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Abstract

A 101-day growing study was conducted to evaluate the growth performance of beef heifers fed wheat middlings in traditional full- fed, sorghum silage-based rations and in limit-fed, high-concentrate rations. Diets were formulated without wheat middlings or with wheat middlings replacing 33, 67, or 100% of rolled corn plus soybean meal. Daily gains decreased linearly (P<.01) with increasing levels of wheat middlings in the roughage-based diets because of lower feed intake (P<.10), but feed efficiency was not affected (P>.30). For the limit-fed diets, heifer daily gains decreased linearly (P<.01) as the proportion of wheat middlings in the diet increased, resulting in a linear reduction (P<.01) in feed efficiency. Wheat middlings can be utilized effectively as the predominant energy/protein source for growing cattle, though their nutritional and economic value, relative to corn and soybean meal, may be different for roughage-based and limit-fed diets.

Keywords

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WHEAT MIDDLINGS IN ROUGHAGE-BASED OR LIMIT-FED, HIGH-CONCENTRATE DIETS FOR GROWING CALVES [1,2]

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Summary

A 101-day growing study was conducted to evaluate the growth performance of beef heifers fed wheat middlings in traditional full-fed, sorghum silage-based rations and in limit-fed, high-concentrate rations. Diets were formulated without wheat middlings or with wheat middlings replacing 33, 67, or 100% of rolled corn plus soybean meal. Daily gains decreased linearly (P<.01) with increasing levels of wheat middlings in the roughage-based diets because of lower feed intake (P<.10), but feed efficiency was not affected (P>.30). For the limit-fed diets, heifer daily gains decreased linearly (P<.01) as the proportion of wheat middlings in the diet increased, resulting in a linear reduction (P<.01) in feed efficiency. Wheat middlings can be utilized effectively as the predominant energy/protein source for growing cattle, though their nutritional and economic value, relative to corn and soybean meal, may be different for roughage-based and limit-fed diets.

(Key Words: Wheat Middlings, Growing Calves, Limit Feeding, Sorghum Silage.)

Introduction

Previous research with wheat middlings (WM) has focused primarily on its use as a supplement for beef cows grazing poor quality roughages, where forage utilization is an important consideration. Limited studies indicate that growing cattle respond very favorably to WM as a replacement for grain and soybean meal in backgrounding rations. The objective of this study was to determine the feeding value of WM relative to corn and soybean meal in traditional high roughage diets and in limit-fed growing cattle diets. This information about the substitution value of WM in growing rations will enable beef producers to make more informed purchase decisions.

Experimental Procedures

Two hundred and eighty-eight predominantly British crossbred heifers averaging 442 lb were used in a randomized complete block design to evaluate the following eight treatments:

1. 40% sorghum silage plus dry-rolled corn (SSCRN100).

[1]Sincere appreciation is estended to the Kansas Wheat Commission, ADM Milling Co., Cargill Flour Milling Division, Cereal Food Processors, Stafford Country Flour Mills Company, and the Wall-Rogalsky Milling Company for partial funding of this research.

[2]Sincere appreciation is also extended to Western Star Mill Company, Division of ADM Milling Co., Salina, Kansas for providing the wheat middlings used in this study.

2. 40% sorghum silage plus 2:1 mixture of dry-rolled corn and wheat middlings (SSCRN67).
3. 40% sorghum silage plus 1:2 mixture of dry-rolled corn and wheat middlings (SSCRN33).
4. 40% sorghum silage plus wheat middlings (SSMID100).
5. Limit-fed diet containing dry-rolled corn as the primary energy source (LFCRN100).
6. Limit-fed diet containing 2:1 mixture of dry-rolled corn and wheat middlings (LFCRN67).
7. Limit-fed diet containing 1:2 mixture of dry-rolled corn and wheat middlings (LFCRN33).
8. Limit-fed diet containing wheat middlings as the primary energy/protein source (LFMID100).

Upon arrival at the KSU Beef Teaching and Research Center, heifers were vaccinated against common viral and clostridial diseases, treated for internal and external parasites with a topically applied parasiticide, implanted with Synovex®-H, and fed a common receiving diet for approximately 2 weeks. At the start of the study, all calves were weighed individually and blocked into three weight groups. On day 2, cattle in each weight block were reweighed individually, stratified by weight, and randomly allotted within strata to 48 pens containing six head each for a total of six replicate pens per dietary treatment. Cattle were pen weighed at about 30-day intervals during the study and were weighed individually on the final 2 days of the experiment.

Diets were formulated for approximately 2.0 lb daily gain. The roughage-based diets contained 40% sorghum silage, 14.8% crude protein and a Ca:P ratio of 2:1, and the limit-fed diets contained 15% chopped alfalfa hay, 16.7% crude protein, and a Ca:P ratio of 2:1. The roughage-based and limit-fed diets were formulated to provide no WM or 33, 67, or 100% replacement of corn/soybean meal with WM (Table 1). WM were obtained directly from a commercial flour mill. Cattle were fed their respective diets once daily at ad-libitum intake (roughage-based) or at 2.4% of body weight (limit-fed, DM basis), during the first 91 days of the growing trial. The amount of feed offered to the limit-fed cattle was adjusted every 14 days. During the final 10 days, all heifers were fed their respective diet at 2.4% (DM basis) of body weight daily to equalize ruminal fill differences between the roughage- and limit-fed diets. Feed consumption, weight gain, and feed efficiency were monitored throughout the growing period.

Results and Discussion

Heifer performance data were analyzed by regression using percentage of WM in the diet as a continuous variable, nested within diet type. Over the spectrum of WM evaluated in either the sorghum silage or limit-fed diets, a similar linear decline ($P<.01$) in daily gain occurred as the proportion of WM was increased (Figure 1). Heifer dry matter intake of the SSMID100 diet was approximately 10% percent less ($P<.10$) than intakes of the other sorghum silage diets (Table 2). On the silage diets, feed efficiency (feed DM/gain) changed little ($P>.30$) as WM increased. However, in the limit-fed diets, efficiency decreased ($P<.01$) as WM increased (Figure 2).

Based on the feed efficiency data from this study, WM had a feed value of 95% relative to corn and soybean meal when used in full-fed sorghum silage-based rations but a value of 83% when used in limit-fed diets.

Table 1. Composition of Experimental Diets

Diet	Dry-Rolled Corn	Wheat Middlings	Sorghum Silage	Alfalfa Hay	Molasses	Soybean Meal	Limestone	Diacalcium Phosphate	Urea	Premix
	% DM basis									
SSCRN100	46.6	0	40.0			10.8	1.2	.33	.66	.38[1]
SSCRN76	33.0	16.5	40.0			7.6	1.7	.23	.66	.38[1]
SSCRN33	17.6	35.1	40.0			4.1	2.2	.12	.66	.38[1]
SSMID100	0	56.2	40.0			0	2.7	0	.66	.38[1]
LFCRN100	68.0	0		15.0	4.0	10.4	1.1	.38	.66	.44[2]
LFCRN67	47.2	23.6		15.0	4.0	7.2	1.8	.26	.46	.44[2]
LFCRN33	24.5	49.3		15.0	4.0	3.8	2.5	.14	.24	.44[2]
LFMID100	0	77.2		15.0	4.0	0	3.3	0	0	.44[2]

[1]Provided 30% salt; 1200 IU/lb Vitamin A; .04 ppm Cu; .50 ppm I; 48 ppm Mn; 23 ppm Se; 48 ppm Zn, and 25 g/ton Rumensin®.

[2]Provided .33% Salt; 1330 IU/lb Vitamin A; .04 ppm Co; 8.8 ppm Cu; .55 ppm I; 53 ppm Mn; .25 ppm Se; 53 ppm Zn; 30 g/ton Rumensin®, and 10 g/ton Tylan®.

Table 2. Dry Matter Intake of Experimental Diets

Diet	Dry Matter Intake, lb/day
SSCRN100	17.8[ab]
SSCRN67	18.0[b]
SSCRN33	18.0[b]
SSMID100	16.5[a]
LFCRN100	12.1[c]
LFCRN67	12.3[c]
LFCRN67	12.2[c]
LFMID100	12.2[c]
SEM	.6

[a,b,c]Means with common superscripts are not different (P>.10).

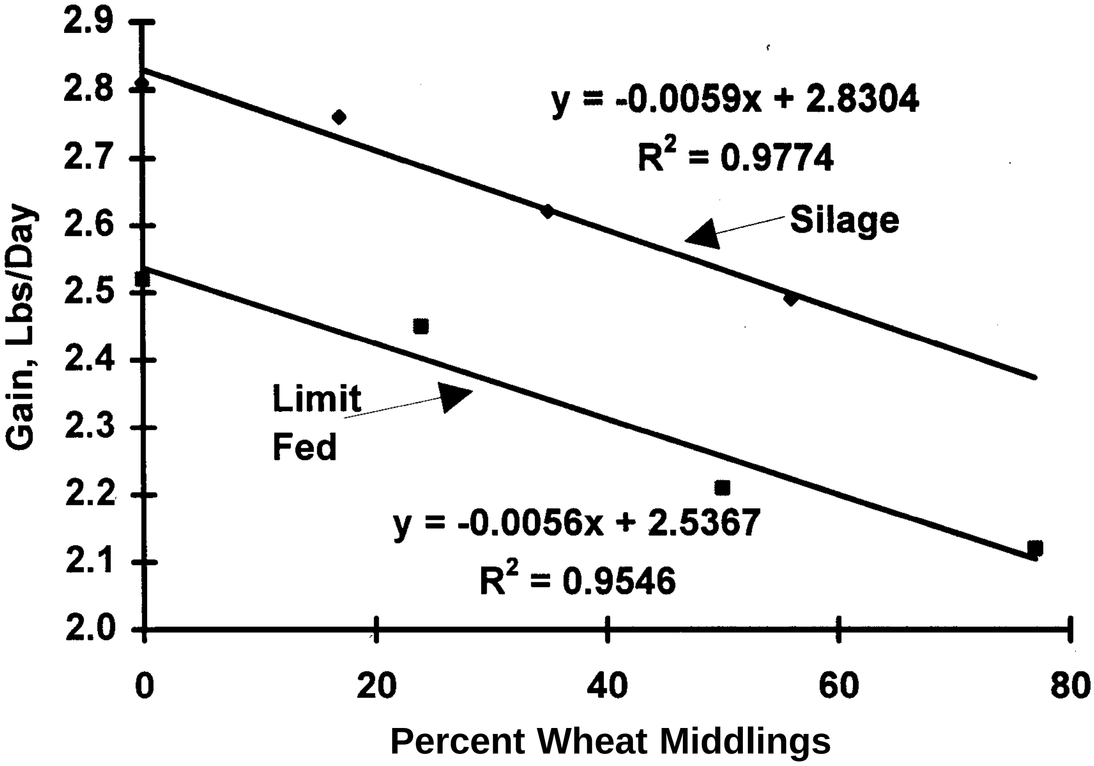

Figure 1. Effect of Increasing Levels of Wheat Middlings on Daily Gain of Growing Heifers Fed either a Sorghum Silage or Limit-Fed Diet.

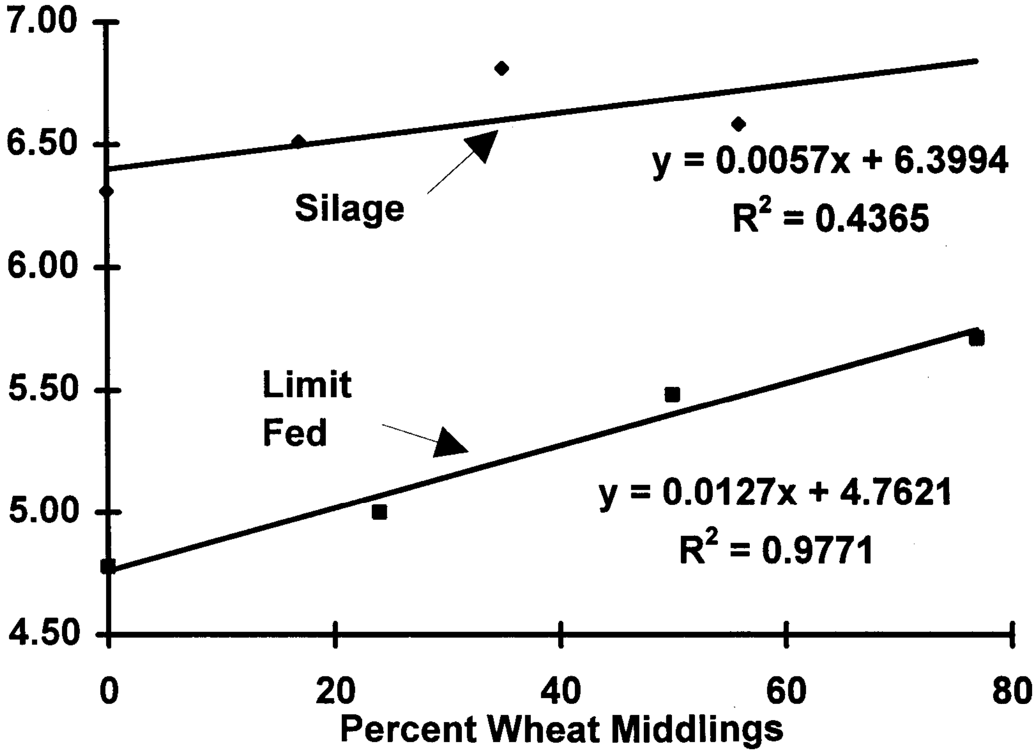

Figure 2. Effect of Increasing Levels of Wheat Middlings on Feed Efficiency of Growing Heifers Fed either a Sorghum Silage or Limit-Fed Diet.