H Cattle Feeding Project is very useful as an educational experience for the participants. However, it can also be educational for others within the beef industry. The information from this type of project helps identify and quantify differences that exist in cattle and also the primary factors affecting profitability. Regression analysis indicated that dressing percent, quality grade, and average daily gain had the biggest impacts on net returns. For the 15% of the steers that required health treatment, medication costs were the second largest expense item. On average, this pen of steers made money and also had carcasses and weights that fit within industry "standards". However, there was considerable variation within the pen for all variables analyzed. High variability with the cattle coming from many different points of origin would be expected, but it does indicate room for improvement.

INTRODUCTION

The commercial feedlot industry in southwest Kansas plays a major role in the economy of the area and the entire state. Individuals or groups of people owning cattle that are fed in a commercial feedlot come from many different walks of life. Cattle ownership in a commercial feedlot should be considered as an investment opportunity and one that is not limited to only ranchers or farmers. The SW Kansas 4-H Cattle Feeding Project was developed to provide 4-H members the opportunity to feed cattle in a commercial feedlot with limited financial risk. This project was started in the fall of 1986 and has been conducted on an annual basis since.

OBJECTIVE

The objective was to provide 4-H members and their families an opportunity to learn about commercial feedlots, cattle performance, carcass characteristics, record-keeping, and factors affecting cattle feeding profitability.

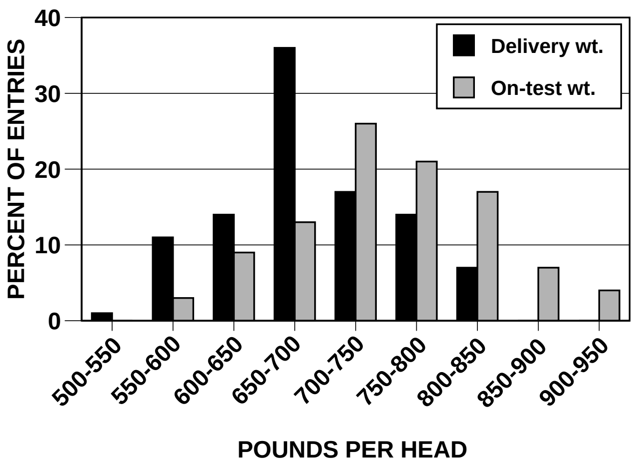
PROCEDURES

The SW Kansas Cattle Feeding Project has been going on for 6 years and was held at Brookover Feed Yard in 1991/1992. Seventy-six steers from 38 4-H members were delivered to the feedyard and individually weighed on December 7, 1991. Individual weights were taken again on December 19 and 20. The average of these two weights was used as the official "on-test weight". Total days in the feedlot was 153, but the official gain period was 140 days. Cattle were fed and managed according to the standard practices of Brookover Feed Yard. Several cattle were treated for sickness during the feeding period, but none died. The cattle were individually weighed, marketed grade and yield to IBP, and delivered to the Holcomb plant on May 8, 1992. Carcass data were collected, and profitability was estimated for individual steers.

RESULTS AND DISCUSSION

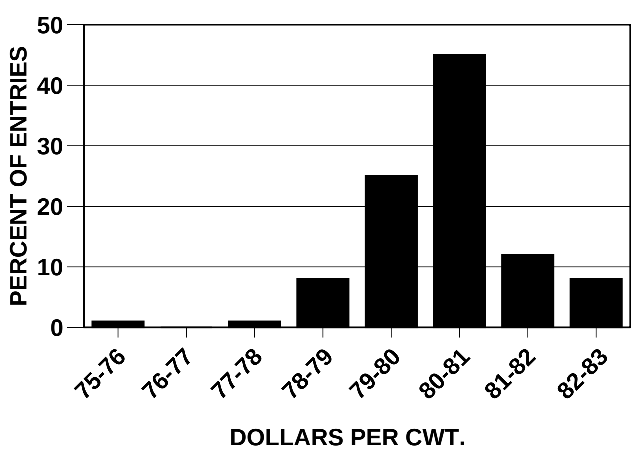
Beginning Weight. The average weight at delivery was 690 lbs with a range of 542 to 840 lbs. The average on-test weight was 751 pounds with a range of 594 to 934 lbs. Nine steers gained over 100 lbs from the first weighing until the second, while one steer lost slightly more than 20 lbs. Figure 1 shows the distribution of delivery and on-test weights.

Figure 1. Distribution of Delivery



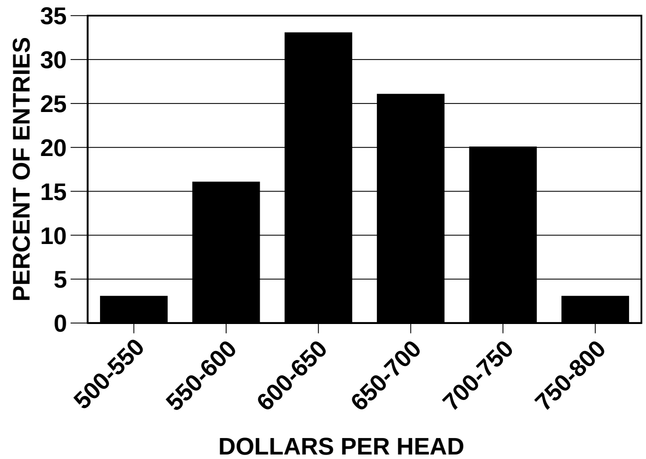
Feeder Cost. When the cattle were individually weighed on December 19 and 20, each animal was evaluated and assigned a purchase price. The purchase price was based on weight and type of animal using current market conditions at that time. The average price was $80.32/cwt., with a range of $75.84 to $82.98. Approximately 80% of the steers were assigned a price between $79 and $81 (Figure 2). The feeder cattle market in the fall of 1991 was fairly constant

Figure 2. Feeder Purchase Prices



across weights. The average cost per head was $625.67 and ranged from $506.50 to $762.86. This indicates that the highest priced steer cost 50% more than the lowest priced steer. Figure 3 shows the distribution of feeder purchase prices in terms of dollars per head. As would be expected, there is a fairly wide

Figure 3. Distribution of Feeder Purchase Prices

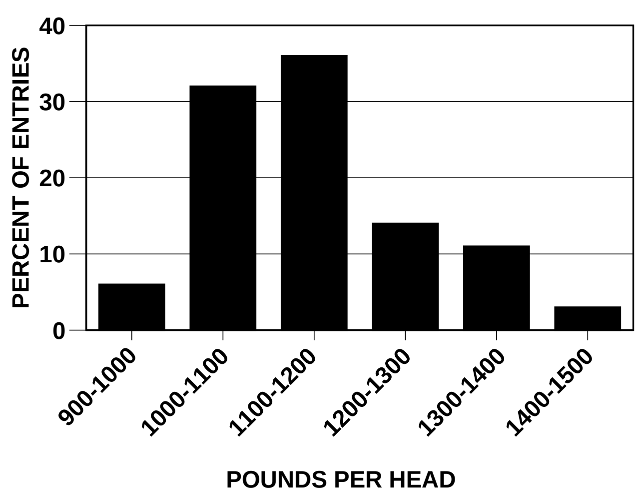


distribution in feeder cost per head, reflecting the wide variation in beginning weights and relatively constant price on a per pound basis.

Ending Weight and Average Daily Gain. Individual weights were taken on May 8 prior to shipping for slaughter. This ending weight was adjusted for 4% shrink and used to calculate average daily gain for both the entire feeding period (153 days) and the on-test period (140 days). The average weight per head after shrink was 1,149 lbs. This weight is very close to an ideal weight for the industry; however, the range of the pen was 938 to 1,431 lbs. Figure 4 shows the distribution of ending weights for the pen.

Average daily gain over the entire feeding

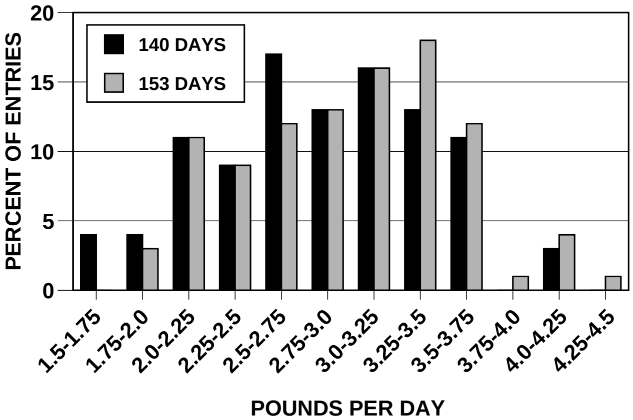
Figure 4. Distribution of Ending Weights



period for the pen was 3.0 pounds and ranged from 1.86 to 4.26 pounds. Daily gain during the test period averaged 2.84 pounds and ranged from 1.54 to 4.11 pounds per day. There was slightly more variation in gains during the on-test period compared to the entire feeding period.

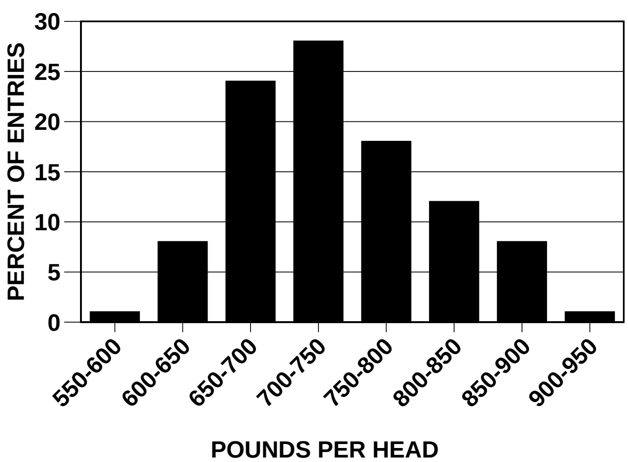
Figure 5 shows the distribution of average daily gains for the on-test feeding period (140 days) as well as the entire feeding period (153 days).

Figure 5. Distribution of Average Daily Gains



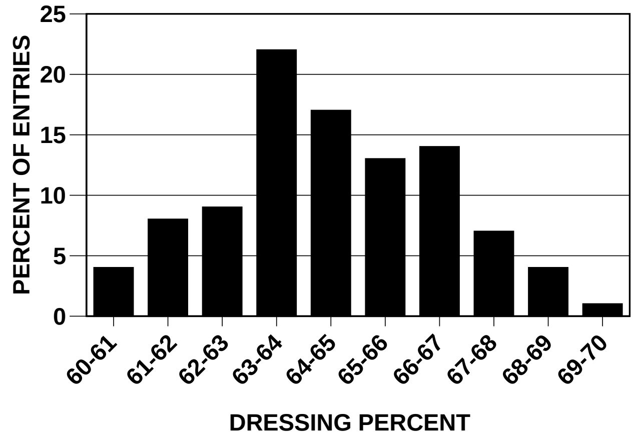
Carcass Weight. The average carcass weight was 742 lbs. Approximately 70% of the carcasses were between 650 and 800 lbs. However, the range for the entire pen was 586 to 939 lbs for a difference of over 350 lbs. At the time the cattle were marketed, IBP was discounting carcasses weighing above 950 lbs and those under 525 lbs by $10/cwt. Therefore, no carcasses received a discount because of weight. Figure 6 shows the distribution of carcass weights for the entire pen.

Figure 6. Distribution of Carcass Weights



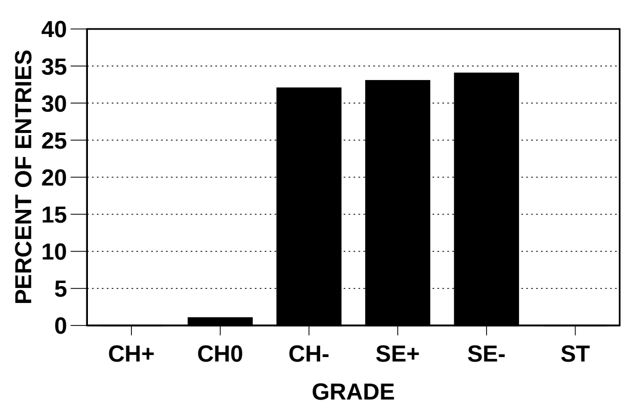
Dressing Percent. Dressing percent has a big impact on income and profitability when cattle are sold grade and yield. This is because payment is based on dressed (carcass) weight and not live weight. Dressing percent was calculated by dividing the carcass weight by the shrunk ending weight. The average dressing percent was 64.55% and ranged from 60.41% to 69.10%. Figure 7 shows the dressing percent distribution.

Figure 7. Distribution of Dressing Percent



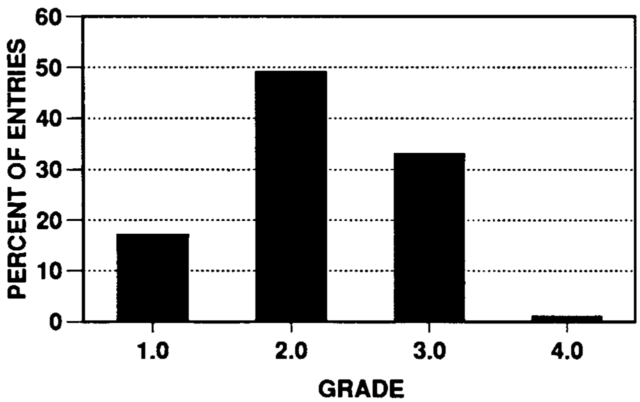
Quality Grade. Quality grade can have a big impact on income and profitability when cattle are sold grade and yield. How much quality grade affects income will depend on the price spread between quality grades. At the time the cattle were marketed, IBP was paying $123/cwt for Choice grades, $119/cwt for Select grades, and $99/cwt for Standard grades. With a $4/cwt spread between Choice and Select the importance of cattle grading Choice is not as significant as with a wider spread. The cattle grading Choice had an average profit of $21.54/head and the cattle grading Select averaged $37.13/head profit. This indicates that, with a narrow spread between Choice and Select prices, other factors are more significant in determining profitability. Thirty-three percent of the cattle graded low Choice or better, with the remaining cattle grading Select. No cattle graded Prime or Standard. IBP was also discounting dark cutters by $10/cwt, but no carcasses were classified as dark cutters. Figure 8 shows a distribution of the quality grades for the pen.

Figure 8. Distribution of Quality Grades



Yield Grade. It is important to understand the effect yield grade can have on income and profitability. As a general rule, cattle with higher yield grades have more external fat and possibly have a better chance of grading choice. However, this will not always be the case and if the yield grade is too high the cattle will usually be discounted. At the time the cattle were marketed, IBP was discounting yield grade 4 cattle by $10/cwt. Any yield grade below 4 received the base price based on quality grade and carcass weight. One steer was a yield grade 4 and received the $10/cwt. discount. Figure 9 shows the distribution of the yield grades for the pen.

Figure 9. Distribution of Yield Grades



Gross Income. Gross income per head was calculated by multiplying the carcass weight by the grade and yield price. The average carcass weight was 742 lbs and the average price was $120.18/cwt, resulting in an average gross income of $891.72/head. The range in gross income per head was over $450 ($697.34 to $1,154.97). Figure 10 shows the distribution of gross income per head. If the cattle had been sold on a liveweight basis, the equivalent liveweight price had been $77.61/cwt (the average live price paid during the week the cattle were marketed was approximately $76/cwt). Figure 11 shows the gross income with cattle being sold grade and yield ranked from lowest to highest compared to what it would have been had the cattle been sold on a live basis for $77.61. The average is the same in both cases, but the range in gross income received would have been different. The steers bringing the lowest gross income under grade and yield would have received higher amounts on a live basis. However, the steers bringing the highest gross income under grade and yield would have received less on a live basis. In other words, cattle marketed on a live basis receive income based on average prices, whereas cattle marketed grade and yield receive income based more on prices reflecting actual quality.

Figure 10. Distribution of Gross Income

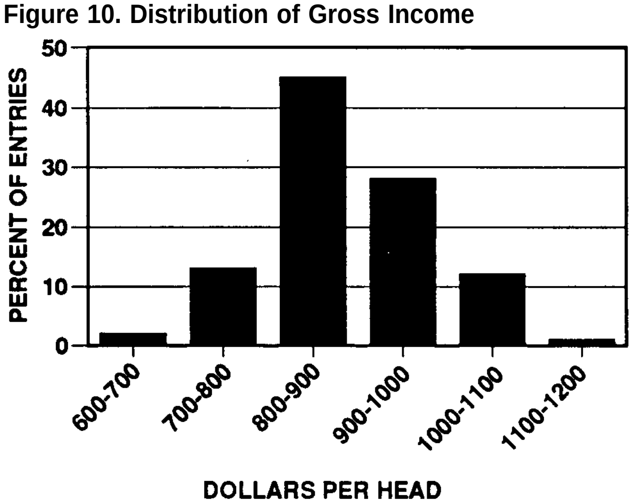
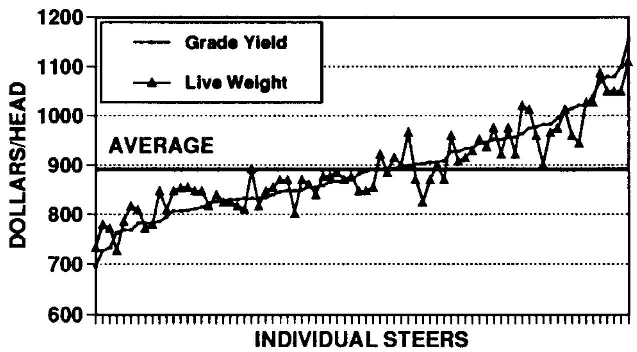
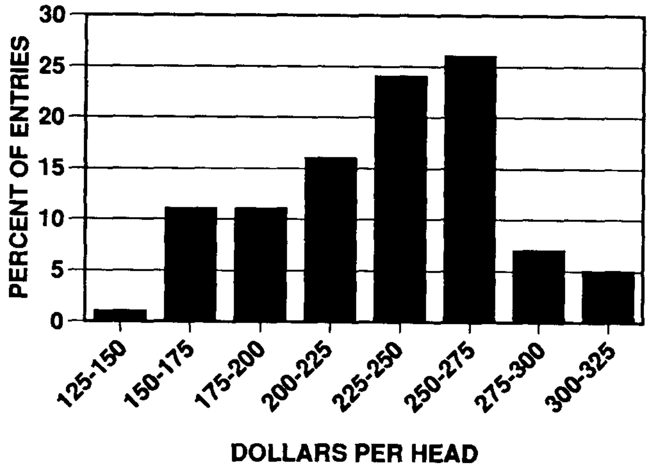


Figure 11. Distribution of Gross Income - Individual Steers



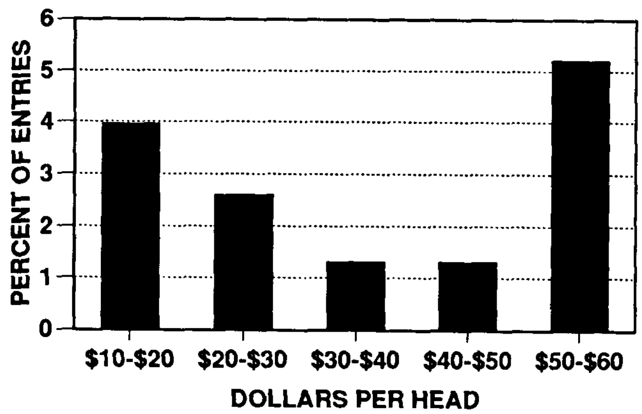
Total Feedlot Cost. Feedlot costs (cost of gain) include the following production expenses: feed, medication, yardage and processing feed finance charges, freight, and the beef checkoff. The only expenses not included are the cost of the feeder steer and interest on that investment. All cattle were processed upon arrival; however, the only cost of processing was the labor charge because products were donated by Great Plains Chemical and Anchor Pharmaceuticals. The average feedlot cost for the pen was $234.04 per head ($50.99/cwt) and ranged from $145.79 to $323.89. The main expense was feed cost, which accounted for 92% of the total feedlot cost. Figure 12 shows the distribution of total feedlot costs per head. Eighty-five percent of the steers did not require any individual medication after the initial processing. Those steers requiring treatment for health reasons

Figure 12. Distribution of Total Feedlot Costs



incurred an additional expense of $35.73 per head (range of $13.97 to $57.96). Figure 13 shows the distribution of treatment costs per head for treated steers. For the majority of the steers (85%) medicine was not a significant cost; however, for those treated (15%), it was the second largest expense item. Because feed and medicine costs are the major expenses, it is easy to see why having healthy cattle that gain well is so important to profitability.

Figure 13. Distribution of Treatment Costs per Head for Treated Steers



Profit/Loss. Profit was estimated based on actual income received, total feed costs, and the assigned feeder value. Eighty percent of the steers had positive profits, whereas the other 20% incurred a loss. The average profit per head was $32.00; the range was from a loss of $93.48 to a profit of $144.27. Table 1 shows a breakdown of the income and expenses.

Figure 14 shows a distribution of the estimated profits per head. Figure 15 shows the estimated profit ranked from low to high from selling grade and yield compared to what it would have been

Table 1. 1991/92 SW Kansas 4-H Cattle Feeding Project Budget per Steer Sold

	Avg	Min	Max
Income	$891.71	$727.91	$1,110.62
Expense,#			
Feeder cost	602.56	487.79	734.68
Interest on feeder	23.11	18.71	28.18
Yardage/processing	8.28	8.28	8.28
Medication	5.17	0.00	57.96
Feed	214.78	133.01	304.62
Finance	3.43	2.13	4.77
Freight/checkoff	2.38	2.38	2.38
Profit	$32.00	($93.48)	$144.27

Figure 14. Distribution of Estimated Profits

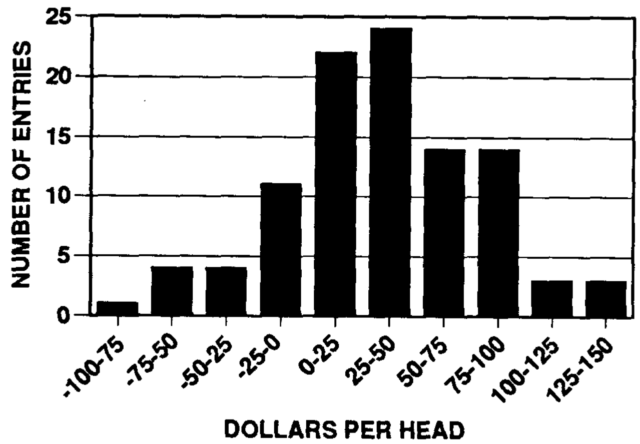
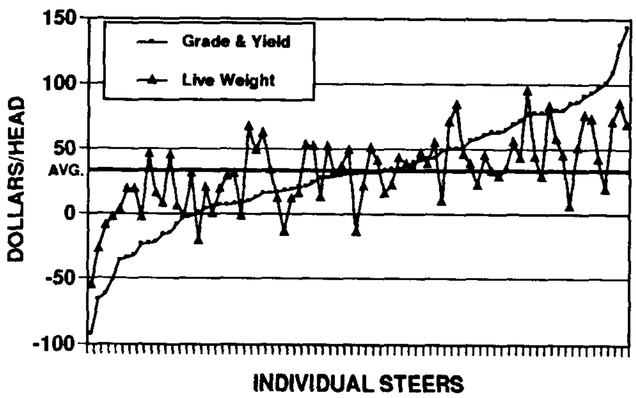


Figure 15. Distribution of Profit, Grade and Yield vs. Live Weight



had the cattle been sold on a liveweight basis for an equivalent price. Selling on a live basis would not have changed the average profit for the pen of $32.00/head, but it would have reduced the extreme highs and lows. Live basis marketing would pay more for the bottom end cattle, while discounting the best cattle.

For this information to be helpful, we need to identify those factors that impact profitability the most. The following regression equation was estimated to help identify the relative impacts different factors had on profitability

$$\text{NET RETURN}_i = B_0 + B_1\text{DRESS}_i + B_2\text{QG}_i + B_3\text{FC}_i + B_4\text{ADG}_i + B_5\text{VET}_i + e_i$$

where i refers to the individual steer, NET RETURN is the profit per head, DRESS is the dressing percent, QG is the quality grade (where Choice=l and Select=2), FC is the feeder cost per head, ADG is the average daily gain, VET is the medicine cost per head in addition to processing cost, B_0 through B_5 are parameters to be estimated, and e is a random error term. DRESS and QG give an indication of the quality of the carcass, hence the value of the animal at slaughter. FC represents what has to be paid for the feeder, and VET reflects major costs not associated with gain. ADG reflects the performance of the animal and accounts for the major expense of feed. Estimating this equation makes it possible to examine how changes in the major factors identified affect profitability. B_1 is expected to be greater than zero, because an increase in the dressing percent would increase returns. B_2 is expected to be negative, because Choice carcasses bring a premium over Select carcasses. B_2 should approximately equal the average carcass weight times the Choice/Select price spread. B_3 is expected to be negative, because as the cost of the feeder increases, returns would decrease. B_4 is expected to be positive, because as average daily gain increases, the final selling weight increases. Feed cost will also increase as average daily grain increases; however, B_4 would be expected to be negative, because the selling price is greater than the feed cost of gain. Feed efficiency would also be expected to improve with higher rates of gain at a constant intake; however, this model does not account for that because all cattle were charged feed cost of gain at the same rate. B_5 is expected to be negative, because as medicine costs increase, net returns decrease.

Important in evaluating the usefulness of this estimated equation is its ability to explain the variability in profit. The R-squared is a statistic that measures the variability in net returns across steers within the pen and is explained by the variables in the regression equation.

Table 2 shows the coefficients on the estimated parameters for the regression equation. The R-squared of .85 indicates that 85% of the variability in net returns for this pen was explained by the variables included in the regression equation. The results can be interpreted as follows; a 1 percent change in dressing percent resulted in a $13/head change in net return. Steers that graded Select received almost $28/head less in returns than steers grading Choice. For every increase of $100/head in the cost of the feeder, net returns decreased by $10.60. Net returns increased by over $36/head for every 1 lb increase in average daily gain. Net returns decreased by approximately 67 cents for every dollar spent on medicine (individual treatments only). Although this equation does not explain all the variability that existed, it does help identify those factors that played a big role in profitability. Dressing percent, quality grade, and average daily gain had the biggest impacts on net returns, whereas feeder cost per head was less important. This indicates that if cattle are going to be sold grade and yield, it is important that they have good carcass characteristics and maintain adequate performance.

Table 2. Estimated Regression Equation of Factors Explaining Net Returns

Variable	Coefficient	T-statistic
Intercept	-803.30	18.16
DRESS	13.00	10.85
QG	-27.60	5.89
FC	-0.106	2.68
ADG	36.61	9.19
VET	-0.666	3.93
R-Squared		.85
Observations		76

INSECTICIDE RESISTANCE OF STABLE FLY IN CATTLE FEEDLOTS

by
J. E. Cilek and G. L. Greene

SUMMARY

During 1992, stable flies collected from seven cattle feedlots were found to be resistant to several insecticides currently used for their control. Resistance to Vapona and Rabon was detected in most of these populations. In many instances, the type of insecticide as well as the number of applications per year were the main factors influencing the severity of resistance in stable flies. In at least two feedlots, Vapona was ineffective in controlling stable flies. Fly control practices to reduce the development of insecticide resistance are suggested.

INTRODUCTION

The stable fly is the primary economic fly pest of cattle in feedlots in the Great Plains. The painful bites of these flies interfere with the feeding behavior of livestock and are generally considered to be responsible for lowered feed efficiency and decreased weight gains. As few as six stable flies per animal have been reported by researchers to cause significant effects. After extrapolating losses attributed to stable fly feeding, it is estimated that these flies cost feedlot managers over $7.00/animal each spring in Kansas.

Currently, the main focus of controlling the stable fly in feedlots is to kill the adult stage by applying insecticides as premise sprays. However, we have received reports from feedlot managers that the materials they were using seemed to be less effective than in previous years.

OBJECTIVE

Our objective was to determine if insecticide resistance was present in adult stable fly populations from several southwest Kansas feedlots.

PROCEDURES

Adult stable flies were collected from seven cattle feedlots from four southwest Kansas counties (Finney, Ford, Gray, and Haskell). After collection, flies from each lot were placed in individual screened cages and taken to the laboratory for testing. Flies were transferred to glass pint mason jars previously treated with an insecticide. All fly populations were tested against Vapona, Rabon, and permethrin. Only four populations were tested against methoxychlor. All insecticides were tested on each population on the same day. After 2 hours exposure inside the jars, the numbers of flies that were dead and/or intoxicated with the insecticide and could not stand upright were recorded. An insecticide-susceptible laboratory colony of stable flies was used as a baseline on which to determine field population susceptibility.

Results are expressed as resistance ratios for each insecticide for each population. Resistance ratios were calculated as follows: LC50 of the field population/ LC50 of an insecticide-susceptible laboratory population.

RESULTS AND DISCUSSION

The feedlot history of insecticide use, number of applications, and mode of application during 1992 are shown in Table 1. According to interviews with the feedlot managers, this information is similiar to procedures for the last 3 to 4 years, with the exception of the E and F populations, for which we were unable to obtain accurate records.

Stable fly populations A and E had the greatest resistance to Vapona (Table 2). Undoubtably, this insecticide is now ineffective on these feedlots. Although resistance was not as great in the B, C, and D populations, resistant flies were also present. Control may not have been lost in these latter populations, but fly kill is probably somewhat lower than it would be if these populations were completely susceptible. Notice that some of the feedlots where these populations were collected had used Dibrom and not Vapona, yet they were resistant to Vapona. This is because Dibrom is broken down by the fly to Vapona in order to become toxic. We also found that the more times Dibrom, malathion, and/or Vapona were applied in a feedlot, the higher the level of resistance to Vapona, with the exception of the E population. Again, we were unable to obtain accurate historical insecticide use records for this feedlot. But it is quite certain that several more applications of Vapona per year on this feedlot had occurred prior to 1992 to cause this level of resistance in the stable flies.

The B, E, and F populations had resistance to Rabon, even though this insecticide had not been used for stable fly control. It appears that resistance to Vapona can result in cross-resistance to Rabon. Also, Rabon and Vapona are in the same class of insecticides, known as organophosphates, which may explain this phenomenon.

Resistance to permethrin was detected in the E population, where previous insecticide use was not determined. No resistance to methoxychlor was detected in any of the stable fly populations. Methoxychlor was tested because it is related to DDT. This insecticide had been used in the 1950's on feedlots in the Great Plains as a control measure against stable flies on cattle.

Our results have shown that resistance to some of the insecticides currently used for the control of stable flies does occur on several feedlots in southwest Kansas. No new insecticides are being developed for livestock insect control and, we must judiciously use the few insecticides that we have available.

Options to avoid or at least delay the further progress of resistance include stopping or mimimizing the use of insecticides by using biological control methods such as parasitic wasps. Insecticides should be used only as a last resort to knock down large numbers of stable flies only on a "as needed" basis. Large-area treatments of entire feedlots should be discouraged, and only spot-treatment of trouble areas such, as perimeters or portions thereof, should be used.

Vegetation management is an important point to consider when attempting stable fly control. After they take their blood meal, stable flies must go to shaded areas to rest in late spring and summer and get away from the lethal effects of the mid-day sun. Removing vegetation early in the season to eliminate resting areas or cutting paths through vegetation and applying an insecticide for quick knockdown and kill can help reduce the fly population with limited amounts of insecticides.

If insecticides are the last resort, apply them only at times when the flies are present (for example, while they are resting or sitting on feedbunks) and the winds are relatively calm, particularly early morning or at dusk. Also, rotate between insecticide classes, not between insecticides within a class, every 2 to 3 weeks. Table 3 presents some of the available insecticides for use against stable flies. It is wise to rotate between pyrethroid and organophosphate insecticides rather than relying on one insecticide class. Rotating between classes ensures that you will not be continuously selecting for the same type of mechanism responsible for resistance. In this way, you can avoid or at least delay the rapid buildup of resistance that can lead to control failures.

Table 2. Adult Stable Fly Insecticide Susceptibility on Several Cattle Feedlots in Southwestern Kansas, 1992

Stable Fly Population	Vapona	Rabon	Permethrin	Methoxychlor	Insecticide Used	No. of Applications
A	148*	0.3	1	——	Dibrom, malathion, synergized pyrethrins, permethrin	50
B	8*	0.4*	1	0.6	Dibrom, permethrin, Vapona	22
C	3*	0.2	1	0.9	Dibrom, Vapona	15
D	1	0.2	0.3	0.3	malathion	6
E	238*	4.6*	1.8	——	Vapona, permethrin	4
F	2*	1*	0.3	0.6	permethrin	1
G	1	0.1	1	—	none	

*Populations with an asterisk are resistant to the insecticide in that column.

Table 3. Insecticides Available for the Control of Stable Flies [1]

Active Ingredient (Trade Name)	Application Use	Insecticide Class
Dichlorvos (Vapona)	space, mist spray	organophosphate
Malathion (Cythion)	space, mist spray	organophosphate
Naled (Dibrom)	space, mist spray	organophosphate
Fenvalerate (Ectrin)	space, mist spray	pyrethroid
Permethrin (Ectiban) Permectrin II)	space, mist spray	pyrethroid
Fenvalerate (Ectrin)	residual spray	pyrethroid
Methoxychlor (Marlate)	residual spray	chlorinated
Permethrin (Atroban, Ectiban, Hard Hitter, Permectrin)	residual spray	pyrethroid
Dichlorvos (Vapona)	direct animal spray	organophosphate
Permethrin ((Atroban, Ectiban, Hard Hitter, Permectrin II, Permectrin)	direct animal spray	pyrethroid

[1] Adapted from: Managing Insect Problems on Beef Cattle. 1990. Kansas State University, Coop. Ext. Serv. Entomology Bull. 200. 64 pp.

[2] Note: resistance to pyrethroids can result in cross-resistance to chlorinated hydrocarbon insecticides.

IMPACT OF THE PARASITIC WASP, *SPALANGIA NIGROAENEA*, ON STABLE FLY POPULATIONS IN KANSAS CATTLE FEEDLOTS

by
J. E. Cilek and G. L. Greene

SUMMARY

A 4-year, large-scale, integrated pest management demonstration-research study was initiated during 1992 using the parasitic wasp *Spalangia nigroaenea* to reduce stable flies on 18 Kansas cattle feedlots. Nearly 50% fewer stable flies were trapped on feedlots where parasite releases occurred than on lots that did not receive releases. Adult stable fly emergence was also lower (59%) and total parasitism was greater (41%) on release lots when compared with check feedlots at 75% and 29%, respectively. Manure management was extremely important in influencing the effectiveness of parasites. Those lots that minimized areas for stable fly breeding achieved a greater reduction per penny spent for parasites than did those lots where sanitation was considered to be poor. Even though *S. nigroaenea* greatly reduced stable fly populations during a cool, wet year, its activity in a hot, dry year is unproven.

INTRODUCTION

Mass release of parasitic wasps for the reduction of filth flies in confined livestock facilities has met with mixed success. Researchers that used the same species of parasites responsible for the early successes observed on poultry farms have not repeated those results in cattle feedlot situations in eastern Nebraska or western Kansas. This prompted investigations in Kansas to identify what native parasites were present in feedlots and the level of natural parasitism in stable fly populations. Parasitic wasps impact fly populations by laying an egg in the pupa, which kills the developing fly and allows the development of the wasp. Collections of naturally occurring pupae were used to determine native wasp populations. In all instances, the majority of parasites that emerged from stable fly pupae were *S. nigroaenea* and nearly 40% of the live fly pupae produced parasites. From 1987 through 1991, a limited number of mass releases of this wasp in feedlots resulted in reducing the number of adult stable flies, while the percentage of fly pupae producing this parasite increased. Based on these initial results, a large-scale, integrated pest management, demonstration-research study of stable fly was initiated during 1992 and will continue through 1995.

OBJECTIVE

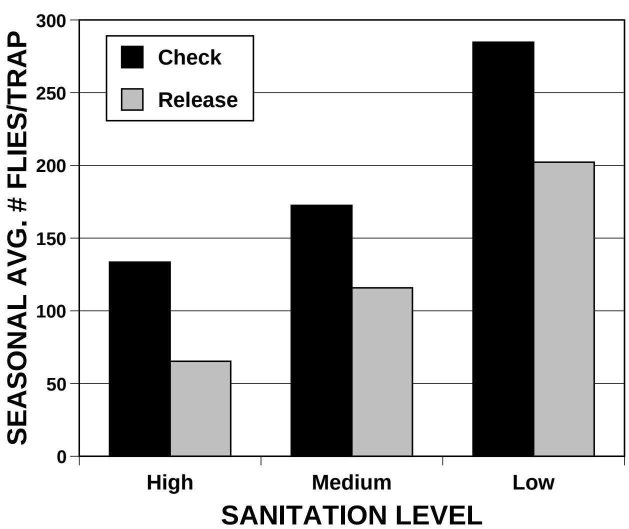
The objective of this large-scale study is to determine the efficacy of mass releases of native *S. nigroaenea* in various environments and feedlot management situations in Kansas. This study will provide useful information to help feedlot managers make informed decisions while utilizing this technology.

PROCEDURE

Twenty-four cooperating commercial cattle feedlots, ranging in size from 2,400 to 100,000 head, were used in this study. Various numbers of *S. nigroaenea* were released weekly, depending on the level of fly breeding, on 18 lots from the middle of May through the first week of September. Adult stable fly abundance was monitored weekly on each feedlot using Alsynite fiberglass sticky traps from the middle of May through the first week in October. Four traps were placed at the margins of each lot in each of the four ordinal directions, except in larger yards where eight traps were used. Samples of naturally occurring stable fly pupae were collected weekly from each lot and held in the laboratory to determine species and number of emerging flies and parasitic wasps.

Sanitation practices on each release lot were rated and assigned to either a high, medium, or low category. Feedlots that were in the high sanitation category generally cleaned pens regularly and did not stockpile wet manure on or near the premises. Drainage areas were free from manure accumulation, and spilled feed around feedbunks was seldom present for stable fly development. Feedlots with low sanitation generally cleaned out pens irregularly; stockpiled wet manure on or near the premises; had manure accumulated along fencelines, drainage areas, and lagoons; and frequently had spilled feed along feedbunks for continuous stable fly breeding. These conditions were not all present in a single feedlot. Feedlots categorized as medium generally practiced sanitation between these two extremes.

Figure 1. Comparison of the Number of Stable Flies Caught on Alsynite Sticky Traps from Kansas Feedlots Using Parasiite Releases versus Check Lots at Three Sanitation Levels



RESULTS AND DISCUSSION

The number of stable flies trapped on parasite release feedlots was lower than that on check lots (Fig. 1). The number of stable flies was lowest on feedlots that practiced high sanitation, and the mean percent fly reduction was also highest in this category when compared with either of the other two sanitation levels (Table 1). However, the percent reduction achieved per penny spent on parasites was greatest on the medium sanitation lots. Apparently, that too many parasites (about double that of the medium lots) were released in the high sanitation lots, which may explain why the percent reduction per penny was about half that of the medium lot. Conversely, not enough parasites were released in the low sanitation lots to economically reduce the stable fly population. That resulted because more fly breeding areas were available than the economical release rate of wasps could control.

Stable fly emergence and total parasitism from pupal collections were not greatly different between sanitation levels (Table 2). However, stable fly emergence was lower and total parasitism was greater on release lots than on check lots. Emergence of *S. nigroaenea* from stable fly pupae was greatest in the high sanitation category when compared with medium or low sanitation lots. Also, *S. nigroaenea* pupal parasitism was greater in all sanitation categories than in check lots (Table 2).

We should mention that two feedlots stopped parasite releases in midseason (July 10) because of economic considerations. These lots were in the low sanitation category and were producing quite a lot of stable fly pupae. During the parasite release period, fly reduction averaged 54%. Stable fly populations

Table 1. Seasonal Stable Fly Abundance, Reduction Levels, Parasitoid Release Rates and Percent Reduction Realized per Penny per Animal During Augmentive Releases of *Spalangia nigroaenea* on Kansas Feedlots, 1992

Sanitation Level	No. of Feedlots	Mean No. Stable Flies	Mean % Reduction	Mean No. Parasites Released per Animal	% Reduction per Parasite Penny Spent per Animal
High	5	65.3	47.1	37.3	1.25
Medium	7	115.8	42.3	17.8	2.84
Low	6	202.2	34.5	41.0	0.94

on these lots dramatically increased approximately 2 weeks after releases stopped (Fig. 2), and only 23% reduction was achieved during this period, giving a seasonal average reduction of 39%. Also for 3 weeks during the nonrelease period, no fly reduction occurred. This point emphasizes that parasite releases did, in fact, have an effect in reducing the stable fly populations on these two lots.

In conclusion, results were promising from the first year of this 4-year study. The native parasite, S. *nigroaenea,* was an effective biological control agent for the reduction of stable flies on Kansas feedlots during a cool, wet year with very high fly populations. An important point to remember from this study, especially for the feedlot manager, is that sanitation profoundly influenced the effectiveness of parasite releases. It should be an important component of plans to use parasitic wasps to reduce stable fly populations.

Figure 2. Stable Fly Counts with Parasite Releases on Poor Sanitation Feedlots.

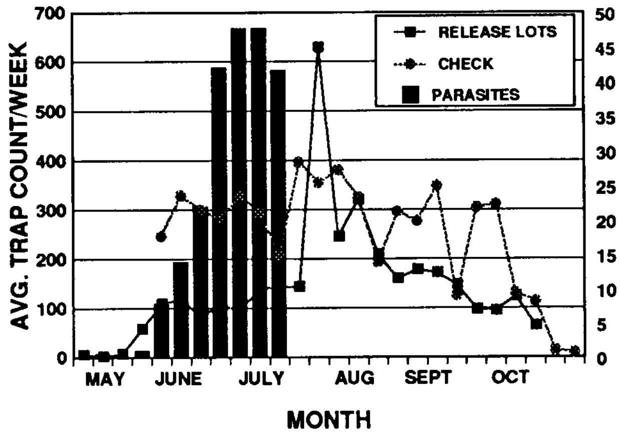


Table 2. Stable Fly Pupal Parasitioid Collections from Cattle Feedlots in Southwest Kansas during Augmentive Releases of Spalangia nigroaenea, 1992

Sanitation Level	No. of Feedlots	Stable Fly % Emergence	Total Parasitism	*Spalangia nigroaenea*
High	5	59.2	40.8	88.2
Medium	7	63.2	36.8	68.1
Low	6	54.7	45.4	72.0
Average		59.3	40.7	74.5
Nonrelease (control)	6	75.2	24.8	49.8

COSTS OF FLY PARASITES TO MANAGE STABLE FLIES IN CATTLE FEEDLOTS

by

G. L. Greene and J. E. Cilek

SUMMARY

Costs of an integrated pest management research-demonstration project evaluating parasitic wasp releases to reduce stable fly populations on Kansas cattle feedlots are presented. Costs of sampling feedlots to monitor stable fly populations in order to determine release rates average $0.08 per animal for the fly season. Fly parasite costs averaged $0.24 and ranged from $0.06 to $1.10 per animal. Total program costs averaged $0.32 per animal and ranged from $0.09 to $1.34 per animal. These costs were associated with a greater number of stable flies with a longer seasonal duration than in previous years. In spite of this, stable fly control costs at one feedlot decreased 42% in comparison to costs of a commercial service in the previous year, when flies were present for a shorter time and at lower levels.

INTRODUCTION

Early integrated pest management approaches emphasized the use of biological control agents to widen the rather narrow path of insect control previously carved out by insecticides. During that period in the 1970's, commercial production of a variety of fly parasite species was started, and costs were relatively low. An average of $0.05 per animal was invested by cattle feedlots for filth fly parasites until about 1988, when prices increased to as much as $0.50 per animal. At this level, the continuance of nonchemical avenues, such as parasite releases, for fly reduction began to be dictated by economics.

We are investigating the use of native parasitic wasps to reduce stable fly populations in Kansas cattle feedlots. Before this technology can effectively be transferred to feedlot production systems, the economics of such programs need to be addressed.

OBJECTIVE

Our objective was to determine not only the effectiveness of parasitic wasps but to start development of an economical parasite release system for stable fly reduction.

PROCEDURES

Cost figures for parasites and sampling fees in this study were based on 18 cooperating commercial cattle feedlots with a total of 489,000 head of cattle. Adult stable fly populations were monitored to determine parasite release rates. This information was obtained by placing four Alsynite sticky traps at the margins of each feedlot, except for larger yards where up to eight traps were used. Each week, the number of stable flies trapped was recorded and the sticky covers on the traps were replaced. Similar traps were placed in six feedlots where we did not release parasites. Comparing fly counts on release versus nonrelease (check) lots provided comparison figures on fly reduction.

Costs reported in this paper reflect the average expenses paid by the cooperating feedlots. A sampling fee was established to cover sampling costs plus part of the research costs prior to the start of the study. The maximum fee charged was $3,000 per feedlot.

RESULTS AND DISCUSSION

The 18 feedlots purchasing parasites during 1992 provided a broad base to compare parasite and sampling costs. Even though sampling costs were predetermined, based on our anticipated costs, there were considerable differences (Table 1). Sampling costs per animal averaged $0.08 and ranged from $0.03 to $0.30. The smaller 2500 head lot had the highest cost. The maximum charge was $3,000 per feedlot, which was $0.10 per animal and the cost per head reduced as cattle numbers rose above 20,000.

The cost of parasites for the fly season was higher than anticipated based on the $0.23 per animal in 1991. Fly populations were higher and present longer during 1992 than in previous years. The average cost per head was $0.24. The larger, cleaner feedlots had the lowest cost for parasites at $0.06 per animal, whereas the highest cost was $1.10 per animal in a feedlot with several years of manure accumulation present. Total cost for sampling and parasites during 1992 averaged $0.32 per animal. The range was $0.09 to $1.34. Looking at fly levels, the average cost was higher for the high fly lots, $0.54, compared to $0.24 for the medium fly levels lots (Table 1). The cost of $0.37 for the low fly level feedlots was due to smaller number of animal per feedlot and larger numbers of parasites being released.

The greatest fly reduction per penny per animal spent for parasites occurred on lots where manure removal and elimination of other stable fly breeding sites were between regular (good sanitation) and sporadic (poor sanitation). The reduction realized in this case was 2.84%, whereas lots with poor sanitation realized only 0.94%. Good sanitation lots averaged 1.25% reduction per penny per animal spent for parasites. In addition, one feedlot in this study that used a commercial fly control service during 1991 spent 42% less for control during 1992. That reduction, along with the much higher stable fly population and longer duration that were experienced during 1992, emphasizes the benefits of using parasites. Our results indicate that an average of $0.32 per animal is a reasonable cost for stable fly reduction to protect confined cattle against a $5.00 to $10.00 per head loss from stable fly feeding each year.

Table 1. Costs of Cattle Feedlot Stable Fly Management with Parasites in 1992

Fly Level	No. of Lots	No. of Cattle (000)	Cost, $ per Head		
			Parasites	Sampling	Total
Low (49-53)[a]	5	9.84 (2.2 to 2.3)	.26	.11	.37 (.27 to .52)
Medium (107-138)	7	45.57 (9 to 100)	.18	.06	.24 (.09 to 1.15)
High (184-253)	6	20.00 (7 to 37)	.42	.12	.54 (.32 to 1.34)
Average/animal (489,000 cattle)			.24	.08	.32

[a]Numbers in parentheses are the range from low to high.

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