

RUSSIAN KNAPWEED AS A PROTEIN SUPPLEMENT FOR BEEF COWS CONSUMING LOW-QUALITY FORAGE

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ABSTRACT: Russian knapweed (*Centaurea repens*) is a perennial noxious weed. Controlling Russian knapweed has proven very difficult and expensive. Sustainable invasive weed strategies may require that weeds are used in livestock production systems. Russian knapweed has protein values similar to alfalfa and may have potential as a protein supplement for beef cattle consuming low-quality forages. Therefore, we compared Russian knapweed and alfalfa (13 and 21% CP, respectively; DM basis) as protein supplements using 48 Hereford × Angus, mid-gestation, beef cows (530 ± 5 kg) offered ad libitum hard fescue straw (4% CP; DM basis) in an 84-d study. Treatments included an unsupplemented control (CON) and alfalfa (ALF) or knapweed (KNAP) provided on an iso-nitrogenous basis (approximately 0.50 kg CP/d). Cows were stratified by weight and BCS and allotted to treatments in a randomized complete block design using 12 pens (4 cows/pen; 16 cows/treatment). Means were compared using orthogonal contrasts (CON vs ALF and KNAP; ALF vs KNAP). Protein supplementation increased ($P < 0.01$) cow weight gain and BCS compared to CON with no difference between ALF and KNAP ($P = 0.47$). There was no difference ($P = 0.60$) in the quantity of straw offered between CON and supplemented groups but ALF cows were offered approximately 11% more ($P = 0.03$) than KNAP cows. Total DM offered to cows was greater ($P < 0.01$) for supplemented compared with CON cows with no difference noted between ALF and KNAP ($P = 0.79$). Russian knapweed can be used as a protein supplement for beef cows consuming low-quality forage. Thus, haying Russian knapweed in the spring and feeding in the winter may provide an alternative to controlling of large scale infestations.

Key words: Management; Ruminant; Supplementation; Weed

Introduction

Russian knapweed (*Centaurea repens*) is a perennial noxious weed native to Eurasia that is highly competitive and invades productive habitats (Duncan, 2005). It is widely established throughout the western U. S., with infestations estimated at 557,000 ha in 1998 (Whitson, 1999). Also, this weed is rapidly expanding its range, with annual spread in the western U.S. estimated between 8 and 14% (Simmons, 1985; Duncan, 2005).

Russian knapweed can be controlled with herbicides for about 3 yr, but will reinvade the site, especially if cool-season grasses cannot be established (R. L. Sheley, ARS-USDA, personal communication). A single type of treatment, such as herbicide application, will

not provide a sustainable means of control for Russian knapweed. As a result, an integrated management system is the most effective for controlling this weed. However, integrated management of Russian knapweed is very difficult and expensive (Whitson, 1999).

Russian knapweed has been reported to have protein values similar to alfalfa and may have potential as a protein supplement for beef cattle consuming low-quality forages (< 6% CP; DM basis). Therefore, we compared Russian knapweed and alfalfa as protein supplements to beef cows consuming low-quality forage.

Materials and Methods

Experimental Design

Forty-eight pregnant (approximately 120 d), 3 yr old, primiparous, Angus × Hereford cows (530 ± 5 kg) were used in an 84-d performance study. Cows were stratified by body condition score (BCS; 1 = emaciated, 9 = obese; Herd and Sprott, 1996) and weight and assigned randomly, within stratification, to one of three treatments. Treatments were an unsupplemented control (CON), alfalfa supplementation (ALF), or Russian knapweed supplementation (KNAP; Russian knapweed was harvested, pre-flower, from an infested site in Harney County, OR, in May of 2005). Cows were then sorted by treatment and allotted randomly to 1 of 12 pens (4 cows/pen; 4 pens/treatment). A trace mineralized salt mix was available free choice (7.3% Ca, 7.2% P, 27.8% Na, 23.1% Cl, 1.5% K, 1.7% Mg, .5% S, 2307 ppm Mn, 3034 ppm Fe, 1340 ppm Cu, 3202 ppm Zn, 32 ppm Co, 78 ppm I, 85 ppm Se, 79 IU/kg vitamin E, and 397 kIU/kg vitamin A). Cows were provided ad libitum access to hard fescue grass seed straw (3.8% CP; DM basis). The quantity of straw provided was noted daily. Alfalfa (20.6% CP; DM basis) and Russian knapweed (13.4% CP; DM basis) were provided Monday, Wednesday, and Friday on an iso-nitrogenous basis (approximately 0.50 kg·hd⁻¹·d⁻¹ averaged over a 7-d period). The amounts (DM basis) provided on Mondays and Wednesdays was 4.54 kg/hd and 6.80 kg/hd for ALF and KNAP, respectively. On Fridays, ALF cows received 6.80 kg/hd and KNAP cows received 10.21 kg/hd.

Data Collection

Cow body weight and BCS was independently measured every 42 d following an overnight shrink (16 h) by three trained observers. The same technicians were used throughout the experiment. Grass seed straw, ALF, and KNAP (approximately 200 g) were collected weekly, dried at 55°C for 48 h, ground through a Wiley mill (1-mm

screen), and composited by 42-d period for analysis of ADF and NDF (Ankom 200 Fiber Analyzer, Ankom Co., Fairport, NY), N (Leco CN-2000; Leco Corporation, St. Joseph, MI), and OM (AOAC, 1990).

Statistical Analysis

Cow performance data were analyzed as a randomized complete block design (Cochran and Cox, 1957) using the GLM procedure of SAS (SAS Inst. Inc., Cary, NC). The model included block and treatment. Orthogonal contrasts (CON vs ALF and KNAP; ALF vs KNAP) were used to partition specific treatment effects. Response variables included: 1) cow weight change, 2) cow BCS change, and 3) grass seed straw offered.

Results and Discussion

Supplementation with protein has been shown to increase cow weight gain and body condition score (Clanton and Zimmerman, 1970; Bohnert et al., 2002), forage intake and digestibility (Kartchner, 1980; Köster et al., 1996), and can improve reproductive performance (Sasser et al., 1988; Wiley et al., 1991). The results of the current study agree with the studies of Clanton and Zimmerman (1970) and Bohnert et al. (2002) that protein supplementation of low-quality forage (< 6% CP; DM basis) increases cow BCS and weight gain compared with unsupplemented controls. The ALF and KNAP supplemented cows each gained 42 kg during the feeding period compared with a loss of 19 kg by the CON cows ($P < 0.01$; Table 1). No difference was noted between ALF and KNAP ($P = 0.70$). Likewise, final BCS of ALF and KNAP cows increased 0.3 and 0.2, respectively, while CON cows lost 0.9 BCS. Consequently, supplemented cows had the same BCS (5.6) at the end of the 84-d feeding period ($P = 0.47$) but greater scores than CON (4.2; $P < 0.01$).

The quantity of hard fescue straw offered was not affected by supplementation ($P = 0.60$; Table 1); however, the quantity offered to the ALF cows was 1.2 kg/d greater than that offered to the KNAP ($P = 0.03$). This was probably the result of the greater quantity of supplement DM (1.2 kg/d) provided by the KNAP which substituted for the hard fescue straw. This was verified when the total DM offered was compared. There was no difference between ALF and KNAP ($P = 0.79$; 13.2 kg/d for each), while supplemented cows had more total DM offered than the CON ($P < 0.01$).

Implications

Russian knapweed can be safely used as a protein supplement for beef cattle consuming low-quality forages. However, it should not be fed to horses because of the potential for a fatal neurological disorder, equine nigeropallidal encephalomalacia or "chewing disease". Thus, haying Russian knapweed in the spring and feeding in the winter may provide an alternative to controlling of large scale infestations.

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Table 1. Effects of Alfalfa and Russian knapweed supplementation of low-quality, hard fescue straw offered to mid-gestation beef cows

Item	Treatment ^a			SEM ^b	P-Value	
	Control	Alfalfa	Knapweed		Control vs Supplemented	Alfalfa vs Knapweed
Initial Wt., kg	500	512	506	8.8	0.41	0.70
Final Wt., kg	481	554	548	5.9	< 0.01	0.47
Initial BCS	5.3	5.3	5.4	0.06	0.72	0.74
Final BCS	4.2	5.6	5.6	0.81	< 0.01	0.47
Hard fescue straw offered, kg/d	10.2	11.0	9.8	0.32	0.60	0.03
Alfalfa or Knapweed offered, kg/d	0.00	2.27	3.42			
Total DM offered, kg/d	10.2	13.3	13.2	0.32	< 0.01	0.79

^a Control = hard fescue straw provided ad libitum; Alfalfa = Control + 2.27 kg/d alfalfa; Knapweed = Control + 3.42 kg/d Russian knapweed. All hard fescue straw, alfalfa, and Russian knapweed values are expressed as average daily DM/cow.

^b n = 4.