Kika de la Garza Plant Materials Center

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SECOND YEAR FORAGE PRODUCTION OF WILDRYE ACCESSIONS IN SOUTH TEXAS

ABSTRACT

This report looks at second year forage production of Canada wildrye (*Elymus canadensis)* and Virginia wildrye (*Elymus virginicus)* in seeded and transplanted evaluation plots located at Kika de la Garza Plan Materials Center in Kingsville, Texas. Two accessions of *Melica nitens* were also included in the transplanted plots. 'Beefbuilder'ryegrass, a commerical variety of annual ryegrass, was included in both plots as a comparison standard. Clipping data was taken in winter of 1998 and the spring of 1999. Canada wildrye produced the most forage for both the winter and spring clippings of the seeded plot. It produced the highest percentage of plot cover for the spring clipping of the seeded plot and it also produced the most forage for both clippings of the transplanted plot. The Virginia wildryes and the ryegrass tended be the second best producers, with accessions #845 and #763 being the best forage producers, followed by the ryegrass, and with accessions #971 and #957 being the low end of this group for South Texas. The melics did poorly and did not seem suitable for forage production in South Texas.

INTRODUCTION

Virginia wildrye *(Elymus virginicus*) and Canada wildrye (*Elymus canadensis*) are both native, cool season, perennial bunchgrasses which grow two to three feet in height. Both species reproduce by tillering and seed. Virginia wildrye can be found throughout the United States except for Nevada, California, and Oregon; whereas Canada wildrye is distributed throughout the United States except for Alabama, Georgia, Louisiana, South Carolina, and Tennessee (Hitchcock, 1971). Both species can be found scattered on shaded banks, along fencerows and in open woodlands (Gould, 1975). Virginia wildrye prefers moister soils, higher soil fertility, heavier soil textures, and is more shade tolerant than Canada wildrye (Phillips Petroleum Company, 1963). Virginia wildrye is very palatable and nutritious, and is readily eaten by all classes of livestock in the spring and fall when it is green (Phillips Petroleum Company, 1963). In the spring when it is green, Canada wildrye also has good forage value for cattle and horses; however, the forage value for sheep and wildlife is reported to be only fair. (Stubbendiek, Hatch, and Kjar, 1980). Stubbendiek, et al. also note that the forage value of Canada Wildrye decreases sharply when the plant matures. Both species self-fertilize (Dewey, 1979), but have been known to hybridize and

introgress (Brown & Pratt, 1960). The objective of this study is to evaluate the potential of specific wildrye accessions for a cool-season forage for South Texas.

The two plots were planted in December 1997 and January of 1998 at the Kika de la Garza Plant Material Center in Kingsville, Texas. One plot was seeded, and one utilized transplants set into bedded rows. The seeded (Wildrye Small Field Planting) planting consists of two accessions of Virginia wildrye and one accession of Canada wildrye currently being studied at the Kika de la Garza Plant Materials Center. The transplanted plot (Wildrye/Melic Plot) used the same three wildrye accessions from the seeded plot, and also included two wildrye accessions currently being studied by the East Texas Plant Materials Center in Nacogdoches, Texas, and two accessions of *Melica nitens*. In addition, 'Beefbuilder' ryegrass, a commercial variety of annual ryegrass, was used as a comparison standard.

Materials and Methods

The Seeded Plot

The small field planting consisted of 16 plots that were six feet by twenty feet, surrounded by a ryegrass border to prevent an edge effect. Each plot was separated by a six-foot alleyway. The plot was divided into four blocks of four plots each. Block order was randomized. Block 1 contained the four plots in the southeast corner. Block 2 was made up of the four plots in the northeast corner. Block 3 fell in the southwest corner, and Block 4 was in the northwest corner. The wildrye accessions and the ryegrass were randomized within each block. The seeds were broadcast into prepared beds by hand, and then pressed into the soil with a 5-foot cultipacker. Seeding rate for the wildryes was 40 pure live seed per square foot. The actual seed amount was calculated by multiplying the number of seed required for one plot (120 sq. ft.) by the percent of pure live seed for the particular accession. The ryegrass was reseeded in the fall of 1998, at a rate of 20 lbs. of pure live seed per acre. The soil type was Victoria Clay.

On December 15, 1998, ten 1 foot by 1 foot samples were clipped from each of the four plots within the four blocks of the Wildrye Small Field Planting located in Block E of the Kika de la Garza PMC in Kingsville, Texas. There were two accessions of Virginia wildrye (#763 and #845); one accession of Canada wildrye (#285), and 'Beefbuilder' ryegrass (BB) included in this study. All plots were broadcast seeded in December of 1997. The annual ryegrass plots were reseeded in November of 1998. The wildryes are perennials, so plots did not require reseeding.

The ten sample locations were randomly selected by choosing grid locations with the help of a random numbers table and numbers picked from a hat. Samples sites were located within each plot and a 1 foot by 1 foot frame was placed in the designated location. Then, percent of total cover within the frame was estimated, as well as the percent of wildrye cover. All vegetation within the frame was clipped to a standard height of 2 inches using garden

clippers. Each sample was weighed and the green weight recorded. Each sample was saved and dried in a drying room for fourteen days. Total dry weight was then recorded, and the weeds and wildrye were sorted and weighed separately. The percentage of dry weight to green weight was also calculated. Seed heads were removed from the wildrye portion of the sample, and forage weight was calculated as well.

The plot was clipped a second time in April of 1999. Sample locations were again chosen randomly. A percent of wildrye or ryegrass cover was recorded for each plot. The same clipping procedure was followed. Three of the ten samples for each accession/block combination were randomly selected to be weighed for green weight. All samples were taken to a drying room for two weeks and then weighed to obtain a dry weight. Seed heads were removed where they were present, and a forage weight was obtained as well.

The Transplanted Plot

The Wildrye/ Melic Plot consists of four replications of eight 15-foot sections of bedded rows, with each row section within a replication containing 15 plants. Locations of each accession within a replication were randomly selected. There is a five-foot wide alley between each replication, and a border row of seeded annual ryegrass on either side of the plot to control for an edge effect. Plants for this plot were grown individually in the greenhouse in seeded cones. They were transplanted by hand into their randomly assigned locations at one-foot intervals. They were irrigated immediately following planting, and as needed throughout the growing season. Dead plants were replaced to maintain plot integrity.

On December 15, 1998, ten plants plus one sample were clipped from each row, except the ryegrass rows, in each replication of the Wildrye/Melic Plot located in Block D of the Kika de la Garza PMC in Kingsville, Texas. Plant accessions located in this plot included: two accessions of melic (#904 and #905), 'Beefbuilder' ryegrass; two accessions of Virginia wildrye (#763 and #845) and one accession of Canada wildrye (#285) being studied by the Kika de la Garza PMC; and two accessions of *Elymus spp*. that are being studied by the East Texas PMC (#957 and #971). The ryegrass grass rows were not clipped because the row replacements had been planted only three weeks earlier.

The ten plants were clipped at a standard height of four inches using hedge trimmers from either the north or south end of the row, excluding the end plant. The decision to clip either the north or south end of the row was made using a coin flip to ensure random selection. A representative plant was chosen from the remaining plants (excluding the end plants) to be the sample. The ten plants were bagged together and weighed green as one unit. The sample plant was kept separate and weighed green. It was then taken to a drying room for a period of two weeks, and then reweighed to establish a dry weight. The percentage of dry weight in relation to green weight was also calculated. Finally, an adjusted dry weight was computed for the ten plants bagged together. This adjusted bag weight was achieved by multiplying the original green weight for

each bag by the percentage of dry weight for the sample. Forage weights for the ten plants bagged together was calculated in a similar fashion.

On March 22, 1999, the plot was clipped a second time. This time ten plants from each row were clipped to a height of four inches using grass shears. Plants were clipped from either the north or south end of the row using a coin flip to ensure random selection. The end plant was always excluded from the clipping. The ten plants were bagged separately, and three random samples from each accession/replication combination were weighed for green weight. All clipped samples were taken to a drying room for two weeks and then weighed to obtain dry weight. Finally, stems and seed heads were removed from the samples, and a leaf or forage weight was obtained.

RESULTS AND DISCUSSION

Statistics were run using SPSS statistical program for both clippings of the seeded plot and the Spring clipping of the transplanted plot. M-Stat statistical program for the December clipping of the transplanted plot. For data from both plots, a descriptives table, an ANOVA, and Tukey's Test for Honestly Significant Difference (Tukey's HSD) using Accession as the factor were run for each dependent variable.

The Seeded Plot

December Clipping

Both percent of vegetative cover and percent of wildrye cover were recorded for each one foot by one foot sample location. Data was analyzed to look for main effect differences for the factors replication and accession, as well as any interaction effect from the combination of those two factors. No replication (block) differences were found with the exception of block four having a significantly higher percent of vegetative cover than the other three blocks. However, this difference is inconsequential because the difference was due to a higher percent of weed cover. The percent of wildrye cover was not significantly different for any of the four blocks. Additionally, no interaction effect was found for any of the dependent variables.

Accession differences were found using the results of an ANOVA for all five dependent variables. Tukey's HSD was used to pinpoint the differences. The ryegrass plots were found to have significantly less vegetative cover. It is believed that this is due to the fact that the ryegrass plots had to be tilled so that the ryegrass, an annual, could be replanted. As the wildryes were all perennials, no tilling was necessary and therefore more weed cover was present. The results of an ANOVA also found an accession difference for the percent of wildrye cover; however, this difference was not supported by Tukey's HSD. Based on the mean wildrye cover for each accession (see table 1), if there truly was a significant difference, it would be that the ryegrass plots had significantly less cover than the wildrye plots. This may be due to the fact that the ryegrass

plants were newly seeded, whereas the perennial wildrye plants were already established and only needed to regrow.

Using green weight as the dependent variable, Canada wildrye #285 was found to have significantly more green weight than the Virginia wildryes and the ryegrass. The Canada wildrye was also found to have a significantly higher dry weight than the Virginia wildryes and the ryegrass. Additionally, the two Virginia wildryes were found to have a significantly higher dry weight than the ryegrass. However, when weeds were sorted from the dry samples, and wildrye dry weight used as the dependent variable, the only significant difference was for the Canada wildrye. It showed a significantly higher wildrye dry weight than all three other accessions. It is believed that the higher clipping weights for the Canada wildrye are due to the fact that it begins to regrow earlier than the Virginia wildryes, and does not need to be reseeded like the ryegrass. Means for the December clipping of the seeded plot can be found in Table 1.

April Clipping

Percent of wildrye or ryegrass cover was estimated for each plot and green weights were obtained for three random samples from the ten samples collected for each plot. Dry weights and forage weights were obtained for all collected samples after two weeks in a drying room. Seed heads were removed from the dried samples before the forage weights were obtained. Data was analyzed to look for main effect differences for the factors block and accession. Means and a one-way ANOVA were run to determine if a significant difference existed. Tukey's HSD was used to help pinpoint specific differences where a significant difference was found. No block differences in percent of cover, green weight, dry weight, or forage weight were found.

Accession differences were found for all four dependent variables. The results of a one way ANOVA found a significant difference in percent of cover between accessions. Tukey's HSD results indicated that the 'Beefbuilder' ryegrass had significantly less cover and the #285 Canada wildrye had significantly more cover than the Virginia wildryes #763 and #845. ANOVA results also indicated a significant difference in mean green weight between accessions. Tukey's HSD found the #285 Canada wildrye to have a significantly higher mean green weight than either the 'Beefbuilder ryegrass' or the #763 Virginia wildrye.

Based on ANOVA results, a significant difference in mean dry weight between accessions also existed. Tukey's HSD found the#285 Canada wildrye to have a significantly higher mean dry weight than either the 'Beefbuilder ryegrass' or the #763 Virginia wildrye. Also, the #845 Virginia wildrye was found to have a significantly higher mean dry weight than the 'Beefbuilder ryegrass'. A significant accession difference in mean forage weight was also found using a one-way ANOVA. Tukey's HSD found the #285 Canada wildrye to have a significantly higher mean forage weight than either the 'Beefbuilder ryegrass' or the #763 Virginia wildrye. Additionally, the #845 Virginia wildrye was found to have a significantly higher mean dry weight than the 'Beefbuilder ryegrass'. Means for this April clipping of the seeded plot can be found in Table 2.

The ‘Beefbuilder’ ryegrass performed poorly this season. It was reseeded in November of 1998, and although it emerged, it put on little growth due to extremely droughty conditions (less than 2” of rain between November 1998 and April of 1999). Further, many of the smaller plants died early in the season due to moisture stress and/or insect damage. This is one of the disadvantages of planting an annual. The perennials fared much better in the droughty conditions, as well established root systems could access moisture that the small, newly seeded ryegrass plants could not. In addition, as more established, stronger plants, the new growth on the wildryes was less susceptible to insect damage then the struggling ryegrass seedlings. Consequently, the wildryes established better cover, and had better growth and seed production than the ryegrass.

The Transplanted Plot

December Clipping

Three dependent variables were analyzed for main effect differences for the factors replication and accession. Only one significant replication difference was found. Replication four was found to have a significantly higher ten plant sample (Bag) green weight than the other three replications. This replication falls at the south end of the plot, so location may play a role. No other replication differences were found.

Accession differences were found for all three dependent variables based on ANOVA findings. Tukey’s HSD was used to pinpoint specific differences between accessions. First, Canada wildrye #285 was found to have a significantly higher Bag green weight than either the wildryes or the melics. Also, Virginia wildrye #845 was found to have a significantly higher Bag green weight then either melic accession, while Virginia wildrye #763 had a significantly higher Bag green weight than Melic #904.

When looking at Bag dry weight; the only significant difference was for the Canada wildrye, which was found to have a significantly higher Bag dry weight than all other accessions. Once seed heads and stems were removed and Bag forage weight was used as the dependent variable, two significant differences were found. The Canada wildrye had a significantly higher Bag forage weight than all six other accessions. In addition, Virginia wildrye #845 was found to have significantly higher Bag forage weight than the two melic accessions. Means for the December clipping of the transplanted plot can be found in Table 3.

March Clipping

Three dependent variables were analyzed for main effect differences for the factors replication and accession. No significant differences in either green weight, dry weight, or forage weight were found between replications based on the results of a one-way ANOVA.

Significant differences in green weight between accessions were found at the .05 confidence level based on the results of a one-way ANOVA. Tukey's HSD was used to pinpoint these differences. The #904 and #905 melics had significantly lower green weight than all other accessions with the exception of wildrye #957. In addition, #957 wildrye had a significantly lower green weight than all other accessions except the melics and #971 wildrye. Finally, wildrye #971 had a significantly lower green weight than the 'Beefbuilder' ryegrass.

Significant differences in dry weight between accessions were found at the .05 confidence level based on the results of a one-way ANOVA. Again, Tukey's HSD was used to pinpoint specific differences. Tukey's broke the accessions into five homogenous subsets, each subset being significantly different from all others. Subset one contained the #904 and #905 melics, which had significantly lower dry weights than all other accessions. Subset two contained wildrye #957, which had a significantly lower dry weight than everything except the melics. Subset three contained wildrye #971, which had a significantly lower dry weight than all else except the melics and the #957 wildrye. Subset four contained the 'Beefbuilder' ryegrass and the #763 Virginia Wildrye. They had significantly higher dry weight than subsets one to four, but significantly lower dry weight than the #845 Virginia wildrye and the #285 Canada wildrye. The latter two accessions make up the fifth subset, and had significantly higher dry weight than all other accessions.

Significant differences in forage weight between accessions were found at the .05 confidence level based on the results of a one-way ANOVA. Tukey's HSD was used to pinpoint specific differences and broke the accessions into five homogenous subsets based on their mean forage weight. Subset one contained The two melics, #904 and #905, which had significantly lower mean forage weights than all other accessions. Subset two contains wildryes # 957 and #971, which had significantly higher mean forage weights than the two melics, but significantly lower mean forage weights than all other accessions, with one exception. The #971 wildrye is also included in subset three with Virginia wildrye #763, so those two accessions are not significantly different from each other where mean forage weights are concerned. Virginia wildrye #763 is also included in subset four along with the 'Beefbuilder' ryegrass and Virginia wildrye #845. These three accessions had significantly higher mean forage weights than all the accessions in subsets one, two, and three, with the exception of the #763 Virginia wildrye not being significantly different from the #971 wildrye. In addition, the Virginia wildrye #763 and the 'Beefbuilder' had significantly lower mean forage weights than the Canada wildrye #285, which makes up the fifth subset along with Virginia wildrye #845. The Canada wildrye #285 had a significantly higher mean forage weight than all other accessions except for the Virginia wildrye #845. Means for this March clipping of the transplanted plot can be found in Table 4.

There are several explanations for the above differences. First, weights may differ due to genus and species differences. This is particularly true for the melics, as they continuously have lower mean green, dry and forage weights than either the wildryes or the ryegrass. They just do not appear to be suited for

production in South Texas. Another example is the 'Beefbuilder' ryegrass. Ryegrass contains a lot more water than either the wildryes or the melics, so it always has very high green weights. However, once dried, there is a significant drop in weight. Also, as an annual, it needs to be replanted each year, which may allow the perennials to surpass it in growth. In addition, the Canada wildrye differs morphologically from the other wildryes in that it is equally bushy, but taller. Also, it tends to come on earlier in the growing season. This may help to explain why it continuously has higher green, dry, and forage weights than the other wildryes.

Second, among the wildryes of the same species, we have noticed a distinct relationship between the original location of collection and when each accession begins to put on growth. Basically, the further south the collection site, the earlier the growth begins. For instance, the Virginia wildrye #845 is from San Marcos, and it begins growing earlier than the Virginia wildrye #763 which came from Madisonville. These come on earlier than the two East Texas accessions, #971 and #957, which come from Anderson county Texas and Payne County, Oklahoma respectively. Additionally, the #971 begins growing earlier than the #957, offering further support for this hypothesis.

Finally, our field observations show that Canada wildrye #285 tends to regrow earlier than the other wildryes being evaluated. This "headstart" on the growth cycle is probably why Canada wildrye #285 outperformed the other accessions as far as green, dry, and forage weights. This "headstart" has other advantages as well. Because of its tendency to begin to regrow early in the season, this Canada wildrye can provide a good source of forage at a time when the warm season grasses have quit growing, and the other cool season grasses have not yet begun to regrow. This can make it a valuable addition to a cool season forage planting. By using Canada wildrye and the Virginia wildrye together in a cool season planting mix, a farmer or rancher can stretch the grazing season a little by providing early cool season forage with the Canada, and by providing the Virginia as an alternative source of forage once the Canada has gone to seed.

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Table 1.

Table of Means for the Seeded Plot – December Data

Rep #	Total Cover (%/ft^2)	Wildrye Cover (%/ft^2)	Green Weight (gms/ft^2)	Dry Weight (gms/ft^2)	Wildrye Dry (gms/ft^2)
1	33.0000^{2}	20.8750^{1}	40.6000^{1}	19.9625^{1}	11.3697^{1}
2	29.0000^{2}	15.6250^{1}	36.5000^{1}	17.8500^{1}	16.5295^{1}
3	30.8750^{2}	23.1750^{1}	52.0000^{1}	20.5500^{1}	21.0264^{1}
4	39.2000^{1}	20.4000^{1}	51.5000^{1}	23.2375^{1}	25.2119^{1}
ACC#					
285	34.5000^{a}	22.6500^{a}	74.2000^{a}	34.9875^{a}	27.1500^{a}
763	34.5000^{a}	18.2500^{a}	43.1750^{b}	19.4375^{b}	8.3000^{b}
845	38.2500^{a}	23.2500^{a}	44.1250^{b}	21.4000^{b}	9.4750^{b}
BB	24.8250^{b}	15.9250^{ab}	18.8500^{b}	5.7750^{c}	4.9500^{b}

*Means in columns followed by the same superscript are not significantly different at the 5% probability level.

Table 2.

Table of Means for the Seeded Plot – April Data

Rep #	Green Weight (gms/ft^2)	Dry Weight (gms/ft^2)	Forage Weight (gms/ft^2)	Cover (%)
1	47.5833^{a}	18.4750^{a}	14.1875^{a}	60.00^{a}
2	61.4167^{a}	24.0000^{a}	20.0000^{a}	56.25^{a}
3	75.5000^{a}	34.1250^{a}	28.0750^{a}	58.75^{a}
4	77.2500^{a}	26.4375^{a}	21.4500^{a}	57.50^{a}
ACC				
285	115.4167^{2}	44.5750^{3}	36.3375^{3}	85.00^{3}
763	45.0000^{1}	22.4875^{1,2}	17.8250^{1,2}	55.00^{2}
845	77.0833^{1,2}	29.7000^{2,3}	24.0250^{2,3}	58.75^{2}
BB	24.2500^{1}	6.2750^{1}	5.5250^{1}	31.25^{1}

*Means in columns followed by the same superscript are not significantly different at the 5% probability level.

Table 3.

Table Of Means for the Transplanted Plot – December Data

Rep #	Green Weight Bag (lbs)	Total Dry Weight Bag (lbs)	Forage Weight Bag (lbs)
1	1.2570[2]	0.6410[1]	0.3630[1]
2	1.2000[2]	0.6340[1]	0.4160[1]
3	1.3140[2]	0.6770[1]	0.3940[1]
4	1.7430[1]	0.8740[1]	0.5240[1]
ACC			
285	3.3500[a]	1.5050[a]	0.8620[a]
763	1.4500[bc]	0.7270[b]	0.4570[bc]
845	1.6000[b]	0.7550[b]	0.5550[b]
904	0.6000[d]	0.4100[b]	0.1900[c]
905	0.7000[cd]	0.5000[b]	0.2450[c]
957	0.9000[bcd]	0.4850[b]	0.3100[bc]
971	1.0500[bcd]	0.5650[b]	0.3500[bc]

*Means in columns followed by the same superscript are not significantly different at the 5% probability level.

Table 3.

Table Of Means for the Transplanted Plot – March Data

Rep #	Green Weight (gms)	Dry Weight (gms)	Forage Weight (gms)
1	61.5417[a]	26.6563[a]	18.9938[a]
2	70.3333[a]	26.6125[a]	19.7625[a]
3	73.2292[a]	29.5688[a]	21.8063[a]
4	66.9844[a]	28.3313[a]	22.4125[a]
ACC			
285	114.6667[3,4]	54.8250[5]	39.8000[5]
763	86.5000[3,4]	39.9250[4]	26.4750[3,4]
845	101.916[3,4]	50.1750[5]	32.0500[4,5]
904	1.0417[1]	1.0563[1]	1.0438[1]
905	2.5833[1]	1.7813[1]	1.1738[1]
957	36.5000[1,2]	13.8625[2]	12.9125[2]
971	71.4167[2,3]	23.5875[3]	20.8215[2,3]
BB	129.2500[4]	37.1250[4]	30.9750[4]

*Means in columns followed by the same superscript are not significantly different at the 5% probability level.