

## Grazing potential of barley or oat forage for yearling beef heifers in the Northern Great Plains

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*In difference to previous work, cattle performance when grazing barley or oat forage did not differ. Furthermore, forage production and quality were not affected by forage type. These data suggest that cattle can be grazed successfully on pastures annually seeded to small grain forage without regard to forage type during the summer in the Northern Great Plains.*

### Abstract

Barley (*Hordeum vulgare*) forage has been shown to be higher in quality compared to oat (*Avena sativa*) forage in many agronomic experiments. Conversely, oat often produces more biomass. An experiment was designed to compare the grazing potential of barley and oat forage for yearling beef heifers. Forages were evaluated on the basis of animal performance and forage production and quality. In 2000, six 1-ha paddocks were blocked into two groups (3 paddocks per group) based upon previous cropping history and randomly allotted within group to be seeded to either barley or oat. Twenty-four bred yearling beef heifers (418.2  $\frac{20}{1}$  2.69 kg; 6.8  $\frac{20}{1}$  .23 body condition score) were then stratified by weight and randomly assigned to paddock within weight stratum (4 heifers/paddock). Heifers were turned out to graze paddocks in early June (approximately 47 d post-seeding) and grazed for 28 d. There were no differences in final BW (P=.15) or condition score (P=.53), ADG (P=.87) or total gain (P=.87). Heifers gained .87  $\frac{20}{1}$  .07 kg/d and produced 95.9  $\frac{20}{1}$  7.6 kg/ha of BW gain over the grazing period. There were no differences in cereal (P=.48), weed (P=.46) or overall (P=.29) forage available for grazing between forage types. The percentage of cereal (P=.58) contribution to overall forage mass also did not differ between forage types. On average, there was 4338  $\frac{20}{1}$  154 kg/ha of forage available for grazing of which 78.2  $\frac{20}{1}$  2.5 % was cereal. Crude protein (P=.20), ADF (P=.85), NDF (P=.30), and TDN (P=.40) concentrations did not differ with forage type. Average concentrations were 139  $\frac{20}{1}$  6.4, 363  $\frac{20}{1}$  5.1, 579  $\frac{20}{1}$  8.6 and 556  $\frac{20}{1}$  3.8 g/kg for CP, ADF, NDF and TDN, respectively. In difference to previous work, cattle performance when grazing barley or oat forage did not differ. Furthermore, forage production and quality were not affected by forage type. These data suggest that cattle can be grazed successfully on pastures annually seeded to small grain forage without regard to forage type during the summer in the Northern Great

## Introduction

Oat (*Avena sativa* L.) is the most popular, cool-season cereal forage grown in the Northern Great Plains. However, barley (*Hordeum vulgare* L.) forage yield (Cherney and Martin, 1982; Chapko et al., 1991) and quality (Cherney and Martin, 1982) in sub-humid regions of the US has been shown to be superior to oat forage.

Barley forage yield has been inconsistent compared to oat in the more arid regions of the Northern Great Plains. Oat cultivars produced more forage yield than barley cultivars in some studies (Carr et al., 1998); while forage yield was not different between oat and barley cultivars in other studies (unpublished data, Carr et al., 1996). In a more comprehensive cultivar comparison (Carr et al., 2000, 2001) involving multiple oat and barley cultivars selected primarily for either grain or forage production, oat and forage-type cultivars produced more forage yield than barley or grain-type cultivars, respectively. In this same study, barley forage had higher crude protein (CP) concentrations than oat forage.

Anecdotal evidence (Poland et al., 1997, 1999) suggests that beef cattle grazing pastures seeded to barley have fewer grazing days, higher daily animal performance and similar overall animal gains when compared to pastures seeded to oat.

## Objectives

To compare the grazing potential (animal performance and forage production and quality) of barley and oat forage for yearling beef heifers.

## Materials and Methods

- Six 1.0-ha paddocks were blocked into two replicates (3 paddocks/replicate).
- Paddocks within replicate were randomly assigned to be seeded to either an oat (Dumont) or barley (Haybet) cultivar.
- 24 pregnant beef heifers were stratified by weight and randomly assigned within weight stratum to individual paddocks (4 heifers/paddock). Animals were weighed on consecutive days at the beginning and end of the grazing period.
- Heifers were allowed to graze individual paddocks until forage visually available for grazing was depleted.
- Forage in paddocks was sampled by randomly clipping five 0.25-m areas in each paddock at 14-d intervals. Forage was manually separated into either seeded or weed categories at clipping.
- Forage samples were dried (55C until constant weight) and weighed to determine dry matter yields. All forage (seeded and weed) within a paddock and clip date was combined, ground and subsampled for chemical analysis (CP and acid [ADF] and neutral [NDF] detergent fibers). Total digestible nutrients (TDN) and relative feed values (RFV) were calculated using standard equations.

- Data were analyzed as either a randomized complete block or split plot in time design. Replicate and cereal type were main effects and, where appropriate, sampling day was a split plot factor.

## Conclusions

Animal performance ([table 1](#)):

- All paddocks were grazed for 28 d.
- There were no differences in animal performance due to cereal type.
- Heifers gained .87 kg/d and 95.9 kg/ha.

Botanical composition ([table 2](#)):

- Cereal type did not affect forage yield or percentage of total forage that was cereal.
- Cereal and total forage yield increased between days 0 and 14 and then declined through day 28. Numerically, weed yields followed this same trend.
- Percentage of total forage that was cereal did not change across the grazing period.

Nutritional composition ([table 3](#)):

- Overall the nutritional composition for available forage was not affected by cereal type. However, there was numerically higher CP concentrations in barley forage (approximately 15 g/kg).
- There was a tendency for ADF concentration to be higher in barley forage at the initiation of grazing.
- CP concentrations declined across the grazing period; while fiber concentrations increased, and TDN and RFV values decreased, between days 0 and 14 and subsequently remained relatively constant through day 28.

## Discussion

Cereal type did not affect grazing animal performance or botanical or nutritional composition of available forage. These data contradict

earlier observations where oat forage yielded more dry matter and grazing days and barley forage supported higher animal performance. In retrospect, specific cultivar selection may have inadvertently compared grain-type oat (Dumont) and forage-type barley (Haybet) cultivars. This selection may have minimized the expected differences in forage production and animal performance. The numerically higher CP concentration in barley forage suggests higher forage quality. However, similar animal performance suggests that some nutrient other than CP (e.g. energy or TDN) was first-limiting.

## Implications

In difference to previous work, cattle performance when grazing barley or oat forage did not differ. Furthermore, forage production and quality were not affected by forage type. These data suggest that cattle can be grazed successfully on pastures annually seeded to small grain forage without regard to forage type during the summer in the Northern Great Plains.

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**Table 1.** Effects of cereal type (Trt) on animal performance.

	Trt			Probability Level	
Item	Oat	Barley	SEM	Rep	Trt
<b>Initial</b>					
Weight, kg	416.4	420.0	1.60	.26	.22
Body condition score	6.8	6.8	.14	.78	.78
<b>Final</b>					
Weight, kg	440.9	443.9	1.08	.40	.15
Body condition score	6.6	6.4	.24	.53	.53
Total grazing days, d	28.0	28.0	--	--	--
Daily gain, kg/d	.88	.86	.068	.59	.87
Condition score change	-.14	-.45	.328	.56	.56
Total gain, kg/ha	96.7	94.8	7.62	.60	.87
<sup>a</sup> Rep and Trt refer to effects of replication and treatment (cereal type), respectively.					

**Table 2.** Effects of cereal type (Trt) on dry matter yields and the percentage of cereal in total yield.

	Day of Grazing					Probability Level <sup>a</sup>					
Item	0	14	28	SEM		Rep	Trt	Error A	Day	Rep*Day	Trt*Day
<b>Cereal yield, kg/ha</b>											
Oat	2910	4165	3176	176		.03	.48	.29	<.01	.28	.51
Barley	2885	3764	3161								
Total	2897 <sup>x</sup>	3965 <sup>y</sup>	3168 <sup>x</sup>	122							
<b>Weed yield, kg/ha</b>											
Oat	1007	1129	881	171		.20	.46	.38	.36	.82	.99

	Barley	871	1008	740							
	Total	940	1068	811	119						
<b>Total yield, kg/ha</b>											
	Oat	3917	5295	4058	156	.15	.29	.13	<.01	.10	.46
	Barley	3756	4772	3902							
	Total	3836 <sup>x</sup>	5034 <sup>y</sup>	3979 <sup>x</sup>	108						
<b>Cereal yield, %Total</b>											
	Oat	74.3	78.4	77.4	3.6	.10	.58	.32	.59	.80	.92
	Barley	77.0	78.9	80.9							
	Total	75.6	78.6	79.1	2.5						
<p><sup>a</sup> Rep, Trt and Day refer to effects of replication, treatment (cereal type) and day of grazing, respectively. Error A represents the interaction of Rep and Trt and was used as error term for testing main effects of Rep and Trt.</p> <p><sup>x,y</sup> Means within a row with differing superscripts differ (P&lt;.05).</p>											

**Table 3.** Effects of cereal type (Trt) on nutritional composition of available forage.

Item	Day of Grazing				Probability Level <sup>a</sup>						
	0	14	28	SEM	Rep	Trt	Error A	Day	Rep*Day	Trt*Day	
<b>Crude Protein (CP), %DM</b>											
	Oat	17.5	12.5	9.3	.49	.05	.20	.05	<.01	.05	.26
	Barley	19.5	12.9	11.3							
	Total	18.5 <sup>z</sup>	12.7 <sup>y</sup>	10.3 <sup>x</sup>	.34						

<b>Acid Detergent Fiber (ADF), %DM</b>											
Oat	29.5	38.8	40.4	.50	.02	.85	.11	<.01	.74	.06	
Barley	31.5	38.0	39.6								
Total	30.5 <sup>x</sup>	38.4 <sup>y</sup>	40.0 <sup>z</sup>	.35							
<b>Neutral Detergent Fiber (NDF), %DM</b>											
Oat	49.7	60.5	61.4	1.47	.02	.30	.46	<.01	.62	.68	
Barley	50.9	60.9	64.4								
Total	50.3 <sup>x</sup>	60.7 <sup>y</sup>	62.9 <sup>y</sup>	1.01							
<b>Total Digestible Nutrients (TDN), %DM</b>											
Oat	65.3	51.3	49.3	.77	<.01	.40	.58	<.01	.62	.29	
Barley	64.3	53.0	50.2								
Total	64.8 <sup>z</sup>	52.2 <sup>y</sup>	49.8 <sup>x</sup>	.53							
<b>Relative Feed Value (RFV)</b>											
Oat	125	90	87	2.8	.01	.33	.36	<.01	.13	.46	
Barley	118	91	84								
Total	122 <sup>y</sup>	91 <sup>x</sup>	86 <sup>x</sup>	1.9							

<sup>a</sup> Rep, Trt and Day refer to effects of replication, treatment (cereal type) and day of grazing, respectively. Error A represents the interaction of Rep and Trt and was used as error term for testing main effects of Rep and Trt.

