

# Rootstock Screening and Salinity Management in Avocado

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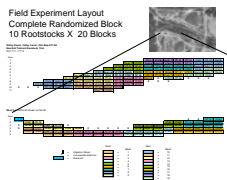
## Objectives:

1. Compare salinity tolerance of currently used and newly developed rootstocks.
2. Identify rootstocks that can be incorporated into the avocado breeding program.
3. Compare Lamb Hass and Hass scions relative uptake of salinity on different rootstocks.

## Stehly Ranch, Pauma Valley Comparison of 10 Rootstocks Grafted with Hass Scions



## Miller Orchard Comparison of Hass and Lamb Hass on 7 Rootstocks



## Water Analysis Stehly Ranch

Block	Rootstock	EC (dS/m)	Cl <sup>-</sup> (mg/L)	SO <sub>4</sub> <sup>2-</sup> (mg/L)	NO <sub>3</sub> <sup>-</sup> (mg/L)
1	Duke 7	1.8	12	14	434
1	Parida	1.8	12	14	434
1	PP 14	1.8	12	14	434
1	PP 16	1.8	12	14	434
1	PP 24	1.8	12	14	434
1	Spencer	1.8	12	14	434
1	VC 207	1.8	12	14	434
1	VC 218	1.8	12	14	434
1	VC 44	1.8	12	14	434
1	VC 801	1.8	12	14	434
2	Duke 7	1.8	12	14	434
2	Parida	1.8	12	14	434
2	PP 14	1.8	12	14	434
2	PP 16	1.8	12	14	434
2	PP 24	1.8	12	14	434
2	Spencer	1.8	12	14	434
2	VC 207	1.8	12	14	434
2	VC 218	1.8	12	14	434
2	VC 44	1.8	12	14	434
2	VC 801	1.8	12	14	434

Irrigation was begun in mid April, after which soil water availability was maintained between 0 and 50 centibars by irrigation with 3 hour applications of water biweekly or as needed to maintain water availability in the desired range.

Salinity of the irrigation water was measured biweekly and had EC values ranging between 1.8 and 2.3. Analysis of the chloride levels showed that this water supply contained very high levels of chloride for avocado production, ranging between 12 and 14 meq (434 to 490 ppm).

## Results Stehly Ranch 2006

This experiment compares a selection of rootstocks from Israel that were released from quarantine, as well as some of the most promising selections from the rootstock breeding program. Leaf samples were collected in October 2006 and analyzed for Cl content.

Both tree growth measurements and leaf tissue chloride analysis show that there are significant differences between the rootstocks in their tolerances to saline irrigation water. The overall best performing rootstocks are VC 207 and VC 801, having both good canopy volume and low leaf tissue chloride contents.

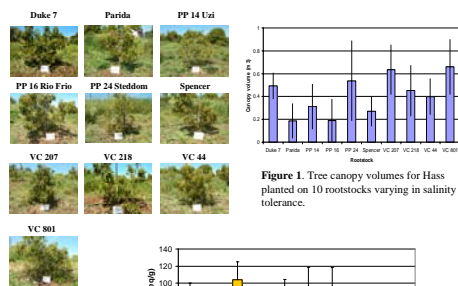


Figure 2. Leaf chloride contents in October 2006 for Hass avocado on 10 rootstocks varying in salinity tolerance.

## Results Miller Orchard 2006

No difference in Hass vs Lamb Hass growth by rootstock apparent in 2006.

Wide variation in growth on different rootstocks. Toro Canyon is visibly most vigorous with least visible salt damage.

Dusa and Latas, both planted late (July, 2003), have lagged in growth behind other trees that were planted earlier in the season (May, 2003). This suggests these trees should be compared separately.

Rootstock	Canopy Volume	Fruit / Tree
Dusa	8 (4)*	0.5 (5)
Latas	14 (9)	11 (16)
PP-14	23 (10)	16 (15)
PP-24	18 (3)	14 (14)
PP-4	22 (6)	14 (18)
Thomas	18 (6)	13 (13)
Toro Canyon	22 (10)	28 (15)

\*Values in parentheses represent 1 standard deviation

## Comparison of Rootstock-Plant-Soil Water Relations.

Plant water relations are a major contributing factor in the development of leaf burn which is the major symptom of salt damage. We are thus very interested in whether rootstocks vary in their abilities to provide water to the leaves and how this may be affected by soil salinity levels.

To examine this question, we have measured the leaf water potentials of the Stehly trees using a Scholander pressure bomb. Leaf water potentials were measured pre-dawn (2 to 4 AM) to determine the water levels after resupply of water from the roots to the leaves at night when the leaf stomata are closed and the trees have recovered from the previous day's desiccation. Other measurements were made a midday (11 AM to 1 PM) to determine the peak leaf water stress encountered during the day.

Our results show that at predawn, leaf water potentials are remarkably consistent across all rootstocks and measure between -5 to -6 bars. At midday leaf water potentials increase to -15 to -20 bars, with maximum values occurring at approximately -25 bars. Our results suggest that the most salinity tolerant rootstock, VC 801, may be superior for delivery of water to the scion due to the fact that it had the lowest leaf water potential and highest leaf area.

## Use of Leaf Water Potential to Determine Water Use Efficiency

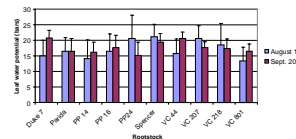
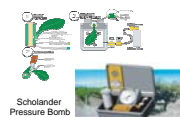


Figure 3. Leaf water potential at midmorning for Hass scions on rootstocks varying in salinity tolerance.

## Conclusions

Several rootstocks have been identified which show greater salinity tolerance than those that are commonly used by the industry. Among these the most promising are VC207 and VC 801.

While growth and chloride contents are good indicators of rootstock performance under high salinity conditions, it is critical to evaluate the yield potential of these rootstocks under these conditions before deciding to replant with these particular rootstocks.

The development of criteria for breeding and selection of rootstocks for use with saline irrigation water requires a mechanistic understanding of the physiological traits that confer this tolerance. Future research should continue to examine plant water relations, root distribution, chloride exclusion, and other factors that confer salinity tolerance.