Effects of Feeding Peas at Different Times During Feedlot Finishing on Steer Performance and Carcass Merit

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Introduction

Field peas are a relatively new and useful feed resource for beef producers in the Northern Plains states (Anderson, et al., 2007). Previous research at the Carrington Research Extension Center indicated newly weaned steer calves fed field peas during the receiving period continued to exhibit increased dry matter intake (DMI) and average daily gain (ADG) than control diets (Anderson et al., 2007). The differences were significant and justified further investigation of the long-term effects of peas in receiving diets on feedlot performance and carcass traits. Increased carcass quality and meat tenderness was also reported to be a result of inclusion of field peas in finishing rations (Anderson, 1999; Maddock-Carlin, 2006). This study will also evaluate effects of peas fed at different times on mechanical tenderness of the ribeye muscle.

Materials and Methods

One hundred forty-four recently weaned steer calves (initial weight 634.9 pounds) were provided by North Dakota cow/calf producers participating in the Central Dakota Feeder Calf Show in the fall of 2006. Steers were assembled at Turtle Lake, ND, and transported to the Carrington Research Extension Center. After a rest period, steers were weighed, blocked by weight into four replicates and randomized into 16 pens. Four pens were assigned to each of the four treatments. The dietary treatments tested were: 1) control (CTR), no field peas fed during the study, 2) receiving (REC), field peas fed at 15% of the ration during the 56-day receiving period , 3) finishing (FIN), field peas fed at 15% of the ration during the last 80 days of the finishing period, and 4) continual (CNL), field peas fed at 15% of the ration during the entire feeding period from arrival until marketing.

Ration composition for the corn-based growing and finishing diets with and without peas is provided in Table 1. The receiving diets were formulated with 60% concentrate, contained 57 Mcal/lb NEg and were fed for 56 days (Period 1 and 2). The finishing diets were formulated with 85% concentrate, contained 62 Mcal/lb NEg and were fed for the remainder of the feeding period until animals were ready for market. A graphic representation of the feeding regime according to period and treatment is found in Figure 1.

Table 1. Rations with and without field peas fed during different growing periods.

	Growing Diets		Finishing Diets	
	Control	Field Peas	Control	Field Peas
	Percent, DM Basis		Percent, DM Basis	
Corn	46.71	32.62	66.76	53.81
Corn Silage	27.39	27.50	11.64	11.55
Field Peas	-	25.61	-	25.99
Straw	12.04	12.09	6.19	6.14
Canola Meal	11.69	-	13.1	-
Limestone	0.77	0.77	0.87	1.08
Ionophore Suppl	1.40	1.41	1.44	1.43

Figure 1. Timeline for inclusion of field peas in feedlot rations

	Treatment Diets				
	Control	Receiving	Continual	Finishing	Diet description
Period 1	No peas	Peas	Peas	No peas	Growing - 57 Mcal Neg
Period 2	No peas	Peas	Peas	No peas	Growing - 57 Mcal Neg
Period 3	No peas	No peas	Peas	No peas	Finishing -62 Mcal Neg
Period 4	No peas	No peas	Peas	No peas	Finishing -62 Mcal Neg
Period 5	No peas	No peas	Peas	No peas	Finishing -62 Mcal Neg
Period 6	No peas	No peas	Peas	Peas	Finishing -62 Mcal Neg
Period 7	No peas	No peas	Peas	Peas	Finishing -62 Mcal Neg

Bunk calls were made by 8AM and steers were fed a totally-mixed ration to appetite once daily in fenceline bunks. Steers had free access to water in ice-free automatic fenceline water fountains. Steers were weighed approximately every 28 days to monitor progress and determine relative performance during the trial. Bedding was provided during severe winter weather and steers had wind protection from wind fences and tree belts near the feedlot pens. Dependent variables measured during the feedlot study included feed intake, gain, and feed efficiency. Steers were marketed at a commercial abattoir (Tyson Fresh Meats, Dakota City, NE) when an estimated 60% graded choice by visual appraisal. Carcass traits were measured by trained personnel in the abattoir. Traits recorded included hot carcass weight (HCW), dressing percent (DP), ribeye area (REA), fat thickness (FTH), kidney pelvic and heart fat (KPH), USDA Quality Grade by marbling score, and Yield Grade was calculated.

For the Warner-Bratzler Shear (WBS) force measurement, a 3-inch (approximate) rib sample was procured from the anterior end of the shortloin (NAMP #174; NAMP, 1997). Shortloin sections were aged in the vacuum packaged bags for 16 days postmortem at 39°F. After aging, shortloins were processed into 1-inch thick steaks with one steak from each steer used for the WBS evaluation (AMSA, 1995). Steaks were thawed for 24 hours at 36°F prior to cooking. Steaks were oven broiled at 500°F until the internal temperature reached160°F and allowed to cool to room temperature. Seven to ten .5-inch cores from each steak were obtained parallel to the muscle fiber. Each core was sheared once using a Warner-Bratzler shear machine (G-E Electric Manufacturing Co., Manhattan, KS) with a 250 mm/min crosshead speed. The mean of the force (measured in pounds) recorded for six different cores from each steak was used in the statistical analysis. Taste panel response has not been conducted but will be reported in future publications.
All animals were fed and cared for in accordance with the published guidelines of the NDSU Institutional Animal Care and Use Committee, which approved this project. All staff and faculty associated with this project were trained in the care and management of livestock as required. Statistical analysis was conducted using SAS Mixed procedures with pen as the experimental unit. P values and standard errors are reported in respective tables so the reader can interpret effects of treatments on the variables measured.

Results

Steers were weighed eight times during the course of this trial (Table 2) and live animal weight was not affected by treatment ($P > 0.17$). Similarly, DMI was not affected by treatment for any of the periods ($P > 0.25$). During period 6, however, steers fed the FIN treatment gained more ($P < 0.10$) (3.08 pounds) than the control (2.34 pounds) with the other two treatments intermediate. Over the entire study, effects on ADG due to treatment approach significance ($P = 0.11$) with a tendency for the two diets with peas to gain more than the diets without peas when contrast comparisons are made (P=0.13). Steers on the FIN treatment gained the most during the entire study (3.58 pounds) followed by CNL (3.47), REC (3.39) and CTR (3.37).

Table 2. Feedlot performance of steers fed field peas during various stages of production.

	Treatment						Contrasts
Weight, lbs	Control	Receiving	Finishing	Continual	St. Error	*P* Value	Peas vs. No Peas
23-Oct-06	636.88	634.42	632.88	635.60	37.34	0.88	
21-Nov-06	742.83	738.53	743.38	743.00	40.69	0.93	
19-Dec-06	845.51	839.45	849.47	851.00	40.65	0.70	
16-Jan-06	954.94	946.54	963.02	964.98	41.38	0.46	
13-Feb-07	1049.89	1042.57	1061.95	1060.46	41.41	0.52	
13-Mar-07	1142.43	1139.65	1154.02	1153.87	41.77	0.74	
10-Apr-07	1207.77	1209.11	1239.75	1226.62	39.70	0.19	
21-May-07	1348.78	1351.51	1389.08	1365.32	43.14	0.17	
Dry Matter Intake, lbs./hd/day							
Period 1	16.50	17.37	17.71	17.04	0.85	0.62	
Period 2	19.60	19.91	19.54	19.81	0.74	0.94	
Period 3	21.34	21.79	20.39	20.55	0.66	0.25	
Period 4	22.60	22.68	22.50	22.32	0.90	0.98	
Period 5	24.76	24.65	24.45	25.23	0.93	0.89	
Period 6	23.51	23.40	23.62	24.42	0.65	0.52	
Period 7	24.51	23.36	23.88	24.41	0.60	0.41	
Growing	18.05	18.43	18.63	18.64	0.76	0.83	0.40
Finishing	23.35	23.38	22.97	23.17	0.66	0.91	0.75
Overall	21.84	21.97	21.73	21.88	0.65	0.98	0.96
Average Daily Gain, lb./hd/day							
Period 1	3.65	3.59	3.82	3.70	0.15	0.54	
Period 2	3.66	3.60	3.80	3.87	0.17	0.70	
Period 3	3.78	3.70	3.91	3.94	0.16	0.67	
Period 4	3.39	3.43	3.53	3.41	0.13	0.88	
Period 5	3.31	3.48	3.26	3.35	0.17	0.83	
Period 6	2.34[a]	2.48[ab]	3.08[b]	2.61[ab]	0.20	0.09	
Period 7	3.44	3.48	3.65	3.38	0.18	0.69	
Growing	3.44	3.65	3.86	3.82	0.10	0.22	0.48
Finishing	3.71	3.22	3.38	3.19	0.07	0.12	0.17
Overall	3.37	3.39	3.58	3.47	0.06	0.11	0.13

[ab] Values with different superscripts are significantly different (P< .10)

Feed efficiency data is found in Table 3, where feed per unit gain (feed efficiency) and gain per unit feed (feed efficiency) comparisons are made. No differences due to treatment (P > 0.16) were observed for the growing, finishing or overall feeding periods. Gain efficiency in Period 6 appears to favor the FIN treatment (P<.09). The carcass quality data is provided in Table 4. Final shrunk body weight was not different due to treatment (*P* = 0.46), nor was hot carcass weight (*P* = 0.38). Average marbling score was greatest (472) for CNL steers fed field peas for the entire trial (*P* < 0.01) and the least for the steers on the CTR and REC diets, (412, 410) with FIN marbling scores intermediate (441). Yield grade was significantly different between the REC (3.08) and FIN (3.35) treatments (*P* = 0.04) with CNL (3.27) and CTR (3.14) intermediate. It appears that field peas in the diet during the finishing period tended to increase ADG, feed efficiency, and carcass quality traits. Warner-Bratzler shear force summary is depicted on Figure 2. Significant differences (P < 0.01) in mechanical tenderness testing were found between CNL steers and CTR steers (*P* = 0.05). The CNL steers were the most tender with a WBS score of 6.03 pounds of force required, and CTR were the least tender at 6.91 pounds. The other treatments (REC and FIN) were intermediate in mechanical tenderness. This difference is easily detectable by consumers as taste panel experience indicates recognition of .5 lbs difference in shear force. Taste panel data will be published in the future.

Table 3. Feedlot efficiency of steers feed field peas during various stages of production.

	Treatment						Contrasts
	Control	Receiving	Finishing	Continual	St. Error	*P* Value	Peas vs. No Peas
Feed per Gain (Feed Efficiency)							
Period 1	4.53	4.75	4.65	4.70	0.19	0.87	
Period 2	5.37	5.52	5.21	5.19	0.32	0.87	
Period 3	5.65	5.59	5.24	5.53	0.22	0.56	
Period 4	6.66	6.52	6.43	6.67	0.32	0.88	
Period 5	7.50	7.30	7.57	7.38	0.33	0.92	
Period 6	10.41	10.11	7.76	8.99	0.82	0.13	
Period 7	7.17	7.10	6.60	6.93	0.33	0.57	
Growing	4.94	5.12	4.90	4.93	0.18	0.79	0.82
Finishing	7.19	7.06	6.61	6.93	0.21	0.16	0.13
Overall	6.76	6.70	6.21	6.48	0.22	0.20	0.20
Gain per Feed (Gain Efficiency)							
Period 1	0.22	0.21	0.22	0.21	0.01	0.82	
Period 2	0.19	0.18	0.20	0.19	0.01	0.76	
Period 3	0.18	0.18	0.19	0.18	0.01	0.50	
Period 4	0.15	0.15	0.16	0.15	0.01	0.79	
Period 5	0.13	0.14	0.13	0.14	0.01	0.88	
Period 6	0.10^{a}	0.10^{ab}	0.13^{b}	0.11^{ab}	0.01	0.09	
Period 7	0.14	0.14	0.15	0.14	0.01	0.52	
Growing	0.20	0.20	0.21	0.20	0.01	0.76	0.86
Finishing	0.14	0.14	0.15	0.14	0.00	0.18	0.17
Overall	0.16	0.16	0.17	0.16	0.01	0.39	0.42

^{ab} Values with different superscripts are significantly different (P< .10)

Table 4 . Carcass quality traits of steers fed field peas during various stages of production.

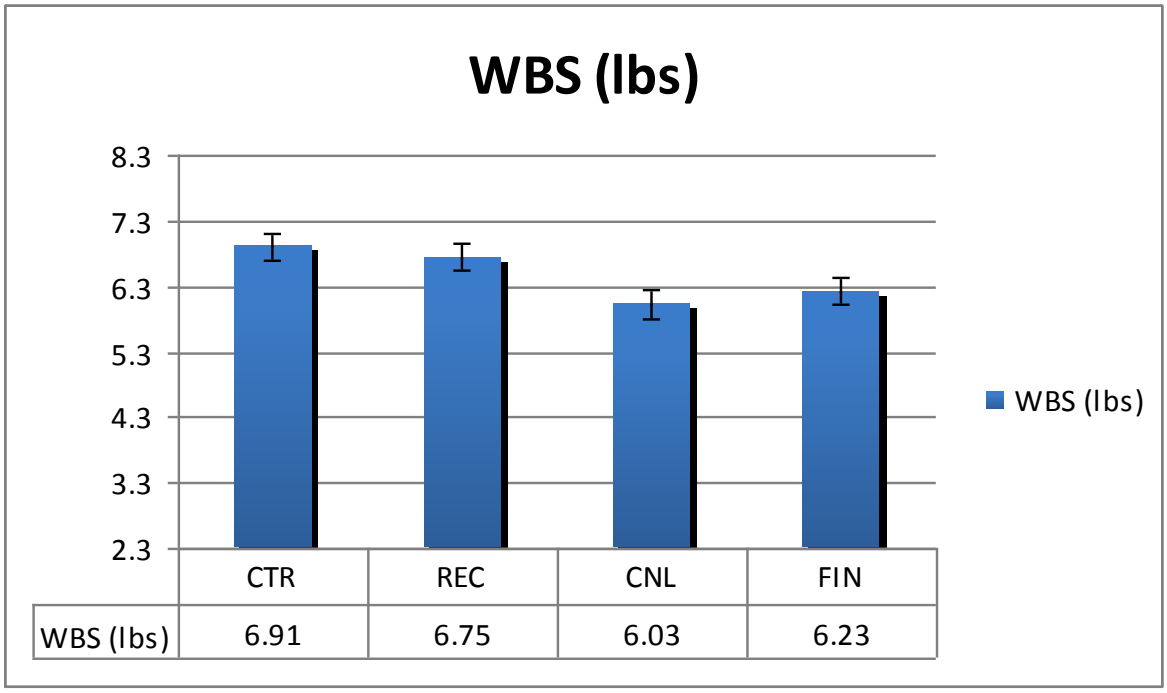
	Treatment					
Item	Control	Receiving	Finishing	Continual	St. Error	*P* Value
Final Wt., lbs.	1334.09	1337.98	1372.81	1347.09	20.43	0.46
Hot Carcass Wt. lbs.	807.30	802.26	830.05	818.15	13.10	0.35
Marbling Score*	412.00^{b}	409.71^{b}	441.25^{ab}	472.29^{a}	14.28	0.01
Dressing Percent	65.53	64.95	65.53	65.80	0.29	0.12
Ribeye Area	13.80	13.61	13.54	13.72	0.18	0.75
Yield Grade**	3.14^{ab}	3.08^{b}	3.35^{a}	3.27^{ab}	0.08	0.04
Back Fat	0.45^{ab}	0.43^{b}	0.54^{a}	0.51^{ab}	0.03	0.04
KPH, %	2.51	2.43	2.37	2.48	0.49	0.16

* Marbling score is numeric value based on dispersion of fat inside ribeye muscle, select, select = 300-399; low choice= 400-499. Higher marbling scores = higher carcass value.

** Yield grade is a measure of fat to lean ratio, 1 = lean, 5 = fat.

^{ab} Values with different superscripts are significantly different (P< .10)

Figure 2. Warner Bratzler shear force tenderness scores for steers fed field peas during different growing stages.



	CTR	REC	CNL	FIN
WBS (lbs)	6.91	6.75	6.03	6.23

Conclusions and Implications

It appears from this data that the long-term positive effect of feeding field peas during the receiving period observed in a previous study is not repeatable. However, some benefits of including peas in the diet at different times were observed. The inclusion of field peas at 15% of the diet was most effective when fed during the final 80 days of the feeding period. A tendency for improved gain and feed efficiency was observed and some carcass traits exhibited significant improvement. Higher marbling scores lead to greater value when cattle are sold on a quality grid. Beef fed peas is gaining recognition in the regional meat markets for consistent tenderness and juiciness. The inclusion of peas in feedlot diets will depend on the relative price of the grain legume and the potential for increased return from a more desirable beef product. More research is planned to study the effect of peas on other muscles in the carcass and to determine the component of peas that causes the tenderness effect.

References

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