FORAGE PRODUCTION POTENTIAL OF POA ARACHNIFERA TORR IN SEMI-ARID CLIMATES

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ABSTRACT

This study was undertaken to determine the forage potential of Texas bluegrass (*Poa arachnifera* Torr). Texas bluegrass is a perennial cool-season grass native to Kansas, Oklahoma, western Arkansas, and the central region of Texas, USA (Gould, 1975). Thirteen different accessions were established in 1988 at the Texas A&M University Centers at Dallas and Stephenville and tested for 2 years. Mean yields at Stephenville and Dallas were 3610 and 6022 kg ha^{-1}. Two synthetic varieties (Syn-1 and Syn-2) were tested from 1990 to 1995 at four locations in Texas. Yields of Syn-1 was greater than Syn-2 whereas Syn- 2 provided significantly higher mortality than Syn-1 of larvae of the fall armyworm (*Spodoptera frugiperda* (J.E. Smith)) in no-choice laboratory feeding tests.

KEYWORDS

Texas bluegrass, host plant resistance, yield, protein, forage quality, armyworm

INTRODUCTION

In the semi-arid regions of the southern United States with rainfall amounts between 50 to 80 cm, the cool-season temperate grasses such as tall fescue (*Festuca arundinacea* Schreb.) are not sustainable but many livestock producers desire a cool-season perennial grass so as to eliminate the cost of seeding winter annuals. A reliable cool-season perennial forage grass would allow substantial savings from the yearly cost of land preparation and seed purchases to establish annual grasses. The fall armyworm is a destructive pest of over 50 species of plants, including many grasses in the southern and central United Sates (Luginbill, 1928).

Texas bluegrass is a tufted dioecious perennial cool-season grass with long, slender rhizomes. In Texas, it is most frequent in the region where rainfall is between 50 and 82 cm. It also occurs in Oklahoma, southern Kansas, and western Arkansas (Gould, 1975). This study was conducted to determine the forage potential and sustainablity of Texas bluegrass when utilized as a forage in pure stands and if host resistance to fall armyworm exist in this population.

MATERIALS AND METHODS

Two different test were conducted to determine the forage potential of Texas bluegrass. The first test consisted of 13 different ecotypes of Texas bluegrass, each from a different Texas county. Plots were established in the fall of 1988 at Dallas and Stephenville using transplants. At Dallas the soil was Houston black clay, a deep, fertile soil. At Stephenville, the soil type was a Windthorst fine sandy loam, a shallow-type soil underlaid by a clay hardpan. Each year, fertilizer was applied at rates of 71.7 kg nitrogen (N) ha^{-1} in fall and spring at Dallas, and 67.0 kg N ha^{-1} in fall and 67.0 kg N and 29 kg P ha^{-1} in spring at Stephenville, during the 1989-90 and 1990-91 growing seasons, respectively.

Subsamples were collected at harvest for N determination at the Dallas location. Samples for in vitro true digestibility (IVTD) were hand-harvested from plants grown at Dallas in a parent-progeny space plant nursery. All samples were oven-dried at 60^{o}C. Total N was determined by micro-Kjeldahl (Bremmer, 1965), and IVTD was determined using the method of (Goering and Van Soest, 1970).

A second study consisted of two different TX bluegrass experimental synthetic lines designated Syn-1, Syn-2 and PI-100 tall fescue as a check. Syn-1 was selected for forage production and Syn-2 was selected for turfgrass attributes. PI-100 tall fescue is an endophyte free experimental line selected for survival at Dallas. Test sites consisted of Dallas, Stephenville, Overton and Temple with yearly average rainfall of 93, 76, 114 and 85, respectively. Soil types at Dallas and Stephenville locations is the same as reported in the first study and Temple has the same soil type as Dallas. Overton test site consisted of a complex of two different soil types, Keithville very fine sandy loan and Sawtown, silt loam. Plots were established using 200 transplants per 1.5 x 6.1 m plot during the fall of 1990. Harvests started in the 1991-92 growing season except for Dallas where one harvest was made during the late spring of 1991. Multiple harvests were made in most years and locations. Host resistance to the fall armyworm was evaluated in laboratory feeding studies at Dallas. Survival, larval weight, and time required to complete development to the adult stage were determined under no-choice feeding on excised plant material for both genotypes. Data was analyzed by PC-SAS with mean separation by Duncan Multiple Range Test at 0.05 level (SAS/STAT Guide, 1987).

RESULTS AND DISCUSSION

In the first test of 13 ecotypes, dry matter production at Dallas had averages of 7757 and 4288 kg ha^{-1} for the first and second years. Average production at Stephenville was 2554 and 4667 kg ha^{-1} for the two years, respectively. There were no significant differences due to ecotype except at Dallas the first year and then only the 5 best ecotypes yielded significantly better than the lowest yielding ecotype. Crude protein content of the different ecotypes ranged from 149 to 220 g kg^{-1} and averaged 155 g kg^{-1} at Dallas. Differences were due to different harvest dates (plant maturity) and not ecotypes.

IVTD values were not significantly different among plants but varied for plant maturity. The vegetative stage samples had a mean IVTD value of 879 g kg^{-1} and the early anthesis samples had a mean IVTD value of 783 g kg^{-1}.

In the second test Syn-1 had higher dry matter production at all locations each year. This difference was not significant but was consistent (Table 1). Production was variable due to location and year with a high of 11,374 kg ha-1 during the 1991-92 harvest season at Overton and a low of 1248 kg ha^{-1} at Stephenville. In all cases, means for Syn-1 were greater than 4,000 kg ha^{-1}. This is comparable to small grain yields in most years. The stands of tall fescue had been eliminated after 1 year at Stephenville and at least $^{1}/_{2}$ of the stand had died at the other locations by 1993. By 1994 all fescue plots were eliminated. Excellent stands have been maintained for the TX bluegrass at all locations. In the fall armyworm study Syn-2 provided the highest resistance to developing larvae with 22% mortality at 17 days of age and 39% at adult emergence. Syn-1 provided little mortality.

In summary, Texas bluegrass produces adequate dry matter production and is sustainable with stands being maintained after several years. Forage quality is comparable to other cool-season grasses. Based upon these tests, Texas bluegrass has potential as a cool-season perennial forage grass for semi-arid regions.

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Table 1
Dry matter production of Texas Bluegrass at Dallas, Overton, Stephenville, and Temple, Texas.

		Harvest Season					
Location	Cultivar	1990-91[1]	1991-92	1992-93	1993-94	1994-95	mean
		kg ha^{-1}					
Dallas	Syn1	3,081	3,465	6,350	3,902	5,917	4,909
	Syn2	1,988	2,753	5,520	2,789	5,123	4,047
Overton	Syn1	———	11,374	7,748	552[2]	———	9,561
	Syn2	———	10,464	7,501	310	———	8,982
Stephenville	Syn1	———	6,287	6,158	1,828	5,003	4,819
	Syn2	———	5,300	5,649	1,248	3,803	4,001
Temple	Syn1	———	7,195	3,817	———	5,528	5,666[3]
	Syn2	———	5,985	3,707	———	5,084	4,926

[1] Year of establishment, values not included in mean.
[2] Only one harvest was made this season and the values were not included in the mean. Harvest was made on 3 Jan 94.
[3] Mean of only 3 years. Not harvested in 1993-94 due to relocation of personnel.