Evaluation of Stockpiled Berseem Clover and Brown Midrib Sorghum x Sudangrass as Supplements for Grazed Cornstalks in Beef Cow Wintering Systems

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Summary

Berseem clover and oats were incorporated into a corn-corn-oat/berseem clover rotation in 1994 and 1995. Two cuttings of oat-berseem clover hay were harvested during the summer before forage was allowed to stockpile for winter grazing. In 1995, a brown midrib sorghum x sudangrass hybrid was seeded into a field adjacent to a corn field. After corn grain harvest in 1994 and 1995, Charolais x Angus x Simmental cows in midgestation were allotted to replicated fields containing corn crop residues with no complementary forages at 2.5 acres/cow, or corn crop residues and stockpiled berseem clover (2:1) at 2.5 acres/cow to simultaneously graze, or to a drylot. In 1995, cows were allotted to fields containing corn crop residues and brown midrib sorghum x sudangrass (7:3) at 2.5 acres/cow. Berseem clover had greater concentrations of digestible organic matter and crude protein than corn crop residues at the initiation of grazing, but had a more rapid decrease in digestible organic matter concentration than corn crop residues. Brown midrib sorghum x sudangrass forage also had a higher initial concentration of digestible organic matter, but an equal rate of decrease in digestible organic matter concentration to corn crop residues in ungrazed areas of the field. Cows grazing berseem clover with corn crop residues had greater body condition score increases during the first half of the grazing season than cows grazing corn crop residues without complementary forages. Cows grazing corn crop residues without complementary forages required 2,786 and 1,412 less lb hay per cow than cows maintained in a drylot in 1994 and 1995. In 1994, simultaneous grazing of berseem clover with corn crop residues did not reduce hay feeding more than feeding corn crop residues alone. However, in 1995, grazing berseem clover or brown midrib sorghum x sudangrass with corn crop residues reduced the amount of hay required to maintain cows by 358 and 376 lb hay per cow compared with grazing corn crop residues without complementary forage.

Introduction

Because feeding stored feeds is the single largest cost in cow-calf production, enterprise profitability may be improved by extending the grazing season into the fall and winter. Corn crop residues provide a forage resource for winter grazing of beef cows. In previous experiments, cows grazing corn crop residues needed .9 ton less hay to maintain body condition than cows maintained in a drylot. However, because they have low concentrations of energy, protein, phosphorus and vitamin A, corn crop residues need to be supplemented with other feedstuffs that supply these nutrients. The need for supplementation becomes particularly great late in the winter because weather damage further reduces forage nutritive value by leaching and metabolism of soluble nutrients, leaving poorly digested fiber.

Because of their high concentrations of energy and protein, winter grazing of stockpiled grass and legume forages has reduced the amount of hay needed to maintain cows by 1.25 ton/cow compared with maintaining cows in a drylot. Berseem clover is an annual legume that has recently been used in short term crop rotations. Similar to other legumes, berseem clover has high concentrations of energy and protein. Therefore, if stockpiled for winter grazing, berseem clover may be used to supplement corn crop residues if simultaneously grazed with cornstalks.

Because weathering removes the soluble nutrients from forages during winter leaving primarily fiber, having a fiber with a high digestibility may be valuable in winter grazing systems. Brown midrib hybrids of sorghum x sudangrass have a low concentration of lignin and, therefore, have a highly digestible fiber.

The objectives of this experiment were to evaluate the nutritive value of stockpiled berseem clover and brown midrib sorghum x sudangrass forages and to determine the amount of hay needed to maintain cows grazing corn crop residues either without stockpiled forages, simultaneously grazed with berseem clover, or sequentially grazed with brown midrib sorghum x sudangrass.

Materials and Methods

In the spring of 1994 and 1995, "Bigbee" berseem clover and "Frank" forage oats were seeded into replicate five-acre fields adjacent to 25-acre corn fields. Hay was harvested from the oat-berseem clover fields in two cuttings. In midsummer of 1995, a brown midrib sorghum x sudangrass hybrid was seeded into replicate three-acre fields at the end of two seven-acre corn fields.

After grain harvest, replicate 10-acre fields of corn crop residues were fenced with each five-acre berseem clover field to be grazed simultaneously. The fields containing brown midrib sorghum x sudangrass and corn crop residues were fenced to be grazed simultaneously. The remaining replicate 15-acre fields of corn crop residues were also fenced to be grazed. On November 3, 1994, and November 9, 1995,

Charolais x Angus x Simmental cows in midgestation were allotted to each corn crop residue, corn crop residue-berseem clover, and corn crop residue-brown midrib sorghum x sudangrass field at 2.5 acres/cow. In addition, 14 cows in 1994 and 12 cows in 1995 were allotted to replicate drylots. All cows were supplemented with hay as necessary to maintain a body condition score of five. Winter treatments were utilized for 140 days to March 10 in the winter of 1994-95 and 114 days to March 1 in the winter of 1995-96.

Cows were weighed monthly. Body condition was visually scored on a nine-point scale by two individuals biweekly. Corn stalks and brown midrib sorghum x sudangrass were sampled from four 4-m^2 locations monthly in grazed and ungrazed areas of the fields. At the end of the experiment, corn crop residues and brown midrib sorghum x sudangrass were also sampled from two 4-m_2 exclosures in each field. Berseem clover was sampled in twelve .25-m^2 locations monthly in grazed and ungrazed areas of the field during the experiment and from four .25-m^2 areas within exclosures at the end of the experiment.

Results and Discussion

In 1994, there was no difference in the initial yields of total or digestible organic matter of corn crop residues or berseem clover (Table 1). In contrast, organic matter yield at the initiation of grazing in 1995 was greater for corn crop residues than for berseem clover or brown midrib sorghum x sudangrass. Digestible organic matter yield, however, was greater for brown midrib sorghum x sudangrass than for the other two forages. In 1994, rates of loss for both total and digestible organic matter were greater for corn crop residues than berseem clover. In 1995, however, the rates of total and digestible organic matter loss were greater from berseem clover and brown midrib sorghum x sudangrass than for corn crop residues. Furthermore, in 1995, the rates of total and digestible organic matter loss were greater from grazed than ungrazed areas of the field.

In 1995, corn crop residues had a higher initial concentration of organic matter than berseem clover or brown midrib sorghum x sudangrass (Table 2). Furthermore, in both years of the experiment, corn crop residues had higher initial concentrations of neutral detergent fiber, acid detergent fiber, and acid detergent insoluble nitrogen and lower initial concentrations of crude protein and digestible organic matter than the other forages. In 1995, berseem clover had lower initial concentrations of neutral detergent fiber, acid detergent fiber and digestible organic matter and greater initial concentrations of crude protein and acid detergent insoluble nitrogen than brown midrib sorghum x sudangrass. In 1994, the rate of decrease in organic matter concentration was greater for corn crop residues than for berseem clover, implying greater soil contamination of corn crop residues. In 1995, however, the rate of organic matter loss was greater in berseem clover than corn crop residues and was greater for brown midrib sorghum x sudangrass than berseem clover. Over the winter of both years, the rates of increase in neutral detergent fiber and acid detergent fiber and the rate of decrease in digestible organic matter were greater for berseem clover than corn crop residues. In 1995, the rates of increase in the concentrations of neutral detergent fiber and acid detergent fiber in berseem clover were also greater than brown midrib sorghum x sudangrass. However, rates of change in digestible organic matter concentration did not differ between berseem clover and brown midrib sorghum x sudangrass. In 1994, the rate of increase in acid detergent insoluble nitrogen was greater in corn crop residues than in berseem clover. In 1995, however, the rate of increase in acid detergent insoluble nitrogen did not differ between forage species. The greater rates of loss in the concentrations of total and digestible organic matter and greater rates of increase in the concentrations of acid detergent fiber and acid detergent insoluble nitrogen from grazed than nongrazed areas of the corn crop residue and berseem clover fields imply that cows selectively grazed portions of the plants with lower fiber concentrations and greater digestibility. Similarly, the rate of loss in the concentrations of digestible organic matter was greater from grazed areas of the field than from ungrazed areas of the field implying selective grazing. This difference, however, seemingly was not caused by selective grazing against the fibrous portions of the plant.

In both years, cows grazing corn crop residues with berseem clover or maintained on hay in a drylot had greater bodyweight gains during the first half of the winter than cows grazing corn crop residues (Table 3). However, there was no difference in bodyweight gains between cows grazing corn crop residues or berseem clover during the second half of the winter or the entire winter season. Although hay supplementation was to be controlled to maintain a body condition score of five, seasonal body condition score increases were greater for cows grazing corn crop residues and berseem clover or maintained in a drylot than for cows grazing corn crop residues in the winter of 1994. In the first half of the winter of 1995, cows grazing corn crop residues with stockpiled berseem clover had greater increases in body condition than cows grazing corn crop residues or maintained in a drylot. In contrast, cows grazing corn crop residues and berseem clover had greater losses of body condition than cows grazing corn crop residues supplemented with alfalfa-grass hay during the second half of the winter in 1995-96. However, because of the increase in body condition that occurred during early winter, cows grazing corn crop residues with berseem clover had less loss of body condition during the entire winter season than did cows grazing corn crop residues with or without brown midrib sorghum x sudangrass forage or maintained in a drylot.

In both years, cows grazing corn crop residues without stockpiled forage required considerably less hay to maintain body condition than cows maintained in a drylot (Table 4). The low amount of hay needed by cows grazing corn crop residues likely resulted from the considerable amount of ear droppage that occurred in this field because of insect damage. In 1994, supplementation of corn crop residues with stockpiled berseem clover did not affect the amount of hay required to maintain the body condition of cows. In 1995, however, simultaneous grazing of berseem clover and corn crop residues or sequential grazing of corn crop residues and brown midrib sorghum x sudangrass resulted in less hay being required to maintain cows than grazing corn crop

residues alone. The only system in which hay was produced was from the oat-berseem clover fields. Therefore, over the two years of the experiment, 733 lb of hay per cow in excess of that fed was produced from the corn crop residue-berseem clover treatment whereas all of the hay fed in the other treatments came from outside the treatments.

Implications

Although corn crop residues will considerably reduce the need for hay feeding of gestating beef cows compared with maintenance in a drylot, stockpiled berseem clover provides supplemental nutrients to reduce the need for hay feeding even further. Because weather damage to berseem clover is considerable, it is most effective as a supplement to corn crop residues during late fall and early winter. Brown midrib sorghum x sudangrass forage has a high digestibility at the initiation of the winter and loses its digestible organic matter concentration at a low rate. As a result, stockpiled brown midrib sorghum x sudangrass forage can provide a relatively high quality forage late in the winter. Unfortunately, the brown midrib sorghum x sudangrass hybrid is still in the experimental stage of development and is not currently available to the public.

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Table 1. Initial and daily changes in the yields of total and digestible organic matter of corn crop residues, berseem clover and brown midrib sorghum x sudangrass forages.

	Initial, lb/ac			Change, lb/ac/day					
				Corn crop residues (CCR)		Berseem clover (BC)		Brown midrib sorghum x sudangrass (SS)	
Year	CCR	BC	SS	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed
					Organic matter				
1	5293	4730	-	-14.3	-10.1	2.9	1.7	-	-
2	4878	4125	4163	-17.4	-4.3	-20.6	-20.3	-24.7	-17.1
					Digestible organic matter				
1	2497	2593	-	-9.2	-8.5	-6.0	-7.3	-	-
2	2422	2506	2815	-10.6	-5.0	-13.8	-13.5	-19.9	-12.6

Table 2. Initial and daily changes in the compositions of corn crop residues, berseem clover and brown midrib sorghum x sudangrass forages.

	Initial, %			Change, % units/day					
				Corn crop residues (CCR)		Berseem clover (BC)		Brown midrib sorghum x sudangrass (SS)	
Year	CCR	BC	SS	Grazed	Ungrazed	Grazed	Ungrazed	Grazed	Ungrazed
				Organic matter, % of dry matter					
1	90.6	91.4	-	-.18	-.14	-.04	-.04	-	-
2	93.6	88.6	87.8	-.01	-.01	-.09	.01	-.11	-.04
				Digestible organic matter, % of organic matter					
1	47.2	54.7	-	-.09	-.09	-.16	-.16	-	-
2	49.7	60.6	67.6	-.08	-.06	-.12	-.08	-.22	-.06
				Neutral detergent fiber, % of organic matter					
1	77.7	60.1	-	.02	-.01	.08	.06	-	-
2	76.5	43.4	64.3	.01	-.02	.11	.12	.04	.05
				Acid detergent fiber, % of organic matter					
1	49.5	40.1	-	.07	.03	.11	.09	-	-
2	48.3	29.3	38.1	.05	.01	.12	.07	.07	.07
				Crude protein, % of organic matter					
1	5.2	14.1	-	.01	.01	.02	.02	-	-
2	4.7	17.3	11.2	0	0	-.04	0	-.01	-.02
				Acid detergent insoluble nitrogen, % of total N					
1	24.2	16.9	-	.14	.06	.10	.08	-	-
2	17.9	13.5	7.0	.03	.03	.06	.01	.06	.05

Table 3. Weight and condition score changes of cows maintained in a drylot or by grazing corn crop residues without or with stockpiled berseem clover or brown midrib sorghum x sudangrass forage.

Year	Item	Winter system			
		Drylot	Corn crop residues		
			w/o complementary forage	w/ berseem clover	w/ brown midrib sorghum x sudangrass
1	Body weight, lb				
	Initial	1410[a]	1395[b]	1388[c]	-
	Seasonal change,				
	Early	78.5	15.4	71.1	-
	Late	126.5	124.5	101.4	-
	Total	205.0	139.9	172.5	-
	Condition score				
	Initial	5.1	5.2	5.2	-
	Seasonal change,				
	Early	.36	-.25	.44	-
	Late	.75	.45	.46	-
	Total	1.11[a]	.20[b]	.89[ab]	-
2	Body weight, lb				
	Initial	1388	1401	1399	1366
	Seasonal change,				
	Early	73.5[ac]	-9.7[b]	90.4[a]	7.9[bc]
	Late	33.0	89.5	40.9	68.0
	Total	106.5	79.6	131.3	75.9
	Condition score				
	Initial	5.3	5.4	5.4	5.5
	Seasonal change,				
	Early	.29[a]	-.08[b]	.76[c]	.26[a]
	Late	-.75[ab]	-.30[a]	-.84[b]	-.75[ab]
	Total	-.46[ab]	-.38[ab]	-.08[a]	-.50[b]

[abc]Differences between means with different superscripts are significant.

Table 4. Amounts of hay produced and fed to cows maintained in a drylot or by grazing corn crop residues without or with stockpiled berseem clover or brown midrib sorghum x sudangrass forage.

Item	Winter system			
	Drylot	Corn crop residues		
		w/o complementary forage	w/ berseem clover	w/ brown midrib sorghum x sudangrass
Hay production, lb/ac				
Year 1	0[a]	0[a]	1815[b]	-
Year 2	0[a]	0[a]	2364[b]	0[a]
Hay fed, lb/cow				
Year 1	4118[a]	1432[b]	1613[b]	-
Year 2	3881[a]	774[b]	416[c]	398[c]
Hay balance, lb/cow				
Year 1	-4118[a]	-1432[b]	-99[c]	-
Year 2	-3881[a]	-774[b]	1562[c]	-398[c]

[abc]Differences between means with different superscripts are significant.