

Integrating Field Peas into Feedlot Cattle Diets

Erika Lundy-Woolfolk—beef specialist, ISU Extension and Outreach

Dan Loy—professor, Department of Animal Science

Matt Groves—superintendent, Armstrong Memorial Research and Demonstration Farm

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 used in diets. This study was designed to evaluate the effect on steer growth performance, carcass characteristics, and meat quality of replacing corn in the traditional Iowa finishing diet with field peas.

Materials and Methods

Fifty-four purebred Angus steers were fed for 117 days at the Armstrong 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 groups based on age, marbling expected progeny difference (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 used 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% used 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 one, all steers were implanted with Component TE-IS (Elanco). Steers were harvested at a commercial packing plant (Upper Iowa Beef) where individual carcass data including hot carcass weight, ribeye area, marbling score, yield grade, and backfat thickness was collected. A 3-in. rib section from each carcass was collected and transported back to the Iowa State Meats Laboratory for further analysis of meat characteristics including Warner-Bratzler Shear Force (WBSF, a measurement of tenderness) and fatty acid profiles.

Table 1. Ingredient composition of diet 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
Analyzed composition		
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 used 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	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

Results

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 with 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 with 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 Grade 4s and 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 due to the quality of the cattle used in this research project, as the McNay farm cow herd has been selected for marbling for more than 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 with steaks from CON-fed steers. Steaks from PEA-fed cattle had higher levels of total omega-3 fatty acids ($P < 0.01$) compared with 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.

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

		CON	PEA	SEM	P-Value
Body weight ¹ , lbs.	d0	844	852	14.3	0.57
	d56	1075	1088	16.7	0.44
	d117	1284	1281	19.6	0.89
Dry matter intake, lbs./hd/d	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
Average daily gain, lbs./hd/d	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
Feed to gain (F:G), lbs./hd/d	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
Carcass characteristics	Hot carcass weight, lbs.	809	805	12.3	0.73
	Marbling score ²	795	802	23.0	0.76
	Ribeye area, sq. in.	13.06	13.16	0.270	0.72
	Rib fat thickness, in.	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 using hot carcass weight and standard 63% dressing percentage.

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

Key Takeaways

In this study, peas successfully replaced 30% of corn in finishing diets resulting in similar average daily gain and feed conversion, while tending to consume less feed compared with steers fed traditional corn-based diets. Dietary treatments resulted in similar carcass traits, meat quality, and fatty acid composition. Steaks from steers fed peas resulted in greater omega-3 content and a more favorable ratio of omega-6 to omega-3 than steers fed higher concentration of corn in the finishing diet. Since all beef is low in omega-3, the biological significance of this difference may be questioned.

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