Economics of Grazing Calves on Oats Planted After Corn Silage in Eastern Nebraska

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Summary and Implications

A five-year study (2015–2019) evaluated profitability of planting and grazing an oats cover crop after early harvested corn silage in eastern Nebraska. Oats were typically planted in the first week of September. Stocking rate ranged from 1.7 to 0.6 steers per acre and was based on oats biomass. Calves were turned out in early November each year and allowed to graze until oats biomass or weather limited intake. Grazing period ranged from 30 to 69 days. Average daily gain of calves ranged from 3.35 to 1.29 pounds with an average of 1.97 pounds. Shortened grazing seasons in some years were due to ice or excessive trampling losses which resulted in higher forage expenses per day and calves being sold prior to the usual market uptick in January which reduced profitability. However, the system was profitable four out of five years.

Introduction

Early corn silage harvest leaves behind bare ground in addition to unused growing degree days in the season. Growing degree days are heat units that are used in determining plant growth and maturity. A cover crop planted after corn silage harvest provides ground cover, weed suppression, and decreased soil erosion, while utilizing GDD. While cover crops offer potential soil benefits, producers may choose not to use them due to the expense of establishment. Additionally, fear of decreased subsequent crop yields may also cause producers to be wary. However, forage resources can be increased, and grazing season extended by the cover crop. The additional forage and potential calf weight gain provided by fall grazing may provide economic incentive to plant cover crops after early harvested corn silage. Late summer planted oats can provide a high-quality forage that do not over winter and thus do not require spring management. They also produce more fall biomass than winter-hardy species such as rye. Producers weaning calves in the fall or feedlots looking to purchase calves at a low cost in the fall can potentially utilize late summer planted oats for fall/winter grazing. The objective of this study was to evaluate the economics of planting oats after early corn silage harvest and grazing weaned calves.

Procedure

A five-year study was conducted on a 104-acre irrigated, no-till, field enrolled in a corn and soybean rotation at the Eastern Nebraska Research and Extension Center (ENREC) near Mead, Nebraska. Half the field was planted to corn and the other half in soybeans. Within the half planted to corn, one half was harvested as high moisture corn and the other half as corn silage. The effects of planting oats and effects of grazing the oats after high moisture corn harvest or corn silage during the first 4 years of the trial has previously been reported (2020 *Nebraska Beef Cattle Report*, pp. 35–37). Planting and grazing oats after high moisture corn or corn silage did not impact subsequent yields. The amount of oat forage produced after high moisture corn was minimal, resulting in less desirable cattle gains than corn silage. This current report summarizes the variation in oat yield, animal performance, and economics of planting and grazing oats after corn silage harvest.

Corn silage harvest occurred each year around September 1st with the planting of an oat-monoculture following soon afterwards. Planting dates were September 1st, September 6th, September 7th, August 29th, and September 5th, for 2015, 2016, 2017, and 2019, respectively. In 2018, oats experienced limited emergence and were therefore replanted in mid-September. Horsepower oats were planted using a no-till drill at 96 lb/ac with 7.5-inch row spacing. Oats also received urea fertilizer to deliver 40 lb/ac of nitrogen before or during oats planting.

The area to be grazed was divided into 2 paddocks (~11.5 acres each) and oats forage were hand-harvested from 5 locations (36 x 22.5 in) in each paddock in late October at ground level and dried at 60°C to determine dry matter (DM) yield/ac and determine stocking rate. With the exception of 2015, post-grazing oats biomass samples were collected in the same manner after the grazing period ended. Oats disappearance was then determined for 2016, 2017, 2018, and 2019 using pre-graze minus post-grazing oats biomass divided by the number of steers divided by number of grazing days.

Oat quality samples were also collected in late-October. Forage samples were cut at ground level from random locations (~20) within each paddock. These samples were freeze dried and analyzed for organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), in-vitro organic matter digestibility (IVOMD), and digestible organic matter (DOM).

Growing steers (485 ± 18 lb) were stocked according to available initial forage biomass in paddocks and targeting a 70-day grazing period. Forage allotments in the initial years (2015 and 2016) were approximately 25.5 lb DM/hd/day. Later years (2017, 2018, and 2019) forage allotments were increased to 39 lb DM/hd/day of oats biomass to increase chances of a 70-day grazing period. Stocking rates were 1.7, 1.3, 0.9, 0.7, and 0.6 hd/ac for 2015, 2016, 2017, 2018, and 2019, respectively. Random-

Table 1. Biomass of oats planted after corn silage harvest and sampled in late October before grazing (pre-graze) and again after grazing (post-graze) with growing steers.

	Year						
Item	2015	2016	2017	2018	2019	SEM	*P-value*
Oat pre-graze biomass, (lb DM/ac)	2857[a]	2273[b]	2401[b]	1952[c]	1535[d]	76.0	<0.01
Oat post graze biomass, (lb DM/ac)	ND[2]	1909[a]	312[b]	321[b]	254[b]	129	<0.01
Oat disappearance[1], (lb DM/steer/d)	ND[2]	29.5[c]	49.5[b]	80.5[a]	29.5[c]	3.50	<0.01

[1]Total amount of oats disappearance would include consumption, trampling losses, and weathering losses.

[2]Post graze biomass was not measured in 2015.

Table 2. Weather conditions and number of grazing days of each year's grazing season.

	Year				
Item	2015	2016	2017	2018	2019
Number of grazing days	62	42	48	30	69
Percentage of grazing days at or below 32° F	39	31	19	60	45
Percentage of grazing days with precipitation[1], %	31	14	8	20	23
Precipitation total for grazing period[2], inches	6.4	1.2	0.5	1.9	4.3

[1]Percentage of total grazing days at or below freezing.

[2]Percentage of total grazing days in which precipitation was received

ly selected steers in each paddock were designated as testers and used to evaluate animal performance. Ten steers in 2015 and 2016, 5 steers in 2017 and 2018, and 6 steers in 2019 per paddock were designated as testers.

Before being turned out to graze, steers were limit fed a common diet of 50% Sweet Bran (Cargill Wet Milling; Blair, NE) and alfalfa hay for 5 days before being weighed for 3 successive days to establish initial body weight. Steers were implanted with 36 mg Zeranol (Ralgro, Merck Animal Health, Madison, NJ), stratified by body weight and assigned to paddock. Steers were turned out on their assigned grazing pastures in early November and allowed to graze until oat biomass or weather limited intake. After the grazing season, steers were pulled from pastures and returned to the feedlot. They were limit fed the same diet for 8 days and weighed during the last 3 days to determine final body weight.

A partial budget was constructed each year to determine system profitability. Costs of $23.50 per acre for oats seed, $17.00 per acre for custom drilling, $7.00 per acre custom fertilizer application and $4.40 per acre in fencing costs were charged in all five years. A 45% urea fertilizer was applied at 89 lb (40 lb of N) each year with the average cost of $0.11 per pound, resulting in a cost of $9.52 per acre. Expenses per acre were divided across the number of grazing steers that oats forage allowed each year causing expenses to vary with year. Additionally, $2.64 per steer was charged for transportation. Cattle interest was charged per steer at a 5% annual interest on the initial steer price. The number of days cattle were retained was considered when calculating total interest. In order to determine value of gain, animals were valued prior to and after grazing utilizing the Nebraska price reported by the USDA. Cattle gains and market values post-grazing were then compared back to the cost of CC establishment and the expenses associated with grazing cattle.

The MIXED procedure in SAS (SAS Institute, Inc., Cary, N.C.) was used to analyze the data with year as a fixed effect. There were two replicates (paddocks) per year that served as the experimental unit. The pdiff statement was used to separate means when the F-test was significant. Data was considered significant with $P \leq 0.05$.

Results

Oats pre-graze biomass, oats post-graze biomass, and oats disappearance differed ($P < 0.01$) among years (Table 1). Average pre-graze yield was 2,448 lb DM/ac and there was almost a ton of DM per acre difference between the highest and lowest yielding years. Average post-graze biomass was 699 lb DM/ac. The post-graze biomass in 2016 was greater ($P < 0.01$) than all other years. This was caused by an ice storm forcing cattle to be removed from the oats early. Years 2017, 2018, and 2019 did not differ ($P > 0.71$) with an average of 296 lb DM/ac. Oats disappearance was greatest ($P < 0.01$) in 2018, intermediate in 2017 and lowest ($P < 0.03$) in 2016 and 2019 which did not differ ($P = 1.00$). A set of heavy precipitation events early in the 2018 grazing season caused muddy and wet conditions and likely increased cattle trampling. Weather conditions during grazing can be found in Table 2. The amount of pre-graze oats biomass did not appear to directly impact the number of grazing days achieved. Instead, weather (i.e., ice storm, precipitation that resulted in mud) appeared to be the greatest determining factor of grazing period length.

The oats quality including OM, NDF, ADF, IVOMD, and DOM varied among years ($P \leq 0.05$), while CP ($P = 0.35$) did not (Table 3). Overall, differences in nutritive content where minor among years, both digestibility (65% DOM) and protein content (17.8% CP) being excellent for forage.

Steer body weights, average daily gain (ADG), gain per acre, and animal grazing days per acre differed ($P \leq 0.02$) among years (Table 4). Overall, rate of gains

Table 3. Forage nutritive value in late October of oats planted after corn silage harvest

	Year						
Item[1]	2015	2016	2017	2018	2019	SEM	*P-value*
OM, % DM	83.8^{c}	89.1^{a}	85.0^{b}	88.9^{a}	89.2^{a}	0.279	<0.01
NDF, % DM	43.7^{a}	40.8^{b}	36.6^{c}	32.3^{d}	36.7^{c}	0.462	<0.01
ADF, % DM	25.6^{a}	25.7^{a}	25.4^{a}	19.5^{b}	20.7^{b}	0.489	0.05
CP, % DM	18.1	19.2	17.1	18.6	15.8	1.51	0.35
IVOMD, % DM	78.4^{c}	80.4^{b}	78.5^{c}	89.4^{a}	88.1^{a}	0.503	<0.01
DOM, % DM	59.8^{c}	63.3^{b}	60.6^{bc}	71.7^{a}	71.3^{a}	0.964	<0.01

[1]ADF, acid detergent fiber, CP, crude protein, DOM, digestible organic matter, IVOMD, in-vitro dry matter digestibility, NDF, neutral detergent fiber, OM, organic matter.

Table 4. Performance of growing steers grazing oats planted after corn silage

	Year						
Item	2015	2016	2017	2018	2019	SEM	*P-value*
Initial body weight, lb	467^{c}	502^{a}	462^{c}	506^{a}	487^{b}	2.09	0.02
Ending body weight, lb	547^{b}	694^{a}	626^{a}	545^{b}	592^{a}	8.03	<0.01
Average daily gain, lb/d	1.29^{c}	2.41^{b}	3.35^{a}	1.29^{c}	1.53^{c}	0.180	<0.01
Animal grazing days[1], steer·d/acre	92^{a}	47^{b}	38^{c}	18^{d}	35^{c}	1.35	<0.01
Gains per acre, lb/ac	134^{a}	128^{a}	143^{a}	25^{b}	61^{b}	13.2	0.01

[1]Number of days of grazing x number of steers per acre.

Table 5. Economic analysis of grazing growing steers in the fall on oats planted after corn silage harvest

	Year						
Item	2015	2016	2017	2018	2019	SEM	*P-value*
Total cost per steer, $/steer	41.42^{e}	50.70^{d}	72.76^{c}	95.74^{b}	112.44^{a}	2.31	<0.01
Cost of gain, $/lb	0.52^{b}	0.50^{b}	0.46^{b}	2.56^{a}	1.05^{b}	0.245	0.01
Value of gain, $/lb	2.54^{a}	1.04^{b}	1.72^{ab}	2.25^{a}	2.45^{a}	0.285	0.06
Return per steer, $/steer	151.67^{b}	50.57^{c}	193.77^{a}	-16.85^{d}	147.81^{b}	6.53	<0.01

averaged 1.97 lb/d. In 2017, steers had the greatest ADG ($P \leq 0.02$). Daily gain in 2016 was greater ($P \leq 0.03$) than 2015, 2018, and 2019 which did not differ from one another. Weather seemed to be a major factor in rate of gain, as both 2016 and 2017 had relatively few grazing days with subfreezing temperatures and precipitation. The longer grazing period coupled with a higher stocking rate used, resulted in 2015 having the greatest ($P < 0.01$) number of animal grazing days per acre with almost double that of the next best year. Animal grazing days in 2016, 2017 and 2019 did not differ and were greater ($P < 0.01$) than 2018. However, gains per acre were greater in 2016 and 2017 than 2015. Gain per acre in 2016 and 2017 did not differ from one another ($P < 0.01$) while being greater ($P \leq 0.02$) than 2018 and 2019, which did not differ from one another.

Total cost, cost of gain, value of gain and total profit differed ($P \leq 0.01$) among years, while value of gain did not differ ($P = 0.06$) among years (Table 5). Total cost per steer was largely impacted by stocking rates, and the number of steers to which the forage production costs were distributed. All years differed from each other with 2019 being the greatest, followed closely by 2018, then 2017, followed by 2016 and 2015 having the least total cost per steer. However, the short grazing season coupled with low rate of gain resulted in cost of gain to be greatest in 2018 ($P < 0.01$) with all other years not differing ($P \geq 0.16$). Value of gain describes how market value changed over the grazing period, and the five-year average for value of gain was $2 per lb gained. Shortened grazing seasons resulted in cattle being sold in less desirable market conditions than when grazing was extended into January. Profit per steer was the greatest ($P \leq 0.01$) in 2017, followed by 2015 and 2019 which did not differ, but were greater than 2016, and profit per steer was lowest ($P < 0.01$) in 2018 which resulted in a loss. However, across the 5 years, average profit was $136/steer.

Conclusion

In this study, the oats fall-grazing system proved to be profitable four out of five years with the average profit being approximately $136 per steer. Weather proved to have the strongest influence on system profitability as it impacted many other factors within the system (oats biomass, oats disappearance, animal performance, grazing period, and cattle market). Therefore, producers weaning calves in the fall or feedlots looking to purchase calves at a low cost in the fall can potentially utilize late summer planted oats for fall/winter grazing.

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