

Relationship of Citrus Cultivars and Declinio

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ABSTRACT. The relationship of commercial cultivars to declinio was studied in two experiments. Water injection, vigour (trunk diameter), zinc level in the wood and death of trees were measured. The results showed no evidence of declinio transmission. Some differences in water injection and zinc accumulation related to cultivar type indicated the importance of cultivars in this disease. Sweet oranges were the most affected by declinio and mandarins were unaffected. Tahiti was the most affected of the lemon and lime cultivars tested.

Index words. blight, water injection, zinc analysis.

Since 1979, when declinio was described in Brazilian citriculture (4), this disease has become more and more important every year. Some authors have related declinio to similar diseases in other countries (6). In recent years, several diagnostic tests have been used to detect the declinio, which are also used for blight (1, 7, 8).

Studies in commercial and experimental orchards (2, 3, 4) demonstrated the susceptibility of sweet oranges to declinio, mainly when budded on rangpur lime.

The relationship of commercial cultivars to declinio was studied in two experiments. Water uptake by injection, vigour (trunk diameter), zinc level in the wood, and death of trees were parameters observed.

MATERIAL AND METHODS

Two experiments were carried out from 1982 to 1986 in the Faculdade de Ciências Agrárias e Veterinárias de Jaboticabal in São Paulo State, Brazil. The first was a study of the occurrence of declinio in a collection of 16 citrus cultivars budded on rangpur lime, and planted in 1972. The budwood of all cultivars came from the nucellar orchard of the Limeira Experimental Station. The cultivars were as follows: sweet oranges—Valencia, Baianinha, Pera, Barão, Hamlin, Natal, Piralima and Westin; mandarins—Ponkan, Dancy, Cravo, and Mexericado-rio; Siciliano lemon; Tahiti and Galego limes; and Murcott tangor.

The second experiment was planted in 1980 with trees of Pera and Hamlin sweet oranges and Cravo mandarin, all budded on rangpur lime, in three blocks of 24 trees of each cultivar. In 1982, the trees of two blocks were inoculated with two buds from a Pera sweet orange tree severely affected by declinio.

The occurrence of declinio was determined in both experiments by water injection, zinc accumulation, death of trees, and vigour in order to establish the possible relationship of declinio with citrus cultivars or species, when planted under the same soil conditions, climate and cultural practices.

The water uptake by injection was measured in five trees of each cultivar in the first experiment and in 16 trees of each cultivar in the second experiment. Injections were made for 10 sec 20 cm above the budunion and the volume injected was recorded.

The zinc accumulation was measured by atomic absorption spectrophotometry from a 10 g sample, taken from a hole 20 cm above the budunion.

The trees which died before 1982 and 1986 were counted for each cultivar and the cause of death was determined.

The trunk diameters were evaluated in the second experiment in 1980 and 1986 and the averages of inoculated trees were compared with those of non-inoculated trees.

TABLE 1
AVERAGE DIAMETERS FOR CRAVO MANDARIN AND PERA AND HAMLIN SWEET
ORANGES AFTER INOCULATION WITH DECLINIO

	Cravo		Hamlin		Pera	
	inoc. ^z	control ^y	inoc.	control	inoc.	control
1980 ^x	1.56	1.61	1.71	1.73	1.70	1.74
1986	6.94	5.82	10.05	6.92	6.69	6.09

^zAverage of 48 trees.

^yAverages of 24 trees of each cultivars.

^xBefore inoculation.

RESULTS AND DISCUSSION

Table 1 shows the trunk diameters of Cravo mandarin and Hamlin and Pera sweet oranges at the beginning of the experiment and six yr after inoculation with declinio. In 1980, the trunk diameters (before inoculation) were practically the same. In 1986, the trunk diameters of the inoculated trees were larger, especially for Hamlin. For Cravo and Pera the differences were very small. No cause was found for these differences.

Table 2 shows the results of water injection and zinc accumulation in the trunk of citrus cultivars after inoculation with declinio, but without symptoms of declinio. Each value is the average of 16 trees. The difference between the inoculated and noninoculated trees, were not significant by the F test. Although the differences were not statistically significant, the water uptake in Cravo mandarin trunks was greater than in the Hamlin and Pera sweet oranges; Hamlin took up less water than Pera sweet orange. The inoculated trees of

all varieties took up less water. The results of Zn analysis do not correspond with the water injection results. Cravo mandarin and Pera sweet orange had more zinc, and Hamlin less zinc.

Declining trees of the cultivar collection (table 3) were evaluated in relation to declinio incidence and death caused by other diseases. For Valencia and Baianinha the total number changed for 1986, because part of the orchard was removed. The incidence of declinio was greater in the sweet orange cultivars, and within that group, the Barão, Hamlin and Baianinha cultivars averaged more than 6% dead trees. All sweet orange cultivars were affected, but the average percent of declinio was less for Valencia and Pera than for the other cultivars.

For some cultivars of sweet orange, such as Barão and Hamlin, the high percentage of trees with declinio was related to low water uptake. Valencia also had low water uptake, but only 2.69% of the trees had declinio.

TABLE 2
AVERAGE WATER UPTAKE BY TRUNK INJECTION AND ZINC ACCUMULATION IN
TRUNK OF CRAVO MANDARIN AND HAMLIN AND PERA SWEET ORANGES AFTER
INOCULATION WITH DECLINIO

Cultivar	Not inoculated		Inoculated ^z	
	Water uptake (ml/10 sec)	Zinc (ppm)	Water uptake (ml/10 sec)	Zinc (ppm)
Cravo	6.25	6.93	5.96	6.12
Hamlin	3.65	5.75	2.93	4.87
Pera	4.56	6.75	3.25	7.25

^zTrees planted 1980, inoculated 1982 with tissue from declinio-affected tree. Readings made 1986.

TABLE 3
OCCURRENCE OF DECLINIO IN SOME CITRUS CULTIVARS AT 14 YEARS OF AGE

Cultivar	Total no. of trees	Trees with declinio			Death by other diseases ^y 1982 + 1986	Water uptake ^x (ml/10 sec)	Zinc accumulation (ppm)
		1982	1986	Average % ^w			
Sweet orange							
Valencia	300 (188) ^z	5	7	2.69	8	1.8(0-4.5)	7.9
Baianinha	100 (84)	3	9	6.87	1	3.9(3.0-5.0)	7.3
Barão	50	6	10	12.60	1	1.4(0.5-2.5)	5.9
Hamlin	100	0	13	6.50	0	1.7(1.0-2.5)	6.4
Natal	302	6	23	4.79	4	2.9(0.0-5.5)	9.7
Piralima	102	3	4	3.43	15	4.8(3.5-6.0)	5.6
Westin	50	0	3	3.00	1	3.3(1.0-4.5)	9.1
Pera	300	1	4	0.68	11	3.5(2.5-5.0)	7.6
Mandarin							
Mexericario	50	0	0	0.00	15	4.0(1.5-7.5)	6.5
Cravo	100	0	0	0.00	9	6.3(1.0-6.0)	5.5
Dancy	41	0	0	0.00	4	3.5(1.0-6.0)	9.1
Murcott	163	0	0	0.00	18	4.4(2-8.0)	10.9
Ponkan	150	0	0	0.00	4	4.2(2.5-6.0)	6.5
Lime							
Galego	150	0	—	—	10	—	—
Tahiti	153	1	10	3.59	13	1.5(1.0-2.0)	—
Lemon							
Siciliano	50	0	0	0.00	9	0.8(0.5-1.0)	—

^zNumber parentheses is the number of trees in 1986 after removal of part of orchard.

^yCorticium, tristeza, gummosis, leprosis and shell bark.

^xAverage of five trees for each cultivar; number in parentheses equals ranges.

^w% decline calculated from averages of 1982 and 1986.

The mandarin trees evaluated showed no death caused by declinio. In general, the mandarin trees had greater water uptake than sweet oranges, but at least one tree had very low water uptake. Possibly the tree was affected, but without external symptoms. In the lemon and lime group, Tahiti was the most affected. Siciliano lemon showed no trees with symptoms of declinio, but the water uptake was low.

The results for zinc accumulation showed no correspondence with water uptake and no differences between sweet oranges and mandarins. Murcott tangor had the highest zinc

accumulation followed by Natal sweet orange.

Comparing Tables 2 and 3 the cultivars Cravo, Hamlin and Pera showed some differences. Cravo mandarin and Pera sweet orange showed very similar results in relation to water uptake and zinc accumulation. Hamlin sweet orange showed less water uptake and more Zn accumulation in the older trees.

The results presented showed no evidence of declinio transmission. Some differences in water injection and zinc accumulation in relation to cultivars indicated the importance of cultivars in this disease.

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