Profitable calf backgrounding integrating annual forage crops

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This study investigated the impacts of 'Willow Creek' winter wheat, barley and oat cereals harvested as silage and hay on calf backgrounding performance. The data suggests calves consuming barley silage had improved growth and performance, compared with steers consuming the dry-hay treatments. 'Willow Creek' winter wheat shows promise as a calf backgrounding forage.

Introduction

In this four-state region (Montana, North Dakota, South Dakota and Wyoming), cereal forages have become an increasingly important crop to livestock producers. Few statistics are available, but cereal hays are harvested on more than 500,000 acres in this region. One explanation for the popularity of cereal forages may be the current drought conditions and the forages' use as an emergency hay crop.

Small grains (barley, oat, wheat, triticale and rye) are used in crop rotations to renovate alfalfa stands and are an effective way to reduce costs associated with weed and disease control. Cereal hays are a significant source of winter forage for livestock producers in this area. Cereal forages are widely adapted and can be an inexpensive, readily available feed source, with similar harvesting costs as legumes (Helsel and Thomas, 1987). Some advantages of winter cereals, compared with spring cereals, are: greater herbage yields, seasonal distribution of workload and water use efficiency. They have the potential to serve as dual-purpose crops — as both grain and forage.

Previous research has shown differences in feeding value among cereal forage species and across maturity stages at harvest. Some cereal grain seed heads contain rough awns. Awns can affect palatability and cause mouth irritation in livestock. New cultivar development has focused on awn absence or biomass production and not animal feeding performance. This study was designed to evaluate the following objectives: obtain animal performance comparisons of steers consuming a new awnletted (short awns) winter wheat, oat and barley cereal forages; and demonstrate animal performance for a new awnletted winter wheat cultivar.

Procedures

A backgrounding performance study was conducted using 80 purchased crossbred weaned steer calves with initial body weight (BW) of 678 ± 8.4 lbs. Calves were stratified by BW, randomly allotted to one of 16 pens (five steers/pen) and assigned to one of four cereal forage dietary treatments: 1) barley harvested as hay (BH; cv. 'Robust'); 2) barley harvested as silage (BS; cv. 'Robust'); 3) oat harvested as hay (OH; cv. 'Loyal') and 4) winter wheat harvested as hay (WH; cv. 'Willow Creek').

Montana State University in Bozeman developed this awnletted winter wheat. Barley hay, BS and OH harvests were conducted at the same stage of maturity (soft dough stage) during June and July 2005. A commercial farmer grew the WH cultivar near Miles City, Mont., harvested it at flowering and delivered it to the Hettinger Research Extension Center prior to the start of the trial.

At processing, calves were vaccinated twice with Pyramid® 5 MLV vaccine (Fort Dodge, Fort Dodge, Iowa) and

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Ultrabac® 7 clostridial vaccine (Pfizer, Exton, Pa), vaccinated once with One Shot® for Pasturella (Pfizer, Exton, Pa.) and poured with Dectomax® (Pfizer, Exton, Pa.) for internal and external parasites. Calves were implanted with a Ralgro® implant (Schering-Plough, Kenilworth, N.J.) at the beginning of the study.

Steers were fed once daily (9 a.m.), based on pen bunk calls, and given unlimited access to their diets: fresh water, a roughage source, approximately 8 pounds of rolled barley grain and 1 pound of commercial supplement (30 percent crude protein) containing Rumensin®. Deccox® (Alpharma, Fort Lee, N.J.) medicated crumbles were fed during the study for coccidiosis prevention. A commercial hay processor chopped all hays prior to feeding. Two-day unshrunk weights were recorded on day 0, 28 and 57. Diet, feed refusals and fecal samples also were collected on day 0, 28, and 57. Diet samples were collected by pen, combined by respective treatment and analyzed for dry matter (DM), organic matter (OM), nitrogen (N), neutral detergent fiber (NDF) and acid detergent fiber (ADF).

Results and Discussion

Dietary treatment nutrient compositions are displayed in Table 1. In this study, BS had the highest crude protein (CP), net energy gain (NE_g) and OM and the lowest NDF and ADF, with BH and WH being intermediate, and OH having the lowest CP, NE_g, and OM and highest NDF and ADF levels of the dietary treatments (Table 1). High ash content indicates the likelihood the OH diet in this study was contaminated with soil, which resulted in elevated ADF and NDF levels. Previous agronomic research has shown that the chemical compositions of forages are affected by a variety of factors, such as species, varieties within species and stage of growth or maturity, as well as environmental conditions. The diets in this study were formulated to achieve a 2.60-pound average daily gain (ADG); however, the BS treatment had higher NEg values during the feeding trial, compared with the other three dietary treatments, which resulted in higher total and average daily gains (Tables 1 and 2). Although the BS diet had the lowest percentage of rolled barley grain in the total diet, BS forage had higher starch content (greater grain-to-forage ratio) at harvest from seed head fill, compared with the other three forages, thus increasing the diet's overall energy content (Table 1).

Steers consuming BH and BS had similar final weights; however, steers consuming BS had higher final weights, compared with the steers fed OH and WH ($P < 0.10$). Both total gain and ADG were influenced by dietary treatments ($P \leq 0.01$). Calves consuming the BS diet had the highest total gain and ADG of all four treatments, with no difference among BH-, OH- and WH-fed steers ($P > 0.10$). Dry matter intake (DMI) was not affected by treatment ($P = 0.31$) and averaged 2.56 percent of body weight; however, BH steers had DMI that was numerically higher than steers in the other three treatments. Gain-to-feed ratios were the highest for BS steers ($P = 0.02$), compared with the OH, BH and WH steers.

The influence of forage source on dietary intake, diet digestibility and digestible intake is summarized in Table 3. Barley silage had the highest N and lowest ADF and NDF intakes, compared with the dry-hay diets (BH, OH and WH; $P < 0.05$). Barley silage had the highest DM, OM and N digestible intakes and the lowest ADF digestible intake, compared with the other three treatments ($P = 0.02$). In this study, N intake appears to have had the greatest impact on animal performance (total gain and ADG; $P < 0.005$) with these cereal forage treatments.

Table 1. Dietary ingredient and nutrient compositions of diets fed to crossbred steer calves (DM basis).

	Diets			
Ingredient	**Barley Silage**	**Barley Hay**	**Oat Hay**	**Wheat Hay**
Barley silage, %	63.30	---	---	---
Barley hay, %	---	56.08	---	---
Oat hay, %	---	---	54.30	---
Wheat hay, %	---	---	---	58.75
Barley grain, %	31.48	37.67	39.22	35.38
30% CP supplement[a], %	4.02	4.82	5.01	4.52
Deccox medicated crumbles, %	1.2	1.43	1.49	1.35
Nutrient Concentration				
DM, %	58.2	84.5	83.8	87.7
CP, %	13.6	12.4	9.56	11.2
NE_m , Mcal/lb	0.76	0.62	0.53	0.72
NE_g, , Mcal/lb	0.50	0.36	0.27	0.45
OM, %	89.8	78.1	71.6	85.2
NDF, %	30.6	39.1	62.4	46.2
ADF, %	18.0	24.7	46	26.2
Ca, %	1.24	1.02	0.93	0.71
P, %	0.4	0.3	0.28	0.3
Nitrate, ppm	900	400	500	300
Deccox®, mg/hd/d	170	170	170	170
Rumensin®, mg/hd/d	213	213	213	213

[a]30% Commercial supplement (as fed): 29.0% CP, Ca 17.0%, P 0.45%, K 1.2%, Mg 0.7%,Vitamin A 110,000 IU/kg, Vitamin D3 11,000 IU/kg, Vitamin E 330 IU/kg, Cu 550 ppm, Zn 930 ppm and Mn 1,000

During the study, steers on all three dry-hay diets had large amounts of fines in their feed bunks during feed refusal collections, compared with the BS steers (data not reported). The BS steers did not appear to have sorted as much and apparently consumed a more consistent portion of their total daily feed allotment, compared with steers on the other three treatments, thus improving the BS steers' gain and overall feed efficiency.

Implications

In this backgrounding study, barley silage demonstrated greater potential as a backgrounding feed, compared with the dry-hay treatments (BH, OH and WH). 'Willow Creek' winter wheat shows promise as a possible forage option in calf backgrounding rations. Utilizing cereal grains as forage crops in calf backgrounding rations offers unique business opportunities to producers in this region, especially in periods of drought.

Literature Cited

Helsel, Z.R., and J.W. Thomas. 1987. Small grains for forage. J. Dairy Sci. 70:2330-2338.

Table 2. The influence of forage source on backgrounding steer performance.

	Treatments[a]					
Item	BH	BS	OH	WH	SEM	*P* value[b]
Initial wt, lbs	686	674	674	677	8.4	0.74
Final wt, lbs	844	858	824	820	11.6	0.07
Total gain, lbs	159	183	150	143	7.02	≤ 0.01
ADG, lbs/d	2.78	3.22	2.63	2.51	0.122	≤ 0.01
Gain: feed, lbs/lbs	0.138	0.17	0.135	0.135	0.009	0.02
Feed intake as % BW	2.66	2.48	2.65	2.44	0.097	0.31

[a]BH = Barley Hay; BS = Barley Silage; OH = Oat Hay; WH = Awnletted Winter Wheat Hay.
[b]*P* value for *F*-test of treatment.

Table 3. The influence of forage source on dietary intake, diet digestibility and digestible intake.

	Treatments[a]					
Item	BH	BS	OH	WH	SEM	*P* value[b]
Dietary intake, lbs/d						
DM	19.4	19.1	19.5	19.3	0.94	0.99
OM	14.8	15.8	15.2	14.8	0.80	0.78
N	0.35	0.39	0.32	0.32	0.017	0.03
ADF	5.92	4.45	6.11	6.72	0.356	< 0.01
NDF	9.92	8.12	10.0	10.64	0.575	< 0.05
Diet digestibility, %						
DM	41.7	57.1	50.0	48.0	1.50	< 0.005
OM	41.5	59.6	51.4	48.1	2.06	< 0.005
N	25.2	52.0	40.3	37.5	2.45	< 0.005
ADF	29.5	26.5	28.6	31.9	1.88	0.29
NDF	37.0	42.8	39.9	41.4	1.74	0.17
Digestible intake, lbs/d						
DM	8.09	10.92	9.77	9.25	0.52	0.02
OM	6.12	9.42	7.87	7.09	0.53	< 0.01
N	0.09	0.21	0.13	0.12	0.009	< 0.005
ADF	1.75	1.19	1.76	2.14	0.168	0.013
NDF	3.67	3.49	4.03	4.39	0.302	0.214

[a]BH = Barley Hay; BS = Barley Silage; OH = Oat Hay; WH = Awnletted Winter Wheat Hay.
[b]*P* value for *F*-test of treatment.