Proceedings, Western Section, American Society of Animal Science

Vol. 58, 2007

# Effect Of Field Pea and Flaxseed Inclusion in Receiving Calf Diets and Carryover Effect on Finishing Performance, Immune Response, Carcass Quality, and Economics

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**Abstract:** One hundred seventy-three medium-frame crossbred steers (initial BW of 293 ± 0.519 kg) were randomly assigned in a 3 year study to evaluate finishing carryover effect when field pea and flaxseed replaced fiber-based ingredients in 50 d receiving calf diets to determine subsequent feedlot performance, immune response, carcass quality, finishing economics, and net return to retained ownership in the cow-calf enterprise. Each year, steers were assigned to one of four pelleted receiving diets: 1) Control (C), 2) 12.5% Flaxseed (FLX), 3) 20.0% Field Pea (PE), and 4) 20.0% Field Pea + 12.5% Flaxseed (PFLX). Pellet NEg was 1.12, 1.26, 1.17, and 1.26 Mcal/kg for C, FLX, PE, and PFLX, respectively. Receiving diet ADG was greater ($P < 0.05$) when FLX occurred in the diet and there was a tendency for improved efficiency ($P = 0.075$) when FLX was present. Feed cost/kg of gain was lowest for FLX and PFLX treatments ($P < 0.05$). Finishing calf receiving weight, harvest weight, DOF, Gain, ADG, ADFI, and G:F did not differ ($P < 0.05$). The effect of receiving diet on carcass measurements did not effect HCW, QG, or USDA % Choice grade ($P > 0.05$). Flaxseed inclusion in the receiving diet was associated with reduced REA ($P = 0.04$), a tendency for greater fat depth ($P = 0.074$), and less favorable YG ($P = 0.083$). Flaxseed has been reported to illicit an immune response that reduces morbidity, increases % IMF, while reducing BF. Replacing fiber-based ingredients with FLX did not reduce either morbidity or medical treatment cost/head ($P = 0.96$). Finishing net return (NR) was effected by yearly fed cattle prices ($P = 0.0001$); however, response due to receiving diet treatment did not differ ($P = 0.943$). Retained ownership NR favored receiving diets treatments that contained field peas. Results suggest that FLX and PFLX are associated with reduced feed cost/kg of gain during the receiving period; however, when retained through finishing, receiving diets formulated with PE and PFLX were associated with the highest finishing net return.

Key words: Beef Cattle, Field Pea, Flaxseed

## Introduction

Field peas are a nutrient dense, palatable feedstuff with high rumen degradable protein characteristics that can replace corn and barley in a variety of beef cattle feeding situations (Anderson, 1999; Landblom et al., 2002; Gelvin et al., 2004; Soto-Navarro et al., 2004).

Flaxseed may play a role in enhancing immune resistance reducing morbidity and mortality among calf-feds. Receiving diet research conducted by Drouillard, et al. (2001) compared the value of flaxseed to tallow and suggested that the addition of 10 – 15% flaxseed during the first 5 to 6 weeks after weaning would result in improved feed intake, growth, feed efficiency, and may reduce the incidence of bovine respiratory disease (BRD). Additionally, fat inclusion in the receiving diet from either flaxseed or tallow improved carcass quality grade without a marked increase in subcutaneous fat. Drouillard, et al. (2001) concluded that calves fed flaxseed during the stressful 5-6 week period following weaning illicit stronger immunities and may require less antibiotic therapy.

Previous research with flaxseed has been conducted with corn-based diets. 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) averaging 646 pounds were weaned and randomly assigned to four pelleted receiving diet treatments: 1) fiber-based control (C), 2) fiber-base + 10% flaxseed (FLX), 3) fiber-base + 20% field pea (PE) and 4) fiber-base + 20% field pea and 10% flaxseed (PFLX). Receiving diet supplement nutrient composition and analysis are shown in Table 1. Each treatment consisted of four pen replicates and four steers per pen. Steers were weaned the first week of November and backgrounded an average 50 days at the Dickinson Research Extension Center's feed yard

before transfer to a commercial feedyard in Kansas. The pelleted experimental supplements were top-dressed over chopped 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. At the commercial feedyard, the steers were fed to a final harvest end point of 11.43 mm backfat using an electronic cattle management system [Micro Beef Technologies® (ECM)]

To evaluate the effect of flaxseed on health status serum humoral antibody level and BRD incidence were monitored. Three weeks before weaning, calves were vaccinated against economically important bacterial and viral diseases and were administered a booster vaccination at weaning. Blood samples were drawn for serum recovery from the steers 3 weeks before weaning, at weaning, and again 30 days postweaning, and after 60 days in the commercial feedyard. Serum humoral antibody levels for BVD virus types I and II and IBR virus were determined. In addition, morbidity, mortality, treatment frequency, and treatment cost were recorded.

Receiving, finishing, and carcass data were analyzed using PROC GLM of SAS, percent Choice was analyzed using Chi-square procedures in PROC GENMOD of SAS, and antibody titer data was analyzed using the PROC MIXED procedures of SAS.

**Results**

*Receiving Period:*

Three-year performance, efficiency, and economic results for the 50-day receiving-backgrounding period after weaning are shown in Table 2. Since no treatment by year interactions were identified, the data was pooled. Compared to the control diet, supplements that contained flaxseed were 2.09 times higher in fat content and contained 6.2% greater net energy for gain. Average daily feed intake (ADFI) did not differ across treatments ($P = 0.74$). Steers consumed an average 8.4 pounds of the supplement and 9.68 pounds of chopped hay daily. 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 efficiency was greater ($P < 0.10$) compared to FLX treatments. 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, feeding field pea-flaxseed reduced feed cost per unit of gain by 13.1% and compared to field pea alone feed cost per unit of gain was reduced 11.7%.

*Finishing Period:*

Summaries for finishing animal performance and carcass closeout are shown in Table 3. The ECM system predicted final harvest endpoint with a high degree of accuracy; therefore, harvest weight, days on feed, ADG, ADFI, and feed efficiency did not differ ($P > 0.10$). For carcass, HCW, quality grade, and percent Choice did not differ ($P > 0.10$). When flaxseed occurred in the receiving diet, finishing REA was smaller ($P = 0.044$), fat depth was greater ($P = 0.074$), and YG was negatively impacted, which disagrees with the findings of Drouillard et at. (2001). However, when flaxseed occurred with field pea in the receiving diet, fat depth was similar to other receiving diet treatments. Finishing net return was effected by yearly fluctuations in fed cattle price ($P = 0.0001$); however, response due to receiving treatment did not differ ($P > 0.10$).

*Immune Response:*

The carryover effect of flaxseed and pea-flaxseed fed during the first 50 days postweaning on antibody titer change and health status during the early finishing period is summarized in Tables 4 and 5. Antibody titer level was low when pre-weaning bacterial and viral vaccinations were administered, increased steadily following the initial and booster vaccinations, but did not differ between dietary treatments for IBR ($P = 0.78$), BVD Type I ($P = 0.11$), and BVD Type II ($P = 0.90$). The incidence of BRD during receiving and finishing was similar for all treatment groups and medical cost did not differ ($P = 0.96$). The results of this study do not agree with that of Drouillard et al. (2002) as in this investigation we were unable to identify stronger immunities and significantly lower medical cost resulting from flaxseed inclusion in the receiving diet 7 weeks before transfer to the commercial feedyard.

**Implication**

Results suggest that field peas and flaxseed fed during the receiving period improves backgrounding efficiency and reduces feed cost per unit of gain, but during finishing, the carryover effect of flaxseed during the receiving period contributed to increased fat depth and YG was impacted negatively. The data also suggests that when flaxseed and field pea occur together fat depth is not compromised. Similar antibody response, morbidity, and treatment cost during the finishing period suggest that carryover effect resulting from dietary flaxseed inclusion during the 50d receiving period does not appear to enhance finishing immune health status.

**Literature cited**

Anderson, V.L. 1999. Field peas in diets for growing and finishing steer calves. In NDSU-Carrington Research Extension Center's Annual Report, pages 9-15, ND Agric. Exp. Sta., Fargo, North Dakota.

Drouillard, J.S., E.J. Good, C.M. Gordon, T.J. Kessen, M.J. Sulpizio, S.P. Montgomery, and J.J. Sindt. 2001. Flaxseed and flaxseed products for cattle: effects on health, growth performance, carcass quality, and sensory attributes. In Proceedings of the 59th Annual Flax Institute of the United States, North Dakota State University, Fargo, ND.

Gelvin, A.A., G.P. Lardy, S.A. Soto-Navarro, D.G. Landblom, and J.S. Caton. 2004. Effect of field pea-based creep feed on intake, digestibility, ruminal fermentation, and performance by nursing calves grazing native range in western North Dakota. J. Anim. Sci. 82:3589-1862.

Landblom, D.G., W.W. Poland, G.P. Lardy, J.S. Caton, and C.J. Wachenheim. 2002. Evaluation of intake restricted pea-based creep diets among calves grazing western North Dakota native range: Interim Report. In NDSU-Dickinson Research Extension Center, Annual Report, pp. 309-313, Dickinson, North Dakota.

Soto-Navarro, S.A., G.J. Williams, M.L. Bauer, G.P. Lardy, D.G. Landblom, and J.S. Caton. 2004. Effect of field pea replacement level on intake and digestion in beef steers fed by-product-based medium-concentrate diets. J. Anim. Sci. 82:1855-1862.

This project was sponsored in part by a USDA/CSREES Cool Season Legume Special Grant #630-01.

Table 1. Receiving diet ingredient composition and nutrient analysis (As Fed).

| | Control | 12.5% Flax | 20% Pea | 20% Pea + 12.5% Flax |
|---|---|---|---|---|
| Flaxseed, % | 0.0 | 12.5 | 0.0 | 12.5 |
| Field Pea, % | 0.0 | 0.0 | 20.0 | 20.0 |
| Corn, % | 15.0 | 15.0 | 15.0 | 10.0 |
| Soybean Hulls, % | 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 |
| Distillers Dried Grain w/ Sol., % | 12.25 | 10.75 | 8.0 | 0.0 |
| Other, % [a] | 6.297 | 6.297 | 6.297 | 6.297 |
| **Analysis:** | | | | |
| Crude Protein, % | 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 |
| NEg, Mcal/kg | 0.231 | 0.258 | 0.241 | 0.259 |

[a]Molasses, 5.0%; Salt, 0.50%; Calcium, 0.55%; Dicalcium Phosphate, 0.10%; TM Premix, 0.075%; Vitamin A & D Premix, 0.025%; Decoquinate Medication, 0.027%; Monensin Sodium, 36.31 gms/kg

Table 2. Three-year effect of receiving diet treatment on 50d weaning transition backgrounding performance.

| | Control | 12.5% Flax | 20% Pea | 20% Pea + 12.5% Flax | SE | P-Value |
|---|---|---|---|---|---|---|
| No. Steers | 43[a] | 43[a] | 44a | 43[a] | | |
| Initial Wt., kg | 292.4 | 293.3 | 293.1 | 293.6 | 4.34 | 0.99 |
| 50d Final Wt., kg | 363.6 | 371.5 | 362.9 | 371.9 | 4.76 | 0.38 |
| Gain, kg | 71.2[y] | 78.2[x] | 69.8[y] | 78.0[x] | 1.99 | 0.005 |
| ADG, kg | 1.42[y] | 1.56[x] | 1.40[y] | 1.56[x] | 0.040 | 0.004 |
| ADFI, kg | 8.28 | 8.34 | 8.09 | 8.14 | 0.183 | 0.74 |
| Hay/Day, kg | 3.88 | 3.94 | 3.69 | 3.74 | 0.115 | 0.41 |
| Receiving Suppl./Hd, kg | 4.39 | 4.40 | 4.39 | 4.39 | 0.094 | 0.99 |
| F:G, kg | 5.83 | 5.34 | 5.78 | 5.20 | 0.090 | 0.075 |
| Feed Cost/Hd, $ | $41.44 | $41.20 | $39.97 | $39.56 | 0.688 | 0.17 |
| Feed Cost:kg Gain, $[b] | $0.5820[y] | $0.5269[x] | $0.5726[y] | $0.5072[x] | 0.0082 | 0.012 |

aOne steer died of bloat.

bMeans in a row with unlike superscripts differ significantly ($P < 0.05$).

Table 3. Three-year effect of receiving treatment on finishing and carcass closeout.

| | Control | 12.5% Flaxseed | 20% Field Pea | 20% Field Pea + 12.5% Flaxseed | SE | Trmt. | Year | Trmt x Year |
|---|---|---|---|---|---|---|---|---|
| **Growth Performance:** | | | | | | | | |
| Receiving Wt., kg | 356.7 | 364.5 | 358.1 | 366.7 | 4.36 | 0.269 | 0.0001 | 0.943 |
| Harvest Wt., kg | 587.8 | 582.8 | 588.3 | 589.2 | 6.22 | 0.898 | 0.0001 | 0.481 |
| Days On Feed | 147.3 | 137.0 | 143.6 | 141.3 | 3.91 | 0.291 | 0.0001 | 0.463 |
| Gain, kg | 231.1 | 218.3 | 230.2 | 222.5 | 5.94 | 0.355 | 0.0006 | 0.623 |
| ADFI, kg | 8.85 | 8.87 | 8.95 | 8.84 | 0.155 | 0.959 | 0.7790 | 0.456 |
| ADG, kg | 1.568 | 1.593 | 1.603 | 1.575 | 0.032 | 0.834 | 0.0033 | 0.397 |
| F:G, kg | 5.65 | 5.57 | 5.59 | 5.61 | 0.824 | 0.609 | 0.0001 | 0.888 |
| **Carcass Closeout:** | | | | | | | | |
| HCW, kg | 368.8 | 366.2 | 368.9 | 369.4 | 4.40 | 0.955 | 0.0001 | 0.284 |
| REA, Sq. Cm.[a] | $87.03^{xy}$ | $83.23^{y}$ | $88.39^{x}$ | $87.10^{xy}$ | 1.330 | 0.044 | 0.0001 | 0.268 |
| Fat Depth, mm[b] | $11.25^{x}$ | $13.08^{y}$ | $11.79^{x}$ | $11.63^{x}$ | 0.518 | 0.074 | 0.0001 | 0.063 |
| YG[b] | $2.43^{x}$ | $2.69^{y}$ | $2.39^{x}$ | $2.60^{y}$ | 0.940 | 0.083 | 0.057 | 0.008 |
| QG | 4.70 | 3.66 | 3.57 | 3.77 | 0.638 | 0.562 | 0.124 | 0.031 |
| Percent Choice, % | 60.5 | 37.2 | 43.2 | 44.2 | | 0.112 | 0.219 | 0.066 |
| Carcass Value, $ | 1104.93 | 1088.67 | 1106.61 | 1108.44 | 18.24 | 0.862 | 0.0001 | 0.015 |
| Calf & Feed Cost, $ | 1096.03 | 1086.30 | 1093.38 | 1095.39 | | | | |
| Net Return, $ | 8.90 | 2.37 | 13.23 | 13.05 | 17.85 | 0.943 | 0.0001 | 0.017 |

aMeans in a row with unlike superscripts differ ($P < 0.05$).
bMeans in a row with unlike superscripts differ ($P < 0.10$).

Table 5. Effect of dietary field pea and flaxseed replacement on humoral antibody titer values. [a, b]

| | Pre-Wean | Weaning | 30-Day Post-Weaning | 60-Day Finishing |
|---|---|---|---|---|
| Vaccination | Initial | Booster | | |
| Calf Age/Serum Recovery, days | 183 | 203 | 233 | 293 |
| | | | | |
| Control | | | | |
| IBR[c] | 4[d] | 22[e] | 13[f] | 11g |
| BVD Type I[c] | 4[p] | 58[q] | 63[r] | 51[s] |
| BVD Type II[c] | 4[w] | 175[x] | 200[y] | 204[z] |
| | | | | |
| 12.5% Flaxseed | | | | |
| IBR[c] | 4[d] | 18[e] | 13[f] | 7[g] |
| BVD Type I[c] | 4[p] | 67[q] | 117[r] | 83[s] |
| BVD Type II[c] | 4[w] | 144[x] | 298[y] | 184[z] |
| | | | | |
| 20% Field Pea | | | | |
| IBR[c] | 4[d] | 19[e] | 11[f] | 8[g] |
| BVD Type I[c] | 5[p] | 36[q] | 79[r] | 55[s] |
| BVD Type II[c] | 4[w] | 92[x] | 312[y] | 221[z] |
| | | | | |
| 12.5% Flaxseed + 20% Field Pea | | | | |
| IBR[c] | 4[d] | 17[e] | 10[f] | 11[g] |
| BVD Type I[c] | 4[p] | 102[q] | 119[r] | 95[s] |
| BVD Type II[c] | 4[w] | 123[x] | 200[y] | 154[z] |
| | | | | |

[a]Treatment and treatment * time interaction means did not differ significantly.
IBR: Treatment (P = 0.78); Treatment * Time (P = 0.89)
BVD Type I: Treatment (P = 0.11); Treatment * Time (P = 0.30)
BVD Type II: Treatment (P = 0.90); Treatment * Time (P = 0.86)
[b]Serum antibody titer value change over time was significant.
IBR: Time (P = < 0.0001)
BVD Type I: Time (P = < 0.0001)
BVD Type II: Time (P = < 0.0001)
[c]Means in a row with unlike superscripts differ significantly (P < 0.0001)

Table 6. The carryover effect of 50-day postweaning receiving dietary treatment on feedlot morbidity and medical cost.

| Dietary Treatment | Morbidity, % | Medical Cost/Head[a] |
|---|---|---|
| Control | 35.4 | $26.43 |
| Flaxseed | 34.7 | $28.70 |
| Field Pea | 38.9 | $25.83 |
| Field Pea-Flaxseed | 36.1 | $23.41 |
| | | |

[a]Means did not differ: Treatment (P = 0.96); Year (P = 0.08); Treatment * Year (P = 0.20)