Effect of Pulse Grains on Performance of Newly Weaned Steer Calves

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Abstract

Pulse grains, especially field peas, are increasing in acres in the Northern Plains. Livestock feed is the default market for this relatively new category of nutrient dense grains that are .57 to .68 MCal/lb NEg and 22 to 27% crude protein. This study evaluated pulse grains in feedlot receiving diets. One hundred seventy-six spring born steer calves from 40 different ranches in North Dakota and Montana (initial BW 557 ± 40.7 lbs.) were allotted by weight and source to one of four receiving diets that included approximately 17% (DM basis) chickpeas, field peas, or lentils as the protein source compared to canola meal in the control diet. The 60% concentrate isonitrogenous diets included corn grain, corn silage, chopped hay, and Rumensin® supplement. Steers were fed in 16 pens (11 steers per pen; 4 pens per treatment). Experimental diets were fed for 42 days, after which steers were fed a common diet containing 85% concentrate. No differences were observed between the three pulse grains for any of the traits measured. Steers fed chickpea-, field pea-, or lentil-based diets during the first 21-day period gained more (3.12 vs. 2.48 lbs./d) and consumed more dry matter per day (11.9 vs. 10.2 lbs./d) compared to steers fed the control diet ($P < 0.01$). Feed efficiency did not differ ($P = 0.32$) among treatments for the first 21-day period. During the second 21-day period, no difference in gain, dry matter intake, or feed efficiency occurred ($P = 0.38$). Over the entire 42-day receiving period, steers fed pulse grains gained 9.2% faster (4.08 vs. 3.68/d; $P < 0.05$), and tended ($P = 0.11$) to consume more dry matter per day (16.3 vs. 15.0 lbs./d) compared to cattle fed the control diet. Steers fed pulse grains during the receiving period continued to show increased gains (.59 lb./d) for at least 7 weeks after the termination of the receiving trial. Pulse grains increased feed intake and gain and appear to have had a positive effect on feedlot gain for several weeks after removal from the diet. Field peas, chickpeas and lentils appear to be highly palatable and support excellent feedlot performance.

Key words: pulse grains, receiving, beef

Introduction

Field peas, chickpeas, and lentils (pulse grains) are marketed as dry, whole or split seeds primarily for human consumption. Surplus grain, off quality grains, and screenings which contain high levels of protein (22 to 30% CP on a DM basis) and energy (54 to 60 Mcal/cwt NEg), are an attractive, nutrient dense livestock feed. Significant amounts of pulse grains are produced annually in the northern regions of the United States and the Prairie Provinces of Canada. North Dakota leads the United States in pulse grain 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, very little information is available on the use and nutritional value of chickpeas and lentils in beef cattle diets.

Feed intake of newly arrived calves is often low during the first two weeks of the feedlot receiving period because of the stress of weaning and shipping. Fluharty and Loerch (1995) demonstrated that because of low dry matter intake, increasing the CP concentration of the diet to 16% during the first two weeks more closely matches the animal's requirement for protein, and results in increased average daily gain. Various sources of protein (soybean meal, corn gluten meal, blood meal, and fish meal) were tested with no effect on intake or gain; however high protein grains, which are highly palatable and nutrient dense were not tested. Anderson (1999a) observed that gain and creep feed intake of calves increased linearly as dry-rolled peas were added to the diet to replace wheat midds at 0, 33, 67, and 100%. Anderson and Stoltenow (2004) report improved intake and gain during a 42-day preconditioning period with field peas included at 0, 50, and 100% of the concentrate. The 60% concentrate diets (DM basis) included barley and canola meal as the control grains. Field peas have also been successfully integrated into feedlot growing and finishing diets as well (Anderson, 1999b; Anderson and Schoonmaker, 2005; Birkelo et al., 2000; Fendrick et al., 2004). Little information is available on the effect of chickpea and lentil inclusion in receiving diets. The objective of this study was to determine if replacing a portion of a typical corn and canola meal diet with pulse grains would improve feed intake, gain, and feed efficiency of newly weaned feedlot cattle.

Procedures

One hundred seventy-six mixed-breed steers from 40 different ranches in North Dakota and Montana (initial BW 557 ± 40.7 lbs.) were allotted by weight and source to one of four receiving diets (Table 1) containing either canola meal, field pea, chickpea or lentil as the protein source. Diets were formulated to contain 16% crude protein and 51 Mcal/cwt NEg. Cattle were fed at the Carrington Research Extension Center (CREC) in 16 pens (11 steers per pen; 4 pens per treatment) as part of a project designed to provide producers with an understanding of their calves' genetic potential to perform in a feedlot. Feed was delivered as a totally-mixed ration once daily to appetite. Cattle were fed in open drylot pens equipped with automatic waterers and fenceline bunks, which allowed for two feet of bunk space per head. Experimental diets were fed for 42 days, after which cattle were fed a common diet containing approximately 85% concentrate on a DM basis. Effect of receiving diets on subsequent performance was evaluated for the 7-week period following the end of the trial.

Three weeks prior to feedlot entry, cattle were vaccinated for protection against IBR, BVD, BRSV, PI3 (Bovishield-4; Pfizer, Exton, PA), and clostridia (7-way + somnus; Pfizer, Exton, PA). Upon arrival at the CREC feedlot (October 11, 2003) cattle were implanted with Synovex-S (200 mg progesterone, 20 mg estradiol; Fort Dodge Animal Health, Overland Park, KS), re-vaccinated, ear-tagged, weighed, and allotted to treatment. 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. Any animal with a rectal temperature greater than 103.0ºF was treated with one of two antibiotics according to label instructions (Micotil, Elanco, Indianapolis, IN; Baytril, Bayer, Shawnee Mission, KS). Micotil was used on first and second pulls, followed by Baytril (single-day therapy), if cattle were unresponsive. Antibiotic treatment continued until rectal temperature was below 103.0ºF. 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).

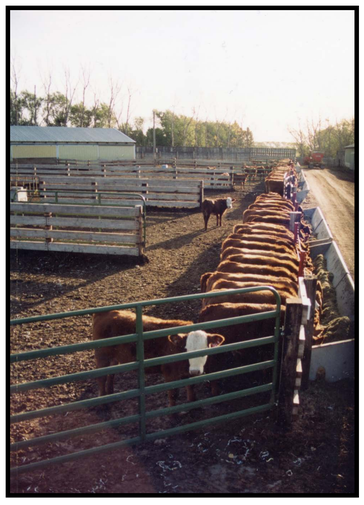
Data were subjected to a one-way analysis of variance as a completely randomized design using the GLM procedures of SAS (Version 8.0; SAS Inst. Inc., Cary, NC). A contrast was used to compare the control diet to the three diets containing pulse grains. The model included effects due to diet and pen was the experimental unit for all analyses.

Results and Discussion

Cattle fed chickpea, field pea, or lentil grain legumes during the first 21-day period gained 25.9% faster (3.12 vs. 2.48 lbs./d) and consumed more dry matter per day (11.9 vs. 10.2 lbs./d) compared to cattle fed the corn-canola meal-based diet ($P < 0.01$, Table 2.). Feed efficiency did not differ ($P = 0.32$) among treatments for the first 21-day period. During the second 21-day period, no difference in gain, dry matter intake, or feed efficiency occurred ($P = 0.38$), indicating that an advantage for feeding pulse grains exists during the first three weeks of receiving newly weaned cattle. Protein level was the same among the four treatments in this trial, indicating that protein from pulse grains may be more palatable or digestible compared to protein from canola meal or corn. When measured for the entire 42-day receiving period, cattle fed pulse grain-based diets gained 9.2% faster (4.02 vs. 3.68 lbs./day; $P < 0.05$), and tended ($P = 0.11$) to consume more dry matter per day (16.3 vs. 15.0 lbs./day) compared to cattle fed the corn-canola meal-based diet. At the termination of the receiving study, cattle were penned as treatment groups (4 pens, ~44 head per pen) and placed on a common corn-based finishing diet. Cattle previously fed pulse grains continued to follow a trend for increased gains for the 7-week period after termination of the receiving trial. The advantage for pulse grains in receiving diets needs further study.

Table 1. Receiving diets with pulse grains.

Item	Control	Field Pea	Chickpea	Lentil
Ingredients	----------% DM basis----------			
Corn	39.30	32.43	30.46	32.91
Canola meal	9.42	2.22	2.28	
Field peas		16.26		
Chickpeas			16.80	
Lentils				17.31
Alfalfa	26.87	27.13	27.79	27.37
Corn silage	21.47	19.18	19.94	19.75
Barley malt sprouts	1.00	0.94	0.93	0.90
Limestone	0.27	0.26	0.25	0.25
Rumensin (mg)	250	250	250	250
Vitamin/Mineral supplement	.33	.33	.33	.33
YeaSacc 1026	0.87	0.82	0.81	0.78
Deccox	0.44	0.42	0.41	0.40
Nutrient composition				
Crude protein, %	15.86	15.75	16.35	16.19
Calcium, %	0.69	0.66	0.67	0.64
Phosphorus, %	0.45	0.41	0.41	0.40
NEm, Mcal/cwt	80.0	80.2	78.2	78.9
NEg, Mcal/cwt	51.8	52.0	49.7	50.5



Cattle fed pulse-grain receiving diets continued to follow a trend for increased gains for the 7-week period after the termination of the receiving trial.

Table 2. Performance of calves fed pulse grains in post-weaning receiving diets.

Item	Control	Field Peas	Chickpeas	Lentils	SE	P Value Pulse vs. Control
Weight, lb.						
Initial	558.5	559.4	561.7	561.3	40.7	0.96
Intermediate	610.6	626.2	627.3	625.8	41.1	0.74
Final	712.9	727.4	735.3	733.4	46.1	0.72
Post-trial (7 weeks)	882.4	926.7	933.3	931.1	--------	----------
Daily dry matter intake, lb./d						
Period 1	10.2[a]	11.8[b]	11.8[b]	12.2[b]	0.5	0.01
Period 2	19.4	19.9	20.1	20.9	0.8	0.38
Receiving overall	15.0	16.0	16.2	16.7	0.7	0.11
Post-trial (7 weeks)	22.0	23.3	22.1	20.9	--------	----------
Average daily gain, lb./d						
Period 1	2.48[a]	3.18[b]	3.12[b]	3.07[b]	0.16	0.01
Period 2	4.87	4.82	5.14	5.12	0.29	0.64
Receiving overall	3.68	4.00	4.13	4.10	0.16	0.05
Post-trial (7 weeks)	3.46	4.07	4.04	4.03	--------	----------
Feed efficiencey, lb./lb.						
Period 1	4.1	3.7	3.7	4.0	0.4	0.32
Period 2	4.0	4.1	3.9	4.1	0.1	0.68
Receiving overall	4.1	4.0	3.9	4.1	0.1	0.27
Post-trial (7 weeks)	6.4	5.7	5.5	5.2	--------	----------

Field Pea

Chickpea

Lentil

Literature Cited

Anderson, V. L. 1999a. Field peas in creep feed for beef calves. Beef and Bison Production Field Day Proceedings, Carrington Research Extension Center, North Dakota State University, Vol. 22, p. 1-4.
Anderson, V. L. 1999b. Field peas in diets for growing and finishing steer calves. Beef and Bison Production Field Day Proceedings, Carrington Research Extension Center, North Dakota State University, Vol. 22, p. 9-15.
Anderson, V. L., and C. S. Stoltenow. 2004. Field peas in preconditioning diets for beef calves. J. Anim. Sci. Vol. 82 (Supplement 1):65 (Abstr.).
Birkelo, C. P., B. J. Johnson, and D. B. Rops. 2000. Field peas in finishing cattle diets and the effect of processing. http://www.abs.sdstate.edu/ars/beeftext/BeefReports/2000/
Fendrick, E. M., I. G. Rush, D. R. Brink, B. E. Ericson, and D. D. Baltensperger. 2004. Effects of field peas in finishing feedlot performance. J. Anim. Sci. Vol. 82 (Supplement 1):73 (Abstr.).
Fluharty, F. L., and S. C. Loerch. 1995. Effects of protein concentration and protein source on performance of newly arrived feedlot steers. J. Anim. Sci. Vol. 73, p. 1585-1594.
Anderson, V. L. and J. Schoonmaker. 2005. Effects of processing field peas on performance and carcass characteristics of feedlot heifers. Beef Feedlot Research Report and Beef Production Field Day Proceedings, Carrington Research Extension Center, North Dakota State University, Vol. 28, p. 26-31.

Steers were fed receiving diets containing either field pea, chickpea, lentil or corn and canola meal as the concentrate and protein source for 42 days.