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Using native plants to control buffelgrass

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Introduction

Integrating active restoration into an invasive species treatment plan by seeding or planting with native species that can competitively suppress an invader may help improve weed management outcomes. This occurs because native plants can have traits (methods of accessing resources) that overlap with invasives, restricting invasives from taking up resources such as light and space. How well this approach works, however, is often modified by water availability. This is because plants may respond to changes in water availability by modifying traits-such as root density and size (biomass)-subsequently affecting the magnitude to which they can compete with invasives (Potts et al. 2019). Identifying traits of native species that are competitive against invasive species in dryland systems with varying water availability may help improve weed control outcomes.

Buffelgrass (*Pennisetum ciliare*) is a weedy perennial grass that has been expanding its range in Arizona and is problematic, in part, due to its negative effects on native plants. Despite extensive efforts from land managers, buffelgrass has often been shown to be difficult to manage and requires multiple follow-up treatments to achieve suppression (Farrell & Gornish 2019). We conducted a greenhouse study to explore what types of traits might be important for native species used for competition in a buffelgrass control program.

Methods

In the greenhouse, we grew buffelgrass in competition with eight native grasses in either non drought (watered every 3 days) or drought (watered every 9 days) conditions. The native grasses included: *Aristida adscensionis* (sixweeks threeawn, annual); *Aristida ternipes* (spidergrass, perennial); *Bothriochloa barbinodis* (cane bluestem, perennial); *Bouteloua barbata* var. *rothrockii* (six-weeks gramma, annual); *Dasyochloa pulchella* (desert fluff-grass, perennial); *Heteropogon contortus* (tanglehead, perennial); *Muhlenbergia porteri* (bush muhley, perennial); and *Sporobolus cryptandrus* (sand dropseed, perennial). After twelve weeks, we measured a series of traits on all plants including number of flowering culms, below ground (root) biomass, above ground (shoot) biomass, leaf height, initial growth (short term height), leaf nitrogen and leaf total carbon to assess how native plants traits might influence buffelgrass growth and vigor.

Results

When buffelgrass was grown with grasses characterized by large above ground biomass and fast initial growth (traits commonly associated with annual species), buffelgrass responded by increasing its own above ground biomass, especially when exposed to drought (Fig. 1A, B). However, when buffelgrass was grown with grasses characterized by slower growth and smaller size (traits commonly associated with drought tolerant perennial species), buffelgrass responded by decreasing its above ground biomass, especially when exposed to drought (Fig. 1A, B). In particular, when buffelgrass was grown with *Dasyochloa pulchella* (a small, highly drought tolerant perennial), it hardly grew at all over 12 week experiment. We also found that buffelgrass maintained a high growth rate when exposed to drought but only when grown in competition with other species that have a tall initial grass height. Buffelgrass was most stressed by drought when grown with native grasses characterized by rapid growth, early flowering and high leaf nitrogen, particularly the annual species *Aristida adscensionis* and *Bouteloua barbata*.

Management recommendations

We found that small, slow growing, drought tolerant perennial grasses can reduce buffelgrass shoot biomass by upto 95%. This suggests that reseeding rapidly with drought tolerant perennial grasses after managing buffelgrass may be a useful strategy for weed control. Because we found that competition with natives characterized by fast initial growth, high leaf nitrogen, and large root systems (e.g. large, fast-growing annual grasses) did not reduce buffelgrass

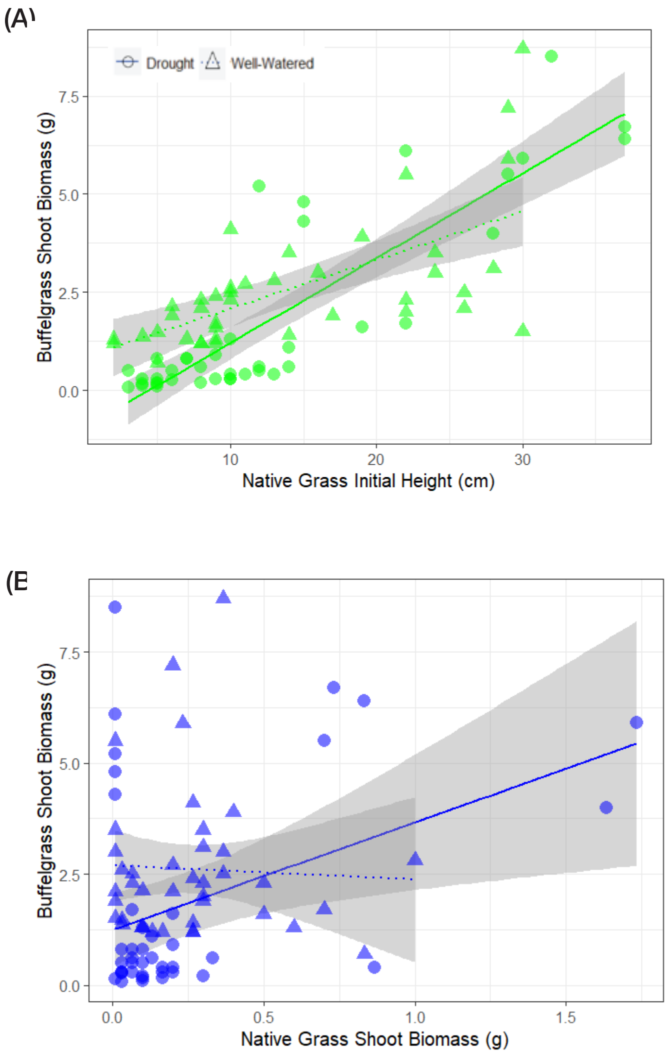

Figure 1. The relationship between buffelgrass shoot biomass withnative grass traits (a) Initial heightand (b)Shoot biomass.Graph adapted from Farrell et al. 2022

growth, but rather caused an increase in buffelgrass growth when water is plentiful, plants with these traits should be omitted from a buffelgrass control program unless management is occurring during a drought.When using a native grass in a buffelgrass management program, ensuring that native species germinate prior to or at the same time as buffelgrass emergence might be critical for helping the native to withstand competitive pressure (Stevens & Fehmi 2011).

Our results also suggest that there is an opportunity to use different follow-up treatments depending on how dry it has been and what species buffelgrass has for neighbors. For example, herbicide requires active growth to be effective and the higher the plant's growth rate the more effective the herbicide is (Harker & Blackshaw 2003). So, buffelgrass growing amongst fast growing species during drought might be the ideal condition in which to use herbicide due to rapid buffelgrass biomass accrual. Conversely, if buffelgrass is growing amongst slow growing species during a drought, its growth rate might stay suppressed, and herbicide would be expected to be less effective.

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