

Field Peas As An Ingredient In Fiber-Based Calf Weaning Transition Diets

Interim Progress Report

D. G. Landblom¹, D. K. Olson³, W. W. Poland¹, K. Helmuth¹, and G. P. Lardy²

¹NDSU Dickinson Research Extension Center, Dickinson, ND

²NDSU Animal & Range Science Dept., Fargo, ND

³DSU Dickinson State University, Dickinson, ND

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 to evaluate the effect of energy during the weaning phase on subsequent carcass quality in a retained ownership program.

Three weaning groups have been completed in the investigation and the third group of calves are being commercially finished.

Combining years, four hundred five crossbred heifer and steer calves have been 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.

Favorable response to pea replacement was observed up to 20% pea ($P=0.0001$). Response to the SBM/corn weaning supplement was comparable to the 0 to 20% pea replacement diets ($P=0.0001$). Feed efficiency did not differ between treatments ($P=0.39$). Replacing fiber-based ingredients with 30% pea reduced growth performance ($P=0.0001$) but feed efficiency did not differ ($P=0.39$).

In a companion intake and digestibility study conducted in the Animal and Range Science Department with ruminal and duodenal cannulated steers (Soto-Navarro et al. 2003), organic matter intake decreased ($P<0.10$) with increasing field pea level, however organic matter digestibility was unaffected. Supplementation of medium concentrate diets with field pea decreases ruminal CP digestibility and increases microbial protein supply to the small intestine.

Steers within each treatment have been sent to Decatur County Feed Yard, Oberlin, Kansas, for final finishing and carcass evaluation. Combining the two

years of carcass evaluation that have been completed, no differences in carcass characteristics have been measured. However, steers that received 20 and 30% pea replacement weaning diets tended to be younger ($P=0.11$) and require fewer days on feed ($P=0.13$). Steers receiving a 20% pea replacement diet postweaning tended to have higher quality grade and percent choice carcasses. Heavier final carcass weight and lower weaning feed cost for the SBM/corn postweaning test diet resulted in higher net returns to finishing despite a trend toward fewer SBM/corn carcasses grading choice ($P=0.15$), which emphasizes that carcass weight is of first importance followed by carcass grade premiums.

Highest enterprise net returns with respect to retained ownership were realized for steers receiving SBM/Corn, 0 and 20% pea weaning transition diets.

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 an average five to six weeks 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 field peas to be 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 limited attention as an ingredient in weaning transition supplements.

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).

In a companion intake and digestibility study, Soto-Navarro et al. (2003) evaluated the effect of increasing field pea level on diet intake and digestive characteristics. Four beef steers affixed with rumen and proximal duodenum cannulas were used in a 4 x 4 Latin square design. Treatments tested were: 1) control - 0% peas, 2) 15% peas, 3) 30% peas, and 4) 45% peas. Organic matter intake, as a percent of body weight, decreased ($P < .10$) with increasing field pea level, however, organic matter digestibility was unaffected ($P > .10$). Non-microbial CP flow to the small intestine increased quadratically ($P > .10$) with level of field pea which was the result of a linear decrease ($P < .10$) for apparent and true ruminal protein digestibility. Non-microbial CP is largely escape protein, therefore, escape protein increased with increasing level of field pea. As with CP, NDF and ADF intake decreased linearly ($P > .05$) with decreasing dry matter intake response to increasing field pea level, however, ADF and NDF digestibilities were unaffected. The rate of ruminal disappearance for forage dry matter, NDF, ADF and soybean hull NDF decreased linearly ($P < .10$) with increasing field pea level. The rate of ruminal disappearance for field pea dry matter increased quadratically ($P < .05$) with increasing field pea level. Effective CP degradation of soybean hulls and field peas decreased quadratically ($P < .10$) with increasing pea level. Overall, supplementing medium concentrate diets for beef cattle with field peas decreases ruminal CP digestibility and increases escape protein supply.

The purpose of this investigation is to evaluate corn-based soybean and field pea supplements, and to evaluate the replacement value of field peas for up to 30% of the fiber-based ingredients in a complete pelleted weaning feeds. Additionally, the project is evaluating the effect of weaning feed concentrate on growing-finishing performance, carcass quality, carcass grade, and net return to the cow/calf enterprise following retained ownership to final harvest.

Procedure

Four hundred five spring-born heifer and steer calves, that previously grazed fall native pasture, have been used over a three year period. Calves have been weaned and stratified across treatments based on sex, sire, and weaning weight. Supplement treatments evaluated were two grain-based supplements to include either soybean meal and corn or field peas and corn and four fiber-based supplements that containing 0, 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 six to eight calves per pen have been fed an average of 38.3 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 commercially. 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 38.3-day transition feeding period, heifer calves were retained and steer calves from each experimental treatment were shipped immediately to the Decatur County Feed Yard, Inc. where they were fed to final harvest using Decatur's Electronic Cattle Management (ECM) program that provided individual feedlot performance. The steers were slaughtered at Excel Packing Company.

Results and Discussion

Combined years (00, 01, 02) weaning growth and efficiency 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.

Growth performance was greatest among calves that received weaning supplements containing SBM/corn, and 0, 10, and 20% pea replacement diets ($P = .0001$). Average daily feed intake (ADFI) was greatest for calves that received from 0 to 20% pea replacement ($P = .0001$). Replacing 30% of the fiber-based ingredients with peas reduced gain and feed intake, and as expected, increased feed required per pound of gain. While some numerical differences were measured across treatments for feed efficiency, differences observed were not significant ($P = .39$). It is important for freshly weaned calves to begin eating as soon as possible after weaning. Average daily feed intake (ADFI) was highest for calves offered 0, 10 and 20% pea replacement diets. ADFI was intermediate for the SBM/corn and 30% pea diets, but was reduced significantly when peas and corn were combined ($P = .0001$).

Steers within each treatment have been sent to Decatur County Feed Yard, Oberlin, Kansas, for final finishing and carcass evaluation for two consecutive years in the study. The third year of data collection is in progress. Combining the two years of data available, calf age at final harvest ($P=.11$) and days in the feed yard ($P=.13$) did not differ, however, steers that received 20 and 30% pea replacement weaning diets required numerically fewer days on feed ($P=.13$) than calves fed the other test diets. No difference was measured for hot carcass weight ($P=.58$), rib eye area ($P=.53$), marbling score ($P=.14$), yield grade ($P=.18$), quality grade ($P=.13$) or percent choice ($P=.15$). Regarding quality grade and percent choice, steers receiving a 20% pea replacement diet graded numerically higher than steers fed the other test diets. A combination of heavier final carcass weight and lower weaning feed cost resulted in higher finishing net returns from steers that received the SBM/Corn weaning diet. This occurred despite a smaller number of carcasses grading choice, emphasizing the point that carcass weight is of first importance followed by carcass grade premiums.

Highest enterprise net returns with respect to retained ownership were realized for steers receiving SBM/Corn, 0 and 20% pea weaning transition diets.

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

	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
Decoquinat	.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

Table 2. Three year combined weaning transition diet growth and efficiency (00, 01, 02).

	SBM/ Corn	Pea/ Corn	0% Pea	10% Pea	20% Pea	30% Pea	P- Value
No. Calves	68	68	68	68	67	66	
Ave. Days Fed	38.3	38.3	38.3	38.3	38.3	38.3	
St. Wt.	607.20	614.89	310.60	608.93	630.26	603.91	.73
End Wt.	703.11	689.80	714.44	709.02	726.84	688.37	.28
Gain	95.91 ^a	74.91 ^c	103.82 ^a	100.09 ^a	96.58 ^a	84.46 ^b	.0001
ADG	2.54 ^a	2.00 ^c	2.75 ^a	2.65 ^a	2.57 ^a	2.24 ^b	.0001
ADFI, (As Fed)	16.74 ^c	15.17 ^d	19.36 ^a	18.17 ^b	18.66 ^a	17.19 ^{bc}	.0001
F:G	7.02	8.13	7.11	7.19	7.32	8.16	.39
Feed Cost/Hd, \$	37.53	35.03	46.14	44.21	44.30	41.10	
Feed Cost:Gain, \$.387	.470	.438	.444	.448	.500	

¹One calf died.**Table 3.** Two year combined feedlot growth performance and carcass measurements (00, 01).

	SBM/ Corn	Pea/ Corn	0% Pea	10% Pea	20% Pea	30% Pea	P- Value
Growth Performance:							
Receiving Wt.	736.1	719.1	756.9	741.3	744.7	729.8	0.51
Harvest Wt.	1169.18	1161.80	1181.84	1164.01	1141.62	1156.37	0.69
Days at Feedyard	130.9	142.2	126.8	131.7	124.0	129.4	0.13
ADG	3.31	3.15	3.35	3.26	3.21	3.32	0.64
Feed:Gain Efficiency	6.1	6.2	6.2	6.2	6.1	6.0	0.17
Carcass Measurements:							
Age at Final Harvest, da.	413.1	430.0	409.6	419.3	408.2	416.8	0.11
Hot Carcass Wt.	737.5	721.2	750.7	730.6	718	725.4	0.58
Rib Eye Area	11.79	11.3	11.5	11.9	11.6	11.6	0.53
Marbling Score ¹	49.01	54.43	52.84	52.7	54.32	47.95	0.14
Yield Grade	3.1	3.2	3.3	3.0	3.1	3.1	0.18
Quality Grade ²	2.58	2.43	2.38	2.45	2.28	2.52	0.13
Percent Choice	45.1	56.6	64.7	55.1	71.3	48.0	0.15

¹ 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.² Quality Grade: 1= Prime, 2= Choice, 3= Select, 4= Standard.

Table 4. Two year economic analysis for finishing and return to the North Dakota cow calf enterprise through retained ownership (00, 01).

	SBM/ Corn	Pea/ Corn	0% Pea	10% Pea	20% Pea	30% Pea	P- Value
Feedlot Analysis:							
Carcass Value, \$	799.39	768.85	797.47	785.58	778.40	773.33	0.9
Receiving Calf Value, \$ ¹	648.03	641.96	658.95	654.50	658.54	647.62	0.6133
Feedlot Cost/Head, \$ ²	222.16	235.59	220.23	220.65	203.72	214.52	0.2151
Net Return to Finishing, \$	-70.80	-108.70	-81.71	-89.57	-83.86	-88.81	
Cow-Calf Enterprise Analysis:							
Carcass Value, \$	799.39	768.85	797.47	785.58	778.40	773.33	
Transition Feed Cost, \$ ³	32.79	31.04	42.87	43.14	42.66	38.53	
Transition Yardage Cost, \$	8.25	8.25	8.25	8.25	8.25	8.25	
Feedlot Cost/Head, \$ ²	222.16	235.59	220.23	220.65	203.72	214.52	
Annual Cow Cost ⁴	341.03	341.03	341.03	341.03	341.03	341.03	
Transportation to Feedlot/Head, \$	16.20	16.05	16.47	16.36	16.46	16.19	
Net Return to ND Cow/Calf Enterprise with Retained Ownership, \$ ⁵	178.96	136.89	168.62	156.15	166.28	154.81	

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 2001, ND Farm and Ranch Business Management Education Program, Table 12-1.

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.