PRELIMINARY REPORT FOR SOUTHWEST FEEDERS PROJECT: PROFITABLE CALF BACKGROUNDING INTEGRATING ANNUAL FORAGE CROPS

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IMPACT STATEMENT

Barley harvested as hay and silage had greater potential as a backgrounding forage for steer calves as compared to oat and winter wheat harvested as hay.

INTRODUCTION

In the four-state region of Montana, North Dakota, South Dakota and Wyoming, cereal forages have become an increasingly important crop. Few statistics are available, but cereal hay is harvested on over 500,000 acres in the region. One explanation for the popularity of cereal forages may be the current drought conditions and their use as an emergency hay crop. Additionally, small grains are used in crop rotations to renovate alfalfa stands. This methodology is an effective way to reduce costs associated with weed and disease control. Small grains harvested as hay are a significant source of winter forage for livestock producers in the four-state region. These forages are widely adapted, and they can be an inexpensive and readily available feed source. Cereal forages are easier to grow when compared to alfalfa in terms of seed drills, herbicides, and risk and require similar harvesting techniques as legumes (S.D. Cash, personal communication; Helsel and Thomas, 1987). Proper harvesting can maximize feed value.

Research has shown striking differences in feeding value among cereal forage species and across stages of maturity at harvest. Khorasani et al. (1997) determined that barley had the highest forage quality followed by triticale and then oat. Barley has often been determined to have higher forage quality when compared to oat, wheat, or triticale (Cherney and Martin, 1982; Cherney et al., 1983, McCartney and Vaage, 1994). In addition, Khorasani et al. (1997) found that the nitrate concentration in barley and triticale declined rapidly with advancing maturity while the nitrate concentration of oat remained elevated. Research centers in the four-state region have been evaluating several annual crops for forage production. A summary of research at Central Agricultural Research Center, Moccasin, Montana and Sheridan Research and Extension Center, Sheridan, Wyoming is presented in Table 1. Some small grains that are cut for hay have rough awns. Rough or barbed awns of cereal grains can affect palatability and can cause mouth irritation. Bolsen and Berger (1976) found lambs consuming awned wheat silage had decreased dry matter intake (DMI) compared to those consuming awnless wheat silage. Many new annual forage crops are being developed as hooded, awnless, or awnletted (very short

awns). The experimental winter wheat line set for release from Montana State University (MSU) in 2005 is awnless. In addition, the most recent release of forage barley 'Hays' from MSU is hooded.

Table 1. Yield and Quality Data from the Central Montana Agriculture Research Center, Moccasin, MT and Sheridan Research and Extension Center, Sheridan, WY Trials in 2003

	DM Yield, t/a	NDF, %	ADF, %	CP, %	NO_3-N, ppm
Moccasin, MT					
Triticale	4.0	60.3	34.5	13.0	905
Winter Wheat	3.5	59.1	32.5	13.9	544
Forage Barley	2.0	48.9	25.5	10.0	350
Forage Oat	1.3	50.7	25.3	11.0	1500
Sheridan, WY					
Triticale	3.2	65.1	36.9	7.8	319
Winter Wheat	3.5	67.3	36.6	8.4	173

Most hay crops (including cereal hay) are fed on-site for livestock winter rations, and they also may be included as the major component in a backgrounding ration. Backgrounding is a means of economically adding value to calves and increasing profit by using an inexpensive feed such as barley to increase weight gain prior to entering a feedlot. Backgrounding allows retained ownership of calves past weaning when prices may be higher and allows lightweight or later born calves to add weight before marketing. A backgrounding program allows for skeletal and muscle development and adds a higher potential for compensatory gain (Rasby et al. 1994). In previous 60-day backgrounding studies at MSU, steers fed a diet comprised of approximately 17.6 lb of chopped barley hay, 5.7 lb cracked barley and 1 lb of a commercial 32% crude protein (CP) supplement had average daily gains (ADG) of about 2.64 lb/day (Surber et al., in progress). The four-state region has a unique mixture of crop and livestock production. Cereal forages provide an excellent option to capitalize on developing alternative copping systems that will provide added value through backgrounding cattle.

Scientists in the four-state region are working on solutions to address some of the questions and concerns associated with growing and feeding cereal forages. In some areas of the four-state region, winter cereals have distinct advantages over spring cereals in terms of production, water use efficiency and their seasonal distribution of workload. Montana State University is developing new cultivars of awnletted winter wheat and triticale and new lines of barley forage that show promise to improve forage quality and feeding value. Awnletted winter wheat cultivars have the potential to be dual purpose crops for producers, while there are limited markets for triticale feed or grain. Cereal forages appear to be very promising; however, cultivar development has only focused on the absence of awns or biomass production. Further, direct comparisons of these experimental crops with more traditional cereal forage crops in terms of feeding performance have yet to be made. Backgrounding feeding trials were designed and conducted in the late fall 2005 to assess the following objectives: 1) obtain animal performance comparisons of experimental and traditionally grown cereal forages, 2) demonstrate animal

performance for an experimental awnless winter wheat cultivar and 3) evaluate steer cost of gain for the experimental and traditionally grown cereal forages. Our intent is to provide crop and livestock producers with more options to add value to commodities such as hay and calves.

MATERIALS AND METHODS

A performance study was conducted using eighty crossbred steer calves purchased from a local sale barn in late fall, 2005. Steer calves initial body weight averaged 678 lbs (± 109 lb). Calves were stratified by weight and randomly allotted to one of 16 pens (5 steers/pen) with pen serving as experimental unit. Pens were then assigned to one of four cereal forage dietary treatments (4 replications/treatment): 1) barley (variety 'Robust') harvested as hay (**BH**); 2) barley (variety 'Robust') harvested as silage (**BS**); 3) oat (variety 'Loyal') harvested as hay (**OH**) and 4) a new awnless winter wheat cultivar (variety 'Willow Creek') developed by MSU harvested as hay (**WH**). Cereal forages utilized in the feeding trial were seeded at the recommended rates for the soil types and environment for southwest North Dakota and Miles City, MT. Barley hay and silage and oat hay harvest were conducted at the same stage of maturity (soft dough stage) during the months of June and July 2005 at the HREC. The winter wheat hay cultivar was grown and harvested near Miles City, MT by a commercial farmer and was delivered to HREC.

Backgrounding diets consisted of a roughage source (BH, BS, OH or WH); 8 lb of rolled barley and 1 lb of a locally produced 32% CP supplement containing Rumensin at 450 gram/ton. Diets were isocaloric (Table 2). Target ADG for the feeding ration was 2.60 lbs. Deccox crumbles were fed throughout the entire feeding period for coccidiosis prevention. Steers were given ad libitum access to their diets and fresh water throughout the feeding trial. All hay sources were chopped to a 2.5 inch chop length by a custom hay processor.

When calves were initially weighed upon arrival at Southwest Feeders, rectal body temperatures were taken to determine the incidence of respiratory illness (BRD complex) on the calves. Steers having a rectal body temperature of 105 degrees F or greater were given a subcutaneous injection of Excede (Ceftiofur Crystalline Free Acid, Pfizer Animal Health, Exton, PA) antibiotic in the middle one-third of the posterior aspect of the ear. When calves were processed, steers were vaccinated twice with Pyramid 5 vaccine (Bovine Rhinotracheitis-Virus Diarrhea-Parainfluenza-3-Respiratory Syncytial Virus; modified live virus; Fort Dodge Animal Health, Overland, KS) and Ultrabac® 7 Clostridial vaccine (Pfizer Animal Health, Exton, PA); vaccinated once with One Shot® bacterin-toxid for *Mannheimia haemolytica* (Pfizer Animal Health, Exton, PA), and poured with Dectomax® Pour-On dewormer (doramectin; Pfizer Animal Health, Exton, PA) for internal and external parasites. Calves were implanted with a Ralgro® implant (Schering-Plough Animal Health Corporation, Kenilworth, NJ) at the beginning of the backgrounding study.

Steers were fed backgrounding diets for a period of 57 days following an 8 day diet adaptation period. Pen feed adjustments were based on individual bunk calls made prior to the cattle being fed once daily (9:00 am). Animals were individually weighed prior to the morning feeding for 2 day on-test, 28 day interim and 2 day off-test weights. A health protocol was established through a local veterinary clinic including a monthly pen walk-through by the attending veterinarian. Diet and feed refusals (orts) were taken once every 14 d and fecal samples were collected midway (d 28) and upon completion (d 57) of the trial. Diet and fecal samples were composited

by pen and analyzed for dry matter (**DM**), organic matter (**OM**), nitrogen (**N**; AOAC, 2000), NDF, ADF (Van Soest et al, 1991) and indigestible acid detergent fiber (**IADF**; Bohnert et al., 2002). Indigestible ADF will be used as an internal marker to estimate fecal output and to calculate apparent nutrient digestion. Individual diet ingredient samples were analyzed by Midwest Laboratories (Omaha, NE), a commercial laboratory using wet chemistry and ICAP methods for mineral analysis; Midwest Laboratories is a certified by the National Forage Testing Association.

Backgrounding performance, feed intake and nutritional data was analyzed as a randomized complete block design using the GLM procedures of SAS (SAS Inst. Inc., Cary, NC) to test the main effects of dietary forage source. Pen was used as the experimental unit. Planned pairwise comparisons (least significant difference) were used to separate forage least square means when the protected *F*-test was significant ($P < 0.10$).

Table 2. Dietary ingredient and nutrient compositions of diets fed to crossbred steer calves

	Diets, % DM Basis			
Ingredient	Barley Silage	Barley Hay	Oat Hay	Wheat Hay
Barley Silage	63.30	---	---	---
Barley Hay	---	56.08	---	---
Oat Hay	---	---	54.28	---
Wheat Hay	---	---	---	58.76
Barley grain	31.48	37.67	39.22	35.38
32% CP supplement[a]	4.02	4.82	5.01	4.52
Deccox crumbles	1.2	1.43	1.49	1.35
Nutrient Concentration				
DM, %	48.5	85.4	82.0	91
CP, %	14.8	14.4	13.5	14.2
NE_m, Mcal/lb	0.80	0.81	0.83	0.81
NE_g, Mcal/lb	0.44	0.45	0.46	0.45
Ca, %	0.85	0.81	0.83	0.72
P, %	0.36	0.39	0.36	0.33
K, %	1.80	1.54	1.98	1.55
Cu, ppm	19	22	22	22
Zn, ppm	74	90	82	75
Mn, ppm	69	98	112	111
Deccox, mg	170	170	170	170
Rumensin, mg	213	213	213	213

[a] 32% Commercial supplement (as fed): 32% CP, min Ca 10%, min P 0.50%, min K 1.4%, min Mg 0.5%,Vit A min 50,000 IU/lb, Vit D_3 min 5,000 IU/lb, Vit E min 150 IU/lb, min Cu 260 ppm, min Zn 915 ppm, min Mn 945 ppm.

RESULTS AND DISCUSSION

Initial weights were not affected by dietary treatment ($P = 0.87$; Table 3). Steers consuming barley hay and barley silage did not have differing final weights; however, steers consuming oat

hay had lower final weights compared to the barley hay and barley silage steers, but higher final weights as compared to the steers consuming winter wheat hay ($P = 0.09$; Table 3). Both total weight gain and total ADG was influenced by treatments ($P < 0.001$; Table 3). Calves on the barley silage diet had the highest total weight gain and ADG of all four treatments ($P < 0.05$); however, the steers consuming the barley hay diet had higher total weight gains and ADG than both the steers consuming the oat and winter wheat hay diets($P < 0.05$). At press time, feed intake data and total mixed rations, orts, and fecal samples had had not been analyzed. It is quite possible that physical and/or nutritional characteristics of the oat and winter wheat hays negatively influenced feed intake for these treatments, leading to lower ending weights and ADG. Since the steers consuming the oat hay diet had a higher body weight at the end of the feeding trial as compared to the winter wheat hay steers, it appears that steers consuming the oat hay diet may have had higher dietary feed intakes as compared to the steers consuming winter wheat hay.

Table 3. The influence of diet on backgrounding steer performance

	Treatments[a]					
Item	BH	BS	OH	WH	SEM[b]	*P* value[c]
Initial Wt, lbs	686	674	674	677	11.1	0.87
Final Wt, lbs	844[z]	857[z]	824[y]	819[x]	11.7	0.09
Total gain, lbs	159[y]	183[z]	150[x]	143[x]	4.9	< 0.001
ADG, lbs/day	2.78[y]	3.21[z]	2.63[x]	2.50[x]	0.09	< 0.001

[a]BH = Barley Hay; BS = Barley Silage; OH = Oat Hay; WH = Winter Wheat Hay.
[b]Standard Error of Mean; n = 4.
[c]*P* value for *F* test of treatment.
[xyz]Within a row, means without a common superscript differ ($P<0.10$).

IMPLICATIONS

In this backgrounding study, barley hay and barley silage illustrated greater potential for use as a feedstuff in backgrounding cattle rations as compared to oat and winter wheat harvested as hay. More research is needed to further define if the variety of grains used for the forages had negative influences on feed intake by backgrounding steers. Utilizing cereal grains as forage crops in post-weaning cattle rations offers unique business opportunities to producers in the region, especially in times of drought.

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