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Screening Arabidopsis accessions for alkaline stress tolerance

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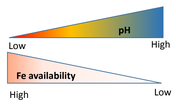
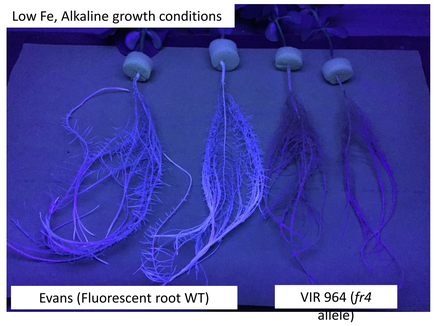
INTRODUCTION

Alkaline soils comprise 30% of the earth and have low plant-available iron concentration. Alkaline stress causes iron deficiency and decreased growth.



Arabidopsis is an easy to study plant species for laboratory settings, and discoveries in Arabidopsis can be transferred to other plant species, like soybean. Many hundreds of accessions of Arabidopsis have been collected from different ecosystems. Our hypothesis is that the more sensitive lines will be relatively smaller at alkaline pH, while the tolerant lines will grow and look more close to normal.

Fluorescent and non-fluorescent soybean roots



No matter soybean or arabidopsis, roots are always fluorescent. The picture above show us how the roots look like under UV light.

Coumarins are a class of phenolic compounds that are released by some species of plants when they are Fe deficient. These compounds can improve Fe uptake in alkaline comditions. Coumarins are fluorescent, and can be seen and measured under UV light. Natural variation is present for coumarin synthesis in Arabidopsis, but only a few accessions have been screened, and this screen was not done under Fe deficient conditions.

RESEARCH QUESTIONS

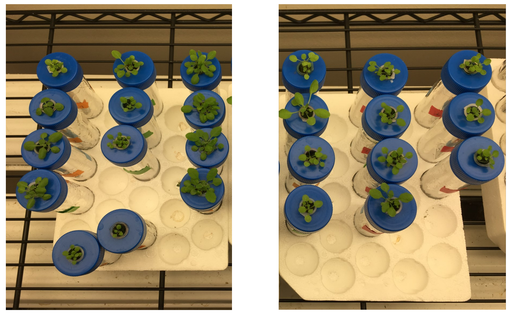
1. Will there be differences between Arabidopsis accessions for alkaline stress tolerance in potting mix growth conditions?
2. Will there be differences for fluorescent concentration between inside and outside roots in hydroponic system?
3. Will there be differences for fluorescent concentration between different Arabidopsis accessions in hydroponic system?

METHODS

We use hydroponic system to measure fluorescence in nutrient solution. First, we germinated seeds for 3-5 days, then planted them into modified column with rockwool. For the first 13 to 16 days, the nutrient solution concentration was 0.1 µM Cu and 25 µM Fe. Secondly, transfered well-grown Arabidopsis in hydroponic system to individual treatment with 10mM Bic (Sodium Bicarbonate) and grow for 5-10 days.
We use potting mix to measure the fresh weight of Arabidopsis. First, we germinated seeds for 3-5 days, then planted them into possting mix. Before the seeds germinate, the nutrient solution concentration is 0.1 µM Cu and 25 µM Fe. After the seeds germinate, we changed half of them to alkaline treatment and let them growth about 25 days.

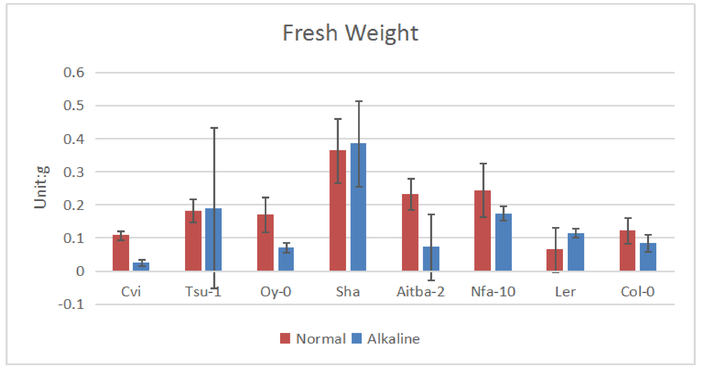
Hydroponic System

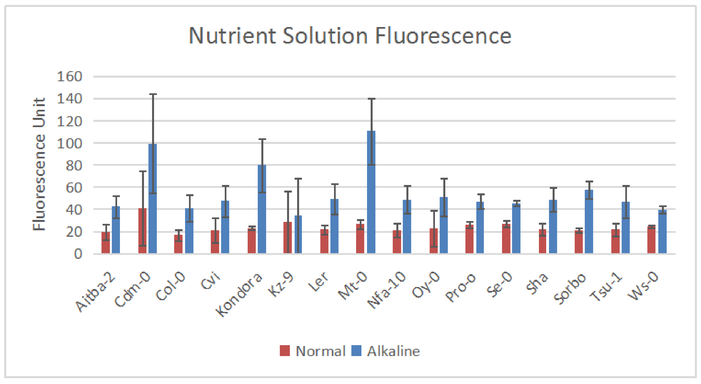
Normal (0 Bic) **Alikaline (10 Bic)**



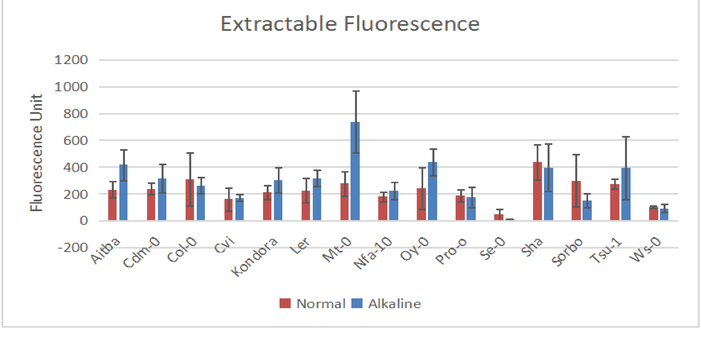
Potting Mix

RESULTS





After individual treatment, we cut the roots and put them into 1mL methanol in the dark place for one day to let the roots release fluorescence from inside roots to outside roots. . Finally, we measure the fluorescence in methanol.



CONCLUSION

1. Therefore, the fresh weight graph directly show us Aitba-2, Oy-0,and Cvi are sensitive lines.
2. The fluorescence concentration outside the roots is very different between different treatment and similar inside the roots.
3. The nutrient solution fluorescence graph show us Aitba-2, Cdm-0, Kondora and Mt-0 are sensitive lines because there are large gap between normal and alkaline condition .