

Field Peas As An Ingredient In Calf Weaning Transition Diets

Interim Progress Report

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Summary

Transitioning calves from grazing to the feedlot environment is the subject of a long-term investigation to study the utilization of field peas in calf weaning diets and subsequent finishing performance. The first year of the investigation has been completed and the second year will be completed when finished steers are harvested this spring.

Year 1:

One hundred ninety-two heifer and steer calves were weaned from Fall pasture and assigned to one of six weaning treatments. Treatments consisted of chopped mixed hay that was replaced with six different complete pelleted weaning feeds. Two of the weaning feeds were corn-based in which protein was balanced with either soybean meal (SBM/Corn) or field peas (Pea/Corn). The other four weaning feeds were prepared such that field peas replaced either 0, 10, 20, or 30% of the fiber-based ingredients (soyhulls, wheat midds, and barley malt sprouts) present in the diet.

Feed intake and subsequent ADG for calves receiving the control diet without peas were significantly greater than all other treatments evaluated except calves receiving a 10% pea replacement diet in which daily feed consumption was similar, but growth rate was slower. The authors do not have a explanation for the observed depression in feed intake and growth performance.

Steers within each treatment were sent to Decatur County Feed Yard, Oberlin, Kansas, for final finishing. In the feed yard, days on feed and ADG to final harvest did not differ; however, steers originating from treatments that had previously grown at a slower rate during the weaning transition period grew at a similar rate and had improved feed efficiency and yield grade. Across treatments, age at slaughter, hot carcass weight, rib eye area, marbling score, and quality grade did not differ. Numerically, there was a trend toward a greater number of choice carcasses following weaning treatments that received up to 20% pea replacement, but the difference was not significant. Net return to the cow/calf enterprise arising from retained ownership in this investigation favored the fiber-based control weaning feed prepared without peas. Higher net return to the cow/calf enterprise was due to numerically heavier carcass weight resulting from improved weaning to final harvest growth rate.

Year 2:

The second year is incomplete, therefore, only limited comments will be made for this interim report. Overall performance among all treatments shown in [Table 1](#) were improved during the second weaning as shown in [Table 2](#), however, relationships observed between treatments appear to be similar. Further discussion will appear in the next interim report.

Introduction

Weaning protocols that minimize weaning growth lag and ease calves through the difficult phase from grazing to a feed yard environment will reduce weaning stress. Calves that are weaned and on feed for 30 to 45 days before shipment are better prepared to enter various marketing and production channels. Utilization of weaning feeds by producers during the transitioning period prior to movement to a commercial feed yard is part of a sound weaning management program. Current commercial feed formulations utilize a variety of highly digestible fiber-based ingredients (soyhulls, wheat midds, barley malt sprouts, beet pulp, etc.) to prepare weaning feeds. Although North Dakota research with field peas has shown that peas are an excellent feedstuff in creep feeds for grazing calves, and as a source of protein and energy in backgrounding and finishing diets, field peas have not been evaluated as an ingredient in weaning feeds.

Peas contain more than 50% starch. The starch content of pea grain is of concern when peas are to be used as an ingredient in weaning feed, since starch, when introduced in forage-based diets, has been shown to decrease forage intake and (or) digestibility resulting in reduced performance (Chase and Hibberd, 1987; Sanson and Clanton, 1989). Limited Canadian research with dairy cattle suggests that the degradability rate of pea starch is slower than that of conventional cereal grains such as barley, wheat and oats, and are similar to corn (Robinson and McQueen, 1989). Considering the potential for slower starch degradation, crude protein of 20% or greater, and an energy content paralleling corn, field peas appear to be excellent feedstuff for inclusion in calf weaning feeds.

The purpose of this investigation is to evaluate field peas as a replacement for up to 30% of the fiber-based ingredients in a complete pelleted weaning feed, to compare pea inclusion in a fiber-based diet to performance resulting from a grain-based supplement, and to evaluate the impact of weaning feed supplement type on growing-finishing performance and net return to the cow/calf enterprise following retained ownership to final harvest.

Procedure

One hundred ninety-two spring-born heifer and steer calves grazing Fall pasture were weaned and stratified across treatments based on previous pasture assignment, sex, sire, and weaning weight. Supplement treatments evaluated in the weaning feed study were two grain-based supplements to include either soybean meal and corn or field peas and corn and four fiber-based supplements that contained either no peas or 10, 20 and 30% pea replacement for fiber-based ingredients ([Table 1](#)). The fiber-based control diet was formulated to contain 39.4% soyhulls, 24.6% wheat midds, 20.0% barley malt sprouts and 10% corn. Incremental pea inclusion replaced a proportional amount of soyhulls, wheat midds, and barley malt sprouts in each test diet. Four pen replicates of eight calves per pen were fed a period of 33 days prior to shipment to Decatur County Feed Yard, Inc., Oberlin, Kansas. Weaning feeds evaluated were prepared as complete feeds, medicated with decoquinate for coccidiosis control at the rate of 22.5 mg/100 lbs. body weight, and pelleted by Circle K Feeds, Glen Ullin, North Dakota. Five weeks before weaning all calves were vaccinated with One Shot Ultra® and Cattlemaster 4®. A booster vaccination of Cattlemaster 4® was administered at weaning. Calves assigned to the experiment were weaned over a four day period and received chopped grass hay to appetite until all calves were in drylot. Once all calves were weaned and delivered to the drylot pens, supplementation protocol called for hay to be gradually replaced with the experimental weaning feeds until the calves in the grain-based groups were consuming from 11 to 14 pounds/hd/day and up to 21 pounds/hd/day among the calves receiving the fiber-based pea replacement weaning feeds.

Upon completion of the 33-day transition feeding period, steer calves from each experimental treatment were shipped immediately to the Decatur County Feed Yard, Inc. where they were fed to harvest based on Decatur's Electronic Cattle Management (ECM) program which provided individual feedlot performance. The steers were slaughtered at Excel Packing Company.

Results and Discussion

Weaning transition growth and efficiencies have been summarized in [Table 2](#). Using challenge feeding, calves receiving the experimental weaning diets were worked up to predetermined intake levels during the first 10 days after weaning. After approximately 17 days on feed, the calves' dry matter intake decreased sharply in all treatments except the fiber-based control diet that contained no peas. As previously mentioned, starch addition to fiber-based diets can affect dry matter intake and digestibility. Dietary starch intake, as a percent of body weight, midpoint in the 33-day feeding period was calculated to be 1.15, 1.31, 1.07, 1.02, .98 and .99% for the SBM/Corn, Pea/Corn, and 0, 10, 20, and 30% pea replacement diets, respectively ([Table 3](#)). Daily gain and subsequent feed intake for calves receiving the control diet (no peas) was greater ($P=.0001$) than all other treatments evaluated except calves receiving the 10% pea replacement diet that consumed a similar amount of daily feed, but grew slower ($P=.0001$). Feed efficiency across treatments was similar, however, there was a trend toward improved feed efficiency when peas were not present in the diet. A explanation for the observed intake depression and reduced growth response when peas replaced fiber-based ingredients is not clear, since other research with peas has shown, in most cases, an increase in feed intake, improved daily gain, and similar feed efficiency when compared to other protein/energy ingredients fed in creep feeds, growing/finishing cattle diets, and lamb finishing diets (Poland et al., 1997; Anderson, 1999; Loe et al., 1999; Landblom et al. 2000). Based on the calculated daily starch intake level expressed as a per percent of body ([Table 3](#)), there is no suggestion that starch alone reduced intake and subsequently growth performance. The project is being repeated during the 2001 weaning season along with a

companion rumen digestibility trial. These two investigations will be conducted to determine if the observed depression in feed intake and growth response is repeatable and to measure rumen digestibility parameters that may explain the observed response.

Steer calves from each treatment were finished at the Decatur County Feed Yard, Oberlin, Kansas, to determine the impact of weaning transition diet on subsequent finishing performance ([Table 4](#)). Days on feed and ADG to final harvest did not differ; however, steers in those treatments that grew at a slower rate during the weaning transition period had improved feed efficiency values during the finishing period. Steers were slaughtered at Excel Packing Company. All carcass measurements were similar across treatments with the exception of yield grade. Steers receiving either the pea/corn supplement or the fiber-based control diet without peas had average yield grade values that were greater than 3.0 but quality grade did not differ. In this data set, the impact of dietary protocol during the weaning transition period on net return to finishing and subsequently to the cow/calf enterprise with retained ownership were important measurements. Economic analysis for finishing and potential returns to the cow-calf enterprise is shown in [Table 5](#). Net return to the cow/calf enterprise favored the fiber-based control diet that contained no field peas, because growth rate from weaning to final harvest resulted in earlier slaughter and numerically heavier carcasses. Slower growth in all other treatments resulted in net losses which were a function of a wider select-choice price spread for carcasses from steers across treatments that were on feed longer.

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Table 1. Complete pelleted weaning transition feed formulation and nutrient analysis (% As Fed).

Ingredient	SBM/Corn	Pea/Corn	0% Pea	10% Pea	20% Pea	30% Pea
Corn	77.801	31.365	10.0	10.0	10.0	10.0
Peas	0	62.046	0	10.0	20.0	30.0
SBM	15.601	0	0	0	0	0
Soyhulls	0	0	39.421	38.226	37.086	35.628
Wheat Midds	0	0	24.56	20.748	16.888	13.346
Barley Malt Sprouts	0	0	20.0	15.0	10.0	5.0
Molasses	5.0	5.0	5.0	5.0	5.0	5.0
Limestone	.85	.85	.3	.3	.3	.3
Dical	.1	.1	.1	.1	.1	.1
Salt	.5	.5	.5	.5	.5	.5
TM Premix	.075	.075	.075	.075	.075	.075
Vit A & D	.025	.025	.025	.025	.025	.025
Decoquinate	.0489	.0386	.0269	.0269	.0269	.0269
Total	100.0	100.0	100.0	100.0	100.0	100.0
Cal. As Fed Anal.						
CP, %	16.0	16.1	16.5	16.2	16.0	15.7
TDN, %	85.2	79.2	69.3	69.9	70.7	77.5
C. Fiber, %	2.8	5.0	18.0	17.9	17.9	17.7
Fat, %	3.6	2.2	2.4	2.4	2.3	2.2
Deg. CP, %	58.0	70.3	71.4	72.0	72.9	73.7
Ne _m , Mcal/lb	.96	.87	.73	.74	.75	.76

Ne _g , Mcal/lb	.65	.59	.46	.47	.48	.49
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Table 2. Midpoint transition diet calf weight, starch content, and dietary starch intake as percent of body weight.

	SBM/ Corn	Pea/ Corn	0% Pea (Ctrl)	10% Pea	20% Pea	30% Pea
Calf Wt. (Midpoint)	657	643	673	652	663	635
Dietary Starch, %	44.1	51.3	32.1	33.3	34.6	36.0
Avg. Daily Starch Intake, lb.	7.61	8.46	7.22	6.66	6.49	6.30
Starch Ratio To Control	1.05	1.17	1.00	.92	.90	.87
Starch Intake (% of Body Wt.)	1.15	1.31	1.07	1.02	.98	.99

Table 3. Weaning transition diet growth and efficiency summary - Year 1 - Fall 2000

	SBM/ Corn	Pea/ Corn	0% Pea	10% Pea	20% Pea	30% Pea	P-Value SBM vs Pea	P-Value Grain vs Fiber	P-Value Fiber Linear
No. of Calves	32	32	32	32	32	31 ¹			
Ave. Days Fed	33.78	33.53	33.56	33.69	33.56	33.67			
St. Wt.	597.7	591.3	607.8	599.7	610.3	588.9			
End Wt.	658.7	643.3	701.7	676.4	687.4	646.3			
Gain	61.0 ^c	51.94 ^c	94.0 ^a	76.7 ^b	77.2 ^b	55.7 ^c	NS	.0004	.0001
ADG	1.81 ^c	1.55 ^c	2.80 ^a	2.28 ^b	2.30 ^b	1.71 ^c	NS	.0003	.0002
ADFI, (As Fed)	17.16 ^c	14.96 ^d	21.00 ^a	19.48 ^a	18.76 ^b	17.09 ^c	.047	.0001	.0001

F:G	9.48	9.65	7.50	8.54	8.16	9.99	NS	NS	NS
Feed Cost/Hd, \$	27.07	26.40	47.32	43.83	41.58	36.96			
Feed Cost:Gain, \$.4438	.5083	.5034	.5715	.5386	.6635			

¹One calf died.

Table 4. Weaning transition diet growth and efficiency summary - Year 2 - Fall 2001

	SBM/ Corn	Pea/ Corn	0% Pea	10% Pea	20% Pea	30% Pea
No. of Calves	18	18	18	18	18	18
Ave. Days Fed	41.2	41.0	41.0	41.4	41.0	41.1
St. Wt.	648.7	658.6	660.3	638.4	678.3	640.7
End Wt.	784.0	758.4	783.1	772.4	799.8	759.9
Gain	135.3	99.8	122.8	134.00	121.5	119.2
ADG	3.28	2.43	3.00	3.24	2.96	2.90
ADFI, (As Fed)	12.07	10.54	13.25	13.02	13.76	12.54
F:G	3.67	4.31	4.41	4.03	4.64	4.32
Feed Cost/Hd, \$	39.87	36.27	47.76	47.77	49.09	45.79
Feed Cost:Gain, \$.2947	.3630	.3888	.3564	.4042	.3842

Table 5. Feedlot growth performance, carcass measurements, and economic returns to the cow/calf enterprise with retained ownership following pea replacement during the transition period.

	SBM/	Pea/	0%	10%	20%	30%
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	Corn	Corn	Pea ¹	Pea	Pea	Pea	P-Value
Growth Performance:							
Receiving Wt.	699.0	703.6	749.0	725.8	715.7	705.3	
Slaughter Wt.	1123	1155	1157	1120	1108	1136	
Days Fed	134.3	144.9	127.4	128.6	124.7	137.4	.167
ADG	3.14	3.13	3.18	3.08	3.14	3.14	.98
Feed:Gain Efficiency	6.34 ^b	6.50 ^{ab}	6.64 ^a	6.49 ^{ab}	6.51 ^{ab}	6.29 ^b	.036
Carcass Measurements:							
Age at Slaughter, da.	415.8	430.9	407.4	408.5	405.5	421.9	.21
Hot Carcass Wt.	694.1	709.0	727.3	688.4	681.8	705.7	.43
Rib Eye Area	11.5	11.3	11.6	11.7	11.5	12.0	.48
Marbling Score ²	38.8	44.2	42.6	42.4	44.1	37.7	.139
Yield Grade	3.0 ^b	3.2 ^{ab}	3.3 ^a	3.0 ^b	3.0 ^b	2.9 ^b	.076
Quality Grade ³	2.7	2.4	2.3	2.5	2.3	2.6	.117
Percent Choice	37.5	58.3	66.7	50.0	75.0	37.5	.178

¹ One steer died of bloat.

² Marbling Score: Marbling Score relationship to USDA Degrees of Marbling are as follows 10-19 Practically Devoid-Standard, 20-29 Traces-Standard, 30-39 Slight-Select, 40-49 Small-Choice, 50-59 Modest-Choice, 60-69 Moderate-Choice, 70-79 Slightly Abundant-Prime, 80-89 Moderately Abundant-Prime, 90-99 Abundant-Prime.

³ Quality Grade: 1= Prime, 2= Choice, 3= Select, and 4= standard

Table 6. Economic analysis for finishing and return to the North Dakota cow calf enterprise through retained ownership.

	SBM/	Pea/	0%	10%	20%	30%
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	Corn	Corn	Pea ¹	Pea	Pea	Pea
Feedlot Analysis:						
Carcass Value, \$	861.90	877.00	917.30	867.70	869.60	877.50
Receiving Calf Value, \$ ¹	641.80	643.50	664.50	659.60	652.90	646.50
Feedlot Cost/Head, \$ ²	230.66	247.82	229.70	221.15	216.94	232.58
Net Return to Finishing, \$	-10.56	-14.32	23.10	-13.05	-0.24	-1.58
Cow-Calf Enterprise Analysis:						
Carcass Value, \$	861.90	877.00	917.30	867.70	869.60	877.50
Transition Feed, \$ ³	27.07	26.40	47.32	43.83	41.58	36.96
Transition Yardage, \$	8.25	8.25	8.25	8.25	8.25	8.25
Feedlot Cost/Head, \$ ²	230.66	247.82	229.70	221.15	216.94	232.58
Annual Cow Cost ⁴	340.75	340.75	340.75	340.75	340.75	340.75
Transportation to Feedlot/Head, \$	17.48	17.59	18.73	18.15	17.89	17.63
Net Return to ND Cow/Calf Enterprise with Retained Ownership, \$ ⁵	237.69	236.19	272.55	235.57	244.19	241.33

¹ Receiving Calf Value established using price slide at Decatur County Feed Yard

² Feedlot Cost/Head includes cost of processing, treatment, and electronic cattle management

³ Transition Feed Value from Table 2

⁴ Annual Cow Cost from Annual Report 2000, ND Farm and Ranch Business Management Education Program, Table 12-1, pg 96.

⁵ Net return to cow/calf enterprise with retained ownership calculation: gross carcass value less weaning transition cost, total finishing cost, shipping cost, and the Dickinson Research Extension Center's estimated annual cow cost of \$340.75.

