# FORAGE KOCHIA FOR FALL/WINTER GRAZING

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

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## INTRODUCTION

Winter feeding costs have often been cited as one of the most expensive aspects of beef cattle production in the Intermountain West. Research and rancher experience suggests that using forage kochia for fall/winter grazing may help reduce these costs.

Forage or prostrate kochia (*Kochia prostrata*) is native to the heavily grazed rangeland regions of Central Eurasia. It is a long lived, semi-evergreen half-shrub that averages 1 to 3 feet high. It is drought, saline, and alkaline tolerant, and grows on a wide range of soils in areas receiving 5 to 20 inches of yearly precipitation. It is well adapted to marginal rangelands, out-competing cheatgrass and halogeton 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.

Forage kochia can be used for (1) forage for livestock and wildlife; (2) food and cover for upland game birds, small mammals, reptiles, insects, etc., (3) prevention of erosion and stabilization of disturbed soils; (4) competition against cheatgrass, russian thistle, medusahead, and halogeton; and (5) greenstrips to reduce the spread of wildfires.

Because of its high nutritional value, the Utah Division of Natural Resources has planted areas of forage kochia in north-central Utah for winter forage for deer and elk. The Nevada BLM also reports sage grouse and antelope utilization of forage kochia for forage and habitat.

## BEEF COW STUDY

### 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 with the objective of determining the potential of grazing forage kochia for over-wintering beef cows compared to feeding alfalfa hay. In mid-November, 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. Treatments were a control fed alfalfa hay in drylot and a treatment grazing pastures planted to a mixture of kochia and crested wheatgrass. The three kochia/crested wheatgrass pastures were each about 40 acres. Pastured cows received no supplement for the duration of the experiment. Cow body condition

score (scoring system from 1-9 wherein 1 was emaciated and 9 was obese) and ultrasound backfat thickness were collected initially and every 28 days. Forage clip samples were also taken every 28 days on all three pastures to estimate forage yield and quality. Clipped forage samples were taken at random in representative areas of the pastures using a 1 square meter plot and assuming 70% utilization. Grass and kochia were clipped separately and forage quality was analyzed by determining crude protein, acid detergent fiber (ADF), neutral detergent fiber (NDF) and in vitro true digestibility (IVTD). Samples of the diet selected by cows were collected in November and January using ruminally cannulated cows grazing the pastures. Quality of the diet selected by cows was compared to the forage quality of the available grass and forage kochia from the clip plots.

## 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.

Table 1. Nutritional quality of forage samples clipped from pastures.

| | 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 |

Forage quality based on the clipped samples 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 (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 continues to mature and weather throughout the winter, losing nutritional value in the process.

The quality of cow diets 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 the diet quality was its lowest.

Table 2. Nutritional quality of diets selected by cows from the pastures.

| | November | January |
|---|---|---|
| Crude protein % | 12.6 | 7.3 |
| NDF % | 53.8 | 64.6 |
| IVTD % | 62.2 | 60.1 |

**Forage Yield**

Forage yield for all three pastures averaged 865 lbs/acre (DM basis). The average yield for forage kochia was estimated to be 588 lbs/acre and crested wheatgrass was 277 lbs/acre. Pasture yield decreased substantially throughout the duration of the study. Total yield decreased from 1160 lbs/acre in November to 412 lbs/acre by the end of January. Over time there was an estimated 458 lb decrease in forage kochia and a 290 lb decrease in crested wheatgrass. The forage kochia yielded significantly more than did the crested wheatgrass on average (310 lb/acre more). 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**

Average body condition score for the cows on pasture was 5.3 and in the feed pens 5.6. The average condition score for pastured and penned cows increased over the 84 days .5 and 1.2 respectively. Average backfat increased .11 inches for the animals on pasture and .33 inches for the animals in the feed pens. Considering that there was no supplementation for the pastured cows, their performance was very good. The winter, however, was mild and the forages may have retained a higher-than-normal overall quality. Body condition score and backfat for the pasture treatment cows remained ideal.

The cows fed in the pens had higher than desired condition score and backfat which was a result of free-choice alfalfa hay, although the difference between backfat levels determined in the pasture treatment cows and pen treatment cows was statistically insignificant. This indicates that the winter grazing system was comparable to feeding traditionally stored feeds for animal performance. From an economic sense, a grazing system would be more profitable because it would cost approximately $45-$50 / AUM to feed stored feeds and only about $16-$20 / AUM to pay for pasture rent and fees. Grazing systems are also much less labor intensive.

**Other Research**

Crude protein has been reported to range from 14 to 8 % during the period of August to March, respectively. The University of Wyoming found that forage kochia tested 7.7 % crude protein in late February, and was higher than 12 perennial grasses and three legumes (Table 1). They also reported lower NDF and ADF than other tested species (Table 1). Because NDF and ADF are related to forage intake and digestibility, this indicates forage kochia has a high nutritive value during the winter.

Dr. David Koch (Univ. of Wyoming) evaluated cows grazing forage kochia on the Broadbent Ranch in Uinta County, WY. The cows grazed from early January until mid-March and calved in late-March. A seed crop had been harvested from the kochia, leaving most of the remaining plant below snow. The kochia yielded 830 lbs per acre of dry matter compared to 33 lbs per acre in an adjacent sagebrush range. The cows were provided 2 lbs per day of a grain-based supplement that contained 13% crude protein during the coldest period. The cows improved 2 points in body condition score during the grazing period. The kochia tested over 7.5 % crude protein at the end of the trial.

Forage kochia grown at the USU Blue Creek farm tested over 20% crude protein when harvested in July, suggesting that it may be used to alleviate protein deficiencies faced by non-migratory wildlife after annual and perennial grasses go dormant. However, our observations and long-term experience in Kazakhstan suggests that it is less palatable to cattle during the summer months.

**USDA-ARS Research**

Immigrant, the only cultivar that is currently available in the U.S., has short stature which limits its use in areas where snow is more abundant. The USDA-ARS Forage and Range Research Lab in Logan, UT has a project to better understand its management and to develop forage kochia with larger, shrub-like stature, and improved forage quality characteristics. Plant materials recently collected from Kazakhstan and Uzbekistan show promise.

Table 3. Forage production and quality of stockpiled forages for fall/winter grazing.

Archer, WY (Univ. of Wyoming Research – data available at http://www.uwyo.edu/ag/ces/pubs2.htm)

| Species | Crude Protein (Nov 5, 1998) | Crude Protein (Feb 26, 1999) | NDF | ADF | Forage Production lbs/acre (Nov 5, 1998) |
|---|---|---|---|---|---|
| 'Immigrant" forage kochia | 9.5 | 7.7 | 56.3 | 37.4 | 3035 |
| Leagumes | 8.7 | 7.7 | 61.0 | 50.4 | 649 |
| Wildryes | 6.5 | 5.6 | 70.0 | 45.1 | 1734 |
| Wheatgrasses | 6.1 | 5.6 | 67.1 | 41.5 | 1471 |

## 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 feedstuff for grazing beef cows during the winter as an alternative to feeding harvested forage. Alternate varieties are being studied to further enhance this potential. Other uses, which are also being examined, include use for fire protection and reclaiming rangeland infested with cheatgrass and other invasive species. Viability of beef producers can be increased if feed costs are decreased, and forage kochia can be used as a tool to achieve this.