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Winter Grazing Systems for Gestating Ewes

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Summary

Four winter-feeding systems for gestating ewes were investigated over a 3-year period. The systems investigated were: 1) low-density corn; 2) high-density corn; 3) fescue regrowth; and 4) round-baled hay. Effects on ewe performance and winter-feed costs were determined. An average of 118 mature (3 to 7 year old) Hampshire x Dorset ewes (avg initial BW = 91.6 kg) were used each year. Each of the wintering-grazing treatments was replicated by two fields, and the hay treatment was replicated by two drylot pens. The low- and high-density corn treatments were planted to achieve densities of approximately 54,000 and 91,000 corn plants/ha, respectively. Each replicate corn field was 0.4 ha and contained 12 ewes. The stockpiled fescue treatment consisted of replicate fields of 0.8 ha, each containing 12 ewes. For the hay treatment, first-cutting fescue hay was offered free choice in replicate drylot pens of 23 ewes each. Ewes grazing low-density corn gained the most weight (10.9 kg), those grazing stockpiled fescue lost 1.8 kg and those grazing high-density corn and eating fescue hay in drylot were intermediate (7.7 and 5.9 kg, respectively; $P < 0.01$). Carrying capacity of both corn density treatments was similar. Stockpiled fescue pasture supported only 20 percent of the carrying capacity of the corn fields ($P < 0.01$). Grazing corn (both planting densities) resulted in feed costs of 19¢/d and 23¢/d for the low- and high-planting densities, respectively. Estimated costs for feeding fescue hay were 21¢/d. Grazing stockpiled fescue was lowest at 17¢/d. In conclusion, winter-grazing standing corn or stockpiled fescue were effective and economical feeding strategies to meet the nutritional needs of gestating ewes.

Key words: Ewes, Grazing, Corn, Fescue

Introduction

Feed costs represent approximately two-thirds of all production costs for a sheep enterprise (Dickerson, 1978). More than half of all feed costs are expended during the winter to provide harvested winter feed to breeding animals (Rayburn, 2000). Traditionally, producers feed hay to ewes when grass is not available. Hay is often an expensive source of feed to meet caloric requirements (Loerch, 1996). Stock-piled forage, that is set aside for winter grazing offers, some potential to reduce hay needs and reduce winter feed costs (Schoonmaker et. al., 2003). However, the availability and yield of stock-piled forages is compromised by weathering, as well as snow and ice cover. Grazing standing corn may provide an opportunity to reduce winter feed costs and meet the nutrient requirements of the flock. More than half of the energy in the corn plant is contained in the grain (NRC, 1985). Grain is less susceptible to weathering losses than forages (Schoonmaker et. al., 2003). Furthermore, corn plants have a high profile and access by grazing animals would not be restricted by snow or ice. The optimum management system for corn grazing by sheep has not been identified. Optimum grazing management, corn fertilization rates, hybrids, planting dates, and planting density are unknown. The objective of this research was to determine the effects of four winter-feeding systems on ewe performance and winter-feed costs.

Materials and Methods

This research was conducted at The Ohio State University Sheep Center at the Ohio Agric. Research and Development Center, Wooster, OH. The trial was conducted from early January to mid-March (average 72 d) in 2002, 2003, and 2004. The treatments investigated were: 1) low-density corn; 2) high-density corn; 3) fescue regrowth, and 4) round-baled hay. Each treatment had two replicates per year. An average of 118 mature (3 to 7 year old) Hampshire x Dorset ewes (avg initial BW = 91.6 kg) were used each year. Ewes were 8 d to 43 d in gestation when the experiments were initiated each year. Each of the wintering-grazing treatments was replicated by two fields, and the hay treatment was replicated by two drylot pens. The 118 ewes were randomly allotted to eight outcome groups of appropriate size, and the outcome groups were allotted to treatment replicates. The low- and high-density corn treatments were planted to achieve densities of approximately 54,000 and 91,000 corn plants/ha, respectively. Corn fields were fertilized with 68 kg of N/ha applied in two applications. Each replicate corn field was 0.4 ha, and electric fence was used to divide each field into 10 paddocks for strip-grazing. All ewes were fed a corn-silage-based diet for 14 d before the experiment began. Those randomly selected to go on corn treatments were adjusted to corn grain by feeding 0.1, 0.2, 0.3, and 0.45 kg of corn, respectively, on the four days immediately preceding turnout in the corn fields. Twelve ewes were allotted to each of the four corn replicates (48 ewes with 12 ewes per 0.4 ha corn field). Ewes grazed each paddock for 7 d to 14 d and were moved to their next paddock when all corn grain was consumed. Due to the abundance of feed in each replicate, ewes rarely required all 10 paddocks in the 0.4 ha fields to complete the 72 d trial. Amount of area actually grazed was quantified and used to calculate ewe grazing days per hectare. The stockpiled fescue treatment consisted of replicate fields of 0.8 ha each. Forage in these pastures was mob grazed the first week of August each year and forage regrowth was stock-piled for winter grazing. Each replicate was fertilized with 56 kg of N/ha the first week of August. The fescue treatments were investigated over two years (2003 and 2004). Twelve ewes were allotted to each replicate, and fields were strip grazed with the aid of electric fence. Ewes were given access to a new forage strip approximately every 7 d. For the hay treatment, first-cutting fescue hay was offered free choice in two replicate drylot pens. Each pen contained 23 ewes.

Ewes were weighed, and body condition scored initially and every 14 d during the trial. Body condition score was on a 1-to-5 scale with 1 being emaciated and 5 being obese. Fescue-pasture samples were collected in ungrazed areas at the initiation and end of the trial. The samples were obtained by use of a 61 x 61 cm metal square that was randomly tossed 6 times for each replicate. All forage within the square was hand clipped and composited. After collection, forage samples were dried, ground, and analyzed for DM, CP, NDF, and ADF (AOAC, 1996). For corn treatments, plants/ha and grain yield (kg/ha) were determined by counting the number of plants in a 730 cm distance within a row, and multiplying that number by 1000 to give plant density. Grain yield was calculated using the yield component method (Univ. of Illinois, 2005) by measuring 730 cm in 6 randomly selected rows and collecting every fifth ear to count average kernel rows and average number of kernels per row. Yield equals ear number x average row number x average kernel number divided by 90. The total kilograms of DM/ha were determined by randomly cutting, drying, and weighing 6 plants/ha in each corn replicate and multiplying by the actual plant density determined for each replicate. After collection, these corn-plant samples were ground and analyzed as described above for forage samples.

Feed costs were calculated for all four systems based on average-commodity prices and yields during the three-year trial (2002 to 2004). The kilograms of corn grain present in the corn paddocks was estimated as described above, and the grain was valued at \$0.079/kg of grain at 86 percent DM. Fescue pasture was valued at \$86/ha. Hay was valued at \$0.088/kg and supplemental corn was priced at \$0.079/kg on an as-fed basis.

Data were analyzed according to the PROC GLM procedures of SAS ver. 9.1 (SAS Institute Inc., Cary, NC). The model included the effects of treatment, year, and treatment x year. Treatment means were separated by PDIFF protected by a significant ($P < 0.05$) F-value. Each replicate was the experimental unit for all analyses.

Results and Discussion

Target corn-plant density for the low-density corn was 54,361 plants/ha. Actual density varied from 49,419 in

Table 1. Estimated plant density and corn yield of low and high planting density treatments.

Item	Low density	High density
Year 1		
Plants/ha	49,419	88,955
Year 2		
Plants/ha	56,420	110,163
kg/ha	7975	10,413
Year 3		
Plants/ha	55,597	77,010
kg/ha	6,095	6,654

Table 2. Yield and chemical composition of low and high density corn plants, fescue pasture, and fescue hay dry matter.

	Corn density			
Item	Low	High	Fescue pasture	Fescue hay
DM/ha, kg				
Initial	9,808	10,394	712	--
Final	8,118	8,519	484	--
CP, %				
Initial	7.9	8.7	14.4	10.6
Final	8.1	7.9	13.8	--
NDF, %				
Initial	51.3	56.3	69.9	72.2
Final	52.8	49.1	70.8	--
ADF, %				
Initial	22.4	24.3	37.2	40.7
Final	24.2	23.5	39.4	--

Year 1 to 56,420 plants/ha in Year 2 (Table 1). More variation was observed for the high-density-corn treatment. The target was 91,416 plants/ha, and the range observed was from 77,010 in Year 3 to 110,163 in Year 2. Germination rate or inaccurate settings on the planter may have contributed to this variation. Grain yield was not recorded in Year 1. Low-density corn had a yield of 7,975 and 6,095 kg/ha for Years 2 and 3, respectively. High-density corn had a yield of 10,413 and 6,654 kg/ha for Years 2 and 3, respectively. Lower yields in Year 3 were likely due to lack of rain in the summer of 2004. Dry-matter yield and nutrient content of corn plants, fescue pasture, and fescue hay are shown in Table 2. The corn fields (both treatments) averaged about 10,000 kg of DM/ha in January at the start of the trial. In mid-March ungrazed areas averaged about 8,294 kg of DM/ha. This difference could be attributed to weathering losses. Stockpiled fescue pastures only had 7.3 percent as much DM (712 kg DM/ha) as the cornfields initially. By mid-March, only 484 kg of DM/ha was available for grazing. Schoonmaker et. al. (2003) and Kallenbach et. al. (2003) reported herbage mass of stockpiled fescue was approximately 2,000 kg DM/ha when measured in November. Hagsten et. al. (1976) investigated supplemental-nutrient needs for ewes grazing stockpiled fescue. Estimated-forage available was not reported, and their grazing period was from December until February. These authors used a winter-stocking rate of 5 ewes/ha, whereas the fescue -stocking rate in our trial was 15 ewes/ha. In the present trial, crude-protein content of corn plants was lower than fescue pasture, while the fescue hay was intermediate. Values showed little change between early January and mid-March. This is typical of other reports for change in protein content of stockpiled fescue over time (Kallenbach et. al., 2003; Schoonmaker et. al., 2003). Protein values of corn and forages in the present trial were adequate to meet the needs of ewes in gestation (NRC, 1985). Fiber (NDF and ADF) values were lower for corn plants than for both sources of fescue (pasture and hay) and as with protein, they did not change over the course of the trial. Ewe-gain data (averaged over all three years) are presented in Table 3. Ewes grazing low-density corn gained the most weight during the 72-d trial (10.9 kg), those grazing stockpiled fescue lost weight (1.8 kg), and those grazing high-density corn or fed fescue hay in drylot were intermediate (7.7 and 5.9 kg, respectively; $P < 0.01$). We could not find reports in the literature about the efficacy of grazing unharvested corn plants as a source of winter feed for sheep or cattle. Wedin and Jordan (1961) evaluated corn plants as a source of forage for summer grazing lambs, but this was done before grain development occurred. Grazing of corn stalks after grain harvest is a common practice and represents an important strategy to reduce winter-feed costs (Hitz and Russell, 1998; Sulc and Tracy 2007).

There was a treatment x year interaction ($P < 0.05$) for body condition score change (Figure 1). In Year 1, ewes grazing low-density corn had a greater

Table 3. Effects of winter feed source on ewe body weight change.

	Corn density				
Item	Low	High	Fescue pasture	Fescue hay	SEM
Initial wt, kg	91.6	91.6	91.6	91.6	0.1
Final wt, kg	102.5^a	99.3^b	89.8^c	97.5^b	1.0
BW change, kg	10.9^a	7.7^b	-1.8^c	5.9^b	1.1

^{abc} Means with different superscripts within rows differ ($P < 0.01$).

Fig. 1 Effect of winter feeding system and year on body condition score change. Year x treatment interaction ($P < 0.05$). Bars with different superscripts differ ($P < 0.05$).

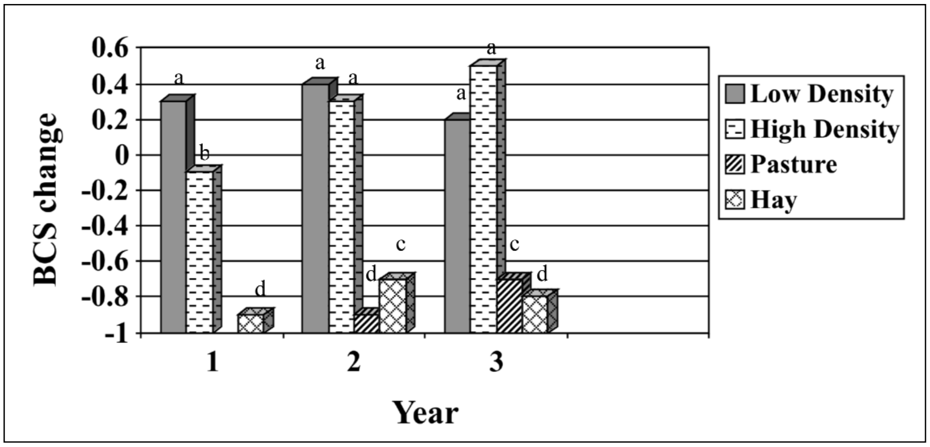
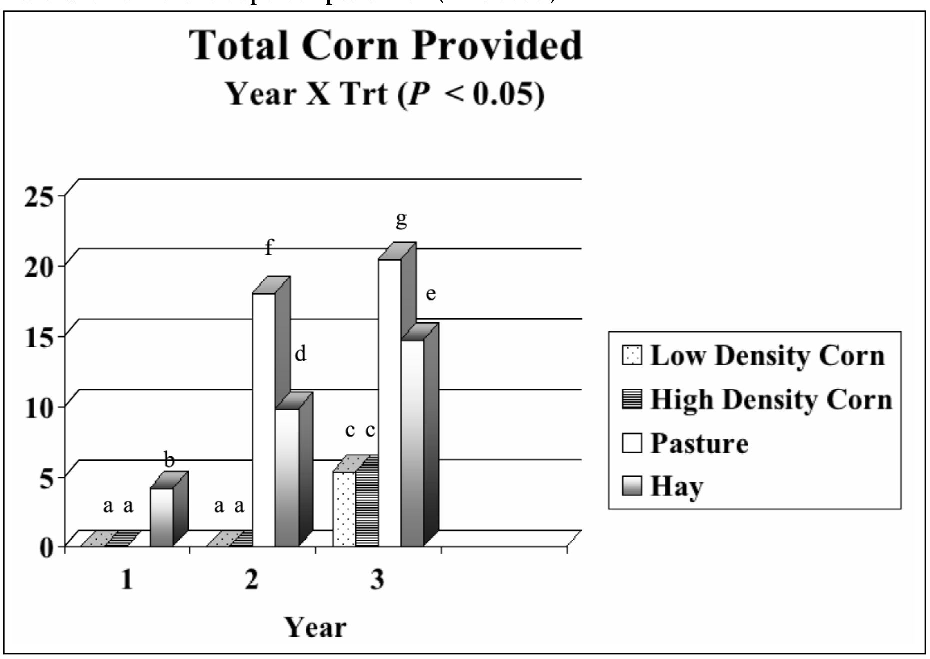


Fig. 2 Effect of winter feeding system on amount of supplemental corn DM provided per ewe during the 72-d trial. Year x treatment interaction ($P < 0.05$). Bars with different superscripts differ ($P < 0.05$).



increase in condition score than those grazing high-density corn, but in subsequent years, condition-score change was similar between corn treatments. Ewes grazing stockpiled fescue or fed fescue hay lost from 0.7 to 0.9 units of body condition (Figure 1). Emergency/supplemental corn grain was provided when deemed necessary (obvious lack of feed available or loss in body weight) and there was a treatment x year interaction ($P < 0.05$) for total supplemental corn grain provided (Figure 2). For the corn-grazing treatments, no supplemental-corn grain was provided in Years 1 or 2; a total of 5 kg of corn DM/ewe was provided in Year 3 due to adverse weather conditions. These ewes were moved to a barn for 5 days due to rain followed by a period of -17° C weather. Ewes grazing fescue pasture were supplemented with 18.1 kg to 20.4 kg of corn DM/ewe during the trial to prevent undesirable losses in weight and body condition score. Hagsten et. al. (1976) has reported the advantages of supplementing ewes grazing stockpiled-fescue pastures during late gestation with the major advantage being a reduction in winter-feed costs. In an attempt to maintain weight and body-condition score, ewes fed fescue hay in the present trial were supplemented with 4.1 kg, 9.5 kg, or 15 kg of corn DM during Years 1, 2, and 3, respectively. Effects of winter-feed source on ewe carrying capacity are shown in Table 4. Ewes in drylot consumed an average of 2.3 kg of hay DM/d. Carrying capacity of ewes grazing both corn-density treatments was similar. For both systems, a hectare of corn would have supported 100 ewes for about 30 days (Table 4). Stockpiled-fescue pasture supported only 20 percent of the carrying capacity of the corn fields ($P < 0.01$, Table 4). The DM yield data presented in Table 2 supports the lower carrying-capacity calculation for stockpiled fescue. Feed costs were calculated for all four systems, and data are provided in Table 5. When grazed corn was valued based on value of the average grain yield/ha for each planting density ($556/ha for low density and $674/ha for high density planting), daily feed costs were $0.190/ewe and $0.228/ewe for low- and high- density corn, respectively. If these corn paddocks were valued based solely on the cost to plant the crop ($370/ha), grazing corn (either planting density) resulted in calculated feed costs of $0.127/d. Estimated costs for feeding fescue hay were $0.212/d. Grazing stockpiled fescue was lowest at $0.168/d. These cost estimates are dependent on feed-cost assumptions outlined above and would vary depending on commodity price fluctuations.

Table 4. Effect of winter feed source on carrying capacity.

	Corn density				
Item	Low	High	Fescue pasture	Fescue hay	SEM
100 Ewe d/ha	29.2[a]	29.5[a]	5.9[b]	--	0.3
Hay DM, kg/d	--	--	--	2.3	--

[ab] Means with different superscripts within rows differ($P < 0.01$).

Table 5. Effects of wintering systems on daily feed costs ($/ewe).

	Corn density			
Feedstuff	Low	High	Fescue pasture	Fescue hay
Grazing[a]	.190	.226	.146	--
Hay[b]	--	--	--	.201
Corn[c]	--	--	.022	.011
Total	.190	.226	.168	.212

[a] Fescue pasture was valued at $86/ha and grazed corn was valued based on value of the average grain yield for each planting density ($556/ha for low density and $674/ha for high density planting).
[b] Hay was valued at $0.088/kg (as fed basis).
[c] Corn was priced at $0.079/kg (as fed basis).

Conclusion

In conclusion, compared to traditional hay feeding, winter-grazing standing corn or stockpiled fescue, plus emergency corn supplementation, were effective strategies to meet the nutritional needs of ewes during the first two-thirds of gestation. Grazing stockpiled fescue resulted in the lowest daily feed costs.

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