

# Effect of field pea-flaxseed blends on receiving calf weaning performance, immune response, feedlot performance, carcass quality, and economics

## Progress Report

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### Introduction

Research conducted in North Dakota has shown field peas to be a nutrient dense and palatable feedstuff with high rumen degradable protein characteristics that can replace corn and barley in virtually all beef cattle feeding situations, i.e. creep-feeding, receiving, backgrounding, and finishing diets (Poland et al., 1996; Anderson, 1998, 1999; Landblom et al., 2002, 2005; Reed, et al., 2004<sup>ab</sup>, Soto-Navarro et al., 2004;). Field peas have also been shown to improve eating quality of beef (Anderson and Schoonmaker, 2004).

Flaxseed, grown predominantly in North Dakota and Canada, may play a role in weaning, backgrounding, and finishing performance. Compared to yearling feedlot cattle, calf-feds experience substantially more health problems resulting in greater number of treatments and added expense. Receiving diet research conducted by Drouillard, et al. (2001) comparing the value of flaxseed to tallow suggested that the addition of 10 – 15% flaxseed during the first 5 to 6 weeks after weaning would result in improved feed intake, growth, and feed efficiency, and the incidence of bovine respiratory disease (BRD) and death loss was reduced. In addition to improved health status with the addition of fat from either flaxseed or tallow, carcass quality grade at slaughter was improved without marked increase in subcutaneous fat. Highly stressed heifer calves that were fed receiving diets containing flaxseed, tallow, or tallow topdressed with a micro-algae preparation were challenged with a bacterial lipopolysaccharide endotoxin (Farran et al., 2002). Heifers receiving flaxseed in the receiving diet had significantly lower rectal temperature than those receiving either tallow or tallow top-dressed with a micro-algae preparation. Drouillard, et al. (2002) concluded that calves fed flaxseed during the stressful 5-6 week period following weaning illicit stronger immunities and may require less antibiotic therapy.

While flaxseed, a source of omega-3 fatty acid, has been shown to improve receiving calf health in corn-based diets, research to evaluate the impact of flaxseed on health status, when fed in conjunction with field peas, has not been investigated. The purpose of this investigation is to evaluate the effect of field pea-flaxseed blends on receiving calf performance, carry-over effect on subsequent finishing performance and carcass merit, immediate and carry-over effect on health status, and feeding economics.

### Procedure

One hundred seventy-six steer calves (Angus X Hereford X Gelbvieh) that averaged 646 pounds were weaned and randomly assigned across four pelleted dietary receiving/weaning transition treatments that included a 1) fiber-based control, 2) fiber-base + 10% flaxseed, 3) fiber-base + 20% field pea and 4) fiber-base + 20% field pea and 10% flaxseed. The supplement nutrient composition and nutrient analysis is shown in Table 1. Each experimental diet was assigned to four pen replicates with four steers assigned to each pen replicate. Steers were weaned the first week of November and backgrounded an average 50 days at the Dickinson Research Extension Center's feed yard. Initially, upon arrival, the steers were offered long mixed hay (80% crested wheatgrass; 20% alfalfa) for the first 2 days after weaning and then gradually switched to chopped hay with the pelleted supplements top-dressed over the hay. As daily supplement level was increased, the quantity of chopped hay was reduced until the steers were consuming 9-10 pounds of supplement per day. When the average 50d receiving/transitioning period was complete, the steers were transported to a commercial feed yard at Oberlin, Kansas, where they were fed to final harvest using an electronic cattle management system to determine final end point (Micro Beef Technologies<sup>®</sup>).

Beginning with the second year of this multiple-year investigation, an immune response component was added to determine the potential impact of

flaxseed on calf resistance to bovine respiratory disease.

Two to four weeks before weaning date, calves were vaccinated against economically important bacterial and viral diseases and were administered a booster vaccination for the same diseases at weaning. Blood samples are drawn from the steers at preweaning, weaning, 30, 60, and 90 days postweaning, and serum antibody level for BVD virus types I and II and IBR virus are being determined. In addition the incidence of illness, treatments, and treatment cost are also being recorded.

## Results

Results of the receiving/backgrounding transition effect on animal performance, efficiency and economics are shown in Table 2. In the analysis model, treatment, year, and year by treatment interactions are being tested. With the exception of an interaction that was identified for finishing starting weight, no treatment by year interactions were identified in backgrounding and finishing data; therefore, the multiple-year data was combined. On average, and compared to the control diet, supplements that contained flaxseed were 2.09 times higher in fat content and had 6.2% greater net energy for gain. On average, the steers consumed 8.4 pounds of chopped mixed hay and 9.68 pounds of the control and test supplements. When field pea occurred alone in the supplement, intake did not differ between treatments ( $P > 0.10$ ); however, rate of gain was slower ( $P < 0.01$ ) and feed per pound of gain was greater ( $P < 0.10$ ) compared to treatments that included flaxseed. When flaxseed was included alone in the supplement or as a blend with field pea, inclusion was associated with improved rate of gain ( $P < 0.01$ ) and feed efficiency ( $P < 0.10$ ) when compared to control and field pea test supplements. Economically, compared to control and field pea test supplements, flaxseed and the field pea-flaxseed blended test supplements were associated with the lowest feed cost per pound of gain ( $P = 0.01$ ). Compared to the control supplement, feeding a field pea-flaxseed blend reduced the cost per hundred pounds of gain by 13.1% and compared to field pea supplement feed cost per hundred pounds of gain was reduced 11.7%.

The finishing phase of the investigation was conducted at a commercial feed yard in Kansas (Decatur County Feed Yard, Oberlin, Kansas). The subsequent effect of weaning diet treatment during backgrounding (field pea and flaxseed) in North

Dakota was determined based on finishing performance, carcass merit, incidence of bovine respiratory disease, treatment cost, and the economics of retained ownership were evaluated. Summaries for finishing animal performance, carcass measurements, and the economics associated with retained ownership in the data sets are shown in Tables 3 and 4. The electronic cattle management system (Micro Beef Technologies<sup>®</sup>) employed at the yard predicted final finishing endpoint with a high degree of accuracy (Table 3). With this report, two of three finishing periods have been completed and summarized, and a third, and final, steer group was on feed when this progress report was prepared.

The finishing data analysis model includes year, treatment, and a test for year by treatment interactions in the model. In the two-year data set, an interaction was identified for receiving weight and carcass fat depth measured between the 12<sup>th</sup> and 13<sup>th</sup> ribs. Receiving weight was greater for field pea-flaxseed backgrounded steers, which is reflective of the performance and efficiency advantages observed when a field pea-flaxseed blended supplement was fed. The data analysis reflects a highly significant year effect for all criteria measured ( $P < 0.01$ ) with the exception of average daily finishing feed intake, which did not differ for year effect ( $P > 0.55$ ). Within the finishing data set, no growth performance or carcass measurement differences were recorded that differed significantly.

Finishing economics and a summary associated with retained ownership economics are shown in Table 4. While growth performance among steers that received the field pea supplement during the receiving/weaning transition phase unremarkable, supplementation with field peas in the receiving diet was associated with higher carcass value, higher net return to finishing, and to retained ownership. Compared to the average of the other treatments, field pea inclusion during the receiving period was associated with a \$27.93 advantage per steer marketed.

The effect of flaxseed on immune response and health status is incomplete. This component of the study will be completed when the last steer groups are harvested this spring.

## Implication

While this project is still in progress, results to date suggest that inclusion of field peas and flaxseed during the receiving-weaning transition phase improves backgrounding efficiency and reduces feed

cost per hundred-weight. Two years of finishing data suggests that there may be a positive carry-over effect on carcass quality when 20% field peas are included in the backgrounding diet and that field pea carry-over may improve net return to finishing.

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**Table 1.** Complete pelleted receiving-weaning transition feed formulation that was top-dressed over chopped hay; and nutrient analysis (% As Fed).

	<b>Control</b>	<b>12.5% Flax</b>	<b>20% Pea</b>	<b>20%Pea/12.5%Flax</b>
Flax	0.0	12.5	0.0	12.5
Peas	0.0	0.0	20.0	20.0
Corn	15.0	15.0	15.0	10.0
Soyhulls	21.5	28.803	30.753	34.303
Wheat Midds	24.953	11.75	10.0	12.0
Barley Malt Sprouts	20.0	15.0	10.0	5.0
DDGS	12.25	10.75	8.0	0.0
Molasses	5.0	5.0	5.0	5.0
Salt	0.50	0.5	0.5	0.5
Calcium	0.55	0.45	0.50	0.45
Dical	0.10	0.10	0.10	0.1
TM Premix	0.075	0.075	0.075	0.075
Decoquate	0.027	0.027	0.027	0.027
Vit A & D	0.025	0.025	0.025	0.025
Monensin (80 gm/LB)	0.02	0.02	0.02	0.02
Total	100.0	100.0	100.0	100.0
<b>Cal. As Fed Anal.</b>				
CP, %	15.54	15.54	15.53	15.56
TDN, %	69.08	60.11	70.22	60.58
NDF,%	34.82	33.37	32.93	31.70
ADF,%	16.03	17.68	18.03	18.79
Fat, %	3.75	7.40	2.81	6.10
NEm, Mcal/lb	.76	.84	.78	.84
NEg, Mcal/lb	.51	.57	.53	.57

**Table 2.** Three-year pea and flaxseed replacement effect on weaning transition backgrounding performance 2003 – 04 – 05.

	<b>Control</b>	<b>12.5% Flax</b>	<b>20% Pea</b>	<b>20%Pea/ 12.5%Flax</b>	<b>SE</b>	<b>P-Value</b>
No. Calves	43 <sup>a</sup>	43 <sup>a</sup>	44	43 <sup>a</sup>		
Ave. Days Fed	50	50	50	50		
St. Wt., lb.	644.1	646.1	645.6	646.8	9.57	0.99
End Wt., lb.	801.1	818.4	799.5	819.3	10.48	0.38
Gain, lb.	157.0 <sup>y</sup>	172.3 <sup>x</sup>	153.9 <sup>y</sup>	172.5 <sup>x</sup>	4.40	0.005
ADG, lb.	3.14 <sup>y</sup>	3.45 <sup>x</sup>	3.08 <sup>y</sup>	3.45 <sup>x</sup>	0.087	0.0044
ADFI, lb. (As Fed)	18.23	18.37	17.82	17.93	0.404	0.74
Hay/da, lb.	8.55	8.68	8.14	8.25	0.253	0.41
Weaning Suppl/da, lb.	9.68	9.69	9.68	9.68	0.207	0.99
F:G, lb.	5.81 <sup>y</sup>	5.32 <sup>x</sup>	5.79 <sup>y</sup>	5.20 <sup>x</sup>	0.198	0.075
Feed Cost/Hd, \$	41.44	41.20	39.97	39.56	0.688	0.17
Feed Cost:Gain, \$	0.2639 <sup>y</sup>	.2391 <sup>x</sup>	0.2597 <sup>y</sup>	0.2293 <sup>x</sup>	0.0082	0.012

<sup>a</sup> One Steer Died of Bloat

**Table 3.** Two year effect of field pea and flaxseed replacement on finishing performance and carcass characteristics.

	Control	Flaxseed	Field Pea	Field Pea/ Flaxseed	SE	Trmt.	P-Value	
							Year	Trmt X Year
<b>Growth Performance:</b>								
Receiving Wt., lb.	773	787	775	788	10.58	0.647	0.0001	.077
Harvest Wt., lb.	1270	1261	1281	1254	17.21	0.693	0.0001	0.84
Days On Feed	145.1	132.4	142.7	134.4	4.55	0.14	0.0001	0.37
Gain, lb.	497	474	506	466	16.04	0.24	0.0028	0.74
ADFI, lb.	19.47	19.68	19.87	19.31	0.455	0.83	0.55	0.31
ADG, lb.	3.42	3.58	3.54	3.47	0.086	0.56	0.0014	0.217
Feed:Gain <sup>a</sup> , lb.	5.69	5.50	5.61	5.56	0.083	0.23	0.0001	0.71
<b>Carcass Measurements:</b>								
HCW, lb.	801.6	786.4	802.2	780.3	12.02	0.47	0.0001	0.89
REA, sq. in.	13.22	12.80	13.13	13.48	0.246	0.22	0.0001	0.99
Fat Depth	0.438	0.449	0.457	0.415	0.0246	0.66	0.45	0.043
Yield Grade	2.49	2.58	2.50	2.36	0.1077	0.53	0.047	0.49
Quality Grade	5.1	3.27	3.94	2.74	0.691	0.95	0.039	0.17
Percent Choice, % <sup>b</sup>	61.3	38.7	53.1	45.2		0.30		

**Table 4.** Finishing economics and returns to retained ownership.

	Control	Flaxseed	Field Pea	Field Pea/ Flaxseed	SE	Trmt.	P-Value	
							Year	Trmt X Year
<b>Finishing Economics:</b>								
Carcass Value, \$	1110.94	1099.33	1143.67	1096.97	22.64	0.43	0.0001	0.04
Receiving Calf Cost, \$	731.32	741.99	734.48	741.79	6.91	0.61	0.0001	0.77
Feeding Cost/Hd, \$	280.38	257.83	281.51	254.68	8.89	0.054	0.0001	0.44
Finishing Net Return, \$	99.24	99.51	127.68	100.50	17.85	0.59	0.0004	0.0053
<b>Return to Retained Ownership:</b>								
Carcass Value, \$	1110.94	1099.33	1143.67	1096.97				
Receiving Feed Cost, \$	41.44	41.20	39.97	39.56				
Receiving Yardage, \$	10.50	10.50	10.50	10.50				
Finishing Cost/Hd, \$	280.38	257.83	281.51	254.68				
Annual Cow Cost, \$	341.00	341.00	341.00	341.00				
Freight to Finish Lot, \$	32.25	32.25	32.25	32.25				
NR to Retained Ownership, \$	405.37	416.55	438.44	418.98				