Dietary Field Pea Effects on Feedlot Performance, Carcass Characteristics and Beef Tenderness in Finishing Beef Steers.

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The objectives of this study were to evaluate the effect of increasing field pea inclusion on the intake, performance and carcass characteristics of finishing steers and to evaluate beef palatability, particularly differences in tenderness. Increasing the level of field pea inclusion did not affect dry matter intake (DMI), average daily gain (ADG), gain-to-feed ratio (G:F) or calculated dietary net energy gain (NE_g). Carcass characteristics also were similar among all levels of field pea inclusion. Additionally, no differences were found in sensory panel and Warner-Bratzler shear force values.

Introduction

Field pea production in North Dakota is increasing rapidly. Since 2000, production has increased 89% to reach a level of 6.1 million bushels per year. North Dakota led the nation in field pea production in 2006 (USDA NASS, 2006). As field pea production increases, a substantial amount is available for livestock consumption. This includes those peas unsuitable for human consumption, such as the splits and brokens. However, interest in raising field peas primarily for livestock consumption is increasing.

Relative to corn, field peas are higher in crude protein. Therefore, they are an attractive feedstuff in many different phases of beef production. Field peas have been incorporated into creep feeding diets. Field peas replacing between 33% and 100% of wheat midds in a creep diet resulted in increased dry-matter intake and increased daily gain up to 67% field pea inclusion (Anderson, 1999a). Feed efficiency declined with increasing field pea inclusion. Gelvin et al. (2004) reported that field peas at 55% of the creep feed diet resulted in increased dry matter intake and no effect on gain or feed efficiency.

Field peas fed to growing steer calves at 60% of the dry matter improved feed efficiency over the barley control (Anderson 1999b). When field peas were included in a growing diet up to 26% of the diet, dry matter intake increased linearly ($P = 0.06$); however, gain and feed efficiency were similar (Fendrick et al., 2005a).

Field peas replaced the barley control and canola meal (76% dietary dry matter, or DM) in a finishing diet. The field pea treatment tended ($P < 0.10$) to increase dry matter intake and daily gain. Therefore, gain efficiency was similar among treatments. The field pea-fed group had greater ($P \leq 0.05$) marbling scores and percentage of steers grading Choice in this experiment (Anderson, 1999b). Whole peas were fed at 0%, 20%, 40% and 59% of the dry matter to finishing steers (Fendrick et al., 2005b). Dry matter intake increased ($P < 0.01$) up to the 40% inclusion level; however; gain efficiency and carcass traits were unaffected ($P > 0.10$). A finishing diet that included 0%, 5%, 10% or 20% field peas resulted in decreased ($P < 0.05$) dry matter intake with increasing levels of field pea inclusion (Flatt and Stanton, 2000). Gain efficiency and carcass characteristics were unaffected ($P > 0.10$). With finishing lambs, Loe et al. (2004) determined that field peas contain 1.24 and 0.91 megacalories per pound (Mcal/lb) of net energy for maintenance and net energy for gain, respectively. This represents a value approximately 14% greater than that of corn. Finally, field peas replaced corn and soybean meal at 0%, 10%, 20% and 30% of the dry matter in a study with finishing heifers (Maddock Carlin et al., 2006). No differences in feedlot performance were noted in this study. However, field pea inclusion resulted in a quadratic decrease ($P = 0.001$) in Warner-Bratzler shear force and a linear increase ($P = 0.002$) in consumer taste panel ratings of tenderness. The objectives of the current study were to determine the effect of increasing the level of field peas (replacing corn and soybean meal at 0%, 10%, 20% and 30% of dietary dry matter) on feedlot performance and carcass characteristics, as well as Warner-Bratzler shear force tenderness and sensory panel ratings for tenderness, juiciness and flavor of resulting steaks.

Material and Methods

One hundred forty-three crossbred steers were housed at the NDSU animal research center in concrete-floored pens (five to six head/pen). The steers were blocked by initial weight (955 ± 42 pounds) and assigned randomly to one of four dietary treatments. Treatments included field peas replacing 0%, 10%, 20% or 30% of the corn and soybean meal in the basal diet. The basal diet DM was composed of 80% dry-rolled corn, 5% beet pulp, 5% mixed grass/legume hay, 5% concentrated separator byproduct and 5% supplement that provided 27.5 grams per ton (g/T) Rumensin and 11 g/T Tylan. The diets were formulated to provide a minimum of 0.70% calcium (Ca) and 0.28% phosphorus (P), and provide 13% crude protein (CP), with the exception of the 30% field pea inclusion treatment. Due to the increased crude protein content of the field peas, the formulated diet contained 14.2% crude protein.

Initial weight was an average of three consecutive days and subsequently weight was measured every 28 days. Final weight was computed from hot carcass weight, using a common dressing percentage of 62.5% and a common shrink of 4%. Feed offered was recorded daily and feed refusal was recorded weekly. Weekly feedstuff samples were collected to determine diet DM and to analyze nutrient composition. Calves were implanted with Synovex Choice on day 0. Carcass data was collected at slaughter. A 7-centimeter (cm) (approximately) portion of longissimus muscle was removed caudally starting from the 12th rib location on the left side of each carcass. Longissimus muscle samples were vacuum-packaged, aged for 14 days at 4 degrees Celsius, cut into two 2.54-cm thick steaks and frozen. One steak was evaluated for Warner-Bratzler shear force (WBSF). Each steak was broiled to an internal temperature of 72° C and allowed to cool to room temperature. Six cores were removed from each steak parallel to the muscle fibers and sheared. The second steak was evaluated by a trained panel for tenderness, juiciness and flavor, using a scale of 1 to 8 (1 = extremely tough, dry and bland; 8 = extremely tender, juicy and intense beef flavor) and for off-flavor, using a scale of 1 to 4 (1 = extreme off flavor, 4 = no off flavor). Data were analyzed with the mixed model of SAS with linear and quadratic contrasts ($P \leq 0.05$).

Results

The effects of field pea inclusion on intake, performance and net energy are shown in Table 1. Final weight (1,296 ± 25 pounds.; P = 0.80), ADG (4.32 ± 0.11 pound/day; P = 0.49) and dry matter intake (23.74 ± 0.62 pound/day; P = 0.44) were not affected by treatment. In addition, feed efficiency (5.49 ± 0.10 pound feed/lb. gain; P = 0.92) and calculated dietary net energy for gain (69.0 ± 1.8 megacalories per hundredweight, or Mcal/cwt; P = 0.74) were similar among treatments. This data is different from that of Loe et al. (2004), who determined that field peas increased dietary net energy when replacing only corn in lamb finishing diets. In this experiment, dietary energy was not different among treatments. Therefore, field pea would have a similar energy to dietary ingredients they replaced; 89.8% corn (70.3 Mcal/cwt) and 10.2% soybean meal (67.1 Mcal/cwt) for a field pea net energy of gain of 70 Mcal/cwt.

Table 1. Effect of field peas on intake, performance and net energy.

	Field pea level, % DM					
	0	10	20	30	SEM[a]	Lin *P*
Pens	6	6	6	6		
Steers	35	36	36	36		
Final BW, lbs.	1299	1285	1303	1296	25	0.8
ADG, lbs./d	4.32	4.17	4.45	4.34	0.11	0.49
DMI, lbs.	23.5	23.1	24.7	23.7	0.6	0.44
Dietary NE_g, Mcal/cwt	69.85	68.95	67.59	69.4	1.81	0.74
F:G	5.41	5.56	5.56	5.43	0.17	0.92

[a] Standard error of the mean, n = 6.

The effects of field pea inclusion on carcass characteristics are presented in Table 2. Hot carcass weight (777 ± 15 pounds; P = 0.80), 12th rib fat (0.39 ± 0.02 inch; P = 0.51), longissimus area (13.01 ± 0.19 $inch^2$; P = 0.14) and kidney, pelvic and heart fat, or KPH (1.95 ± 0.06%; P = 0.12) were not different among treatments. In addition, marbling score (394 ± 12; P = 0.62) and yield grade (2.66 ± 0.11; P = 0.56) were similar among treatments.

Table 2. Effect of field peas on carcass characteristics.

	Field pea level, % DM					
	0	10	20	30	SEM[a]	Lin *P*
Hot carcass weight, lbs.	778	772	780	778	15	0.8
Marbling[b]	389	392	398	395	12	0.62
Final BW, lb	1345	1344	1351	1345	26	0.93
Ribeye area, in^2	12.59	12.77	13.04	12.93	0.19	0.14
12th rib fat, in	0.38	0.37	0.4	0.39	0.02	0.51
KPH, %	1.9	1.85	2.07	1.96	0.06	0.12
Yield grade	2.73	2.6	2.64	2.65	0.11	0.56

[a] Standard error of the mean, n = 6.

[b] 300 = $slight^0$, 400 = $small^0$.

The effect of field pea inclusion on carcass characteristics in this study agrees with previous data with one exception. Anderson (1999b) replaced barley with field peas at 76% of dietary dry matter and noted an increase in marbling score and percentage of steers grading Choice. The current study only included field peas up to 30% of the dry matter, similar to much other previous research. Therefore, increasing field pea inclusion above 30% of the dry matter may affect carcass quality.

The effects of field pea inclusion on meat palatability measurements are presented in Table 3. Measurements for WBSF (8.27 ± 2.09 pounds; P = 0.12), sensory panel tenderness (5.80 ± 0.32; P = 0.53), juiciness (5.43 ± 0.37; P = 0.81), flavor (5.65 ± 0.19; P = 0.58) or off-flavor (3.72 ± 0.10) were not different. The results of this data contradict a previous study (Maddock Carlin et al., 2006), which reported a decrease in Warner-Bratzler shear force and an increase in sensory panel tenderness scores when field peas were included in the ration. The reason why our data differs may be related to differences between the two studies. These differences include the use of implants (moderate potency

implants were used in this study, while the cattle in the previous study were not implanted), sex of cattle (steers vs. heifers) and age of cattle at harvest (calves fed in this study vs. yearlings in the previous work).

Table 3. Effect of field peas on beef palatability.

	Field pea level, % DM					
	0	10	20	30	SEM[a]	Lin *P*
WBSF[b], lbs.	8.36	7.83	8.62	8.03	2.09	0.12
Sensory panel						
Tenderness	5.76	5.92	5.69	5.92	0.32	0.53
Juiciness	5.34	5.55	5.42	5.41	0.37	0.81
Flavor	5.66	5.74	5.64	5.58	0.19	0.58
Off flavor	3.74	3.72	3.76	5.69	0.1	0.68

[a] Standard error of the mean, n=6

[b] Warner-Bratzler shear force

Implications

As field pea production in North Dakota increases, a growing volume of excess field peas is available to be used as a feedstuff. These present an attractive alternative to corn, as they may be less costly. In addition, the increased crude protein concentration of field peas allows for the removal of more expensive protein sources from the diet, further reducing feed costs. These data indicate that replacing corn with field peas up to 30% of the dietary dry matter does not impact feedlot performance, carcass characteristics or palatability of the resulting meat products. Therefore, field peas present an attractive alternative feed source in North Dakota.

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