

No-till Dryland Cover Crops as a Forage Option for Beef Cattle

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Forage crops can enhance the sustainability of a cattle operation by providing a grazing alternative to native range to prevent overgrazing of range resources. Multispecies crops typically include legumes, annual grasses, and deep rooted species such as brassicas (turnips and radishes). Multispecies forage crops are becoming popular in no-till farming operations as an alternative to fallow. Additional benefit from these crops could be realized if some of the biomass produced from these cover crops could be used as a source of forage for beef cattle.

Studies were conducted at the High Plains Ag Lab near Sidney, NE in 2010, 2011, and 2012 to determine the quality and quantity of cover crop forage produced in a dryland cropping system in a high elevation, low rainfall area.

2010 Plot Study

On April 9, 2010 seven combinations of grasses, legumes, and brassicas were planted in replicated plots (Table 1). Each plot was sampled in replicate June 1, June 17, and July 2. Plots were then sprayed to stop growth, and residual herbage was left to protect the soil prior to winter wheat planting. During the second week of May, the nighttime low temperature was in the low 20s. These lower temperatures, coupled with a planting depth greater than 1 in., may have contributed to limited forage production by the brassicas, clovers, vetch and sunflowers, as their seeds are smaller compared with the other species evaluated. However, rainfall in 2010 was greater than normal (19 in. vs. 14 in.) and contributed to good yields of the legumes and grasses once the soil temperatures warmed up (Figure 1). The tons DM/acre were greatest for the forage pea and oat combinations (TRT 2, 4, 6) at all three collection times (Figure 1; $P < 0.05$). Forage production was the least for the triticale (TRT 7) at each collection ($P < 0.05$). The triticale used was a winter triticale hybrid, and it remained in a vegetative state throughout the growing season, which reduced forage production in relation to the oats. Although there were differences in the seeding rates (lb of seed/acre) among mixtures evaluated, there was no correlation between seeding rate ($r = 0.26$; $P = 0.25$) and forage yield. The in vitro dry matter disappearance (IVDMD) (similar to TDN) of all the mixtures was greater than 80% during the first sampling on June 1, and greater than 74% during the second sampling on June 17 (Table 2). The IVDMD of mixtures containing triticale remained above 70% in July, while the IVDMD of mixtures containing oats ranged from 59 to 65%. Mixtures containing triticale did not decrease in CP content as dramatically as mixtures containing oats. This is again a function of the rapid growth and maturity of the oats while the triticale remained vegetative. Producers would need to determine if quantity or quality was more important when determining what to plant and whether to plan to graze or hay the forage.

2011 and 2012 Grazing Study

A two-year study (June 2011 and June 2012) was conducted at the University of Nebraska's High Plains Agricultural Lab located near Sidney, NE. The objective of this experiment was to compare forage quality of cover crops in a dryland no-till farming system to crested wheatgrass pastures grazed by yearling cattle. Treatments were cover crops (CC) and crested wheatgrass pasture (CWP). The oats, forage 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 were applied according to soil test results. Cattle were allowed to graze paddocks five weeks. 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 yr 1, and 2 steers/ac for CWP both years as well as CC in yr 2. Stocking density was held constant over the entire grazing period.

Hand-clipped forage samples and diet samples collected using esophageally-fistulated cows were analyzed for IVDMD (similar to TDN), crude protein (CP), neutral detergent fiber (NDF), and acid detergent fiber (ADF) in both years. The IVDMD and CP were higher and the NDF and ADF lower for the hand-clipped CC compared to CWP in both years, suggesting the quality of the CC for cattle was greater than for CWP (Table 3). The esophageally-collected samples followed the same pattern and resulted in similar values to the clipped samples (Table 4). Samples from CC were sorted by plant species in week 1, 3, and 5 of grazing. In both years oats contributed the most to the dry matter yield. In 2011, the percentage of oats and peas remained similar over the grazing period. In 2012, oats increased and peas decreased over the season suggesting greater selectivity by the grazing cattle for the forage peas. In both years turnips contributed less than 4% of the dry matter (Table 5). In 2011, cumulative rainfall for April, May, and June was 12.1 inches. Also, as mentioned previously, the CC was not fertilized that year. As a result, the dry matter tonnage produced was considerable less than that of the CWP, and consequently, the AUMs available for the month of June were less as well (Table 6). 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 to the AUMs available for CC and CWP being very similar.

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, daily gain was calculated based on Net Energy of gain (NE_g) adjustments from diet quality data and historic gain data. Previous research (1996 NE beef report, p.51) indicated yearlings grazing crested wheatgrass for 62 d gained 2.0 lb/d. 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/d, respectively. In 2012, the predicted gain for cattle grazing CC and CWP was 2.2 and 1.1 lb/d, 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.

Implications

Cover crops had greater forage quality compared with 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.

Table 1. Forage crop mixtures and planting rates.¹

Forage Crop	Treatment						
	1	2	3	4	5	6	7
Forage Peas	120	80	40	40	40	40	
Oats		40		40		40	
Winter Triticale			50		50		65
Turnips			1	1			
Yellow Sweet Clover			1	1	1	1	
Sunflower			1.5	1.5	1.5	1.5	
Medium Red Clover			1	1	1	1	
Vetch			4	4	4	4	
Oilseed Radish			2.5	2.5			
Brassica Hybrid ²					3.75	3.75	

¹All values are in pounds per acre.

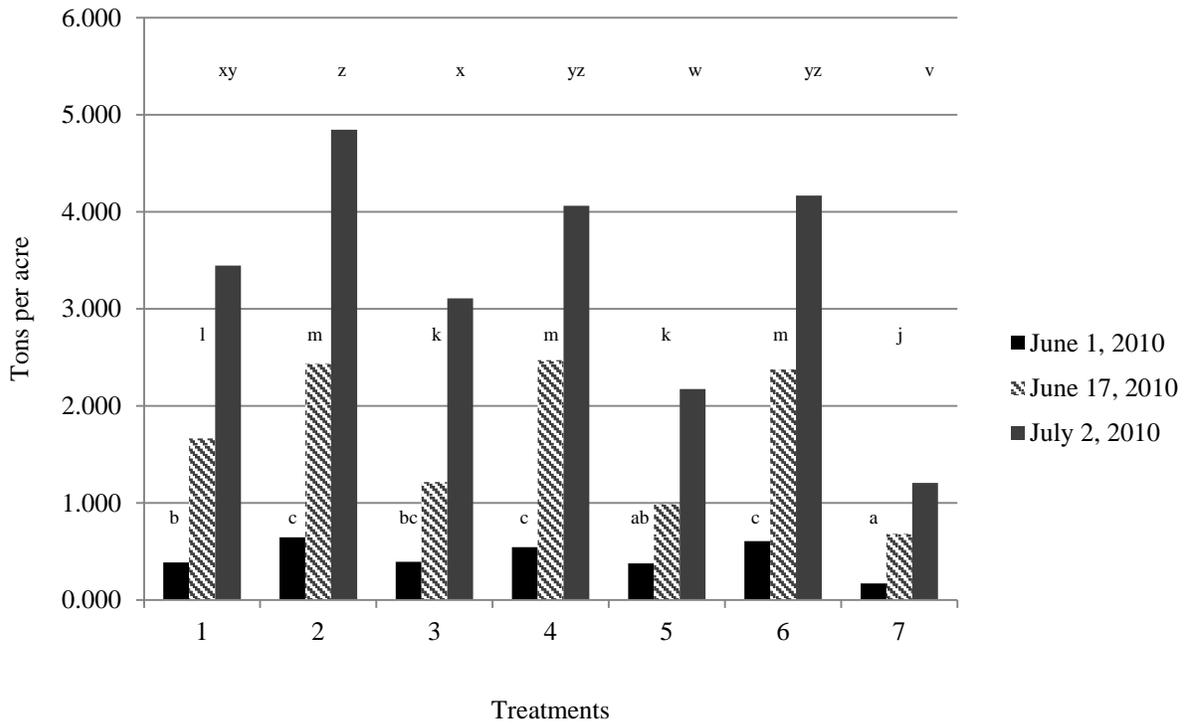
²Brassica Hybrid mix was 37.85% Hunter hybrid brassica, 25.84% Rangitikei rape, 18.94% Winfred hybrid brassica, and 17.17% Turnip.

Table 2. Nutrient composition and IVDMD of forage crop mixtures during 3 sampling dates.¹

	June 1, 2010				June 17, 2010				July 2, 2010			
	IVDMD, %	CP, %	NDF, %	ADF, %	IVDMD, %	CP, %	NDF, %	ADF, %	IVDMD, %	CP, %	NDF, %	ADF, %
Treatment 1	84.4	25.3	23.3	16.2	74.3	20	37.8	29.0	72.7	17.1	38.0	29.9
Treatment 2	82.5	25.8	30.6	17.3	78.1	17.2	42.7	27.1	65.2	8.1	62.4	37.9
Treatment 3	80.4	27.3	31.0	14.8	77.3	20.5	36.4	25.9	71.7	14.6	43.1	31.6
Treatment 4	82.5	25	29.3	18.0	77.1	13.2	42.4	26.7	59.8	7.7	63.2	38.3
Treatment 5	80.6	29	35.7	14.9	76.4	19.6	38.1	28.8	71.1	13.7	44.2	26.2
Treatment 6	83.4	25.1	33.6	30.5	78.8	14.6	43.9	19.1	59.0	7.5	62.2	41.2
Treatment 7	81.8	29.9	37.1	15.9	78.2	22.1	44.2	24.9	73.4	12.8	50.8	28.9

¹Values reported on a 100% DM basis.

Figure 1. Forage Production of No-till Forage Crops for Grazing Cattle



^{abc} Means with unlike superscripts are different ($P < 0.05$) during the first clipping (June 1, 2010).
^{ijklm} Means with unlike superscripts are different ($P < 0.05$) during the second clipping (June 17, 2010).
^{vwxyz} Means with unlike superscripts are different ($P < 0.05$) during the third clipping (July 2, 2010).

Table 3. In vitro digestibility and nutrient composition in clipped quality samples for cover crops (CC) and crested wheatgrass pasture (CWP).

Item	CC	CWP	SEM	<i>P</i> -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

²In vitro DM digestibility

Table 4. 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	<i>P</i> -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	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

¹ % DM

²In vitro DM digestibility

Table 5. Yields of each crop within cover crops (CC) treatment¹.

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	-	-

¹Values are a % of the total mass measured in each clip.

^{a,b}Means within a row with unlike superscripts differ ($P < 0.05$).

Table 6. Total dry matter production and Animal Unit Months available for cover crops and crested wheatgrass pasture.

	2011		2012	
	Total production measured June 28		Total production measured July 11	
	Cover Crops	Crested Wheatgrass	Cover Crops	Crested Wheatgrass
DM ton/acre	0.55	0.97	0.74	0.76
AUM/acre	0.40	0.69	0.53	0.54