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ESTABLISHING BUNDLEFLOWERS IN BERMUDA AND SWITCHGRASS

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Summary and Application

Native bundleflowers interseeded into existing grass pastures may contribute to restoring the original forb/grass mixtures of Texas. 'Sabine' Illinois bundleflower [*Desmanthus illinoensis* (Michx.) MacM.], velvet bundleflower (*D. velutinus* Scheele; see Fig.1) and two accessions of rayado bundleflower [*D. bicornutus* (S.) Watson] were seeded into bermudagrass [*Cynodon dactylon* (L.) Pers.] and switchgrass (*Panicum virgatum* L.) stands in rows with no seedbed preparation (control), a 18 in. wide tilled seedbed, and 6, 12 or 18 in. wide bands defoliated with Roundup. The switchgrass trial was conducted during two years in north-central Texas, while the bermudagrass trial included both the Texas and a Louisiana site during 2 years. Seedling emergence was generally lower in bermudagrass and differed by year and site, a reflection of precipitation differences. Establishment was more consistent in the tilled strips. Although the rayado bundleflowers had greater initial establishment, Illinois bundleflower was more winter-hardy in both Texas trials during growing seasons with adequate precipitation. Illinois bundleflower appears to have promise for northern Texas but only in open bunchgrass stands.

Introduction

Native herbaceous legumes were likely much more common in prairies and woodlands of Texas before cattle were introduced and widespread land clearing changed native vegetation. These atmospheric nitrogen-fixing forbs may have contributed seed and forage to the native wildlife as well as nitrogen to the soils. Today, the re-introduction of native legumes back into Texas range or abandoned pastures where they have been greatly reduced by indiscriminate clearing, herbicide application and over-grazing by cattle, sheep and goats, will likely take a conscious effort on the part of landowners.

Bundleflowers (in the genus *Desmanthus*) are a widely adapted native herbaceous forb group in Texas (2). Illinois bundleflower is widely distributed in Texas and cultivar 'Sabine' (1) was released to provide a perennial native legume for range and pasture plantings. Rayado bundleflower is widely distributed in the American tropics and subtropics into the southern portions of the United States and accessions have recently been selected for south and central Texas (3, 5). Velvet bundleflower is found throughout northern Texas and has been recognized as useful for domesticated browsers or deer and as a seed source used for quail and other birds (4).

In this study, different methods for establishing Illinois, rayado, and velvet bundleflower into bermudagrass and

switchgrass were assessed at Stephenville, TX and into bermudagrass at Rosepine, LA.

Fig. 1. *Desmanthus velutinus* (velvet bundleflower).

Methods and Materials

Establishment of Illinois bundleflower cv. Sabine, velvet bundleflower accession PMT-2406), and two lines of rayado bundleflower ('BeeTAM-06' and 'BeeTAM-57') was assessed in bermudagrass stands at Stephenville, TX and Rosepine, LA and in 'Alamo' switchgrass at Stephenville in 1998 and 1999. Seedbed preparation treatments included strip tillage with an 18 in. wide strip rototilled to an 8 in. depth, Roundup (glyphosate at 8.5 quarts active ingredient $acre^{-1}$) in strips 6 in., 12 in., and 18 in. wide, and an undisturbed control. Each year in a new but adjacent site, the 4 entries were hand-planted ¼ in. deep into single-row plots 16 ft. long with rows spaced 5 ft. apart. At each site each year, a randomized-complete-block-design with factorial arrangement of treatments was used with 4 replications.

At the Stephenville site, both the bermudagrass and switchgrass stands were on Windthorst fine sandy loams (pH 5.8, 14 ppm P, 236 ppm K, 993 ppm Ca, and 250 ppm Mg for bermudagrass; pH 5.8, 7 ppm P, 256 ppm K, 1840 ppm Ca, and 531 ppm Mg for switchgrass). The Rosepine site is in the Coastal Plain of west Louisiana with a Bowie fine sandy loam (pH 5.2, 8 ppm P, 54 ppm K, 1824 ppm Ca, and 65 ppm Mg).

At Stephenville, the bermudagrass variety was 'Coastal', and common bermudagrass was used at Rosepine. Preliminary germination tests of the legumes were used to adjust seeding rates to a live-seed basis. Seeding rates of all four entries were calculated to provide 40 live seed (not including non-viable and hard seed) per row. Seed were mechanically scarified and inoculated with bundleflower-specific *Rhizobium* inoculant immediately before planting. Planting was from late May to early June at Stephenville where seedbeds were irrigated with 3 in. of water prior to planting in April 1998 to enhance grass regrowth and herbicide effectiveness. Due to extremely dry soils and lack of effective precipitation from early April through June 1998, planting was delayed until the first week of July in 1998 at Rosepine. The 1999 planting at Rosepine was made in early June.

Plants were counted in August of the year of seeding for all trials and June the year following planting (showing winter survival) in the bermudagrass trial only. Analysis of variance on data from the bermudagrass swards was conducted using a model including location (bermudagrass only), year, plant entry, seedbed preparation, and multi-factorial interactions. Due to interactions involving location and years, data from the two sites were subsequently analyzed separately for each year. A year by plant entry and seedbed preparation interaction was also measured for the

switchgrass trial at Stephenville so all results are presented by year. Significant (P=0.05) differences among treatments were separated with least significant difference (LSD) procedure. Analysis of data from the switchgrass sward was similar to that of the bermudagrass stands except location was not included in the model.

Results and Discussion

Bermudagrass study

Moisture limitations at Rosepine were severe during the 1998 establishment period, despite slightly greater total rainfall (March-October 33 in.) than at Stephenville (March-October 25 in.) the same year. In 1999, inadequate rainfall was particularly detrimental at Stephenville (March-October 11 in. compared to 39 in. at Rosepine). These rainfall patterns were associated with location by year interactions with the seedbed preparation and entry treatments; thus, responses of the bundleflower plantings in bermudagrass sod were analyzed separately for each location and year.

Rosepine

At Rosepine in 1998, frequent observation of the planting revealed a few emerged seedlings during the initial month; however, these seedlings failed to survive longer than two or three days. During subsequent periodic observation dates through the 1998 growing season and the following year, no bundleflower plants were found in this field.

Spring and early summer rainfall at Rosepine was much more favorable in 1999 than in 1998 but there was no interaction between entries and seedbed treatments. August seedling numbers (Fig. 2) were greatest for the two rayado entries but by June the following year, only the Illinois bundleflower had any significant survival. Velvet bundleflower did not establish at all. Differences among seedbed treatments at Rosepine in 1999 were evident in August, with greater numbers in the tilled seedbed (Fig. 3).

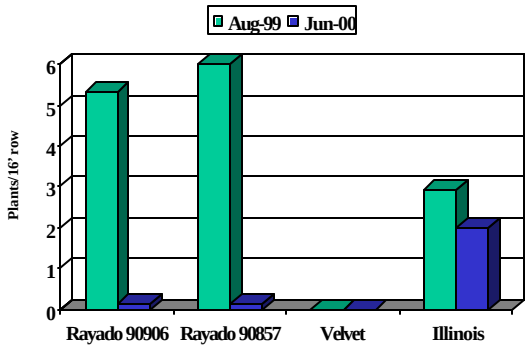

Fig. 2. Seedling numbers of bundleflowers sown in 1999 at Rosepine, LA averaged over five bermudagrass suppression treatments (August 99 P<0.01 and $LSD_{0.05}$=2.2; June 00 P=0.13).

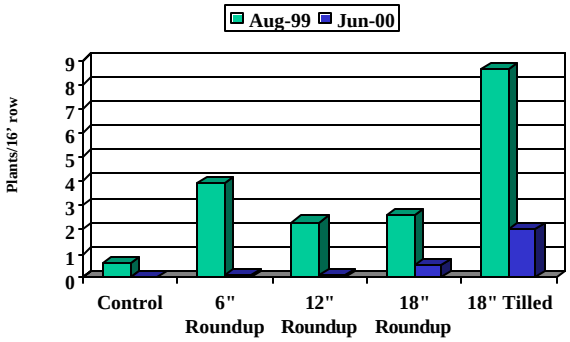

Fig. 3. Average seedling numbers of four bundleflowers sown in 1999 at Rosepine, LA with different bermudagrass suppression (August 99 P<0.01 and $LSD_{0.05}$=2.5; June 00 P=0.30).

Stephenville

The Stephenville 1998 planting resulted in substantial seedling numbers for all four entries at the August 1998 assessment date (Fig. 4).

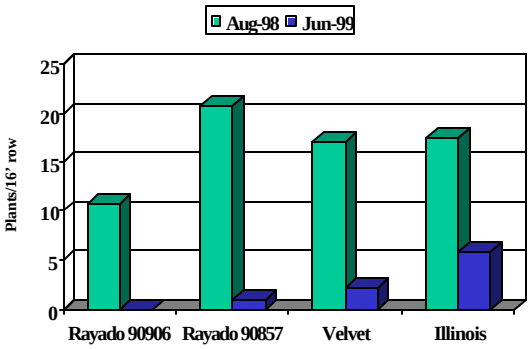

Fig. 4. Seedling numbers of bundleflowers sown in 1998 at Stephenville, TX averaged over five bermudagrass suppression treatments (August 98 *P*<0.01 and $LSD_{0.05}$=4.0; June 99 *P*<0.01 and $LSD_{0.05}$=1.2).

By June the following year, numbers were reduced with Illinois bundleflower again more persistent than the other species. More seedlings emerged in the tilled and 18 in. Roundup seedbed at Stephenville in 1998 compared to other treatments (Fig. 5). This advantage only persisted over the control and 6 in. wide Roundup treatment following winter. Bermudagrass recovered more quickly and invaded the tilled strips more rapidly than it did in the 12 in. and 18 in. sprayed strips.

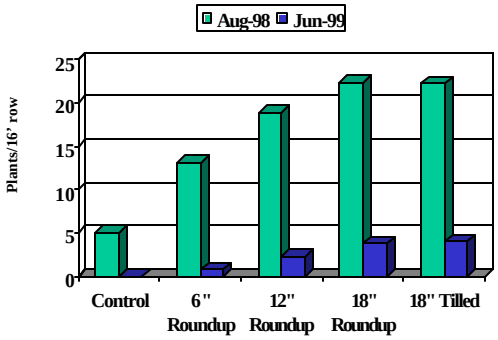

Fig. 5. Average seedling numbers of four bundleflowers sown in 1998 at Stephenville, TX with different bermudagrass suppression (August 98 *P*<0.01 and $LSD_{0.05}$=4.5; June 00 *P*<0.01 and $LSD_{0.05}$=1.4).

Bundleflower emergence in the Coastal bermudagrass at Stephenville was substantially less in 1999 than in 1998 (data not shown). Illinois bundleflower had the greatest emergence, although seedlings of all entries died by August 1999. Initial emergence in the tilled treatment was greater than that in the 6 in. and 12 in. sprayed treatments and the control, but these differences did not last into 2000.

Switchgrass study-Stephenville

In the switchgrass sward at Stephenville, year by treatment interactions were apparent for bundleflower establishment. By August of both years, fewer plants of rayado bundleflower BeeTAM-06 survived than of the others and Illinois bundleflower had as great or greater seedling numbers than the other bundleflowers (Fig. 6). In 1999, bundleflower seedling emergence in the switchgrass sward was much less than in 1998. In 1998, seedling numbers were high in all seedbed preparation treatments and were undifferentiated both years (Fig. 7).

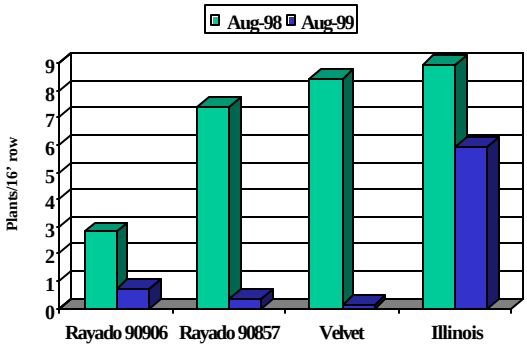

Fig. 6. August seedling numbers of bundleflowers sown in 1998 (August 98 *P*<0.01 and $LSD_{0.05}$=2.3) and 1999 (August 99 *P*<0.01 and $LSD_{0.05}$=2.7) at Stephenville, TX averaged over five switchgrass suppression treatments.

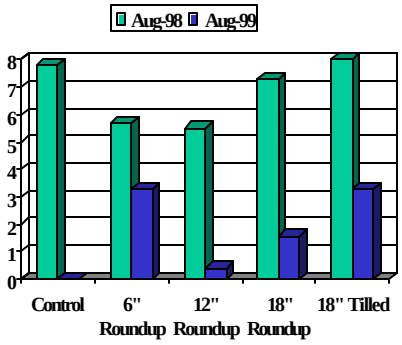

Fig. 7. August seedling numbers of bundleflowers sown in 1998 (August 98 *P*>0.10) and 1999 (August 99 *P*>0.10) at Stephenville, TX in switchgrass stands averaged over four bundleflower species.

Conclusions

Several conclusions appear to be obvious from these trials. The first is that successful establishment depends very heavily on rainfall, both season totals and distribution. In a poor rainfall year, all combinations of seedbed preparation and species selection produced the same result: establishment failure.

The second conclusion is that bundleflowers appear to be more compatible with switchgrass than with bermudagrass. The latter is an aggressive, sod-forming grass that quickly invades any prepared seedbed, indicating that bundleflowers are competitive only in bunchgrass stands.

The third conclusion is that the Illinois bundleflower cultivar used in this study (Sabine) was consistently more persistent following winter dormancy than any other entry. This may mean that either the species or the ecotypes included in this study were not as well adapted to the study sites as Sabine or that the rhizobia utilized was not a good match or both.

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