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Evaluating field peas as an energy source for growing and finishing beef cattle

H. L. Greenwell,* K. H. Jenkins,†[1] PAS, and J. C. MacDonald,* PAS
*Department of Animal Science, University of Nebraska, Lincoln 68583; and †Panhandle Research and Extension Center, University of Nebraska, Scottsbluff 69361

ABSTRACT

Field peas were evaluated in beef growing and finishing diets in a 2-yr experiment. A total of 114 steers (initial BW = 348 kg, SD = 22 kg) in yr 1 and 114 heifers (initial BW = 249 kg, SD = 11 kg) in yr 2 were used in a 3 × 2 factorial. The first factor was grazing supplementation (0.5% BW, DM basis) with the following treatments: (1) field pea (FP); (2) blend of 70.8% corn, 24% corn condensed distillers solubles, and 5.2% urea (CB); and (3) no supplement (CON). The second factor was presence or absence of 20% FP in finishing diets. Growing phase ADG was greatest for CB, followed by FP and CON (0.99, 0.87, and 0.69 ± 0.08 kg for CB, FP, and CON, respectively; $P < 0.01$). There were no interactions between growing and finishing treatment, and presence of FP in the finishing diet did not affect finishing performance or carcass characteristics ($P \geq 0.20$). However, grazing supplementation influenced finishing performance; CON had the greatest finishing ADG, whereas CB and FP did not differ (1.93, 1.79, and 1.79 ± 0.06 kg for CON, CB, and FP, respectively; $P < 0.01$). The CON treatment was also most efficient, followed by CB and FP, which were not different (0.145, 0.135, 0.138 ± 0.014, for CON, CB, and FP, respectively; $P = 0.01$). Field peas may be fed to growing and finishing cattle if appropriately priced. However, reduced ADG during the growing phase may result in compensatory gain in the finishing phase.

Key words: cattle, field peas, finishing, grazing

INTRODUCTION

On a national scale, the number of hectares planted to field peas in the United States increased from 146,496 in 2011 to 513,141 million in 2016 (NASS, 2016). Processing capacity for field pea grain has not kept pace with production. Although a large part of this production is used in the human consumption and pet food market, there has also been an increase in the availability of commodity peas for the livestock feed market. The majority of field peas are designated for the human consumption market (McKay et al., 2003). However, those market outlets are limited in the amount of product that they can purchase due to limitations in processing, as well as the maintenance of quality standards. Therefore, feeding field peas to livestock, specifically cattle, began because of a surplus of low quality field peas with no outlet (Fendrick et al., 2006). Petit et al. (1997) suggested that field peas could be used as a protein and energy source in livestock diets. Previous research has shown that field peas are capable of providing similar or improved performance compared with other cereal grains such as corn, wheat, millet, barley, and so on at moderate inclusion rates (Reed et al., 2004; Jenkins et. al, 2011).

Peas provide a viable rotation in wheat production because they fix nitrogen in the soil and naturally break up pest cycles (Haynes et al., 1993; Walley et al., 2007). Determining the best use of field peas for the livestock sector is important for both the cattle producer and field pea farmer. This study was designed to determine the efficacy of field peas as a supplement to cattle grazing pasture, in comparison with cattle consuming dry-rolled corn when supplemental RDP was added to the equivalent of that contained in field peas. Following grazing, a second phase either included or excluded field peas from the finishing diets. Therefore, the objective of this study was to determine the effects of feeding field peas during growing and finishing phases on the animal and carcass characteristics.

MATERIALS AND METHODS

All animal care and management procedures were approved by the University of Nebraska–Lincoln Institutional Animal Care and Use Committee.

A total of 114 crossbred steers (initial BW = 348 kg, SD = 22 kg) in yr 1 and 114 crossbred heifers (initial BW = 249 kg, SD = 11 kg) in yr 2 were used in a 3 × 2 factorial arrangement of treatments. Cattle were limit fed at 2% BW for 5 d and then weights were collected on 2 consecutive days to minimize the effect of gut fill (Watson et al., 2013). Cattle were blocked by BW, stratified by BW within blocks, and randomly assigned to 3 weight blocks. Then cattle were randomly assigned to initial pasture, which had been assigned to treatment. Cattle were also implanted with 40 mg of trenbolone acetate and 8 mg of estradiol

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[1] Corresponding author: kjenkins2@unl.edu

(REVALOR-G, Merck Animal Health, Kenilworth, NJ); given a 5-way respiratory vaccination against infectious bovine rhinotracheitis, bovine viral diarrhea types I and II, parainfluenza-3, and bovine respiratory syncytial virus (yr 1: Express FP 5, Boehringer Ingelheim, St. Joseph, MO; yr 2: Titanium 5, Elanco Animal Health, Greenville, IN); and poured with Eprinomectin endectocide (IVOMEC, Merial Limited, Duluth, GA). The first factor of the trial was the 3 supplementation treatments applied during a summer grazing season. Supplementation occurred at a rate of 0.5% BW (DM Basis) prorated for 6 d in a 7-d period and was fed at approximately 0800 h.

The 3 treatments consisted of (1) whole, unprocessed field peas (90.4% DM, 26.8% CP, 32.2% starch; **FP**); (2) a mixture of dry-rolled corn (84.2% DM, 8.9% CP, 72.9% starch) (70.8%), condensed distillers solubles (24%), and urea (5.2%) balanced to provide similar RDP to the field peas (corn blend, **CB**); and (3) control group receiving no supplement (**CON**). There were 4 replications per treatment per year, resulting in a total of 8 replications per treatment across 2 yr. Each replicate (experimental unit) consisted of 8 or 10 head. Cattle grazed 12 crested wheatgrass pastures grouped in their experimental units at the High Plain Agriculture Laboratory near Sidney, Nebraska. Cattle were allowed 4.25 ha per animal for a 4-mo grazing season. The cattle rotated through pastures every 2 wk so that each experimental unit grazed a different pasture every 2 wk to minimize pasture effects on treatment. Cattle had ad libitum access to trace mineralized salt blocks. The grazing period was 117 d in yr 1 and 142 d in yr 2.

Pasture samples were collected at the beginning of the grazing period (June) and at the end of the grazing period (August) in 2015 (Table 1). Three pastures were selected at random to be the representative samples for the 12 pastures. Six random collection sites within each pasture were used to clip total area samples measuring 0.61 m by 0.61 m in area. Samples were then dried in a forced-air oven at 60°C (model LBB2–21–1; Despatch Industries, Minneapolis, MN) for 48 h (AOAC Method 935.29, AOAC International, 2016) and ground through a 1-mm screen using a Wiley mill (number 4; Thomas Scientific, Swedesboro, NJ). Processed samples were then analyzed for OM, IVDMD, in vitro OM digestibility, CP, NDF, and ADF. Ash was determined by placing samples in a muffle furnace for 6 h at 600°C (AOAC, Method 942.05, AOAC International, 2016). In vitro OM and DM digestibility were determined with the use of the in vitro method described by Tilley and Terry (1963) modified by adding 1 g/L of urea to the McDougall's buffer (Weiss, 1994). Crude protein was determined through the use of a combustion chamber (TruSpec N Determinator; Leco Corporation, St. Joseph, MI; AOAC Method 990.03, AOAC International, 2016). Neutral detergent fiber and ADF analysis was conducted using the procedure described by Van Soest et al. (1991) without the addition of amylase or sodium sulfite.

Table 1. Nutrient analysis of clipped samples from crested wheatgrass pastures[1]

Nutrient analysis, % DM	June 2015	August 2015
IVDMD	49.0	40.3
NDF	69.5	68.8
ADF	47.6	48.0
CP	8.7	6.4

[1]Established, predominately crested wheatgrass pastures near Sidney, Nebraska, at the University of Nebraska High Plains Agricultural Laboratory in 2015.

The second factor in the experiment was finishing with or without field peas in the dry-rolled corn (**DRC**)–based finishing diet. The finishing period was conducted at the Panhandle Research and Extension Center feedlot near Scottsbluff, Nebraska. At the conclusion of the grazing period, cattle were shipped to the feedlot where they remained in their respective grazing groups in 1 of 12 pens. Upon arrival cattle were limit fed for 5 d a diet consisting of 35% wheat straw, 35% corn silage, 20% wet distillers grains, and 10% distillers condensed solubles (DM basis). On the fifth and sixth days cattle were weighed, implanted with 200 mg of trenbolone acetate and 40 mg of estradiol in yr 1 and 200 mg of trenbolone acetate and 20 mg of estradiol in yr 2 (yr 1: REVALOR-XS, yr 2: REVALOR-200, Merck Animal Health), given a 7-way bacterial-toxoid vaccine (Vision 7 Somnus, Merck Animal Health) and a 5-way respiratory vaccine (yr 1: Express FP 5, Boehringer Ingelheim; yr 2: Titanium 5, Elanco Animal Health), and poured with Eprinomectin endectocide (IVOMEC, Merial Limited).

The finishing diets were a DRC-based finishing diet with or without 20% whole, unprocessed FP (DM basis; Table 2). Monensin was included at 360 mg/head daily, and tylosin was included at 90 mg/head daily (Rumensin and Tylan, Elanco Animal Health). Cattle were fed once daily in the morning, and diets were provided ad libitum. Feed bunks were assessed at approximately 0600 h and managed so that trace (≤0.2 kg) amounts of feed were left in the bunk each morning at time of feeding. Feed was delivered with a truck-mounted mixer and delivery unit (Roto-Mix model 274, Roto-Mix, Dodge City, KS; scale readability ±0.91 kg) each morning at 0800 h. Cattle were adapted to a finishing diet over a 21-d period using 4 diets with corn replacing alfalfa hay. Diets containing field peas in the finisher contained field peas in the adaptation diets as well.

Days on feed were 119 and 131 d for yr 1 and yr 2, respectively. Cattle were slaughtered and carcass data were collected at Tyson Foods in Lexington, Nebraska.