YIELD AND NUTRITIONAL QUALITY OF NINE SUMMER ANNUAL FORAGES[1]

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Summary

Nine summer annual forages were studied to evaluate yield and nutritional quality differences resulting from forage type and cultivar when cut at two stages of maturity. Substantial dry matter yield and quality differences were observed among the six hybrid pearl millets tested. Several hybrid pearl millets gave comparable dry matter yields to the sorghum-sudans at boot and headed stages of growth. Hybrid pearl millets were much higher in crude protein than the hybrid sorghum-sudans and sudangrass. Although yield increased markedly between boot and headed cutting stages, nutritional value declined greatly. Nitrate levels were excessively high in all forages when harvested at the boot stage in July, and several were still above safe levels at the headed stage. Therefore, nitrate and feed quality testing is recommended for safe and efficient utilization of summer annual forages.

(Key Words: Summer Annuals, Pearl Millet, Sudan, Yield, Forage Quality, Nitrate.)

Introduction

In 1989, many acres of wheat failed, so livestock producers statewide planted additional acres to summer annuals such as Sudan and pearl millet as replacement crops. These drought- and heat-tolerant crops can provide excellent forage during summer months in Kansas, when other grasses have declined in production and quality. However, insufficient research exists on the relative productivity of commercially available cultivars, especially with regard to hybrid pearl millets. This study compared the yields and nutritional values of Piper sudangrass, two sorghum-sudans, and six cultivars of pearl millet cut at two stages of growth.

Experimental Procedures

An on-farm demonstration plot was established in Pratt County to evaluate forage yield and quality of nine annual forages, harvested at either boot or headed stages of maturity. Forage cultivars tested were Piper sudangrass; Chieftain and Haygrazer, hybrid sorghum-sudans; and Mil-X, Mil-Hy 300, Milgrazer, Tifleaf 1, Horsepower, and Mil-Hy 99, hybrid pearl millets.

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All forages were planted on June 15, 1989 in 8-in. rows at a seeding rate of 15 lb per acre. The cultivar plots were planted in a failed wheat field without additional fertilization.

The forages were harvested at the boot or heading growth stages on July 20 and September 5, respectively. Forages were cut at three replicated sites per cultivar plot at 2 in. above ground level. Samples of the freshly cut material were analyzed for nutritional quality.

Results and Discussion

Substantial differences in forage dry matter yield and height were found among the pearl millet cultivars at both harvest stages. Mil-Hy 300 and Horsepower hybrid pearl millets, in particular, gave comparable dry matter yields to the hybrid sorghum-sudans at both cuttings (Table 41.1). The pearl millets were much higher in protein than the hybrid sorghum-sudans and sudangrass cultivars at both cuttings.

As expected, forage height and yield increased markedly from the boot to headed plant cutting stages for all cultivars (Table 41.1). However, forage feeding value, as indicated by crude protein, acid detergent fiber and most minerals, declined substantially with advancing plant maturity. Protein content dropped more sharply in Sudan-based forages than in the pearl millets between the two cutting stages, likely a reflection of millets' greater leafiness. Surprisingly, the phosphorus content of the pearl millets generally increased with plant maturity.

Very high nitrate levels were found in all forages harvested at the boot stage and in several cultivars cut at heading (Table 41.2). Piper sudangrass declined more rapidly in nitrate between cutting stages than the pearl millets in this study. Nitrate levels exceeding 6,000 to 9,000 ppm (NO_3, dry basis) are considered potentially toxic to cattle fed all-roughage rations. The high levels found in this study are surprising, considering the results of a soil test taken on September 5, the last harvest date. Soil nitrogen was only 6 lb/acre, whereas phosphorus and potassium were 87 and 260 lb/acre, respectively. Soil moisture conditions were generally good during the growing season, as indicated by forage yields, although a dry spell occurred around the time of the boot stage harvest. A partial explanation of the higher than expected nitrate levels relates to the short (2 in.) stubble height employed in gathering the yield data. In general, about two-thirds of total plant nitrate accumulates in the bottom one-third of the plant. Thus, if a 6 to 7 in. stubble height, typical of multiple cutting recommendations, had been used, nitrate levels likely would have been less alarming. Moreover, the relatively cool summer and overcast mornings preceding the harvest dates may have contributed to nitrate accumulation in these summer annuals of tropical origin.

Prussic acid (cyanide) levels were very low in all forages evaluated (Table 41.2). Normally, levels less than 500 to 600 ppm cyanide on a dry basis are considered safe. In contrast to the sorghums and sudans, hybrid pearl millet cultivars are not considered to accumulate toxic prussic acid levels.

In summary, the competitive yield and higher nutritional value of selected hybrid pearl millets relative to the other summer annuals evaluated indicates that they should be considered seriously for summer forage production, particularly in multiple harvesting programs, if environmental and agronomic considerations permit.

Table 41.1. Yield and Nutritional Quality of Nine Summer Annual Forages

Forage type/ cultivar	Stage of growth	Height, in.	Dry matter yield, lb/acre	Dry matter, %	Crude protein, % of DM	Acid detergent fiber, % of DM
Sudangrass						
Piper	Boot	50	4,285	17.6	12.3	32.4
	Headed	79	6,448	27.4	8.8	43.0
Hybrid sorghum-sudan						
Haygrazer 2	Boot	56	4,510	14.7	13.8	32.0
	Headed	90	10,871	25.2	6.5	37.0
Chieftain	Boot	56	5,605	15.4	13.3	32.4
	Headed	84	8,232	24.9	8.0	36.3
Hybrid pearl millet						
Mil-X	Boot	33	3,578	17.6	18.1	29.9
	Headed	50	6,714	20.5	14.6	36.7
Mil-Hy 300	Boot	37	4,229	16.6	14.2	33.4
	Headed	74	10,096	20.1	11.1	34.0
Milgrazer	Boot	30	4,234	16.2	17.2	31.3
	Headed	49	7,069	16.2	15.0	37.6
Tifleaf 1	Boot	32	3,408	15.4	17.9	30.9
	Headed	49	7,810	16.7	14.6	37.2
Horsepower	Boot	44	5,380	20.2	16.0	32.6
	Headed	72	9,975	21.0	10.4	38.4
Mil-Hy 99	Boot	40	3,828	22.9	15.0	32.8
	Headed	69	7,827	19.0	12.0	38.2

Table 41.2. Mineral, Nitrate, and Prussic Acid Content of Summer Annuals-Dry Basis

Forage type/ cultivar	Stage of growth	Calcium %	Phos-phorus, %	Potas-sium, %	Magne-sium, %	Nitrate, ppm NO_3	Prussic acid, ppm HCN
Sudangrass							
Piper	Boot	.48	.20	2.87	.31	22,700	25
	Headed	.52	.18	1.64	.29	3,600	31
Hybrid Sorghum-Sudan							
Haygrazer 2	Boot	.52	.20	3.37	.44	36,700	68
	Headed	.36	.20	1.47	.29	5,000	36
Chieftain	Boot	.49	.19	2.98	.45	33,000	73
	Headed	.40	.20	1.97	.26	8,400	35
Hybrid Pearl Millet							
Mil-X	Boot	.72	.23	4.02	.44	33,000	72
	Headed	.63	.39	2.88	.37	9,000	45
Mil-Hy 300	Boot	.60	.21	4.24	.46	33,000	70
	Headed	.45	.25	2.72	.40	11,600	62
Milgrazer	Boot	.63	.24	4.51	.50	43,000	82
	Headed	.55	.37	4.17	.52	19,000	32
Tifleaf 1	Boot	.60	.22	4.56	.44	41,000	47
	Headed	.48	.36	4.10	.38	18,000	29
Horsepower	Boot	.62	.25	4.18	.48	32,000	22
	Headed	.43	.24	2.64	.40	16,000	38
Mil-Hy 99	Boot	.63	.22	3.94	.43	26,600	24
	Headed	.63	.26	3.23	.44	18,000	46