Effects of Processing Field Peas on Performance and Carcass Characteristics of Feedlot Heifers

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Summary
North Dakota leads the United States in field pea production, giving producers in the state a high quality, palatable protein and energy source for beef cattle. This study was conducted to compare the common processing methods for field peas (grinding, rolling, or feed whole) in finishing feedlot diets. One hundred twenty- seven crossbred heifers (avg. wt. 799.9 ± 11.4 lbs.) were allotted by weight to one of three pea-supplemented diets (4 pens per treatment, 10 or 11 head per pen) to determine the optimum level of pea processing needed to maximize cattle performance. The corn-based diets contained ground, dry-rolled or whole peas as a protein source. Diets were formulated to contain 13.5% CP with 56.5 Mcal/cwt NEg in the finishing diet. Intake was greatest for cattle fed rolled peas. Heifers consumed more ($P<.05$) of the dry-rolled pea diet and gained faster ($P<.01$) than rations with ground or whole peas. Particle size was 701 microns for ground, 3100 for rolled, and 9250 for whole peas. No differences in feed efficiency or carcass traits were observed ($P>.10$). Field peas can be successfully included in feedlot rations with the greatest intake and gain from dry-rolled peas.


Field peas.

Introduction
Field peas are marketed as dry, shelled products primarily for human consumption. Surplus grain, off quality grains, and screenings which contain high levels of protein (approximately 24% CP) and energy (approximately 48% starch), are an attractive, nutrient dense livestock feed. Significant amounts of pulse grains are produced annually in the northern Great Plains of the United States and the prairie provinces of Canada. North Dakota leads the United States in field pea production, giving producers in the state a high quality option for protein in beef cattle rations. Field peas can be successfully included in corn- or barley-based rations as a protein supplement; however little information is available on the optimum level of processing needed to maximize cattle performance. Thus, our objective was to determine whether dry-rolling, grinding, or feeding peas whole was the optimum level of field pea processing in growing and finishing diets of feedlot heifers. Whole grains are less digestible than processed grain; however, dry rolling has a tendency to split the peas into a hull or endosperm fraction, which does not mix well and adds variation to the diet. Three levels of pea processing in both a growing and finishing diet were investigated in this trial: whole, dry-rolled, and ground.

Experimental Procedures
One hundred twenty-seven crossbred heifers (approximately 799.9 ± 11.4 lbs.) were allotted by weight to one of three pea-supplemented diets (4 pens per treatment, 10 or 11 head per pen) to determine the optimum level of pea processing needed to maximize cattle performance. Steers were housed and fed at the Carrington Research Extension Center feedlot in open drylot pens. Each pen was equipped with automatic waterers and fenceline bunks which allowed for two feet of bunk space per head. Feed was

delivered as a totally-mixed ration once daily to appetite. Diets were corn-based and contained whole, dry-rolled, or ground peas as a protein source. During the first 28-day period, the diet contained 22% grass-hay (Table 1), after which cattle were transitioned to a 15% grass-hay diet, fed until slaughter. The 22 and 15% grass hay diets were formulated to contain 13.5% CP and 52.5 and 56.5 Mcal/cwt NEg, respectively. Feed samples were taken every week and composited for analysis of DM and CP. De-sugared beet molasses (concentrated separator by-product provided courtesy of Midwest Agri Commodities, East Grand Forks, MN), a by-product of the sugar beet industry, was used to condition the ration and make it more palatable.

Table 1. Diet composition for finishing heifers with field peas (DM basis).

	Growing Diet	Finishing Diet
Ingredients		
Corn	40	48
Peas	28	27
De-sugared beet molasses	8	8
Native range hay	22	15
Limestone	0.37	1.00
Rumensin MGA Supplement	1.00	1.00
Diet specifications		
Crude protein, %	13.55	13.63
NEg, Mcal/cwt	52.5	56.5
Ca, %	0.67	0.51
P, %	0.36	0.38

Cattle were vaccinated for protection against IBR, BVD, BRSV, PI3 (Bovishield-4; Pfizer, Exton, PA), and clostridia (7-way + somnus; Pfizer, Exton, PA) at the initiation of the trial. Health status of the cattle was monitored daily. Rectal temperatures were measured in animals that were visibly anorexic or had severe nasal mucous drainage and rapid or labored breathing. Sick animals were treated with one of two antibiotics according to label instructions (Micotil, Elanco, Indianapolis, IN; A180, Pfizer, Exton, PA). Micotil was used on first and second pulls, followed by A180 if cattle were unresponsive. Antibiotic treatment continued until animals appeared healthy. Research protocols regarding animal care followed guidelines recommended in the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching (FASS, 1998). Heifers were not implanted.

Cattle were slaughtered at Tyson Foods (Dakota City, NE) when fat thickness for the entire group was estimated to be 0.40 in. Hot carcass weight, fat thickness, percentage kidney, pelvic and heart fat, ribeye muscle area, and USDA quality and yield grades were determined by qualified personnel 48 hours after slaughter. Final live weight was determined by using hot carcass weight and an assumed dressing percentage of 61%.

Data were subjected to a one-way analysis of variance as a completely randomized design using the GLM procedures of SAS (Version 8.0; SAS Inst. Inc., Cary, NC). Pair-wise comparisons (least significant difference) were used to separate treatment least squares means when the F-test was significant ($P < 0.05$). The model included effects due to diet and pen was the experimental unit.

Results

Particle size of ground, rolled, and whole peas was 701, 3100, and 9250 microns, respectively. Dry matter intake was greatest ($P<.05$) for the rolled-pea treatment (22.81 lbs. per hd/day) for the entire feeding period (Table 2) compared to ground (21.21 lbs.) and whole (21.33 lbs.). Intake exhibited a quadratic response (P<.05) to processing treatment during each of the three feeding periods with reduced intake for the ground- and whole-pea treatments. Average daily gains were also greatest (P<.01) for the rolled- pea treatment for the entire feeding period (3.39 lbs./hd/day) compared to ground (3.12 lbs.) and whole (2.96 lbs.). Statistical differences in gain were greater during period 1 (P<.01) and period 2 (P<.06) than period 3 (P<.15). Feed efficiency expressed as feed per gain or gain per feed (Table 2) was not different during any of the feeding periods or overall (P>.16).

Table 2. Performance of feedlot heifers finished with ground, rolled or whole peas.

	Treatment				
	Ground	Rolled	Whole	St Error	P Value
Weight, lbs.					
July 22, 2004	799.2	802.3	802.9	10.91	0.96
August 19, 2004	886.3	903.4	889.6	11.24	0.54
September 16, 2004	976.2	998.7	974.0	11.87	0.29
November 11, 2004	1117.2	1148.2	1105.2	14.86	0.13
Dry Matter Intake, lbs.					
Period 1^{c}	19.50^{a}	21.11^{b}	20.19^{ab}	0.34	0.03
Period 2^{c}	20.71^{a}	22.76^{b}	21.37^{ab}	0.55	0.07
Period 3^{c}	23.42^{ab}	24.55^{a}	22.43^{b}	0.54	0.06
Overall	21.21^{a}	22.81^{b}	21.33^{a}	0.38	0.04
Average Daily Gain, lbs.					
Period 1^{c}	3.11^{a}	3.61^{b}	3.10^{a}	0.11	0.04
Period 2^{c}	3.21^{ab}	3.40^{a}	3.02^{b}	0.11	0.06
Period 3	3.07^{ab}	3.25^{a}	2.85^{b}	0.14	0.15
Overall^{c}	3.12^{ab}	3.39^{a}	2.96^{b}	0.08	0.01
Feed/Gain					
Period 1	6.32	5.91	6.60	0.30	0.31
Period 2	6.49	6.63	7.56	0.51	0.32
Period 3	7.72	7.57	8.03	0.53	0.82
Overall	6.84	6.75	7.23	0.17	0.16
Gain/Feed					
Period 1	0.159	0.169	0.153	0.007	0.36
Period 2	0.156	0.152	0.136	0.009	0.33
Period 3	0.132	0.132	0.127	0.008	0.87
Overall	0.146	0.148	0.139	0.003	0.16

^{ab} means on the same line with different superscripts differ.

^{c} Quadratic effect

Carcass data followed the pattern of rate of gain and final weight with predictable numerical differences observed. Hot carcass weight (P<.13) and yield grade (P<.10) showed the greatest response to treatment with higher values for the rolled-pea treatment. (Table 3).

Table 3. Carcass traits for feedlot heifers finished with ground, rolled or whole peas.

	Treatment				
	Ground	Rolled	Whole	St Error	P Value
Hot carcass weight, lbs.	681.8	700.4	674.2	9.06	0.13
Fat thickness, in.	0.48	0.49	0.45	0.198	0.29
Ribeye area, sq. in.	12.22	12.26	12.38	0.154	0.76
Kidney, pelvic, heart fat, %	2.29	2.33	2.29	0.039	0.74
Yield grade	2.84	2.93	2.68	0.082	0.1
Marbling score	431	459	450	11.97	0.27
Choice, %	72.1	85.0	69.0	0.06	0.21

Discussion

Bock (2000) reported that when peas were fed at 40% of the diet DM in a forage-based diet, cattle fed dry-rolled peas gained the least compared to cattle fed ground and whole peas in a Calan headgate study with seven individually fed animals per treatment. Birkelo et al. (2000) reported no statistical differences from rolled or whole peas in finishing diets when peas were included at 10% of the diet DM. Pea-fed steers grew faster than non-pea-fed steers through 56 days on feed, but gained slower from day 57 to slaughter. Intake did not differ among treatments. Pea-fed steers were more efficient than non-pea-fed steers the first half of the trial, but feed efficiency did not differ during the second half of the trial.

Dry rolling has a tendency to split the peas into a lighter and fluffier hull fraction and a heavier endosperm fraction. The lighter particles may not mix well and could add variation to the diet. It may be possible that separation of the hull from the endosperm is more of a problem in diets where peas are included at a high level. When fed at 28% of the diet DM, as in this trial, separation of the hull and endosperm in the dry-rolled treatment does not appear to be a problem.

The optimum level of field pea inclusion in feedlot diets is not clear. Flatt and Stanton observed a linear decrease in intake and linear improvement in feed efficiency as level of pea inclusion increased from 0 to 20% of diet DM, but saw no effect on gain. In contrast, Fendrick et al. (2004) demonstrated that DM intake increased up to 40% peas, then decreased when the pea level was increased to 59% of the diet DM but gain did not differ due to level of peas. Fendrick et al., (2005) also observed coarse-rolled peas or whole peas fed at 15 or 30% of dry matter intake in a finishing ration replacing corn did not affect performance or carcass traits (P>.10).

Results appear to be mixed for the few studies addressing processing options for peas in feedlot diets. Intake in the study reported here was greatest for cattle fed rolled peas indicating that rumen status from finely ground peas and digestibility of whole peas may be issues for further study. The cud chewing associated with high forage diets may contribute to particle size reduction of whole peas.

The cost of processing is a consideration if special accommodations are required for rolling peas. Purchasing field pea splits or screenings may be the least costly method of processing peas but the buyer has little control of particle size.

Note: Appreciation is expressed to George Brown for his cooperation in this study by providing feeder heifers. The cattle were fed on a custom basis with the owner billed for normal commercial yardage rates and feed costs.

References

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