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Forage and Grain Yields and Forage Composition of Barley, Wheat, and Oats

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Summary

We harvested barley, wheat and oat varieties at the dough stage. Average yields in tons of 65% moisture forage/acre were 9.3 (barley), 10.2 (hard wheat), 9.5 (soft wheat), and 10.0 (oats). Barley variety yields varied most because of winter kill. Barley forages were the most digestible; oats, the least digestible. Crude fiber and grain contents of the forages were highly correlated with digestibility.

Barley yielded highest in digestible dry matter, but hard wheat yields were more consistent from year to year.

Introduction

Barley, wheat, and oat forages are potential livestock feeds. Cereals harvested as whole-plant hay or silage usually yield more dry matter than grain harvest or pasture grazing yields. Under some economic conditions cereal forage is more profitable than cereal grain. Previous KSU research has shown corn and barley silages about equal in feeding value, with wheat silage worth somewhat less. We harvested the cereal silages at the dough stage of maturity for highest TDN yield per acre.

Here we used barley, wheat, and oat varieties common to Kansas and determined forage dry matter yields, forage composition, grain yields, and in vitro digestibilities.

Experimental Procedure

Three field experiments were conducted at the South Central Kansas Experiment Field, Hutchinson, in 1975, 1976, and 1977. Plot areas received 32 lb. nitrogen and 40 lb. phosphorus per acre each fall before seeding.

Winter barley varieties were Paoli and Kanby all three years; soft red winter wheat varieties were Arthur-71 all three years, plus Blue Boy II in 1975 and Abe in 1976 and 1977; hard red winter wheat varieties were Eagle and Sage all three years; and spring oat varieties were Pettis and Lodi in 1976 and 1977. Barley, wheat, and oat varieties were seeded at rates of 90, 75, and 60 lb./acre, respectively. Planting dates for barley and wheat were October 2, 1974, October 2, 1975, and October 13, 1976; planting dates for oats were

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March 19, 1976, and March 2, 1977. Varieties were replicated four times.

Forage harvest was at the dough stage (Table 14.1). Plants were hand-harvested by mower clipping a 60-square-foot area of each plot. Dry matter, proximate analysis, Van Soest fiber analysis, and in vitro dry matter digestibility were determined for each variety. Grain yields were measured from three, 12-square-foot areas of each plot.

Results

Forage and grain yields (Table 14.2) are tons of 65%-moisture forage per acre, and bushels of 12%-moisture grain per acre. Overall forage yields show hard wheat or oats yielded more forage than barley or soft wheat ($P < .05$). Yields in 1977 were less than in 1975 or 1976 ($P < .01$). Difference in variety yields were not consistent. For example, Kanby barley yielded more than 10 tons/acre in 1975 and 1976, but only 6.8 tons in 1977 because an extremely cold winter reduced the stand. Grain yields were highest for barley and lowest for oats. Grain contents (DM basis) were 45.6% for barley, 29.7% for soft wheat, 32.1% for hard wheat, and 20.2% for oats.

Table 14.3 shows forage crude protein, crude fiber, and in vitro dry matter digestibility averaged over years for each variety. The crude protein values are about 2% lower than for similar forages machine-harvested. Oat forage protein, although higher on average, varied more and was lower than barley forage protein in 1977. Variation between varieties was small. Crude fiber values were lowest for barley and highest for oats. Wheats were intermediate in crude fiber; soft wheats had less than hard wheats. Crude fiber values of barley and wheat tended to be less when forage yields were highest. In vitro dry matter digestibility was highest for barley. Paoli barley was consistently more digestible than Kanby barley (62.7 vs. 59.9%). Other varietal differences were less pronounced, except for low digestibility of Blue Boy II one year. Soft wheats tended to be more digestible than hard wheats, but both were more digestible than oats. In vitro dry matter digestibility, the best measure of feeding value in these experiments, is inversely related to crude fiber with a correlation of $r = -.83$. Crude protein content did not affect ($r = -.13$) digestibility. Higher grain content of the forage also is associated with increased digestibility ($r = +.64$).

Digestible dry matter yield per acre (IVDMD x forage dry matter yield) is shown for specie and year in Figure 2.1. Year affected ranking of species, with barley yielding highest in 1975 and 1976, but lowest in 1977. Hard wheat digestible dry matter yields were the most consistent, and exceeded soft wheat yields in 1975 and 1977.

Table 14.1. Dates of forage harvests.

Specie	1975	1976	1977
Barley	May 26	May 20	Nay 23
Wheat	June 5	June 4	June 1
Oats, Pettis	--	June 16	June 10
Oats, Lodi	--	June 22	June 20

Table 14.2. Forage and grain yields of barley, wheat, and oat varieties.¹

Specie and variety	1975		1976		1977		Average	
	Forage	Grain	Forage	Grain	Forage	Grain	Forage	Grain
<u>Barley</u>							9.3	71
Paoli	9.4	85	9.8	66	8.6	66		(3408 lbs.)
Kanby	10.3	79	11.1	79	6.8	48		
<u>Soft Wheat</u>							9.5	50
Arthur-71	8.5	46	10.6	56	9.0	47		(3000 lbs.)
Blue Boy II	10.3	49	--	--	--	--		
Abe	--	--	10.3	55	8.5	49		
<u>Hard Wheat</u>							10.2	44
Eagle	10.6	42	9.8	41	9.7	46		(2640 lbs.)
Sage	10.5	44	10.8	51	9.6	37		
<u>Oats</u>							10.0	50
Pettis	--	--	10.7	73	9.6	53		(1600 lbs.)
Lodi	--	--	9.2	35	10.3	39		

¹Forage yields are in tons of 35% DM forage per acre; grain yields in bushels of 12%-moisture grain per acre (barley, 48 lbs./bu.; wheat, 60 lbs./bu.; oats, 32 lbs./bu.).

Table 14.3. Crude protein, fiber and in vitro DM digestibility of barley, wheat, and oat forages.

Specie and variety	Crude protein %	Crude fiber %	<u>In Vitro</u> DM diestibility %
<u>Barley</u>			
Paoli	7.5	23.6	62.7
Kanby	7.1	26.1	59.9
<u>Soft wheat</u>			
Arthur-71	6.5	26.6	56.1
Blue Boy II	6.6	28.8	50.5
Abe	7.2	24.8	58.2
<u>Hard wheat</u>			
Eagle	6.4	29.6	55.9
Sage	6.5	31.0	56.4
<u>Oats</u>			
Pettis	8.2	31.8	50.8
Lodi	8.6	34.8	50.1

Fig. 2.1. Digestible DM yield of barley, wheat, and oat forages.

