ID-152

UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY—COLLEGE OF AGRICULTURE

Grazing Corn: An Option for Extending the Grazing Season in Kentucky

D.C. Ditsch, J.T. Johns, S.G. Isaacs, T.B. Mark, and C.D. Lee

Introduction

Grazing is the cheapest way to feed cattle on a cost per pound of nutrient basis. However, producers with limited land resources in Kentucky have been able to use commodities or grain by-products to increase cattle numbers due to low cost and availability of these inputs. Extending the grazing season is one solution that would enable producers to reduce costs and expand production with little or no impact on the environment.

Corn is not a traditional grazing crop in Kentucky, but results from several on-farm trials in southeastern Kentucky suggest that grazing corn could be part of such an extended grazing program. In addition:

- Significant increases in animal production per unit of land area from grazing standing mature corn during late fall/early winter are possible and economical. Grazing corn during late fall/early winter allows producers to take advantage of historically positive changes in market prices from fall to spring. For the cow-calf producer, reducing winter feed and labor costs are of major importance. Grazing standing corn with beef cattle could reduce dependence on hay, provide an opportunity for fall pastures to rest and accumulate, and allow extended grazing into the early winter.
- November through March is typically a nonproductive period for cool-season forage crops in Kentucky, requiring the feeding of stored feeds. If cattle are used to harvest standing corn, there is no need for harvesting, storage, and feeding of this high-energy feed, which should reduce equipment needs, fuel costs, capital investment, and labor costs.
- Grazing can be managed with temporary fencing and properly placed watering systems. Such systems return the manure to the land and thus promote nutrient cycling and minimize potential impacts on ground and surface water. Soil erosion potential is greatly reduced with the plant residue cover that is maintained on the land.

Field Selection

Selecting a good site is the first and probably the most important step in establishing grazing corn. The following characteristics should be considered when selecting a field for grazing standing mature corn:

1) the need for renovation,
2) corn yield potential,
3) drainage characteristics, and
4) access to livestock water.

Planting corn in a pasture or hay field that needs to be renovated due to increasing weed pressure and/or the absence of preferable forage species is an excellent practice that breaks the cropping cycle and allows for a wider spectrum of herbicides to be used in preparation for future re-seeding of forage species. Producers not familiar with weed control options in corn production should carefully select herbicides that do not present a carry-over risk to spring-seeded forage grasses and legumes following winter corn grazing. Likewise, careful attention needs to be paid to the most appropriate herbicides for corn weed control. Poor selection of herbicides for optimum weed control and corn production can result in lower yields and increased weed pressure in subsequent years.

The economic feasibility of grazing corn is highly dependent on maximizing the number of grazing days per acre, which is a function of dry matter and/or grain yield per acre. Attention to details such as corn hybrid selection, weed control, planting date, planting depth, and plant population are important for optimum yields.

Soils that are poorly drained or subject to a high water table should not be considered for late-season grazing. Wet soil conditions are common during the winter months with temperatures often above freezing. Concentrated animal traffic during this period can result in soil compaction, increased soil erosion, lower corn utilization, and a rough surface requiring tillage to correct. The best sites for late-season corn grazing have good surface and internal drainage.

Access to good quality livestock water is an important feature when selecting fields for corn grazing. Portable systems work well for summer or fall grazing, but water systems protected from freezing are necessary for late-winter grazing. Livestock access to ponds, creeks, and streams should be avoided when possible.

Corn Hybrid Selection

The economic feasibility of grazing corn is highly dependent on the number of grazing days per acre, which is a function of dry matter and/or grain yield per acre. Attention to details such as corn hybrid selection, weed control, planting date, planting depth, and plant population are all important regardless of whether the corn is to be grazed or harvested for grain.

Few seed corn companies evaluate and advertise their corn hybrids for livestock grazing, and little information is available to help guide producers in deciding which seed corn to use. However, for midsummer grazing, silage-type hybrids appear to be the best choice. For late-winter grazing, hybrids that have high grain yield potential and stand well should be considered. According to field trials at the UK Robinson Station, not all corn hybrids stand well for winter grazing or protect the ear from weather loss (Table 1).

Corn hybrids that perform well in the Kentucky Hybrid Corn Test should be good candidates for grazing corn. The Kentucky Hybrid Corn Test ranks hybrids based on harvestable yield. For corn to rate high in yield, it must produce large ears, maintain those ears on the stalk, and remain upright for mechanical harvest. These traits should lend themselves to grazing corn late in the year.

Selecting good hybrids is a major part of ensuring an adequate feed source for grazing. However, timely planting, proper plant population, proper fertilization, and early-season weed control are all factors that need to be managed for successful corn grazing. Corn should be planted somewhere between April 1 and May 1 in western Kentucky and between April 15 and May 15 in central and eastern Kentucky. Corn seeding rates should be targeted at final stands ranging from 22,000 to 30,000 plants per acre. Soil pH should be in the range of 6 to 7 for optimum nutrient availability. Weeds need to be managed early in the season to maximize corn growth. Weeds occurring in the field after the corn has reached physiological maturity (blacklayer) pose no threat to corn yields. For more information on corn production, consult ID-139, *A Comprehensive Guide to Corn Management in Kentucky*, which is available through your county Extension office or online at http://www.ca.uky.edu/agc/pubs/id/id139/id139.htm.

Table 1. Corn hybrid evaluation for late-season grazing—Robinson Station (2001).

Hybrid	% Standing	Grain Yield (bu/ac)	Population plants/ac
NK83r7	97.2 a*	229.4 a	23,320 a
NX9188	93.9 a	207.1 a	21,690 abc
DK720s	92.4 a	147.3 b	18,330 bc
Pioneer 3527	87.9 ab	142.4 b	17,610 bc
Baldridge AmGraze	62.6 bc	98.4 c	17,510 c
Baldridge 38	55.9 c	135.8 b	22,050 ab
Baldridge 33	40.2 c	156.7 b	21,690 abc

* Values within a column followed by the same letter are not significantly different at the 95% level of probability.

Planting Date: 5-30-01

Harvest Date: 11-5-01

Winter Grazing Efficiency

Results from on-farm trials in Pulaski and Laurel counties indicate that beef cows and stocker cattle that continuously graze standing mature corn can utilize approximately 80% to 90% of the grain produced (Table 2). In 2001-2002, grazing efficiency (i.e., percent grain consumed) on Farm No. 4 was only 48% due to high rainfall and subsequent weathering loss of grain that remained in contact with moist soil during a 62-day winter grazing period. In contrast, the highest grazing efficiency measured during this study was 99% on Farm No. 3 in 2002-2003 during a 91-day winter grazing period (Table 3). Unfortunately, the higher grazing efficiency resulted in a lower average daily gain (ADG) compared to the grazing efficiency of 48% (1.13 lb and 2.22 lb, respectively).

In another on-farm trial in Laurel County, grazing efficiency and animal performance under continuous and strip grazing were compared (Table 4). Stockers in the strip grazing field were given access to 1-acre allotments of corn using one strand of electric fence, then moved to a new strip at the discretion of the producer. Strips were laid out so stockers could return to previously grazed strips for further grazing. Grain yield in the continuously grazed field was low due to high johnsongrass weed pressure. Cattle could only be maintained on the strip and continuously grazed fields for 44 and 48 days, respectively. In general, grazing efficiency was higher with strip grazing compared to continuous grazing (89.7% and 73.7%, respectively). Strip grazing limits cattle access to the corn crop and requires a higher level of management to ensure an adequate rate of intake for optimum animal performance. Continuous grazing requires less management but often results in less utilization of the corn crop due to a combination of animal traffic and weathering loss of grain. These results suggest that as grain utilization increases, individual animal intake decreases, resulting in reduced animal performance. The decision to terminate corn grazing in a given field is based entirely on the producer's assessment of the amount of corn remaining and

Table 2. 2001-2002 corn grazing project in southeast Kentucky.

Farm	Acres	Head	Stocking Density	Grazing Days	Grazing Period	Grain Yield	Grazing Efficiency	ADG
			hd/ac			bu/ac	%	lbs
1	5.5	82	14.9	43	10/30-12/13	148.3	89.7	1.77
1	11.8	73	6.2	47	9/7-10/25	44.8	73.4	2.47
2	12.4	64	5.2	68	11/30-2/5/02	107.5	93.7	1.66
3	10.5	25	2.4	89	11/18-2/15/02	89.1	85.4	1.95
4	8.9	45	5.0	62	11/24-1/26/02	51.3	48.1	2.22
Mean						82.9	78.1	2.0

Table 3. 2002-2003 corn grazing project in southeast Kentucky.

Farm	Acres	Head	Stocking Density	Grazing Days	Grazing Period	Grain Yield	Grazing Efficiency	ADG
			hd/ac			**bu/ac**	**%**	**lbs**
1	13.4	120	8.9	28	9/3-10/2	67.5	97.0	1.45
1	4.4	73	16.6	21	11/13-12/5	77.7	90.7	1.05
1	6.3	47	7.5	41	12/5-1/16/03	94.9	97.0	2.12
2	5.8	38	6.6	52	2/5-4/2/03	128.5	58.0	1.34
3	13.7	32	2.3	91	11/24-2/22/03	90.8	99.0	1.13
4	7.25	43	5.9	64	12/1-2/2/03	132.5	NA	2.13
Mean						82.3	88.3	1.49

the rate of cattle intake. Therefore, the goal for managing the grazing period should not be to maximize utilization of grain. Based on these studies, a grazing efficiency of 80% should be the goal for grain utilization and best animal performance.

Table 4. Strip vs. continuous grazing of standing mature corn with stockers in southeast Kentucky (2001).

Grazing System	Strip	Continuous
Head	82	73
Acres	5.5	11.8
Stocking Density (hd/ac)	14.90	6.18
Grain Yield (bu/ac)	148.3 (total 815.7 bu)	44.8 (total 528.6 bu)
Days Grazed	44	48
Average Daily Gain (lb)	1.77	2.42
Grazing Efficiency (%)	89.70	73.4

Economic Evaluation of Corn Grazing Studies 2001-2003

The economic benefits of grazing standing corn crops with stocker beef cattle are quite variable. Determination of profitability depends greatly on assumptions concerning the methodology of expensing the homegrown feed.

Economists and farmers often disagree on the method of determining the cost of homegrown resources. The **economic cost** method would expense the resource at its opportunity cost, or the value the resource would have in its best alternative use. This opportunity cost would often be a market price minus any transactions costs associated with the sale of the resource. For pasture, this might be the prevailing rental rate for pasture of similar quality. For harvested hay, it might be the market price for the hay minus any transportation or handling costs. For the standing corn in this study, it might be the market price for grain minus the costs of harvest, storage, and transportation.

An alternative method of expensing the resource is at its **production cost**. For pasture or hay, this might be the cost to seed, fertilize, maintain, harvest, and store the crop. For the corn in this study, it would be the cost of seed, fertilizer, chemicals, and machinery to grow the crop. This cost of production method may be appropriate when the alternatives (or opportunities) to market the resource are limited.

In evaluating corn grazing, it is appropriate to use and compare both methods. Harvested corn is a commodity that generally has a well-defined and accessible market with an easily identified market price. Therefore, in most cases the opportunity cost, or **economic cost**, of corn can be readily determined. However, some farms could produce corn on steep land that could not be easily harvested mechanically. In some cases, harvesting, storage, and transportation equipment may be limited. Therefore, the opportunities or intentions to market the corn might be limited, making a **cost of production** approach more appropriate.

Enterprise budgets were constructed from the production data in this study to determine the profitability of the grazing systems. Revenue was the out-weight of the stockers multiplied by the sale price for Kentucky feeder steers for the appropriate weight and date at the end of each study. Costs for this study were limited to variable operating costs. These costs included the purchase price of the stockers (again, based on the weight and beginning date of the study), veterinary and medicine costs (standardized at $15 per head), feed and mineral costs, feeding labor, and an interest charge on the investment in the stocker. Net returns then are identified as a return over variable costs. No fixed cost charges for land, machinery, or management were assessed. The net return would be the residual payment to the fixed resources.

For purposes of this evaluation, budgets for both economic cost and cost of production were used and compared. The economic cost budgets charge the corn at its opportunity cost, while the cost of production budgets charge the corn at the variable cost required to produce the crop. Economic cost is the local market price of the corn multiplied by the estimated yield per acre minus the cost of harvesting the corn. Market value of the corn was determined by multiplying the estimated grain yield of the plot times a market value of $2.50 per bushel. Harvesting costs of $22/acre were subtracted from the market value to determine economic costs because, in this case, the livestock will harvest the crop. Costs of production per acre of corn were assumed to be $125/acre for all the farms.

Net returns per head are presented in Table 5 for the 2001-02 grazing season, both on a cost of production and an economic cost basis. Net returns were variable, with two farms receiving positive returns in each cost determination method. Net returns are significantly affected by market price for stockers. The price differential between purchase and sale price is often the most important determinant of profitability. Therefore, costs per pound of gain are also presented in Table 5. Cost of gain on a production cost basis suggests that corn grazing is a relatively economically efficient way to add value to stockers. Costs of gain ranged from 44 cents to 54 cents per pound in these studies when the corn was valued at its production cost. Costs generally were about 20 cents per pound higher when the corn was valued at its opportunity cost. The exception is the Producer 1 CG study, where very low corn yields (44.8 bu/ac) led to low opportunity costs per acre for the grazed corn.

Only one farm was profitable on either cost determination basis (Table 6). The cost of gain values were more variable, ranging from 33 cents to 91 cents per pound on a cost of production basis. Economic cost of gain was uniformly higher than cost of production levels indicating the value of higher corn yields.

Summary

On-farm trials in southeast Kentucky suggest that grazing beef cattle on standing mature corn may be a viable option for extending the grazing season. No significant impact on surface water quality was noted. During the two-year study period reported, no herd health problems such as laminitis (founder) or grain overload were observed. Animal performance measured as average daily gain was highly variable, ranging from 1.05 to 2.47 lb, and appeared to be related to grazing efficiency and corn grain yield. Although the relationship between ADG and grazing efficiency in this study was weak (R^2=0.143, data not shown), it does suggest that managing grazing for maximum grain utilization may limit intake and result in lower cattle weight gain. Economic analysis suggested that cost of gain was also highly variable, ranging from 33 cents to 91 cents per pound.

Grazing days per head per acre were also highly variable in this study, ranging from 211 to 637. This is most likely related to variable grain yield levels and the subjective management decision to terminate grazing in each field. More data will be necessary to evaluate the relationship between corn grain yield and grazing days per head per acre for predictive purposes.

Producers with limited grain crop production experience and potentially erodible land should pay close attention to no-till production details, such as setting planters for optimum plant populations, seeding depth, and weed control to improve their odds of economic success. More work is also needed to evaluate corn hybrids suitable for late-season grazing. In addition to high grain yield potential, corn hybrids for late-season grazing need to produce a strong stalk capable of standing and supporting the ear to reduce weathering loss. Farmers unfamiliar with corn production may choose to contract the production with a farmer who regularly grows corn.

Firm conclusions on the profitability of grazing corn are difficult to draw from these results. Clearly, the method of determining costs could lead to very different conclusions. For farms with corn harvesting and storage equipment and an accessible local market, these results would seem to suggest that selling the corn is the best option. On farms where the opportunity cost of the corn is low or approaches cost of production, grazing the corn seems to have merit. This is not a clear-cut economic decision. Yield potential, alternative markets for the corn, alternative uses for the land, and other factors may influence this decision.

Table 5. 2001-02 economic evaluation.

	Producer 1 CG**	Producer 1 SG*	Producer 2	Producer 3
Acres Grazed	11.8	5.5	12.4	10.5
Animals Grazed	73	82	64	25
Stocking Density (hd/ac)	**6.18**	**14.90**	**5.16**	**2.38**
Total Gain (lb/head)	116	75	113	174
Days Grazed	49	43	67	89
ADG	**2.37**	**1.74**	**1.69**	**1.96**
Cost of Production Basis ($/hd)				
Revenue	$649.44	$553.50	$490.23	$514.64
Cost	$654.93	$569.40	$484.22	$477.05
Net return	($5.49)	($15.91)	$6.02	$37.58
Economic Cost Basis ($/hd)				
Revenue	$649.44	$553.50	$490.23	$514.64
Cost	$649.27	$584.41	$507.73	$508.96
Net return	$0.17	($30.91)	($17.50)	$5.68
Cost of Gain ($/lb)				
Cost of Production Basis	$0.44	$0.53	$0.50	$0.54
Economic Cost Basis	$0.39	$0.73	$0.70	$0.73

*SG=Strip graze; **CG=Continuous graze

Table 6. 2002-03 economic evaluation.

	Producer 1	Producer 1	Producer 2	Producer 3	Producer 4
Acres Grazed	13.4	4.4	5.75	13.66	7.25
Animals Grazed	120	73	38	32	43
Stocking Density (hd/ac)	**8.95**	**16.59**	**6.55**	**2.34**	**5.89**
Total Gain (lb/head)	41	48	70	103	137
Days Grazed	28	42	52	91	64
ADG	**1.46**	**1.14**	**1.34**	**1.13**	**2.13**
Cost of Production Basis ($/hd)					
Revenue	$472.13	$475.04	$ 382.98	$ 395.57	$ 529.83
Cost	$498.10	$489.85	$ 424.69	$ 446.21	$ 444.81
Net return	($25.97)	($14.81)	($41.71)	($50.64)	$85.02
Economic Cost Basis ($/hd)					
Revenue	$472.13	$475.04	$ 382.98	$ 395.57	$ 529.83
Cost	$500.41	$492.64	$ 450.91	$ 479.93	$ 475.70
Net return	($28.28)	($17.60)	($67.93)	($84.36)	$54.13
Cost of Gain ($/lb)					
Cost of Production Basis	$0.90	$0.68	$0.57	$0.91	$0.33
Economic Cost Basis	$0.95	$0.74	$0.94	$1.24	$0.56

Educational programs of Kentucky Cooperative Extension serve all people regardless of race, color, age, sex, religion, disability, or national origin. Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, M. Scott Smith, Director of Cooperative Extension Service, University of Kentucky College of Agriculture, Lexington, and Kentucky State University, Frankfort. Copyright © 2004 for materials developed by University of Kentucky Cooperative Extension. This publication may be reproduced in portions or its entirety for educational or nonprofit purposes only. Permitted users shall give credit to the author(s) and include this copyright notice. Publications are also available on the World Wide Web at www.ca.uky.edu. Issued 5-2004.