The Battle of the Grasses: The Effect of Competitive Landscape on the Growth of *Triticum* and *Setaria*

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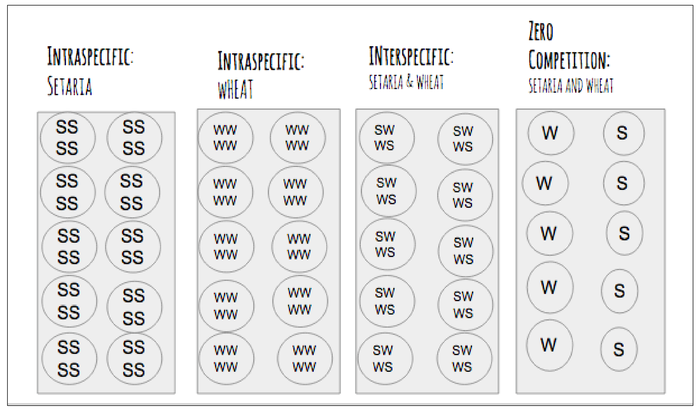
Introduction

C3 grasses (Wheat) are known to quickly establish in its environment by absorbing as much soil moisture as it can during its early growing stages. C3 grasses are also know to grow well with other grasses, and is usually used to control weeds and other unwanted plants use to their ability to scavenge excess nutrients(3). C4 grasses (Setaria) have higher water requirements than the C3 grasses(2). Both C3 and C4 grasses are grown from April to November with optimal temperatures between 68-70 *F(1).
If Wheat, a C3 grass, is planted with a Setaria, a C4 grass, based on the characteristics of C3 grasses the wheat will grow more efficiently than a C4 grass when grown in a interspecific growing environment. To show the differences in growth we will also grow the C3 and C4 grasses in intraspecific competitive and competition landscapes to show how the grasses respond with different amounts of space and grass types.

Goals of the Study:
We want to see whether or not growing C4 and C3 grasses together affects their height, leaf number, and biomass, and how they react when introduced into an environment where there is competition. Due to the lack of land available to grow crops on and they growing population of the United States and the world, we could use this information to help our current crops thrive and therefore produce more output (5). This will also help show whether or not more plants can be planted more closely together, which would maximize the use of land.

Experimental Setup

Independent variable- competitive landscape
Dependent variable- Height, leaves, and shoot biomass.



Results

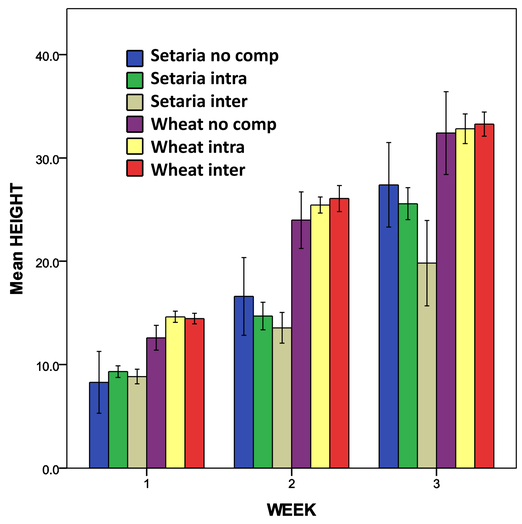


Figure 1 shows the average plant height in cm over the course of three weeks for a no competition landscape, intraspecific competitive landscape, and interspecific competitive landscape. The **p-value** for the relationship between vertical height growth and competitive landscape was 2.693E-18.

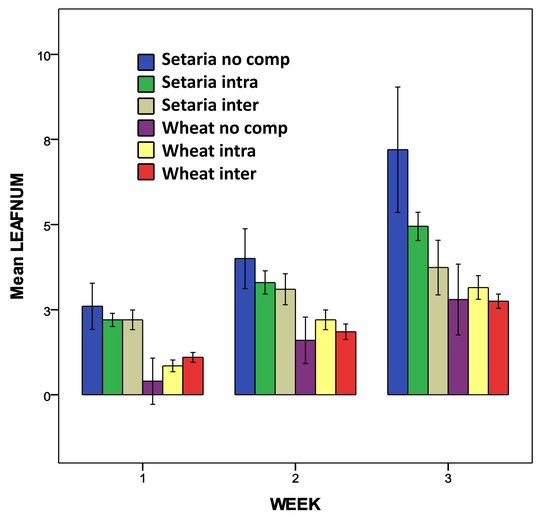


Figure 2 shows the average leaf number over the course of three weeks for a no competition landscape, intraspecific competitive landscape, and interspecific competitive landscape. The **p-value** for the relationship between leaf number and competitive landscape was 4.395E-19.

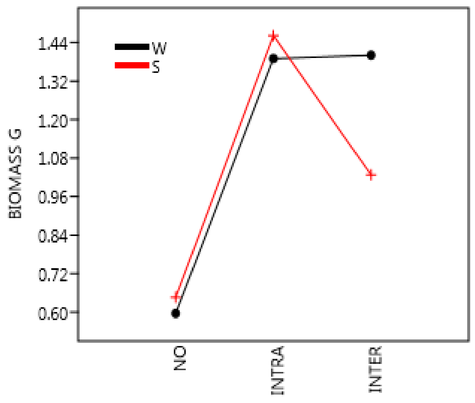
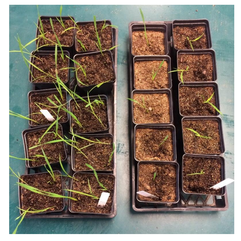


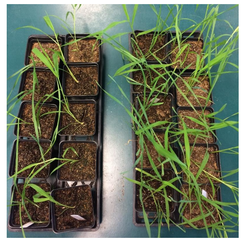
Figure 3 shows the average biomass at the end of three weeks for a no competition landscape, intraspecific competitive landscape, and interspecific competitive landscape. The **p-value** for the relationship between leaf number and competitive landscape was 2.132E-08.

Week 1- NO competition: Setaria on left, Wheat on right



Week 1- Interspecifc: Setaria on left, Wheat on right

Week 3- NO competition: Setaria on left, Wheat on right



Week 3- Interspecific: Setaria on left, Wheat on right

Discussion

Our original hypothesis which stated, “Due the characteristics of C3 grasses , Wheat will grow more efficiently than a C4 grass, Setaria, when grown in a interspecific competitive landscape. The efficiency of growth was measured by plant height, leaf number, and biomass weekly then averaged and compared at the end of 3 weeks. Figures 1 and 2 show how greatly the Setaria’s growth was impaired by the Wheat. As hypothesized, the wheat quickly established itself and took over the interspecific competitive landscape. Figure 3 shows the most drastic difference in the grasses. In an interspecific competitive landscape, Wheat absorbed more nutrients than the Setaria, giving it a substantially higher biomass. Figures 4 and 5 show a weekly difference among the different competitive landscapes. Overall, our hypothesis was supported by our data. This conclusion suggests that when grown together, C3 grasses will take over C4 grasses eventually causing the C4 grasses to die. Comparing our data to a previous experiment done between Setaria and a C3 grass, both experiments showed that C3 grasses were much more efficient in taking over their environments when grown with Setaria(4). These results could potentially be used to aid farmers growing large plots of crops, such as wheat, and helping them decide where to plant and what they could plant together to maximize their yields.

References

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