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Summary with Implications

An oat monoculture was planted in late summer at 100 lb/ac and compared to oats planted at 50 lb/ac with rapeseed included at 3 lb/ac. Seed cost of the oat monoculture (\$20/ac) was greater than the mix (\$15/ac). Initial forage yield was not affected by the inclusion of rapeseed with fall oat. Calf gain was significantly greater and cost of gain was significantly decreased when rapeseed was included due to the combination of greater gains and lesser seed cost. Including rapeseed in late summer planted oats may be beneficial for producers who want to graze growing calves in the fall.

Introduction

Cover crops planted after corn silage harvest, spring wheat, or hybrid seed corn harvest provide an opportunity for grazing calves or cows in late fall and into winter. Winter-sensitive annuals such as oats with or without brassicas such as turnips or rapeseed are commonly used in Nebraska. These species are highly digestible and thus considered high energy with only slight decreases in digestibility throughout the winter (2018 *Nebraska Beef Cattle Report*, pp. 60–62). Crude protein (CP) content of late-summer planted oats and brassicas remains relatively constant throughout the winter grazing period. Fall grazing an oat monoculture planted after corn silage harvest resulted in average daily gain (ADG) of 2.35 lb/d (2020 *Nebraska Beef Cattle Report*, pp. 35–37). In a different study, fall grazing of an oat-brassica mix resulted in ADG of

2.25 lb/d (2016 *Nebraska Beef Cattle Report*, pp. 55–57). However, direct comparisons of oat monocultures to oat-brassica mixes have not been conducted. The extremely high digestibility of brassicas (87 % IVOMD) likens them to a concentrate and would be expected to increase the energy content of the diet. Brassicas also contain elevated protein (22% CP) content (2018 *Nebraska Beef Cattle Report*, pp. 60–62). Therefore, inclusion of rapeseed into a late fall and winter grazing system may improve calf gain compared to grazing oats, while also decreasing cost of gain due to lower cost per acre for seeding rapeseed. The objective of this study was to evaluate the inclusion of a brassica (rapeseed) with late summer planted oats and the effect on forage yield, forage quality, and calf gain. It was hypothesized that forage yield of the oats-rapeseed mix would be similar to the oats monoculture and that growing calf performance and cost of gain would be improved by inclusion of rapeseed.

Procedure

This 3-year study was conducted at the US Meat Animal Research Center near Clay Center, Nebraska. An initial report of the first 2 years of this study was previously published (2019 *Nebraska Beef Cattle Report*, pp. 40–41). Following corn silage harvest or alfalfa termination, 5 irrigated pivots were divided into four quarters and planted. Pivots were identified as 33A in year one, 23C and 24D in year two, and 32B and 34A in year three. Of the pivots previously described, 33A and 24D followed alfalfa termination while the other 3 pivots followed corn silage harvest. Two quarters from each pivot were planted with 100 lb/ac oat seed (*Avena sativa*; OAT) while the other two quarters were planted with 50 lb/ac oat seed and 3 lb/ac rapeseed (*Brassica napus*; MIX). Nitrogen (N) was applied via pivot to 23C and 24D in year 2 (15.6 and 31.4 lbs of N/ac, respectively) and to 34A in year 3 (26.3 lbs of N/ac). Nitrogen was

not applied to pivots that followed alfalfa termination.

Spring born cross-bred steers (n = 120, 240 and 240 in years 1, 2 and 3, respectively) were assigned to treatments based on weights taken prior to d 0. Steers were then weighed, sorted, and began grazing on d 1 (initial BW 583 ± 4.9, 637 ± 11.7, and 516 ± 9.5 lbs in years 1, 2 and 3, respectively). Steers were turned out to graze on November 1 in year 1, November 13 in year 2, and November 9 in year 3. Grazing continued until forage appeared to be limiting in one quarter, with approximately 3 inches of growth remaining, upon which grazing ceased for all steers. Steers grazed until February 7 in year 1 (99 days), January 23 (71 days) in year 2 and January 19 (71 days) in year 3. Steers were removed from pivots and weighed on the same day and placed into the feedlot.

Forage quality and biomass samples were taken prior to grazing, monthly throughout the grazing period, and post grazing. Oat and rapeseed were clipped to ground level and immediately put on ice and froze for at least 24 hours before drying in a 60°C oven. Samples were ground to a 1 mm particle size through a Wiley mill. Nutrient analysis was conducted to evaluate organic matter (OM, % of DM) and in-vitro organic matter digestibility (IVOMD, % of OM). Digestible organic matter (DOM) was used to express the actual amount of digestible energy of each treatment and to serve as a similar comparison to total digestible nutrients (TDN). Calculation for DOM was made by multiplying the OM% of the forage by the IVOMD.

A partial budget analysis was conducted to evaluate the establishment costs of each forage treatment. Average seed costs for OAT across years was \$20.33/ac while cost of seed for MIX was \$14.83. Average seeding and fencing costs for all pivots across years were \$13.88/ac and \$5/ac, respectively. Fertilizer amounts were different among pivots and were charged using N cost of \$0.42 /lb N in year 2 and \$0.40/lb

Table 1. Forage yield, initial forage quality and for disappearance of a oat monoculture or a oat-rapeseed mix planted in late-summer and grazed from early November into January

Item	OAT	MIX	SEM	P-value
Yield, lbs DM/ac				
Pre-grazing	3119	3144	284	0.86
Post grazing	1415	1379	126	0.78
Disappearance, lb/hd/d	28.2	28.4	5.70	0.92
Nutrient content, % of DM				
OM	86.4	86.0	0.55	0.16
DOM ¹	65.5 ^a	68.9 ^b	0.83	<0.01

¹DOM = digestible organic matter a proxy for total digestible nutrients. Calculated by multiplying IVOMD by the OM content of the forage

^{ab}Means with different superscripts differ ($P \leq 0.05$)

Table 2. Steer performance during the grazing period

Item	OAT	MIX	SEM	P-value
IBW, lbs	580	577	3.6	0.60
EBW, lbs	737	748	4.05	0.075
ADG, lb/d	1.93 ^a	2.10 ^b	0.053	<0.01
Cost of gain, \$/lb	0.54 ^a	0.46 ^b	0.039	<0.01

¹Abbreviations: IBW = initial body weight, EBW = ending body weight, ADG = average daily gain

^{ab}Means with different superscripts differ ($P \leq 0.05$)

²Cost of gain includes seed costs at \$20.33 /ac for oats or \$14.83/ac for mix, plus seeding costs at \$13.88/ac, fertilizer \$6.80/ac, irrigation \$33.40/ac and fencing at \$5/ac.

N in year 3. Irrigation costs and amounts were also different among pivots and were charged \$8.92/acre-inch in years 1 and 2 and \$9.39/acre-inch in year 3. Amount of water applied was 3.8, 2.6, and 4.6 inches/acre in years 1, 2, and 3, respectively. Total costs per acre were estimated to be \$76.16/ac for OAT and \$70.66/ac for MIX.

Performance and forage quality data were analyzed using the MIXED procedure of SAS (SAS Institute Inc., Cary, N.C.) as a completely randomized design with pivot quarter as the experimental unit. Year and treatment were included in the model as fixed effects and pivot as a random effect. Treatment differences were significant at $\alpha \leq 0.05$ and tendencies were discussed when $0.05 \leq \alpha \leq 0.10$. There were 2 replicates per treatment in year 1 and 4 replicates per treatment in years 2 and 3.

Results

With the exception of post-grazing biomass, no interactions between treatment

and year were observed. Initial yield prior to the start of grazing did not differ ($P = 0.86$; Table 1) among the OAT and MIX, nor was an effect of year observed ($P = 0.17$). In the MIX, rapeseed represented 25.4% of initial biomass on a dry matter (DM) basis. No significant differences were observed for post grazing yield ($P = 0.78$) although a significant difference was observed for effect of year ($P < 0.01$). A tendency for an interaction between treatment and year was observed ($P = 0.07$) for post grazing which is due to there being no differences among treatment in year 1 and 2, but a tendency ($P = 0.06$) for MIX to be greater than OAT in year 3, with yields of 1518 and 1123 lbs/ac, respectively.

No differences ($P = 0.83$) were observed between MIX and OAT for forage disappearance, at approximately 28 lbs of DM/hd/d. This disappearance rate would equate to 4.8% of BW, suggesting that significant trampling losses occurred as it is unlikely that cattle consumed more than 50 to 60% of what disappeared. There were no

differences in disappearance among years ($P = 0.14$).

There were no differences ($P = 0.16$) in initial OM content of the forage, however a greater ($P < 0.01$) initial DOM was observed for MIX, suggesting that the mix could offer the potential for greater energy intake.

Average daily gain (ADG) was greater ($P < 0.01$) for MIX than OAT, with MIX steers gaining 0.17 lb/d greater than OAT, although both would be considered moderate to high gains (Table 2). A year effect ($P < 0.01$) was observed for ADG, with the low being 1.86 lb/d and the high being 2.2 lb/d. Cost of gain decreased significantly ($P < 0.01$) for MIX steers, being \$0.08 lower per pound of gain. Again, this is due to not only a greater gain for MIX, but also to a lower seed cost.

Conclusion

Inclusion of rapeseed at 3 lb/ac with 50 lb/ac of oat seed in late summer produced yield in November that was similar to an oat monoculture planted at 100 lb/ac. The higher digestibility of rapeseed yields a more energy-dense cover crop when planted with oats in late summer. Greater ADG and a decreased cost of gain were observed for steers grazing MIX, suggesting that inclusion of rapeseed into late-summer planted oats is a viable option for producers wanting to economically achieve calf gain during the fall and winter grazing period.

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