

VeGIN Stakeholders' Meeting December 2021

Stress to success: identifying resilient phenotypes in onions and carrots

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BACKGROUND

Climate change

Factors for
healthy plant

Sustainable
food production

Crop resilience

Genotypic
variation

Phenotypic
variation

Desirable traits

Aim and hypotheses

- To develop a robust assay to quickly screen and phenotype onions and carrots under drought and heat stress, flooding, and nutrient stress

Hypotheses

- Plants within the same half sib family would show similar phenotypic responses (similar tolerance to stress)
- Plants from different accessions would have varying phenotypic responses (different tolerance ranges)
- Some lines would show more tolerance than others to the abiotic stresses

Methods

- 1 half sib family chosen per accession
- 20 seeds per half sib family planted, thinned to 5 control, 5 stress
- Watered every 2-3 days (well-watered)
- Stress period starts at 2-3 true leaves (4-6 weeks)
- Plants grown on for 3 weeks under optimal
- Harvest – FSW, leaf number, photo
- Assays replicated over time, i.e. 3 harvests per experiment

Stress treatments

Drought + heat

- 48 h onions, 30 h carrots
- 38°C, 60% relative humidity

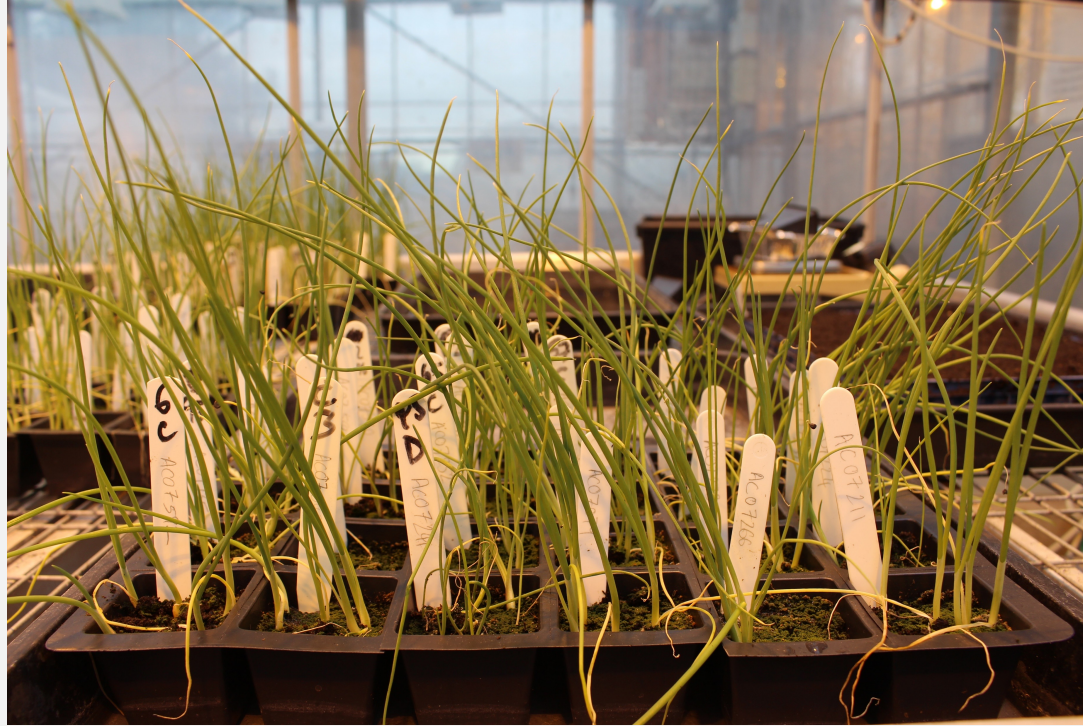
Flooding

- Flooding applied for 7 days
- Water 1 cm above soil level

Nutrient stress

- 6 extreme accessions (2-3 lines tolerant, 2-3 lines susceptible)
as sub-set to test nutrient stress response after drought + heat

Onion trials
started in
January 2021



Pre-drought &
heat stress (Rep1)



Post-drought and
heat stress (Rep1)

Visible difference between control and stress

Control (Rep1 AC07839)



Stress (Rep1 AC07839)



No visible difference between control and stress

Control (Rep1 AC07062)



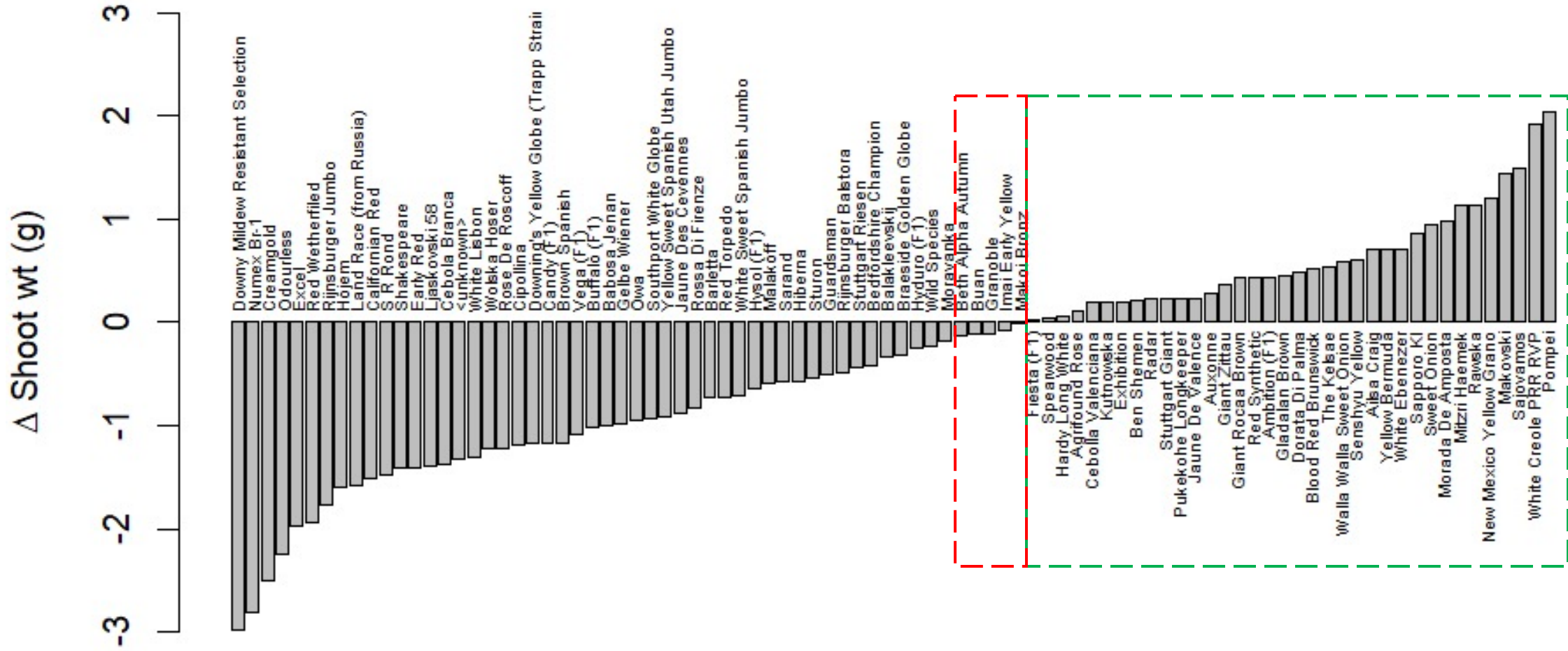
Stress (Rep1 AC07062)



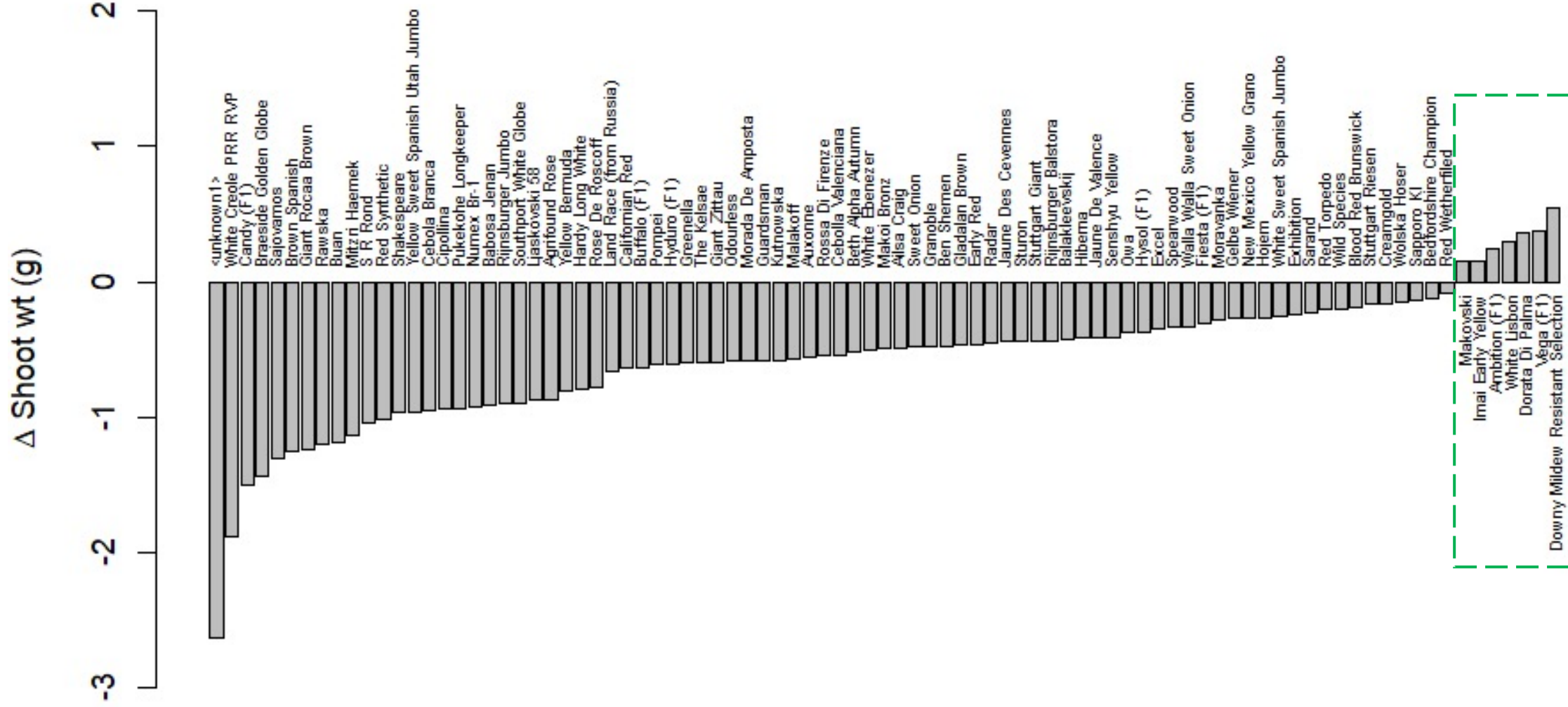
Data Analysis

- Used general linear mixed effects model with replication group as a random effect
- Tested effect of stress treatment and accession (& interaction effect) on onion FSW
- Significance for treatment and/or accession for flood
- Interaction present for drought + heat

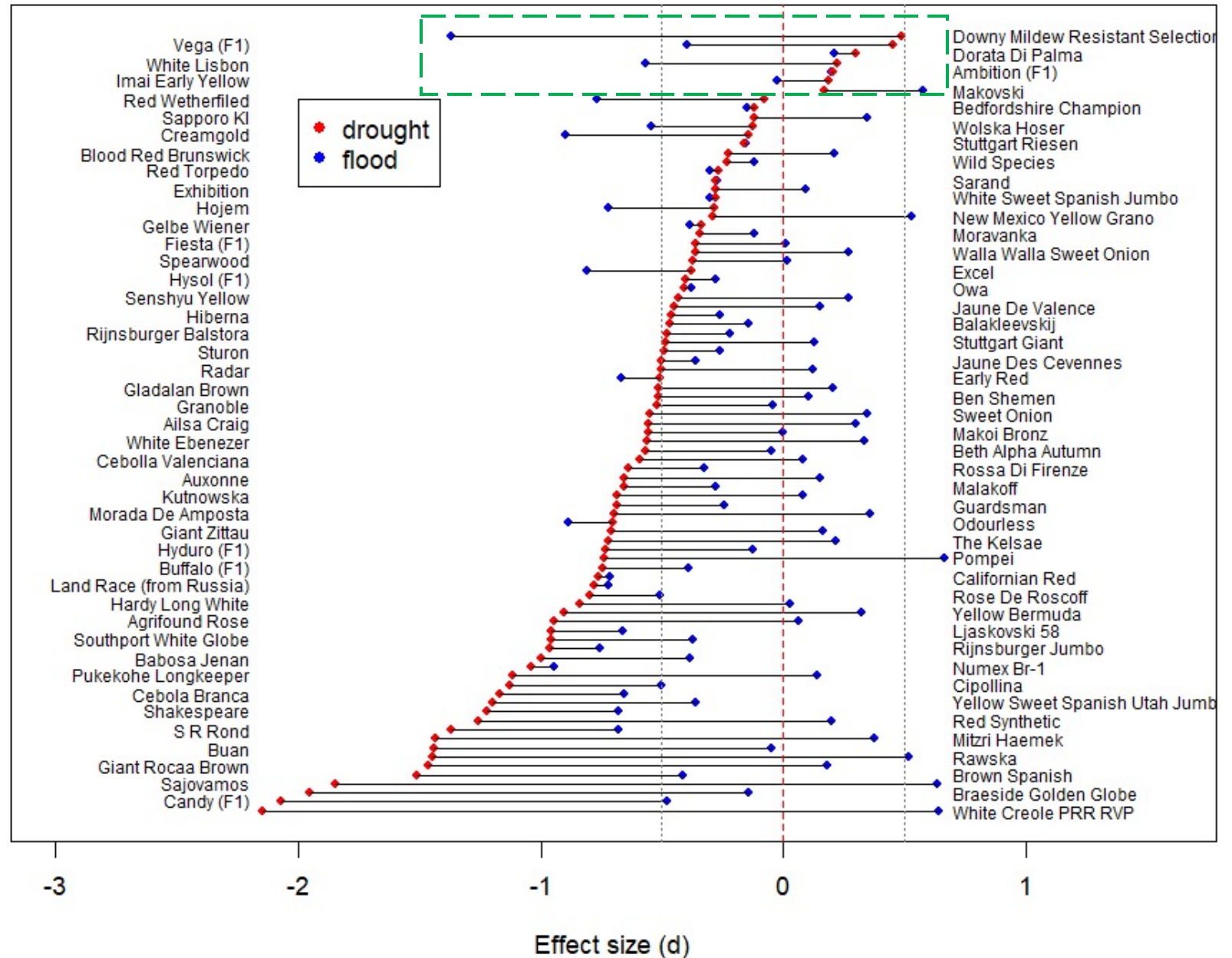
Onion - flood



Onion - drought + heat



- Calculated effect size (cohen's d) to determine level of resilience
- Suggests accessions with effect size >0 have some resilience to stress
- Small distance between dots suggests small difference between drought and flood stressed accessions e.g. Dorata Di Palma, Ambition (F1)



Carrot assays started
in June 2021

- Flooding in 8L boxes with 2x steel rods per plant tray to weigh down
- Water 1 cm above soil





Pre-flooding
(Rep1)



Post-flooding
(Rep1)

Visible difference between control and stress

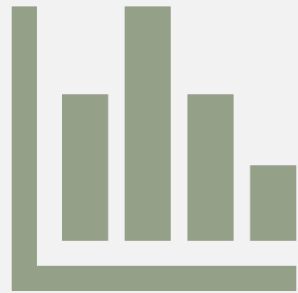
Control (Rep1 006100)



Stress (Rep1 006100)



Future Work



Statistical analysis



Nutrient stress response

Thank you