SUDANGRASS VARIETY EVALUATION AT LA PAZ COUNTY, 1996 (PRELIMINARY)

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Abstract

Two common (Piper and Sweet Sudan), four hybrid sudangrass (NK Trudan 8, Cargill HS 35, and Germaine's G 555), and three sorghum-sudangrass hybrid (DK SX 17, TE Haygrazer II, and Pioneer 877F) varieties are currently being evaluated for hay yield and quality at four cuttings in large field plots located at Quail Mesa Farms in southwest La Paz County. Preliminary results from the first two hay cuttings are presented showing that of the nine sudangrass varieties examined in this study, Piper, Cargill HS 35, and NC+ 200 sudangrass varieties had superior hay tonnage and quality. However, we need to determine if this pattern of hay tonnage and quality can be maintained over at least four hay cuttings. The sorghum-sudangrass hybrids produced relatively poor quality hay, and had relatively high prussic acid levels at the second cutting.

Introduction

Recently, high demand for fine stemmed sudangrass hay by the Japanese has created a market opportunity for Arizona and California hay producers. Sudangrass hay previously worth only $30-50 per ton on the U.S. market can now be double compressed and exported to Japan (F.O.B. ports of California) for $80-120 per ton including commissions, compression, containerization, and freight to ports beyond California. This sudangrass hay export market has resulted in a dramatic increase in sudangrass acreage within Yuma, La Paz, and Mohave Counties over the last three years.

Unfortunately, updated University of Arizona guidelines for suggested varieties and production practices for sudangrass hay are non-existent. The most recent publication examining variety selection and production practices for sudangrass was written by George Worker of the University of California in 1976. The most recent University of Arizona guidelines for sudangrass variety selection were published by Dennis and Voigt in 1971. These bulletins are 20 years old and suggested vanities and production practices outlined within them are outdated.

La Paz and Mohave County hay growers are in the process of "rediscovery" trying to develop economically feasible sudangrass production practices. Most grow the variety 'Piper', just because it is a well known time-proven standard. Many new sudangrass and hybrid sorghum- sudan hay varieties are available commercially, however they have not been tested for yield and quality under irrigated production in hot, dry climates such as those in western Arizona.

Non-adapted sudangrass hay varieties can accumulate prussic acid and nitrate-nitrogen in concentrations that are toxic to livestock. Western Arizona hay producers are reluctant to test new sudangrass varieties since hay that is too stemmy or high in prussic acid or nitrate cannot be sold on the export market. Thus, an unbiased University evaluation of growth, hay yield, and hay quality of commercially available sudangrass varieties was undertaken to strengthen the new export market potential for sudangrass hay production in Arizona and California.

Materials and Methods

A field experiment was conducted during 1996 to determine the yield potential and quality of nine sudangrass vanities at 4 hay cuttings. Two common sudangrass varieties (Piper and Sweet Sudan), four sudangrass hybrids (NC+ 200, NK Trudan 8, Cargill HS 35, and G 555), and three sorghum-sudangrass hybrids (DK SX 17, TE Haygrazer II, and P 877F) were planted with a grain drill at a rate of 120 pounds seed per acre on 40-inch beds. Each plot was 8 rows wide by the length of the irrigation run (1250 feet) or 0.76 acre and each variety was replicated three times in a randomized complete block experimental design. The experiment was basin irrigated and managed under grower conditions. At harvest, each plot was visually evaluated for leafyness and stem diameter, and cut baled and raked to determine hay yield. Also, at each of four harvests, a subsample of hay from each plot was analyzed for quality factors including dry matter, crude protein, nitrate-nitrogen, acid detergent fiber (ADF), neutral detergent fiber (NDF), and hydrocyanic acid production (qualitative measure of prussic acid concentration) by Stanworth Crop Consultants (Blythe, CA) and the U of A Veterinary Diagnostic Lab (Tucson, AZ). Statistical analyses were performed on the data using ANOVA and Duncan's Multiple Range Test at the 0.05 level of probability when appropriate.

Crop History:

Location: Quail Mesa Farms, Colorado River Indian Reservation
Cooperators: Jim Lloyd and Scott Knight
Soil Type: Glenbar silt loam
Planted: 27 March 1996
Fertilizer: 150 lbs. 11-52-0 at planting, plus 100 lbs. N/acre following each cutting as NH_3
First Harvest: Cut 29 May and Baled 6 June
Second Harvest: Cut 5 July and Baled 15 July
Third and Fourth Harvests: In Progress

Results and Discussion

At the first two hay cuttings, uncompressed sudangrass bale weights ranged from 102 to 118 pounds with average total dry matter ranging from 93.3 to 94.8 percent (Table 1). The sorghum-sudangrass hybrids had the largest stem diameters (ranging from 0.29-0.35 inch) compared to the common (0.20-0.23 inch) and hybrid (0.21-0.28 inch) sudangrass varieties (Table 1). Generally, the two common sudangrass varieties (Piper and Sweet Sudan) had superior leafyness ratings, followed by the sudangrass hybrids, and the sorghum-sudangrass hybrids. The sudangrass hybrid, Germaine's G 555 was a notable exception since it had relatively low stem diameter and superior leafyness. The sorghum-sudangrass hybrids (P 877 f, Haygrazer II, and DK SX 17) tillered less and produced a coarser hay that was stemmy compared to the common and hybrid sudangrass varieties. Overall, at the first two cuttings, the sudangrass varieties exhibiting superior ratings of stemminess and leafyness included Piper, G 555, Sweet Sudan, NC+ 200, and Cargill HS 35.

Piper, Trudan 8, and HS 35 had the highest hay yields at the first cutting (2.19-2.29 ton/acre), followed by NC+ 200, DK SX 17, Haygrazer II, P 877 F, Sweet Sudan, and G 555 sudangrass varieties (Table 2). There were no significant differences between sudangrass varieties in hay quality parameters including crude protein concentration (8.3-9.4%),

nitrate-nitrogen concentration (330-440 ppm), hydrocyanic acid production (2-4 ppm), and acid detergent fiber or ADF (38.2-39.8%). Although significant differences between sudangrass varieties in neutral detergent fiber or NDF were observed, from a practical standpoint, there was little difference in NDF between varieties which ranged from 62.3 to 67.0 percent. Considering hay quality and yield at the first cutting, of the sudangrass varieties examined in this trial, Piper, Cargill HS 35, and NC+ 200 were superior performers.

Piper, NC+ 200, and Trudan 8 had the highest hay yields at the second cutting (1.90-2.10 ton/acre), followed by HS 35, P 877 F, DK SX 17, G 555, Sweet Sudan, and Haygrazer II sudangrass varieties (Table 3). Of the nine sudangrass varieties, Piper, Trudan 8, P 877 F, DK SX 17, Sweet Sudan, and Haygrazer II had the highest crude protein concentration (10.5-11.6%). Prussic acid concentration can not be measured directly in dry plant tissue or hay, threfore hydrocyanic acid (HCN) production was determined on hay samples from each plot. The sorghum-sudangrass hybrids DK SX 17, P 877 F, and TE HG II had the highest hydrocyanic acid production (28-84 ppm), and thus the highest potential for prussic acid poisoning of livestock that consume hay cut from these varieties. There were no significant differences between sudangrass varieties in hay quality parameters including nitrate-nitrogen concentration (453-770 ppm), acid detergent fiber or ADF (38.3-40.0%), and neutral detergent fiber or NDF (63.0-66.1%). Considering hay quality and yield at the second cutting, of the sudangrass varieties examined in this trial, Piper, NC+ 200, and Cargill HS 35 were superior performers.

Sudangrass hay with nitrate-nitrogen concentration greater than 1000 ppm and/or hydrocyanic acid concentration exceeding 200 ppm is likely to cause toxic effects in susceptible livestock that consume enough of this hay. None of the common and hybrid sudangrass varieties examined in this experiment accumulated toxic concentrations of nitrate-nitrogen or prussic acid at the first two cuttings. However, the sorghum-sudangrass hybrids had relatively high hydrocyanic acid production which is a qualitative measure of prussic acid content. Hay protein concentrations at the second cutting of all nine sudangrass varieties were higher than at the first cutting probably because the grower got behind on nitrogen fertilizer applications early in the season. The sorghum-sudangrass hybrids had higher stem diameters and less than optimum leafyness ratings, compared to the common and hybrid sudangrass varieties. Of the nine sudangrass varieties harvested twice in this large plot field experiment, the following varieties had the highest hay tonnage; Piper (4.39), NK Trudan 8 (4.18), Cargill HS 35 (4.02), NC+ 200 (3.96), and DK SX 17 (3.78). Of these three varieties, Piper, HS 35, and NC+ 200 exhibited superior hay quality. The common and hybrid sudangrass varieties produced higher quality hay than the sorghum-sudan hybrids.

This experiment is still in progress since we hope to get at least two more hay cuttings from the field. Based on previous sudangrass variety research at the University of California, sorghum-sudangrass varieties were shown to tiller less compared to common and hybrid sudangrass varieties, start to lose stand after the third or fourth cutting, and can die out after the second cutting. Thus, it will be interesting to see how hay tonnage and quality of each of the nine sudangrass varieties holds up over four hay cuttings.

References

Dennis, R.E. 1971. Sudangrass variety suggestions for Arizona. University of AZ Cooperative Extension AZ Agri-File, Field Crops 248.203, University of Arizona, Tucson, AZ. 2 pp.

Worker, G.F., Jr. 1976. Sudangrass production in the irrigated deserts of southern California. University of California Leaflet 2891. University of California, Davis, CA. 7 pp.

Table 1. Characteristics of the nine sudangrass varieties harvested twice in 1996 at Quail Mesa Farms

Source	Variety	Type	Average Bale Weight	Average Dry Matter	Average Stem Diameter	Visual Leafyness Rating
			pounds	%	inches	0 to 5
Public	Piper	common	106	94.4	0.20 f	4.7 a
Germaine's	G 555	sudan hybrid	102	94.4	0.21 ef	4.4 a
Cal West	Sweet Sudan	common	119	93.4	0.23 def	4.5 a
NC+	NC+ 200	sudan hybrid	118	93.5	0.23 def	3.9 b
Cargill	HS 35	sudan hybrid	109	93.3	0.25 cde	3.9 b
Northrup King	Trudan 8	sudan hybrid	113	94.3	0.28 cd	3.4 c
Pioneer	P 877 F	sorghum-sudan hybrid	118	94.3	0.29 bc	3.4 c
Taylor-Evans	Haygrazer II	sorghum-sudan hybrid	113	94.2	0.33 ab	3.5 bc
Dekalb	DK SX 17	sorghum-sudan hybrid	115	94.8	0.35 a	3.1 c

a) Means within columns followed by the same letter are not significantly different at the 0.05 level of probability according to Duncan's Multiple Range Test.
b) Leafyness rating from 0 (poor) to 5 (best), with 3 and above indicative of acceptable quality.

Table 2. Sudangrass hay yield and quality at the first cutting.

Variety	Hay Yield	Crude Protein	Nitrate-N	Hydrocyanic Acid Produced	Acid Detergent Fiber	Neutral Detergent Fiber
	ton/acre	%	ppm	ppm	%	%
Piper	2.29 a	8.8 a	327 a	2 a	39.0 a	62.3 ab
Trudan 8	2.28 a	9.4 a	430 a	2 a	38.7 a	65.6 ab
HS 35	2.19 ab	9.2 a	367 a	2 a	38.7 a	65.6 ab
NC+ 200	2.05 abc	8.3 a	330 a	2 a	39.0 a	65.3 ab
DK SX 17	2.03 bcd	8.8 a	440 a	3 a	39.8 a	67.0 a
Haygrazer II	1.94 cd	8.3 a	403 a	4 a	39.4 a	65.5 ab
P 877 F	1.93 cd	8.5 a	357 a	2 a	39.3 a	66.1 ab
Sweet Sudan	1.88 cd	8.8 a	373 a	2 a	38.2 a	63.3 c
G 555	1.79 d	9.4 a	378 a	2 a	38.4 a	64.5 bc

Means within columns followed by the same letter are not significantly different at the 0.05 level of probability according to Duncan's Multiple Range Test.

Table 3. Sudangrass hay yield and quality at the second cutting.

Variety	Hay Yield	Crude Protein	Nitrate-N	Hydrcyanic Acid Produced	Acid Detergent Fiber	Neutral Detergent Fiber
	ton/acre	%	ppm	ppm	%	%
Piper	2.10 a	10.5 abc	747 a	3 c	38.9 a	65.5 a
NC+ 200	1.91 ab	10.1 c	550 a	3 c	39.5 a	66.1 a
Trudan 8	1.90 ab	11.3 ab	843 a	5 c	38.3 a	64.7 a
HS 35	1.83 b	10.2 bc	453 a	3 c	38.9 a	64.9 a
P 877 F	1.77 bc	11.4 ab	880 a	36 b	38.6 a	64.3 a
DK SX 17	1.75 bc	10.5 abc	620 a	84 a	40.0 a	65.6 a
G 555	1.75 bc	10.2 bc	463 a	3 c	38.8 a	64.9 a
Sweet Sudan	1.69 bc	11.4 ab	723 a	7 c	38.7 a	63.1 a
Haygrazer II	1.55 c	11.6 a	770 a	28 b	38.6 a	63.0 a

Means within columns followed by the same letter are not significantly different at the 0.05 level of probability according to Duncan's Multiple Range Test.