Old World Bluestem herbicide control trials in restored mixed native grass stands

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Abstract

Old World Bluestems (OWB) has been a staple of range plantings across the southern U.S. for the last 50 years because of their ease of establishment, quick growth, and abundant forage production. In South Texas OWB are considered an invasive species by many because they are prolific seed and forage producers, allowing them to out compete native grass. Consequently, we wanted to see if we could use herbicides to control the OWB within a restored mixed native grass stands without damaging the seeded native prairie grass species. To accomplish this we applied three herbicide treatments, Glyphosate (RoundupPowermax), Nicosulfuron+Metsulfuron methyl (Pastora), and a mixture between Nicosulfuron+Metsulfuron methyl (Pastora) and Glyphosate(RoundupPowermax).None of the three herbicide treatments were able to control the OWB; however, we were able to see signs of phototoxicity and even a reduction in plant density. The most effective treatment at 30 days post treatment was the mixture of Glyphosate and Nicosulfuron+ Metsulfuron methyl which resulted in decreased density of OWB by 50% allowing a number of annual native species to establish such as tropical sprangletop. Although this treatment reduced the density of OWB it also reduced the number of native species recorded in pretreatment sampling. The second most effective treatment was the Glyphosate treatment which reduced the density of OWB by 10%. This treatment also reduced the density of a number of the native species, but a few of the species showed no effect. The Nicosulfuron+ Metsulfuron had no effect on OWB, and we saw a reduction in native species. There appears to be an additive effect of the 2 herbicides used causing a greater reduction in OWB, however this reduction comes at the expense of native species. In controlling OWB we saw that none of the herbicides proved to be successful at eliminating OWB, although we did see some suppression, it came at the cost of reduced favorable grass species.

Introduction:

Old World Bluestems (OWB) are a group of non-native grass species that were introduced to the US in the early 20th century. They mostly originated from Eastern Europe and Asia, and were brought to the US in order to improve grazing for livestock. The characteristics that make OWB good forage grasses, such as drought tolerance, growth rate, and biomass production also make them likely to become invasive (Ahring 1978). Old World Bluestems also have a high impact on the diversity of insects, rodents, and birds due to their ability to produce monotypic stands (Chapman 2004). Conversely, native grasses provide a number of habitat requirements for ground dwelling birds such as the bobwhite quail (Klataske 2016). Planting native warm season grasses and forbs can provide cover for grassland animals and also beneficial for insects due to the open ground cover (Denny 2013). However, due to OWB fast establishment and prolific seed production it makes it difficult to restore because of reinvasion. Our goal was to suppress the OWB in a restored native grass stand and hopefully changing the ratio from OWB dominated to Native grass dominated.

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Materials & Methods

Our experiment was set up as a randomized complete block design with 3 different herbicide applications aimed at controlling OWB. The experiment was replicated at two locations within the same restoration area at the Las Palomas Wildlife Management Area - Longoria Unit (26°19'06.1"N 97°49'30.8"W). Both locations were located within an area that had been previously dominated by OWB and restored to native grassland in the fall of 2017. In order to control the reinvading OWB we tested 2 different herbicides recommended for controlling OWB and a combination of the two. Herbicides were applied at rates recommended by the manufacturer with a CO2 Model T- Back pack sprayers unite connected to a 4 nozzle spray boom (R&D Sprayers). This was done in order to provide a consistent application rate and to replicate a tractor mounted application. Suppression treatments applied were:

- Glyphosate applications- Roundup PowerMax was applied 7 L/ha(96 oz/ac)
- Multiple Nicosulfuron+ Metsulfuron methyl applications- Pastora was applied twice 105 g/ha (1.5 oz/ac)
- Multiple Nicosulfuron+ Metsulfuronmenthyl and Glyphosate applications- Roundup PowerMax 7 L/ha (96oz/ac) and Pastora 105 g/ha (1.5 oz/ac) was applied twice

Plant density was collected by counting the number of individuals of each species within a 0.25 m^2 before the herbicide applications, and at 30 and 90 days after the initial application.

Results

In all 3 of our herbicide treatments OWB were not successfully controlled or suppressed compared to the control. Two out of the three herbicide treatments did show a reduction in the density of OWB compared to pretreatment data; however this reduction was nearly equal reduction in the density in the untreated control plots. Conversely, the multiple nicosulfuron+ metsulfuron methyl treatment showed a slight increase in OWB density (Figure 1). The trends in the seeded native species were similar to the OWB with nearly matching slopes between the glyphosate, mixed, and control treatments. In all three of these treatments there was a large drop in density seen at the 30 sampling date followed by a rebound at the 90 say sampling. Conversely, the multiple nicosulfuron+ metsulfuron methyl saw a slow constant increase (Figure 2). We do see a difference in trajectory between the seeded native species and the OWB with the OWB showing a steady to even declining density between 30 and 90 days compared to the natives which are increasing during this same period.

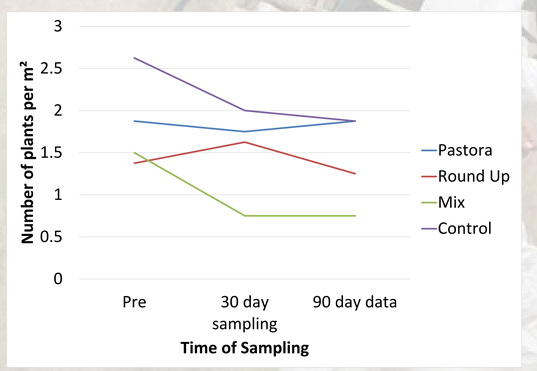

Figure 1: Density of OWB within all treatments over time, collected at the Longoria Unit.

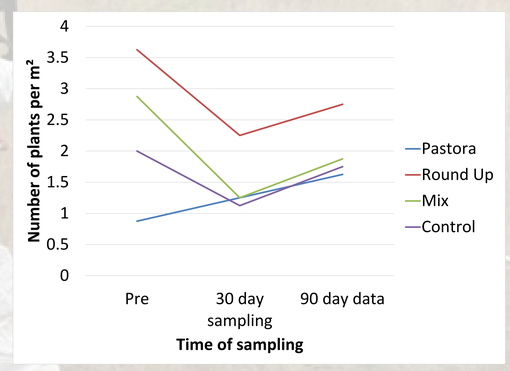

Figure 2: Density of seeded natives within all treatments over time, collected at the Longoria Unit.

Figure 3. Pre-sample photo of a mixed plot

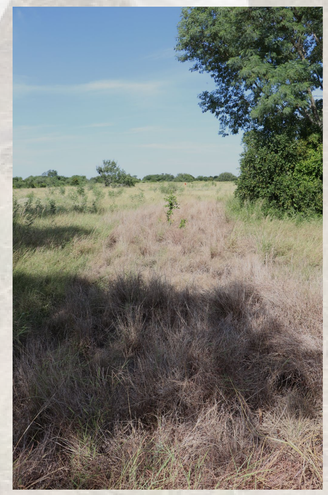

Figure 4. 30 day sample photo of a mixed plot

Figure 5. 90 day sample photo of a mixed plot

Discussion

Our data shows that applying glyphosate, nicosulfuron+ metsulfuron methyl, or a combination of the two is not able to control OWB. Although not specifically measured all herbicide treatments did create phototoxcity within the OWB, however mortality did not occur. Already established seeded natives showed similar signs of phototoxcity. During the 90 day sampling we saw signs of re-growth of OWB and seeded native species from herbicide damaged plants. One reason for the re-growth could be from the weather. Our study site received 13 inches of rain the week following herbicide application. These ideal growing conditions could have caused the plants to send more nutrients to growing points and prevented translocation into roots which would have caused mortality. Recommended application rate for Pastora is two applications over two weeks to help suppress re-growth with the second occurring after irrigation. We were fortunate in our trial to have favorable conditions for this treatment receiving an inch of rain between the first and second applications. Even with favorable conditions which are not common for the region we did not see suppression with this herbicide. Although we did see a reduction in density between the pre-sampling and the 90 sampling we do not feel that this reduction was caused by the treatments because of the similar reduction in the control treatments. One possible explanation for the decrease in plant density seen was due to an increase of canopy cover of stronger individuals reducing overall density

Conclusion

All three herbicides were not able to successfully control OWB. We also damaged the seeded native species in this restoration planting with our treatments. We do see some hope from several of the treatments that have decreasing to level trends of OWB density with increasing density of seeded native species. We are still currently collecting data an the site to hopefully be able to detect any long term trends. With the goal of increasing seeded native species and also increase the number of ground dwelling animals.

Acknowledgments

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