Salinity Stress in Almond, Rootstock Screening and Tree Response to Non-Uniform Salinity

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Rootstock Screening for Salinity Tolerance

Objectives

- To study the salinity tolerance of different almond rootstocks by monitoring tree growth and salt accumulation in leaves

Materials and Methods

- One year old grafted plants of Nonpareil on different rootstocks were planted in 7 gallon pot having Calcined clay (Turface)
- Plants were irrigated with nutrient solution having all essential nutrients with salinity of ~1 dS/m
- Treatments consisted of control and 4.5 dS/m salinity using ~ 2 NaCl and 1 Na_2SO_4 to represent Na dominant salinity.
- Leaves were analyzed for Na^+ and Cl^- concentration
- Plant canopy size was estimated by taking pictures and analyzing images

Results

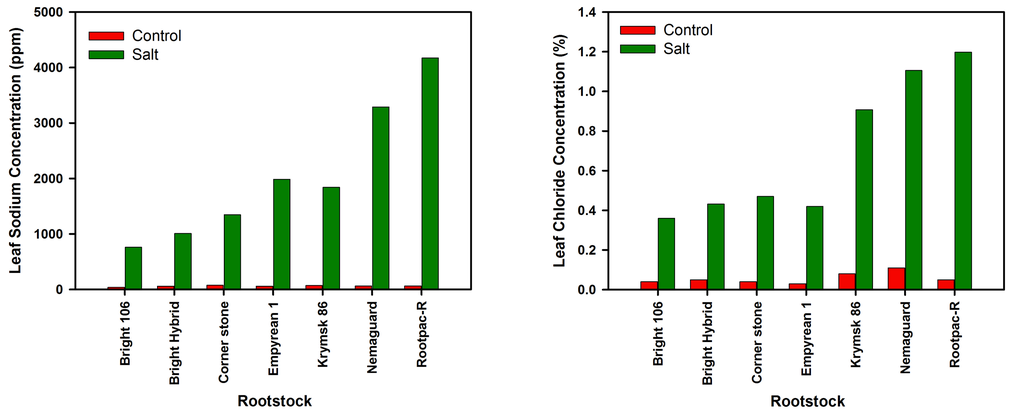

Fig. Leaf Na^+ and Cl^- concentrations of Nonpareil grafted on different rootstocks. Rootstocks varied in Na^+ and Cl^- accumulation in leaves. Rootpac-R and Nemaguard accumulated more Na and Cl^- in leaves whereas Bright 106, Bright Hybrid, Corner Stone and Empyrean 1 accumulated significantly less Na^+ and Cl^- in leaves.

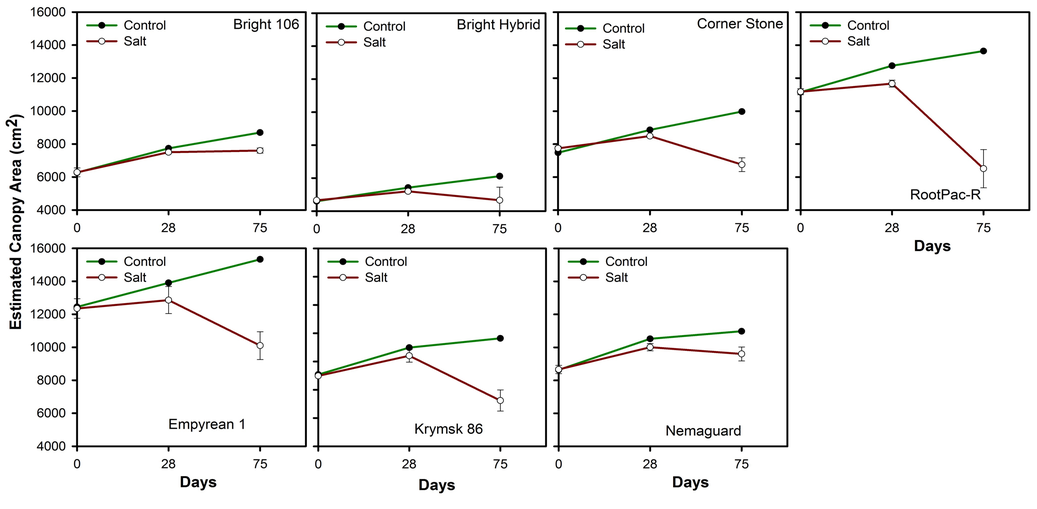

Fig. Estimated canopy size of Nonpareil on different rootstocks. Growth of trees on all rootstock declined for salt treatments, however trees on rootstock which accumulated less Na^+ and Cl^- was less affected by salinity. Growth of RootPac-R appeared to be most sensitive to salinity whereas growth of Bright 106 was less affected by salts.

Effect of Non-uniform salinity of plant growth and salt accumulation

Objectives

- Study the effects of non-uniform root zone salinity on tree growth and leaf Na^+ and Cl^- accumulation

Materials and Methods

- Root of 90 Nonpareil trees grafted on Nemaguard, Hansen 536 and Empyrean 1 were split into two equal halves and placed in special pots to accommodate split roots
- Three salt levels (control, 2 dS/m (low salt) and 4 dS/m (high salt)) with six treatment combination - control/control, control/low salt, control/high salt, low salt/low salt, low salt/high salt and high slat/high salt were applied to five replicated trees
- Leaf samples were collected periodically for Na^+ and Cl^- analysis and tree growth was estimated by photographic analysis.

Results

- Leaf Na^+ and Cl^- concentrations decreased for all rootstock when partial good conditions were given to trees
- Tree growth under non-uniform salinity conditions was significantly improved than uniform salinity

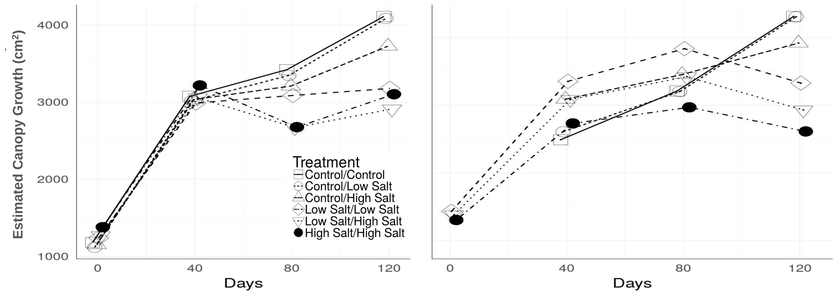

Fig. Canopy size of Nonpareil grafted on Nemaguard and Empyrean 1 under uniform and non-uniform salinity. Half of the tree roots exposed to good soil condition and half exposed to high salinity (+4 dS/m) had significantly more canopy area than uniform salinity

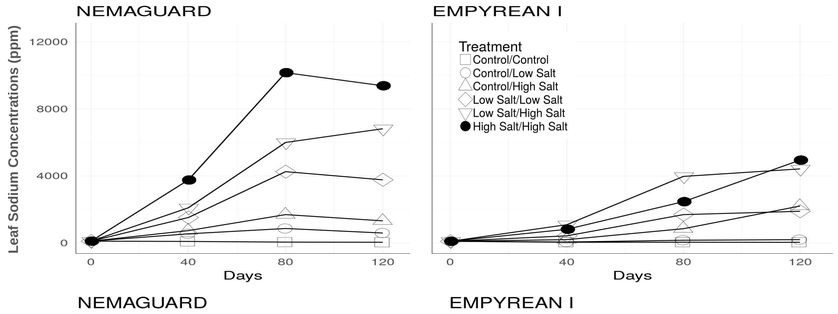

Fig. Leaf sodium concentrations of Nonpareil grafted on Nemaguard and Empyrean 1. Leaf Na^+ concentrations was lower for trees with half of the roots exposed to salinity and half to better soil conditions compared to uniform salinity.

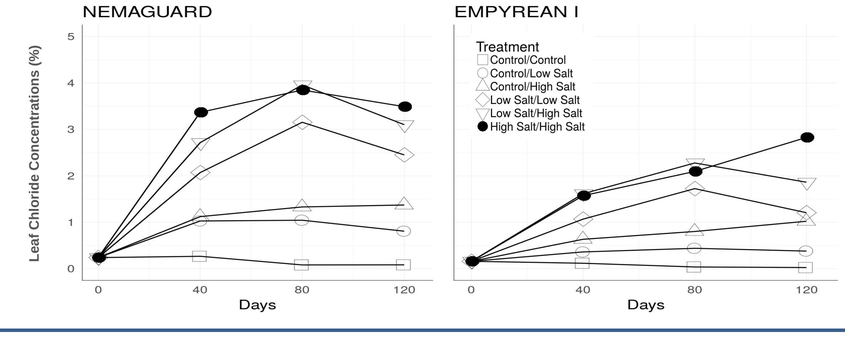

Fig. Leaf Chloride concentrations of Nonpareil grafted on Nemaguard and Empyrean 1. Leaf Cl^- was lower for trees with half of the roots exposed to salinity and half to better soil conditions compared to uniform rootzone salinity.

Conclusions

- Bright 106, Bright Hybrid and Corner Stone accumulated significantly less Na^+, while RootPac-R and Nemaguard accumulated more Na^+. Empyrean and Krymsk 86 were intermediate in Na accumulation in leaves.
- Bright 106, Bright Hybrid, Corner Stone and Empyrean 1 accumulated lower Cl^- while RootPac-R and Nemaguard accumulated more Cl^- in leaves
- Plants roots can uptake more water and nutrients from areas of low salinity when exposed to non-uniform saline conditions.

Acknowledgements

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