

Integrating Field Peas into Feedlot Cattle Diets

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Summary and Implications

The objective of this experiment was to evaluate the effect of replacing corn in the traditional Iowa finishing diet with field peas on steer growth performance, carcass characteristics, and meat quality. Fifty-four purebred Angus steers were assigned to treatment by age, marbling potential, and initial body weight to one of two dietary treatments ($n = 27$ hd/trt): 1) a finishing diet composed of 66% corn, 20% modified distillers grains, 10% ground hay, and 4% supplement on a dry matter (DM) basis (CON) or 2) a finishing diet composed of 36% corn, 30% field peas, 20% modified distillers grains, 10% ground hay, and 4% supplement (PEA). While no differences were observed for body weight or average daily gain, PEA-fed steers tended to have lower dry matter intake compared to CON-fed steers. Carcass characteristics, Warner-Bratzler Shear Force, and fatty acid composition were not impacted by dietary treatments. In this study, field peas successfully replaced 30% of corn in finishing diets (dry matter basis) with minimal impact on growth performance, carcass characteristics, and meat quality of steers.

Introduction

Interest in yellow peas as a grain product in Iowa and the Upper Midwest has been on the rise due to the added farm diversity and the potential for double cropping. Adding peas into the cropping system also provides the beef industry with a novel grain to be utilized in diets. This study was designed to evaluate the effect of replacing corn in the traditional Iowa finishing diet with field peas on steer growth performance, carcass characteristics, and meat quality.

Materials and Methods

Fifty-four purebred Angus steers sourced from the ISU McNay Research Farm were fed for 117 days at the ISU Armstrong Research Farm. Steers were fed in open pens equipped with bunks capable of monitoring individual feed disappearance (Feed Intake Monitoring System, FIMS). Steers were assigned to treatment group based on age, marbling potential utilizing marbling expected progeny difference (MARB EPD), and body weight (BW) to one of two dietary treatments ($n = 27$ hd/trt): 1) a finishing diet composed of 66% corn, 20% modified distillers grains, 10% ground hay, and 4% supplement on a dry matter (DM) basis (CON) or 2) a finishing diet composed of 36% corn, 30%

field peas, 20% modified distillers grains, 10% ground hay, and 4% supplement (PEA; Table 1). The comparison of nutrient profile of peas to whole shelled corn utilized in this study is found in Table 2.

Individual BW were collected on consecutive days at the beginning of the trial with a single day, midpoint yearling weight collected on day 56. A final carcass adjusted BW was calculated using hot carcass weight and a standard dressing percentage of 63% and utilized in performance calculations. Dry matter intake (DMI), average daily gain (ADG), and feed conversion (feed to gain, F:G) were calculated on an individual steer basis. On day -1, all steers were implanted with Component TE-IS (Elanco). Steers were harvested at commercial packing plant (Upper Iowa Beef, Lime Spring, IA) where individual carcass data including hot carcass weight, ribeye area, marbling score, yield grade, and backfat thickness was collected. A 3-inch rib section from each carcass was collected and transported back to the ISU Meats Laboratory for further analysis of meat characteristics including Warner-Bratzler Shear Force (WBSF; a measurement of tenderness) and fatty acid profiles.

Results and Discussion

Throughout the trial, no differences in BW or ADG were observed between CON vs. PEA-fed steers ($P < 0.36$; Table 3). However, PEA-fed steers ate 4.8 lbs of DM/hd/d less ($P < 0.01$) during the first 56 days on feed, leading to an improved F:G ($P < 0.01$) compared to their CON-fed counterparts. However, this advantage was lost during the second half of the feeding period. Overall, PEA-fed steers tended to have lower DMI ($P = 0.07$) with no difference in feed conversion ($P = 0.14$) compared to CON-fed steers.

Carcass characteristics were not impacted by dietary treatments ($P \leq 0.72$; Table 3). Overall, steers on this trial graded 100% Choice and higher with 17% grading Prime and 30% Yield Grades 4s & 5s.

Individual ribeye sections were analyzed for pH and color and no differences were found ($P \leq 0.16$; Table 4). Warner-Bratzler Shear Force (WBSF) was not impacted ($P = 0.71$) by dietary treatment. These steaks being considerably more tender than consumer acceptability threshold of 4.1 kg (Huffman et al., 1996), likely to due to the quality of the steers utilized in this research project as the ISU McNay Research Farm cow herd has been selected for marbling for over two decades.

Meat samples were analyzed for fatty acid composition (Table 5). No differences were observed ($P \leq 0.39$) for total saturated, monosaturated, or polysaturated fatty acids from steaks from PEA-fed steers compared to steaks from CON-fed steers. Steaks from PEA-fed cattle had higher levels of total omega-3 fatty acids ($P < 0.01$) compared to steaks from CON-fed cattle. While the concentrations of omega-6 fatty acids were not impacted ($P = 0.85$), the ratio of omega-6 to omega-3 was lower and more desirable in steaks from PEA-fed cattle ($P < 0.01$). Although consuming beef from cattle fed PEA would only have a small impact on overall

omega-3 intake, the higher levels of dietary omega-3 are advantageous to support various human health benefits including cardiovascular health.

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Table 1. Ingredient composition of diets fed (% dry matter basis).¹

	CON	PEA
Whole shelled corn	66	36
Peas	0	30
Modified distillers grains	20	20
Ground hay	10	10
Supplement	4	4
<i>Analyzed composition</i>		
Dietary dry matter	76.2	77.3
Crude protein	13.8	18.2
Starch	52.1	40.1

¹Abbreviations: CON = corn-based diet; PEA = corn-based diet containing 30% peas.

Table 2. Nutrient profile of field peas and whole shelled corn utilized in the study (% dry matter basis).

	Pea	Corn
Dry matter	84.87	85.30
Crude protein	23.63	8.51
Acid detergent fiber	5.59	4.14
Neutral detergent fiber	8.22	7.86
Starch	48.33	73.22
Fat	1.32	4.30
Ash	3.20	2.78
Non-fiber carbohydrates	65.67	80.61
Total digestible nutrients	84.05	87.40
Net energy for gain, Mcal/lb	0.68	0.65
Calcium	0.16	0.03
Phosphorus	0.38	0.35
Magnesium	0.16	0.11
Potassium	0.10	0.36
Sulfur	0.23	0.14

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Table 3. Growth performance and carcass characteristics of steers fed a traditional corn-based finishing diet (CON) compared to finishing diet containing 30% field peas (PEA).

	CON	PEA	SEM	P-Value
<i>Body weight¹, lbs</i>				
d0	844	852	14.3	0.57
d56	1075	1088	16.7	0.44
d117	1284	1281	19.6	0.89
<i>Dry matter intake, lbs/hd/d</i>				
d0 – 56	28.0	23.2	1.46	<0.01
d57 – 117	27.5	27.1	1.36	0.77
d0 – 117	27.8	25.4	1.33	0.07
<i>Average daily gain, lbs/hd/d</i>				
d0 – 56	4.13	4.21	0.171	0.61
d57 – 117	3.48	3.30	0.194	0.36
d0 – 117	3.76	3.70	0.122	0.64
<i>Feed to gain (F:G), lbs/hd/d</i>				
d0 – 56	6.955	5.535	0.4224	<0.01
d57 – 117	8.373	8.637	0.8534	0.76
d0 – 117	7.494	6.858	0.4184	0.14
<i>Carcass characteristics</i>				
Hot carcass weight, lbs	809	805	12.3	0.73
Marbling score ²	795	802	23.0	0.76
Ribeye area, sq. inches	13.06	13.16	0.270	0.72
Rib fat thickness, inches	0.67	0.69	0.054	0.73
Calculated yield grade	3.67	3.67	0.176	0.98

¹d0 and d56 = live body weights with 4% shrink applied. d117 = Carcass adjusted final body weight utilizing hot carcass weight and standard 63% dressing percentage.

²600 = average Choice; 700 = high Choice; 800 = Prime.

Table 4. Meat quality characteristics of steers fed a traditional corn-based finishing diet (CON) compared to finishing diet containing 30% field peas (PEA).

	CON	PEA	SEM	P-Value
pH	5.50	5.47	0.025	0.18
<i>l</i> ¹	38.54	38.32	0.485	0.65
<i>a</i> ²	20.29	19.98	0.219	0.16
<i>b</i> ³	6.62	6.57	0.174	0.79
Prewrite, g	231.1	231.5	7.58	0.96
Postweight, g	170.0	171.7	6.03	0.77
Cookloss, %	26.4	25.9	0.76	0.49
WBSF ⁴ , kg	2.32	2.37	0.141	0.71
Total lipid, %	8.30	7.54	0.447	0.10

¹*l* = a measurement of lightness.

²*a* = a measurement of redness.

³*b* = a measurement of yellowness.

⁴Warner-Bratzler Shear Force.

Table 5. Fatty acid profile of steaks from steers fed a traditional corn-based finishing diet (CON) compared to finishing diet containing 30% field peas (PEA).

	CON	PEA	SEM	P-Value
<i>Total saturated fatty acids</i>	45.76	45.25	0.586	0.39
<i>Total monounsaturated fatty acids</i>	48.36	48.21	0.470	0.75
<i>Total polyunsaturated fatty acids</i>	3.80	3.86	0.161	0.71
<i>Omega fatty acids</i>				
Omega-3	0.195	0.252	0.0110	<0.01
Omega-6	3.302	3.332	0.1500	0.85
Omega-6:omega-3	16.933	13.222	0.0023	<0.01
<i>Ratio of fatty acids</i>				
Polyunsaturated:saturated	0.083	0.085	0.0042	0.63
Monounsaturated:saturated	1.061	1.070	0.0237	0.70
Unsaturated:saturated	1.143	1.160	0.0283	0.56