

Report for 2002AZ4B: The effect of mycorrhizae on competitive ability and drought tolerance of cottonwood (*Populus fremontii*) and saltcedar (*Tamarix ramosissima*)

There are no reported publications resulting from this project.

Report Follows:

A. Research objectives

The objective of this project is to investigate the effects of mycorrhizal fungi on growth and competitive ability of Fremont cottonwood and saltcedar, under drought and non-drought conditions. By monitoring growth, productivity, and survivorship of seedlings grown with and without fungi, we will (1) determine whether mycorrhizal fungi influence growth and competitive ability of Fremont cottonwood and saltcedar, and (2) determine whether the fungal symbionts increase drought tolerance of either woody species.

B. Methodology

Saltcedar seeds were sown in 20, 8-gallon tree pots on August 2, 2002. All soil was sterilized prior to planting. Half of these pots were inoculated with a mixture of endo- and ectomycorrhizae obtained from Fremont cottonwood root zones, and the remainder served as uninoculated controls. All pots were placed in 5 gallon buckets and bottom-watered to simulate a water-table. On September 1, the seedlings were thinned to 15 per pot and the water level in the buckets was dropped to 15 cm to reduce algal growth. Three to five sudan grass (*Sorghum vulgare* var. *sudanens*) seeds were planted in each pot to serve as colonization indicators. Sudan grass is colonized by most endomycorrhizae and measurement of root colonization levels will allow us to determine if the inoculation in each experimental pot was successful and to ensure that no control pots were contaminated with mycorrhizae during the experiment.

After thinning, the standing height of the seven tallest seedlings per pot was measured weekly. Beginning on October 11, the length of the longest stem was also measured weekly and beginning on October 29, the length of all stems on all 15 seedlings per pot was measured monthly. Water was turned off to all pots on November 25 and the pots were allowed to dry down. Due to cold temperatures and cloudy days, the pots dried very slowly. On December 2, all excess water was siphoned from the pots, and on January 13, 2003, the pots were removed from the buckets to facilitate draining. Many of the pots were still saturated in the lower levels.

All saltcedar and grass seedlings were harvested on January 18-22. Above-ground saltcedar biomass was stored in a drying oven at 60°C for one week. Extensive intermingling of saltcedar and grass root systems prevented collection of saltcedar belowground biomass. Roots found physically attached to grass or saltcedar plants were collected and stored for assessment of mycorrhizal colonization.

Very few saltcedar seedlings reached the size necessary to perform accurate measurements of photosynthesis and water potential. These measurements were not taken during this experiment, but will be performed on cottonwood in the next experiment.

C. Preliminary results

Repeated measures ANOVA showed no significant differences in standing height, height of longest stem, average total plant length (sum of all stems), and average stem length per

pot between inoculated and uninoculated seedlings. Seedlings in uninoculated pots had a marginally higher number of stems per pot ($p=0.06$). There was no difference in above-ground biomass between inoculated and uninoculated seedlings. Mycorrhizal colonization was very low in the inoculated seedlings (7.8%) but higher than the sterile controls (0.02%; Mann-Whitney U $p=0.001$) Only hyphae and vacuoles were encountered in saltcedar roots.

These results indicate that saltcedar can be colonized by mycorrhizae, but the low levels of colonization, lack of arbuscules, and similarity in growth between the two treatments suggest that saltcedar does not benefit from mycorrhizal colonization in the wet conditions used in this experiment.

Competition between saltcedar and cottonwood could not be evaluated because facilities problems at ASU delayed the start of this experiment until August, and the cottonwood seeds we collected would no longer germinate. Thus, we decided to re-focus the experiment on the effects of mycorrhizae on the survival and growth of saltcedar. Drawing on knowledge gained in this experiment, a second experiment will be initiated in early summer of 2003 to study effects of mycorrhizae on competition between cottonwood and saltcedar, under drought and non-drought condition.