Reed Canarygrass Yield Improvement

Purpose: The purpose of this publication is to describe the potential of reed canarygrass (*Phalaris arundinacea* L.) for biomass yield improvement.

Biomass Potential

Reed canarygrass has good potential as a biomass species, as it is suited to the northern half of the USA and southern Canada. This grass can produce relatively high yields with infrequent harvesting, resulting in good bioenergy feedstock potential. There has been relatively little effort in the USA to breed for increased yield in reed canarygrass, most of the breeding efforts have focused on development of low alkaloid cultivars for forage use.

Figure 1. Reed canarygrass at spring harvest.

Reed canarygrass is a tall, vigorous, coarse, sod-forming cool-season perennial. It is found in a wide range of habitats, well adapted to both dry and excessive soil moisture conditions, and tolerates a soil pH range of 4.9 to 8.2. Roots of reed canarygrass have been observed to penetrate soil to a depth in excess of six feet. Reed canarygrass can be grown on most soil types, from highly productive soils to marginal soils. Very few cultivars have been released in North America, with selection almost exclusively for alkaloids. All available cultivars are currently low alkaloid types.

Germplasm Collection

In 2004, reed canarygrass accessions were collected over a wide range of habitats in and near Iowa, Wisconsin and New York. Collection sites were selected by visual observation from roadways, and were primarily rural sites. These were all sites that were not intentionally planted to reed canarygrass, and were not specifically cultivated for pasture, hay, or other purposes. Seeds were dried, threshed, and cleaned, and 15 accessions were discarded due to insufficient viable seed.

Study Details

Seventy-two accessions collected from a wide range of natural habitats from Iowa to New Hampshire were evaluated with 8 cultivars for biomass yield. Collected seed was sown in 2005 at one site in Iowa and two sites each in Wisconsin and New York. Plots were fertilized with 75 lbs N fertilizer, and P and K were maintained according to soil test recommendations. Forage yield (two harvests/season) was determined for two years after stands were established. First harvest was shortly after flowering, and the second harvest was taken in the fall after a killing frost.

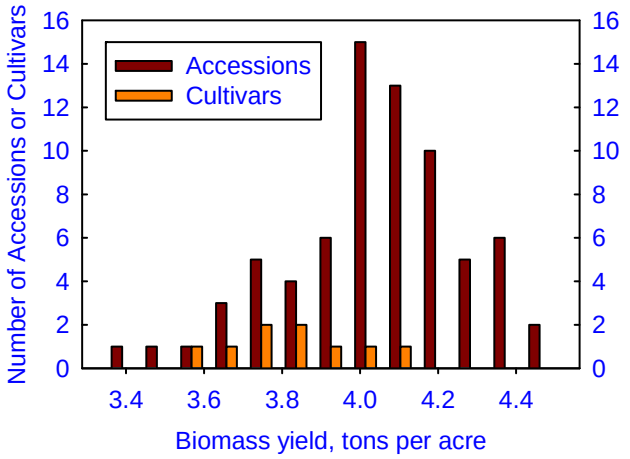

Figure 2. Histogram of mean biomass yield, average of 5 locations and two years. (adapted from Casler et al., 2009).

Biomass Yields

Accessions and cultivars were highly variable in mean biomass yield, with a broad-sense heritability of 0.67. Genotype x environment interactions were minor, indicating a broad adaptation of reed canarygrass across the northern USA. Accessions produced on average about 7% higher biomass yield than the cultivars (Fig. 2). Cultivars ranked from 50th to 77th in biomass yield out of the 80 total entries.

Geographic variation was the largest source of variation among accessions. Accessions from more southern and western sources within this region had the highest biomass yield. Genetic expression for yield was consistent across locations and years. The high biomass yield of some accessions, coupled with a large amount of genetic variability, offer potential for both short-term and long-term breeding gains. These results were similar to past studies with accessions collected in Europe and Canada.

Are Accessions High Alkaloid?

Samples were not analyzed for alkaloids, but visual evidence leads us to believe that most of the naturalized populations probably contain high alkaloids.

Figure 3. Naturalized population plot (left) next to a severely grazed low-alkaloid cultivar plot.

During harvest in the fall of 2007 in Ithaca, it was observed that the study was home to numerous meadow voles. It was also observed that regrowth in some plots was severely damaged. Closer inspection revealed that the damage was caused by meadow vole grazing, and visible damage stopped precisely at the plot border (Fig. 3). Damaged plots were identified and recorded. Plots located on the perimeter of the study were less likely to be damaged.

Meadow voles were clearly selecting low-alkaloid reed canarygrass for grazing, similar to what army worms will do if given a choice between low and high alkaloid types. All cultivars had multiple plots with significant visible damage except Vantage. Vantage is not particularly low in alkaloid concentration, compared to “low-alkaloid” cultivars. Sixteen of the 20 plots with visible damage were low-alkaloid cultivar plots. Only 4 out of 216 non-cultivar plots showed any visible damage.

Summary

Reed canarygrass is well adapted to the northern USA. Eight cultivars and 72 accessions collected in rural landscapes from Iowa to New Hampshire were evaluated for yield. Accessions produced on average 7% higher biomass yield compared to existing cultivars. Naturalized populations of reed canarygrass have the potential for increasing biomass yields, but are likely to be high alkaloid types not suited for ruminant forage.

Additional Resources

Casler, M.D., J.H. Cherney, and E.C. Brummer. 2009. Biomass yield of naturalized populations and cultivars of reed canarygrass. Bioenerg. Res. 2:165-173.

Cherney, J.H. and D.J.R. Cherney. 2011. Reed Canarygrass. Grass Information Sheet Series #6. www.forages.org/grass.

Cherney, J.H., M. Davis, and D.J.R. Cherney. 2011. Reed Canarygrass Seeding Rate Studies. Grass Information Sheet Series #12. www.forages.org/grass.

For more information

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