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GLASSHOUSE STUDIES ON THE SALT TOLERANCE AND GROWTH OF PERSEA FLOCCOSA AS A ROOTSTOCK

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SUMMARY

A glasshouse study using *P. floccosa* in addition to three *P. americana* varieties representing three different races was made for salt tolerance and growth. Clonal cuttings of each plant in addition to each grafted to Fuerte were studied. The data indicated that *P. floccosa* as a rootstock resulted in a higher leaf concentration of sodium than in any one of the *P. americana* varieties. *P. floccosa* seemed to be even more sensitive to chlorine than to sodium, but the degree of chlorine injury was about the same as Topa Topa. Fuerte leaves, regardless of the rootstock, retained more chlorine after 180 days than leaves of the other plants. Chlorine was translocated to leaves faster than sodium. The distribution of sodium and chlorine among leaves, bark, wood, and roots is given. The weights of the plants indicated further the possibility that *P. floccosa* may be a dwarfing rootstock, although this must be evaluated in long-time field studies.

INTRODUCTION

During the years immediately preceding 1952, low winter rainfall in southern California resulted in a high incidence of tip burn and leaf scorch in avocado from sodium or chlorine accumulations ([1, 2, 4, 5, 6]). These workers pointed out the extreme sensitivity of avocados to salt and the suggestion was made that resistance to salt injury be included in any rootstock breeding program, especially since some varieties were found to be more resistant than others.

Persea floccosa was introduced from Mexico in 1947 by Schroeder[7]. Although it has been found susceptible to root rot[8] there is some interest in it because of the relative ease with which it can be either crossed with or grafted to *P. americana* varieties and the possibility that it may be a satisfactory dwarfing rootstock. The main purpose of this study was to test *P. floccosa* for salt tolerance.

In 1951 some clonal cuttings[3] were made by E. Frolich at U.C.L.A. of *P. floccosa,* Waldin (West Indian race), Fuerte, Topa Topa (Mexican race), and Hass (Guatemalan race). Fuerte scion pieces were grafted on *P. floccosa,* Waldin, Topa Topa, and Hass cuttings to make a clonal root-stock study. These cuttings and combinations were eventually potted each in six gallon cans in a virgin loam soil. There were 37 trees in all.

In June, 1954, some of the plants, representing all cuttings and graft combinations, received an application of 25 grams of sodium chloride per container. The treated plants were in duplicate and triplicate. Leaf analyses for sodium and chlorine were made after 14 days. After 180 days leaves, bark and wood of stems, and roots were analyzed after weight measurements were made. In November, 1954, five grams of sodium chloride were added to one set of the plants and 24 days later samples were taken for leaf, bark, wood and root analyses. Control plants were similarly handled.

RESULTS AND DISCUSSION

The 25 grams of sodium chloride per pot was a relatively low application rate compared with actual saline soils. It is approximately one-twentieth as saline as what would be considered a moderately saline soil. Fourteen days following its application all plants showed some degree of injury. *P. floccosa* cuttings actually showed the least injury, but injury increased on *P. floccosa* following 14 days such that one of them died. After 180 days the weight reductions for *P. floccosa* cuttings were as great if not greater than for other cuttings (table 1). For the *P. floccosa* cuttings, sodium remained high in the leaves (table 2), whereas for the other avocados it was reduced to nearly zero 180 days after application. The abscission of salt-injured leaves when Topa Topa, Hass, and Waldin varieties were the root systems may have been at least in part the cause of this phenomenon. *P. floccosa* leaves remained longer without abscising.

There was a tendency for chlorine to persist in Fuerte leaves 180 days following salt application more so than in the leaves of the other avocados (table 2).

Twenty-four days after the addition of five grams sodium chloride per plant, there was a slight to moderate amount of leaf tip-burn on plants having Topa Topa and *P. floccosa* roots. This was verified as chlorine injury rather than sodium (table 2), according to the levels established by Ayers, et al.[2] Most of the analyses indicated that chlorine was translocated to leaves faster than was sodium. Since the salt application rate was very low it is possible that *P. floccosa* as well as Topa Topa would be, as a rootstock, extremely sensitive to chlorine injury. The distribution of sodium and chlorine in leaves, bark, wood, and roots is also included in table 2.

Table 1. Weights of leaves, twigs and branches, and roots of *P. floccosa* and *P. americana* cuttings and grafted cuttings grown in soil without sodium chloride and 180 days following a 25-gram application of sodium chloride per tree.

	Leaves			Twigs and Branches			Roots		
	Without salt	With salt	% Decrease	Without salt	With salt	% Decrease	Without salt	With salt	% Decrease
	Fresh weight in grams			Fresh weight in grams			Dry weight in grams		
Fuerte cutting	185	133	28	224	196	13	146	96	34
Fuerte on Hass	--	169	--	--	148	--	--	97	--
Fuerte on Topa Topa	187	110	41	150	132	12	114	62	46
Fuerte on *P. floccosa*	116	111	4	102	86	16	78	18	77
Waldin cutting	188	99	47	164	121	26	145	87	40
Hass cutting	208	96	54	232	158	32	149	65	56
Topa Topa cutting	116	78	33	139	106	24	104	38	64
P. floccosa cutting	130	51	61	117	63	46	68	39	42

Table 2. Sodium and chlorine contents as percent of dry weight of various parts of different avocado cuttings and grafted cuttings with and without sodium chloride treatments.

Variety or Species	Without NaCl				14 days after 25 gm. NaCl per pot	180 days after 25 gm. NaCl per pot				24 days after 5 gm. NaCl per pot			
	leaves	bark	wood	roots	leaves	leaves	bark	wood	roots	leaves	bark	wood	roots
					Sodium								
Fuerte cutting	.01	.01	.01	.01	.70	.04	.13	.23	.49	.01	.01	.01	.20
Fuerte on Hass	--	--	--	--	.07	.01	.03	.08	.38	--	--	--	--
Fuerte on Topa Topa	.01	.01	.01	.33	.59	.01	.07	.10	.38	.01	.01	.01	.44
Fuerte on *P. floccosa*	.01	.01	.01	.25	.52	.42	.60	.78	.38	.01	.04	.13	.32
Waldin cutting	.01	.01	.01	.30	.72	.03	.17	.29	.39	.02	.01	.04	.37
Hass cutting	.01	.01	.01	.25	.40	.01	.06	.05	.25	.01	.01	.01	.25
Topa Topa cutting	.01	.01	.01	.38	.92	.02	.27	.30	.37	.01	.03	.06	.43
P. floccosa cutting	.05	.05	.12	.26	.11	.81	.26	.19	.39	.18	.10	.16	.41
					Chlorine								
Fuerte cutting	.16	.06	.04	.07	1.89	.59	.12	.07	.28	.25	.02	.14	.04
Fuerte on Hass	--	--	--	--	0.48	.66	.12	.05	.14	--	--	--	--
Fuerte on Topa Topa	.17	.05	.11	.09	1.60	.65	.15	.08	.10	.59	.10	.07	.14
Fuerte on *P. floccosa*	.18	.03	.08	.11	1.75	1.22	.21	.07	.05	.75	.15	.07	.17
Waldin cutting	.22	--	--	--	1.55	.36	.15	.06	.36	.18	.16	.04	.18
Hass cutting	.28	--	--	--	1.16	.34	.25	.07	.12	.30	.03	.01	.11
Topa Topa cutting	.10	.03	--	.11	2.11	.28	.12	.03	.28	.92	.22	.03	.19
P. floccosa cutting	.07	.02	.07	.07	0.44	.20	.04	.03	.15	.60	.17	.05	.27

The weights of leaves, twigs and branches, and roots in table 1 indicate the possible dwarfing nature of *P. floccosa,* but it should be pointed out that this test was made under the environmental conditions of a glasshouse. Dr. C. A. Schroeder is obtaining information on this point in his field studies. Such field information must be obtained before any conclusions can be made. It is believed that most of the effects of sodium chloride were independent of plant size, although it is possible that some were accentuated by this difference.

LITERATURE CITED

1. *Ayers, A. D. 1950. Salt tolerance of avocado trees grown in culture solutions. Calif. Avocado Soc. Yearbook 35: 139-148.*
2. *Ayers, A. D., D. G. Aldrich, and J. J. Coony. 1951. Sodium and chloride injury of Fuerte avocado leaves. Calif. Avocado Soc. Yearbook* 36: *174-178.*
3. *Frolich, E. F. 1951. Rooting Guatemalan avocado cuttings. Calif. Avocado Soc. Yearbook 36: 136-138.*
4. *Haas, A. R. C. 1950. Effect of sodium chloride on Mexican, Guatemalan, and West Indian avocado seedlings. Calif. Avocado Soc. Yearbook 35: 153-160.*
5. *- ..... -*..... 1950. *Calcium in relation to the effects of sodium in avocado seedlings. Calif. Avocado Soc. Yearbook 35: 161-168.*
6. *.....- ..... 1952. Sodium effects on avocado rootstocks. Calif. Avocado Soc. Yearbook 37: 159-166.*

1. Schroeder, C. A. 1951. Avocado materials for horticultural research. Calif. Avocado Soc. Yearbook 36: 107-112.

8. Zentmyer, G. A., and C. A. Schroeder. 1953-54. Tests of Persea species for resistance to Phytophthora cinnamomi. Calif. Avocado Soc. Yearbook 38: 163-164.