Effect of Field Pea and Pea Components on Feedlot Performance, Carcass Traits and Consumer Response to Multiple Muscles in Beef

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Field pea grain is an excellent feed ingredient for beef cattle (Anderson et al., 2007; Lardy et al., 2009). Field pea is fed to beef cattle as whole seed (dry rolled), pea hulls, or pea chips with the latter two being co-products available as feed for livestock from some pea processing plants. There has been no research evaluating the differences in animal performance based on the different components of field pea.

Previous studies with field peas (Carlin et al., 2006) found a highly significant improvement in ribeye tenderness with 10 percent or more field pea in the finishing diet fed for 76 or more days. No additional improvement in tenderness was observed when field pea was included at 20 percent or 30 percent of dry matter intake. Magolski et al., (2008) also observed a positive trend for improved ribeye tenderness in steers fed field pea at 20 percent of DMI during different stages of the grow-finish feedlot phases. Hinkle et al., (2010) at the University of Nebraska observed a linear increase in tenderness and improved eating satisfaction of taste panelists with whole field pea fed at 10, 20, and 30 percent field peas in the finishing diet. Two other studies reported in Carlin et al., (2010) did not detect any improvement in tenderness but the animals in those studies were apparently genetically predisposed to be tender. All of these studies evaluated the ribeye muscle, and no evaluation of other muscles has been conducted for effects of field pea or pea components.

A feedlot finishing study was conducted to evaluate the effects of individual components of field pea in yearling beef heifer diets on feedlot performance, carcass traits, and tenderness of multiple muscle samples. Components of field pea from processing include pea hulls and pea chips or splits (endosperm of the seed). The corn-based treatment diets (Table 1) included 1) control (no pea products); 2) pea hulls; 3) pea chips; and 4) whole peas. Yearling Angus x Piedmontese crossbred heifers (n=128, avg wt. 868 ± 16.4 lbs) were procured from a cooperating producer in North Dakota and fed a warm-up ration at the Carrington Research Extension Center for three weeks prior to the start of the study. Heifers were weighed and randomly allotted to one of 16 pens with four treatments and four pens per treatment. Peas and pea components were fed at the equivalent level of approximately 15 percent field pea inclusion of the diet dry matter.

Table 1. Rations with field pea components fed to finishing yearling heifers.

Ingredient	Control	Pea Hulls	Pea Chips	Whole Peas
		%, DM basis		
Corn, dry rolled	0	19.77	38.94	56.73
Pea hulls	60.57	41.15	21.58	3.4
Pea chips	17	17.1	17.25	15.41
Whole peas, dry rolled	6.6	3.74	0.94	0
Canola meal	5.66	8.19	10.66	13.14
MDDGS	6.82	6.83	6.89	6.89
CDS	1.23	1.26	1.33	1.39
Straw	1.54	1.37	1.76	2.36
Supplement	1.5	1.45	1.55	1.65
CaCo3	0.59	0.6	0.65	0.68

All the heifers were harvested at the North Dakota Natural Beef abattoir in New Rockford, ND and fabricated at the break plant in Fargo, ND, where carcasses were evaluated. Collection of steaks was conducted at the North Dakota Natural Beef Fabrication Plant in Fargo. The longissimus thoracis (ribeye roll), semimembranosus (inside round), gluteus medius portion of the sirloin, and

supraspinatus (chuck tender) muscles were removed, two steaks cut from each muscle perpendicular to the muscle fibers, vacuum packaged, and aged for 14 days. Warner-Bratzler shear force was determined as the average of six cores from each steak cooked to a medium degree of doneness from each heifer according to the American Meat Science Association guidelines. Trained sensory panel analysis was conducted on the steaks for determination of tenderness, juiciness, and flavor components of the various beef steaks from different muscles. Eight trained panelists were served a 1 cm x 1 cm x 2.54 cm portion of a steak cooked to a medium degree of doneness on a clam shell grill. They scored each sample on a hedonic scale from 1 to 8 (1 = least tender, least juicy, and least flavor and 8 = most tender, most juicy, and most flavor).

Feed intake was similar for all treatments (Table 2). Over the entire 95-day feeding period, gains tended to be higher (P = 0.07) for whole peas, pea chips, and the control diet compared to pea hulls. Feed efficiency was not affected by diet treatment. Carcass traits (Table 3) were not affected (P ≥ 0.14) but pea hulls in the diet resulted in only 33 percent of the steers grading Choice, compared to 50 percent for whole peas, 60 percent for pea chips and 69 percent for the control diet. In this study, pea hulls tended to support lower gains with no apparent effects on other variables measured except percent of carcasses grading USDA Choice was lower.

Table 2. Performance of yearling heifers fed components of field peas in finishing rations.

	Treatments, Field pea components						
Item	Control	Pea Hulls	Pea Chips	Whole Peas	St Err	P Value	P Value
Number of pens	4	4	4	4			
Number of animals	32	31	32	31			
Initial wt , June 7, lb	942	953.11	946.95	955.27	14.39	0.92	0.92
Final wt., Sep 20, lb	1262	1256	1265	1285	17.57	0.69	0.69
Feed intake, lb DM/hd/d	26.59	26.51	26.81	26.86	0.63	0.97	0.97
Avg. Daily Gain, lbs	3.37	3.18	3.34	3.47	0.08	0.07	0.07
Feed efficiency, DM:Gain	7.91	8.37	8.03	7.78	0.24	0.39	0.39

Heifers fed on the field pea component trial.

Table 3. Carcass traits of yearling heifers fed field pea components in finishing rations.

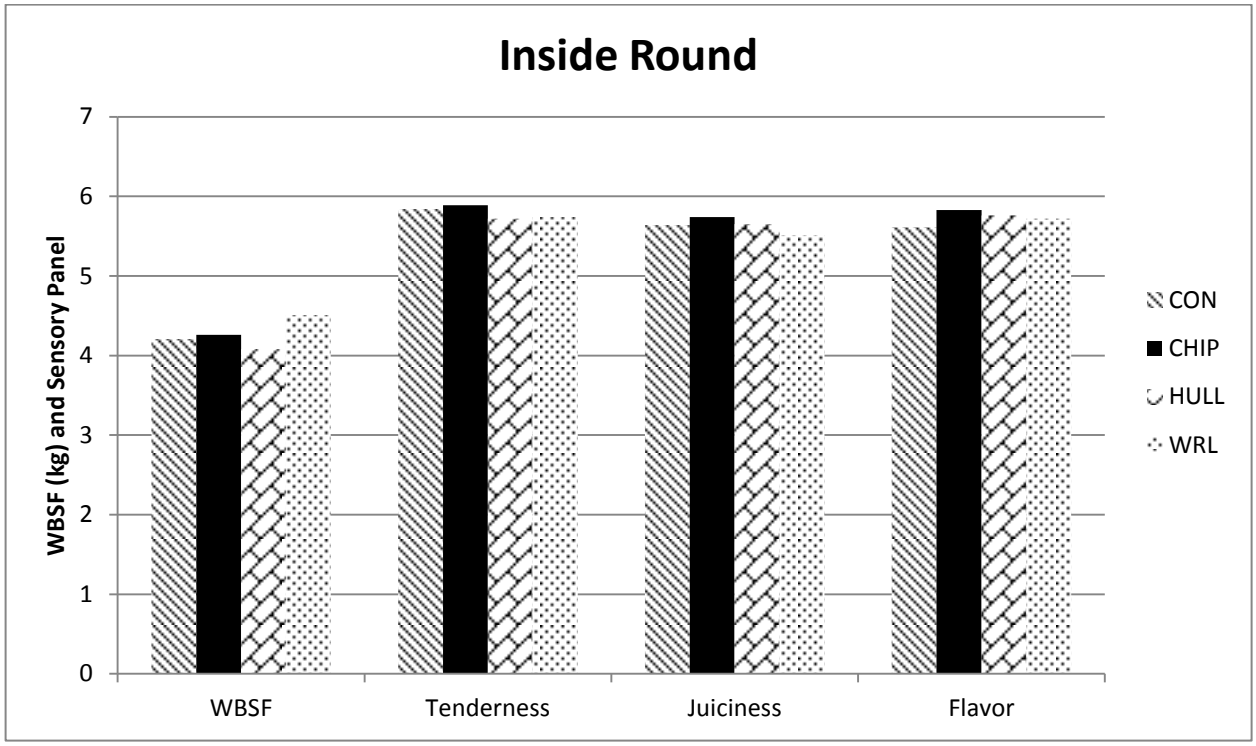
	Treatments, Field pea components					
Item	Control	Pea Hulls	Pea Chips	Whole Peas	St Err	P Value
Hot carcass wt., lb	784.13	783	787.88	784.14	10.37	0.99
Dressing percent	63.53	63.37	63.25	62.77	0.91	0.87
Rib eye area, sq in.	14.17	13.88	14.09	14.74	0.38	0.48
Fat thickness, in	0.61	0.53	0.57	0.53	0.03	0.14
KPH, %	2.67	2.42	2.34	2.48	0.1	0.15
Marbling score[1]	411	396	414	396	10.17	0.46
Yield grade**	3	2.84	2.88	2.59	0.16	0.38
Percent USDA Choice	69	33	60	50		

[1] Based on scores of 399 and below = USDA Select quality grade and scores of 400 and above = USDA Choice quality grade.

[2] Yield Grade is composite calculation of fat to lean yield in a carcass based on a relationship of hot carcass wt, rib eye area, fat thickness, and KPH.

Although the expected results of increasing beef tenderness for the respective muscles (Figure 1-4) through feeding field pea components was not observed, field peas make an excellent feedstuff for finishing diets for feedlot cattle and do not have any adverse effects on performance or meat quality. From this and other studies, we have observed that many cattle in the Northern Plains are categorized as tender. Field pea in the ration at 10 percent or more is considered as insurance to produce tender beef for the consumer. Identifying which individual animals or breeds have less desirable tenderness such as Brahman-influenced cattle, continental breeds, or cull cows will create a target market for peas in finishing diets in the future.

The results of the taste panel and mechanical tenderness tests (shear force) indicate that there was no effect of field pea component on meat tenderness, juiciness or flavor regardless of muscle cut or Igenity® profile score in this experiment. The results are in contrast to previous studies that indicate field pea inclusion in feedlot diets had a positive impact on meat palatability, specifically tenderness. It should be noted that the tenderness evaluations indicated that the steaks used in this experiment were of acceptable quality, thus field peas did not improve on already acceptable meat tenderness. Results of Warner-Bratzler Shear Force (WBSF; kg) and Sensory Taste panel are shown in the figures 1-4, which are separated by steak type. There were no significant differences ($P > 0.25$) in any of the reported components due to treatment. Although this project did not have the expected results of increasing beef tenderness through feeding field pea components, it did illustrate that field peas make an excellent feedstuff for finishing diets for feedlot cattle and does not have any adverse effects on performance or meat quality. Additionally, it identified value for components of field peas from processing.


Inside Round
WBSF (kg) and Sensory Panel
0
1
2
3
4
5
6
7
WBSF
Tenderness
Juiciness
Flavor
CON
CHIP
HULL
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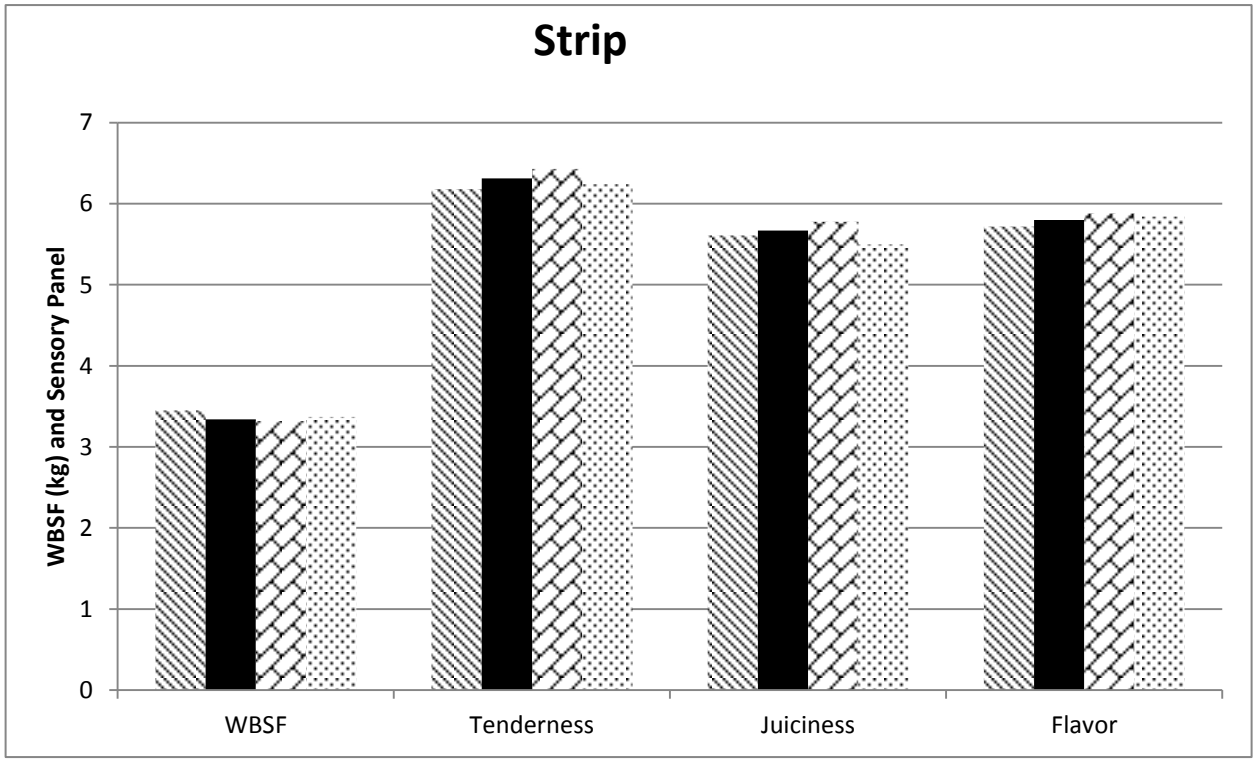
Strip
WBSF (kg) and Sensory Panel
0
1
2
3
4
5
6
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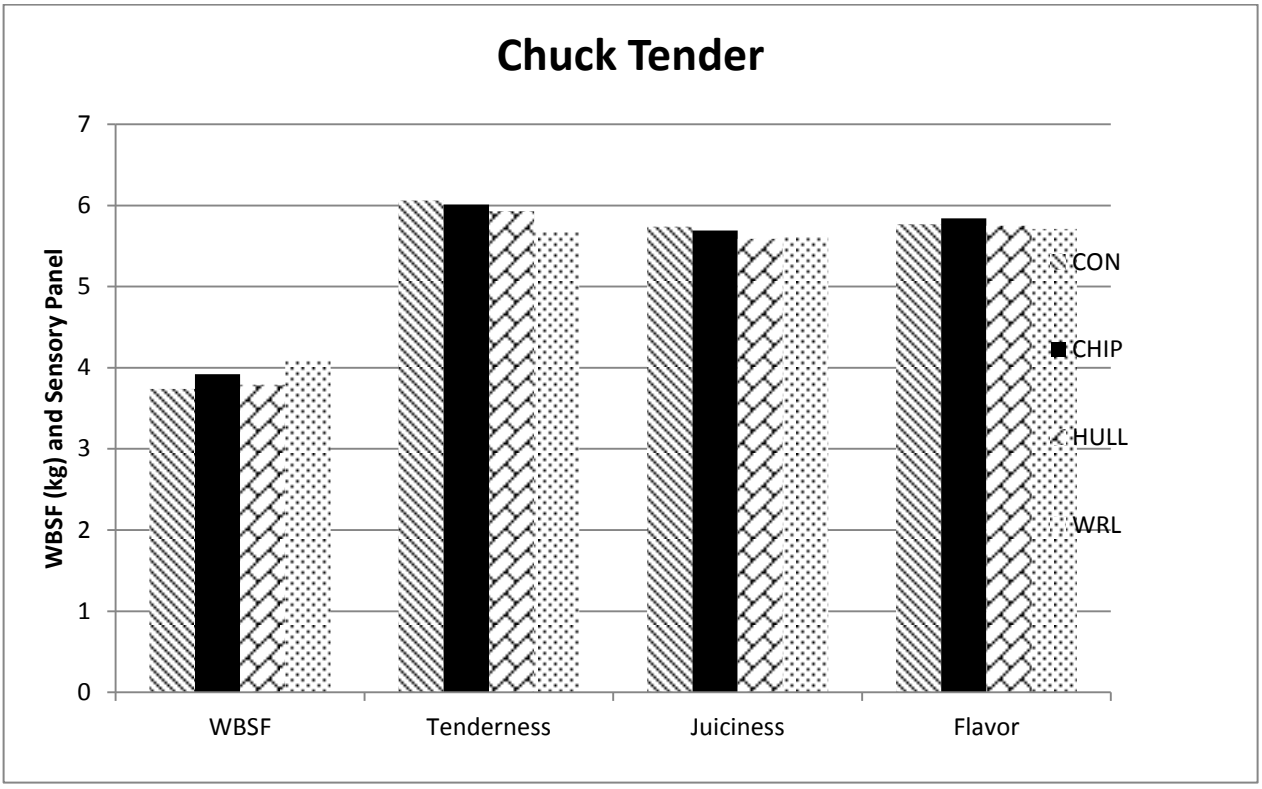
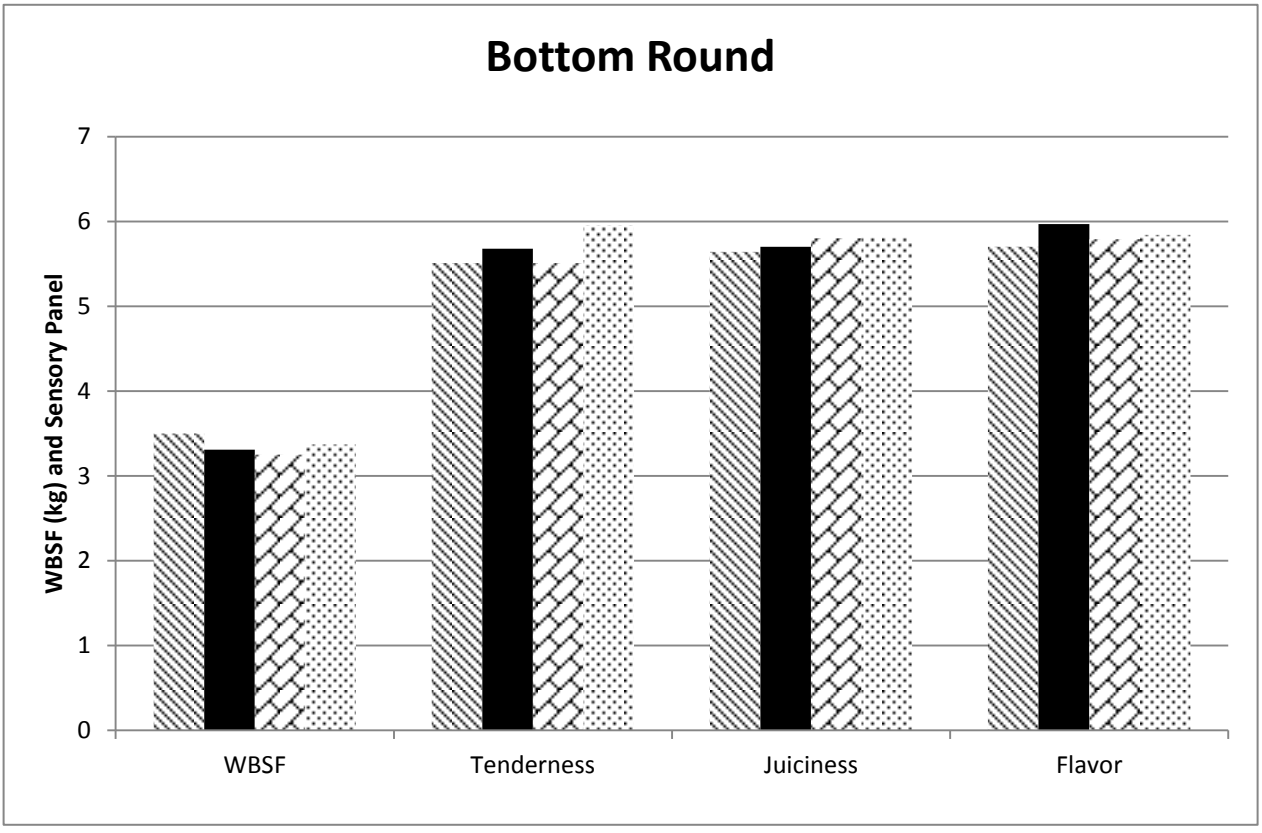
WBSF
Tenderness
Juiciness
Flavor





Figures 1-4. Taste panel response of different muscles to field pea components.

We hypothesize that genetically tender cattle will not see the benefits of field peas to the extent that cattle that would tend to produce tough meat. Future studies are warranted to evaluate the role of field peas in feedlot diets of cattle that are genetically known to produce meat that has less desirable tenderness such as Brahman-influenced cattle, continental breeds, or cull cows.

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Heifers fed field pea components.

Appreciation is expressed to the Saskatchewan Pulse Growers Association for funding support for the feedlot phase of this study. Funding for the meats research was provided by the USDA Specialty Crops Grant administered by the North Dakota Department of Agriculture.

This material is based upon work supported by the U.S. Department of Agriculture. Any opinions, findings, conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U. S. Department of Agriculture.