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UTILIZATION OF FORAGE KOCHIA FOR FALL/WINTER GRAZING

D.R. ZoBell[1*], B.L. Waldron[2], K.C. Olson[1], R.D. Harrison[2], and H. Jensen[1]
[1]Utah State University and [2]USDA-ARS, Logan, UT

ABSTRACT: The objective of this study was to evaluate forage kochia as a resource for fall/winter grazing beef cows compared to a traditional stock-piled roughage feeding program. In mid-November, 42 beef cattle were randomly assigned to one of two treatments: Control - received stock-piled alfalfa hay free-choice, or Treated - placed on pastures containing a mix of forage kochia and crested wheatgrass. All groups were replicated three times. Initial and final data were obtained for body condition score and backfat. Pastures and alfalfa were analyzed for nutritive properties throughout the trial. A preference study was also conducted utilizing cannulated beef cows on the pastures. Pasture results from this 84 d study showed that clipped forage samples of forage kochia had higher crude protein than crested wheatgrass and lower NDF but higher ADF than the grass samples. Forage quality of both forage kochia and crested wheatgrass decreased as the winter progressed. Crude protein for the forage kochia was 10.7% in November and gradually decreased to 5.3% by the end of January. Crude protein for crested wheatgrass was 6.7% in November and dropped to 5.1% by late January. Forage yield for all three pastures averaged 971.2 kg/ha (DM basis). The average yield for forage kochia was estimated to be 660.2 kg/ha and crested wheatgrass was 311.0 kg/ha. Pasture yield decreased from 1302.4 kg/ha in November to 462.6 kg/ha by the end of January. Cow performance data indicated that BCS and BF changed over time for the alfalfa and kochia fed cows ($P<0.05$). Cows in the drylot pens averaged 13.6 kg/day of alfalfa hay which was more than adequate to meet requirements. The quality of cow diets based on the preference study was always higher than quality of the forage available to them. The grazing system would have been more profitable due to lower costs. It was concluded that forage kochia has tremendous potential advantages for beef producers using it as a roughage source for grazing beef cows during late fall and early winter as an alternative to feeding harvested forage.

Key words: Beef Cows, Forage Kochia, Feed Costs

Introduction

Winter feeding costs in the Intermountain West can represent 50 to 70 percent of the input costs per cow per year (Hathaway, 2003). Research and rancher experience suggests that using forage kochia for fall/winter grazing may help reduce these costs (Koch, 2002; ZoBell et al, 2003). Forage or prostrate kochia (*Kochia prostrata*) is native to the heavily grazed rangeland regions of Central Eurasia and is an important fall and winter forage for various domestic and wildlife species (Waldron, 2001). It is a long lived, semi-evergreen half-shrub that averages .30 to 1.0 meter high. It is drought, saline, and alkaline tolerant, and grows on a wide range of soils in areas receiving 13 to 50 cm of yearly precipitation (McArthur and Sanderson. 1996). It is well adapted to marginal rangelands, out-competing cheatgrass (*Bromus tectorum*) and halogeton (*Halogeton glomeratus*) and stabilizing disturbed soils. Forage kochia is different than the weed annual kochia (*Kochia scoparia*), in that forage kochia is a perennial semi-shrub, will not spread into perennial plant stands, and does not have nitrate or oxalate toxicity (Harrison, 2000). Forage kochia can also be used as greenstrips to reduce the spread of wildfires (Harrison et al., 2002).

The objective of this study was to evaluate forage kochia as a resource for fall/winter grazing beef cows compared to a traditional stock-piled roughage feeding program.

Materials and Methods

An 84-day study was conducted in Box Elder County in cooperation with the USDA Farm Service Agency and the Salt Wells Cattle Company. In mid-November, 2002) 42 late-gestation Black Angus beef cattle (average age 7 years) were divided into six groups to provide three replicate groups of each feed treatment. Control cows were fed alfalfa hay in drylot pens and treated cows grazed pastures planted to a mixture of kochia and crested wheatgrass. The treatment pastures were 16.2 hectares in size. Pastured cows received no supplement for the duration of the experiment but had free access to salt and water.

Cow body condition score (BCS - scoring system from 1-9 wherein 1 was emaciated and 9 was obese) and ultrasound backfat (BF) thickness were collected initially and at termination on each cow.

Forage clip samples were taken every 28 days on all three pastures to estimate forage yield and quality. Clipped forage samples were taken in representative areas of the pastures using a 1 m^2 plot and clipped to stubble that assumed 70% utilization. Grass and kochia were clipped separately and forage and alfalfa quality were analyzed by determining crude protein, acid detergent fiber (ADF) and neutral detergent fiber (NDF). In vitro true digestibility (IVTD) was also determined on forage samples from the pastures.

Samples of the diet selected by cows on pasture were collected in November and January using ruminally cannulated cows which measured CP, ADF and NDF. Quality of the diet selected by cows was compared to the forage quality of the available grass and forage kochia from the clip plots, as well as the alfalfa hay.

Cow BCS and backfat responses and diet CP and NDF were analyzed using the MIXED procedure of SAS (SAS Institute, Cary, NC) in a completely randomized design. Body condition scores and backfat thickness were evaluated in a model that included treatment, period (i.e. initial and final) and their interaction. Period was designated a repeated measure. When interactions occurred, means were separated within each level of each main effect using LSD. Diet variables were evaluated in a model that included month, pasture, and cow within pasture. The test of interest was the month effect. Pasture and cow were designated as random effects.

Results and Discussion

Forage Quality

Clipped forage samples of forage kochia had higher crude protein than crested wheatgrass (Table 1). This was expected because shrubs retain higher levels of crude protein than grasses during the winter. The kochia had lower NDF but higher ADF than the grass samples. The reason that ADF was higher in kochia than grass is because shrubs have higher lignin levels than grasses, and lignin is a component of ADF. Higher NDF in grasses is reflective of higher levels of fiber in the cell wall of grasses. The grass samples had higher digestibility because fiber is potentially digestible while lignin is totally indigestible. This relationship of higher crude protein from shrubs and higher digestibility from grass is typical. Thus, allowing ruminants to consume a combination of kochia and dormant grass is most desirable for obtaining a balance of nutrients and energy in the diet.

Forage quality based on the clipped samples of both forage kochia and crested wheatgrass decreased as the winter progressed (data not shown). Crude protein for the forage kochia was 10.7% in November and gradually decreased to 5.3% by the end of January (study termination). Additionally, crude protein for crested wheatgrass was 6.7% in November and dropped to 5.1% by late January. Reduction of forage quality as the grazing season progresses is to be expected for two reasons. First, cattle graze selectively and remove the best material first, leaving poorer quality material. Second, the forage weathers throughout the winter, losing nutritional value in the process.

The quality of cow diets based on the preference study was always higher than quality of the forage available to them (Table 2). As stated previously, this is to be expected because grazing livestock always select a diet that is higher in nutritional value than the average of all the forage available. Diet quality declined from November to January. This is also to be expected because the value of the forage that remains late in the grazing season is less than what was available in November. Despite the rather dramatic decline from November to January, January diets still had adequate crude protein to support ruminal digestion of forage (7% is considered the minimum crude protein that will support rumen fermentation). Additionally, diets that are 60% digestible should be adequate to meet requirements of nonlactating cows in mid- to-late gestation. This is supported by their ability to maintain body condition, even in January when diet quality was lowest.

Forage Yield

Mean forage yield for the pastures throughout the grazing period was 971.2 kg/ha (DMB). The average yield for forage kochia and crested wheatgrass was 660.2 kg/ha and 311.0 kg/ha, respectively. Pasture yield decreased substantially throughout the duration of the study. Total yield decreased from 1302.4 kg/ha in November to 462.6 kg/ha by the end of January. Over time there was an estimated 208.2 kg decrease in forage kochia and a 131.8 kg decrease in crested wheatgrass. The forage kochia yielded significantly more than did the crested wheatgrass on average (348.0 kg/ha more) ($P<0.05$). Despite the drop in forage availability, the cattle had access to adequate forage to select a diet that met or exceeded their nutrient requirements. However, it appears that cows should be removed from pastures at about the level of residual forage that we observed so that diet quality does not fall below maintenance requirements.

Animal Performance

Treatment and period interacted ($P = 0.04$) for BCS and tended to interact ($P = 0.08$) for backfat (Table 3). Both BCS and backfat increased for cows in both treatments, but the interactions occurred because cows receiving alfalfa hay had a statistically greater increase in BCS and backfat than cows grazing kochia. Cows in drylot were offered 13.6 kg/d of alfalfa hay, with very little being wasted. This exceeded nutrient requirements for cows in late gestation based on NRC (1996). The experiment ended within days of the onset of parturition. The final BCS of 6 observed with alfalfa feeding was greater than necessary for cows to quickly return to estrus and be fertile by initiation of breeding (Perry et al., 1991). The final BCS of 5.3 observed with kochia grazing would optimize reproductive performance and winter feed costs.

From an economic sense, the grazing system would have been more profitable due to lower costs. This is based on approximately \$45-\$50 / AUM to feed stored feeds and approximately \$16-\$20 / AUM to pay for pasture rent and fees. Grazing systems are also much less labor intensive.

Conclusions

Forage kochia is a nutritious perennial that is well adapted to the Intermountain West region of the U.S. There are tremendous potential advantages for beef producers using it as a roughage source for grazing beef cows during late fall and early winter as an alternative to feeding harvested forage. Viability and sustainability of beef production in the western U.S. can be increased if feed

costs are decreased. Forage kochia could be an important management option to reduce winter feed costs and improve livestock ranching profitability.

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Table 1. Nutritional quality of forage samples clipped from the pastures (% of DM)

Item	forage kochia	crested wheatgrass
Crude protein	7.2	5.9
NDF	59.5	63.6
ADF	47.3	42.5
IVTD	52.1	55.8

Table 2. Backfat and Body Condition Score for alfalfa and kochia

	Backfat, cm		BCS	
Item	Initial	Final	Initial	Final
Alfalfa	$0.41^{a,x}$	$1.24^{b,y}$	$4.95^{a,x}$	$6.02^{b,y}$
Kochia	$0.38^{a,x}$	$0.66^{a,z}$	$4.86^{a,x}$	$5.31^{b,z}$

^{a,b} Numbers with different superscripts differ ($P<0.05$) across rows for BF and BCS.

^{x,y,z} Numbers with different superscripts differ ($P<0.05$) down columns for BF and BCS.

Table 3. Nutritional quality of diets selected by cows from the pastures (% of DM)

Item	November	January	P
Crude protein	12.6	7.3	0.02
NDF	53.8	64.6	0.01
IVTD	62.2	60.1	0.60