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Comparative Yield and Quality of Summer Annual Grasses as Fresh-cut Forage

M. H. Jo

College of Agriculture, Seoul National University

夏型 靑刈飼料作物의 生産性과 飼料價値比較

曺武煥

서울大學校 農科大學

摘 要

本 試驗은 새로 導入된 13個 品種의 수수-수단그라스雜種(*Sorghum bicolor* (L.) Moench), T-E Goldmaker 수수雜種(*S.bicolor* (L.) Moench), NC⁺ 88SS 수단그라스 雜種(*S. bicolor* (L.) Moench), Supermill pearlmillet (*Pennisetum americanum* (L.) Leeke) 및 teosinte (*Euchlaena mexicana* Schrad.)를 Pioneer 988 수수-수단그라스 雜種을 대조 품종으로 하여 乾物生産性, 粗蛋白質含量, ***in vitro*** 乾物消化率(IVDMD) 및 그밖의 生育特性을 비교하여 農家에 새로운 資料를 제시하기 위하여 수행되었다. 乾物收量에 있어서 14品種間의 유의성은 인정되지 않았으나 teosinte 및 TE Goldmaker는 수량이 가장 낮았다. 各 品種間에 다소의 차이는 있었으나 대부분의 品種들이 葉病(잎마른병)에 강하였으며 pearlmillet과 teosinte는 전혀 葉에 이병이 안되었고 NC⁺ 88SS는 葉枯病에 매우 약하였다. 수수-수단그라스系 雜種의 平均 粗蛋白質 含量은 pearlmillet 과 수수雜種 보다는 낮았으나 수단그라스 雜種보다는 높았다. G-83F, TE Goldmaker, Teosinte 및 HW 5111의 IVDMD는 대조 품종인 P-988보다 높았으며 高溫期 靑刈用 飼草의 粗蛋白質 含量과 IVDMD 간에는 일정한 相互關係가 없었다.

I. INTRODUCTION

The use of summer annual grasses as fresh-cut forage for confined feeding has been increasing in recent years in the middle plain areas of Korea. The most widely used annuals are sorghum-sudangrass hybrids (*Sorghum bicolor* (L.) Moench) and sudangrass hybrids (*S. bicolor* (L.) Moench). The forage yield and agronomic characteristics of the newer varieties of sorghum-sudangrass hybrids have been well documented. Kim et al. (1982), working with eighteen sorghum-sudangrass hybrids, found that the recently developed Pioneer 988 and TE Haygrazer to be promising for forage production in Korea. Read et al. (1978) of Texas, using twentv-seven varieties of sorghum-sudangrass hybrids, reported that forage yield varied form 16,358 to 7,676 lb/ac with no significant differences among the 17 varieties. However, the capabilities of the summer annual grasses introduced more recently are not so well known. The experiment reported here was designed to provide comparative data on the newly imported sorghum-sudangrass hybrids, sorghum hybrid, sudangrass hybrid, pearlmillet (*Pennisetum americanum* (L.) Leeke) and teosinte (*Euchlaena mexicana* Schrad.) in comparison with the check variety Pioneer 988 sorghum-sudangrass hybrid for dry matter yield, protein content, *in vitro* dry matter digestibility, and other desirable agronomic characteristics.

II. MATERIALS AND METHODS

Experimental plots were established on May 8, 1984, with 18 varieties of summer annual grasses in a randomized block design with four replications. Fertilizer was applied at the rate of

60-100-50 (kg/ha of N-P_2O_5-K_2O) in a band on all plots at seeding time and again additional fertilizer at rate of 60-0-50 (kg/ha of N-P_2O_5-K_2O) was side dressed immediately after the first and second harvests. On May 9, seeds of each variety were drilled 3cm deep to form individual plots comprising 3 rows, 60cm apart, each row 4.2m long Plots were seeded at the following rate in kg/ha by species; Sorghum-sudangrass hybrids, 15; Sorghum hybrid, 15; Sudangrass hybrid, 15; Pearlmillet, 8, Teosinte, 15. All plots were hand thinned to plant every 7cm within the drill rows. 4.2m of the center row was harvested for yield data. There were three harvests: July 2, August 3, and September 7. The forage were cut by hand, and green weight was determined. A sample, of approximately 500g fresh weight, was taken from each plot, oven dried at 75°C, and percent dry matter calculated. Samples were ground using a Wiley mill to pass a 1-mm screen for chemical analyses. Total nitrogen content was determined by the Kjeldahl method. *In vitro* dry matter digestibility was determined by the modified Tilley and Terry method (1963).

III. RESULTS AND DISCUSSION

Yield Performance and Disease Traits: Table 1 presents the dry matter yield of 18 summer annual grasses for the 1984 growing season. The summer annual grasses compared in this experiment showed dry matter yield difference due to varieties.

Table 1. Dry matter yield and disease traits of summer annual grasses, 1984.

Variety	Dry matter yield on harvest dates				Leaf diseases	Height	Leaf Width
	July 2	Aug. 3	Sept. 7	Total			
	kg/ha				(1-9)	cm	
SX-17	5100	6027	4512	15639	9	198	4.7
NC+ 855	5018	6245	4168	15431	7	207	4.1
ST-6	4799	6122	3827	14748	7	208	3.8
Speedfeed	4295	5892	3855	14022	8	204	3.7
G-83F	4395	5463	4082	13940	8	203	4.0
Jumbo sorgo	4589	4929	3950	13468	8	197	3.7
GW 9110G	4506	5295	3452	13253	8	203	3.9
Jumbo	5380	4380	3251	13011	8	185	4.2
Jumbo sudan	3703	6289	2902	12894	8	183	3.2
Pioneer 988	4327	5455	2989	12771	8	203	3.6
TE Haygrazer II	4178	4954	3302	12434	8	203	4.1
FP-4	4479	4209	3196	11884	8	188	4.6
Pioneer 989	4181	4091	3637	11809	8	191	4.2
HW 5111	3710	3863	3113	10686	8	164	4.5
TE Goldmaker	4006	2611	2231	8848	9	166	5.3
NC+ 88SS	3935	5621	3344	12900	7	197	2.4
Supermill	4063	3883	4701	12647	9	158	3.6
Teosinte	898	6527	2665	10090	9	151	4.8
Mean	4198	5103	3504	12804	8	189	4.0
LSD (0.05)	1137	1178	858	2168		24	0.6

Diseases: 1; Very susceptible, 9; Very tolerant

Two sorghum sudangrass hybrids SX-17 and NC+ 885 gave significantly higher dry matter yield than the check variety Pioneer 988 sorghum-sudangrass hybrid. These two varieties produced 2,806 and 2,660kg more dry matter per ha than the check variety. There was no difference in total dry matter yield of the remaining varieties with the exception of teosinte and TE Goldmaker which had the lowest yield. The dry matter yield of the remaining varieties including the check variety varied from 14,748 to 10,686 kg/ha. One of the reasons for lower yield of the latter varieties can be explained by the poor regrowth characteristics as compared with sorghum-sudangrass hybrid (Farhoomand and Wedin, 1968). In general, sorghum-sudangrass hybrid recovered more rapidly than did sorghum hybrid. There was no significantly higher yield variety than the check variety at the first and second harvests, however, Supermill pearlmillet, SX-17, NC+ 855, Jumbo sorgo, G-83F and Speedfeed significantly more dry matter yield than the check variety at the third being lower in yield check variety at the third harvest. There were differences in the yield for dates of harvest, with regrowth being lower in yield than the previous harvest with the exception of the second harvest which had the highest forage yield. Clapp et al. (1970) reported summer annual forage grasses varied widely in manner of regrowth between cultivars and among harvests within cultivar. In this experiment, the most hybrids were moderately resistant to leaf diseases although differences exist among varieties. Hanson (1963) described that sorghum-sudangrass hybrids were more resistant to many leaf diseases than sudangrass. No diseases were found in pearlmillet and teosinte, but NC+ 88SS sudangrass hybrid was very susceptible to leaf diseases, specially leaf blight (*Helminthosporium turcicum* Pass.) among the hybrids used. Sorghum-sudangrass Hybrids and sudangrass hybrid were generally taller in plant height than sorghum hybrid, pearlmillet and teosinte. Leaf width of sorghum hybrid and teosinte was bigger than that of all other varieties.

Crude Protein: The percent crude protein of the summer annual grasses at the third harvest is shown in table 2. The percent crude protein in the grasses tested ranged from 9.0 to 15.8% with varieties. Read et al. (1978) observed differences in percent crude protein among sorghum-sudangrass hybrids. The percent crude protein of sorghum-sudangrass hybrids in this experiment was considerably higher than that of Read et al. (1978) of Texas, this being presumably associated with the environmental conditions between two

Table 2. Percent crude proteinaand IVDMD of summer annual grasses at the third harvest.

Variety	% on dry matter basis	
	Crude protein	IVDMD
	%	
SX-17	11.9	66.3
NC+ 855	14.0	62.1
ST-6	15.0	62.8
Speedfeed	14.4	62.3
G-83F	9.0	69.3
Jumbo sorgo	13.7	62.0
GW 9110G	15.5	63.5
Jumbo	12.9	64 2
Jumbo sudan	12.5	55.9
Pioneer 988	13.0	67.1
TE Haygrazer II	10.4	62.4
FP-4	11.8	65.1
Pioneer 989	11.4	66.7
HW 5111	13.7	67.7
TE Goldmaker	15.7	68.8
NC+ 98SS	10.1	60.3
Supermill	15.8	67.2
Teosinte	12.1	68.2
Mean	12.0	64.6

locations. Supermill was the highest variety and G-83F was the lowest in the crude protein content among the varieties used. TE Goldmaker, GW 9110G, ST-6, Speedfeed and NC+ 855 were higher in the crude protein content than the check variety. The mean percent crude protein of sorghum-sudangrass hybrids was lower than that of pearlmillet and sorghum hybrid, but was higher than that of sudangrass hybrid in this experiment. This agreed with the result of Farhoomand and Wedin (1968). They, working with sudangrass and forage sorghum, found that percent crude protein decreased with advancing maturity in both species but more so in sudangrass than forage sorghum.

In Vitro Dry Matter Digestibility: The *in vitro* dry matter digestibility (IVDMD) of the summer annual grasses at the third harvest is shown in Table 2. There were considerable differences in IVDMD between varieties. Varieties yielding below 11,884 kg/ha generally showed higher IVDMD with the exception of NC+ 88SS which was so susceptible to leaf diseases at the third harvest. The IVDMD of G-83F, TE Goldmaker, teosinte and HW 5111 was higher than the check variety. In this experiment, there was no significant correlationship (r=0.01) between the percent crude protein and IVDMD of the summer annual grasses. Hart (1967) working with pearlmillet, reported that crude protein was significantly correlated with leaf digestibility, but stem digestibility was not significantly correlated with protein or fiber content.

IV. SUMMARY

This experiment was conducted to provide comparative data on the newly imported thirteen sorghum-sudangrass hybrids (*Sorghum bicolor* (L.) Moench), TE Goldmaker sorghum hybrid (*S. Bicolor* (L.) Moench), NC+ 88SS sudangrass hybrid (*S. bicolor* (L.) Moench), Supermill pearlmillet (*Pennisetum americanum* (L.) Leeke) and teosinte (*Euchlaena mexicana* Schrad.) in comparison with the check variety Pioneer 988 sorghum-sudangrass hybrid for dry matter yield, protein content, *in vitro* dry matter digestibility (IVDMD), and other desirable agronomic characteristics. SX-17 and NC+ 855 gave significantly higher dry matter yield than the check variety. There was no significant difference in total dry matter yield of the remaining 14 varieties with the exception of teosinte and TE Goldmaker which had the lowest yield. The most varieties were moderately resistant to leaf diseases although differences exist among varieties. No diseases were found in pearlmillet and teosinte, but NC+ 88SS was very susceptible to leaf blight. The mean percent crude protein of sorghum-sudangrass hybrids was lower than that of pearlmillet and sorghum hybrid, but was higher than that of sudangrass hybrid. The IVDMD of G-83F, TE Goldmaker, teosinte and HW 5111 was higher than that of the check variety. There was no consistent relationship between the percent of crude protein and IVDMD of the summer annual grasses.

V. References

1. Clapp, J.G. and D.S. Chamblee, 1970. Influence of different defoliation systems on the regrowth of pearl millet, hybrid sudangrass, and two sorghum-sudangrass hybrids from terminal, axillary, and basal buds. Crop Sci. 10: 345-349.
2. Farhoomand, M.B. and W.F. Wedin. 1968. Changes in composition of sudangrass and forage sorghum with maturity. Agron. J. 60: 459-463.
3. Hanson, A.A. 1963. Summer annual forage grasses in the United States. USDA Agric. Handbook No. 238.
4. Hart, R.H. 1967. Digestibility, morphology, and chemical composition of pearl millet. Crop Sci. 7: 581-584.

5. Kim, D.A., S. Seo, H.W. Lee, S.H. Lim, M.H. Jo and M.Y. Lee. 1982. Performance of sudangrass, sudangrass hybrids and sorghum-sudangrass hybrids for forage production. I. Comparison of soiling type hybrids. Kor. J. Anim. Sci. 24: 192-197.
6. Read, J.C., E.C. Holt and C. Davis. 1978. Quality and yield of forage sorghums. TAES PR-3521.
7. Tilley, J.M. and R.A. Terry. 1963. A two-stage technique for the *in vitro* digestion of forage crops. J. Brit. Grassl. Soc. 18: 104-111.