WIRESTEM MUHLY GROWTH AND DEVELOPMENT IN CORN, SOYBEANS OR ALONE

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Wirestem muhly (*Muhlenbergia frondosa*) is a warm season perennial grass that is native to North America. This weed not only produces a dense rhizome system but is also a prolific seed producer (3,600 to 125,000 seeds per plant) which enhances it's reproductive potential. Wirestem muhly populations have been increasing and spreading in Wisconsin over the past few years. Because there is little published information on the growth and seedling survival of wirestem muhly, we have done research to quantify the growth of wirestem muhly alone and with corn and soybeans.

Methodology

Research trials were conducted at the Arlington and Lancaster Agricultural Research Stations in 1998 and 1999. A split plot design with two replications was used; the main plot was the environment (corn, soybeans, and crop free), and the sub-plot was wirestem muhly source (plants originating from seed or rhizomes). In 1998 the crops were planted in early to mid May and in 1999 mid to late May. Wirestem muhly seeds were planted in the greenhouse at the time of corn planting. Each year wirestem muhly from seed and rhizomes was transplanted into the field in the first week of June. The rhizome transplants ("plugs") were dug from an area adjacent to the plots that was managed is a similar fashion as the plot area. The plugs consisted of 3 to 6 stems and about 54 in^3 (6 x 3 x 3 inches) of soil and rhizomes. The corn was planted in 30-inch rows, the soybeans were drilled in 7.5-inch rows, and thirty wirestem muhly seedlings or rhizome plugs were transplanted into each sub-plot with 30 inches between plants. Every two weeks during the growing season and once in September and October wirestem muhly plants were destructively harvested, stem length and rhizome depth and width measured, and stems counted. Foliage and rhizomes were dried to determine biomass accumulation. After digging, the rhizomes were washed, measured and frozen with dry ice to stop biological activity. These rhizome samples were then freeze dried in preparation for total nonstructural carbohydrate (TNC) analysis in the laboratory. Data were analyzed using mean separations to find differences between treatments at each sampling time and location. In the figures, columns for each location and harvest date with the same letters are not significantly different (p= 0.10).

Results

To reduce the quantity of data to a manageable size in this paper, only results from 56 and 110 days after wirestem muhly planting (DAP) are presented. These dates correspond to late July and mid September and show some important differences. Due to interactions, data could not be combined over years or locations. Stem number (Figures 1 and 2) was greatly affected by competition. Surprisingly, wirestem muhly from seed

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formed as many or more stems than plants from rhizomes in the no-crop area. In contrast, wirestem muhly originating from rhizomes had the most stems in the cropped areas at both 56 and 110 DAP. Stem numbers per plant increased over time, especially when growing without competition; the maximum number was 140 stems per plant at Arlington in 1999. Stem height (data not shown) was the shortest for wirestem muhly growing without crop competition. This was expected because plants growing under shade are usually taller. Rhizomes produced (Figures 3 and 4) by wirestem muhly were deeper on plants originating from rhizomes than on those started from seed in their respective environments. Rhizome depth generally increases from 56 to 110 DAP; with the deepest rhizomes 5 to 6 inches below the soil surface. Total plant dry weight (Figures 5 and 6) was greatest in the crop-free plots, as expected. Wirestem muhly originating from seed grew as well as from rhizomes without crop competition. With crop competition, wirestem muhly plants originating from rhizomes were larger than those from seed. Maximum plant weight was recorded 144 DAP. Stem biomass reach a maximum at 110 DAP while rhizome biomass continued to increase until the first frost. Soybeans reduced wirestem muhly biomass more than corn (78 to 97% compared to plants grown without competition). The concentration of rhizome total nonstructural carbohydrates (TNC) (Figure 7) was not affected by crop competition. Rather TNC steadily increased from a low point early in the season until the first frost in October in all three environments.

Discussion

Competition from corn and soybeans significantly reduced wirestem muhly stem numbers and plant biomass. Soybeans reduced stem numbers 82 to 99% and corn reduced them 71 to 96% compared to the crop-free treatment. Wirestem muhly biomass was reduced 78 to 97% in soybeans and 72 to 95% in corn compared to the crop-free treatment. Stem numbers and biomass in the crop-free area started rapidly increasing around 56 DAP. By about 70 DAP, biomass of wirestem muhly originating from seed equaled or exceeded that of plants orginating from rhizomes in the crop free treatment. Crop competition had little effect on rhizome TNC; the lowest TNC was early in the growing season and began to increase by 56 DAP.

Postemergence herbicide applications and cultivations are usually done in early to mid June and this seems to be the optimal time to control wirestem muhly for the following reasons: 1) carbohydrate levels in rhizomes are low so plants have fewer resources for regeneration, 2) wirestem muhly plants are at the appropriate height for herbicide application, and 3) the crop canopy will usually close shortly after the weed control practice to aide in weed suppression. Even though crop competition dramatically affected wirestem muhly plants originating from seeds, these plants survived in both corn and narrow-row soybeans and produced seed and rhizomes. Thus management programs must focus on both wirestem muhly plants that arise from both rhizomes and seed.

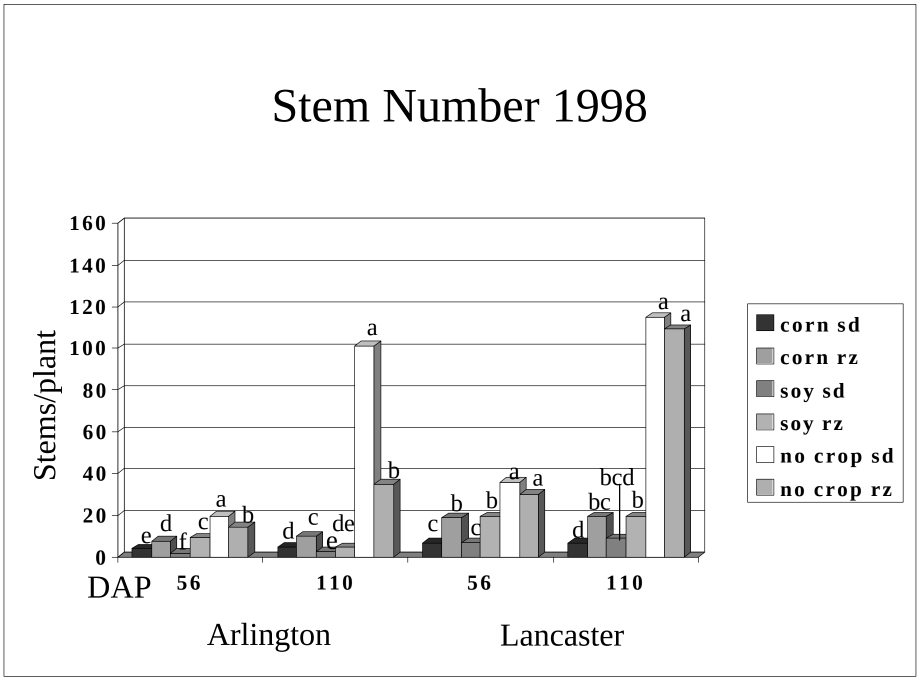

Figure 1. Wirestem muhly stem production 56 and 110 DAP at Arlington and Lancaster from plants started from seed and rhizomes in three environments in 1998.

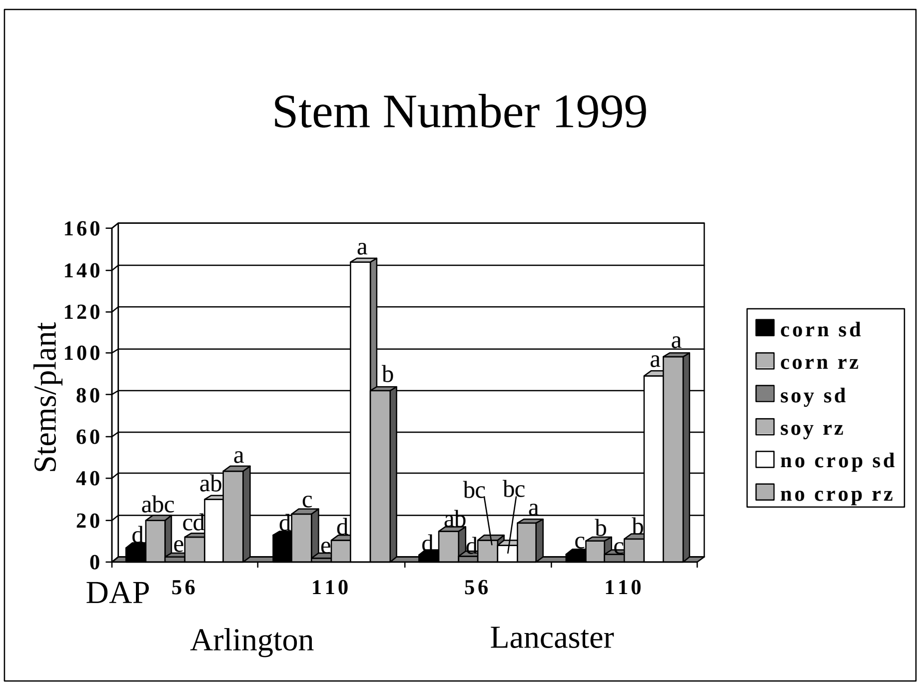

Figure 2. Wirestem muhly stem production 56 and 110 DAP at Arlington and Lancaster from plants started from seed and rhizomes in three environments in 1999.

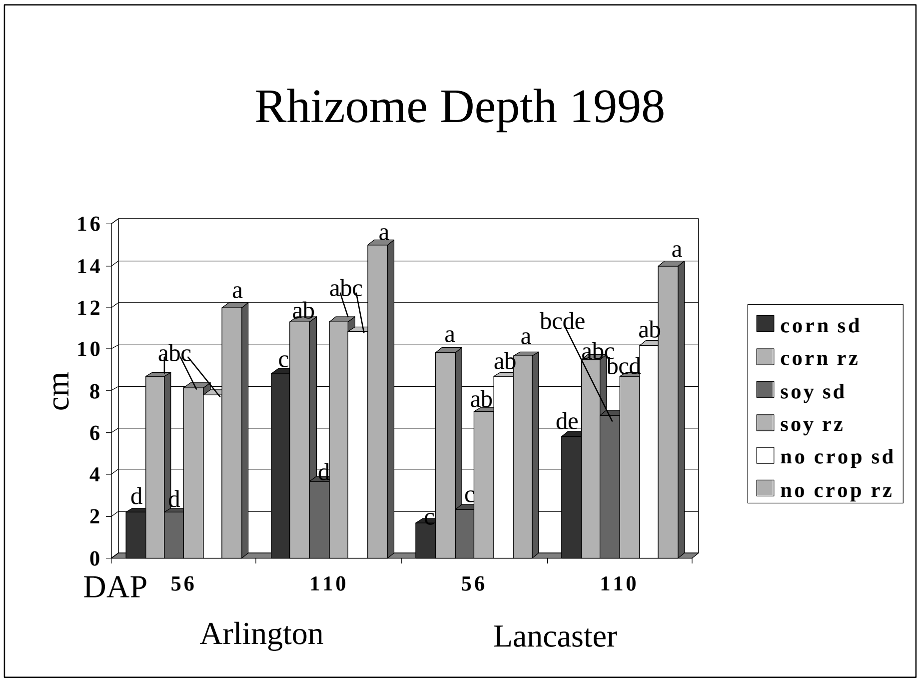

Figure 3. Wirestem muhly rhizome depth 56 and 110 DAP at Arlington and Lancaster from plants started from seed and rhizomes in three environments in 1998.

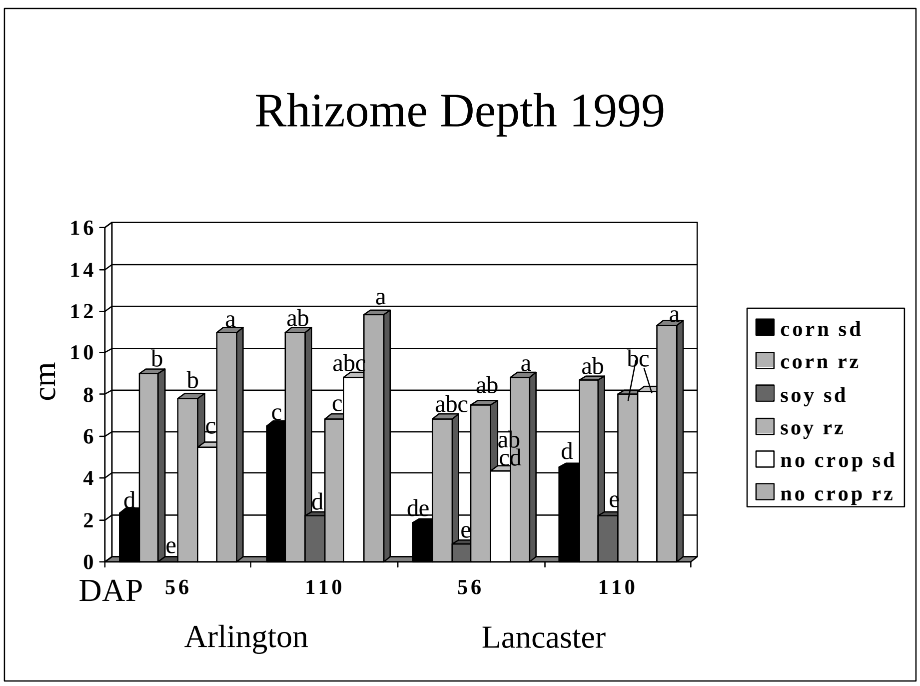

Figure 4. Wirestem muhly rhizome depth 56 and 110 DAP at Arlington and Lancaster from plants started from seed and rhizomes in three environments in 1999.

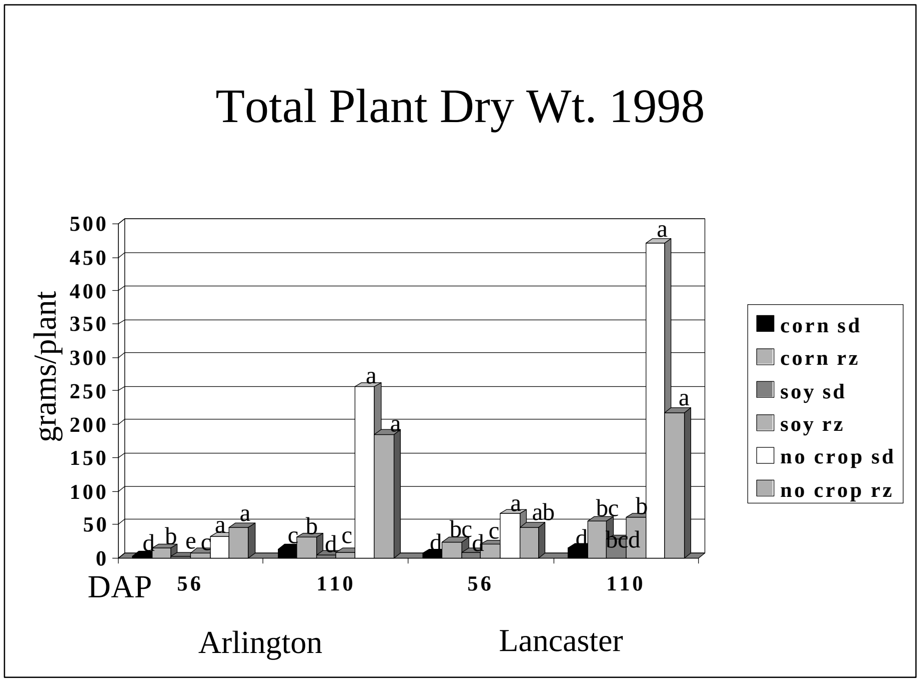

Figure 5. Wirestem muhly biomass production 56 and 110 DAP at Arlington and Lancaster from plants started from seed and rhizomes in three environments in 1998.

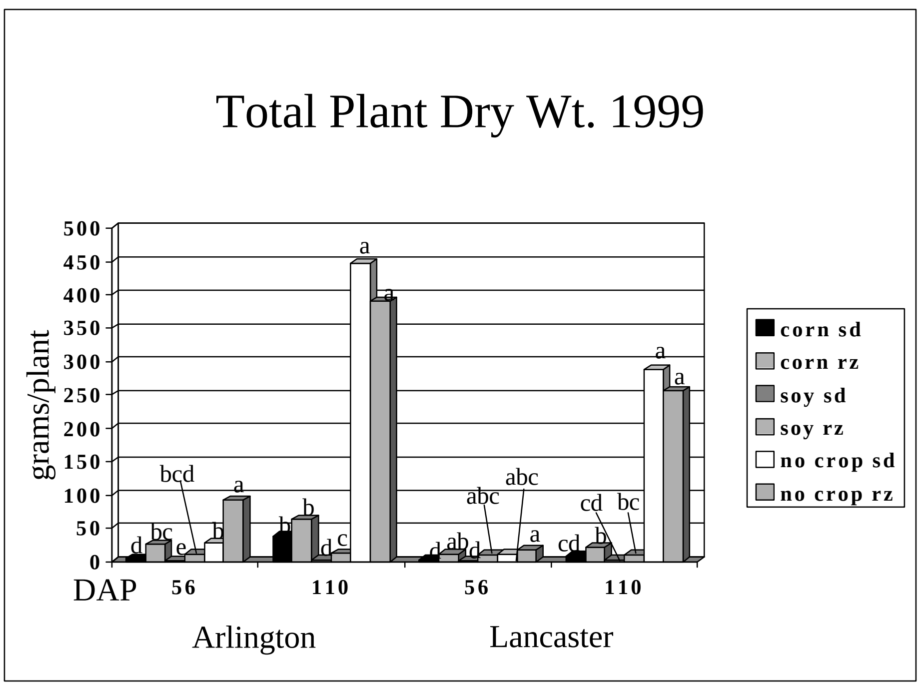

Figure 6. Wirestem muhly biomass production 56 and 110 DAP at Arlington and Lancaster from plants started from seed and rhizomes in three environments in 1999.

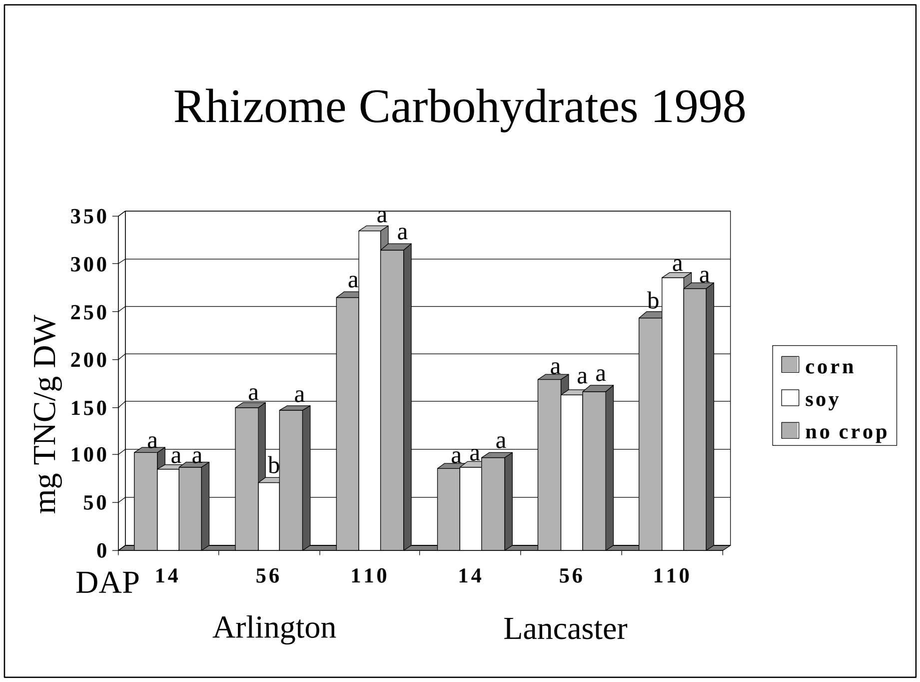

Figure 7. Wirestem muhly rhizome carbohydrates 14, 56, and 110 DAP at Arlington and Lancaster from plants started from rhizomes in three environments in 1998.