Dryland Cover Crops as a Grazing Option for Beef Cattle

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Summary

A two-year grazing study was conducted to evaluate forage quality and utilization of cover crops (CC) in dryland cropping systems compared to crested wheatgrass pastures (CWP). The CC mixture consisted of oats, peas and turnips planted in March with a no-till drill. Both CC and CWP were grazed during the month of June. Total tract dry matter digestibility and CP were greater for CC compared to CWP while NDF and ADF of CC were less. The CC was observed to have greater forage quality over both years and may produce similar amounts of forage as crested wheatgrass pastures allowing deferred grazing on native pasture.

Introduction

Many producers in dryland wheat farming regions have made a shift from the typical winter wheat fallow rotation to a no-till system paired with crop rotations which may include forage crops. Combinations of cereals and legumes provide biomass to inhibit water loss due to evaporation as well as provide organic matter for the soil from their decomposing residues. The legumes provide nitrogen through fixation which can then be available for the next crop, while brassicas, as another component, have the ability to loosen compacted soils with their roots reducing the requirement for tillage.

The biomass from cover crops could potentially be used as a source of forage for cattle producers and return most of the nutrients to the cropping system when grazed. Cover crops may decrease pressure on pasture grasses or allow for deferred grazing when pastures need rest. The objective of this experiment was to determine the differences in forage quality of cover crops in a dryland no-till farming system compared to crested wheatgrass pastures grazed by yearling cattle.

Materials and Methods

A two-year study (June 2011 and June 2012) was conducted at the University of Nebraska High Plains Agricultural Lab located near Sidney, Neb. Treatments were cover crops (CC) and crested wheatgrass pasture (CWP). Oats, peas, and turnips utilized in the CC treatment were planted with a no-till drill in March. Seeding rates for CC were 40, 40, and 2 lb/ac for oats, peas, and turnips, respectively. In 2011, no fertilizer was applied prior to planting. In 2012, 30 lb/ac nitrogen was applied according to soil test results. The field was replicated into three 6-acre paddocks in year 1 and three 10-acre paddocks in year 2. A 30-acre pasture was utilized for the CWP treatment and divided into three 10- acre paddocks both years. The CWP treatment pasture predominantly consisted of crested wheatgrass but also included buffalo grass and blue grama. All paddocks were sampled for forage production the first, third, and fifth week of grazing. Samples from CC treatment were sorted by each plant species and weighed individually to determine DM yields at each sampling date. Cattle were allowed to graze paddocks for five weeks. Ungrazed samples were clipped to determine DM tonnage. The forage in the CC treatment was chemically killed at the end of five weeks, after cattle were removed, to preserve moisture for fall wheat planting. Five steers were used in each paddock, which resulted in stocking densities of 3.6 steers/ac for CC in year 1, and two steers/ac for CWP both years, as well as CC in year 2. Stocking density was held constant over the entire grazing period.

Hand clipped forage samples (5.4 ft^2, n = 4/paddock) and diet samples collected using three esophageally fistulated cows were analyzed for IVDMD (similar to TDN), CP, NDF, and ADF in both years. In year 2, diet samples were also analyzed for undegradable intake protein (UIP) as a percent of CP.

Samples were analyzed with time (week) as a repeated measure using the MIXED procedure of SAS (SAS Institute, Inc., Cary, N.C.). Additionally, linear and quadratic contrasts were used to determine effects of nutrient composition over the grazing season.

Results and Discussion

Hand-clipped Forage Samples

Hand-clipped forage samples were analyzed for IVDMD and nutrient composition (CP, NDF, and ADF) each year (Table 1). Values "for IVDMD and CP were greater ($P \leq 0.05$) and NDF was lower ($P = 0.02$) for CC compared to CWP over the grazing season for both years. In 2011, ADF content tended ($P = 0.08$) to be lower for CC compared to CWP. Conversely, in 2012 ADF content was lower ($P < 0.01$) for CC compared to CWP. In 2011, IVDMD percentages decreased linearly ($P < 0.01$) across weeks for CC and CWP (Table 2). The CP concentration for CC responded quadratically ($P < 0.01$), with weeks 1 and 5 having the greatest CP content and week 3 having the lowest, while CP content of CWP tended ($P < 0.06$) to decrease linearly. Additionally, a linear ($P \leq 0.03$) increase in NDF and ADF content was observed for CC. The NDF content increased in CWP ($P < 0.01$) while ADF content was not different ($P \geq 0.17$). In 2012, IVDMD decreased linearly ($P< 0.01$) for CC and CWP. The CP content decreased

Table 1. ***In-vitro* digestibility and nutrient composition in clipped quality samples for cover crops (CC) and crested wheatgrass pasture (CWP).[1]**

Item	CC	CWP	SEM	*P*-Value
2011				
IVDMD[2]	71.5	58.3	2.2	0.05
CP	10.5	7.8	0.4	0.05
NDF	46.5	67.5	1.5	0.02
ADF	34.3	41.5	1.1	0.08
2012				
IVDMD	60.1	46.3	1.1	0.02
CP	9.4	5.9	0.2	0.01
NDF	55.2	69.7	1.5	0.04
ADF	38.9	54.5	0.8	< 0.01

[1]% DM.
[2]*In vitro* DM digestibility.

Table 2. Clip sample forage quality for cover crops (CC) and crested wheatgrass pasture (CWP) over time.

Item	Week 1	Week 3	Week 5	SEM	Linear[1]	Quad[2]
2011 CC						
IVDMD[3]	77.1	73.9	63.6	2.2	< 0.01	0.32
CP	11.3	8.7	12.5	0.6	0.19	< 0.01
NDF	34.5	44.8	52.3	1.1	< 0.01	0.31
ADF	31.0	30.2	39.6	2.6	0.03	0.13
2011 CWP						
IVDMD	63.1	58.1	53.9	2.2	< 0.01	0.85
CP	9.1	7.4	7.3	0.6	0.06	0.32
NDF	62.1	68.3	70.8	1.1	< 0.01	0.18
ADF	37.7	44.6	42.3	2.6	0.24	0.17
2012 CC						
IVDMD	70.3	60.4	53.5	0.7	< 0.01	0.11
CP	11.2	9.6	8.2	0.3	< 0.01	0.72
NDF	41.3	54.2	61.6	1.0	< 0.01	0.04
ADF	32.5	40.7	42.4	1.1	< 0.01	0.03
2012 CWP						
IVDMD	49.2	46.2	46.0	0.7	< 0.01	0.13
CP	6.0	5.8	5.8	0.3	0.50	0.77
NDF	68.4	68.9	67.8	1.0	0.70	0.53
ADF	53.8	54.7	54.9	1.1	0.47	0.77

[1]Linear effect of week.
[2]Quadratic effect of date.
[3]*In vitro* DM digestibility.

Table 3. ***In-vitro* digestibility and nutrient composition of samples collected using esophageally fistulated cows in 2011 and 2012 for cover crops (CC) and crested wheatgrass pasture (CWP)[1].**

Item	CC	CWP	SEM	*P*-Value
2011				
IVDMD[2]	69.4	58.9	1.47	< 0.01
CP	9.5	7.3	0.60	0.04
NDF	50.2	69.9	0.02	< 0.01
ADF	31.6	40.9	0.02	< 0.01
2012				
IVDMD[2]	62.7	51.4	3.9	< 0.01
CP	9.3	7.4	0.7	0.01
NDF	54.2	64.4	3.5	< 0.01
ADF	39.2	47.9	3.2	0.02
UIP[3]	29.5	32	2.9	0.41

[1]%DM.
[2]*In vitro* DM digestibility.
[3]Undegradable intake protein as a % of CP.

linearly ($P < 0.01$) for CC but was not significantly different for CWP. Both NDF and ADF content of the CC increased linearly ($P < 0.01$) and quadratically ($P \leq 0.04$; respectively), while NDF and ADF were not significantly different across weeks for CWP. The relatively small decrease in IVDMD and no differences in CP, NDF, and ADF content during the 2012 grazing period, suggests that the CWP may have been dormant during the grazing period due to a combination of reduced precipitation and warm temperatures observed during that year. The high temperatures for April, May, and June in 2012 were 10 degrees higher than for 2011. Additionally, cumulative rainfall for those three months in 2012 was only 3.6 inches compared to 12.1 inches in 2011.

Diet Samples

The diet sample quality for 2011 and 2012 followed similar tends as the clipped sample (Table 3). In both years CC was greater ($P \leq 0.04$) in IVDMD and CP content than CWP while the NDF and ADF content was less ($P \leq 0.02$) for CC compared to CWP. These data suggest the diet selected when grazing CC was of greater quality than the CWP. The undegradable intake protein was not different ($P = 0.41$) for CC compared with CWP.

Yields of Cover Crop Species

The yields of oats, peas, and turnips within the CC were analyzed to determine DM contribution of each species (Table 4). No differences ($P \geq 0.73$) were observed for the yield (as a % of total yield) of oats or peas across the grazing season in 2011. In 2011, the dry matter contribution of turnips decreased each week. However, the small amount of turnips available (approximately 2.5% of total yield) would likely have little effect on the selectivity of the cattle. In 2012, by week five, the yield of oats increased ($P = 0.03$) and the yield of peas decreased ($P = 0.03$). In 2012, turnips did not establish and grow in

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the CC treatment. Oats dominated the available forage in both years at 85% of the total yield with peas contributing most of the remaining yield. There was a trend for oats to increase and peas to decrease over the grazing period in 2012. A possible explanation of this could be a greater selection preference for peas compared to oats. The lack of precipitation and elevated temperatures observed in 2012 may have caused the oats to mature and earlier and likely made the peas more desirable for grazing. As mentioned previously, in 2011, cumulative rainfall for April, May, and June was 12.1 inches, and the CC was not fertilized that year. As a result the CC dry matter tonnage produced was considerably less than that of the CWP and consequently, the AUM's available for the month of June were less as well (Table 5). In 2012, the total rainfall for April, May, and June was only 3.6 inches, the average high temperature was 10 degrees higher for each of those months compared to 2011, and the CC was fertilized. These factors may have contributed largely to the tonnage and therefore AUM's available for CC and CWP being very similar.

Table 4. Yields of each crop within cover crops (CC) treatment[1].

Item	Week 1	Week 3	Week 5	SEM	*P*-value
2011					
Oats	80.0	84.0	80.6	3.7	0.73
Peas	16.1	13.9	17.8	3.8	0.77
Turnips	3.9[a]	2.1[ab]	1.6[b]	0.5	0.06
2012					
Oats	87.9[a]	87.9[a]	94.3[b]	1.4	0.03
Peas	12.1[a]	12.1[a]	5.7[b]	1.4	0.03
Turnips	0	0	0	—	—

[1]Values are a % of the total mass measured in each clip.
[a,b]Means within a row with unlike superscripts differ ($P < 0.05$).

Table 5. Total dry matter production and Animal Unit Months available for cover crops and crested wheatgrass pasture.

	2011 Total production measured June 28		2012 Total production measured July 11	
	Cover Crops	Crested Wheatgrass	Cover Crops	Crested Wheatgrass
DM ton/acre	0.55	0.97	0.73	0.76
Digestible DM ton/acre[1]	0.38	0.57	0.46	0.44
AUM/acre	0.40	0.69	0.53	0.54

[1]Digestible DM calculated from tons DM*IVDMD.

Predicted Cattle Performance

Obtaining accurate cattle weights after only one month of grazing is difficult because of changes in gut fill. With no accurate way to account for differences in gut fill, the authors chose to calculate daily gain based on NEg adjustments from diet quality data and historic gain data. Previous research (*1996 Nebraska Beef Cattle Report*, p. 51) indicated yearlings grazing crested wheatgrass for 62 days gained 2.0 lb/day. The average weight of the cattle over both years was used as the BW (750 lb) in NRC calculations which resulted in forage intake of 18.4 lb for both treatments. The predicted gain of cattle grazing CC and CWP in 2011 was 2.7 and 2 lb/day, respectively. In 2012, the predicted gain for cattle grazing CC and CWP was 2.2 and 1.1 lb/day, respectively. Greater cattle performance is expected when grazing CC based on NEg adjustments and diet quality data. The predicted ADG of CC may be supportive of stocker cattle or early weaned calves due to the quality of this forage source.

Cover crops had greater forage quality compared to crested wheatgrass pastures. Greater digestibility improved predicted performance at similar intakes compared to crested wheatgrass. Depending on the year and environmental factors, cover crops may be able to produce similar amounts of forage as native pastures. Cover crops planted on acres used for no-till wheat production offer a source of high-quality forage in addition to traditional grazing and haying acres. This integration of crops and livestock increased productivity per unit of land compared to fallow. This integration may offer a more sustainable approach utilizing acres for both grain and cattle production, but effects of grazing cover crops on wheat production need to be evaluated.

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