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Summary

*An economic analysis of a three-year study evaluated use of N fertilizer and dried distillers grains plus solubles (DDGS) supplementation to yearling steers grazing smooth bromegrass in eastern Nebraska (*Nebraska Beef Report, 2009, *pp. 26-28). Costs of gain tended to be lower for cattle on fertilized pastures. Grazing profitability was lowest for cattle on non-fertilized pastures, intermediate for cattle supplemented with DDGS, and highest for cattle on fertilized pastures. The weight advantage (9%) of steers supplemented with DDGS during the grazing period was maintained through the finishing period, leading to greater profitability. Profitability for steers supplemented with DDGS at the end of the grazing period was significantly reduced due to the price slide on heavier cattle. Therefore, to maximize profits from DDGS supplementation in the grazing period, ownership of the steers through the finishing period is necessary.*

Introduction

Nitrogen fertilizer costs have increased because fossil fuel is used to produce ammonia and urea. Growth of the ethanol industry has produced byproducts at a reasonable cost. A three-year study was conducted to determine the feasibility of using distillers grains as a substitute for N fertilizer on brome pastures grazed by yearlings. The treatments included yearling steers stocked at 4 AUM/acre on smooth bromegrass pastures fertilized with 80 lb N/acre (FERT); stocked at 2.8 AUM/acre on non-fertilized smooth bromegrass pastures (CON); and stocked at 4 AUM/acre on non-fertilized smooth bromegrass pastures with 5 lb DM of corn DDGS supplemented daily (SUPP). Our objective in this study was to determine the economic feasibility of substituting distillers grains for N fertilizer.

Procedure

Biological data were collected over a three-year period (Greenquist et al., *2009 Nebraska Beef Report*, pp. 26-28).

Grazing Economics

All costs were based on three-year (2005 to 2007) average pricing (unless otherwise noted) and expressed on a dollars per head basis for the entire grazing period. The initial steer weight was multiplied by the USDA Nebraska auction market average for April steer (450 to 750 lb) prices. A regression equation was generated to account for the weight price slide. A similar approach was used to calculate final steer live values in September to adjust for weight differences. Simple interest (6.6%) was charged on initial steer cost for the entire ownership period. Cash rent costs were based on the cost per acre of the control (CON; $84.09/acre, calculated by multiplying the number of AUMs from the CON by the Nebraska average AUM value of $26.65) multiplied by the number of acres, divided by the total head days, then multiplied by the average number of grazing days. Costs per acre were then multiplied by the number of acres, divided by the total head days, and then multiplied by the average number of grazing days.

Animal unit equivalents of the steers used in this study were determined by taking the average weight of the steers during the grazing period divided by 1,000 lb. Simple interest (6.6%) was charged on the entire cash rent amount for one half of the grazing period. Yardage ($0.10 head/day) was charged while steers were grazing to cover labor for electrical cross fencing and for the daily checking of animal health, fresh water and minerals.

An additional $20/ton was added to the price of DDGS to account for handling and delivery. Dried distillers grains were priced based on the weekly DTN spot prices for the Midwest region during the grazing months of April through September. The average price during this time period was $110.54/ton in 2006 and 2007. Fertilizer costs were based on dry urea (46-0-0) prices from the National Agricultural Statistics Service (USDA, 2008). Urea prices for the period averaged $363/ton with the addition of $4.00/acre for cost of application. Steers were charged $8.33/head for health and processing costs during the grazing period, with a death loss of 0.5% assessed to an initial value of the animal.

Finishing Economics

Finishing costs were calculated from performance data following a 109-day finishing period. The final live values from the grazing period were used as the initial live values for the finishing period. Simple interest on initial steer cost (April), plus all expenses incurred during the grazing period were charged for the duration of the feeding period plus one half of the total feed costs. Feed costs for the yearling steers were based on the average prices of feed ingredients during the feeding period, assuming a corn and corn byproduct based diet. Wet distillers grains were priced at 85% the value of corn DM. Daily dry matter intakes were not available for individual treatments and were cal-

(Continued on next page)

Table 1. Economic evaluation of grazing management and supplementation strategies for steers grazing smooth bromegrass and subsequent finishing performance.[1]

	Treatment[2]					
Item	CON	FERT	SUPP	F+S	SEM	*P*-value
Initial BW, lb	726	724	726	726	7	0.95
Final BW, lb	968[a]	961[a]	1049[b]	1049[b]	42	< 0.01
Steer cost, $	805.10	804.30	805.10	805.10	11.58	0.99
Grazing						
Steer interest, $	23.28	23.25	23.28	23.28	0.57	0.99
Total cost, $	150.47[a]	139.65[b]	160.99[c]	154.27[d]	6.50	< 0.01
COG, $/lb[3]	0.63[a]	0.60[a]	0.50[b]	0.48[b]	0.03	< 0.01
Breakeven, $/lb[4]	1.01[a]	1.01[a]	0.95[b]	0.94[b]	0.02	< 0.01
Live value, $[5]	992.64[a]	991.50[a]	1009.12[b]	1009.12[b]	9.34	< 0.01
Profitability, $	13.79[a]	24.30[b]	19.75[ab]	26.47[b]	8.35	0.01
Finishing						
Steer interest, $	20.63	20.52	20.89	20.82	0.67	0.99
Total costs, $	248.25[a]	248.15[a]	262.40[b]	262.39[b]	6.10	< 0.01
COG, $/lb [3]	0.60	0.60	0.61	0.61	0.02	0.66
Total						
Breakeven, $/lb[4]	0.88[a]	0.88[a]	0.85[b]	0.85[b]	0.04	0.01
Live value, $[6]	1274.88[a]	1275.46[a]	1355.48[b]	1355.48[b]	41.44	< 0.01
Profitability, $	13.93[a]	20.05[a]	67.51[b]	71.28[b]	28.72	< 0.01

[1]Least square means are expressed per steer for the grazing analysis in years 2005, 2006 and 2007, and for the finishing analysis in years 2005 and 2006.
[2]Pastures were either non-fertilized (CON), fertilized with dry urea at 80 lb/acre of N (FERT); non-fertilized and steers were supplemented with 5 lb (DM) of DDGS (30.4% CP) daily for the entire gazing period (SUPP); or fertilized with dry urea at 80 lb/acre^{-1} of N and steers were supplemented with 5 lb (DM) of DDGS (30.4% CP) daily for the entire gazing period (F+S: hypothetical treatment based on equal steer performance of SUPP and equal pasture performance of FERT).
[3]Total costs divided by weight gain.
[4]Total costs plus initial steer cost and its interest for each period divided by sale weight.
[5]USDA Nebraska 3-year average auction market price (slide adjusted) multiplied by the live weight.
[6]Final weight multiplied by the 3-year average fed cattle prices.
[a,b,c,d]Means within a row with unlike superscripts differ ($P < 0.01$).

culated based on percent body weight (2.5%). Yardage was charged at $0.35 per head daily.

Increased volatility in inputs such as commercial fertilizer, DDGS and cash rent prices make it difficult to accurately predict cost of gain and profitability in livestock production systems. Therefore, evaluating inputs over a wide range of costs can be useful to project costs of gain for different management decisions. All costs were held constant at their respective three-year averages as described previously, and incremental price increases and decreases were evaluated separately for cash rent, urea and DDGS. Cost of gain breakpoints were established at varying prices for comparing treatments. A separate model was used based on the hypothetical treatment that included both N fertilizer and DDGS supplementation. This treatment was included so that varying prices of both urea and DDGS could be evaluated simultaneously for their effects on costs of gain.

Results

Fertilizer costs ($/head) were $0 for CON and SUPP, $28.15 for FERT and $18.58 for F+S (a hypothetical treatment based on equal steer performance of SUPP and equal pasture performance of FERT; Table 1). Fertilizer and fertilizer application costs were lower for F+S compared to FERT because of the increase in total head days, spreading the costs over a greater number of steers. Total head days were increased with supplementation and fertilization, partially due to forage replacement and/or an increase in pasture productivity. Dried distillers grain cost was $52.22/steer for both SUPP and F+S supplementation at a level of 5 lb/head daily. Total costs per steer for the grazing period were higher with DDGS supplementation ($P < 0.01$) and lower with N fertilization ($P < 0.01$) compared to CON. The sum of the total costs during the grazing period (minus interest on the steers) was $139.65 for FERT, $150.47 for CON, $160.99 for SUPP and $154.28 for F+S. The additional weight gain from DDGS was large enough to offset costs and decreased ($P < 0.01$) costs of gain for the SUPP and F+S compared to CON and FERT. Costs of gain were not different ($P > 0.05$) between SUPP and F+S or between CON and FERT.

Profitability at the end of grazing was lowest for CON ($13.79), intermediate for SUPP ($19.75) and highest for FERT ($24.30) and F+S ($26.48). During the grazing period, increasing the stocking rate by fertilizing pastures and spreading out cash rent costs over a greater number of steers appears to be more economical than increasing steer performance by supplementing. This phenomenon is largely due to the negative price slide associated with heavier steers. If steers were sold at the same price per pound, performance advantage and added weight from DDGS supplementation would have greater profitability than increasing stocking rate or fertilizing. Increasing stocking rate and performance at these prices would be the most profitable option. Full value of supplementing DDGS to grazing steers can be obtained by retaining ownership through the finishing period, assuming the finishing period is breakeven or better.

Finishing data were not yet available for year 3, so only final mean weights and prices from years 1 and 2 are presented in Table 1. The weight advantage (9%) of steers supplemented with DDGS during the grazing period was maintained through the finishing period (9%). Finishing performance was similar ($P = 0.88$) among treatments. Supplemented and F+S steers had higher ($P < 0.01$) feed costs than CON and FERT, but costs of gain did not differ ($P = 0.66$). Feed costs were based on the average cost of the ration and DMI for the feeding

period. Dry matter intakes were not measured individually by treatment, though cattle were fed a common finishing diet across treatments. Dry matter intakes for economic purposes were determined by multiplying the average weight during the feeding period by 2.5%. Therefore, the heavier cattle from SUPP and F+S had greater feed costs. Costs of gain were not statistically different, but were about $0.02/lb greater for SUPP and F+S because of the added feed costs. Even though performance did not differ, finished live values were greater ($P < 0.01$) for SUPP ($1,356) and F+S ($1,356) compared to CON ($1,275) and FERT ($1,275) because of the additional weight maintained throughout the feeding period. No compensatory gain was observed during the finishing period in this experiment, a result consistent with other reports (*2006 Nebraska Beef Report*, pp. 30-32; *2007 Nebraska Beef Report*, pp. 10-11).

Total production system breakevens were lower ($P < 0.01$) for SUPP and F+S compared to CON and FERT. Profits were greater ($P < 0.01$) for SUPP ($67.51) and F+S ($71.28) for the total production system compared to CON ($13.93) and FERT ($20.05).

Effects on costs of gain were evaluated for a wide range of input costs. Cost of gain breakpoints were established at varying prices for comparing treatments with a separate model designed to evaluate the effects of input costs of DDGS and N fertilizer. All other inputs were held constant at their three-year average values. The cost of gain breakpoint for cash rent was $21.2/AUM (data not shown). Average three-year cash rent prices ($26.65/AUM) currently are well above this breakpoint, indicating a strong economic incentive to use N fertilizer and DDGS supplementation, based on cost-of-gain values. As land values increase, the advantage for fertilization and DDGS supplementation over the control increases as well.

The cost of gain breakpoint for N fertilizer was $0.51/lb N. Average three-year N fertilizer costs ($0.40/lb) were below this breakpoint, indicating an economic incentive to keep using N fertilizer until this point is reached. However, current prices and those in the future may be above this breakpoint. The costs of gain breakpoints for DDGS were $205/ton and $233/ton for SUPP compared to FERT and CON, respectively. The last two years of prices for DDGS ($130/ton), including handling, also are still below this breakpoint and indicate a strong economic incentive to supplement DDGS to grazing steers.

Evaluating the interaction of both DDGS supplementation and N fertilization on cost of gain is more complex and the simultaneous price movement of both inputs is likely. Table 2 shows the effect of price movement in either direction compared to the three-year average pricing. Current three-year average pricing shows a cost of gain of $0.48/lb.

Table 2. Effects of varying N fertilizer and DDGS prices on costs of gain for steers grazing smooth bromegrass in eastern Nebraska.[1]

DDGS prices, $•ton^{-1}	Fertilizer prices, $/lb N							
	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60
80	0.39	0.40	0.41	0.41	0.42	0.43	0.44	0.44
90	0.40	0.41	0.42	0.43	0.43	0.44	0.45	0.45
100	0.42	0.42	0.43	0.44	0.45	0.45	0.46	0.47
110	0.43	0.44	0.44	0.45	0.46	0.46	0.47	0.48
120	0.44	0.45	0.46	0.46	0.47	0.48	0.48	0.49
130	0.45	0.46	0.47	0.48	0.48	0.49	0.50	0.50
140	0.47	0.47	0.48	0.49	0.49	0.50	0.51	0.52
150	0.48	0.49	0.49	0.50	0.51	0.51	0.52	0.53
160	0.49	0.50	0.50	0.51	0.52	0.53	0.53	0.54
170	0.50	0.51	0.52	0.52	0.53	0.54	0.55	0.55
180	0.52	0.52	0.53	0.54	0.54	0.55	0.56	0.57
190	0.53	0.53	0.54	0.55	0.56	0.56	0.57	0.58
200	0.54	0.55	0.55	0.56	0.57	0.58	0.58	0.59
210	0.55	0.56	0.57	0.57	0.58	0.59	0.60	0.60

[1]Pastures were fertilized with 80 lb/acre and steers were supplemented with 5 lb of DDGS daily. The average 3-year value of N fertilizer and 2-year value of DDGS were $.40/lb N and $130/ton, respectively. Values expressed as $/lb of gain.

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