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R.L. Hale

C.T. Thompson

M. Hampton

G.L. Gold

See next page for additional authors

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Yield of irrigated cool-season grasses in southwestern Kansas

Abstract

Nine varieties and a commercial mix of perennial cool-season grasses were planted in four replicated plots in two counties in southwestern Kansas to evaluate yield and adaptability when produced under irrigation. The varieties were smooth bromegrass, "˜Slate' intermediate and "˜Hycrest' crested wheatgrass, "˜Kentucky 31' and "˜Max-Q®' tall fescue, "˜Profile' orchardgrass, "˜Hykor' festulolium, and "˜Dixon®' and "˜Lakota®' matua grass. The mix was Sharp Brothers' "˜Pasture Mix #6®', a blend of smooth bromegrass, "˜Regar' meadow bromegrass, Slate, Profile, and "˜Garrison' creeping foxtail. Grasses were planted in September 2002. Forage samples were collected in the spring and fall of 2003 and 2004 to measure dry matter content and yield. Fall 2003 samples were not collected at Stevens County because calves grazed them. The greatest grazing preference was for orchardgrass. The least preferred was crested wheatgrass. Spring cuttings yielded less forage than expected in Ford County in 2004 and in Stevens in both years due to dry winters and higher than normal spring temperatures in 2004. Annual dry matter yields ranged from 10,565 to 13,694 lb per acre in Ford County during 2003, 5661 to 9032 lb per acre in Ford in 2004, and 6189 to 14,552 lb per acre in Stevens County in 2004. The consistently highest-producing grasses for both years were the fescues, intermediate wheatgrass, orchardgrass, and the pasture mix. The matuas had high yields in Ford County during 2003, but winter kill reduced the other spring yields. However, new grass plants from a high 2003 and 2004 seed production improved fall 2004 matua yields. The overall lowest-producing grass was crested wheatgrass.

Keywords

Cattlemen's Day, 2005; Kansas Agricultural Experiment Station contribution; no. 05-144-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 943; Beef; Irrigated cool-season grasses; SW Kansas

Authors

R.L. Hale, C.T. Thompson, M. Hampton, G.L. Gold, and Troy J. Dumler

YIELD OF IRRIGATED COOL-SEASON GRASSES IN SOUTHWESTERN KANSAS

R. L. Hale[1], C. T. Thompson[1], T. J. Dumler[1], M. Hampton[2], and G. L. Gold[3]

Summary

Nine varieties and a commercial mix of perennial cool-season grasses were planted in four replicated plots in two counties in southwestern Kansas to evaluate yield and adaptability when produced under irrigation. The varieties were smooth bromegrass, 'Slate' intermediate and 'Hycrest' crested wheatgrass, 'Kentucky 31' and 'Max-Q®' tall fescue, 'Profile' orchardgrass, 'Hykor' festulolium, and 'Dixon®' and 'Lakota®' matua grass. The mix was Sharp Brothers' 'Pasture Mix #6®', a blend of smooth bromegrass, 'Regar' meadow bromegrass, Slate, Profile, and 'Garrison' creeping foxtail. Grasses were planted in September 2002. Forage samples were collected in the spring and fall of 2003 and 2004 to measure dry matter content and yield. Fall 2003 samples were not collected at Stevens County because calves grazed them. The greatest grazing preference was for orchardgrass. The least preferred was crested wheatgrass. Spring cuttings yielded less forage than expected in Ford County in 2004 and in Stevens in both years due to dry winters and higher than normal spring temperatures in 2004. Annual dry matter yields ranged from 10,565 to 13,694 lb per acre in Ford County during 2003, 5661 to 9032 lb per acre in Ford in 2004, and 6189 to 14,552 lb per acre in Stevens County in 2004. The consistently highest-producing grasses for both years were the fescues, intermediate wheatgrass, orchardgrass, and the pasture mix. The matuas had high yields in Ford County during 2003, but winter kill reduced the other spring yields. However, new grass plants from a high 2003 and 2004 seed production improved fall 2004 matua yields. The overall lowest-producing grass was crested wheatgrass.

Introduction

Interest in irrigated grass production has increased in southwestern Kansas during the past few years. In 2001, grass producers were surveyed for grasses used, management practices, and reasons for converting from traditional crops. Reasons given were related to existing corn and cattle prices, effluent utilization, reduced well-water production, and importance in a cattle-production program. Cool-season grasses have several advantages over warm-season grasses, including ease of establishment, earlier use after planting, longer growing season, and potentially higher forage yields. Disadvantages include poor summer production and less-efficient use of water and fertilizers than warm-season grasses. Although several cool-season grasses are being used, there has been limited research comparing grass species under irrigation in southwestern Kansas. This project evaluated the adaptability and yield of several cool-season grasses and the economics of production under irrigation.

[1]Southwest Research and Extension, Garden City.
[2]Dodge City Community College.
[3]Stevens County Agricultural Extension Agent.

Procedures

Nine varieties and one commercial mix of cool-season grasses were planted in two counties in southwestern Kansas. The varieties were smooth bromegrass, 'Slate' intermediate and 'Hycrest' crested wheatgrass, 'Kentucky 31' and 'Max-Q®' tall fescue, 'Profile' orchardgrass, 'Hykor' festulolium, and 'Dixon®' and 'Lakota®' matua grass. The smooth bromegrass variety was not stated, but it is likely was 'Achenbach'. Kentucky 31 was endophyte free, whereas Max-Q® contained an endophyte that does not produce toxins harmful to livestock. Festulolium is a cross of tall fescue and perennial ryegrass. The matuas are also called bromegrass but are actually a rescuegrass. Reportedly, Dixon is better adapted to southern climates, whereas Lakota® has a northern adaptability. The cool season mix was Sharp Brothers' 'Pasture Mix #6®' (PM6), a blend of smooth bromegrass, 'Regar' meadow bromegrass, Slate, Profile, and 'Garrison' creeping foxtail.

Each variety and the mix were planted in four randomly assigned plots in both locations. The Ford County plots were under a 2.4-acre center pivot sprinkler at Dodge City Community College, which has a Ulysses silt loam soil type. The Stevens County plots were under a 15-acre pivot on a Vona-Tivoli loamy fine sand. The plots were planted on September 6 and 7 of 2002 in Stevens and Ford counties, respectively. At the Ford County location, the grasses were planted into standing sorghum-sudangrass stubble left after haying. Five days after planting, the plots were sprayed with glyphosate (0.75 lbs A.E./acre) to kill the sorghum-sudangrass regrowth and weeds. At the Stevens County location, the seed was planted into existing common crabgrass cover that had been grazed short and sprayed with glyphosate 7 days before planting. A no-till grass drill, with depth bands, was used to plant the seed 0.25 inches deep in 8-inch row spacing. Planting rates were: crested wheatgrass 15 lb/acre, intermediate wheatgrass and orchardgrass 20 lb/acre, smooth bromegrass 22 lb/acre, and the matuas, fescues, festulolium, and pasture mix 25 lb/acre. Approximately 45 lbs of nitrogen per acre were applied as urea in early October. The soil was closely monitored to ensure it remained moist throughout the fall.

During the following years, extensive hand weeding, Dual Magnum® (1.5 pint/acre), Treflan® (10 lbs/acre), Paramount® (8 oz./acre) with crop oil, and 2,4-D (1 pint/acre) were used as needed to develop pure research stands. The chemicals were not used until stands were well established and may be too cost prohibitive for use in pastures. Common weeds were crabgrass, grassy sandbur, henbit, bindweed, buckwheat, and pigweed. Urea provided 150 lbs of nitrogen per acre before spring green-up and 100 lbs of nitrogen before fall regrowth. Phosphorous and potassium were applied during the fall, according to recommendations based on soil samples collected at each location. Plots were irrigated when necessary to provide a minimum of 22 inches total water during the growing season.

Forage samples were collected by cutting 20 square feet of each plot to a height of approximately 4 inches. Samples were collected at late-boot to early-head stages in the spring of 2003 (Table 1). Subsequent cuttings were collected from all varieties when late boot was first observed in any variety. This occurred on June 1, 2004, and October 21, 2004, in Stevens County, and on October 13, 2004, and October 29, 2004, in Ford County. In early October 2003, calves gained access to and grazed the Stevens County plots. The plots were not sampled, but they were ranked for apparent grazing preference on the basis of evidence of grazing and remaining grass height. The plots were then mowed to a 4-inch height.

Results and Discussion

Table 1 shows fall grazing preference of the Stevens County plots. Orchardgrass was the most preferred, having been grazed the shortest. It was followed in preference by smooth bromegrass, intermediate wheatgrass, and the pasture mix. Dry stems from the spring's post-cutting regrowth and seed production may have been responsible for the reduced preference for the two matua grasses relative to the three previous grasses. The two fescues were the next preferred, with festulolium being slightly less desirable. The calves essentially did not graze the crested wheatgrass. Grazing preferences will likely differ in the spring, and may have little impact on intake in a monoculture pasture. There was no obvious preference for any of the pasture-mix varieties, inasmuch as all were grazed to a similar height.

Table 1 also lists the date at which each grass was cut when at the late-boot to early-head stage in the spring of 2003. The two matuas were the earliest developing grasses. It is interesting that they also exhibited rapid regrowth after spring and fall cuttings, to the point of producing a seed head in early summer. Festulolium and the fescues were cut on the same date as the matuas were in Ford County, but were cut 8 days later in Stevens County. Orchardgrass, smooth bromegrass, the pasture mix, and crested wheatgrass generally exhibited slower development. Intermediate wheatgrass was typically the last to reach the late-boot stage, as indicated in Ford County and as observed in unclipped sections of plots in 2004.

Considerable differences in the dry matter content (Table 2) occurred between varieties and locations. A narrow range in dry matter content was observed in the spring of 2003, which was the only time that all varieties at both locations were cut at a similar stage of maturity. The wide ranges in dry matter content of subsequent cuttings likely occurred because the grasses were not cut at similar maturities.

Spring yields for 2003 (Table 3) indicate that the grasses were either better established or less winter stressed in Ford than in Stevens County. Low spring 2004 (Table 4) yields in both counties may have been the result of plant stress caused by the abnormally dry winter and unseasonably high spring temperatures. Annual yields were poorer in Ford County during 2004 than in 2003, despite the cool, wet summer. Grass yields were higher in Stevens County than in Ford County in 2004.

The matuas suffered an estimated 15 to 25% winterkill in Stevens County in 2003 and 2004 and a 15 to 20% kill in Ford County in 2004, resulting in low spring yields. These were the only varieties to have winterkill losses. Seed production during both years produced new plants, however, which improved fall yields. Ford County annual matua yields were among the highest in 2003 when there was no winter kill.

Despite low spring yields, the fescues and festulolium had high fall yields, making them some of the top annual producers in Ford County during 2003 and 2004, and the highest producing varieties in Stevens County during 2004. These three varieties seem to be better adapted to Stevens County than the other grasses, on the basis of the 2004 annual yields.

Intermediate wheatgrass, smooth bromegrass, orchardgrass, and the pasture mix had the highest spring yields of all grasses at both locations during both years. Fall yields of these four grasses were similar to, or lower than, the fescues and festulolium. Although intermediate wheatgrass was the highest annual forage producer during 2003, all varieties in Ford County produced more than 10,000 lbs of forage dry matter per acre that year. In 2004, festulolium, intermediate wheatgrass, Kentucky 31, Max-Q®, orchardgrass, and

PM6® yielded more than 8,000 lb/acre of forage dry matter in Ford County and more than 10,000 lb/acre in Stevens County. Crested wheatgrass, being the shortest grass, had the lowest annual yields at both locations.

Choosing a grass variety for irrigated production should not be based on annual yield only. Important agronomic factors that should be considered include soil and climate adaptation, fertility and water requirements, and winter hardiness. Animal-related factors include species and class of animals that will consume the forage, and their nutritional requirements, forage nutritional quality, and grazing tolerance. Other factors to consider include primary use, whether haying or grazing, and management style. These factors, as well as others, all have an important place in determining what species and variety is best adapted to the environment, the intended use, and management.

Table 1. Spring 2003 Cutting Dates by County and Calf Preference for Fall Growth in Stevens County 2003

	2003 Spring Cutting		Calf Grazing Preference
Variety	Ford	Stevens	Stevens Fall 2003*
Crested wheatgrass	May 22	May 6	4[d]
Dixon® matua	May 12	April 28	2.3[b]
Hykor festulolium	May 12	May 6	3.3[c]
Intermediate wheatgrass	May 29	May 20	2[b]
Kentucky 31 fescue	May 12	May 6	3[c]
Lakota® matua	May 12	April 28	2.3[b]
Max-Q® fescue	May 12	May 6	3[c]
Orchardgrass	May 22	May 20	1[a]
Sharp's PM6®	May 22	May 20	2[b]
Smooth brome	May 22	May 20	2[b]

*1 = most preferred, 4 = least preferred.
[abcd]Means having different superscripts differ significantly (P<0.05).

Table 2. Dry Matter Content of Irrigated Cool-season Grasses in 2003 and 2004

	2003			2004			
	Spring		Fall*	Spring		Fall	
Variety	Ford	Stevens	Ford	Ford	Stevens	Ford	Stevens
Crested wheatgrass	25.9^{ab}	28.7^{a}	25.3^{c}	37.0^{ab}	32.8^{cde}	37.1^{bc}	37.9^{b}
Dixon® matua	24.2b^{cde}	24.5^{abcde}	34.3^{a}	30.0^{ef}	26.5^{f}	28.2^{hi}	33.5^{defg}
Hykor festulolium	25.7^{abc}	22.9^{de}	30.9^{ab}	32.0^{de}	28.8^{ef}	34.2^{defg}	34.9^{def}
Intermediate wheatgrass	23.0^{de}	22.7^{de}	24.3^{c}	32.7^{de}	36.3^{abc}	36.3^{cd}	39.0^{ab}
Kentucky 31 fescue	23.7^{cde}	23.0^{de}	30.6^{abc}	34.2^{bcd}	31.7^{de}	31.4^{gh}	32.1^{g}
Lakota® matua	24.7^{abcde}	24.9^{abcde}	29.4^{abc}	30.1^{ef}	28.8^{ef}	26.6^{i}	36.2^{cd}
Max-Q® fescue	23.8^{cde}	22.6^{de}	30.5^{abc}	34.5^{abcd}	31.0^{de}	32.1^{fg}	33.4^{defg}
Orchardgrass	24.5^{abcde}	21.4^{e}	30.2^{abc}	30.6^{e}	30.3^{ef}	33.0^{efg}	35.5^{cde}
Sharps PM6®	24.0^{cde}	24.4^{bcde}	27.2^{bc}	32.3^{de}	30.0^{ef}	31.3^{gh}	35.3^{cde}
Smooth bromegrass	25.4^{abcd}	26.4^{ab}	32.5^{ab}	31.7^{de}	37.8^{a}	33.1^{defg}	41.4^{a}
Location average	24.5	24.1	29.5	32.5	31.4	32.4	35.9

*No fall cuttings in Stevens County.
^{abcdefghi}Seasonal means having different superscripts differ significantly (P<0.05).

Table 3. Dry Matter Yield of Irrigated Cool-season Grasses in 2003

	Spring			Fall*	Annual*
Variety	Ford	Stevens	Both	Ford	Ford
Crested wheatgrass	5755^{cd}	1289^{g}	3522	4901^{c}	10656^{d}
Dixon® matua	4078^{ef}	672^{g}	2375	8632^{a}	12710^{bcd}
Hykor festulolium	3070^{f}	1196^{g}	2133	8726^{a}	11796^{cd}
Intermediate wheatgrass	9905^{a}	5088de	7497	6938^{b}	16842^{a}
Kentucky 31 fescue	3388^{f}	998^{g}	2193	8789^{a}	12177^{bcd}
Lakota® matua	5175^{cde}	741^{g}	2958	8519^{a}	13694^{bc}
Max-Q® fescue	4306^{ef}	1238^{g}	2772	9888^{a}	14194^{b}
Orchardgrass	6056^{bcd}	3577^{f}	4817	5146^{c}	11203^{d}
Sharps PM6®	6567^{bc}	3841^{ef}	5204	5862^{bc}	12429^{bcd}
Smooth bromegrass	7162^{b}	3892^{ef}	5527	5552^{bc}	12714^{bcd}
Location average	5546	2253		7295	12841

*No fall cuttings in Stevens County.
^{abcdefg}Seasonal or annual means having different superscripts differ significantly (P<0.05).

Table 4. Dry Matter Yield of Irrigated Cool-season Grasses in 2004

	Spring			Fall			Total Annual		
Variety	Ford	Stevens	Both	Ford	Stevens	Both	Ford	Stevens	Both
Crested wheatgrass	2396	1069	1732[bcd]	3265[h]	5120[fg]	4192	5661[e]	6189[de]	5925
Dixon® matua	1498	953	1225[e]	4770[g]	8188[bc]	6479	6268[de]	9141[c]	7705
Hykor festulolium	1689	1245	1467[de]	6329[ef]	13307[a]	9818	8018[c]	14552[a]	11285
Intermediate wheatgrass	2639	2639	2639[a]	6268[ef]	9069[b]	7669	8907[c]	11708[b]	10307
Kentucky 31 fescue	1868	1133	1500[de]	6715[de]	12125[a]	9420	8583[c]	13258[a]	10920
Lakota® matua	1206	1086	1146[e]	4988[fg]	8487[b]	6738	6194[de]	9573[c]	7884
Max-Q® fescue	1673	1623	1648[cd]	6985[cde]	12192[a]	9588	8658[c]	13815[a]	11236
Orchardgrass	2383	1764	2073[b]	6650[de]	9878[b]	8264	9032[c]	11641[b]	10337
Sharps PM6®	2450	1492	1971[bc]	6302[ef]	8542[b]	7422	8751[c]	10033[c]	9392
Smooth bromegrass	2348	1867	2108[b]	5048[fg]	7940[bcd]	6494	7396[cd]	9807[c]	8602
Location average	2015[i]	1487[j]		5732	9485		7747	10972	

[abcdefgh]Seasonal or annual means having different superscripts differ significantly (P<0.05).
[ij]Location means differ significantly (P<0.05).