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PERENNIAL FORAGE KOCHIA FOR IMPROVED PRODUCTIVITY OF GRASS DOMINATED WINTER GRAZING PASTURES

L.K. Greenhalgh[1], K.C. Olson[2], D.R. ZoBell[1], B.L. Waldron[3], A.R. Moulton[1], B.W. Davenport[4]

[1]Utah State University Cooperative Extension, UMC 4815, Logan, Utah 84322
[2]South Dakota State University, West River Ag Center, 1905 N. Plaza Blvd, Rapid City, South Dakota 57702-9302
[3]USDA-ARS Forage and Range Research Lab, Logan, Utah 84322
[4]USDA-NRCS, 185 N. Main, Tooele, Utah 84074

ABSTRACT: Grazing forage kochia (*Kochia prostrata*) during fall/winter has been shown to improve livestock health and reduce winter feeding costs. The objectives of this study were to compare the differences of traditional winter pastures versus pastures with forage kochia. Fifty mature, pregnant, Black Angus crossbred cows were body condition scored (BCS) and randomly divided into two groups of 25 head. One group was placed in a forage kochia/crested wheatgrass (*Agropyron desertorum)* pasture, the other (control) group in a crested wheatgrass/cheatgrass (*Bromus tectorum*) pasture. Both groups were placed in the pastures on 10/02/07 and removed on 01/03/08. Upon removal, cows were combined in one group and condition scored. Forage availability measured by the double sampling method showed the control and study pastures to contain 496 kg/ha and 3370 kg/ha of forage respectively. Crude protein was 2.5 and 9.8 percent for crested wheatgrass and forage kochia respectively. Estimated carrying capacities were 0.66 AUM/ha for the control and 4.46 AUM/ha for the forage kochia pasture. Initial (control = 5.33, kochia = 5.09) and final (control = 5.64, kochia = 5.63) BCS were similar ($P > 0.10$) among treatment groups. Although not statistically significant ($P = 0.12$), there was a trend for greater increase in BCS for the kochia pasture (+ 0.54) compared to the control pasture (+ 0.31). Overall, this study found that both pastures had adequate forage to maintain body condition; however, carrying capacity was almost seven times greater in the forage kochia pasture than the crested wheatgrass pasture. This study further indicates that winter grazing can be enhanced by including forage kochia as one of the plant components.

Key Words: beef cattle, body condition score, perennial forage kochia

Introduction

DelCurto and Olson (2000) and Hathaway (2003) reported that winter feed costs is one of the major challenges for beef producers in the Western United States. One alternative is finding ways to maximize low-quality forage utilization by cattle, but minimize the use of extensive supplements. Arthun et al. (1992) reported that one way to do this is to include forbs and shrubs in low-quality forage-based diets to reduce protein supplementation, and Otsyina et al. (1984) reported that shrubs are particularly important in winter grazing systems. Improving winter grazing is important economically because it can reduce costs associated with feeding stored hay (Waldron et al., 2006; Gade and Provenza, 1986; Waldron, 2004).

Forage kochia (*Kochia prostrata*) has been shown to be good forage for livestock, especially during the fall and winter grazing seasons (Waldron et al., 2006; Otsyina et al., 1984; Stevens et al., 1985). During winter, dormant grasses are high in energy (fiber) but low in protein (Waldron et al., 2006; Cook, 1972). Simultaneously, shrubs such as forage kochia are low in energy and high in protein (Waldron et al., 2006; McKell et al., 1990). Therefore combining grasses and shrubs can optimize protein and energy levels by meeting microbial crude protein requirements of 7% (Van Soest, 1994) during nutritionally stressful times (Arthun et al., 1992). Maximizing the amount of energy utilization will also increase reproductive efficiency (Dunn et al., 1969; Selk et al., 1988).

Reported benefits of forage kochia prompted researchers and local entities to conduct a study in Tooele County of traditional winter pastures versus pastures with forage kochia. The objectives were to assess the differences between forage production, forage quality, carrying capacity and body condition score (BCS).

The site in Tooele Valley was first grazed in the mid 1800's and became overcrowded and overgrazed. In 1929, the first dust storm was reported and conditions continued to deteriorate to the point that dust storms made life unbearable and hazardous in the area. In 1934, the worst of these storms finally brought about action (Helm and Quate, circa 1980). The area was fenced and excluded from grazing. The land was eventually given to the Grantsville Soil Conservation District and Tooele Army Depot and seeded with crested wheatgrass. Restoration efforts and more careful grazing management eliminated dust storms.

This area of the Tooele Valley is still important winter grazing land. It is sensitive to overgrazing and subject to wildfire that could seriously threaten the surrounding communities. For these reasons it is imperative to maintain proper grazing which reduces fuel loads and thus the likelihood of devastating fires. Forage kochia planted in strips can serve as effective fire-breaks (Harrison et al., 2002, Newhall et. al., 2004), and help

prevent blowout areas (Newhall et. al., 2004, Stevens et. al., 1984; Rasmussen et al., 1992).

Materials and Methods

Site Information. The Tooele Valley ecological site (lat 40º 34' 16.91" N, long 112° 24' 25.74" W) classification is Semi-Desert Alkali Loam (Black Greasewood). Elevation is 1311 to 1615 meters. The average annual precipitation is 254 to 305 mm, mean air temperature 7 to 11° C and the average frost free period is 110 to 140 days. (USDA Soil Survey of Tooele Area). Based on this description, average total dry weight forage production should be 732 kg/ha.

Kochia Establishment. Thirty-two hectares in Tooele Valley were prepared by disking in November 2004 and seeded with forage kochia in January 2005 at a rate of 2.25 kg/ha of pure live seed. In the spring of 2005 the forage kochia was observed to have germinated but because of an especially wet spring was overshadowed by crested wheatgrass and was hard to detect.

Forage Evaluation. Forage production was estimated using the double sampling method described by (Herrick et al., 2005). Ten 0.89 m^2 subplots were randomly selected for each pasture. Samples were taken on 10/27/08, six days before cattle began grazing. In three subplots, each species was clipped and bagged separately. Air dry weight in grams was recorded at least one week later. Species weights in all subplots were estimated ocularly. A correction factor was applied to each estimated weight based on the total clipped weight divided by the total estimated weight. Multiplying the estimate of the grams from each 0.89 m^2 plot by 11.2 produces an estimate for kg/ha.

Samples of forage kochia and crested wheatgrass were collected and analyzed for crude protein.

Cattle Performance. On 11/02/07, fifty mature, pregnant, Black Angus crossbred cows were visually body condition scored and randomly divided into two groups of 25 head. One group was placed in a forage kochia/crested wheatgrass (*Agropyron desertorum)* pasture, the other (control) group was placed in a crested wheatgrass/cheatgrass (*Bromus tectorum*) pasture. On 03 January 2008 both groups were gathered, combined and given a final condition score. The same person did initial and final scoring.

Statistical Analysis. Body condition score and forage availability data were analyzed using SAS.

Results and Discussion

Kochia Establishment. It was hoped that the forage kochia pasture would be ready to graze in the late fall of 2006. However, forage kochia establishment did not proceed as expected and it was determined to wait until the fall of 2007 to graze. In the summer of 2007, it was apparent that there would be enough forage kochia to proceed with the study in the fall.

Forage Evaluation. Forage availability showed the control and study pastures to contain 496 kg/ha and 3370 kg/ha of forage respectively (Table 1). This correlates with Waldron et al., (2006) results that showed forage kochia greatly increases the yield potential of western rangelands.

Table 1. Forage Availability (kg/ha)

Species	Control	Kochia
Agropyron desertorum	461	186
Bromus tectorum	24	79
Kochia prostrata		3065
Poa bulbosa		29
Poa secunda	11	11
Total	496[a]	3370[b]

Values with different letters are significantly different ($P < 0.001$).

Average crude protein value was greater for forage kochia than for crested wheatgrass (Table 2). This also is in agreement with previous studies which show crude protein to be consistently higher in forage kochia than in dormant grasses (Waldron et al., 2006, McKell et al., 1990).

Table 2. Average Crude Protein (%)

Crested Wheatgrass	Forage Kochia
2.5	9.8

Carrying capacities were 0.66 AUM/ha for the control and 4.46 AUM/ha for the forage kochia pasture (Table 3). This nearly seven fold increase in carrying capacity is significant from a management and economical standpoint.

Table 3. Difference in AUM/hectare

Site	Control	Kochia
Tooele Valley	0.66	4.46

Cattle Performance. Body condition scores were similar for the two groups of cattle both initially and finally (Table 4). While not statistically significant, there was a trend for greater increase in BCS for the kochia pasture compared to the control pasture (Table 4).

Table 4. Differences in body condition score

Treatment	Initial	Final	Change
Control	5.33	5.64	0.31
Kochia	5.09	5.63	0.54
P – Value	0.29	0.97	0.12

Implications

The findings of this study are in agreement with previous research on forage kochia. Both quality and availability of forage increased for the forage kochia pasture. In this particular study both pastures had adequate forage to maintain body condition; but, carrying capacity was almost seven times greater in the forage kochia pasture than the crested wheatgrass pasture.

One of the interesting aspects of forage kochia is its ability to thrive in dry, harsh climates. The large majority of forage kochia forage production took place in the spring and summer of 2007 – a year with considerably lower than average precipitation and higher than average temperatures. Overall, we can conclude that winter grazing is enhanced when forage kochia is one of the plant components.

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