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A Review of Corn Stalk Grazing on Animal Performance and Crop Yield

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Summary

The highest cost to beef cow-calf and backgrounding operations is the feeding of stored feeds in winter months. Nebraska has an abundance of corn fields available for grazing following harvest. Utilization of corn crop residue is quite effective in reducing feed costs. There are a number of important considerations associated with residue utilization. Stocking rates, diet quality, genetically modified corn, subsequent crop yields and supplementation are discussed.

Introduction

The highest cost to beef cow-calf and backgrounding operations is the feeding of stored feeds in winter months. To lower feed costs, many producers attempt to extend the grazing season by utilizing corn crop residues. Although corn crop residue grazing is quite effective in reducing feed costs, some producers are concerned that it will have an adverse effect on subsequent crop yields. Other recent concerns include the possibility that genetic enhancements to corn may affect cattle performance when residue is grazed. The objective of this article is to summarize University of Nebraska research conducted on corn crop residue and crop production.

Procedure

This review summarizes Nebraska Beef Report articles and several other publications produced by University of Nebraska research. Reports containing information on corn stalk grazing and cattle performance were utilized as well as the impacts of corn hybrid differences and grazing impacts on subsequent crop yield were utilized.

Table 1. Relative amounts and values of corn residue plant parts.

	Plant Parts			
Item	Husk	Leaf	Stem[a]	Cob
Percent of residue dry matter	12	27	49	12
Crude protein, % DM	3.6	7.8	4.5	2.2
In vitro dry matter disappearance, %	67	47	45	35
Palatability	High	High	Low	Low

[a] Includes leaf sheath.

Results

Quality

Stalk grazing is a unique situation. All of the feed is on the ground at the start of grazing. Forage quality changes during the growing season in summer pastures. Stalks don't change over time like growing forages. However, fields that are grazed can change in quality but for reasons discussed later. Residual grain is the highest-quality feed component available in the field. Forage residue consists of four distinct qualities and apparent palatabilities (Table 1). The husk is digestible and palatable. The leaf is palatable, but not as digestible as the husk. The stem and cob are low in both digestibility and palatability and are consumed only when the amount of remaining leaf and husk is small. The leaf and husk are about 39% of the total corn residue. Cows or calves prefer the grain, followed by husks and then leaves. Stalks (stems) and cobs are rarely consumed. Digestibility of forage components in the field declines daily because of consumption of more digestible parts, trampling, and environmental losses (1988 Nebraska Beef Report, pp 31-33). Logically, greater stocking rates produce a faster decline in diet digestibility.

Digestibility of the diet is quite high at the initiation of grazing, but declines with time because of selection of the more digestible parts early in the grazing period (Figure 1). This decline is over a 60 day grazing period stocked so that essentially all of the leaf and husk was consumed (about 1/3 of the residue). If two animals grazed the same area, the decline would occur over 30 days. If 30 animals grazed the same are, then the decline would occur in 2 days. The only way to minimize this decline with time is to strip graze or move cattle so that new, ungrazed residue is available every few days. It is not clear if the effort and expense are worth the returns. The target gains of the calves or cows will dictate the management program. Many factors affect the average digestibility of the residue consumed. The average is 54-55% digestibility (TDN) but this could vary from 50% to 60%.

Forage disappearance rates are generally lower during winter months, likely because many of the environmental losses have occurred prior to initiation of grazing. Also, less trampling occurs during the winter because of frozen ground. Mud during fall months can reduce forage availability rapidly. The effect of trampling during muddy conditions can be minimized by strip grazing or shifting cattle to a grass sod or drylot during muddy conditions.

Stocking Rates

Stocking rate influences the amount of grain, husk and leaf available per animal. The amount

(Continued on next page)

of grain and husk available affect diet quality because both are highly digested. When smaller quantities of these are available at the initiation of grazing because of hybrid differences, more leaf is consumed, total intake declines and the animals eventually eat stems and cobs. The rate of decline in digestibility is affected by stocking rate, trampling, residue components available and environmental factors. Previous comparisons have shown that gains increase as stocking rate decreases. Stocking rate influences the quality of the diet consumed and, consequently, the animal performance. If cows are in good condition when stalk grazing is initiated, stocking rates can be high. Alternatively, if cows are in poor condition, the stocking rate should be relatively lower so that some improvement in condition can be made.

Residue (leaf and husk) yield is related to grain yield, but hybrids obviously vary in this relationship. With high producing corn (irrigated or with ample rainfall) there will be about 16 lb dry leaf and husk per bushel corn yield. The specific relationship is: lb leaf and husk per acre = ([bu/acre corn yield x 38.2] + 429) x 0.39. Some residue disappears by trampling and other factors. We estimate 50% utilization of the leaf and husk. Therefore, 150 bu corn produces 2400 lb leaf and husk and 1200 is consumed. This is equivalent to about 1.75 AUM. One acre would carry a 1200 lb cow for 44 days or a 600 lb calf for 88 days. Higher grain yields provide more AUM and lower yields less.

Previous research has shown gains in 56 days increased from 10 lb at a stocking rate of 0.5 acres per cow per month to 70 lb at a stocking rate of 2 acres per cow per month. Stocking rates of 0.5 acres per cow per month can provide gains of 20 and 40 lb in 56 days by continuous and strip grazing respectively. Strip grazing, or moving cattle to a new field every two to four weeks allows for a greater grazing capacity.

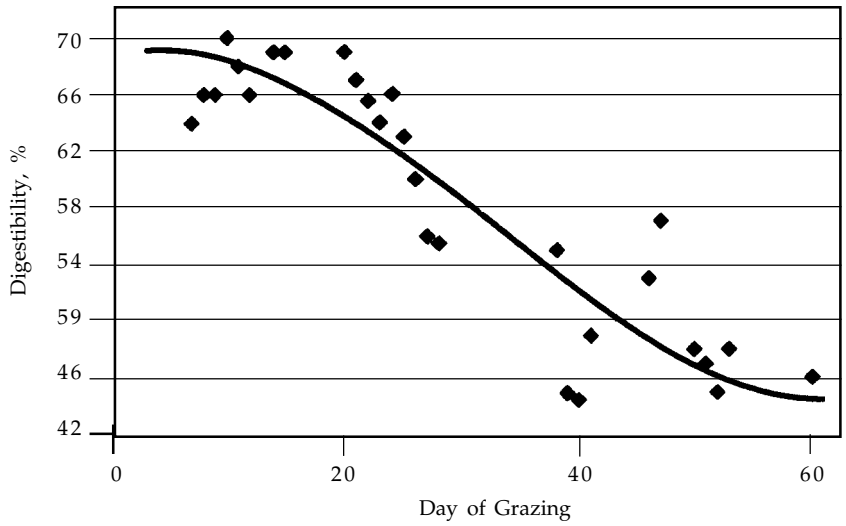

Figure 1. ***In vitro*** **dry matter disappearance of the roughage fraction of diets selected by esophageally fistulated calves grazing cornstalks.**

Genetically Modified Corn

Recent concerns with changes in animal performance due to genetically modified corn residues have also been evaluated. Steer calves grazing four different fields of corn residue (Bt corn root worm protected, nonBt, RR and nonRR) stocked at equal stocking density (1.06 acre/steer/60 days) were used to evaluate genetic enhancement on animal performance (2003 Nebraska Beef Report, pp 18-19). Steer performance was not different between Bt corn root worm protected or RR hybrids and their parental controls following the 60 day grazing period. The animal performance demonstrates feeding value of corn residue does not differ between genetically enhanced corn hybrids and their non-genetically enhanced parent hybrid. Similar research at the University of Nebraska also showed no difference in steer performance due to the incorporation of the Bt trait for corn borer protection (2001 Nebraska Beef Report, pp 39-41). There was also no preference between Bt and nonBt hybrids. During the grazing period, 47.5% of the steers were observed grazing Bt residue, and 52.5% of the steers were observed grazing nonBt residue.

To determine the effects of grazing crop residues for Bt-corn hybrids on performance of pregnant beef cows, one non Bt-corn hybrid and three Bt-corn hybrids were compared (2001 Iowa State Beef Research Report, pp 32-41). Rates of change in the concentrations of digestible dry matter and CP over winter were not significantly affected by corn hybrid. Mean amounts of hay required to maintain body condition score of cows maintained in a drylot were greater than cows grazing crop residues (3199 vs 825 lb/DM/cow) but did not differ between corn hybrids.

The data from these experiments suggest genetic enhancement has no effect on corn residue utilization by grazing beef cattle. Producers can take advantage of increased yields and reduced herbicide/pesticide use with Bt corn root worm protected or RR hybrids without adverse effects on corn residue grazing performance.

Time of Grazing and Crop Yield

Experiments were conducted during the fall and winter to evaluate performance of calves grazing cornstalks on conventional and ridge-till fields (1997 Nebraska Beef Cattle Report, pp 27-29). In these crop residue grazing experiments, calf stocking rate was 1.2 head/acre for a 60 day grazing period from December to February. To determine impact of grazing, yields were measured by

machine harvest the following fall from grazed and ungrazed areas of each tillage method. The three-year yield averages for ridge-till and conventional systems show little difference between treatments. Corn yields averaged 96, 101, 96 and 98 bu/acre for grazed ridge-till, ungrazed ridge-till, grazed conventional, and ungrazed conventional, respectively.

Cows grazed corn residue under 1/4 of a center pivot irrigation system in December and January. This was compared to 1/4 of the center pivot that was ungrazed. Irrigated soybeans were planted in the spring of each year and yields measured on the grazed and ungrazed fields in the fall. Results indicate no effect on soybean yields from grazing corn stalks during the fall and winter. For the three years of the experiment, soybean yields were similar for grazed and ungrazed fields.

Because no differences were observed due to winter grazing, spring grazing was evaluated to determine the impact of compaction on subsequent crop yield. When grazing caused surface compaction we hypothesized that tillage would offset the compaction and maintain yield. Crop production was based on an annual corn-soybean rotation with one-half of the field planted to each crop. Tillage treatments included ridge-tilling during the summer, no-tillage, fall tillage with a chisel followed by conventional tillage (disk) in the spring, or spring conventional tillage alone. All tillage treatments were conducted during the corn rotation with no tillage following the soybean crop. The first grazing trial (2001 Nebraska Beef Report, pp 43-45) was conducted with a calf stocking rate of 0.8 acres per calf for 60 days. The stocking rate was based on average stocking rates to optimize animal performance. Soybean yields showed no difference between grazed and ungrazed treatments. Spring and fall tillage treatments had no effect on soybean yield when compared to the no-till treatments. Corn yields two years post grazing showed no significant differences due to grazing or tillage treatments.

With this in mind the second two-year grazing trial (2003 Nebraska Beef Report, pp 20-21) was conducted with stocking rate increased 2.5 times to 0.32 acres per calf for 60 days. Overall grazing improved soybean yields over ungrazed treatments ($P = .015$) and included significant improvement in yield in no-till grazed over no-till ungrazed treatments. Spring and fall tillage had no effect on soybean yield when compared to no-till treatments. There was a trend ($P = .11$) for grazing to reduce corn yields the second year after grazing when compared to the ungrazed treatments. The no-tillage grazed treatment showed a significant depression in yield compared to no-tillage ungrazed treatment ($P = .05$). The ridge-till grazed treatment showed no difference when compared to ridge-till ungrazed treatment ($P = .79$). This suggests that grazing of ridge-till stalks in the spring is not detrimental to subsequent corn yields.

Grazing Impacts on Soil Density

A three-year study was conducted to evaluate the impact of grazing on soil density (2003 Iowa State Beef Research Report, pp 54-61). After corn grain harvest, fields were divided to determine the effects of cornstalk grazing on the yields of soybeans planted with no tillage or tillage once with a disk the year following grazing. Stocking rate was 0.67 acres/cow/28 days in each year. Soil samples were collected to determine any differences in soil bulk density present before and after grazing. Neither the initial soil bulk measurements nor the post-grazing soil bulk density ratios of areas grazed in any month have differed from the ungrazed areas in the three-year study. Post-grazing soil moisture contents did not differ between grazed and ungrazed paddocks in all three years.

Soybean yields did not differ between ungrazed and grazed areas in fields planted by disking or no tillage. However, soybean yields in the areas grazed in the second period were 8% lower ($P<0.05$) than ungrazed areas in fields planted with no tillage in year 3. The decrease in yield with the no tillage system in year 3 seemed to be an effect of the ground not being frozen during this time period. Therefore the effects of grazing corn crop residue by beef cattle on soil physical properties and subsequent soybean yields will be reduced if grazing is restricted to periods of below freezing soil temperatures.

Supplementation

Protein supplementation is necessary for calves grazing cornstalks. There is some indication that a protein supplement with at least 0.36 lb of escape protein per head per day is appropriate to get the best weight gains with calves. Total protein supplementation may need to be as high as 0.9 lb per day. Calves probably need more supplemental protein early in the grazing period than later because of their need to use the higher energy content of the diet at that time (Gutierrez-Ornelas et al., 1991, Journal of Animal Science, 69:2187-2195).

Corn milling byproducts, corn gluten feed and distillers grains, are readily available and excellent supplements for calves or cows grazing stalk fields. They are excellent sources of protein (16 to 30%), phosphorus (0.8 to 1.0%) and energy (100 to 125% energy value of corn grain). Byproducts could be used as a protein supplement and more could be fed to supply additional energy if needed (2001 Nebraska Beef Report, pp 41-43). Further, high levels could be limit-fed for short periods during periods of snow cover or mud.

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