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E. "Kika" de la Garza PMC
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Range Restoration with Low Seral Plants

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ABSTRACT

In 2001, the USDA-Natural Resources Conservation Service E. "Kika" de la Garza Plant Materials Center (PMC), in conjunction with the South Texas Natives Project of the Caesar Kleberg Wildlife Research Institute at Texas A&M University–Kingsville, began to collect, evaluate, select and release, to the commercial seed trade, local ecotypes of low seral plants for range seeding mixes in south Texas. This report discusses multiple PMC and university studies using low seral plants in range seedings in south Texas. Establishment of native species in seven separate plantings in south Texas were evaluated for percentage of cover provided by low and late successional species 2.5 to 4 years after the first year of establishment. Percentage of native

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cover ranged from 40-95% depending on species and years after establishment. Low seral plants such as slender grama (*Bouteloua repens*) and shortspike windmillgrass (*Chloris subdolichostachya*) provided most of the coverage in early years of the studies. Results of these studies support the benefits of incorporating low seral plants in range mixes in south Texas for providing native cover until late successional species become more dominate on the site. Long-term evaluation of planted sites will examine the effectiveness of these mixes to compete with exotic grasses in south Texas.

INTRODUCTION

In 1992, the availability of native seed adapted to south Texas conditions was limited to one commercially available late successional species, switchgrass (*Panicum virgatum* L.). At that time, the recommended switchgrass cultivar for conservation plantings in south Texas was 'Alamo'. 'Alamo' is a direct increase of seed collected near George West, Texas (Alderson and Sharp, 1994). Jason Holht, NRCS range conservationist, summed it up best in his management note of June 2010, "In the past, many acres of the Conservation Reserve Program (CRP) have been seeded with native plants that were developed in northern parts of the state. When these cultivars were used in south Texas plantings, results were spotty at best. Even when a stand was obtained initially, these grasses did not persist more than a couple years." Not only were the seed mixes of 1992 environmentally maladapted, they also had to compete against introduced exotic species such as buffelgrass (*Pennisetum ciliare*) and old-world bluestems (*Bothriochloa* spp.). It was generally felt at the time that a native seeding of switchgrass, sideoats grama (*Bouteloua curtipendula*) and green sprangletop (*Leptochloa dubia*) had a 10% chance of success. So, the question was what species should the PMC focus their efforts on for releasing to the commercial seed trade in Texas for conservation plantings in south Texas?

A review of the literature, as documented by the following papers, indicated that a range restoration strategy that employed numerous species covering a range of seral stages might be advisable. Tilman (1997) states that in a four-year experiment where up to 54 different species were seeded in patches of native grassland, that the proportion of added species that became established was negatively correlated with initial species richness of plots, suggesting that species-rich sites were more resistant to invasion. Shahid Naeem et al. (2000) reported that higher resident diversity increased crowding, decreased available light and decreased available nutrients all of which increased the competitive environment of diverse plant assemblage. And Fargione et al. (2003) found that established species most strongly inhibited introduced species from their own functional guild. Introduced species attained lower abundances when functionally similar species were abundant and when established species left lower levels of resources unconsumed, which occurred at lower species richness.

Prior to 2001, the Texas Plant Materials Program focused its release efforts on late successional or climax grass species. The above published studies along with previous seeding failures led the PMC to adopt a more diverse plant release strategy for south Texas. We focused our efforts on releasing plants that were considered mid to early successional species. Early successional plants, or low seral plants, are defined as plants that quickly occupy highly disturbed sites. These plants have a small stature, rapid growth rate, low root to shoot ratio, and low shade tolerance.

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The seeds of these plants tend to be small and numerous and wind-blown for dispersal. In south Texas, the windmill grasses (*Chloris* spp.) and slender grama have these characteristics.

This report discusses multiple PMC and university studies using low seral plants in range seedings in south Texas

MATERIALS AND METHODS

A range seeding experiment was initiated at Rancho Blanco, Texas in 2006 to evaluate seeding rates (10, 20 and 30 pure live seed (PLS)/ft ^{2}) and planting dates (spring, late summer and late fall). The design was a randomized complete block with 4 replications. Plot size was 10-ft x 10-ft. The site was tilled 2 weeks prior, then sprayed with glyphosate 5 days prior to broadcast seeding which was followed by cultipacking. Plots were irrigated for one month following seeding. Species survival and cover was taken every 3 months following seeding with 40 random ft^2 samples taken with a Daubenmire frame. Survival/persistence was documented by permanently marking 10 random plants in each plot at the 6 month sampling date.

Total seeded cover, as well as the cover of one late successional species and one early successional species was evaluated on six different ranches in south Texas from 2010 -2014. Total percentage of plant coverage of the seeded species was determined with a Daubenmire frame 3 months after seeding. There were 25 random ft^2 samples taken per treatment. Cover was taken in the spring and the fall. in 2010–2014.

RESULTS AND DISCUSSION

Rancho Blanco Experimental Site

Two years after seeding at the Rancho Blanco site, there were no significant differences in seeded plant coverage for seeding rates (10, 20 and 30 PLS ft^2) or planting dates (April, August and October). However, species survival and coverage were a significant factor. Dilley Germplasm slender grama and Welder Germplasm shortspike windmillgrass had significantly higher cover than any other seeded species with percent covers of 34 and 31%, respectively. The other ten species were Mariah Germplasm hooded windmillgrass (*Chloris cucullata*), Catarina Germplasm bristlegrass (*Setaria spp.*), La Salle Germplasm Arizona cottontop (*Digitaria californica*), Atascosa Germplasm Texas grama (*Bouteloua rigidiseta*), Chaparral Germplasm hairy grama (B*outeloua hirsuta*), Kinney Germplasm false rhodesgrass (*Trichloris crinita*), Falfurrias Germplasm big sacaton (*Sporobolus wrightii*), multiflower false rhodesgrass (*Trichloris pluriflora*), pink pappusgrass (*Pappophorum bicolor*) and sideoats grama.

Gregg Smith Ranch, Jim Well County, Texas

The initial sampling date of June 15, 2012 revealed a 45% coverage of the seeded native species. Slender grama (early successional species), which made up 4% of the seed mix, had a coverage of 17% while little bluestem (late successional species) (*Schizachyrium scoparium*), which made up 33% of the seed mix, had an 11% coverage. By the sampling date of November 15, 2014, 2.5

years later, the total seeded coverage was 60%. Slender grama made up 27% of the cover while little bluestem remained unchanged at 11%.

Temple Ranch, Duval County, Texas

The initial sampling date of November 15, 2010 showed a 77% coverage of the seeded native species. Slender grama, which accounted for 20% of the seed mix, had a coverage of 43% while two-flower trichloris (late successional species), which made up 10% of the seed mix, had a 4% coverage. Four years after the initial sampling, the total seeded coverage had declined to 42%. Slender grama made up 27% of the 42% cover while false rhodesgrass made up 2%, and 13% of the coverage consisted of the 8 other seeded native species.

King Ranch, Kleberg County, Texas

The first sampling date of June 15, 2012 showed a 43% coverage of the seeded native species. Slender grama made up 15% of the seed mix provided 28% of the coverage while pink pappusgrass (late successional species), which accounted for 10% of the seed mix, had 1% coverage. By the sampling date of November 15, 2014, 2.5 years later, the total seeded coverage had risen to 75%. Slender grama made up 46% of the cover while pink pappusgrass made up 9%.

Killem Ranch, Live Oak County, Texas

The initial sampling date of November 11, 2012 revealed a 18% coverage of the seeded native species. Slender grama, which made up 35% of the seed mix, had a coverage of 6% and the late successional species, multiflower false rhodesgrass, which made up 2% of the seed mix had 0% coverage. By the sampling date of November 15, 2014, 2 years later, the total seeded coverage had increased to 49% with slender grama providing 17% of the cover and multiflower false rhodesgrass 1%.

Thompson Ranch, Kleberg County, Texas

The first sampling date of November 11, 2010 showed a 73% coverage of the seeded native species. Slender grama, which accounted for 20% of the seed mix, had a coverage of 35% and the late successional forb species, orange zexmenia (*Wedelia acapulcensis* var. *hispida*), which made up 10% of the seed mix, had 9% coverage. Approximately 3 years later (October 15, 2013), the total seeded coverage had increased to 95%. Slender grama made up 69% of the cover and orange zexmenia 14%.

Comanche Ranch, Maverick County, Texas

The first sampling date of November 11, 2010 there was a 79% coverage of the seeded native species. Slender grama had a coverage of 32%. By the sampling date of November 15, 2014, 4 years later, the total seeded coverage had declined to 40% and slender grama provide 39% or virtually all of this coverage.

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These seven sites clearly show the importance of low seral plants in the restoration process. The average total cover of seeded native species was 56%, with 3 sites having greater than 70% coverage. On all the sites, slender grama had the highest coverage of the seeded native species. Four of the sites had slender comprise greater than 50%. One site had slender providing virtually 100% coverage.

University Studies

Falk et al. (2013) assessed whether sowing 29 locally adapted native species reduced invasion of non-native plant species compared to allowing vegetation to colonize naturally following tillage. Canopy cover of exotic plants was similar in prepared–only and control treatments, ranging from 8 to 40%. Canopy cover of native vegetation was 10 to 20 times greater on prepared and seeded plots than on prepared only and control plots. Establishment of individual native species in each replication varied greatly even though seeds were sown uniformly. The high amount of variation in species composition in sown treatments had little effect on the evenness of overall canopy coverage. Sowing a diverse mixture resulted in higher and more uniform percent canopy coverage than would have been achieved if only a few native species would have been sown. Falk et al. (2013) speculated that the presence of a diverse, native seed mix with species from several plant functional and successional groups assisted in inhibiting invasion of exotic species. Different species have different competitive advantages forming more complex resistance over time and space when coupled with the high resource utilization of the diverse native community. Furthermore, they felt that successful competition of the native species with exotics at the establishment stage was critical. The early successional grasses provided competition with exotics while later successional species were still in the seedling stage. Evidence supporting this competition was the fact that the amount of canopy cover produced by the native species in the prepared and seeded treatments was similar to the amount of canopy coverage produced by the exotics on the prepared only plots. The early successional grass, slender grama, was the dominant species in the early sampling but by the end of the study there began to be a shift from slender grama to the later successional species such as bristlegrass (*Setaria* spp.).

In a second article titled, “South Texas Natives Rangeland Plantings: Observations from 5 Years and Counting”, the South Texas Natives (STN) group in their August 2014 issue of South Texas Natives eNews summarized 5 years of data from nearly 50 different restoration plantings in South Texas (https://www.ckwri.tamuk.edu/sites/default/files/pdf-attachment/2016-05/south_texas_natives_rangeland_plantings.pdf). They have learned that when considering a native rangeland seeding one must assess the presence of exotic grasses. The most successful seedings into previously dominated non-native pastures have followed repeated cycles of tillage (disking & plowing) or herbicide applications. Reducing the exotic seedbank is critical and may take as long as a year or two.

Secondly, the right native species must be selected for each specific planting site. Native species that are chosen must be adapted to not only your ecoregion but also your soils. Minor differences in soils and the timing and amounts of rainfall both before and after planting can make big differences in the resulting vegetation. This inherent variability in conditions is best addressed by planting a diverse adapted native seed mixes of at least 8-10 species. Furthermore, a large percentage of your seed mix must be early successional species with fast germination and establishment. In nearly all the STN seedings, the relationship between the density of seeded

species and the other plants has remained relatively constant from the first sampling through at least 5 years after planting. So, if you have good seeded cover within 30 days after germination, their results suggest that you will probably maintain good seeded species cover for the foreseeable future.

And lastly, Forrest Smith, Director of the South Texas Natives Project, stated that on over 30 different native seeding projects employing low seral plants, they have had over a 70% success rate. With the measure of success being a greater than 30% coverage of the seeded species and 0.5 seeded plants per ft^2 one to two years after planting. Furthermore, he mentioned that the drought of 2010-2012 killed many existing native and restored pastures. However, those pastures that had been planted to those adapted, South Texas Natives seed mixes were able to recover because of the residual seed bank that they had produced. One of the important values of these adapted native species, especially the early successional ones, is that they produce a significant amount of seed that is contributed to the seedbank. Thus, there is seed for recolonizing following a drought. Late successional, maladapted species produce very little seed in the wild and therefore are at risk for long-term failure

CONCLUSION

Native seeding projects using low seral plants have been successful in establishing native cover of 40 to 95%. Results of studies by the PMC and Texas A&M-Kingsville have shown native cover has persisted for over 4 years with most of the coverage in the early years provided by low seral plants such as slender grama and shortspike windmillgrass.

LITERATURE CITED

Alderson, J., and Sharp, W.C. 1994. Grass varieties in the United States. USDA Agric. Handbook 170, U.S. Government Printing Office, Washington, DC

Falk, A.D., Smith, F.S. and Pawelek, K. 2014. South Texas Natives Rangeland Plantings: Observations from 5 years and Counting. South Texas Natives eNews August 2014 edition.

Falk, Anthony D., Fulbright, T.E., Smith, F.S., Brennan, L.E., Ortega-Santos, A.J., and Benn, S. 2013. Does Seeding a Locally Adapted Native Mixture Inhibit Ingress by Exotic Plants. Restoration Ecology. Vol 21, Issue 4, 474-480.

Fargione, J., Brown, C.S. and Tilman, D. 2003. Community assembly and invasion: An experimental test of neutral versus niche processes. PNAS, vol. 100, no. 15.

Naeem, Shahid, Knops, J.M.H., Tilman, D., Howe, K.M., Kenedy, T., and Gale, S. 2000. Plant diversity increases resistance to invasion in the absence of covarying extrinsic factors. Oikos Volume 91, Issue 1, 97–108.

Tilman, D. 1997. Community invasibility, recruitment limitation, and grassland biodiversity. Ecology 78, 81–92.

USDA, NRCS. Reseeding Native Plants in South Texas. Management Notes. Temple, Texas.

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