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Field Pea Grain for Beef Cattle

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Ffield pea *(Pisum sativum)* grain is a nutrient-dense grain legume that is a palatable source of crude protein (25.3 percent; NRC, 1996), energy (0.67 megacalories net energy gain per pound; NRC, 1996) and other nutrients for beef cattle. Field pea grain is highly digestible, but the starch fermentation and ruminal protein degradation rates are slower than several other common feeds. Increased dry-matter intake (DMI) has been observed in some studies with the inclusion of field pea grain in the ration. Apparently, field pea grain does not need to be processed for beef cows. In backgrounding and finishing rations, processing field pea grain has produced mixed results, but dry-rolling may contribute to improved animal performance. In creep feeds, 30 percent to 40 percent field pea grain on a dry-matter (DM) basis may be optimum for animal performance. The inclusion of field pea grain in postweaning receiving rations has resulted in increased DMI. As a protein supplement for feeder cattle, field pea grain can be included at 15 percent to 30 percent of the ration (DM basis); however, growing and finishing cattle can utilize field pea grain as both a protein and energy source. Inclusion of field pea grain at a minimum of 10 percent of the finishing diet improved the tenderness and juiciness of beef without affecting carcass traits. Field pea grain is an excellent pellet binder. Beef cattle producers with access to field pea grain at competitive prices should consider using this grain legume in their ration formulations.

Introduction

Field pea is one of several pulse (from the Latin word *pultis,* meaning thick soup) crops defined as the dried, edible seeds of legumes that are used as food and also include dry bean, lentil, chickpea and fababean. Production of field pea has increased dramatically in the last five years across the northern Plains states (USDA-NASS, 2005b) as farmers include this annual grain legume in crop rotations to reduce reliance on purchased fertilizer inputs. The expanding supply of field pea grain creates an opportunity to utilize this new feed in commercial livestock production. Field pea grain is an energy- and protein-dense feedstuff (Table 1) with energy content similar to corn (Loe et al., 2004). Crude protein content has varied from 17 percent (Bock and Anderson, 2001) to 26.7 percent (Wang and Daun, 2004), based on variety, growing conditions and other factors, but the typical range is 23 percent to 25 percent (Larry White, Northern Pulse Growers Association personal communication). Commonly fed as a protein source, this grain legume will increase the energy density of most diets because field pea grain contains more energy than many common pro-

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tein supplements, such as oilseed meals or crop processing coproducts. The standard density for field pea grain is 60 pounds per bushel. (USDA-FSA, 2005a). Beef cattle producers are the largest potential market for field pea grain in the United States. In Europe, field pea grain has been used for ruminants, especially as a protein source in silage-based diets (Weiss and Raymond, 1989).

Field pea grain may be utilized best in scenarios where nutrient density and palatability of the diet is important, such as in creep feeds and receiving diets, as a component of feedlot diets or as supplementation for grazing livestock. Commercial feed manufacturers are including field pea grain in a number of commercial products because of its nutrient density, palatability, competitive price and ability to act as a binding agent for pelleted feeds (K. Koch, Northern Crops Institute, personal communication). Field pea also can be harvested as an annual forage for hay or silage. In this role, it is commonly intercropped with a cereal grain, such as oats or barley. Substantial research data is available on field pea grain, as are considerable positive producer experiences with feeding this legume grain. This review paper summarizes research on the feeding characteristics of field pea as it specifically relates to beef cattle and gives recommendations on feeding this increasingly popular grain legume.

Field Pea Grain Use

The northern United States and Canadian Prairie Provinces are known as cow-calf production areas with a recent increase in feedlot enterprises. This is the geographic area where peas primarily are grown (Statistics Canada, 2006; USDA-NASS, 2005b). The greatest potential use of field pea grain is feed for cattle at different stages of production; however, peas will have to compete with feeds such as barley, corn, wheat middlings, distillers grains, oil seed meals and other commodities.

Feed Intake

Palatability is critical to starting calves on feed during creep feeding or in feedlot receiving diets. In most studies, cattle consumed greater quantities of rations that included field pea grain. A North Dakota creep feed study observed a linear increase (Anderson, 1999a) in DMI with increasing levels (0 percent, 33 percent, 67 percent and 100 percent) of peas in the creep feed. In a feedlot finishing study (Anderson, 1999b), field pea grain was fed at 0 percent and 76 percent of the diet DM to determine if any anti-nutritional concerns arose when feeding high levels of field peas. Numerically greater DMI (105 percent of control) was observed for the field pea grain diet. A linear increase in DMI was observed with peas at 0 percent, 20 percent and 40 percent of diet DM but DMI decreased at 59 percent in a Nebraska finishing study (Fendrick et al., 2005b). No effects on gain and carcass traits were noted in the Nebraska study. With pea levels at 0 percent, 8.8 percent, 17.5 percent and 26.3 percent of diet DM in a corn silage-based growing diet, DMI increased linearly with pea level, but gain and feed efficiency were not affected (Flatt and Stanton, 2000). Weiss and Raymond (1989) conducted a series of studies using silage-based diets in Europe and reported diets containing field pea

Table 1. Comparison of selected nutrients in field peas with other feedstuffs

Item	Field Peas*	Corn**	Barley**	Wheat Midds**	Sunflower Meal**	Canola Meal**	Soybean Meal**
Dry matter, %	89	88	88	89	90	92	89
			100% Dry matter basis				
TDN, %	87	90	85	80	65	69	84
NEg, Mcal/lb	0.67	0.68	0.63	0.62	0.40	0.45	0.64
Crude Protein, %	25.3	9.8	13.2	18.4	25.9	40.9	49.9
Fat, %	1.40	4.30	2.20	3.20	2.90	3.47	1.60
Calcium, %	0.15	0.03	0.05	0.15	0.45	0.70	0.40
Phosphorous, %	0.44	0.31	0.35	1.00	1.02	1.20	0.71
Potassium, %	1.13	0.33	0.57	1.10	1.27	1.37	2.22

*NRC, 1984; **NRC, 1996.

grain were consumed at 102 percent of the level of diets containing soybean meal. In contrast to the above studies, a Colorado State University study (Flatt and Stanton, 2000) fed increasing levels of field pea grain (0 percent, 5 percent, 10 percent and 20 percent of ration DM) in finishing diets for beef steers with a linear decrease in DMI observed. However, gains were similar and feed efficiency improved with increasing levels of field pea grain. In creep feed, receiving or growing diets, DMI is equal or greater with pea grain in the diet, while during finishing, diets with peas were consumed at equal or lower DMI but gains were not affected.

Rumen Degradability

Field pea protein is highly rumen-degradable protein (RDP). Estimates of RDP range from 78 percent to 94 percent (Aufrere et al., 1994; NRC, 1989; unpublished data from our laboratory), leaving modest amounts as rumen-undegradable protein (RUP). However, the disappearance rate for pea protein was slower during the first six hours (1.6 percent/hour) than for soybean meal (4.5 percent/hour; Lindberg, 1981), but increased thereafter. The more slowly and thoroughly degraded protein fraction in field pea grain may be beneficial for growth of rumen microbes and therefore be a positive influence on forage digestion and gain efficiency. Processing field pea grain by dry- or temper-roasting did not change rumen degradability of protein until the grain was roasted for 12 minutes at 300 F (Gilbery et al., 2005). Maximum reduction in ruminal protein degradation was observed when field pea grain was toasted at 302 F for 30 minutes (Ljøkjel et al., 2003). However, Aguilera et al. (1992) achieved a significant reduction in ruminal degradation at 147 F for 30 minutes. Extrusion decreased ruminal degradation of field pea grain at 284 F (Goelema et al., 1999; Walhain et al., 1992; Focant et al., 1990); however, ruminal protein degradation increased with pelleting (Goelema et al., 1999) and extrusion (Aufrere et al., 2001). Steam flaking had no effect (Focant et al., 1990). Some varietal differences appear to occur in RUP of pea grain (Table 2; unpublished data from our laboratory). Processing field pea grain at high temperatures for long periods of time is not practical unless animal performance or feed efficiency will improve net return. Animals with high requirements for metabolizable protein may require more RUP than provided by field pea; in this case, heat treatments may be more economical. Starch in field pea grain degrades more slowly in the rumen than wheat or barley starch and at about the same rate as starch from corn (Robinson and McQueen, 1989; Weiss and Raymond, 1989). Total tract starch digestibility was similar when field pea grain replaced dry-rolled corn in medium-concentrate growing diets for beef steers (Reed et al., 2004b). The fermentation rate for pea protein and starch in the rumen may contribute to a more stable rumen environment.

Pelleting Field Peas

In addition to adding nutrient density to commercial feeds that use high proportions of fiber-based ingredients, field pea grain is an excellent binding agent for pelleting formula feeds. However, field pea grain is difficult to

Table 2. Effect of field pea cultivar on in situ protein degradation characteristics

	Cultivar				
Item	Profi	Arvika	Carneval	Trapper	SEM[a]
CP, % (DM basis)	22.6	26.1	22.6	19.4	-
0 h N disappearance, %	54.3[c]	53.0[c]	47.4[c]	32.0[b]	5.65
Slowly degradable, %	45.7[b]	47.0[b]	52.6[b]	68.0[c]	6.00
Rate of CP digestion, % h^{-1}	14.6[d]	8.6[c]	10.5[d]	7.3[b]	0.26
Estimated RDP*, % of CP					
k^f = 0.02	93.4[c]	91.5[c]	92.7[c]	87.4[b]	2.05
k^f = 0.04	88.2[c]	85.4[c]	86.6[c]	77.7[b]	3.29
k^f = 0.06	84.3[c]	81.0[c]	82.0[c]	71.0[b]	4.02

[a]n = 4.
[b, c, d, e]Row means with different superscripts are different (P < 0.02).
[f]k = ruminal outflow rate (h^{-1}). Adapted unpublished data in our laboratory.
*Rumen degradable protein.

pellet alone because the binding properties reduce the processing rate. Pellet quality and processing rate generally are satisfactory when field pea grain is included at 20 percent to 60 percent of a feed formulation (K. Koch, Northern Crops Institute, personal communication).

Effect of Variety and Color

Protein content varies due to variety, yield, soil type, fertility, temperature, rainfall and planting date. A trial comparing the varieties (v.) Profi and Integra (24 percent vs. 17 percent crude protein, respectively; Bock and Anderson, 2001) suggested animal performance differs due to varieties even though the control diet contained crude protein (CP) levels recommended by NRC (1996). No data is available to compare green and yellow varieties to date.

We have investigated the effect of variety on *in situ* CP disappearance (Table 2; unpublished data). Differences exist among varieties for many nutritional characteristics, including rate and extent of ruminal degradation. This may be more important in situations where nutrient requirements are high (e.g., high-producing dairy cows). In particular, v. Trapper had slower rates of ruminal degradation and lower degradability estimates than v. Profi, Arvika and Carneval. Additional research and selection is needed on the nutritional characteristics of different field pea varieties and the effects on animal performance.

Creep Feed Research

In a two-year study with 128 cow-calf pairs (Anderson, 1999a), wheat middlings and field pea grain were offered in four reciprocal, creep feed combinations to determine the optimum level of field pea grain. Treatments were reciprocal amounts of dry-rolled field pea grain and pelleted wheat middlings at 0 percent to 100 percent, 33 percent to 67 percent, 67 percent to 33 percent and 100 percent to 0 percent, respectively. Field pea grain was coarsely rolled and wheat middlings were fed as .025-inch diameter pellets. Dry-matter intake increased linearly with increasing level of field pea grain in the diet during the 56-day study. Calf average daily gain (ADG) increased from 2.82 pounds at 100 percent middlings to 3.11 pounds at 33 percent field pea grain to 3.18 pounds at both 67 percent and 100 percent field pea grain. Feed efficiency decreased with increasing pea levels. These data suggest that the best inclusion rate for field pea grain in beef creep feeds is between 33 percent and 67 percent.

A study (Landblom et al., 2000) that limited intake of creep feeds containing field pea grain included up to16 percent salt as the intake limiter. Eighty cow-calf pairs were used to compare four treatments: 1) no creep feed, 2) 33 percent field pea grain, 3) 67 percent field pea grain and 4) 100 percent field pea grain. Peas replaced wheat middlings in these creep feed formulations. Daily DMI was approximately 2.99 pounds per head for all creep rations. Gains tended to be greater for creep feed vs. no creep feed. No differences were observed due to level of field pea grain.

Creep feeds formulated with 18 percent or 50 percent field pea grain produced equal calf gains when DMI was limited to 4.12 pounds using 16 percent salt (DM basis) in a season-long grazing study (Gelvin et al., 2004). Salt added at only 8 percent (DM basis) of a creep feed containing 55 percent field pea grain resulted in greater DMI, but no differences in gain or gain efficiency were observed.

Gelvin et al. (2004) also utilized ruminally cannulated nursing steer calves to investigate the effects of a field pea grain-based creep feed on ruminal fermentation characteristics, forage intake and digestibility while calves grazed native rangeland. No differences in forage intake were noted. However, calves supplemented with field pea grain creep feed had greater total DMI than control calves. Supplementation decreased ruminal pH (measurement of acidity or alkalinity), but increased ruminal concentrations of volatile fatty acids and ammonia.

Nursing beef calves were fed creep diets formulated with 40 percent ground, rolled or whole field pea grain in a 56-day trial at the NDSU Carrington Research Extension Center (Anderson et al., 2006). Dry-matter intake was not affected by processing treatment, but calf daily gains were numerically greatest with rolled field pea grain (3.31 pounds per head), compared with ground (3.12 pounds) or whole (3.13 pounds) field pea grain. Creep feed with field peas appears to be more palatable and allows for improved animal growth.

Research in Receiving Rations

Dry-rolled field pea grain was fed at 28 percent and 56 percent (DM basis) of receiving diets to 294 head of newly weaned calves from 34 different ranches (Anderson and Stoltenow, 2004). Dry-rolled barley and canola meal were used as basal ingredients in the control diet. The 60 percent concentrate isonitrogenous diets also included corn silage and mixed hay. Dry-matter intake increased linearly with increasing pea level (14.59, 15.50 and 16.50

pounds per head, respectively, for 0 percent, 28 percent and 56 percent field pea grain) during the 42-day receiving study. Daily gains were greater for the 56 percent pea diet (3.53 pounds), compared with the 28 percent pea diet and the control, which were the same (3.31 pounds).

Dry-rolled pulse grains (field pea, chickpea or lentil) were fed as the protein sources at 17 percent of DMI, compared with canola meal in four isonitrogenous receiving diets (Anderson and Schoonmaker, 2004). Freshly weaned calves (n=172) from 39 North Dakota ranches were allotted randomly by ranch to 16 pens for the 42-day trial. The 60 percent concentrate rations included dry-rolled corn, corn silage and chopped mixed hay. Diets were formulated to provide 0.0005 pound/head/day monensin (Elanco Animal Health, Greenfield, Ind.) daily. Dry-matter intake increased from 14.99 pounds per day for the control to 16.29 pounds per day for each of the three pulse grain treatments. Daily gains were equal for the three pulse treatments (4.08 pounds) and greater than the control diet (3.68 pounds). At the end of the receiving study, calves were placed on a common corn-based finishing diet and fed to slaughter weight. Calves previously fed pulse grains continued to gain faster (4.03 pounds per day for the three pulse diets vs. 3.46 pounds for the control diet) for seven weeks following the conclusion of the receiving study. This carryover effect attributed to the inclusion of pulse grains in receiving diets is interesting and warrants further study. Pea grain in receiving diets appears to increase DMI and gain.

Growing Studies

Cattle producers widely use field pea grain as a protein supplement for wintering ranch-raised calves. Reed et al. (2004a) investigated the optimum level of field pea grain in a forage-based diet. Field pea grain was offered at 0, 1.79, 3.57 and 5.36 pounds per head to steers consuming medium-quality grass hay in a 4 by 4 Latin square design. Total DMI and organic matter (OM) intake increased with increasing level of field pea grain. As expected, forage DMI decreased with increasing field pea grain level. Rumen volatile fatty acids, total tract CP digestibility and apparent ruminal DM digestibility tended to increase linearly with increasing field pea level. Field pea grain had no effect on total tract DM or OM digestibility. Reed et al. (2004) concluded that field pea had similar effects to cereal grain on forage intake, ruminal fermentation and digestion when supplemented in medium-quality forage-based diets.

Anderson (1999b) also investigated the use of field peas as a dietary ingredient for growing calves. In this study, weaned crossbred steer calves were fed one of three 60 percent concentrate diets. The concentrate treatments were: 1) dry-rolled barley with canola meal at CP levels recommended by NRC (1996); 2) dry-rolled field pea grain as the only concentrate source fed at the same percentage as concentrates in treatment 1 or 3) dry-rolled barley with increased canola meal proportion to equalize the CP level of the treatment 2 pea grain diet. Treatment 2 and 3 diets both contained 16.28 percent CP (DM basis) and exceeded published requirements of 13.7 percent CP (NRC, 1996). Dry-matter intake of the field pea diet was 112.3 percent of the control and 109.3 percent of the barley plus canola meal treatments, respectively. Daily gains from the pea grain diet also were numerically greater than the barley treatment (116.8 percent) and barley plus canola meal (107 percent).

In a Nebraska study, calves were fed diets containing 69 percent corn silage (DM basis) with rolled field pea grain at 0 percent, 8.8 percent, 17.5 percent and 26.3 percent of intake replacing corn grain (Fendrick et al., 2005b). Dry-matter intake increased linearly with pea level, but no differences in gain or gain efficiency were observed, although gains were 105 percent of control for the 26.3 percent field pea grain treatment.

Field pea grain was substituted for grain milling coproducts (soybean hulls, barley malt sprouts and wheat middlings) at 0 percent, 15 percent, 30 percent and 45 percent of DM intake in a 4 by 4 Latin square study (Soto-Navarro et al., 2004) utilizing four multicannulated steers. The diets contained 45 percent grass hay and 55 percent concentrate. Dry-matter intake decreased with increasing pea level. Starch digestion decreased with increasing pea level, but digestibility of OM, acid detergent fiber (ADF) and neutral detergent fiber (NDF) was not affected.

In diets containing 50 percent concentrate (DM basis), corn silage and alfalfa hay, Reed et al. (2004b) replaced corn as the concentrate with field pea grain at 0 percent, 33 percent, 67 percent and 100 percent in the 4 by 4 Latin square study using four multicannulated steers. Dry-matter intake was not affected, but ruminal fill and ruminal pH decreased with increasing pea level. Ruminal ammonia, total tract volatile fatty acid concentrations and total OM, NDF and ADF disappearance all increased with increasing pea level. Starch digestion was not affected. In western North Dakota, growing heifer calves were fed field pea grain as an isonitrogenous replacement for barley and soybean meal with no effect on DMI, ADG or gain efficiency (Poland and Landblom, 1998). In another

study reported by Poland and Landblom (1998), performance was similar but DMI decreased in a field pea diet, tending to improve gain efficiency. Field pea grain was used as a protein source, compared with soybean meal, in silage-based diets in several European trials (Weiss and Raymond, 1989). In five trials, DMI and gain from field pea grain-supplemented diets averaged 102 percent of control, while gain efficiency was similar.

A growing trial included 40 percent (DM basis) ground, rolled or whole field pea grain in 60 percent forage rations (Bock et al., 2000). Seven steers were assigned to each of the three treatments and individually fed in Calan headgates (American Calan Inc., Northwood, N.H). No differences were observed for DMI, but a quadratic response for ADG was observed associated with particle size. Calves fed ground peas gained 3.62 pounds per day, rolled peas resulted in gains of 3.37 pounds per day and whole peas produced gains of 3.75 pounds per day during the 84-day study. Field pea grain can be used effectively in growing diets, with potential to improve intake and gain or contribute to greater feed efficiency.

Finishing Experiments

Steer calves (n=83) were fed totally mixed finishing diets with dry-rolled barley and canola meal or field pea as the only grain source in the 85 percent concentrate diets (Anderson, 1999b). Compared with a barley-based diet, DMI was numerically greater (104.7 percent), as were gains (105.5 percent) for the field pea diet, with similar gain efficiency observed. Marbling scores and the percent USDA Choice carcasses were greater for steers fed field pea when animals were slaughtered at the same time. Whole field pea grain was fed at 0 percent, 20 percent, 40 percent and 59 percent of finishing diets (DM basis) to 129 yearling steers in a Nebraska study (Fendrick et al., 2005a). Dry-matter intake increased with increasing pea level up to 40 percent and decreased at 59 percent. Average daily gain, gain efficiency and carcass traits were not different. In another Nebraska finishing study with 206 steers (Fendrick et al., 2005b), no differences were observed between dry-rolled or whole peas fed at 15 percent or 30 percent of the diet DM replacing corn.

Field pea grain was used as a protein supplement at 10 percent (DM basis) of the finishing diet replacing corn and soybean meal (Birkelo et al., 2000). No differences were observed in any of the overall feedlot performance or carcass traits measured; however, during the first 56 days on feed, improved gains and gain efficiency were observed for the cattle fed field pea grain.

Flatt and Stanton (2000) fed field pea grain at 0 percent, 5 percent, 10 percent and 20 percent (DM basis) of finishing diets to steers and heifers substituting field pea grain for soybean meal. The field pea variety Profi used in this trial was 20 percent CP. Increasing field pea grain decreased DMI but did not affect gain, thereby improving gain efficiency linearly with increasing field pea level. Carcass traits were not affected. Mortality was lower for the calves fed field pea (0.75 percent) compared with the control diet (6.75 percent).

Anderson et al. (2006) compared three processing treatments for field pea grain (ground, rolled or whole) using 112 feeder heifers fed diets with peas at 28 percent of diet DM. Particle size of ground peas averaged 0.03 inch, rolled peas averaged 0.12 inch and whole peas averaged 0.30 inch. Dry-matter intake was greatest for heifers fed rolled pea grain (22.8 pounds), compared with ground (21.2 pounds) and whole (21.3 pounds) pea treatments, which were similar. Average daily gain was greatest for rolled peas (3.40 pounds), compared with whole peas (2.95 pounds), with ground peas (3.11 pounds) intermediate. Gain efficiency was similar for all treatments.

Loe et al. (2004) utilized lambs to estimate the net energy value of field pea grain in finishing diets. In two research trials with 200 crossbred lambs, field pea grain replaced corn and at graded levels. The net energy-maintenance (NEm) and net energy-gain (NEg) value of field pea grain was estimated at 1.25 and 0.92 megacalories per pound (Mcal/lb), respectively. These values are 14 percent greater than corn.

Carcass Traits and Taste Panel Response

Feedlot heifers (n=118) were fed increasing levels of dry-rolled field pea grain (0 percent, 10 percent, 20 percent and 30 percent of DM intake; Carlin et al., 2006). No differences due to treatment were observed for DMI, ADG, gain efficiency or USDA quality or yield grade. Samples of the anterior end of the short loin (~3 inches) were collected for Warner-Bratzler shear force evaluation and for evaluation by a trained taste panel for sensory attributes. Increasing level of field pea grain quadratically decreased Warner-Bratzler shear force (9.48 ± 0.33 pound, 8.00 ± 0.33 pound, 8.11 ± 0.35 pound and 8.18 ± 0.33 pound for 0 percent, 10 percent, 20 percent and 30 percent levels, respectively). Sensory panel analysis indicated a linear increase in tenderness with the addition of field pea grain (4.56 ± 0.18, 5.14 ± 0.17, 5.28 ± 0.18 and 5.34 ± 0.18 for 0 percent, 10 percent, 20 percent and 30 percent levels, respectively). Sensory panel ratings also indicated a tendency for increased juiciness and no differences in flavor

or off flavor due to increasing level of field pea grain. These responses indicate that the inclusion of field pea grain in finishing diets may affect consumer enjoyment of beef positively and warrant further investigation.

Beef Cow Supplementation Research

Little research has been done on feeding field pea grain to beef cows; however, numerous field reports of cow-calf producers using field pea grain for wintering cows are available. Encinias et al. (2000) fed increasing levels of field pea grain or a barley-canola meal protein supplement to gestating cows consuming grass hay. No differences were observed in cow ADG, condition score, calving or other performance traits.

Poland et al. (2005) used 45 cows to compare feeding a field pea grain supplement with a sunflower meal or a barley-based supplement for cows grazing stockpiled forage from November through January. Each supplement was fed at 7 pounds per head three times weekly. No differences were noted in cow performance.

Field pea grain was fed ground, rolled or whole at 20 percent of diet DM to gestating mature beef cows (n=102) consuming low-quality forage from December until March (Anderson et al., 2006). No differences were observed in cow performance due to processing treatments. Rumination or cud chewing activity may contribute to reducing the particle size and allowing thorough digestion and utilization of whole peas in high-forage diets. Field peas are useful in beef cow diets as a protein and energy source.

Feeding Recommendations

The nutrient density of field pea grain is greater than most other feedstuffs, so including pea grain in limit-fed applications may be the best use of this feed. These uses include creep feeds, receiving diets and supplementation of low-quality forage diets (e.g., range cake). Processing studies indicate field pea grain should be dry-rolled when fed in creep feeds. Creep feed diet formulations may include 20 percent to 50 percent field pea grain, with 30 percent to 40 percent considered optimum (DM basis). Mixed results for processing have been reported in feedlot trials, but dry rolling field pea grain did not negatively affect performance and was positive in some trials. In addition, anecdotal observations indicate diet mixing is enhanced and sorting is reduced when field pea grain is processed and fed in a totally mixed ration. Field pea grain is used primarily as a protein source in feedlot diets. In corn-based rations, 18 percent to 25 percent inclusion (DM basis) will meet nutrient requirements, although higher levels have been fed with equal or greater performance. The ruminal protein degradation characteristics of peas complement corn-based feedlot diets particularly well. No research has been conducted on feeding field pea grain in barley-based diets.

Beef cows fed low-quality forage will benefit from a highly rumen-degradable protein such as field pea grain. Pea grain does not need to be processed for beef cows consuming forage-based diets. This grain legume works well as a binder in pelleted formulations and will increase nutrient density of commercial feedstuffs based on high-fiber coproducts. Commercial range cake that contains field pea grain provides increased levels of protein, energy, vitamins and minerals and may be fed at lower rates than other cake products based on feeds with lower nutrient densities. Heating, toasting or extruding field pea grain may increase rumen-undegradable protein, but does not appear to be economically feasible or necessary for most beef cattle ration applications.

Implications

The major factor in determining whether to use field pea grain in cattle rations is the cost compared with other feedstuffs. The equivalent feed value should be calculated based on respective nutrient contents with potential savings in logistics because pea grain is more nutrient-dense than other commodity feeds. In some cases, superior animal performance may result with field pea grain in the diet. Increased tenderness and juiciness of steaks from cattle fed field pea grain may lead to a marketing or branded beef program with associated premium prices. Field pea is an excellent rotation crop for small grains and can provide protein and energy for livestock that ultimately may enhance the biological and economic sustainability of farms and ranches.

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