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Influence of Salinity and Rootstock on Hass Seedling Growth

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The effects of salinity and Mexican-Guatemalan parentage rootstock on Hass seedling growth are under study at Brokaw Nurseries. Two experiments have been completed. Twelve rootstock varieties grafted to Hass have been tested including: Borchard, Duke 6 and 7 , G 6, G755c, 1033, Huntalas, Lula 3, Thomas, and Toro Canyon (clonals) and the nonclonal Walter Hole. Seedlings were grown for about twelve months in sand media at three salinity levels. The salinity treatments were imposed after the plants were established under nonsaline conditions (3 - 4 mo). Six seedlings per rootstock were established for each salinity treatment. Seedling height, quality, and trunk diameter, and chloride and sodium content of the leaves were measured three to five times after salinization; the chloride and sodium content of leaves and stems were also measured at the end of the experiment. Plant weight was also measured at the end of the second experiment.

The conditions for the two experiments differed with regard to duration of salinization and irrigation water composition. For the first, the plants were harvested in October after irrigation for about one year with 2.9, 3.6 and 4.5 dS/m water (Table 1). For the second, harvest occurred in July after irrigation for eight months with 1.2, 2.2, and 3.3 dS/m water. Sulfate was the predominant anion in the waters used for the first experiment; for the second, it was chloride (Table 1).

Salinity effects on seedling growth (Table 2) and weight (Table 3) varied among rootstocks. The growth and weight for Borchard and Duke 7 seedlings was the highest of the rootstock species included in the two experiments. The growth and weight of Duke 7 decreased with increasing salinity, whereas for Borchard and G755c both were unaffected by salinity. Decreases in growth with increasing salinity were also evident for Lula 3, G6Pt and Duke 6 in the first experiment and for weights of Toro Canyon, Thomas and G1033 in the second.

Relative growth, G, decreased with increasing chloride content (% dry wt.) in the leaves and stems for the first experiment. The regression equation for leaves was

$G = 3.95 - 11.0\ Cl + 11.2\ Cl^2$ ($r = 0.69$);

for stems it was

$G = 3.50 - 12.7\ Cl + 17.5\ Cl^2$ ($r = 0.84$).

Little or no correlation between growth and chloride occurred in the second experiment

although the average stem chloride content was higher (0.2 vs 0.4 %). Also, seedling weight and chloride were not correlated. The lack of correlation may have been a consequence of terminating the second experiment before onset of hot weather in August and September.

The results indicate avocado salt tolerance can be improved through rootstock selection. Prior investigators have also demonstrated the influence of rootstocks on avocado salt tolerance, and that the mechanism may be reduced chloride transport and sodium exclusion by the rootstock. This is consistent with the chloride data obtained in the first experiment but not in the second. Greater attention to performing the rootstock trials under conditions where the seedlings are exposed to the hot and dry conditions of July through September may eliminate this inconsistency.

Table 1. Irrigation water compositions for avocado rootstock experiments conducted at Brokaw Nursery.

	EC	Na	K	Ca+Mg	Cl	HCO_3	SO_4	NO_3	B
	dS/m				meq/L				mg/L
Exp. 1									
1	2.9	8.5	1.1	26.1	1.0	1.0	23.0	11.0	1.1
2	3.6	13.0	1.1	27.3	4.8	.8	24.1	12.0	1.1
3	4.5	17.3	1.1	28.6	10.5	1.2	24.5	12.0	1.1
Exp. 2									
1	1.5	4.6	0.4	7.0	7.8	1.7	-	1.8	0.7
2	2.2	6.8	0.4	11.4	18.2	1.4	-	0.4	0.4
3	3.4	11.0	0.6	16.4	30.2	1.2	-	1.3	0.4

- Not measured.

Table 2. Salinity and rootstock effects on the relative growth of Haas seedlings. Relative growth equals plant height at the end of the experiment divided by the initial plant height.

	Experiment 1				Experiment 2[a]			
EC (dS/m)	2.9	3.6	4.5		1.5	2.2	3.4	
				Ave.				Ave.
Duke 7	2.9	3.1	1.4	2.5	1.7	1.7	1.9	1.8
Toro Canyon	-	-	-	-	2.4	2.3	2.0	2.2
Borchard	2.3	2.8	2.3	2.5	1.7	2.0	1.8	1.8
Thomas	-	-	-	-	2.0	2.1	1.5	1.9
G1033	-	-	-	-	1.7	1.7	1.9	1.7
G755C	1.8	1.8	1.7	1.8	1.6	1.6	1.5	1.6
LULA3	2.3	1.4	1.0	1.6	-	-	-	-
G6PT	2.2	1.9	1.0*	1.7	-	-	-	-
Duke 6	2.0	1.1	1.0*	1.4	-	-	-	-
Walter Hole	1.3	1.0	1.2	1.2	-	-	-	-
Ave.	2.0	1.8	1.4	1.7	1.8	1.9	1.8	1.8

[a]LSD (0.1) for experiment 2: salinity, 0.2; rootstock, 0.3; salinity x rootstock, 0.4.
*Final and initial plant height were assumed to be equal because the seedlings died during the experiment.
-Rootstock not included in the experiment.

Table 3. Influence of salinity on the weight of Haas seedlings in the second experiment.[a]

EC (dS/m)	1.5	2.2	3.4	
	---------- kg ----------			Ave.
Duke 7	0.44	0.29	0.22	0.32
Toro Canyon	0.28	0.22	0.10	0.20
Borchard	0.29	0.26	0.28	0.28
Thomas	0.27	0.18	0.14	0.20
G1033	0.16	0.18	0.13	0.16
G755C	0.09	0.10	0.11	0.10
Ave.	0.26	0.19	0.16	

[a]LSD (0.1): salinity, 0.06; rootstock, 0.08; salinity x rootstock, 0.14.