Cool and Warm Season Forage Grass Performance in the Columbia Basin of Washington

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Introduction

The performance and adaptability of currently available cool and warm season forage grasses for the Columbia Basin has not been studied for many years. New cultivars of grasses continually come on the market. Grass growers of hay and pasture are looking for improved cultivars as new demands for grass fed beef and year-round grazing systems develop in the Columbia Basin. This discussion is limited to the species and cultivars included in the trial planted in 2000 and harvested for two years. The trial terminated in 2002 as the plots were lost due to orchard development. The plot area displayed large soil variations as evidenced by grass growth. Replication was too small to overcome this variation. This resulted in lack of statistical differences between cultivar performances in many cases. However, the greatest value in these results is in the relative performance of the different species. Forage quality determinations were made in the second year only.

Procedures

Several species of grass were included in the study. They consisted of 12 cultivars of orchardgrass, 8 cultivars of timothy, 5 cultivars of bromegrass, 6 cultivars of perennial ryegrass, 7 cultivars of fescue, one bluebunch X quackgrass hybrid (NewHy) and three species of warm-season prairie grass represented by two to four cultivars each.

The grasses were planted as a randomized block design experiment with three replications in 4.5 ft X 14 ft plots with a Hege Cone plot planter in May of 2000 at the Washington State University Royal Slope Research Facility (very fine sandy loam soil), managed by the Irrigated Agriculture Research and Extension Center, Prosser, WA. Plots were fertilized and maintained to encourage strong establishment. The seeding rate ranged from 6.7 to 18 lb bulk seed/ac depending on the pure live seed percentage of each lot of each species. Overhead irrigation was provided by hand-lines placed in the alleys. Weekly irrigations occurred during the production months of May, June, July and August. Weed control was achieved with phenoxy herbicides. Forage was harvested with sickle bar and flail plot harvesters in 2001 and 2002. Three harvests were taken in 2001 on a calendar basis. In 2002, each cultivar was harvested at early heading for the first cutting. Subsequent harvests occurred at heading, or if heads were not initiated harvest occurred at approximately 35 to 45 days. Forage quality was determined by analysis with Near Infrared Spectroscopy (NIRS) in 2002.

Results

The hybrid grass "NewHy" established well and produced forage in 2001 but was replaced by annual grassy weeds over the winter of 2001-2002. No data were taken in 2002. NewHy is not included in the tabled data. Two-year forage yield summaries are presented for orchardgrass, timothy, bromes, fescues, perennial ryegrasses and warm season grasses.

Because of the large amount of soil variation in the plot area and the lack of adequate replication, one should be cautious when interpreting the data. For grass growers and graziers in the Columbia Basin, the greatest value of this report is in the comparisons between grass species rather than in the cultivar differences within species.

The following tables compare the average values of each grass species for two-year forage yields (Table 1.) and one-year (2002) forage yield, quality and total digestible dry matter per acre (Table 2.).

Table 1. Comparison of grass species for two-year 100% Dry matter forage yields.

Grass species	2001	2002	2-year total
		t/ac	
Orchardgrasses	8.1	6.2	14.3
Timothy	7.8	6.2	14.0
Fescues	7.8	5.0	12.8
Bromes	7.0	3.5	10.5
Per. ryegrasses	6.5	2.8	9.3
Diploids	6.4	2.8	9.3
Tetraploids	5.9	2.8	8.7
Indiangrasses	7.5	5.8	13.3
Big Bluestems	6.3	5.3	11.5
Switchgrasses	7.2	4.8	11.9

Forage yields declined in 2002, most likely as a result of insufficient fertility. Fertilizer was applied at 112 lb/ac N, 16 lb/ac P and 16 lb/ac K in March 2002 and again in July, totaling 224 lb/ac N for the season.

Table 2. Comparison of grass species for 2002 forage yield, forage quality parameters and predicted digestible dry matter production.

Grass species	DM yield t/ac	Avg. CP %	Avg. NDF %	Avg. dNDF %	Avg. RFV	Avg. RFQ	Avg. TDN %	Total DDM t/ac
Orchardgrasses	6.2	12.0	58.5	38.9	98	122	58.1	3.6
Timothy	6.2	8.5	60.0	30.7	93	101	55.0	3.4
Fescues	5.0	10.1	54.3	33.7	107	114	57.8	2.6
Bromes	3.5	12.1	57.1	37.1	99	119	57.7	2.0
Per. ryegrasses	2.8	11.3	51.5	33.7	118	133	60.4	1.7
Diploids	2.8	11.2	52.3	33.8	114	130	60.0	1.7
Tetraploids	2.8	11.3	50.6	33.6	121	137	60.8	1.7
Indiangrasses	5.8	11.1	66.8	40.8	80	86	49.9	2.9
Big Bluestems	5.3	11.0	66.4	37.4	80	90	51.5	2.8
Switchgrasses	4.8	11.2	64.6	35.9	85	95	51.6	2.5

The orchardgrasses produced the greatest yield with excellent forage quality and the highest digestible dry matter per acre. The ryegrasses were highest in forage quality, but because of lower forage yield were also lower in digestible dry matter production than both fescues and bromes. The warm season grasses were highest in %NDF fiber, however it is interesting that the digestibility of the NDF (dNDF) in the indiangrasses was also high resulting in greater digestible dry matter per acre production than the bromes.

Orchardgrasses

Forage yield was greater in 2001 than in 2002 with two-year totals ranging from 11.6 to 16.2 t/ac (Table 3.). Differences between cultivars in forage yield occurred in both years. Harvest dates are presented in the yield tables, which indicate maturity differences. Variation in maturity ranged 14 days in the first harvest. "Benchmark" headed first on May 7, Potomac headed May 14 and the last cultivar to head was "Quantum" on May 21. Cultivars changed rank from one year to the next most likely as a result of cutting management. The cultivars are listed in order of highest to lowest 2-year total yield.

Forage quality (Table 4.) differences between cultivars were minor and generally non-significant statistically. Cultivars differed in percent neutral detergent fiber (%NDF), percent digestible neutral detergent fiber (dNDF) and Relative Feed Value (RFV), but not Relative Forage Quality or percent Total Digestible Nutrients (%TDN). Due to the variability of the data and lack of adequate replication, caution should be used when interpreting these differences. In general, the orchardgrass cultivars produced high forage yields and excellent forage quality as compared with the other grasses in the trial.

Timothy

Two-year forage yield totals ranged from 11.7 to 16.5 t/ac (Table 5.). Two of the eight cultivars were harvested three times in 2002 as a result of earlier first harvest in 2002. The third cut produced an average 1 t/ac and propelled the two cultivars to the top of the trial. Experimental variation was large, indicated by large coefficients of variability (%CV). Heading dates in first growth in 2002 spanned 9 days. "Bart" and "CAS-MPP10" were earliest at June 3 with "Climax" and three other cultivars heading June 12. The two early maturing cultivars were harvested a third time on September 23. Significant yield differences resulted from both maturity differences and yield potential in 2002. Two-year total yields were significant at the 10% probability level. Head length differences were noted at ($P>0.1$) among cultivars with "Bart" the largest averaging 4.3 inches long and "Tiller" the shortest at 3.4 inches.

Forage quality (Table 6.) differences were not observed except for %TDN. Timothy cultivars in this trial cut at the same stage of growth appear to be very similar in forage quality. With RFV averaging 93, timothy appears to be slightly less nutritious than full bloom alfalfa.

Bromes

The bromes tested included two cultivars of smooth brome *(Bromus inermus)*, and one each of meadow brome (*B. riparius*), grazing brome, (*B. stamineus*) and upland brome (*B. sitchensis*) (Table 7.). All cultivars performed well in 2001 with an average of 7 t/ac. However, in 2002 the smooth brome plots slowly thinned and were invaded with annual grassy weeds. "Paddock" meadow brome yielded best over the two-year trial with 11.5 t/ac.

Forage quality (Table 8.) of the bromes ranked higher than that of timothy. No differences were observed between cultivars.

Fescues

Forage yields differed between the fescues in 2002 and the two-year totals (Table 9.). Two-year yields ranged from 11.9 t/ac for "Barolex" to 14.3 t/ac for "Longhorn". Maturity differences were only separated by six to seven days. All cultivars of the fescues are well adapted for this environment. Some cultivars are designed for both haying and grazing and some are mainly grazing types. This may account for forage yield differences as measured in this trial and should be considered when choosing fescues for specific applications.

No forage quality differences were statistically significant among the cultivars; however, the grazing types "Fawn", "Barolex", "Longhorn" and "Martin 2" trended higher in forage quality (Table 10.). The fescues produced higher forage quality than the bromes and similar to the orchardgrasses.

Perennial Ryegrasses

Cultivars consisted of both early and late maturing diploid (designated 2n=E and 2n=L) and later maturing tetraploid (4n-L) types (Table 11.). Diploid types are better suited for grazing, whereas tetraploid types are dual purpose. Tetraploid types generally out-yield diploid types but are shorter lived than diploid types. Tetraploid ryegrasses have larger cells, which offer more space for storage of carbohydrates that are responsible for greater nutritive value. Data from this trial did not support the above generalizations for yield. However, the diploid types matured earlier by 7 days in 2002. The two-year average yield spread was from 7.9 t/ac to 10.5 t/ac, both diploid types. Significant yield differences were measured in 2002. Two-year average yields differed at the 10% but not at the 5% probability level.

Forage quality (Table 12.) of the ryegrasses was the highest of all the grasses tested. Although not significant, the tetraploids tended to have higher forage quality than the diploids.

Warm Season Grasses

The warm season grasses included 4 cultivars each of big bluestem and switchgrass and two cultivars of indiangrass. Only two cuttings per year were taken on these compared to three cuttings of the shorter cool season grasses. "Dacotah" switchgrass matured 15 days before any of the other warm season grasses. It was also consistently lower in forage yield. Statistically significant yield differences occurred in 2002 and in the two-year total yields (Table 13.). "Tomahawk" indiangrass led in yield with 13.7 t/ac total two-year yield. "Bonilla" big bluestem finished at the bottom with 10.4 t/ac. The indiangrasses out-yielded the switchgrasses followed closely by the big bluestems.

Forage quality of the warm-season grasses was lower than that of any cool-season grass species (Table 14.). This is not unexpected as warm season grasses are still dormant in the early spring when cool season grasses are actively growing. These warm season prairie grasses grow very rapidly during the summer and produce tall culms (over 4 feet) that are more lignified (note %NDF) than the shorter grasses.

Summary and Conclusions

These grass trials were successful in demonstrating the relative adaptability and potential of cool and warm season species for the Columbia Basin of Washington. Variability within the plot area and inadequate replication resulted in poor separation of differences in forage yield and forage quality among cultivars within species. Under conditions of limited irrigation potential, graziers may consider warm season grasses for mid-summer pasture when cool season grasses slow growth. These should be grazed prior to stem elongation for improved forage quality. Caution should be exercised when interpreting cultivar differences.

Three oversights occurred in the management of this trial. In 2002, some grasses were very slow in initiating seed stalks during the second and third regrowth cycles. This spread harvests out by as much as 7 weeks. This interval should have been kept at a 5-week minimum regardless of heading. Cutting height was from 2-3 inches, but should have been 3-4 inches minimum. The short cutting height slowed regrowth of some species. Insufficient nitrogen fertilizer in 2002 resulted in reduced yield potential of all grass species. The combination of these errors most likely resulted in underestimating the potential yields of some cultivars.

Table 3. Two-year forage yields (tons/ac 100% dry matter) of orchardgrass.

2001-2002 Forage Grass Yield
WSU -IAREC-Royal Slope Research Unit

	2001							2002							
Orchardgrass Cultivar	Cut 1		Cut 2		Cut 3			Cut 1		Cut 2		Cut 3			
	Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	Total 2001	Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	Total 2002	2-yr Total
Bronc	24-May	3.9	16-Jul	3.3	11-Sep	2.2	9.4	14-May	2.9	9-Jul	2.2	24-Aug	1.7	6.8	8.1
Potomac (Check)	24-May	3.7	16-Jul	2.6	11-Sep	2.4	8.7	14-May	3.2	9-Jul	2.6	24-Aug	1.6	7.4	8.1
Benchmark	24-May	3.1	16-Jul	2.7	11-Sep	1.8	7.6	7-May	2.4	5-Jul	2.9	24-Aug	2.3	7.6	7.6
Haymate	24-May	3.0	16-Jul	3.4	11-Sep	2.5	8.9	20-May	2.8	9-Jul	2.0	24-Aug	1.3	6.2	7.6
Ambassador	24-May	3.6	16-Jul	2.8	11-Sep	2.6	9.0	14-May	2.9	9-Jul	1.8	24-Aug	1.4	6.1	7.6
Pizza	24-May	3.0	16-Jul	3.2	11-Sep	2.0	8.2	14-May	2.6	9-Jul	2.1	24-Aug	1.6	6.3	7.3
Orion	24-May	2.7	16-Jul	3.2	11-Sep	1.7	7.6	20-May	3.4	9-Jul	2.0	24-Aug	1.2	6.6	7.1
Renegade	24-May	3.2	16-Jul	2.6	11-Sep	2.0	7.8	14-May	2.7	9-Jul	1.9	24-Aug	1.2	5.9	6.9
Baridana	24-May	3.0	16-Jul	2.4	11-Sep	2.2	7.6	20-May	2.9	9-Jul	2.0	24-Aug	1.3	6.1	6.9
Paiute	24-May	3.0	16-Jul	3.2	11-Sep	1.7	7.9	15-May	2.3	5-Jul	1.6	24-Aug	1.6	5.5	6.7
Quantum	24-May	2.9	16-Jul	2.6	11-Sep	2.0	7.5	21-May	1.5	5-Jul	1.7	24-Aug	1.5	4.7	6.1
Warrior	24-May	2.7	16-Jul	2.3	11-Sep	1.6	6.6	15-May	2.1	5-Jul	1.7	24-Aug	1.2	5.0	5.8
Mean		3.2		2.8		2.1	8.1		2.6		2.0		1.5	6.2	7.1
lsd (.05)		ns		0.6		ns	1.5		0.9		0.4		0.4	1.2	0.8
CV%		19		17		22	14		25		21		24	16	20

Table 4. Forage quality of orchardgrasses in 2002.

2002 Grass Forage Quality
WSU -IAREC-Royal Slope Research Unit

Orchardgrass Cultivar	%CP				%NDF				%dNDF				RFV				RFQ				%TDN			
	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG
Bronc	11.8	12.4	13.8	12.2	57.2	63	61.1	59.5	36.5	41.6	42.0	39.2	103	86	90	99	129	103	109	123	59.0	54.2	56.1	57.2
Potomac (Ck)	10.9	12.8	13.2	12.2	58.0	62.7	61.8	59.9	36.1	42.6	42.6	39.7	101	87	89	93	126	110	113	118	58.7	55.8	56.5	57.5
Benchmark	13.8	13.1	13.6	13.2	53.8	63.0	61.2	58.4	35.5	42.0	42.7	39.8	113	87	90	100	140	107	111	124	60.6	55.0	56.4	57.9
Haymate	10.2	14.1	14.8	12.4	60.0	61.8	59.0	60.0	37.5	40.6	41.7	39.4	96	90	96	95	117	106	116	115	57.3	54.8	57.3	56.9
Ambassador	10.6	12.5	13.7	12.0	61.1	63.4	61.5	59.2	36.8	41.5	42.4	39.1	93	85	89	96	114	100	109	118	60.0	53.7	55.9	57.6
Pizza	12.1	12.3	11.7	11.4	52.7	54.7	59.6	57.2	34.9	34.7	41.1	38.1	115	85	93	103	140	101	119	126	61.2	59.6	57.6	58.6
Orion	11.0	13.8	12.9	12.3	58.0	61.7	58.5	59.1	36.2	40.2	40.9	39.0	100	89	96	96	123	104	122	119	57.8	54.1	58.1	57.2
Renegade	9.6	11.0	12.8	10.9	58.1	64.5	61.6	61.2	37.1	42.7	42.6	42.3	100	83	89	92	125	99	114	115	59.3	53.5	56.6	56.9
Baridana	9.9	13.1	13.6	11.7	57.4	61.5	61.1	59.8	35.8	39.6	41.5	39.5	102	92	91	97	124	117	113	119	58.9	54.8	56.2	57.2
Paiute	10.2	14.2	14.2	12.2	53.9	61.7	60.5	57.4	35.1	41.3	43.0	38.8	111	90	92	101	137	109	116	125	61.5	55.6	57.4	59.1
Quantum	11.9	10.8	12.5	12.0	55.1	61.2	61.2	58.2	35.2	40.0	41.1	38.0	108	90	89	99	131	114	112	122	59.3	56.6	56.3	57.9
Warrior	9.3	11.5	12.7	10.8	49.6	62.4	60.7	55.4	33.5	41.0	41.9	37.6	121	89	92	106	147	113	118	132	64.5	56.2	57.3	60.7
Mean	10.9	a	13.2	12.0	55.8	a	60.6	58.5	35.8	a	42.0	38.9	106	a	91	98	131	a	114	122	59.8	a	56.8	58.1
lsd (.05)	2.8		ns	ns	5.6		ns	6.2	2.8		ns	6.7	19		ns	8	23		ns	ns	5.1		ns	ns
CV%	12		10	14	6		2	7	3		2	8	8		4	11	8		5	11	4		2	5

a = Only one rep in cut 2.

Table 5. Two-year forage yields (tons/ac 100% dry matter) of timothy.

2001-2002 Forage Grass Yield
WSU -IAREC-Royal Slope Research Unit

		2001							2002							
Timothy Cultivar	2002 1st cut head length (Inches)	Cut 1		Cut 2		Cut 3			Cut 1		Cut 2		Cut 3			
		Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	2001	Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	Total 2002	2-yr Total
Bart	4.3	24-May	3.6	16-Jul	2.3	11-Sep	2.4	8.3	3-Jun	4.2	19-Jul	1.80	23-Sep	2.2	8.2	16.5
CAS-MPP10	3.7	24-May	4.0	16-Jul	2.5	11-Sep	2.5	9.0	3-Jun	4.0	19-Jul	1.70	23-Sep	1.5	7.2	16.2
Clair	4.1	24-May	3.6	16-Jul	2.2	11-Sep	2.0	7.8	5-Jun	4.2	31-Jul	2.20	no hvst		6.4	14.2
Climax	4.3	24-May	3.8	16-Jul	2.0	11-Sep	1.9	7.7	12-Jun	4.5	31-Jul	2.00	no hvst		6.5	14.2
Colt	4.3	24-May	3.0	16-Jul	2.7	11-Sep	2.0	7.7	12-Jun	3.7	24-Aug	2.10	no hvst		5.8	13.5
Comtal	4.2	24-May	3.5	16-Jul	2.3	11-Sep	2.1	7.9	5-Jun	3.8	24-Aug	1.30	no hvst		5.1	13.0
Outlaw	3.9	24-May	3.5	16-Jul	2.3	11-Sep	1.8	7.6	12-Jun	3.0	31-Jul	2.20	no hvst		5.2	12.8
Tiller	3.4	24-May	2.8	16-Jul	2.4	11-Sep	1.7	6.9	12-Jun	3.0	31-Jul	1.80	no hvst		4.8	11.7
Mean	4.0		3.5		2.3		2.1	7.8		3.8		1.9		1.9	6.2	14.0
lsd (.05)	1.7*		ns		ns		ns	ns		ns		ns		ns	1.3	ns
CV%	12		20		15		23	16		22		17			19	15

* at (P = 0.1)

Table 6. Forage quality of timothy in 2002.

2002 Grass Forage Quality
WSU -IAREC-Royal Slope Research Unit

Timothy Cultivar	%CP				%NDF				%dNDF				RFV				RFQ				%TDN			
	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG
Bart	6.4	11.0	nc	8.2	62.0	56.2	nc	60.0	31.0	28.4	nc	30.0	89	101	nc	94	94	116	nc	103	54.9	56.7	nc	56.0
CAS-MPP10	7.9	12.0	7.0	8.6	64.7	57.4	53.5	55.0	31.2	29.5	27.6	28.0	83	98	104	95	87	107	110	101	51.4	54.8	58.9	57.0
Clair	7.8	11.3	7.1	9.3	64.8	57.0	49.5	55.0	32.9	29.8	27.7	30.0	83	99	116	93	90	111	127	104	52.4	55.8	62.4	58.0
Climax	6.8	11.1	nc	8.5	63.7	59.2	nc	62.0	32.3	29.6	nc	31.0	85	93	nc	88	91	105	nc	96	53.6	54.2	nc	54.0
Colt	7.1	11.4	nc	8.5	65.5	57.7	nc	61.0	33.6	29.0	nc	31.0	82	97	nc	94	89	110	nc	103	52.5	55.0	nc	54.0
Comtal	6.9	8.8	nc	7.7	63.6	52.2	nc	59.0	33.1	29.2	nc	32.0	85	108	nc	95	94	127	nc	107	54.4	60.7	nc	57.0
Outlaw	6.8	10.9	nc	8.9	65.0	58.0	nc	57.0	32.0	31.0	nc	30.0	83	96	nc	90	81	111	nc	96	50.0	55.0	nc	57.0
Tiller	6.5	12	nc	7.9	62.4	58.7	nc	60.0	30.5	30.1	nc	30.0	87	96	nc	87	93	108	nc	94	54.6	54.3	nc	55.0
Mean	7.1	10.8	7.0	8.5	64.2	57.3	51.9	60.0	32.3	29.5	27.6	30.7	84	98	109	93	90	111	117	101	53.0	55.9	60.3	55.0
lsd (.05)	ns	ns	ns	ns	ns	1.30	ns	ns	1.5	ns	ns	ns	4	8	ns	ns	ns	8	ns	ns	2.3	1.8	ns	2.0
CV%	10	19	24	27	2	4	8	8	4	3	8	7	3	6	10	11	5	8	10	13	3	4	5	6

nc = no cutting due to insufficient growth

Table 7. Two-year forage yields (tons/ac 100% dry matter) bromegrasses.

2001-2002 Forage Grass Yield
WSU -IAREC-Royal Slope Research Unit

Bromegrass Cultivar	2001							2002							
	Cut 1		Cut 2		Cut 3			Cut 1		Cut 2		Cut 3			
	Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	Total 2001	Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	Total 2002	2-yr Total
Badger (Smooth)	24-May	3.7	16-Jul	2.3	11-Sep	1.5	7.5	no hvst		no hvst		no hvst			na
Scout (Smooth)	24-May	3.2	16-Jul	2.5	11-Sep	1.6	7.3	20-May	0.8	no hvst		no hvst			na
Feeder (Grazing)	24-May	3.1	16-Jul	2.5	11-Sep	2.0	7.6	15-May	1.3	5-Jul	1.4	24-Aug	1.2	3.9	11.5
Grasslands Hakari (Upland)	24-May	2.9	16-Jul	3.0	11-Sep	1.1	7.0	15-May	1.2	5-Jul	1.1	24-Aug	0.7	3.0	10.0
Paddock Meadow Brome	24-May	3.0	16-Jul	2.4	11-Sep	0.7	6.1	21-May	1.0	5-Jul	1.5	24-Aug	1.2	3.7	9.8
Mean		3.2		2.5		1.3	7.0		2.6		1.3		1.0	3.5	10.5
lsd (.05)*		ns		ns		0.7	ns		ns		ns		ns	ns	ns
CV%		17		33		41	13		15		17		39	17	11

Table 8. Forage quality of bromegrasses in 2002.

2002 Grass Forage Quality
WSU -IAREC-Royal Slope Research Unit

Bromegrass Cultivar	%CP				%NDF				%dNDF				RFV				RFQ				%TDN			
	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG
Badger (Smooth)																								
Scout (Smooth)	11.5	nd	nd	11.5	56.6	nd	nd	56.6	33.6	nd	nd	33.6	103	nd	nd	103	122	nd	nd	122	57.7	nd	nd	57.7
Feeder (Grazing)	11.6	10.2	12.1	11.3	56.4	61.0	59.3	58.0	36.2	38.0	42.0	38.4	102	89	90	96	122	103	108	114	57.9	55.0	56.0	56.7
Grasslands Hakari	12.3	12.6	10.0	11.6	55.8	59.0	61.1	58.1	34.2	37.0	39.2	36.3	104	95	89	97	122	117	107	115	57.3	57.0	55.5	56.6
Paddock	11.5	nd	16.4	13.4	51.5	nd	59.9	54.8	34.3	nd	40	36.6	116	nd	92	106	144	nd	102	127	62.3	nd	55.9	59.7
Mean	11.7	11.4	12.8	12.1	55.1	60.0	60.1	57.1	34.6	37.5	40.4	37.1	106	92	90	99	127	110	106	119	58.7	56.0	55.8	57.7
lsd (.05)	ns	a	ns	ns	ns	a	ns	ns	1.4	a	ns	ns	ns	a	ns	ns	15	a	ns	ns	3.1	a	ns	ns
CV%	8	a	25	17	5	a	3	6	4	a	4	8	7	a	4	11	9	a	7	13	4	a	3	5

nd = no data

a = only one replication in cut 2

Table 9. Two-year forage yields (tons/ac 100% dry matter) of fescues.

2001-2002 Forage Grass Yield
WSU -IAREC-Royal Slope Research Unit

Fescue Cultivar	2001							2002							
	Cut 1		Cut 2		Cut 3			Cut 1		Cut 2		Cut 3			
	Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	Total 2001	Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	Total 2002	2-yr Total
Longhorn	24-May	3.9	16-Jul	2.9	11-Sep	2.0	8.8	14-May	2.3	9-Jul	1.9	24-Aug	1.3	5.5	14.3
Barcarella	24-May	3.9	16-Jul	2.4	11-Sep	2.1	8.4	14-May	1.9	9-Jul	1.9	24-Aug	1.4	5.2	13.6
Fawn	24-May	2.8	16-Jul	2.4	11-Sep	2.1	7.3	20-May	2.7	9-Jul	1.6	24-Aug	1.5	5.8	13.1
Martin 2	24-May	4.1	16-Jul	2.5	11-Sep	1.3	7.9	21-May	2.2	5-Jul	1.3	24-Aug	1.4	4.9	12.8
Select	24-May	3.2	16-Jul	2.6	11-Sep	1.7	7.5	21-May	1.4	5-Jul	1.8	24-Aug	1.4	4.6	12.1
Fuego	24-May	3.5	16-Jul	2.5	11-Sep	1.5	7.5	15-May	1.8	5-Jul	1.5	24-Aug	1.2	4.5	12.0
Barolex	24-May	2.6	16-Jul	2.4	11-Sep	2.1	7.1	21-May	1.4	5-Jul	2.0	24-Aug	1.4	4.8	11.9
Mean		3.4		2.5		1.9	7.8		2.0		1.7		1.4	5.0	12.8
lsd (.05)*		ns		ns		ns	ns		0.7		0.4		ns	0.6	1.4
CV%		24		18		28	13		30		19		18	12	9

Table 10. Forage quality of fescues in 2002.

2002 Grass Forage Quality
WSU -IAREC-Royal Slope Research Unit

Fescue Cultivar	%CP				%NDF				%dNDF				RFV				RFQ				%TDN			
	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG
Longhorn	9.3	9.7	10.9	9.7	51.0	59.7	55.6	53.7	32.0	35.8	35.2	33.4	116	92.0	104	109	133	96.0	119	123	61.2	52.4	57.0	58.6
Barcarella	8.1	11.1	12.0	9.9	56.1	58.2	55.8	56.3	33.8	34.6	35.6	34.6	102	96	103	101	113	99	113	111	58.0	52.2	55.6	56.3
Fawn	8.9	12.2	9.9	9.8	52.8	55.3	52.1	52.9	32.8	35.2	33.4	33.4	111	104	112	110	123	116	126	123	59.3	56.2	59.5	58.9
Martin 2	9.1	nd	11.2	9.9	50.1	nd	56.1	52.5	31.0	nd	35.6	32.9	119	nd	102	112	132	nd	115	125	61.0	nd	56.3	59.3
Select	8.9	11.7	10.2	11.3	53.5	57.5	56.0	55.8	31.4	33.7	35.6	33.6	111	100	102	103	119	106	115	111	57.9	53.4	56.3	55.6
Fuego	8.9	9.7	9.3	9.2	52.8	58.2	56.3	54.9	33.4	35.9	35.7	34.6	112	97	101	106	125	108	113	114	60.1	55.4	56.9	58.2
Barolex	9.6	nd	13.6	10.4	50.6	nd	56.4	52.1	32.5	nd	35.5	33.3	118	nd	101	114	132	nd	112	127	60.9	nd	55.0	59.5
Mean	8.9	a	11.5	10.1	52.3	a	55.6	54.3	32.4	a	35.1	33.7	112	a	103	107	125	a	114	118	59.8	a	56.4	57.8
lsd (.05)	ns		ns	ns	ns		ns	ns	1.8		ns	ns	ns		ns	ns	ns		ns	ns	ns		ns	ns
CV%	9		20	19	5		4	6	4		4	5	7		5	8	8		7	10	4		4	6

nd = no data

a = only one replication in cut 2

Table 11. Two-year forage yields (tons/ac 100% dry matter) perennial ryegrasses.

2001-2002 Forage Grass Yield
WSU -IAREC-Royal Slope Research Unit

Perennial Ryegrass Cultivar	2001							2002							
	Cut 1		Cut 2		Cut 3			Cut 1		Cut 2		Cut 3			
	Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	Total 2001	Date	Yield t/ac	Date	Yield t/ac	Date	Yield t/ac	Total 2002	2-yr Total
Full Throttle (2n = E)	24-May	3.8	16-Jul	1.9	16-Jul	0.9	6.6	15-May	1.3	15-Jul	1.0	24-Aug	0.6	2.9	9.5
Zero Yatsyn (2n-E)	24-May	3.6	16-Jul	2.2	16-Jul	1.1	6.9	15-May	1.3	15-Jul	1.5	24-Aug	0.8	3.6	10.5
Barfort (4n-L)	24-May	2.9	16-Jul	1.7	16-Jul	0.8	5.4	23-May	1.0	15-Jul	0.8	24-Aug	0.8	2.6	8.0
Barpolo (2n-L)	24-May	2.5	16-Jul	2.2	16-Jul	1.1	5.8	23-May	0.3	15-Jul	1.3	24-Aug	0.5	2.1	7.9
Rosalin (4n-L)	24-May	3.0	16-Jul	1.9	16-Jul	1.2	6.1	21-May	1.1	15-Jul	1.3	24-Aug	0.7	3.1	9.2
Elgon (4n-L)	24-May	2.8	16-Jul	2.3	16-Jul	1.0	6.1	23-May	0.7	15-Jul	1.2	24-Aug	0.8	2.7	8.8
Mean		3.1		2.0		1.4	6.5		1.0		1.2		0.7	2.8	9.0
lsd (.05)*		0.5		ns		ns	ns		0.3		0.4		ns	0.6	ns
CV%		17		23		42	16		41		27		23	19	15

Table 12. Forage quality of perennial ryegrasses in 2002.

2002 Grass Forage Quality
WSU -IAREC-Royal Slope Research Unit

Perennial Ryegrass Cultivar	%CP				%NDF				%dNDF				RFV				RFQ				%TDN			
	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG	Cut1	Cut2	Cut3	AVG
Full Throttle (2n-E)	9.5	12.6	13.6	11.3	49.8	56.5	57.6	53.5	32.1	35.4	38.8	34.9	122	102	101	111	138	116	120	128	62.4	56.1	56.8	59.5
Zero Yatsyn (2n-E)	10.1	10.5	13.7	11.4	50.0	52.3	51.5	50.9	31.0	32.8	35.6	32.8	122	111	115	118	137	127	134	134	61.7	59.1	59.7	60.6
Barfort (4n-L)	11.2	12.2	13.1	12.0	58.1	52.5	52.3	55.2	37.0	37.1	36.8	36.9	100	113	113	107	117	139	139	127	55.9	60.8	60.9	58.3
Barpolo (2n-L)	9.2	10.1	14.1	11.0	53.1	54.5	51.1	52.7	32.7	33.1	36.1	33.9	111	109	117	113	123	126	139	129	59.8	59.2	61.0	60.0
Rosalin (4n-L)	10.5	12.7	10.8	11.0	47.3	50.9	53.8	50.1	29.4	33.6	36.8	32.6	131	117	107	121	141	134	130	136	62.2	59.6	59.7	60.9
Elgon (4n-L)	10.3	11.8	11.9	11.1	41.4	51.3	51.5	46.4	27.9	31.9	36.3	31.4	152	114	115	134	159	126	139	147	66.2	58.2	61.2	63.1
Mean	10.1	11.7	12.9	11.3	49.9	53.0	52.9	51.5	31.7	34.0	36.7	33.7	123	111	111	118	136	128	133	134	61.3	58.8	59.8	60.4
lsd (.05)	ns	a	ns	ns	9.3	a	3.6	ns	2.0	a	1.6	2.5	23	a	ns	19	8.0	a	ns	ns	ns	a	ns	ns
CV%	16		11	17	13		5	10	10		3	10	16		6	13	15		6	12	8		3	4

a = only one replication in cut 2

Table 13. Two-year forage yields (tons/ac 100% dry matter) of warm season grasses.

2001-2002 Forage Grass Yield
WSU -IAREC-Royal Slope Research Unit

Warm season Grass Cultivar	2001					2002					
	Cut 1		Cut 2			Cut 1		Cut 2			
	Date	Yield t/ac	Date	Yield t/ac	Total 2001	Date	Yi Yield t/ac eld	Date	Yield t/ac	Total 2002	2-yr Total
Big Bluestems											
Bonilla	16-Jul	4.1	11-Sep	1.7	5.8	5-Jul	2.4	24-Aug	2.2	4.6	10.4
Sunnyview	16-Jul	3.7	11-Sep	2.2	5.9	5-Jul	2.5	24-Aug	2.7	5.2	11.1
Pawnee	16-Jul	4.5	11-Sep	2.7	7.2	5-Jul	2.6	24-Aug	3.0	5.6	12.8
Bison	16-Jul	3.9	11-Sep	2.3	6.2	5-Jul	3.3	24-Aug	2.4	5.7	11.9
Indiangrasses											
Tomahawk	16-Jul	5.0	11-Sep	2.0	7.0	5-Jul	4.0	24-Aug	2.7	6.7	13.7
NE54 C2 Syn2	16-Jul	5.2	11-Sep	2.8	8.0	5-Jul	2.9	24-Aug	2.0	4.9	12.9
Switchgrasses											
Forestburg	16-Jul	5.1	11-Sep	2.5	7.6	5-Jul	2.8	24-Aug	2.1	4.9	12.5
Trailblazer	16-Jul	4.8	11-Sep	2.6	7.4	5-Jul	2.4	24-Aug	2.6	5.0	12.4
Sunburst	16-Jul	5.0	11-Sep	2.0	7.0	5-Jul	3.0	24-Aug	2.0	5.0	12.0
Dacotah	16-Jul	4.2	11-Sep	2.4	6.6	20-Jun	2.1	31-Jul	2.0	4.1	10.7
Mean		4.6		2.3	6.9		2.8		2.4	5.2	12.1
lsd (.05)*		ns		ns	ns		0.7		0.6	0.9	1.8
CV%		18		23	15		23		19	15	11

Table 14. Forage quality of warm season grasses in 2002.

2002 Grass Forage Quality
WSU -IAREC-Royal Slope Research Unit

Warm Season Grass Cultivar	%CP			%NDF			%dNDF			RFV			RFQ			%TDN		
	Cut1	Cut2	AVG	Cut1	Cut2	AVG	Cut1	Cut2	AVG	Cut1	Cut2	AVG	Cut1	Cut2	AVG	Cut1	Cut2	AVG
Big Bluestems																		
Bonilla	11.0	11.1	11.1	67.3	66.2	66.6	36.0	37.8	37.2	79	79	79	88	88	87	50.1	52.0	51.0
Sunnyview	9.4	11.6	10.9	66.2	65.9	66.0	34.9	38.0	37.0	81	81	81	91	95	93	51.5	52.5	52.1
Pawnee	11.2	10.6	10.8	66.5	68.9	66.8	36.1	38.0	37.4	81	79	80	91	91	91	50.7	51.9	51.5
Bison	11.1	11.6	11.1	66.3	64.7	66.3	38.0	38.8	38.0	80	82	80	90	96	90	51.2	52.6	51.2
Indiangrasses																		
Tomahawk	8.8	11.8	10.8	69.4	66.0	67.1	36.7	42.1	40.3	75	80	79	73	90	84	46.0	51.1	49.4
NE54 C2 Syn2	12.1	11.1	11.4	64.6	67.5	66.5	38.6	42.6	41.2	84	77	80	92	86	88	50.8	50.2	50.4
Switchgrasses																		
Forestburg	9.8	12.1	10.6	66.7	64.5	65.9	34.4	38.9	35.8	81	84	82	89	97	91	50.2	52.3	50.9
Trailblazer	10.0	11.9	11.0	64.5	64.9	65.1	34.4	38.4	36.2	85	83	83	95.0	95	94	51.4	52.1	51.4
Sunburst	11.6	12.3	11.1	64.4	63.9	64.4	37.0	37.2	35.7	84	85	84	95	96	93	51.8	51.8	51.3
Dacotah	10.6	14.4	12.1	64.0	61.3	63.0	35.0	36.9	36.0	88	92	89	97	104	100	51.6	53.9	52.6
Mean	11.0	11.8	11.2	64.0	65.2	65.6	35.0	38.8	37.4	87	82	82	97	94	92	52.0	51.9	51.3
lsd (.05)*	a	ns	ns	a	4.0	ns	a	.0	2.4	a	6	ns	a	6	ns	a	2.0	ns
CV%		14	14		4	4		6	7		6	6		6	7		2	3

a = only one replication in cut 1